2012 Bronx River Riparian Invasive Plant Management Plan

New York City Department of Parks & Recreation
Natural Resources Group
January 2012

NYC Parks

Michael R. Bloomberg, Mayor
Adrian Benepe, Commissioner

Acknowledgements
This plan was prepared by the New York City Department of Parks & Recreation Natural Resources Group in partnership with the Bronx River Alliance and New York Botanical Garden.

This plan would not have been possible without the financial support of Congressman Jose E. Serrano's WCS-NOAA South Bronx Waterfront Partnership and NYC Department of Parks & Recreation.

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The authors would like to thank Matt Palmer (Columbia University) and Ellen Pehek (NYC Department of Parks & Recreation) who provided valuable advice and comments for this project.

We would also like to thank Jessica Arcate-Schuler of the New York Botanical Garden for her exceptional advice, partnership, and support throughout the project.

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bronx river alliance

THE NEW YORK BOTANICAL GARDEN

EXECUTIVE SUMMARY

In 2006, the Bronx River Alliance (BxRA) and the New York City Department of Parks & Recreation Natural Resources Group (NRG) released the Ecological Restoration and Management Plan (EcoPlan) for the Bronx River, which identified goals to protect and improve aquatic and riparian plant and animal biological diversity and habitat. However, the Bronx River ecosystem continues to be threatened by the spread of invasive plants, which have thrived in the disturbed urban environment and fragmented woodlands through which the river flows. The most prevalent invasive plant found along the Bronx River is Japanese knotweed (*Fallopia japonica*), an aggressive invasive plant that has the ability to degrade aquatic and riparian systems by displacing native flora and reducing in-stream habitat structure and diversity and riparian function.

The Bronx River Riparian Invasive Plant Management Plan (RIPMaP) builds on the goals of the EcoPlan by developing and implementing invasive plant management practices for the riparian corridor. The vision guiding the RIPMaP is a healthy river system with a new urban-natural equilibrium that supports diverse native aquatic and riparian communities. The intentions of the RIPMaP are to:

(1) Improve habitat conditions for native plants and wildlife by reducing the spread of invasive species and increasing populations of native riparian plants; and
(2) Increase in-channel habitat diversity and refuge for fish in the Bronx River.

The RIPMaP will improve the coordination of invasive plant management activities by different organizations managing invasive plants along the river, identify priority sites for management activities, identify and implement the best control strategies based on available resources, and establish protocols for documenting management activities. Organizations managing land along the river lack the resources to control invasive plants along the entire riparian corridor in the Bronx. This plan facilitates a more coordinated and efficient effort to manage invasive plants by local agencies, community groups, non-profit organizations, and other stakeholders managing land along the Bronx River.

This plan will serve as a guide to implementing invasive plant management practices in the riparian corridor. The approach progresses from a landscape-level analysis, which identifies Priority Sites for management, to site-level inspections to assess site-specific management needs. Next, management strategies incorporating the standard operating protocols provided in this Plan will be selected and implemented based on target species, resource availability, and other information gathered from site inspections. Finally, sites will be monitored to determine if restoration goals are being met and management practices will be modified to better meet those goals.

With adequate support, the coordinated implementation of this plan will improve aquatic and riparian habitat for native flora and fauna as well as reduce the spread of invasive plants in the system. By basing specific management actions on a combination of scientific study and the experience from restoration practitioners, this plan will help us achieve a shared vision for the Bronx River.

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LIST OF APPENDICES

1. INTRODUCTION

The Bronx River Riparian Invasive Plant Management Plan (RIPMaP) is the result of many years of municipal- and community-led riparian habitat restoration efforts along the Bronx River. Although clean-up efforts have been underway since the 1970s, the creation of the Bronx River Alliance in 2001 helped increase activities that restored native vegetation in the riparian corridor by sharing technical expertise and coordinating vegetation management among several organizations. We have learned over the last 10 years that continued biotic and abiotic disturbance in the urban environment presents significant challenges to achieve sustainable native vegetation communities following a single restoration intervention. Instead, continual maintenance and management is needed, particularly of invasive species, which thrive under these same on-going disturbance conditions. The RIPMaP presents a plan to address these challenges, identifies the best management practices to control invasive plants, and coordinates management activities by the organizations that work along the river.

1.1 Purpose

The overarching goals of the RIPMaP are to:

(1) Improve habitat conditions for native plants and wildlife by reducing the spread of invasive species and increasing populations of native riparian plants; and
(2) Increase in-channel habitat diversity and refuge for fish in the Bronx River.

To accomplish these goals, five management objectives were identified:

(1) Identify priority sites for invasive species management and native plant restoration using a consistent and logical framework and adaptive approach.
(2) Identify species-specific strategies for invasive plant control.
(3) Reduce cover of invasive species and increase cover and natural recruitment of native vegetation on the riverbank through plan implementation.
(4) Establish protocols for tracking management actions in the field.
(5) Determine staff and funding needs for conservation management.

1.2 Context

The Bronx River flows for twenty-three miles from its beginning in Westchester County to its mouth at the East River. The upper fifteen miles of the river flow primarily through suburban Westchester County. As the river enters the Bronx, the landscape transitions to dense urban and residential development. Along the lower eight miles, the river flows through eleven New York City parks including the New York Botanical Garden (NYBG), and the Bronx Zoo. These public parks provide an important protective buffer area to the river in the highly urban environment of the Bronx. The high recreational value of the river and surrounding parks encouraged the formation of grassroots organizations in this underserved community to steward the river and riparian areas. The stakeholders and project partners invested in the RIPMaP are a diverse group of community organizations, government agencies, and non-profit organizations.

This plan summarizes existing invasive plant conditions as of September 2011, identifies priority sites for management activities, identifies the best invasive plant control strategies based on site conditions and available resources, and establishes protocols for documenting management activities. The plan advances the goals identified in the *Bronx River Alliance 2006 Ecological Restoration and Management Plan* by providing protocols to identify priority sites and for vegetation management activities to achieve those goals. In addition, it helps implement recommendations given in the *Bronx River Intermunicipal Watershed Management Plan* (2010).

1.3Users and Stakeholders

The RIPMaP is intended to be used by the Natural Resources Group (NRG) of the New York City Department of Parks & Recreation (DPR), Bronx River Alliance (BxRA), NYBG, and other stakeholders managing land along the Bronx River. These stakeholders include the Wildlife Conservation Society (WCS), Rocking the Boat (RTB), and Phipps Community Development Corporation (PCDC). NRG, BxRA, NYBG, and WCS are members of the Bronx River EcoTeam, which is responsible for implementing the Ecological Restoration and Management Plan (EcoPlan) for the Bronx River. The EcoPlan has three overall goals for the Bronx River: (1) protect and improve water quality; (2) protect and improve aquatic and riparian plant and animal biological diversity and habitat; and (3) reduce environmental stresses on the river ecosystem (BxRA 2006). The RIPMaP builds upon the goals of the EcoPlan by detailing specific management actionsto be implemented by multiple agencies that are engaged in invasive plant management along the river. The following is a list of key agencies and non-profit organizations that will carry out the management actions provided in this plan.

Bronx River Alliance (BxRA)

The Bronx River Alliance was formed in 2001 to serve as a coordinated voice for the river and work in partnership to protect, improve and restore the Bronx River corridor and greenway, and thus establish healthy ecological, recreational, educational, and economic resources for the surrounding communities. With DPR, the BxRA manages the New York City segment of the Bronx River corridor and greenway, implements small-scale restoration projects through the work of its Conservation Crew, coordinates larger scale restoration projects, and supports community-led or sponsored restoration and development projects. In 2006, BxRA and NRG released the Bronx River Ecological Restoration and Management Plan, which provides much of the basis for the RIPMaP. The more than 100 organizations that make up the BxRA partnership play a significant role in support of, participation in, and education about the river's long term improvement. BxRA works with NRG to manage over 6 river miles and 495 acres of parkland around the river. The Conservation Crew monitors water quality, removes trash from the river, plants native vegetation, removes invasive species, andpromotes green infrastructure throughout the Bronx River watershed. BxRA will plan and implement conservation management activities prescribed in the RIPMaP with the assistance of project partners.

New York City Department of Parks & Recreation (DPR)
The mission of DPR's Natural Resources Group (NRG) is to conserve New York City's natural resources for the benefit of ecosystem and public health through acquisition, management, restoration, and advocacy using a scientifically supported and sustainable approach. Of the 28,000 acres under the jurisdiction of DPR, 11,000 acres are natural areas, such as forests, grasslands, wetlands, and water bodies. There are approximately 981 acres of parkland within the Bronx River watershed, including the NYBG and Bronx Zoo. NRG works closely with BxRA to manage the ecological health of the river by protecting the riparian buffer, planning and implementing restoration activities, monitoring abiotic and biotic conditions, and coordinating with DPR Capital division to incorporate natural resource protection objectives into DPR projects. This work includes invasive plant removal, reforestation, streambank stabilization, and stormwater management. NRG employs a staff with a wide range of expertise and experience including wildlife and plant ecologists, ecological restoration specialists, naturalists, landscape architects, hydrologists, foresters, and GIS/mapping specialists. NRG will provide technical and field support to implementing the RIPMaP with the BxRA.

Two divisions within NRG, the Natural Areas Volunteers (NAV) and MillionTrees Training Program (MTTP) also contribute work on the Bronx River. NAV is an environmental stewardship and public service initiative of DPR. MTTP is a collaborative initiative between DPR and the New York Restoration Project (NYRP) that works towards a more environmentally sustainable healthy living for the future through intensive green job training in one of two fields: arboriculture or ecological restoration. NAV and MTTP are actively working to restore the Bronx River Island in the Bronx Forest and provide field support to NRG and BxRA on a variety of projects along the Bronx River, including invasive species management, forest restoration, anadromous fish monitoring, and oyster reef restoration.

New York Botanical Garden (NYBG)
Founded in 1891, The New York Botanical Garden is a pre-eminent center for botanical research center, and a leader and national model for scientific and horticultural practices for people of all ages. The Bronx River flows for 0.87 river miles through the 250 acres of land managed by NYBG. Characterized as "America's Garden" by noted plantsman Dan Hinkley, the Garden educates its visitors through the beauty of its landscape and the diversity of its horticultural and educational programs. At the heart of the Garden, both geographically and historically, lies the largest remaining tract of native northeastern forest in New York City. The Bronx River flows through the 50 acre Forest, creating a dramatic gorge through the rock. The Forest is famous for its venerable native trees, such as oak, sweetgum, maple, and tuliptree. It was admired and preserved by members of the Lorillard family, who settled the area in the late 18th century. Today, Garden visitors are drawn to the Forest's woodland, dramatic views, native birds, and proximity to the Bronx River. The trees in the Forest range in age from young saplings to mature specimens hundreds of years old. NYBG manages invasive species plants native plants, and monitors the success of ecological restoration efforts in the Forest. The

Garden also engages school groups and volunteers to help with the ongoing restoration and monitoring work in the Forest.

Wildlife Conservation Society (WCS)
The WCS, founded in 1895, has a clear mission to save wildlife and wild places worldwide through science, global conservation, education and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. The Bronx River flows for 1 river mile through the 265 acre Bronx Zoo. The WCS works to rehabilitate the river as a vital recreational and educational resource. The Bronx Zoo's Mitsubishi Riverwalk nature trail protects over 15 acres of the Bronx River watershed and highlights the many native species that thrive here. The WCS, in partnership with the National Oceanic and Atmospheric Administration (NOAA) and NRG, has been working to rehabilitate the river's passageways for native fish such as alewife herring. Other WCS projects to monitor habitat along the river include a study of the songbirds that stop over at the Zoo's riverbanks as they migrate toward their northern breeding and southern wintering grounds.

2. CHALLENGES

2.1 Ecological Threats

The river and the vegetation along its corridor (the riparian zone) are highly interconnected. There is close to 500 acres of parkland that buffer the river; however urban land-uses dominate the overall landscape and the remaining woodland areas are highly fragmented and infested by invasive plants. Conserving and enhancing the diversity of native plants along the Bronx River is to maximize habitat diversity, ecological functions, and wildlife it supports. Native woody vegetation provides many benefits for the river, such as providing shade to keep water temperatures cooler during the summer, root structure to help stabilize soil and minimize erosion, and the addition of large woody debris (LWD) to the river that increases habitat complexity. In addition, native plant species provide the most desirable ecological services, because they are best adapted to the local environment and create diverse communities of plants to support native wildlife as habitat and a source of food. Since floodplain forests are so variable and diverse, the goal along the Bronx River is to establish native species suitable to current local disturbance and hydrologic conditions instead of replicating historical plant communities (BxRA 2006).

Invasive plants are one of the most visible threats to ecological integrity on the Bronx River. Decades of watershed development and other anthropogenic disturbances have led to the proliferation of invasive plant species. The urbanized watershed has a high portion of impervious area and infrastructure that pipes untreated stormwater directly to the river, resulting in a larger volume and higher frequency of polluted runoff than under natural conditions. Flooding and sediment transport influence habitat for vegetation through frequency of disturbance, erosion and accretion, and affect soil characteristics including grain size, oxygen availability and nutrient content. The disturbed hydrology increases erosion and sedimentation, and the transport of invasive plant seeds and propagules from upstream to downstream, resulting in conditions that favor the establishment of invasive plants along the banks of the river (Figure 1). Some of the most common and problematic invasive plants include Japanese knotweed (*Fallopia japonica*), lesser-celandine (*Ficaria verna)*, Oriental bittersweet (*Celastrus orbiculatus*), porcelainberry (*Ampelopsis brevipedunculata*), and Japanese hops (*Humulus japonica*).

These invasive species displace and suppress the health and recruitment of native plant species, thereby altering habitats and ecosystems (Wilcove *et al.* 1998), and replace diverse communities with monocultures. Pusey and Arthington (2003) report that invasive species can impact the river's ecosystem by:

(1) reducing the provision of shade and its influence on water temperature;
(2) changingthe organic material entering the channel and subsequent interception, storage and release of nutrients;
(3) reducing the structural influence of large woody debris (LWD) as habitat and substrate for fish, invertebrates and microalgae; and
(4) Altering the configuration of the channel morphology and habitat diversity and refuge over time.

The overall results of these impacts is a river with less in-stream habitat structure – a uniform trapezoid channel, little hydraulic variation, no refuge from high flows and no cover during low flows – and reduced riparian function – poor native woody plant recruitment, no LWD, low diversity in organic matter and habitat, and no shade.

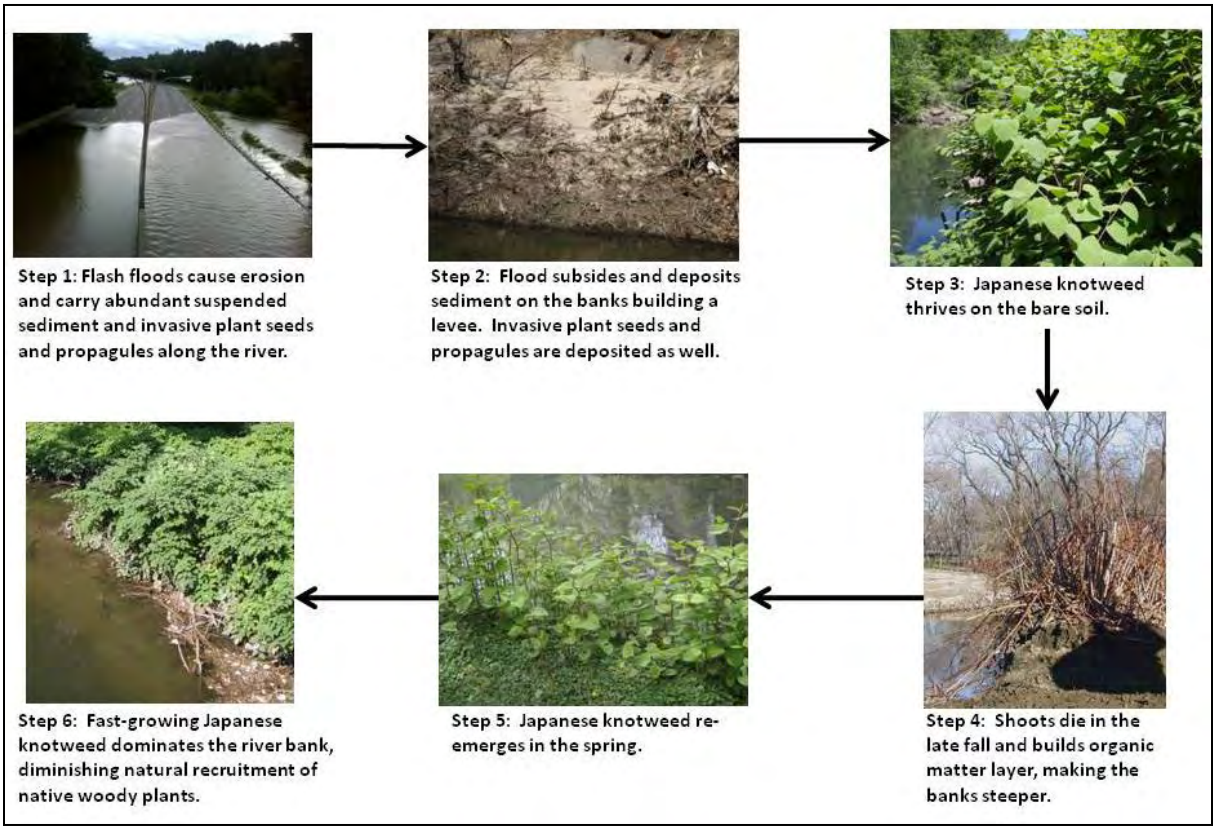

Figure 1. The Bronx River is an urban river system characterized by disturbed hydrology. Frequent flash floods carry invasive seeds and propagules from upstream to downstream, resulting in conditions that favor the establishment of invasive plants, most notably Japanese knotweed.

2.2 Management Challenges

NRG has produced numerous management plans for DPR over the years, but none for the Bronx River. Stewardship of habitat along the Bronx River presents major management challenges, including the following:

- Organizations that manage the land along the river – NRG, BxRA, NYBG, and WCS – currently lack the resources to implement a sustained, intense level of invasive plant control along the entire riparian corridor in the Bronx.
- Addressing invasive species threats requires significant coordination among the land managers.
- Single restoration interventions do not achieve sustainable native plant communities because of continued biotic and abiotic disturbances.
- There is considerable variability in invasive plant management methods along the river and an absence of coordinated tracking or documentation of management activities or goals.

3. EXISTING CONDITIONS

3.1 Bronx River General Conditions

The Bronx River begins in Valhalla, NY near the Kensico Reservoir and flows south, draining a narrow, relatively low-lying, 56 square-mile watershed and emptying into the East River between Soundview and Hunts Point in the South Bronx (Figure 2). The Bronx River serves as a tributary to the Long Island Sound and Hudson River Estuary systems via the East River. The upper 15 miles of the river flow through Westchester County, where the watershed is characterized primarily by suburban development. Along the river’s last eight miles through the Bronx, however, the landscape transitions to increasingly dense urban development, both residential and industrial, and is dominated by impervious surfaces, such as roads, rooftops, and parking lots. The Bronx River valley functions as a transportation corridor, with the Bronx River Parkway and the Metro-North Harlem railroad line bordering and crossing the river for most of its length. The last two miles of the river serve as a federally designated navigable waterway for use by commercial barges.

Throughout its length, the river also serves as a recreation corridor lined with parks, gardens, canoe launches and a planned greenway. Recreation in the river includes canoeing and kayaking and, despite public health advisories, swimming and fishing. The parklands north of the Bronx draw a considerable number of bicyclists; plans to extend this greenway and make it continuous through the Bronx are expected to greatly increase the number of bicyclists using the corridor.

The physical characteristics of the Bronx River watershed and the human actions within it affect the water quality and hydrology of the river, as well as the flora, fauna, and human activities the river is capable of supporting. Despite being highly affected by pollution and urban development, the Bronx River supports aquatic insects, fish, small mammals, and diverse vegetation. Great horned owls, Cooper’s hawks, rare warblers, ibis, and, on the river itself, mergansers and wood ducks are among the interesting birds that inhabit the riparian forest.

Figure 2. The 56 square mile Bronx River watershed.

3.2 Invasive Plant Conditions in the Riparian Corridor in the Bronx

A rapid invasive plant assessment method was developed and implemented in the summer and fall of 2010 to characterize existing conditions and inventory invasive species on NYC Parkland adjacent to the Bronx River. Targeted invasive plants found along the Bronx River and its level of concern for management is listed in Table 1 below. These plants are either known to develop into monotypic stands that displace native vegetation in the forested areas along the

Bronx River or have the potential to do so. The rapid invasive plant assessment methods and accompanying invasive plant monitoring form can be found in Appendix 1.

Table 1: List of the commonly found invasive plants along the Bronx River.

Scientific name	**Common name(s)**	**Level of concern**
HERBACEOUS		
Alliaria petiolata	Garlic mustard	Secondary
Artemisia vulgaris	Mugwort, common wormwood	Primary
Fallopia japonica	Japanese knotweed	Primary
Lythrum salicaria	Purple loosestrife	Secondary
Phragmites australis	Phragmites, common reed	Secondary
Polygonum sachalinense	Giant knotweed	Secondary
Ficaria verna	Lesser-celandine, fig buttercup	Primary
VINES		
Ampelopsis brevipedunculata	Porcelainberry, Amur peppervine	Primary
Celastrus orbiculatus	Oriental bittersweet	Primary
Convolvulus arvensis	Field bindweed	Secondary
Humulus japonicus	Japanese hop	Primary
Lonicera japonica	Japanese honeysuckle	Secondary
SHRUBS		
Lonicera spp.	Bush honeysuckle	Secondary
Rubus phoenicolasius	Wine raspberry	Secondary
TREES		
Phellodendron amurense	Amur corktree	Secondary
Ailanthus altissima	Ailanthus, tree of Heaven	Secondary

<u>Invasive plant conditions by Park</u>

Short descriptions of individual parks (Figure 3) along the river in the Bronx and the status of invasive plants within each park are listed below from north to south. The Bronx Zoo was excluded from this analysis because investigators were prohibited from entering animal exhibits, due to safety reasons, to assess invasive plant conditions. Maps of each individual park with total invasive plant cover and a chart that details the percent cover of target invasive species can be found in Appendix 2.

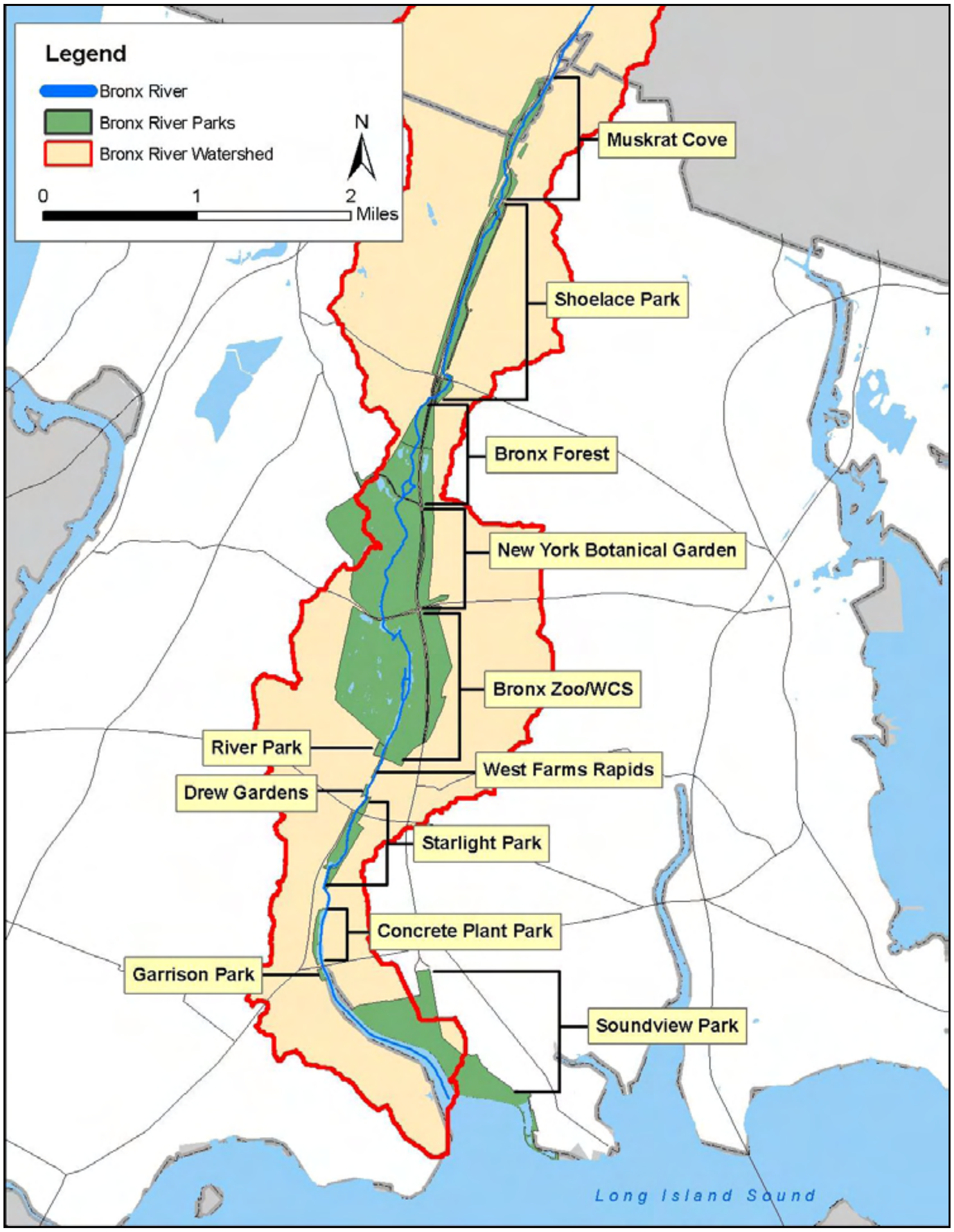

Figure 3. Parks adjacent to the Bronx River in the Bronx.

Muskrat Cove

Muskrat Cove is the most northern NYC Park along the Bronx River. The Bronx River flows through the middle of the park for approximately 1.3 river miles. The county border between the Bronx and Westchester County, which follows the old route of the Bronx River before it was straightened, meanders through Muskrat Cove. DPR and BxRA manage this park from the pedestrian footbridge about 1200 ft north of Nereid Ave to E. 233rd St. Although the park is over 600 feet wide at its maximum, most of the park west of the river is bisected along its length by the Bronx River Parkway reducing the continuous area to a maximum of 200 feet and a minimum of less than 20 feet. The riparian area east of the river is approximately 40 to 175 feet wide and bordered by train tracks. With the Bronx River Parkway bordering the park on the west, the river bisecting the middle of the park, and the railroad on the east, most of this park has an open or disturbed canopy. Japanese knotweed is found in high densities over most of the park. It covers over 50% of the majority of forested riparian areas. Porcelainberry is also prevalent reaching densities over 50% in some areas. Large patches of porcelainberry blanket trees and shrubs through much of the riparian woodland west of the river. Bindweed is the second most prevalent vine and can be found in dense patches reaching 5-25%. Mugwort, garlic mustard, Japanese honeysuckle, and wineberry reached densities of 5-25% in some areas. Japanese hops, ailanthus, and multiflora rose (*Rosa multiflora*) were also found but covered less than 5% of any area. Although it covered less than 5% of any area, purple loosestrife was scattered in isolated patches along the river.

Shoelace Park

Shoelace Park is a long, narrow park located along both sides of the Bronx River for 4.4 river miles. Managed areas of the park vary from 150 to 360 feet wide. Most of the park east of the river is cultivated lawn designated for active and passive recreational use. The Bronx River Parkway runs along the west bank of the river for the entire extent of Shoelace Park. A narrow strip of woodland buffers the river on both sides. The wooded buffer to the west of the river and bounded by the Bronx River Parkway is 30 to 45 feet wide in most parts, but can be as narrow as 15 feet. There is more area to the east of the river as the wooded buffer varies between 40 to 100 feet wide. Japanese knotweed reaches densities over 75% in the thin strip of land between the river and the parkway. On the east bank, patches of Japanese knotweed vary from 25-50% density in the understory of the narrow strip of woodland between the river and the cultivated lawn of the park. Mugwort is the second most prevalent invasive plant reaching densities of 5-25% and establishing itself primarily on the edges of the forest near lawns. Bindweed is the most common vine followed by porcelainberry and Oriental bittersweet. No vine reached densities of 5% in any area but bindweed was established in some small dense patches. Garlic mustard, purple loosestrife, ailanthus, wineberry, and English ivy (*Hedera helix*) have established populations but in densities less than 5%.

Bronx Forest

Bronx Forest has the only remaining floodplain forest in the lower Bronx River watershed. Over 41 acres of forest exist here with recreational areas located around the edges of the forest. The river flows for approximately 0.7 river miles through the park. The park is triangular-shaped with a narrow tip to the north and the wider base to the south. To the south, the park is over 2000 feet wide. The Bronx River Parkway runs through the eastern half of the park.

Japanese knotweed is the most prevalent invasive in the Bronx Forest. It reaches densities of over 50% cover in some areas and is particularly dense along the low river banks. However, a history of removals and restoration plantings has created a patchy mosaic within the forest with several areas such as the “Cricket Pitch” exhibiting very low densities of Japanese knotweed or none at all. Marshy lowland patches to the east of the river are also devoid of

Japanese knotweed. Although some upland areas have few scattered small patches, some areas of upland near the parkway and train tracks have heavy infestations. Mugwort is the second most prevalent invasive plant in the Bronx Forest, however vines aggregated together are more prevalent than mugwort. In order of decreasing frequency, vines found are: Japanese hops, porcelainberry, bindweed, and Oriental bittersweet. By far, the most widespread vine was Japanese hops covering over 50% of some areas. Purple loosestrife, garlic mustard, wineberry, multiflora rose, English ivy, and bush honeysuckle were found in low quantities.

New York Botanical Garden

The areas along both banks of the river in NYBG consist of open floodplain, canopied low areas, steep forested banks, and steep rocky outcrops. The park varies from approximately 2,200 to 3,200 feet wide. Total invasive cover density varied from 5% to over 75% with the highest densities at the northern and southern end of the property. The Bronx River flows through a valley with steep rocky outcrops in the center of the Garden. Japanese knotweed covered more area than any other invasive growing in densities of over 75% in some floodplain areas. Lesser-celandine (*Ficaria verna*) has been observed to be distributed in the same areas as Japanese knotweed (Jessica Arcate-Schuler, personal communication), although we did not perform the assessment when it is visible in the spring. It grew most consistently along the banks of the river except for a few areas in the center of the park and was densest in areas that were lower in elevation along the river. Oriental bittersweet was the second most common invasive. It was broadly scattered but reached densities of 5-25% in some areas. Mugwort, garlic mustard, purple loosestrife, porcelainberry, Japanese honeysuckle, Japanese hops, Japanese barberry (*Berberis thunbergii*), ailanthus, Amur cork tree, English ivy, multiflora rose, Japanese angelica tree (*Aralia lata*), and bush honeysuckle were also found, usually in very low quantities.

River Park

River Park is small park with picnic benches, bbq pits, and a playground on the west side of the river. The park is between 200 to 245 feet wide and the river flows for only 381 feet through the park. Most of the park consists of lawn areas with a several trees planted for shade. Closed canopy woodland is found on the east side (Bronx Zoo side) of the river directly across River Park. The east bank of the river is only accessible by wading across the river or entering through the Bronx Zoo service gate by permission. The 182nd Street Dam is located at River Park. Japanese knotweed is scattered along the east bank in low (<5%) densities. Porcelainberry is growing in low densities on the east bank of the river. There is a small patch of purple loosestrife that is growing out of the downstream face of the dam.

West Farms Rapids

West Farms Rapids is a narrow park between E. 180th St. and E. Tremont Ave. that measures approximately 90 feet wide at its widest point. The river flows for 848 feet past the park. The park consists of mainly passive recreation areas and the Bronx River Greenway (for biking and walking along the river). Considerable high canopy exists along the banks of the river with a scattered understory of native shrubs and low trees. Small patches of Japanese knotweed, mugwort, garlic mustard, bindweed and porcelainberry still persist primarily on the riverbanks. Total invasive cover is no more than 5% of the entire park.

Drew Gardens

Drew Gardens is a community garden managed by the Phipps Community Development Corporation with upland landscaped areas and garden plots, open canopy natural areas along the northern section of the riverbank, and closed canopy forested areas at the southern end of the riverbank. It is approximately 65 feet wide and 362 feet long. A variety of invasive plants were found in patchy distributions throughout the site. English ivy and wineberry each cover 5-25% of the site. Bindweed, porcelainberry, purple loosestrife, Oriental bittersweet, multiflora rose, Japanese knotweed, and mugwort all occupy less than 5 percent of the site each. Overall the total invasive cover did not exceed 25%.

Starlight Park

As of September 2011, Starlight Park was undergoing a complete reconstruction. The park ranges from 320 to 550 feet wide and is bisected by the river for approximately 0.7 river miles. On the west side of the river, the park is dominated by an artificial turf athletic field and playground. On the east side of the river, the park consists of raingardens, woodlands, and grasslands. The riverbanks on both sides consist of vegetation and some areas of riprap. A patch of purple loosestrife reaching a density of 5-25% grows near the canoe launch at the south end of the park. Japanese knotweed is found in small amounts (<5%) in most of the natural areas. Mugwort followed by Oriental bittersweet and porcelainberry were the most common invasive plants found in the park. Mugwort was found in all of the natural areas assessed, ranging from <5% to 51-75% of the units.

Concrete Plant Park

The vegetation in Concrete Plant Park is mainly composed of lawn areas and approximately 1.3 acres of restored natural areas. The park ranges from 80 to 175 feet wide. The river flows past the west bank of Concrete Plant Park for about 0.4 river miles. A portion of the bank has been restored to a thicket of shrubs and low trees such as sumac (*Rhus* spp.), and small areas bordering the river are now salt marsh. Additional plantings of dense shrubs and herbs occur on the upland area in the southern end. Very small quantities of phragmites and purple loosestrife exist in these restored natural areas along with a small percentage (5-25%) of mugwort.

Garrison Park

Garrison Park is a one acre park located in an industrial area. The rectangular shaped park is approximately 150 ft wide and 449 feet long on the west bank of the river. Most of the park except the steep bank was planted with native tree saplings in 2009. Multiple removals of invasives have taken place from 2008-2010. Currently, there are very low quantities (< 5%) of bindweed and ailanthus, and 5-25% of mugwort. Knotweed density is currently very low along the bank due to past removals, but appears to be regenerating.

Soundview Park

Soundview Park is a 205 acre park at the mouth of the Bronx River constructed on a former landfill. The park ranges from 870 to 2,860 feet wide. The river flows for 1.4 river miles along the east bank. The park consists of sports and recreation areas, community and governmental buildings, a composting facility, open natural areas with patches of trees, and a small area of lagoon and mudflat with native salt marsh plants. The natural areas cover over one half of the total acreage. Three acres in the southern section are scheduled for restoration in 2012 into salt marsh wetland and coastal maritime grassland habitats.

The invasive species of greatest concern in Soundview is mugwort; only one percent of the natural areas have less than 10% cover of mugwort and 72% of the natural areas are covered by more than 50% mugwort. Japanese knotweed occurs in small and dense patches throughout the natural areas of the park. Phragmites is the second most abundant invasive plant with highly variable cover rates from zero to over 50%. Ailanthus is scattered throughout the park and reaches densities of 5-25%.

Summary

Results of the Rapid Invasive Plant Assessment unsurprisingly revealed that Japanese knotweed covers more riparian area than any other invasive species. It reaches high densities along both banks of the river in most areas north of Fordham Road. Many natural areas north of the Bronx Zoo have at least 25% to 50% cover of Japanese knotweed. Japanese knotweed covered over 50% of half of the forested areas in Shoelace Park and Muskrat Cove. Most of these areas are difficult to access and treat, such as the west side of the river at Shoelace Park (requires wading across the river), or have only recently received more attention for management. However, because they are at the northern end of the river they provide a constant seed source to areas downstream.

Japanese knotweed is less of a problem in the parks south of the Bronx Zoo either because these areas are actively being reconstructed, were reconstructed recently, or other invasive species dominate. For example, mugwort and phragmites occur in dense patches over large areas of Soundview Park.

Vines cover large patches within the units or in some cases dominate large areas of riparian parkland north of NYBG. Porcelainberry, in particular, is a problem in Muskrat Cove where it has blanketed large trees. Japanese hops and bindweed can be found further south in the Bronx Forest where they often form a dense mixture of invasive plants with Japanese knotweed (Figure 4).


Figure 4. A dense mixture of invasive vines covering Japanese knotweed in the Bronx Forest.

Lesser-celandine, a spring ephemeral, was not found as the assessment was conducted too late in the season. However, it has been observed to be present in large patches along the banks of the river in the spring. A summary table invasive plant cover in each park is found below (Table 2).

Table 2. Summary of invasive plant cover assessmentobserved in each park along the Bronx River in 2010. Cover is characterized as high (H), medium (M), low (L), or not found (NF). Note that *Ficaria verna*, a spring ephemeral, is not listed in the Table 2 although it is a species of primary concern because the invasive plant assessments were not performed in the spring. Please see maps in Appendix 2 for areas which were assessed.

	Length of river (feet)	**Area (ac)**	*Alliaria petiolata*	*Artemisia vulgaris*	*Fallopia japonica*	*Lythrum salicaria*	*Phragmites australis*	*Ampelopsis brevipedunculata*	*Celastrus orbiculatus*	*Convolvulus arvensis*	*Humulus japonicus*	*Lonicera japonica*	*Rubus phoenicolasius*	*Ailanthus altissima*	*Phellodendron amurense*
Muskrat Cove	6,580	69.2	**M**	**L**	**H**	**L**	NF	**H**	**L**	**L**	**L**	**L**	**L**	**L**	NF
Shoelace Park	7,546	83.4	**L**	**L**	**H**	**L**	NF	**L**	**L**	NF	**L**	**L**	**L**	**L**	NF
Bronx Forest	3,885	96.6	**L**	**M**	**H**	**L**	NF	**L**	**L**	**L**	**M**	**L**	**L**	**L**	**L**
NYBG	4,618	246	**L**	**L**	**H**	**L**	NF	**L**	**M**	**L**	**L**	**L**	**L**	**L**	**L**
River Park	381	2.2	NF	**L**	**L**	**L**	NF	NF	NF	NF	NF	NF	NF	NF	NF
West Farms	848	1.1	**L**	**L**	**L**	**L**	NF	**L**	**L**	NF	NF	NF	NF	NF	NF
Drew Gardens	362	1.7	**L**	**L**	**L**	**L**	NF	NF	**L**	NF	NF	NF	**L**	NF	NF
Starlight Park	3,665	29.3	NF	**M**	**M**	**L**	NF	**M**	**M**	NF	NF	NF	NF	**L**	NF
Concrete Plant	1,901	6.5	NF	**M**	NF	**L**	**L**	NF	NF	NF	NF	NF	NF	NF	NF
Garrison Park	449	1.0	NF	NF	**L**	NF	NF	NF	NF	NF	NF	NF	NF	**L**	NF
Soundview Park	7,590	205.3	**L**	**H**	**M**	NF	**H**	NF	**L**	NF	NF	NF	NF	**M**	NF

4. STANDARD OPERATING PROCEDURES

4.1 Invasive plant management

A general strategy NRG and partners use along the Bronx River to control invasive plants in most sites is to establish native trees and shrubs on the site to create a closed canopy or shade in order to keep invasive plant colonies in check. However, until the trees and shrubs have established themselves and created enough shade, reforestation sites will need to be weeded for the restoration to be successful. In some appropriate sites, native herbaceous plants, in combination with a diligent treatment regime, may be planted to control invasive plants.

Invasive plants compete with newly planted trees for water, nutrients and sunlight. Controlling invasive plants usually involves multiple treatments over several years because many species will still likely re-emerge on the site from the remaining rootstock and/or seed bank in the soil. In addition, the Bronx River continually transports seed source and other propagules from invasive plant populations upstream to downstream locations. For most sites, these weeding activities will take three to five years, although in some cases sites may need to continue to be periodically weeded for seven to nine years.

This plan provides species-specific treatment protocolsin section 4.2 below and a timing chart (Appendix 3) that will guide the manager to select the method best suited to the control of invasive plants on site. Each site presents unique management challenges and different invasive species require different methods for successful removal and control. Moreover, different methods for control are required for the same species depending on the degree of infestation. The species specific treatment protocol considers:

- Size and location of area to be treated
- Density of invasive plants
- Length of time available for treatment
- Time of year that invasive plant control needs to begin

Many sites may have multiple invasive species growing in the same area. The most visible and dominant species should be treated first and, once cleared, the others can be located and treated. For example, in sites where porcelainberry is growing within dense stands of Japanese knotweed, it is not possible to locate the origin of each porcelainberry plant until the knotweed has been cleared. The knotweed clearing work would also remove porcelainberry, and then the porcelainberry re-sprouts can be easily located and treated.

For each site, it is important to understand the level of treatment necessary as soon as possible and to develop an appropriate implementation schedule because the timing of invasive control measures is critical. Herbaceous plants are generally best treated in the spring and summer months, whereas woody vines and shrubs can be effectively treated while they are dormant in the winter months. Multi-year treatments are generally more effective than single-year treatments, but making sure the plant is effectively treated during the right season can be as important as treating it multiple times. The risks and long-term costs of not performing multi-year treatments have proven to outweigh any short-term benefits or cost-savings of planting trees before the invasive plants are effectively controlled.

In addition, some invasive control methods call for the cutting and subsequent regrowth of vegetation prior to any herbicide application, which can further complicate project timing.

The majority of invasive plant management will be conducted using mechanical methods of weed removal:

- Hand pulling vine or shrub seedlings
- Mowing mugwort, phragmites, or other invasive plants using hedge trimmers or loppers
- Digging up the rhizomes of knotweed or other clonal species
- Cutting back vines or shrubs using hedge trimmers or loppers

For some sites, volunteers might be engaged in invasive plant removal. The preferred engagement of volunteers would be for a neighborhood or community group to adopt a site and engage in periodic weeding based on an established schedule for site maintenance. If that is not possible, groups could be brought in for invasive plant removal blitzes.

Herbicide treatment
When working in natural areas, select compounds that are effective against the target species, not likely to drift, leach to groundwater or wash into streams, nontoxic to people and other organisms, not persistent in the environment, and easy to apply (Tu *et al.* 2001). In many restored sites, herbicide application will be have to be carefully conducted so as not to harm the newly planted trees or other desirable vegetation. Herbicides can be applied with the proper precautions, such as only spraying foliar herbicides on plants lower than the trees' lowest leaves (about one foot) and refraining from spraying on breezy days or breezy sites. All herbicide spraying needs a NYSDEC permit. Herbicide usage in wetland areas requires a NYSDEC Aquatic Pesticide Permit. Herbicides may be applied using the following methods:

- Application of a foliar spray on vine or shrub seedlings or resprouts
- Application of a foliar spray on mugwort or other herbaceous resprouts after mowing
- Application of a cut stump herbicide on the woody stem of vines or shrubs that return

Herbicide treatment of invasive trees
Herbicide treatment of invasive trees can be performed by the cut stump or basal bark methods (see below). Choosing the appropriate strategy is site, seasonal, and species

dependant. **Note:** removal of any tree is subject to tree restitution required by NYC Local Law 3 2010. Please contact NRG for tree restitution requirements.

<u>Cut Stump Method</u>
The tree is cut down close to the ground and the remaining stump is treated with concentrated herbicide. This may be appropriate for areas where removing the tree from the site is urgent. It is also useful for treating sprouts following other treatments and for precise surgical removal of individual trees without disturbing other plants. The timing of cut stump treatments is essential and cannot be done when the sap is flowing because the tree will push the herbicide out.

<u>Basal Bark Method</u>
A section of the tree trunk is sprayed with a concentrated herbicide and basal oil. The oil carries the product through the bark and into the plant's vascular system. Basal bark treatments are useful because they can be performed in the winter. Another benefit is that it does not require that the dead tree be removed from the site; however this poses a risk of property damage or to human safety because dead plants may eventually fall. Therefore this method may not be suitable in occupied areas.

Herbicide treatment of invasive shrubs

<u>Foliar Spray Method</u>
Herbicide is sprayed on the foliage of the target vegetation. This can only be performed when foliage is present. The exception is multiflora rose, which can be sprayed in the winter because the stem is photosynthetic.

<u>Cut Stump Method</u>
See Cut Stump Method description for trees above. This method is useful when the site must be cleared of all vegetation as quickly as possible. It is also useful for treating resprouts from other treatments and for precise surgical removal of individual shrubs without disturbing other plants.

<u>Basal Bark Method</u>
See description above. Once the herbicide has penetrated and killed the shrub, it can be cut down.

Herbicide treatment of invasive woody vines

<u>Foliar Spray Method</u>
See description above. A diluted herbicide solution is applied to the vegetation without any prior cutting. Once the herbicide has had sufficient time to damage the plant, the dead foliage can be cut down.

Basal Bark Method
See descriptions above.

Cut Stump Method
See descriptions above.

Herbicide treatment of herbaceous plants

Foliar Spray Method
See descriptions above.

Mow or Pull and Spray Method
The existing vegetation is mowed or pulled to eliminate dead plants that are mixed in with the live vegetation. The live vegetation re-sprouts and the resulting regrowth is often less dense than the original stand. As a result, less herbicide is needed to cover the area. Mowing also has the potential to weaken the plants. If timed well and repeated, mowing can often improve the success of invasive control. The timing of mowing (or pulling) and spraying is more complicated than simply spraying, but because it can be more effective, it is often the preferred approach for invasive herbaceous plant control.

4.2 Species-Specific Treatment Protocols
Species specific treatment protocols are presented below to guide the management of invasive plants. The treatments can be done by mechanical methods, herbicide application, or a combination of both. Where appropriate, recommendations are made according to different conditions of invasive plant infestation.

Trees

SPECIES:	*Ailanthus altissima,* tree-of-heaven	
	CONDITION	
TREATMENT	**Small trees <6" diameter**	**Large trees >6" diameter**
Mechanical control	Pull seedlings and small trees <2" diameter prior to fruiting (Jun-Feb)	Not recommended
Herbicide control	Cut-stump trees 2" to 6" with 100% Glyphosate or Triclopyr (Jun-Feb)	TREE VALUATION REQUIRED FOR POSSIBLE RESTITUTION; CONSULT WITH NRG

SPECIES:	*Phellodendron amurense, Amur corktree*	
	CONDITION	
TREATMENT	**Small trees <6" diameter**	**Large trees >6" diameter**
Mechanical control	Pull seedlings and small trees <2" diameter prior to fruiting (Jun-Feb)	Not recommended
Herbicide control	Cut-stump trees 2" to 6" with 100% Glyphosate or Triclopyr prior to fruiting	TREE VALUATION REQUIRED FOR POSSIBLE RESTITUTION; CONSULT WITH NRG

Shrubs

SPECIES:	*Lonicera* spp., Bush honeysuckle	
	CONDITION	
TREATMENT	**Small shrubs <2" diameter**	**Large shrubs >2" diameter**
Mechanical control	Pull and dig	Remove with honeysuckle popper for shrubs less than 6" diameter.
Herbicide control	Use mechanical control	Cut-stump 100% Triclopyr or Glyphosate (Jun-Feb)

Woody vines

SPECIES:	***Ampelopsis brevipedunculata,* Porcelainberry**	
	CONDITION	
TREATMENT	**Seedlings <2" diameter**	**Mature vinelands>2" diameter**
Mechanical control	Cut, pull and dig in late summer for seed source control	Cut, pull and dig in late summer for seed source control
Herbicide control	2-4% Glyphosate or Triclopyr foliar spray (Jun-Aug)	1) Cut-stump 100% Triclopyr (Jun-Mar); or 2) 5-10% Triclopyr basal bark spray in late fall/winter (mid Nov-Feb); or 3) Combo 4-2-2% Glyph-Tric-non-petroleum basal oil (Jun-Aug)
Combination	Cut in winter (Dec-Feb) to facilitate access for summer spraying	Cut in winter (Dec-Feb) to facilitate access for summer spraying

SPECIES:	***Celastrus orbiculatus,* Oriental bittersweet**	
	CONDITION	
TREATMENT	**Seedlings <2" diameter**	**Mature vinelands>2" diameter**
Mechanical control	Pull and dig in late summer (late Aug-Sep) for seed source control	Pull and dig in late summer (late Aug-Sep) for seed source control
Herbicide control	2-4% Triclopyr or Glyphosate foliar spray (Jun-mid Sep)	1) Cut-stump 100% Triclopyr (mid May-mid Mar); or 2) Basal 5% Garlon or 100% Pathfinder in late fall/winter (mid Nov-Feb); or 3) Combo 2-1-2% Glyph-Tric-basal oil (Jun-mid Sep)
Combination	Cut in winter (Dec-Feb) to facilitate access for summer spraying	Cut in winter (Dec-Feb) to facilitate access for summer spraying

Herbaceous plants

SPECIES:	*Fallopia japonica,* Japanese knotweed	
	CONDITION	
TREATMENT	**Isolated/small patches**	**Small/large patches scattered throughout**
Mechanical control	Dig 2x per year (Jun & Aug/Sep), bag and remove all plant material.	Cut 3x per year (Jun, Jul, Aug/Sep), bag and remove all plant material.
Herbicide control	1) Inject 100% Glyphosate in summer 2) 5% Glyphosate foliar spray in summer	3-5% Glyphosate foliar spray in summer
Combination	Cut 2x per year (May & June/July) and allow 6-8 wks after cut before treating with 3-5% Glyphosate foliar spray in Aug/Sep.	Cut 2x per year (May & June/July) and allow 6-8 wks after cut before treating with 3-5% Glyphosate foliar spray in Aug/Sep.

SPECIES:	*Alliaria petiolata,* Garlic mustard
	CONDITION
TREATMENT	**Any size patch**
Mechanical control	1) Hand pull in spring (Mar-May). 2) If pulled after fruiting (June), bag and remove plant material - fruit will still mature to seed even if pulled; too late to pull after July 4.
Herbicide control	1) 1-2% Glyphosate foliar spray in spring and summer; 2) Spray before mid-may if it is affecting plantings; 3) Rosettes can be sprayed anytime of the year

SPECIES:	*Artemisia vulgaris,* Mugwort
	CONDITION
TREATMENT	**Any size patch**
Mechanical control	Cut/Mow 3x per year (May-Aug)
Herbicide control	2% Glyphosate foliar spray in summer
Combination	Cut to ground in winter to facilitate early spring spraying; or if miss spring spraying, mow to calf height and wait 4-6 weeks to spray; if prepping site mid-summer, cut back to thigh height and wait 4-6 weeks to spray in Aug/Sep

SPECIES:	*Convolvulus arvensis,* Bindweed	
	CONDITION	
TREATMENT	**Seedlings**	**Mature vines**
Mechanical control	Pull while flowering but before seeds set (Jun-mid Aug)	Pull while flowering but before seeds set (Jun-mid Aug)
Herbicide control (note: do not spray if growing on desirable vegetation)	1) 2% Glyphosate or 5% acetic acid foliar spray (Jul-mid Aug); or 2) 2% Glyphosate foliar spray (Mar-mid Apr)	1) 2% Glyphosate or 5% acetic acid foliar spray (Jul-mid Aug); or 2) 2% Glyphosate foliar spray (Mar-mid Apr)

SPECIES:	*Humulus japonicus,* Japanese hops	
	CONDITION	
TREATMENT	**Seedlings**	**Mature vines**
Mechanical control	Cut and pull 2-3x per year (April-Aug), bag and remove plant material	Cut and Pull 2-3x per year (April-Aug), bag and remove plant material; mechanical control not recommended for large infestations
Herbicide control (note: do not spray if growing on desirable vegetation)	1% Glyphosate foliar spray (May-Jul)	1% Glyphosate foliar spray (May-Jul)

SPECIES:	*Lythrum salicaria,* Purple loosestrife	
	CONDITION	
TREATMENT	**Isolated/small patches**	**Small/large patches scattered throughout**
Mechanical control	Hand pull in August after flowering and before seed set	Dead head in August to stop seed spread after flowering and before seed set
Herbicide control	2-4% Glyphosate foliar spray in August after flowering and before seed set	2-4% Glyphosate foliar spray in August after flowering and before seed set

SPECIES:	*Phragmites australis,* Phragmites or common reed	
	CONDITION	
TREATMENT	**Isolated/small patches**	**Small/large patches scattered throughout**
Mechanical control	Cut 3x per year (Jul-Aug), bag and remove plant material	Cut 3x per year (Jul-Aug), bag and remove plant material
Herbicide control	1) 5% Glyphosate foliar spray; or 2) If planted site, hand wipe application with 33% Glyphosate in Summer	5% Glyphosate foliar spray in Summer
Combination	Cut to ground in winter to clear dead stems for early season spraying; if prepping site in mid-summer (Jul-Aug), cut back to thigh height and wait 6-8 weeks to spray (target spraying for Sep-Oct)	Cut to ground in winter to clear dead stems for early season spraying; if prepping site in mid-summer (Jul-Aug), cut back to thigh height and wait 6-8 weeks to spray (target spraying for Sep-Oct)

SPECIES:	*Ranunculus ficaria,* Lesser-celandine	
	CONDITION	
TREATMENT	**Isolated/small patches**	**Small/large patches scattered throughout**
Mechanical control	Hand pull Mar-May including underground tubers, bag and remove plant material	Mechanical control inappropriate for large infestations
Herbicide control	2% Glyphosate foliar spray (late Feb-May), better to spray in early spring when leaves have emerged but surrounding vegetation is still dormant, control can be accomplished with several years of treatment but will not eradicate it since new seed source comes from upstream every year	2% Glyphosate foliar spray (late Feb-May), better to spray in early spring when leaves have emerged but surrounding vegetation is still dormant, control can be accomplished with several years of treatment but will not eradicate it since new seed source comes from upstream every year

4.3 Japanese Knotweed Treatment Research

NRG examined the effectiveness of urban riparian restoration (NRG 2007) along the Bronx River and found that the success of native plant restoration efforts could not readily be determined due to variability in invasive plant management along the river and the lack of coordinated tracking of management activities. This finding underscored the need to improve tracking of management activities as well as to better understand the effectiveness of specific invasive plant management techniques used along the Bronx River.

Charles and Palmer (unpublished, 2006) conducted the only study to date focused on invasive plant control on the Bronx River. They looked at the impact on woody species plantings where landscape fabric was installed to control invasives plants. Plots with landscape fabric had a greater percent cover of *F. japonica* than plots that had none, but that were seeded with *Elymus virginicus.* However, landscape fabric sites had larger shrub sizes, greater understory species richness and higher percent native species cover than *E. virginicus* seeded plots. Higher plant diversity may have developed on the fabric sites because of the silt that covered the fabric during flood flows, enabling herbs and graminoids to become established on top of the fabric without competition from *Elymus*.

In 2010, NRG, BxRA, and NYBG worked with Dr. Matthew Palmer of Columbia University to design a study to better understand how to measure the effectiveness of alternative Japanese knotweed control in the riparian corridor. We established 120 study plots along the riverbank to test the response of Japanese knotweed to two different mechanical control treatments. We chose to test mechanical treatments for two reasons: (1) our most common method to control Japanese knotweed is by mechanical means; and (2) we try to limit the application of herbicides in the floodplain to minimize the risks of exposing desirable plants and wildlifeto potentially harmful chemicals. Eradicating knotweed requires removing or killing the underground rhizomes. One method is to cut knotweed stems with manual or power tools multiple times during the growing season over several years until the knotweed draws down its energy reserves in the rhizomes by repeatedly sending up new shoots. Grubbing, which involves digging up to 3 feet or more underground to remove as much of the knotweed's underground biomass as possible, is a more direct and labor intensive method (if performed manually) to remove the underground rhizomes. The plots, each 2m x 2m in size, were randomly assigned one of the two different treatments or as a control: (A) cut three times per growing season, (B) cut once then grub two times per growing season, or (C) no treatment (control). Hereafter, we will refer to treatment A as cut plots, treatment B as grub plots, and treatment C as control plots. We have collected two years of data and will continue the study through at least 2012. Detailed methods and some preliminary results can be found in Appendix 4.

The results of this experiment will help us determine which Japanese knotweed control treatment to employ. Our preliminary findings from this study, after two years of treatment, show that there is no difference in Japanese knotweed average stem height and average stem density in cut plots versus grub plots. Both cut and grub plots, had significantly lower invasive plant height than control plots, suggesting that both treatments were effective in reducing stem height. However, average stem density in both cut and grub plots were higher than control plots. This was likely due to the response of knotweed to the treatments by sending up greater numbers of shoots, which were less rigorous – the stems were smaller in diameter and shorter than the stems that were allowed to grow unchecked in control plots. Species richness was observed to be higher in cut plots than both grub and control plots. This may have been a consequence of (1) causing more unintended damage to other plants by removing plant material other than knotweed in grub plots; and (2) knotweed showing its invasive tendencies by out-competing other plants in control plots. While our preliminary results show that there is no difference in the response of knotweed stem height and density to cutting or grubbing treatments, we will need to collect more data to determine if these trends hold over longer periods of treatment. If the difference between cutting and grubbing is minimal, land managers can conserve significant resources by simply cutting knotweed in a restored site until native trees and shrubs can establish themselves and create a closed canopy to shade out the knotweed. Additionally, in a site where land managers would like to preserve plant diversity, it may be recommended that grubbing knotweed should be avoided. At least one more year of data remains to be collected in this study, after which we will perform additional analysis to better understand how knotweed responds to the different treatments and its impact on native plants.

4.4 Tracking Conservation Management Activities

Whenever any work is performed in the field, a detailed record of the critical invasive plant management activities should be taken and maintained in a format that can be shared by NRG and BxRA and other partners. NRG documents restoration work through its Forestry Tracking Database that is used city-wide, and will continue to do so along the Bronx River. BxRA is developing a Microsoft Excel database to record key conservation actions carried out by its crews and volunteers. This excel database is modeled after NRG's tracking database, but adapted to suit BxRA's specific needs. The primary purpose of the database is to track what type of work is done where along the river; and the secondary purpose is to examine efficiency and effectiveness of the work over time. To track key management actions in the field, field crews will use pre-printed maps and complete a field tracking form (Appendix 5) to record the location and area treated, activity that was performed, time, materials expended, invasive species removed, native vegetation planted, number of volunteers engaged, and staff time. Information from the field tracking form will be entered into an excel database in the office by a crew member. The database will be managed by a designated crew leader or assistant crew leader, who will input data daily or weekly. We estimate that the time need to track and enter this work is 1-2 hours per week.

In times of limited resources, when there may be fewer conservation crews and staff resources to conduct work in the field and document that work in a tracking data base, there is a risk that work will not be consistently recorded. It is important, over time, that the protocols used to track field work are revised so that essential information on the work conducted in the field is tracked. As need arises, the tracking methods used by NRG, BxRA and other partners should be adjusted to ensure ease of use and utility. These databases (whether in excel or other formats) will allow managers to review the actual labor needed to perform specific management actions, including invasive plant removal and reforesting new sites. They will be a valuable tool that will help managers estimate labor and resources needed to perform specific management activities.

5. MANAGEMENT PLAN STRATEGY

The overall strategy to managing the invasive plants along the Bronx River Riparian corridor consists of identifying priority sites for of seven main steps:

1) Develop priority site selection criteria based on ecological, educational, and recreational concerns.
2) Use a GIS prioritization analysis model to identify priority sites using each priority site selection criterion.
3) Conduct annual inspections at priority sites in the field to note actual field conditions.
4) Develop site-specific management strategies based on the target species and difficulty of control.
5) Implement site-specific management strategies.
6) Evaluate the effectiveness of management actions in light of the site goals, and use this information to modify and improve control priorities, methods, and plans.
7) Implement adaptive management.

5.1 Develop Priority Site Criteria

Protection of riparian habitat and function is critical for the long-term health of the Bronx River ecosystem. Many restoration projects have been completed along the Bronx River, but there is a lack of consistent maintenance of restoration sites to prevent re-emergence of invasive plants. A large portion of the riparian corridor, particularly in the northern reaches in the Bronx, has been the target of some restoration effort at some point in the past. For the purposes of this plan, sites where restoration work was conducted since 2001 were prioritized to protect these relatively recent investments. Land managers simply do not have the resources to adequately focus on all areas of the parkland surrounding the Bronx River. Thus, we must prioritize sites for habitat restoration and management. To do this, NRG and BxRA developed criteria for prioritizing sites based on the ecological, educational, and recreational objectives. The riparian invasive plant managementpriority site selection criteria include:

<u>Ecological Priorities</u>

- Restored sites
- Restored sitesbuffer
- Invasive plant cover area
- Short distance to river

Recreational or Educational Priorities

- Close proximity to trails, bridges, and overlooks
- Close proximity river access points

Criterion 1: Restored sites

It is important to protect sites where restoration projects have already been implemented to protect previous investments. While all restored sites will be assessed as part of the RIPMaP, larger sites will receive higher priority than smaller ones, all other factors being equal. Larger restored sites are more valuable than smaller sites because, generally speaking, larger sites have more contiguous native habitat for plants and wildlife and have received a larger investment of resources. The restored sites were classified into three size categories and assigned a ranking score for each category from 1-3, with 1 being the lowest size class and 3 being the largest size class (Table 3).

Table 3. Rank scores for restored sites by size

Restored sites (acres)	**Score**
<0.1	1
0.1 – 0.5	2
>0.5	3

Criterion 2: Restored sites buffer

Native vegetation in a restored site should be protected from encroaching invasive plants by a buffer zone. By placing priority to the buffer area, we can protect the core of the restoration site from encroaching invasive plants. The buffer also increases habitat connectivity if two or more restoration sites are in close proximity to each other. A 50ft buffer was added to the perimeter of every restored site and assigned a ranking score of 2 (Table 4).

Table 4. Rank score for restored sites buffer

Restored sites buffer	**Score**
50ft	2

Criterion 3: Invasive plant cover areas

Sites with the highest infestation of target invasive species in terms of percent coverage receive higher priority than sites with lower infestations. The data is based on the rapid invasive plant assessments performed during the summer of 2010. By targeting problem areas with high levels of invasive plant cover, we are able to address the biggest threats to our restoration sites. Over a few consecutive years of treatment, site-specific management activities will bring sites with the worst infestations to levels that are easier to control. Invasive plant cover was classified into five cover categories and ranking scores from 1-5, with 1 being the lowest and 5 being the highest, were assigned to each category (Table 5).

Table 5. Rank scores for invasive plant cover	
Invasive species cover	**Score**
<5%	1
5-25%	2
26-50%	3
51-75%	4
>75%	5

<u>Criterion 4: Areas close to trails, bridges, and overlooks (Trails buffer)</u>
The Bronx River serves as an educational and recreational resource for its surrounding communities. One of the goals of BxRA is to connect people both physically and emotionally to the river in order to deepen the public's appreciation of nature and the commitment to protect it. Trails defined here include paved pathways, dirt pathways, pedestrian bridges, and overlooks within NYC Parkland. A 30ft buffer was added to trails in the riparian corridor to prioritize management of highly visible and accessible sites by the public and assigned a ranking score of 2 (Table 6).

Table 6. Rank scores for trails, bridges, and overlooks buffers	
Trails buffer	**Score**
<30ft	2

<u>Criterion 5: Distance to river</u>
Areas that are closest to the river were prioritized because these areas serve as buffers and can help improve habitat for aquatic-dependent organisms. A well-vegetated woody riparian buffer helps improve stream health and water quality by filtering and slowing runoff and flood flows, preventing soil erosion, providing edge habitat, contributing essential nutrients to the food chain, providing woody debris for in-stream habitat, and shading the stream to help lower water temperatures down. For these reasons, areas that are in close proximity to the river are prioritized for management and assigned a ranking score from 1-2, with 1 being further away and 2 being closer to the river (Table 7).

Table 7. Rank scores for river buffer	
River buffer (ft)	**Score**
<30ft	2
30-60ft	1

<u>Criterion 6: Close proximity to river access</u>
Recreational canoeing or kayaking on the Bronx River is becoming an increasingly popular way to explore the river. There are eight access points along the river from Muskrat Cove in the north Bronx to Soundview Park at the mouth of the river. As with the trails, bridges, and overlooks, a 50ft buffer was added to each river access point to prioritize management of

invasive plants at these points and maintain easy access and egress. The 30ft buffer was assigned a ranking score of 2 (Table 8).

Table 8. Rank scores for river access buffer	
River access buffer	**Score**
<50ft	2

5.2 Identify Priority Sites using GIS

A GIS prioritization analysis model was used to identify priority sites for invasive plant management at the landscape level. The model incorporates the priority site selection criteria above and combines each of the individual parameters using the ranking scores defined above. The ranking score of each criterion was represented spatially in raster format with 10m cells. The three step prioritization analysis model was created using ArcGIS 9.0 in which the datasets identifying each restoration criterion were combined and manipulated to identify Priority Sites:

1. Classify priority site selection criteria.
2. Assign suitability rank scores to each criteria grid.
3. Add rank scores together to produce final priority site maps.

The GIS prioritization analysis model added the ranked criteria grids together to determine the overall priority site value. Priority criteria parameters were assigned weights ranging from 1-5. The most significant parameters have a weight of 5 and the least significant parameters have a weight of 1. The criteria grids were added together (Figure 5) using the equation:

$$P = (S \times 5) + (B \times 3) + (I \times 5) + (T \times 3) + (R \times 4) + (A \times 3)$$

Where P = overall priority score, S = restored sites, B = restored sites buffer, I = invasive species cover, T = trails buffer, R = river buffer, and A = river access buffer.

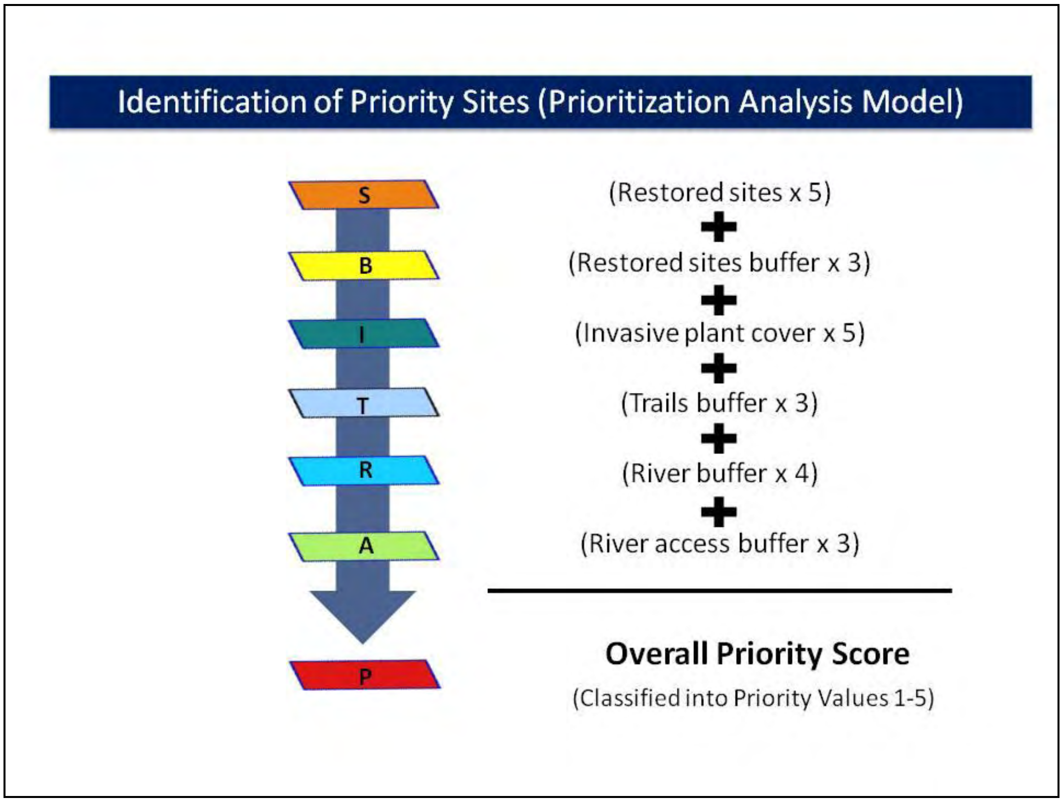

Figure 5. GIS prioritization analysis model to identify priority sites for invasive plant management.

Priority scores that are generated by the model can be species specific if practitioners are targeting individual species (e.g., Japanese knotweed only) or can include multiple species (e.g., Japanese knotweed and porcelain berry). NRG and BxRA will have meetings in the winter to determine which invasive species will be targeted in the following year. Currently, NRG and BxRA are most concerned about controlling Japanese knotweed followed by several invasive vines, including porcelain berry, Oriental bittersweet, Japanese hops, and bindweed. Lesser-celandine is a major concern during the spring. If multiple species are targeted, then the criteria grids can be added together with multiple invasive species cover scores. For example, priority scores can be generated for two different species with the equation:

$$P = (S \times 5) + (B \times 3) + (I_1 \times 5) + (I_2 \times 5) + (T \times 3) + (R \times 4) + (A \times 3)$$

Where I_1 = invasive species #1 cover and I_2 = invasive species #2 cover.

<u>Priority Sites</u>

Using the zonal statistics function in ArcGIS, overall priority scores were divided into five equal-interval categories to identify sites that receive that highest priority for invasive species management. The categories were assigned a priority score value (PSV) from 1 (lowest priority) to 5 (highest priority). Sites that have a high proportion of area with PSVs of 4 or 5 are identified as Priority Sites needing most attention for invasive plant management. Managers at

NRG and BxRA are also allowed to rule out some areas due to special circumstances; these reasons might include areas that are planned for construction, difficult to access, or other reasons. Priority Site maps for Japanese knotweed and a combination of Japanese knotweed and invasive vines are found in Appendix 6. This GIS analysis to identify priority sites is done here to set a baseline for the prioritization. It can be done annually to include new restoration sites. Ideally, the invasive plant coverage data will be updated approximately every five years or as resources allow.

5.3 Conduct Priority Site Inspections

As stated above, organizations managing the land around the Bronx River lack the resources to fully control invasive plants throughout the riparian corridor. Identifying Priority Sites focuses invasive plant control efforts on more manageable units that target problem areas because of ecological, educational, and/or recreational factors. After the Priority Sites are identified through a landscape-level GIS suitability analysis, trained inspectors will record actual field conditions through site visits. Inspectors will also assess all sites that have been restored since 2006 because invasive plants may continue to re-emerge in the site for many years. It is important to sustain a level of maintenance to ensure the successful establishment of trees and restoration of the site. Field inspections can also document other disturbances such as herbivory, fire, or vandalism. In future years, managers will continue to inspect priority sites as identified by the GIS analysis.

NRG (and in future years the BxRA) will train Inspectors to perform field inspections during the first two weeks in June. This timing allows most invasive species to germinate so that inspectors can record the presence and level of infestation of invasive plants, but is still early enough in the season to allow managers to plan for management activities throughout the summer and fall. A field inspection form (Appendix 7) developed by NRG will be used to document conditions observed in the field, including:

- Condition of native woody plant species
- Estimated percent cover of invasive species
- Density and distribution of invasive species
- Average size (height or diameter) of invasive species
- Estimated canopy cover

Since each site presents its own unique management challenges, inspectors will make recommendations for management activities estimating staff hours needed (number of people and estimated hours of work), method of removal, and equipment needed. Method of access may also be recommended if a site is difficult to access (requires wading or floating equipment across the river). Photographs will be taken to document existing conditions and may be used to evaluate the effectiveness of treatments.

If timing and resources allow, additional site inspections can be performed to target species which may be easier to observe during other seasons. For example, lesser-celandine is a spring ephemeral which is best located after flowering in March. Likewise, purple loosestrife is easier to locate after it starts flowering around early August. Bush honeysuckle can easily be located in November because its leaves stay green after most of the deciduous vegetation has undergone leaf senescence.

Often the summer schedule of work will already be set for agencies and conservation organizations by the time the June Priority Site inspections occur. Thus it is important to plan for as much invasive plant management work as resources permit, but allow for flexibility in the sites to be addressed, so that resources can be re-allocated to where they are most needed.

5.4 Develop Priority Site Management Strategies

NRG and BxRA managers will review all site inspections and preliminary recommendations and develop management strategies for each site within one month after the inspections. Considerations that factor into the method of control recommended include:

- Target species
- Size of area
- Site location
- Timing of treatment
- Resource availability (staff and equipment)
- Other programming obligations
- Access to site
- Skill level of staff (licensed herbicide applicator or trainee)
- Other commitments (e.g., emergency storm response)

Most sites will have a mixture of invasive vines and herbaceous plants that are currently present or begin to invade the site once it is cleared and planted. A site specific invasive plant management strategy will be developed listing the target invasive species, preferred management techniques for each species, and schedule for implementation of mechanical and/or chemical removals. Managers must carefully consider the impact of all management activities on the target species, other native species, and the ecological system.

5.5 Implement Priority Site Management Strategies

The implementation of site-specific management action plans will be carried out by NRG or BxRA field crews in NYC Parks. NYBG staff will carry out management actions on NYBG property. Management actions may be mechanical, chemical, or a combination of both. Organizational staff, volunteers, and contractors may be engaged in management activities. If chemical treatment is planned, applicators must follow all federal, state, and local regulations regarding herbicide use.

In some cases, careful coordination between NRG and BxRA will be needed to carry out management activities based on organizational capacity to apply chemical treatments. For example, an area with a well-established, large infestation of Japanese knotweed that dominates the ground cover may be controlled with a combination of cutting and a follow-up herbicide treatment. In the spring and early summer, net movement of carbohydrates in knotweed is to the canopy away from the underground rhizomes to help fuel the first vigorous flush of growth. Two cuts can be performed by BxRA crews about 6 weeks apart, with the first cut starting in early June, and allowing regrowth to draw down the carbohydrate reserves in the rhizomes. To control the rhizomes, the herbicide application needs to be performed in the late summer or early fall when the movement of carbohydrates is back to the rhizomes for growth and storage. After the second cut, knotweed will be allowed to regenerate for at least another 6 weeks and then treated with a foliar sprayby a licensed applicator in late summer or early fall allowing the foliar herbicide to move through the plant with the carbohydrates down to the rhizomes. Knotweed cutting also results in regrowth that is only 2-4 ft tall, as opposed to 6-10 ft tall if left uncut throughout the season, facilitating easier application of herbicide with a backpack foliar spray.

5.6 Monitor and Evaluate Effectiveness of Management Actions

Elzinga *et al.* (1998) defines monitoring as “the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective." It is important to evaluate the effectiveness of management actions in light of the site goals, and use this information to modify and improve control priorities, methods, and plans. In short, monitoring supports long-term management decision-making and allows for adaptive management of the site. Assessment of the effectiveness of invasive plant management along the Bronx River should be conducted using three general methods (NRG 2007):

1. Annual assessment geared towards the identification of management needs – e.g., Priority Site inspections.
2. Monitoring to ascertain effectiveness of specific restoration measures narrowly focused on the changes directly affected by the specific control measures taken – e.g., plot monitoring.
3. Assessment of cumulative impacts of restoration efforts on riparian forest conditions conducted on time frames of 3-5 years or longer – e.g., rapid invasive plant assessments.

<u>1) Annual Priority Site inspections</u>

Annual Priority Site inspections in June can help identify management needs through observations of native plant health and invasive plant infestations. Priority Site Inspection will be conducted a site using NRG protocols. Alternatively, photos can be taken from established points at a site during informal site inspections to compare conditions over time. Observations of changes in invasive plant cover, density and distribution, and size can also help inform managers about the success of control efforts and whether alternative control activities are needed. This type of monitoring can be performed by people of varying skill levels with minimal training.

2) Plot monitoring

This type of monitoring (such as that described in Section 4.3) involves the establishment of randomly located, permanently marked plots or transects according to a specific research design to answer specific questions. It requires a higher skill level and is more time-intensive than routine assessment, and involves sampling to collect specific biological or physical data. Plot monitoring can help answer numerous questions about the effectiveness or impact of specific restoration techniques that warrant further investigation. For example: How does Japanese knotweed react to cutting vs. grubbing treatments (as is currently being studied)? Will saplings that exceed the height of Japanese knotweed in their first years after installation survive without maintenance? Monitoring effectiveness of specific restoration techniques requires controlling for other variables and a sufficient sample size to yield confidence in the study results (NRG 2007).

The feasible number of plots for any research site is often determined by the time and resources available and, especially in urban areas, the size and shape of stands and any local use restrictions. NRG and NYBG can help partners determine the number of plots based on the objectives of the monitoring programand the intended uses of monitoring data (e.g., specific trends that will be evaluated). A Japanese knotweed monitoring protocol specifically designed to be implemented along the riverbank has been developed by NRG and can be applied to many areas along the river. Since plot monitoring and subsequent data analysis is time and resource intensive, plot monitoring should only be conducted if funding and resources are available to have adequate quality control for the monitoring and properly analyze and interpret the resulting data.

3) Rapid invasive plant community cover assessments

Rapid invasive plant assessments should be conducted every 3-5 years to update the existing conditions map. The maps can be compared over time to assess progress towards invasive species management goals. This type of monitoring can reveal changes at a landscape level over time. A 3-5 year time-frame is recommended because the methods are time intensive, requires staff with higher expertise (plant identification skills, map reading, proficiency with GPS technology), and allows time for management actions to make a discernible impact, since troublesome species such as Japanese knotweed usually needs multiple years of sustained control efforts to make an impact (Soll *et al.* 2008). The protocol and forms to perform the rapid invasive plant assessment is located in Appendix 1.

5.7 Implement Adaptive Management

Adaptive management refers to the adjustment of management efforts over time by prescribing new courses of action based on analysis of monitoring data or observations in the field. It is an iterative process of evaluating and refining strategies based on the results of management decisions and the outcomes of the project. The approach includes:

- Analysis of monitoring data and site assessment information
- Decision-making to adapt practices to achieve desired outcomes
- Implementation of adapted practices
- Reporting results and recommendations for use in future practices

The RIPMaP incorporates adaptive management through the analysis of monitoring and site assessment data. It is important that decisions are made and actions are taken based on monitoring and assessment results, even if the action is to maintain current management practices (Fancy 2000). If restoration goals change or are not being met, managers can implement changes at different phases of the strategic plan (Figure 6). Priority site selection criteria can be changed to reflect changing or new goals. The timing or frequency of site inspections can be modified to fit different needs (for example, to address lesser-celandine which is a spring ephemeral or to locate bush honeysuckle in the late fall after the leaves of other plants have senesced). Species-specific management protocols may change if new or more effective techniques are learned. Resource needs, including the staffing and equipment needs, should be informed by our understanding of the conditions of the riparian forest and how much maintenance and management is required to meet the goals of establishing, protecting, and preserving a predominantly native woody riparian corridor. The decision to adapt practices must be coordinated by managers at NRG, BxRA, and NYBG after careful analysis of monitoring and assessment data.

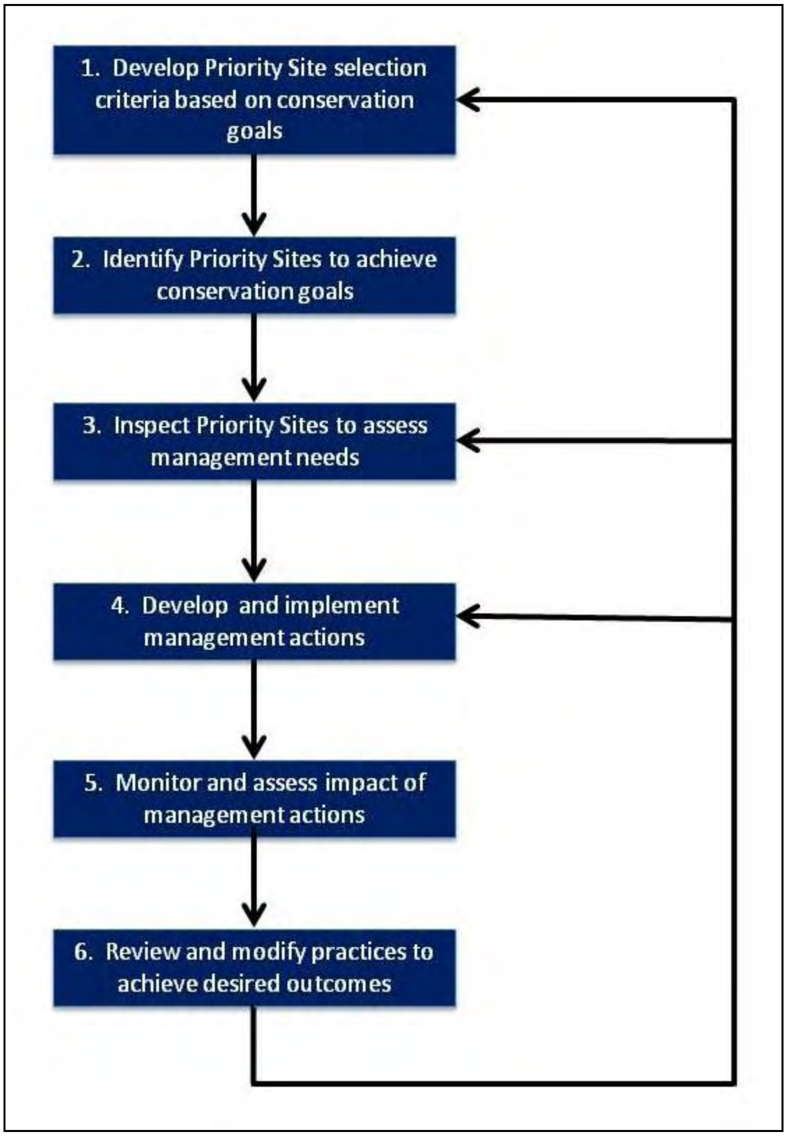

Figure 6. Flow chart of the strategic plan implemented by the RIPMaP. All steps occur annually. Adaptive management is incorporated in step 6 and changes can be implemented at steps 1, 3, or 4 of the plan.

6. SUMMARY

Protection and restoration of riparian habitat and function is critical for the health of the river's ecosystem and much of its wildlife. The Bronx River is a fragmented, highly urban, and disturbed system which needs a consistent and sustained level of management and maintenance to restore and protect ecological functions. Disturbance due to dynamic processes, such as flooding, erosion, and sediment deposition, favors the establishment of invasive plants along the riverbanks. Currently, the most problematic and pervasive invasive plant on the Bronx River is Japanese knotweed. Therefore, the focus of this plan is on the management of Japanese knotweed.

NRG, BxRA, and NYBG have invested significant resources into controlling Japanese knotweed and other invasive plants in the riparian area. However, variability in invasive plant management methods along the river and an absence of coordinated tracking or documentation of management activities has made it difficult to assess the success of restoration efforts. The RIPMaP will improve the coordination and documentation of management activities by the various land managers, prioritize sites for management using a consistent and logical framework, and prescribe standard operating procedures for invasive plant management. It is designed to be an adaptive plan that will guide the implementation of invasive plant management in a consistent and sustained manner that makes the most efficient use of limited resources. It incorporates ecological, educational, and recreational concerns of our partners and prioritizes sites for management activities based on these concerns.

The coordinated implementation of this plan will improve habitat conditions for plants and wildlife, reduce the spread of invasive plants, and increase populations of native plants in the riparian corridor. It will enhance the natural recruitment of native plants along the river, increase in-channel LWD, and increase shade over the river. It will ensure that we continue to make progress in restoring the ecological functions of the river wherever the opportunities exist.

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APPENDIX 1

Rapid Invasive Plant Assessment Method

The rapid assessment groups invasive vegetation cover into landscape units with similar species composition. Each unit is at least 0.25 acres consisting of similar communities of invasive plants. Each unit was defined by visual assessment of a percent cover class for each of the targeted species. Five cover classes were selected: <5%, 5-25%, 26-50%, 51-75%, and >75% cover. Flexibility was built into the monitoring protocol by including a write-in category of 'other' to identify additional invasive species in the area not yet identified to be of special concern. The phenology of each invasive plant was identified to assist in detecting a shift in phenology that would dictate a change in control methods. The phenology categories chosen emphasized the predominance of herbaceous species listed in the species of concern. The categories were: vegetative (plants with leaves but no flower buds, flowers, or), in bud (flower buds are visible), in flower (partially open or fully open flowers are visible), immature fruit (fruit is visible but not the color or texture of mature fruit), mature fruit (mature fruit is visible), dormant (woody plants are without leaves), and dying/senescent (the leaves of woody plants are changing color and dropping or 95% of the leaves in herbaceous plant are dried and withered). Phenology was originally included to be consistent with New York State's method of collecting phenological records for invasive assessment. New York State has since revised their methods and no longer gathers phenological data for invasive plant species.

Evaluators walked through accessible riparian areas at least once to visually identify the borders of the units. GPS points were gathered for critical border points and important landscape features such as paths, boardwalks, and footbridges. An approximation of the unit was drawn on an orthophoto field map with a 1 inch = 200 ft scale. Approximate GPS points and landscape features were also notated on the field map. The Invasive Field Monitoring Form was used to record the cover class and phenology of all invasive plants detected in the unit. The data was used to create an inventory and maps showing the invasive plant coverage of the Bronx River corridor. It is recommended the rapid assessment of invasive plant cover be conducted every 3-5 years to update the existing conditions map. This effort will take a team of two investigators about 3-4 weeks to complete.

Bronx River Riparian Invasive Plants — Monitoring Sheet — Current Status of Invasive Plants

Park (Circle One)			**Date :**	**Evaluators:**	**Organization:**
Fort Knox FK	Muskrat Cove MC	Shoelace Park SP	**Site ID by River Mile to River Mile**		
NYBG BG	Bronx Forest BF	Starlight Park ST	(River Mile + Feet + Park ID + East/West bank + upland point		
Concrete Plant CP	West Farm WF	River Park RP			
	Soundview Park SV				

COVER SCORE	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Phenology**
	<5% cover of entire plot	5-25% cover	26-50% cover	51-75% cover	> 75% cover	Note all Present
	a few plants spreading in from the edge of the plot or a new infestation	includes new sprouts and patches of spreading plants	plants are spreading inward from edges of plot or rapidly spreading outward	heavy infestation recruitment of other plants is limited	almost the entire area is covered by this one species	A. Vegetative B. In Bud C. In Flower D. Immature Fruit E. Mature Fruit F. Dormant G. Dying/Senescent

Terrestrial Plants	**Cover Score**	**Phenology**	**Terrestrial Plants**	**Cover Score**	**Phenology**	**General Notes**
Japanese knotweed *Fallopia japonica*			Japanese Hops *Humulus japonicus*			
Purple loosestrife *Lythrum salicaria*			Oriental bittersweet *Celastrus orbiculatus*			
Phragmites *Phragmites australis*			Bindweed *Convovulus arvensis*			
Mugwort *Artemisia vulgaris*			Porcelainberry *Ampelopsis brevipenduculata*			
Garlic mustand *Alliaria petiolata*			Japanese honeysuckle *Lonicera japonica*			
Lesser-celandine *Ranunculus ficaria*			Japanese stiltweed *Microstegium vimineum*			
Ailanthus			**Aquatic Plants**			
Other			Curly Pondweed *Potamogeton crispus*			
Total Invasive Plant Cover			Elodea (*Elodea canadensis*)			

Park (Circle One)			**Date :**	**Evaluators:**	**Organization:**
Fort Knox FK	Muskrat Cove MC	Shoelace Park SP	**Site ID by River Mile to River Mile**		
NYBG BG	North Forest NF	South Forest SF	(River Mile + Feet + Park ID + East/West bank + upland point		
Concrete Plant CP	West Farm WF	Starlight Park ST			
	Soundview Park SV				

Terrestrial Plants	**Cover Score**	**Phenology**	**Terrestrial Plants**	**Cover Score**	**Phenology**	**General Notes**
Japanese knotweed *Fallopia japonica*			Japanese Hops *Humulus japonicus*			
Purple loosestrife *Lythrum salicaria*			Oriental bittersweet *Celastrus orbiculatus*			
Phragmites *Phragmites australis*			Bindweed *Convovulus arvensis*			
Mugwort *Artemisia vulgaris*			Porcelainberry *Ampelopsis brevipenduculata*			
Garlic mustand *Alliaria petiolata*			Japanese honeysuckle *Lonicera japonica*			
Lesser-celandine *Ranunculus ficaria*			Japanese stiltweed *Microstegium vimineum*			
Ailanthus			**Aquatic Plants**			
Other			Curly Pondweed *Potamogeton crispus*			
Total Invasive Plant Cover			Elodea (*Elodea canadensis*)			

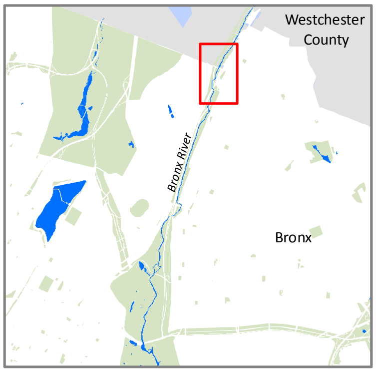
APPENDIX 2

Key:	Scientific name	Common name(s)
AIAL	*Ailanthus altissima*	Ailanthus, tree of Heaven
AIPE	*Alliaria petiolata*	Garlic mustard
AMBR	*Ampelopsis brevipedunculata*	Porcelainberry, Amur peppervine
ARVU	*Artemisia vulgaris*	Mugwort, common wormwood
CEOR	*Celastrus orbiculatus*	Oriental bittersweet
COAR	*Convolvulus arvensis*	Field bindweed
FAJA	*Fallopia japonica*	Japanese knotweed
HUJA	*Humulus japonicus*	Japanese hop
LOJA	*Lonicera japonica*	Japanese honeysuckle
LYSA	*Lythrum salicaria*	Purple loosestrife
PHAU	*Phragmites australis*	Phragmites, common reed
RAFI	*Ranunculus ficaria*	Lesser-celandine, fig buttercup

Invasive Plant Cover Observed in Bronx River Parks 2010-2011

Park	Unit	Area_ac	Date	FAJA	LYSA	PHAU	ARVU	ALPE	HUJA	CEOR	COAR	AMBR	LOJA	AIAL	Other	Total Invasives	Other definition	NOTES
Bronx Forest	BF01	4.16897	8/9/2010	51-75%	<5%	Not found	<5%	<5%	5-25%	Not found	Not found	Not found	Not found	<5%	Not found	>75%		
Bronx Forest	BF02	6.84818	8/9/2010	<5%	<5%	Not found	5-25%	5-25%	Not found	Not found	Not found	<5%	Not found	<5%	Not found	26-50%		knotweed heavy in patch East of trailer ~40' from edge of ballfield, also isolated small patches
Bronx Forest	BF03	2.69643	8/9/2010	51-75%	Not found	Not found	5-25%	<5%	<5%	Not found	Not found	Not found	Not found	<5%	Not found	51-75%		hops near overlook
Bronx Forest	BF04	1.79723	8/9/2010	5-25%	Not found	Not found	<5%	Not found	Not found	Not found	Not found	<5%	Not found	<5%	Not found	5-25%		porcelainbery near stairs;knotweed north of stairs; Ailanthus near road & bridge
Bronx Forest	BF05	2.27078	8/9/2010	5-25%	<5%	Not found	Not found	Not found	5-25%	5-25%	Not found	Not found	Not found	Not found	Not found	51-75%		estimated from bridge with binoculars & opposite bank with binoculars
Bronx Forest	BF06	1.72297	8/9/2010	5-25%	Not found	Not found	<5%	<5%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	5-25%	poss amur honeysuckle	
Bronx Forest	BF07	0.57943	8/9/2010	26-50%	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	Not found	26-50%		
Bronx Forest	BF08	0.79454	8/9/2010	>75%	<5%	Not found	5-25%	5-25%	<5%	Not found	Not found	<5%	Not found	Not found	Not found	>75%		loosestrife near boardwalk intersperced in mugwort, knotweed heavy along parkway
Bronx Forest	BF09	1.86955	8/9/2010	5-25%	Not found	Not found	<5%	<5%	<5%	Not found	Not found	Not found	Not found	<5%	Not found	5-25%		knotweed along bank of river
Bronx Forest	BF10	2.43456	8/9/2010	5-25%	Not found	Not found	<5%	<5%	26-50%	Not found	Not found	Not found	Not found	<5%	Not found	26-50%		thick knotweed along bank of river
Bronx Forest	BF11	0.70209	8/9/2010	5-25%	Not found	Not found	<5%	<5%	26-50%	Not found	Not found	Not found	Not found	<5%	Not found	26-50%		thick knotweed along bank of river
Bronx Forest	BF12	2.17568	8/9/2010	>75%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	51-75%		unable to walk northern section; viewed riverbank from opposite side
Bronx Forest	BF13	0.48458	8/9/2010	5-25%	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	5-25%		knotweed along bank of river
Bronx Forest	BF14	0.82119	8/10/2010	5-25%	Not found	Not found	5-25%	<5%	5-25%	Not found	<5%	<5%	Not found	Not found	<5%	26-50%	WINEBERRY;MULTIFLORA ROSE	
Bronx Forest	BF15	0.81943	8/10/2010	<5%	Not found	Not found	<5%	<5%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	<5%	WINEBERRY	knotweed along bank and individual plants scattered
Bronx Forest	BF16	2.94482	8/10/2010	5-25%	Not found	Not found	26-50%	<5%	5-25%	Not found	<5%	<5%	Not found	Not found	Not found	51-75%	maybe 4	knotweed along bank of river & some big patches; one large patch of garlic mustard
Bronx Forest	BF17	1.76467	8/10/2010	Not found	<5%	Not found	<5%	Not found	<5%	Not found	<5%	Not found	Not found	Not found	Not found	<5%		Vines along edge; mugwort along edge
Bronx Forest	BF18	5.70016	8/10/2010	51-75%	Not found	Not found	5-25%	<5%	<5%	Not found	<5%	5-25%	Not found	<5%	<5%	51-75%	ENGLISH IVY	ivy near road at north end; Dense patches of invasives intersperced with wetland areas w/few invasives
Bronx Forest	BF19	0.51322	8/10/2010	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	<5%		knotweed at edges
Concrete Plant	CP01	1.29363	8/12/2010	Not found	<5%	<5%	5-25%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	5-25%		
Muskrat Cove	MC01	0.75152	8/12/2010	5-25%	<5%	Not found	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	5-25%		observed small area from MC02
Muskrat Cove	MC02	1.25419	8/12/2010	5-25%	<5%	Not found	Not found	Not found	<5%	Not found	<5%	5-25%	Not found	Not found	Not found	5-25%		observed from metro north platform; knotweed near river; vines near platform
Muskrat Cove	MC03	1.6223	8/12/2010	5-25%	<5%	Not found	<5%	Not found	Not found	Not found	<5%	Not found	5-25%	Not found	Not found	5-25%		knotweed near bridge; loosestrife scattered throughout near river
Muskrat Cove	MC04	2.85886	8/12/2010	51-75%	<5%	Not found	Not found	Not found	Not found	Not found	5-25%	5-25%	Not found	Not found	<5%	51-75%	MULTIFLORA ROSE	observed from opposite shore and sampled near overpass
Muskrat Cove	MC05	2.44164	8/12/2010	5-25%	<5%	Not found	5-25%	<5%	Not found	Not found	Not found	5-25%	Not found	Not found	5-25%	26-50%	WINEBERRY	knotweed also upland of path; mugwort dense upland to path; all invasives dense in patches except loosestrife
Muskrat Cove	MC06	1.08828	8/12/2010	26-50%	<5%	Not found	<5%	5-25%	<5%	Not found	5-25%	26-50%	Not found	Not found	Not found	51-75%		
Muskrat Cove	MC07	3.1622	8/12/2010	51-75%	<5%	Not found	5-25%	<5%	Not found	Not found	<5%	51-75%	Not found	<5%	<5%	>75%	MULTIFLORA ROSE; WINEBERRY	largest areas of loosestrife in Muskrat section 4 & above
Muskrat Cove	MC09	3.94236	8/12/2010	51-75%	Not found	Not found	Not found	5-25%	Not found	Not found	Not found	<5%	Not found	Not found	<5%	51-75%	WINEBERRY	inferred from sample at south end
Muskrat Cove	MC10	3.95076	8/12/2010	>75%	<5%	Not found	Not found	5-25%	Not found	Not found	<5%	5-25%	Not found	Not found	<5%	>75%	WINEBERRY	loosestrife inferred
River Park	RP01	1.33619	8/12/2010	<5%	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	<5%		
Shoelace	SP01	0.8735	8/10/2010	5-25%	Not found	Not found	<5%	Not found	Not found	<5%	Not found	Not found	Not found	<5%	<5%	5-25%	ENGLISH IVY	
Shoelace	SP03	0.63417	8/10/2010	5-25%	<5%	Not found	5-25%	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	5-25%		knotweed on north side; mugwort on southside
Shoelace	SP04	0.66524	8/10/2010	26-50%	Not found	Not found	<5%	<5%	Not found	Not found	<5%	<5%	Not found	Not found	Not found	26-50%		
Shoelace	SP06	1.28073	8/10/2010	26-50%	<5%	Not found	<5%	<5%	Not found	Not found	<5%	<5%	Not found	Not found	<5%	26-50%	WINEBERRY	
Shoelace	SP08	0.5069	8/10/2010	<5%	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	<5%		
Shoelace	SP09	1.94473	8/10/2010	26-50%	<5%	Not found	5-25%	<5%	<5%	Not found	<5%	<5%	Not found	Not found	<5%	26-50%	ENGLISH IVY	heavy bindweed patch near north end
Shoelace	SP10	5.18479	8/10/2010	>75%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	>75%		observed from opposite shore
Shoelace	SP12	1.46937	8/12/2010	26-50%	<5%	Not found	5-25%	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	26-50%		knotweed heavy along river; mugwort heavy on edges; bindweed in large patch; observed from bridge
Soundview	SV01	0.79052	9/29/2010	<5%	Not found	5-25%	<5%	51-75%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	>75%		
Soundview	SV02	0.23198	9/29/2010	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found		
Soundview	SV03	4.93555	9/29/2010	<5%	Not found	Not found	>75%	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	Not found	>75%		
Soundview	SV04	1.45935	9/29/2010	Not found	Not found	Not found	51-75%	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	Not found	51-75%		
Soundview	SV05	8.58861	9/29/2010	Not found	Not found	26-50%	51-75%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	>75%		
Soundview	SV06	0.36244	9/29/2010	5-25%	Not found	<5%	51-75%	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	Not found	>75%		
Soundview	SV07	6.28564	9/29/2010	Not found	Not found	5-25%	51-75%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	>75%		
Soundview	SV08	7.521	9/29/2010	<5%	Not found	<5%	26-50%	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	Not found	51-75%		
Soundview	SV09	7.03543	9/29/2010	Not found	Not found	51-75%	26-50%	Not found	Not found	<5%	Not found	Not found	Not found	5-25%	Not found	>75%		
Soundview	SV10	1.63009	9/29/2010	Not found	Not found	5-25%	26-50%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	51-75%		
Soundview	SV11	1.52967	9/29/2010	26-50%	Not found	Not found	26-50%	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	Not found	>75%		
Soundview	SV12	1.96234	9/29/2010	Not found	Not found	Not found	>75%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	>75%		
Soundview	SV13	1.68152	9/29/2010	Not found	Not found	<5%	26-50%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	51-75%		
Soundview	SV14	35.3073	9/29/2010	<5%	Not found	<5%	>75%	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	>75%		
Soundview	SV15	1.61721	9/29/2010	Not found	Not found	Not found	>75%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	>75%		
NYBG	BG01	0.68208	10/8/2010	>75%	Not found	Not found	Not found	Not found	<5%	<5%	Not found	Not found	Not found	<5%	<5%	>75%	SHRUB HONEYSUCKLE, CORK TREE	
NYBG	BG02	0.42927	10/8/2010	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	5-25%	CORK TREE	~ 10' upland from tree edge
NYBG	BG03	0.36238	10/8/2010	51-75%	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	Not found	5-25%	51-75%	CORK TREE	assessed by binoculars from bridge
NYBG	BG04	1.61061	10/8/2010	51-75%	Not found	Not found	Not found	<5%	Not found	<5%	Not found	<5%	Not found	<5%	<5%	51-75%	CORK TREE, DEVIL'S WALKING STICK	knotweed short in removal area, at southern end JK on banks only
NYBG	BG05	0.21203	10/8/2010	51-75%	Not found	Not found	Not found	<5%	Not found	5-25%	Not found	<5%	Not found	Not found	<5%	26-50%	HONEYSUCKLE, DEVIL'S WALKING STICK	up to rock outcrop
NYBG	BG06	0.63573	10/8/2010	5-25%	Not found	Not found	Not found	<5%	Not found	<5%	Not found	Not found	<5%	Not found	5-25%	5-25%	SHRUB HONEYSUCKLE, JAPANESE BARBERRY 1E, MULITIFLORA ROSE 1E, WINEBERRY 1A	river to path
NYBG	BG07	0.48098	10/8/2010	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	<5%		cultivated area by stone mill building
NYBG	BG08	0.48196	10/8/2010	5-25%	Not found	Not found	<5%	Not found	Not found	5-25%	Not found	Not found	Not found	Not found	<5%	26-50%	SHRUB HONEYSUCKLE, DEVIL'S WALKING STICK, ENGLISH IVY, CORK TREE	before floodplain widens
NYBG	BG09	0.70776	10/8/2010	51-75%	<5%	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	<5%	51-75%	SHRUB HONEYSUCKLE, DEVIL'S WALKING STICK, WINEBERRY	wider floodplain
NYBG	BG10	1.27278	10/8/2010	26-50%	Not found	Not found	Not found	Not found	Not found	<5%	Not found	<5%	Not found	Not found	<5%	26-50%	SHRUB HONEYSUCKLE, CORK TREE	
NYBG	BG11	0.1832	10/8/2010	Not found	Not found	Not found	Not found	Not found	Not found	<5%	Not found	Not found	<5%	Not found	<5%	5-25%	DEVIL'S WALKING STICK, CORK TREE, ENGLISH IVY, MULTIFLORA ROSE	small area therefore all the 1's = total of 2
NYBG	BG12	0.18074	10/8/2010	5-25%	Not found	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	Not found	<5%	5-25%	ENGLISH IVY, MULTIFLORA ROSE	
NYBG	BG13	0.45825	10/8/2010	<5%	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	5-25%	5-25%	DEVIL'S WALKING STICK, ENGLISH IVY, JAPANESE BARBERRY	invasives mostly north of bridge, assessed from path above
NYBG	BG14	1.42275	10/8/2010	26-50%	Not found	Not found	Not found	<5%	Not found	<5%	Not found	Not found	<5%	Not found	<5%	26-50%	ENGLISH IVY, WINEBERRY, MULTIFLORA ROSE E, SHRUB HONEYSUCKLE D	JK scattered throughout with heavy patches, honeysuckle heavier in north
West Farms	WF01	0.72567	10/13/2010	<5%	Not found	Not found	<5%	<5%	Not found	Not found	<5%	<5%	Not found	Not found	Not found	<5%		recently restored-removals;vines on wall at north end
Garrison Park	GP01	1.17027	10/13/2010	<5%	Not found	Not found	5-25%	Not found	Not found	Not found	<5%	Not found	Not found	<5%	Not found	5-25%		dead JK on riverebank-coming back slowly, bindweed at southern end;1/3 fabric covered
Drew Gardens	DG01	0.35298	10/13/2010	<5%	<5%	Not found	<5%	Not found	Not found	<5%	Not found	<5%	Not found	Not found	5-25%	5-25%	ENGLISH IVY (2), WINEBERRY (2), MULTIFLORA ROSE (1)	JK mostly small-past removals; loosestrife along river northend; most invasives in south end
Starlight Park	ST01	1.10078	9/22/2011	<5%	<5%	Not found	<5%	Not found	Not found	5-25%	Not found	5-25%	Not found	<5%	<5%	5-25%		
Starlight Park	ST02	4.91274	9/22/2011	<5%	Not found	Not found	<5%	Not found	Not found	5-25%	Not found	<5%	Not found	<5%	Not found	<5%		
Starlight Park	ST03	1.85669	9/22/2011	<5%	5-25%	Not found	5-25%	Not found	Not found	<5%	Not found	<5%	Not found	Not found	Not found	5-25%		
Starlight Park	ST04	0.30776	9/22/2011	Not found	Not found	Not found	5-25%	Not found	Not found	Not found	Not found	<5%	Not found	Not found	Not found	5-25%		
Starlight Park	ST05	1.87806	9/22/2011	<5%	Not found	Not found	51-75%	Not found	Not found	<5%	Not found	<5%	Not found	<5%	Not found	51-75%		

Muskrat Cove



This map depicts the existing total invasive plant cover along the Bronx River as of October 2010. Please see invasive cover chart for detailed breakdowns of each species within the individual units.

Legend

- NYC Parkland
- Bridge
- Trail
- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%
- Bronx River

0 200 400 Feet

N

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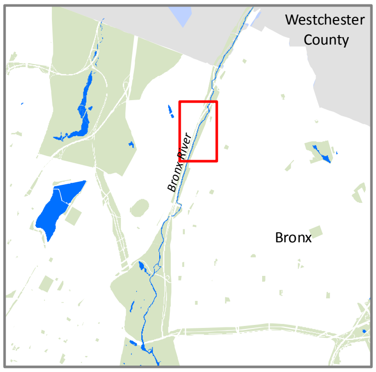
Shoelace Park North

220th St. to 233rd St.



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Legend

- NYC Parkland
- Trail
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 200 400 Feet

N

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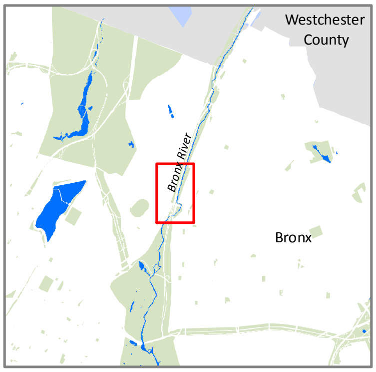
Shoelace Park South

Ft. Knox to 220th St.



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Legend

- NYC Parkland
- Trail
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 200 400 Feet

N

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Bronx Forest North

North of Burke Bridge

This map depicts the existing total invasive plant cover along the Bronx River as of October 2010. Please see invasive cover chart for detailed breakdowns of each species within the individual units.

Legend

- NYC Parkland
- Bridge
- Trail
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 100 200 Feet

N

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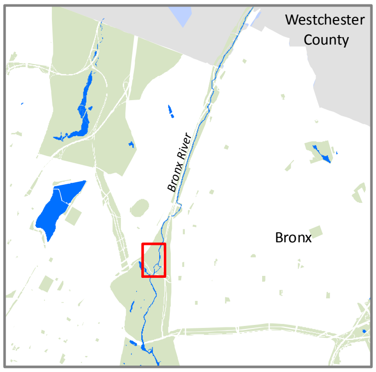
Bronx Forest South

South of Burke Bridge



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Legend

- NYC Parkland
- Bridge
- Trail
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 100 200
Feet

N

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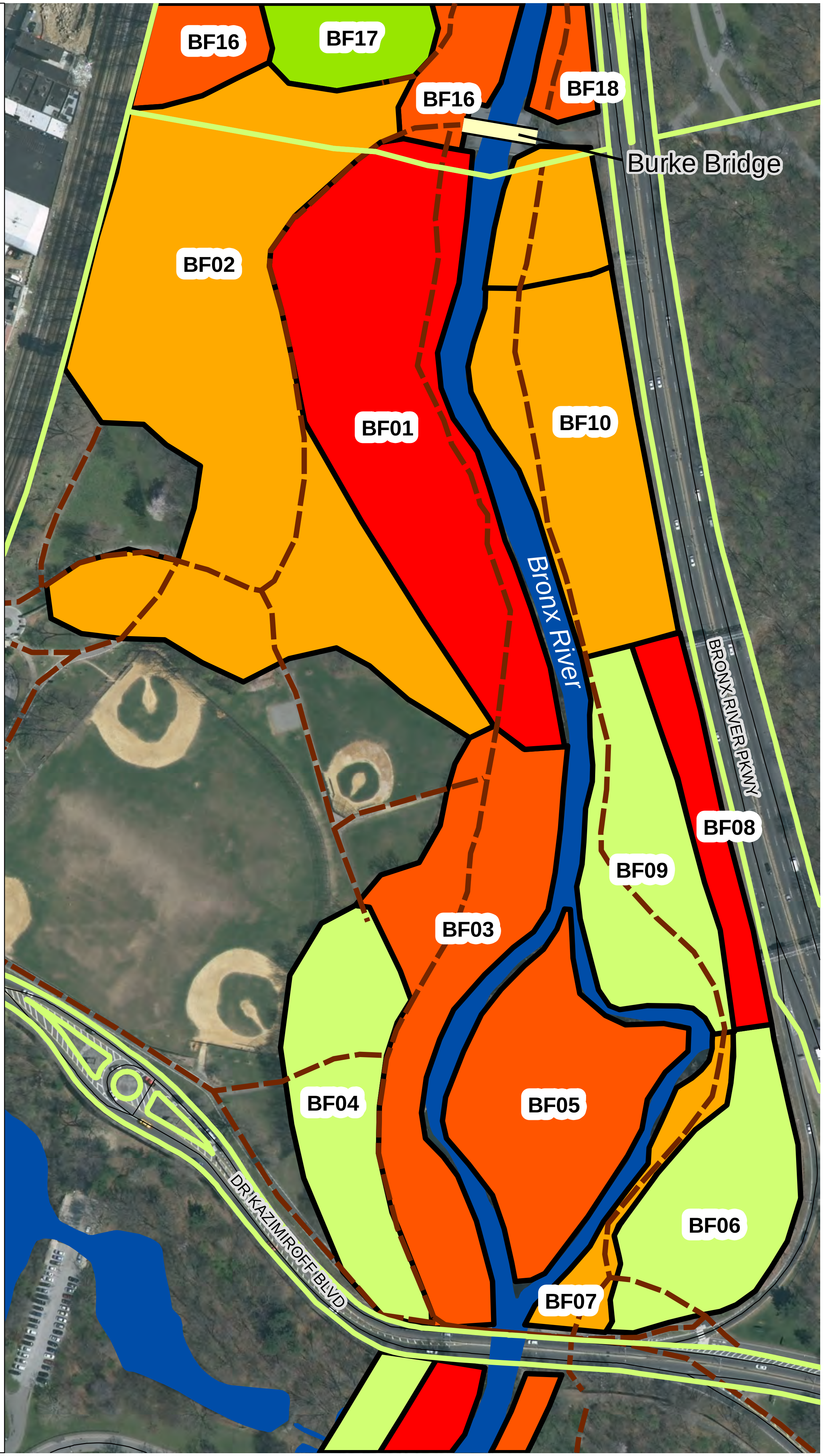
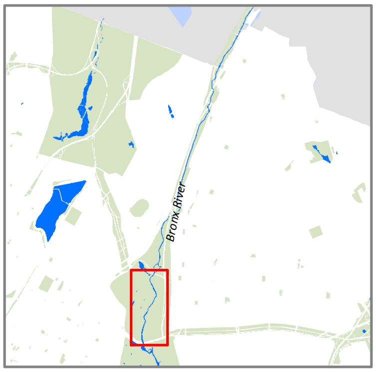


New York Botanical Garden



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Legend

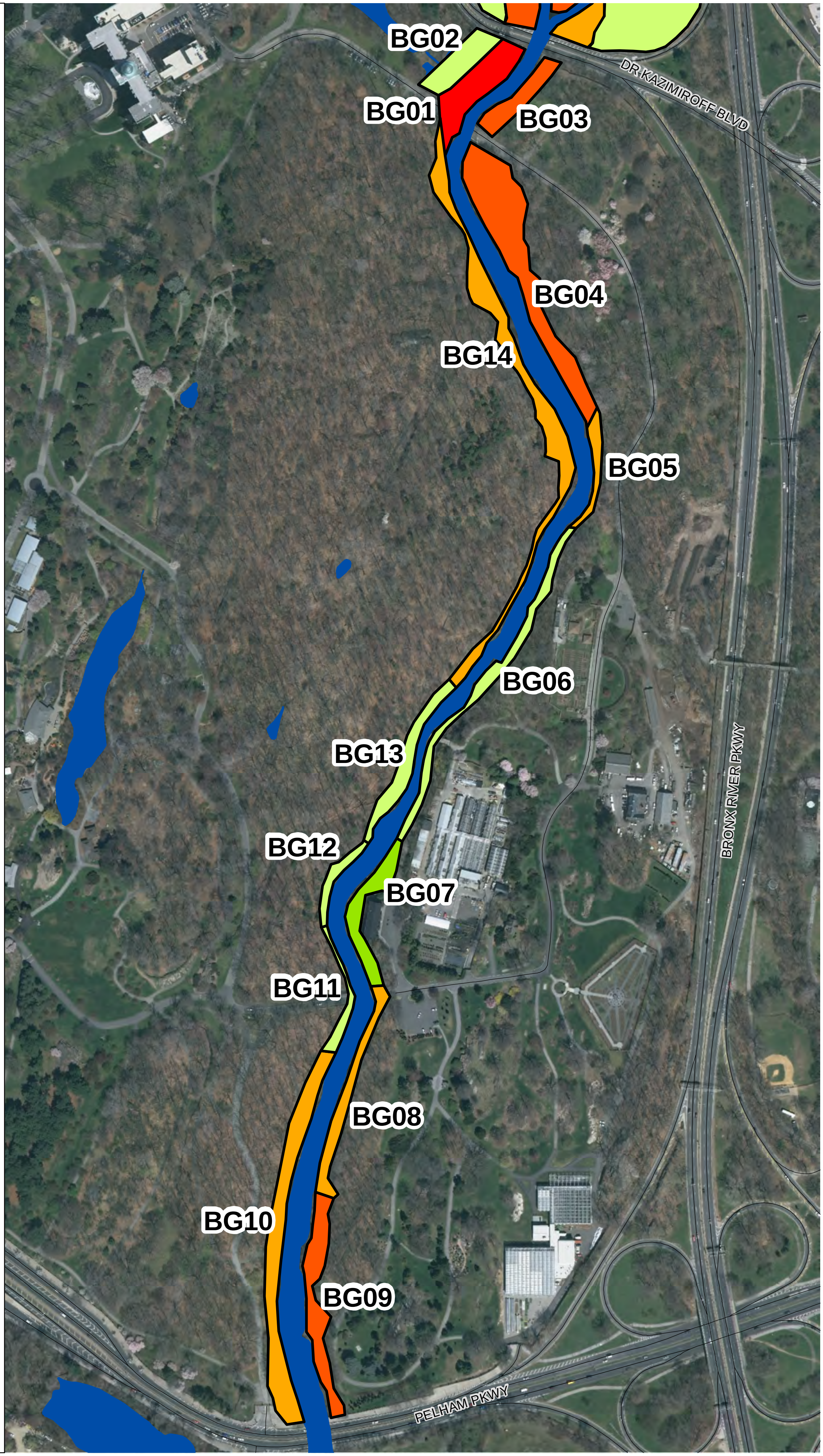
Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 200 400 Feet

N



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River Park and West Farms Rapids

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Legend

- NYC Parkland
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 100 200 Feet

N

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Drew Gardens

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Legend

- NYC Parkland
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 40 80 Feet

N

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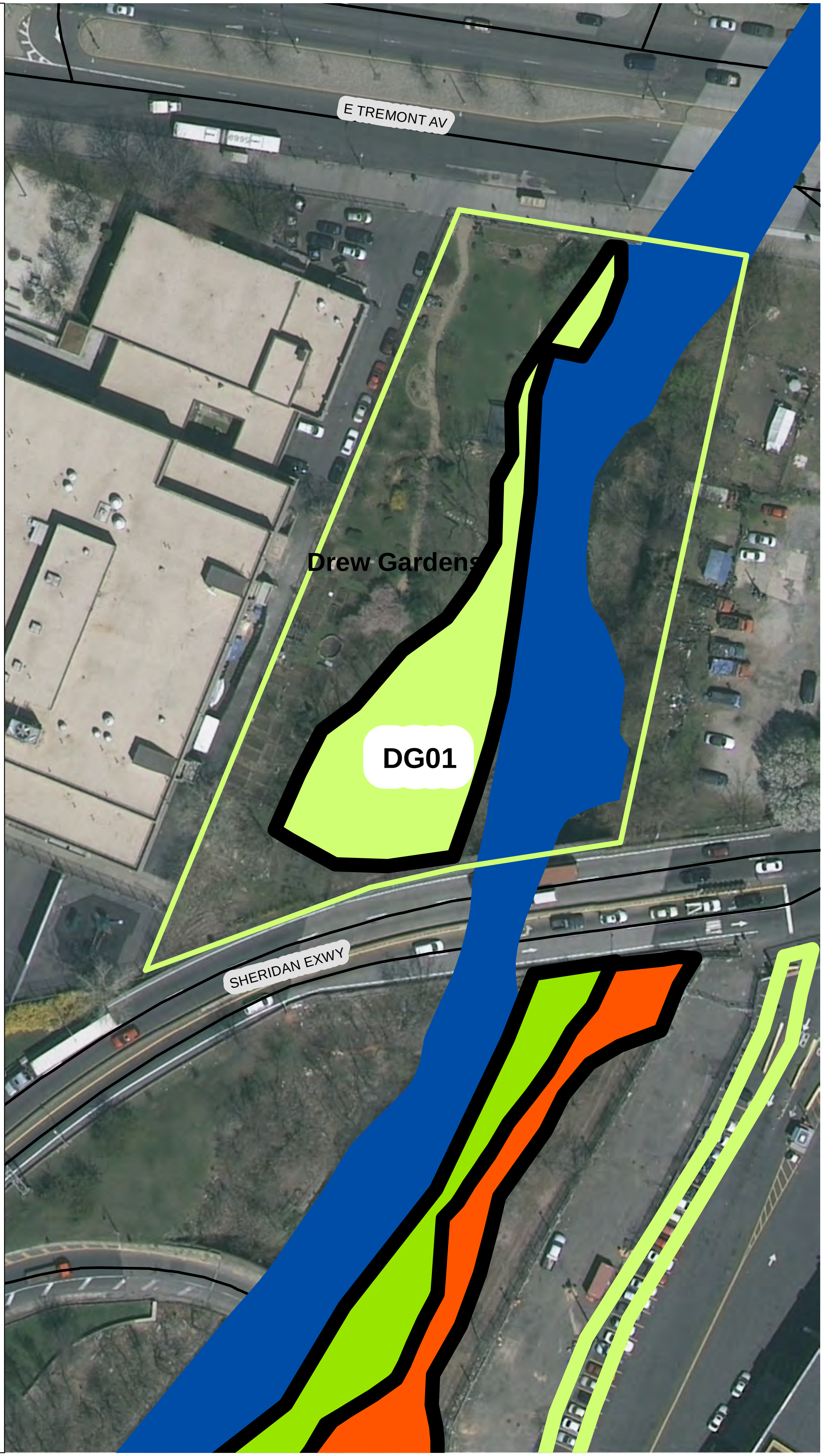
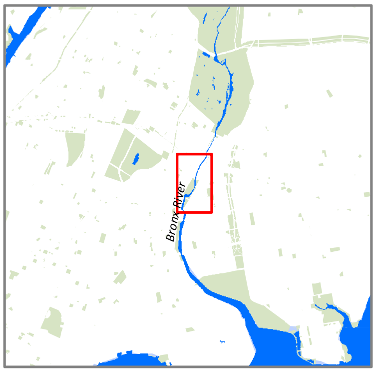


Starlight Park



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Legend

- NYC Parkland
- Bridge
- Trail
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 150 300 Feet

N

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Concrete Plant Park

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Legend

- NYC Parkland
- Trail
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 100 200 Feet

N

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Garrison Park

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Legend

- NYC Parkland
- Bronx River

Total Invasive Cover

- Not Found
- <5%
- 5-25%
- 26-50%
- 51-75%
- > 75%

0 25 50 Feet

N

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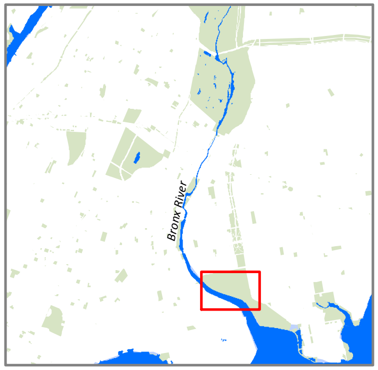
Soundview Park North



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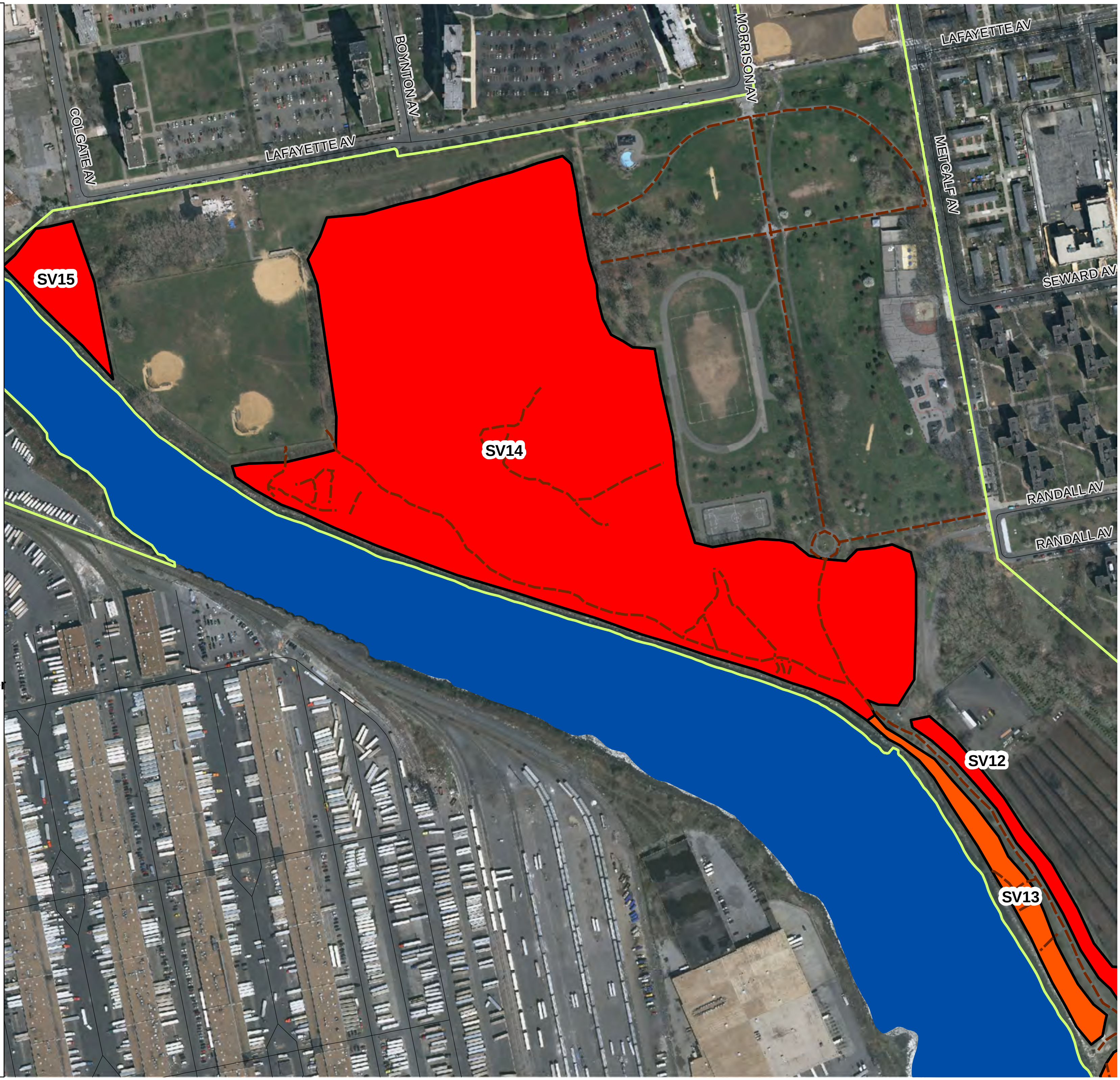
Legend

NYC Parkland
Trail
Bronx River

Total Invasive Cover
Not Found
<5%
5-25%
26-50%
51-75%
> 75%

0 200 400 Feet

N



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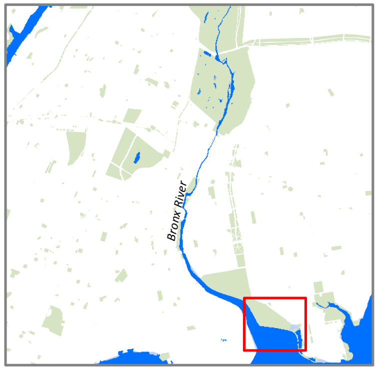
Soundview Park South



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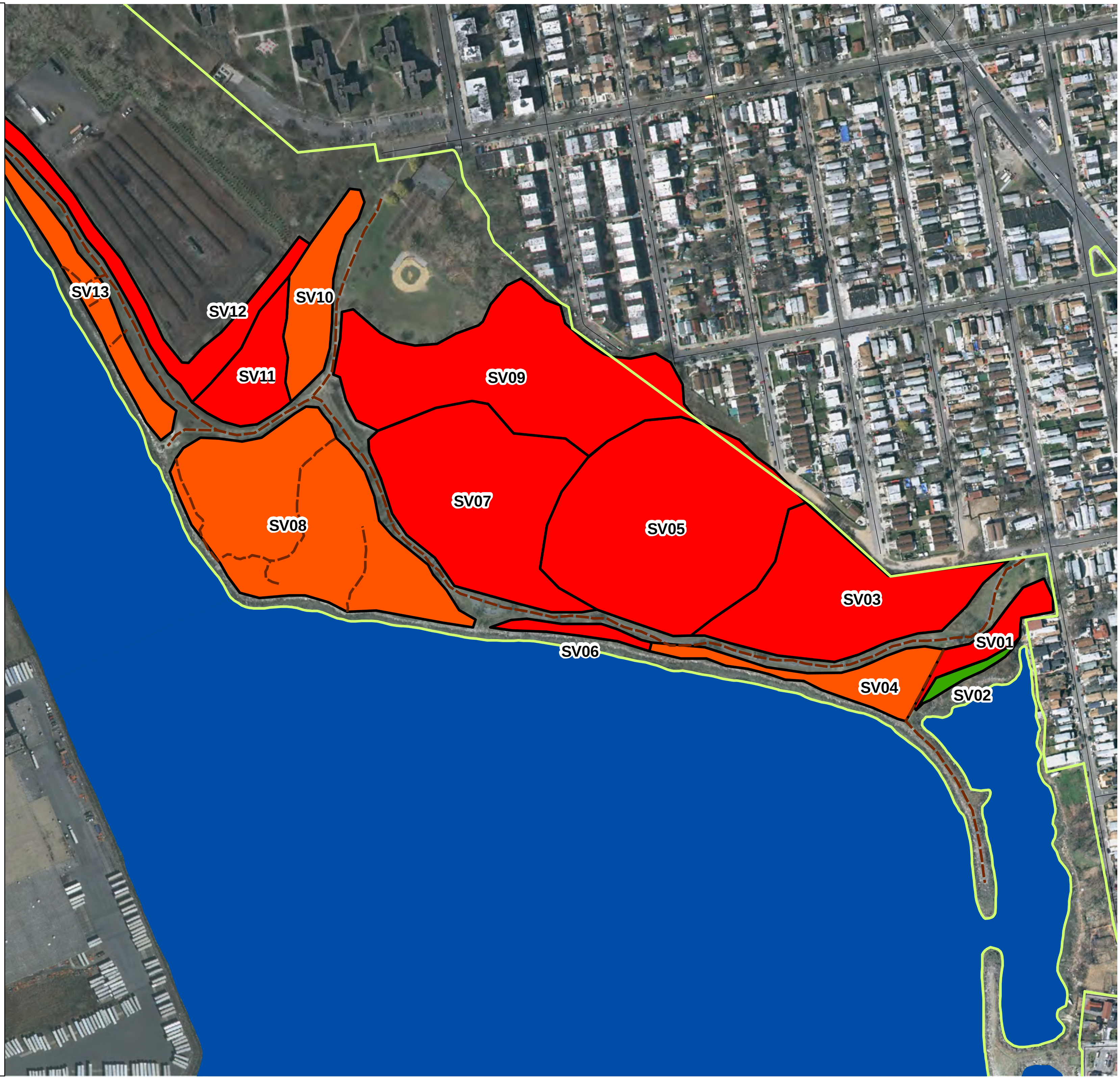
Legend

NYC Parkland
Trail
Bronx River

Total Invasive Cover
Not Found
<5%
5-25%
26-50%
51-75%
> 75%

0 200 400 Feet

N



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APPENDIX 3

NRG HERBICIDE TIMING GUIDE

Always follow the label and law!!		% herbicide	Jan				Feb				March				April				May				June				July				Aug				Sept				Oct				Nov				Dec			
Ampelopsis brevipedunculata	cut-squirt	100% Triclopyr	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	foliar (backpack)	2-4% Triclopyr or Glyphosate																				X	X	X	X	X	X	X	X	X	X	X	X	X	X															
	foliar (big rig)	1-2% Triclopyr and basal oil																				X	X	X	X	X	X	X	X	X	X	X	X	X	X															
Porcelainberry	basal	3-4% Garlon or 100% Pathfinder	X	X	X	X	X	X	X	X																																			X	X	X	X	X	X
	combo	4-2-2% Glyph-Tric-basal oil																				X	X	X	X	X	X	X	X	X	X	X	X	X	X															
	cut-back	late summer for seed source control, winter to facilitate access for summer spraying	X	X	X	X	X	X	X	X																								X	X	X	X	X	X									X	X	X
life cycle																						leaf out					flowering						fruiting										dying back									
Celastrus orbiculatus	cut-squirt	100% Triclopyr or Glyphosate	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	foliar (backpack)	2-4% Triclopyr or Glyphosate																				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X														
	foliar (big rig)	1-2% Triclopyr or Glyphosate																				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X														
Oriental Bittersweet	basal	5% Triclopyr or 100% Pathfinder	X	X	X	X	X	X	X	X																																			X	X	X	X	X	X
	combo	2-1-2% Glyph-Tric-basal oil																				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X														
	cut-back	late summer for seed source control, winter to facilitate access for summer spraying	X	X	X	X	X	X	X	X																								X	X	X	X	X	X									X	X	X
life cycle																leaf out					flowering																fruiting													
Humulus japonicas	foliar (backpack)	2% Glyphosate																		X	X	X	X	X	X	X	X	X	X	X	X																			
	foliar (big rig)	1% Glyphosate																		X	X	X	X	X	X	X	X	X	X	X	X																			
Japanese Hops	cut-back	mow/cut to ground														X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										
	hand-pull	to be done monthly													X	X	X	X	X	X	X	X																												
	combo	if with AMBR, use AMBR combo; if with CEOR, use CEOR combo																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	
life cycle																				leaf out					flowering										fruiting						dying back							
Artemisia vulgaris	foliar (big rig)	1% Glyphosate													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
Mugwort	combo	if with AMBR, use AMBR combo; if with CEOR, use CEOR combo										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
	BROD	2% Glyphosate + blue dye													X	X	X	X	X	X																															
	cut-back	cut to ground in winter to facilitate early spring spraying or if miss spring spraying, mow to calf height and wait 6-8 weeks to treat; if prepping site mid-summer, cut back to thigh height and wait 4-6 wks to spray	X	X	X	X	X	X	X	X										X	X	X	X	X	X	X	X	X	X	X	X												X	X	X	X	X	X	X
life cycle												leaf out																flowering																		dying back						
Alliaria petiolata	foliar (backpack)	2% Glyphosate											X	X	X	X	X																																	
	foliar (big rig)	1% Glyphosate												X	X	X	X	X																																
Garlic Mustard	combo	2% Glyphosate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	hand-pull	after plants shoot, but before seedpods dry out														X	X	X	X	X	X	X	X	X	X	X	X																							
life cycle												leaf out				flowering								fruiting																										
Polygonum cuspidatum	foliar (backpack)	5% Glyphosate																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
	foliar (big rig)	3-5% Glyphosate																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
Japanese Knotweed	combo	if with AMBR, use AMBR combo; if with CEOR, use CEOR combo																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
	inject	100% Glyphosate																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
life cycle															leaf out																	flowering								fruiting			dying back									
Phragmites australis	foliar (backpack)	5% Glyphosate																										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
	foliar (big rig)	3-5% Glyphosate																								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
Phragmites	combo	if with AMBR, use AMBR combo; if with CEOR, use CEOR combo																								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
	hand-wipe	1 part glyphosate/3 parts water																																	X	X	X	X	X													
	cut-back	prepping site mid-summer, cut back to thigh height and wait 6-8 wks to spray	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X															X	X	X	X
life cycle																				leaf out												flowering					fruiting														
Lythrum salicaria	foliar (backpack)	1-5% glysphate or 1-2% Garlon (to inhibit vegetative growth)																										X	X	X	X	X	X	X	X	X	X														
Purple Loosestrife	foliar (backpack)	2% 2,4-D (to prevent seedling growth)													X	X	X	X	X	X	X	X													X	X	X	X	X	X										
	hand-pull	Remove all stems and root mass.																	X	X	X	X	X	X	X	X	X	X	X	X	X																			
life cycle																	leaf out																	flowering						dying back											
Ranunculus ficaria	foliar (backpack)	53.8% glyphosate isopropylamine salt					X	X	X	X	X	X	X	X	X	X	X	X																																
Lesser Celandine/Buttercup	hand pull						X	X	X	X	X	X	X	X	X	X	X	X																																
life cycle								leaf out			flowering												dying back																														
Convolvulus arvensis	foliar (backpack)	glysophate or 5% acetic acid																										X	X	X	X	X	X																		
	foliar (backpack)	2% Accord xrt II (or other glysophate based product)											X	X	X	X	X	X																																	
Bindweed	Cut-back	cut to ground ever 12-14 days																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										
	hand-pull	Pull before seeds set but after flowering																												X	X	X	X																			
life cycle																					leaf out					flowering								fruiting									dying back									
Phellodendron amurense	foliar (backpack)	triclopyr and glysophate	X	X	X	X	X	X	X	X									X	X	X	X	X																						X	X	X	X	X	X	X	X
	cut and girdled		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Amur Cork Tree	combo	triclopyr and oil	X	X	X	X	X	X	X	X									X	X	X	X	X																						X	X	X	X	X	X	X	X
	Cut-stump	cut tree and apply triclopyr	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
life cycle																leaf out									flowering				fruiting																							

APPENDIX 4

Japanese knotweed control study

Purpose
A study by NRG (2007) on the effectiveness of Urban Riparian Restoration (URR) along the Bronx River revealed that the efficacy and success of native plant restoration efforts cannot be determined due to variability in invasive plant management along the river and the absence of coordinated tracking of management activities. Charles and Palmer (unpublished, 2006) conducted the only study focused on invasive plant control on the Bronx River and found that plots seeded with Virginia wildrye, *Elymus virginicus,* had significantly lower cover of Japanese knotweed, *Fallopia japonica,* than did plots treated with weed-control fabric. However, fabric treated plots were observed to have larger shrub size, greater understory species richness and higher percent native species cover than *E. virginicus* seeded plots. With many questions remaining unanswered and needing more information to effectively address the threat of knotweed to the riparian system, NRG and NYBG designed a controlled experiment in 2010 to test the response of Japanese knotweed to two different mechanical control treatments on the banks of the Bronx River in an urban forest over several years. The results of this experiment will inform the control strategies within our adaptive management framework.

Methods
We established 120 vegetation plots in the Bronx Forest and NYBG along the Bronx River in April, 2010. Each plot measured 2m x 2m. We placed 60 plots each in the Bronx Forest (Map 1) and NYBG (Map 2). The plots were placed as close to possible to the edge of the river at the top of the bank with a 0.5 m buffer between plots. Areas were chosen with minimal canopy coverage and *F. japonica* shoots present. Plots were marked with a flag in at least two corners, and GPS points were collected using a Trimble Pathfinder ProXR capable of sub-meter accuracy. Missing flags were replaced as needed. One pin oak (*Quercus palustris*) tree growing in a 2 gallon container was planted in the center of each plot in mid-April 2010. The pin oak tree allowed us to compare the response of a native woody tree species to the different knotweed treatments. The initial sampling was performed approximately two weeks after tree planting. Another sampling was performed during the last week of August each year, a few days prior to the scheduled third application of treatments (see below).

<u>Treatments</u>
Each plot was randomly assigned one of three treatments in equal numbers (40 plots per treatment type): (A) cutting 3 times per growing season, (B) cut first treatment and grub next two treatments per growing season, and (C) control – do nothing. Hereafter, treatment A will be referred to as cut, treatment B will be referred to as grub, and treatment C will be referred to as control. Grubbing involves the removal of all targeted vegetative matter, in this case knotweed roots and rhizomes, to whatever depth is necessary (usually 2-4 ft). Knotweed will root to various depths depending on environmental conditions. We used shovels to grub knotweed roots and rhizomes. Cutting is defined as cutting all non-woody vegetation inside the plot to the base of the stem. Cutting was performed with hand clippers or gas-powered hedgetrimmers. Treatments were applied approximately nine weeks apart commencing with

the first treatment during the first week of May of each year. Plots were randomly assigned a treatment so that we started with an equal number of plots for each treatment.

Vegetation survey

Vegetation sampling was carried out by NRG, BxRA, and NYBG staff. A 2 m x 2 m frame of PVC pipe was used to accurately define the edges of a plot. All plants growing within each plot, excluding the planted pin oak tree, were identified to the species or genus level, and percent cover class assigned. Six cover class categories were employed: <5, 5-10, 11-25, 26-50, 51-75, and 76-100%.

Japanese knotweed

Knotweed vigor was measured by stem density/plot, average plant height, and percent cover. Knotweed was measured concurrently with vegetation sampling. We counted every stem of knotweed in the plot to obtain stem density. The average plant height was determined by measuring the heights of six plants: plants closest to each corner of the plot and 2 plants near the center of the plot – one closest to a point approximately five inches northeast and southwest of the pin oak in the center of the plot. If the plot contained less than 6 stems, we averaged the height of all stems in the plot. The total knotweed cover was visually estimated and classified into six percent cover class categories: <5, 5-10, 11-25, 26-50, 51-75, or 76-100%.

Pin oak

The change in size of the planted pin oak tree was used as an indicator of growth rate and was measured by stem diameter, stem height, crown size, and mortality. The stem diameter was measure six inches above the base of the stem. Height was measured from the ground to the end of the bud of the leader stem. We measured the crown spread in two different directions: the longest line that can be drawn across the crown, and the longest line that can be drawn across the crown perpendicular to the first measurement. It should be noted that a two year time period may not be enough to determine an appreciable difference in the growth rate of pin oak trees transplanted from 2 gallon containers, and some mortality will be expected from transplant shock.

Statistical methods

A Kruskal-Wallis test was performed to look at potential differences in understory vegetation (i.e., species richness), Japanese knotweed variables (i.e., knotweed height, stem density, and percent cover class), and pin oak variables (i.e., tree height, tree diameter, and crown spread) across treatment types and sampling dates. If the test revealed a significant difference among the samples, multiple pair-wise comparisons and a post-hoc Bonferroni correction were performed to determine which means were significantly different. All statistical analyses were performed using SYSTAT version 10 (2000) of SPS.

Results

Preliminary results are reported below. We will be sampling through the 2012 growing season and the data analysis is ongoing.

Species richness
From April 2010 to August 2011, 132 different plants were identified within the 120 plots surveyed along the Bronx River. Of these 132 plants, 41 were native species, 31 were non-native and the remaining plants were only identified to genus level, thus nativity was not determined. Average species richness increased from 6.38 during the initial sampling period (April 2010, time 0) to 8.56 during the second sampling period (August 2010, time 1), and then decreased to 4.55 during the third sampling period (August 2011, time 2). Overall, average species richness differed among sampling dates (Kruskal-Wallis; $H=9.287$, $p<0.001$).

In August 2011, there was an average species richness of 3.47 in control plots, 5.49 in cut plots, and 5.26 in grub plots (Table 1, Figure 1). From April 2010 to August 2011, species richness in control plots decreased by an average of 47.6%. Species richness decreased by an average of 13.2% and 14.7% in cut and grub plots, respectively (Table 2).

Average species richness differed among treatment types (Kruskal-Wallis; $H=6.746$, $p=0.034$). Multiple pair-wise comparisons revealed that species richness differed significantly only between cut and control plots ($p=0.016$). Grub plots did not differ significantly from both cut ($p=0.833$) and control plots ($p=0.117$). However, when we removed control plot data from the sample and only compared cut plots to grub plots, there is a significant difference in average species richness between cut and grub plots (Kruskal-Wallis; $H=5.065$, $p=0.024$).

Table 1: Average species richness by treatment type and sampling period.

Time	Sampling period	Cut	Grub	Control
0	**Apr. 2010**	6.33	6.18	6.63
1	**Aug. 2010**	9.20	9.40	7.08
2	**Aug. 2011**	5.49	5.26	3.47

Table 2: Percent change in average species richness by treatment type during the sampling period April 2010 to August 2011.

Time period	Cut	Grub	Control
0 to 1	45.5%	52.2%	6.8%
0 to 2	-13.2%	-14.7%	-47.6%

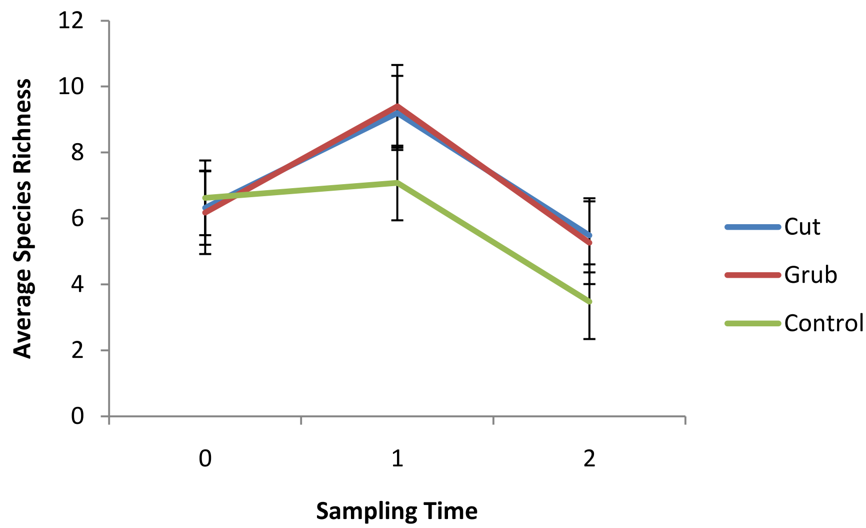


Figure 1: Change in average species richness by treatment type. Bars indicate standard error.

<u>Japanese knotweed</u>

Stem density

From April 2010 to August 2011, average knotweed stem density decreased by 15.74%, 25.77%, and 22.71% in cut, grub, and control plots, respectively (Tables 3 and 4). Overall, average stem density differed among the sampling periods (Kruskal-Wallis; $H=11.229$, $p= 0.004$), showing a decrease in stem density over time. Multiple pair-wise comparisons revealed that stem density differed between all sampling periods ($p<0.001$ for all pairings). However, stem density did not differ among treatment types (Kruskal-Wallis; $H=2.723$, $p=0.256$, Figure 7).

Treatment alone did not significantly change the average knotweed density (Kruskal-Wallis; $p=0.233$).

Table 3: Average knotweed stem density (stems/plot) by treatment type and sampling period.

Time	Cut	Grub	Control
0	52.1	60.275	51.075
1	49.075	51.225	43.308
2	43.897	44.744	39.475

Table 4: Percent change in knotweed stem density by treatment.

Time period	Cut	Grub	Control
0 to 1	-5.81%	-15.01%	-15.21%
0 to 2	-15.74%	-25.77%	-22.71%

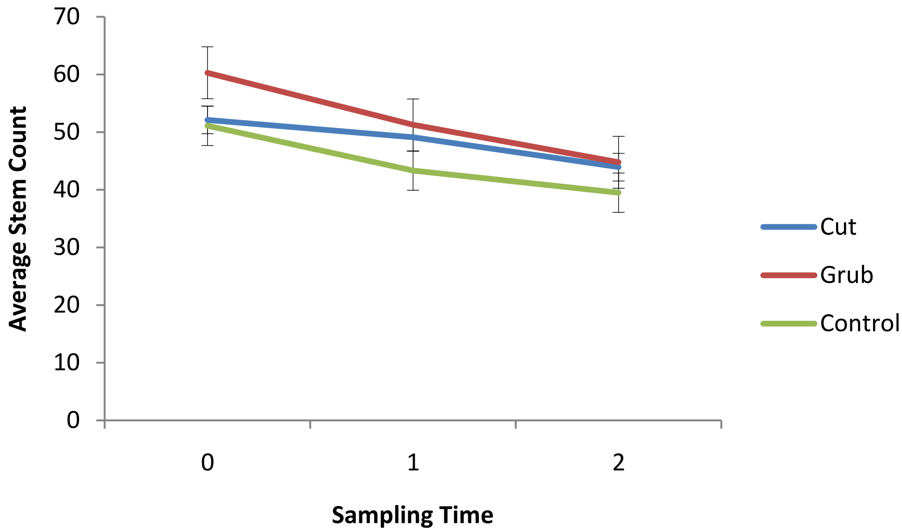


Figure 2: Change in average stem density over time by treatment type. Bars indicate standard error.

Stem height

Average knotweed height decreased over time in the cut and grub treatments, but increased in the control plots (Tables 5 and 6, figure 3). In August 2011, control plots had the highest average knotweed stem height at 106.02 cm, while average knotweed heights for cut and grub plots were 32.64 cm and 33.21 cm, respectively (Table 5). Average knotweed height increased by 77.66% in control plots, but decreased by 41.1% and 47.76% in cut and grub plots, respectively, over the study period (Table 6, figure 3). Average knotweed height differed over the study period (Kruskal-Wallis; $H=14.281$, $p = 0.001$) and differed among treatments (Kruskal-Wallis; $H=68.065$, $p<0.001$). Multiple pair-wise comparisons revealed that average knotweed height in control plots differed from both cut and grub plots ($p<0.001$ for both comparisons), but did not differ between cut and grub plots ($p=0.457$).

Table 5: Average knotweed height by treatment.

Time	Cut	Grub	Control
0	55.41	63.58	59.68
1	46.23	52.67	68.48
2	32.64	33.21	106.02

Table 6: Percentage change in average knotweed height by treatment.

Time period	Cut	Grub	Control
0 to 1	-16.57%	-17.16%	14.76%
0 to 2	-41.10%	-47.76%	77.66%

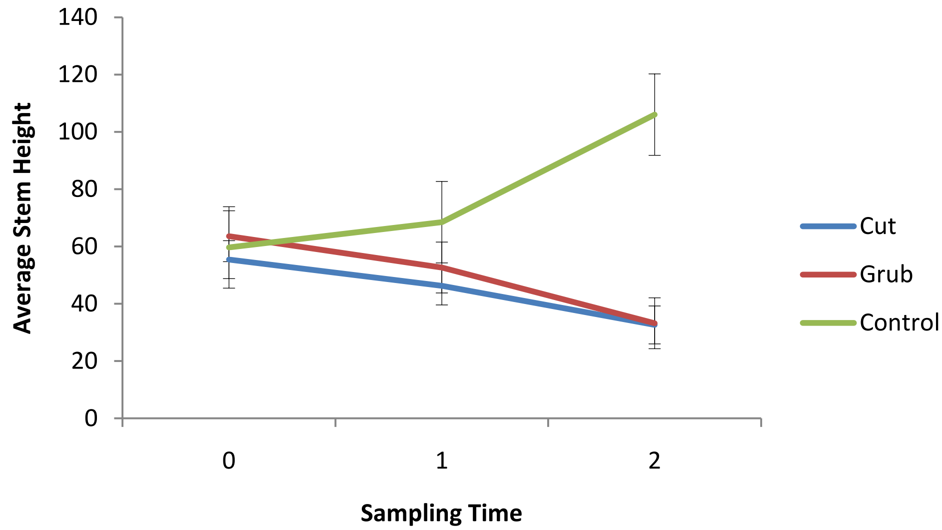
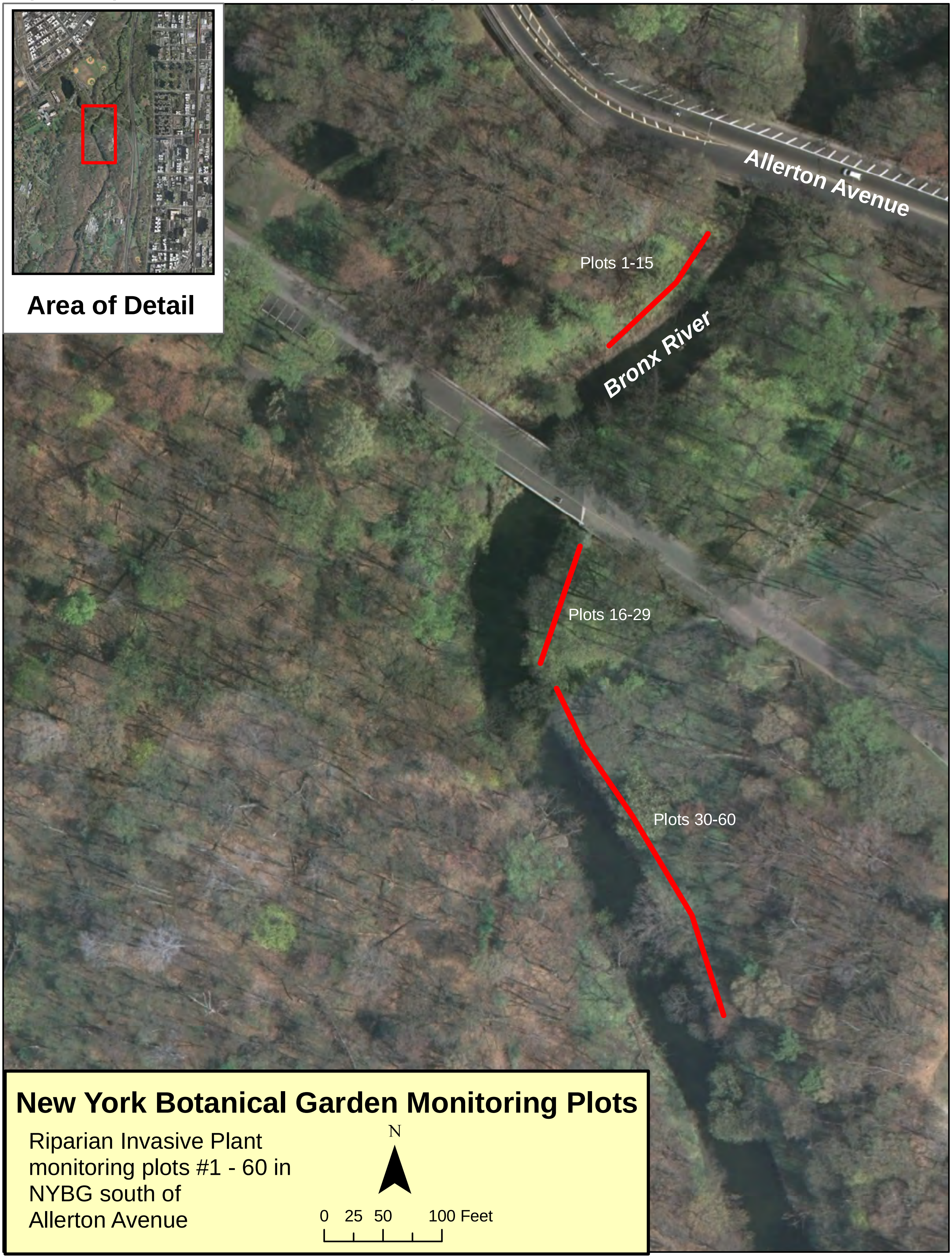


Figure 3: Change in knotweed height over time by treatment. Bars indicate standard error.

Map 1. Japanese knotweed monitoring plots located in the Bronx Forest.

Map 2. Japanese knotweed monitoring plots located in NYBG.



APPENDIX 5

BRONX RIVER ALLIANCE CREW TRACKING FORM

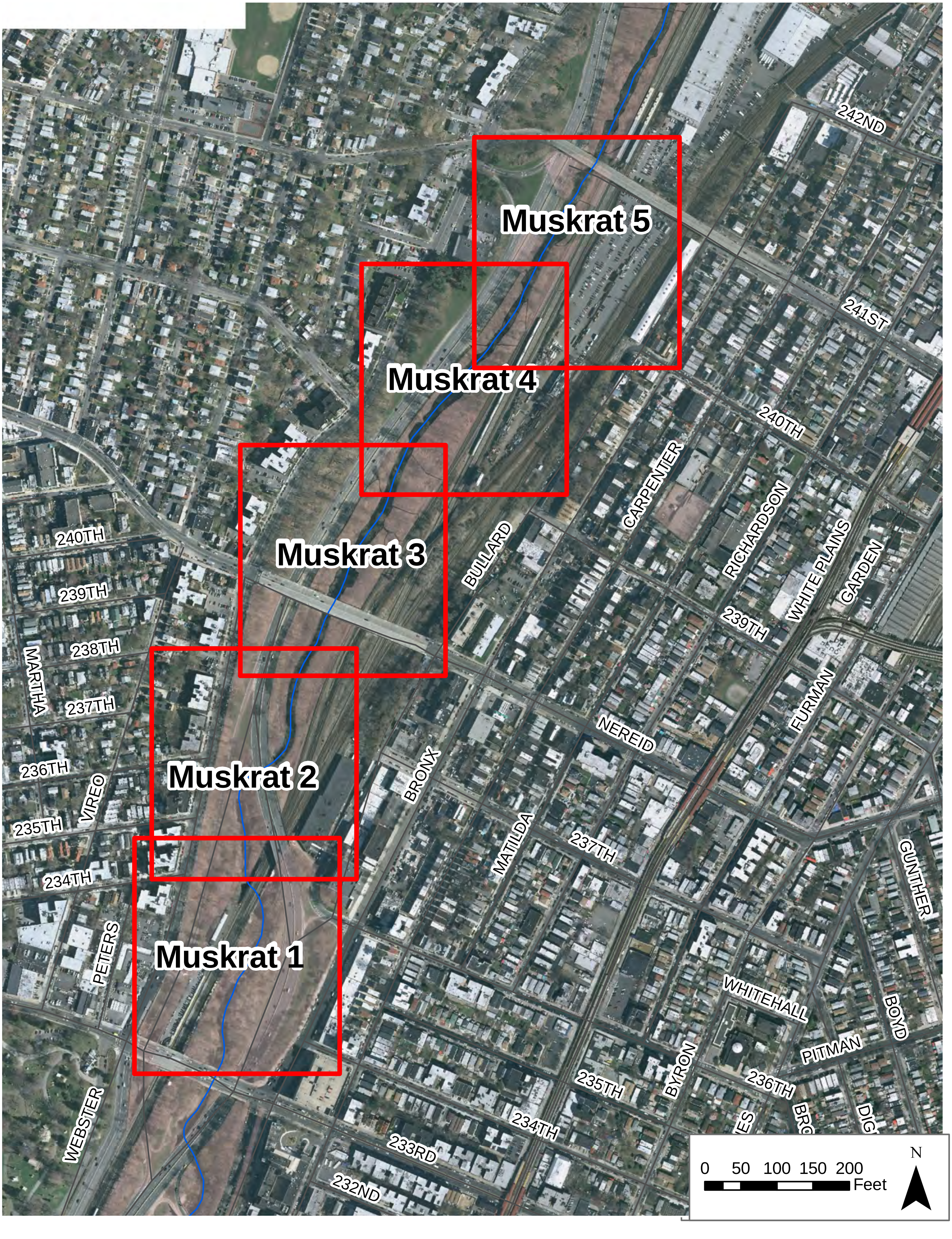
J:\BRONX RIVER ALLIANCE\EcoRestoration&Mngmt\Crew Folder\Forms, Flyers & Logos\NRG-CREW data Forms									
DATE:			VOLUNTEER PARTNER:			STAFF:			
RECORDERS INITIALS:									
						Volunteer last name/s			
# OF VOLUNTEERS:						CREWLEADERS:			
GPS Coordinates			PROGRAM:(CIRCLE) BxRA / Parks / other						
Park name (see back). Example: Shoelace Park	Park Sub-area (define in own words). Example: 227th St playground	Task Code (see back) new = (n) maintain = (m)	Hours per task	Quantity (units on back)	Species	Plant type	Height	Notes	

BRONX RIVER ALLIANCE CREW TRACKING FORM

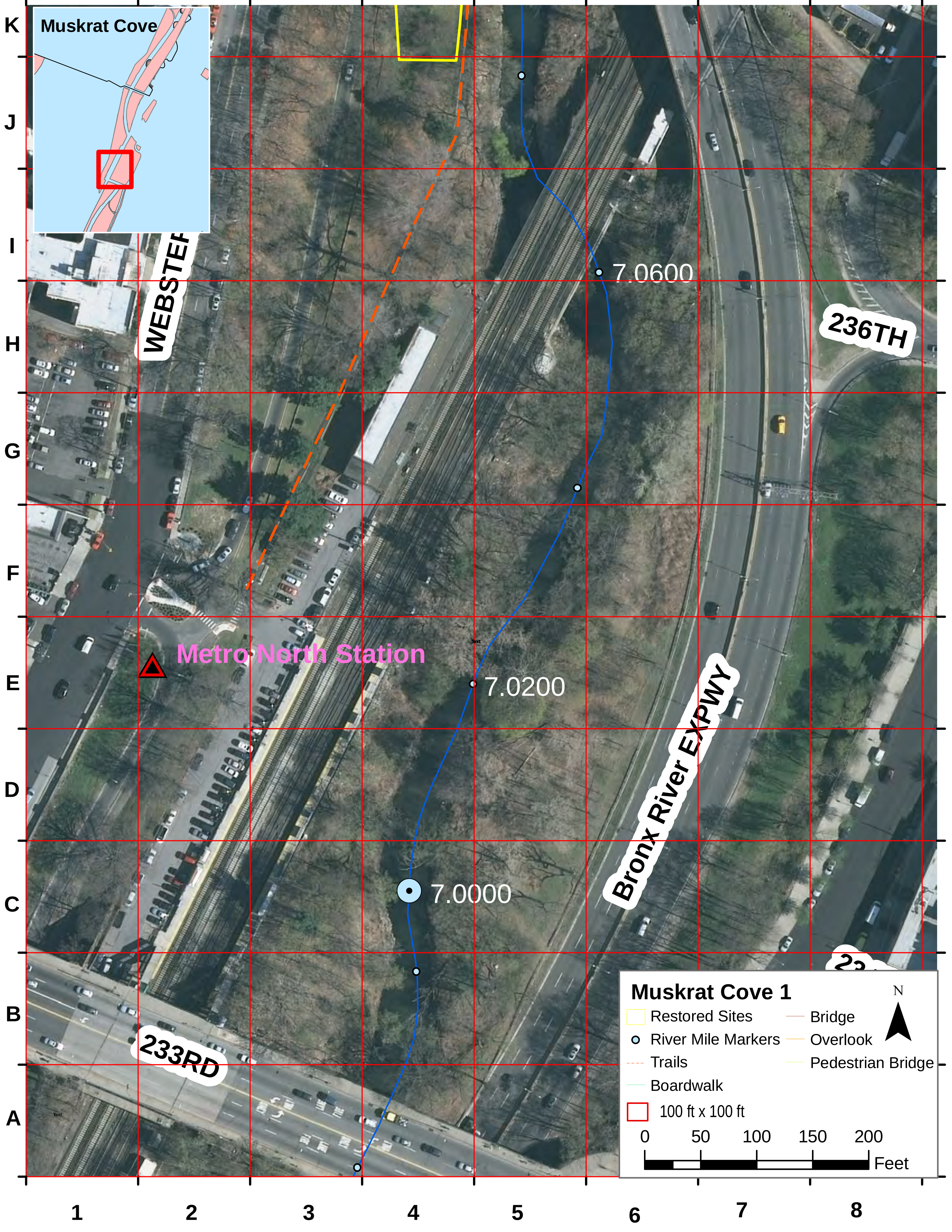
BRONX RIVER ALLIANCE DATA FORM		USE THESE CODES FOR PAGE ONE UNDER TASK CODE			
VEGETATION:	1 WATER 2 PRUNING	3 WOODCHIPPING	4 PLANTING -S/SHRUBS T/TREES H/HERBACEOUS		
MONITORING:	5 HAZARDOUS TREES	6 EVAPORATION PAN(# BUCKETS)	7 H20 TEST 8 RECON	9 PLOT	
	10 FISH	11 LADDERS			
PLANT REMOVAL:	12 HAND PULL (SQ FT)	13 HAND PULL & REMOVE (SQ FT)	14 CUT (SQ FT) 15 CUT & P 16 GRUB		
GENERAL REMOVAL:	17 TRASH 18 TIRE	19 BLOCKAGES	20 # OF TREE IN RIVER	21 # OF TREE ON 22 SNOW/ICE	
INSTALLATION:	23 SNOW FENCE (LINEAR FT)	24 WIRE FENCE (LINEAR FT)	25 JUTE MAT (SQ FT)	26 FELT FABRIC (31 MULCH	
	27 COIR LOGS (LINEAR FT)	28 COIR MAT (SQ FT)	29 HAY (BALES)	30 COMPOST (SQ FT)	
RWH TREATMENT:	32 OFFICE (SPECIFY)	33 SUPPLIES (PURCHASE, PICK UP, DROP OFF)		34 SITE VISIT/ DESIGN/MAINTENANCE	
	35 BARREL INSTALL	36 GUTTER INSTALL	37 WINTERIZE/SUMMERIZE		
OTHER ACTIVITIES:	38 MEETINGS	39 SALT SPREADING	40 CLEAN-UP 41 EVENT PREP		42 SPECIAL EVENT
	43 TRAINING	44 ADMINISTRATIVE/ DATA ENTRY			
RECREATION:	45 CANOE TRIPS	46 EDUCATION WALKS	47 BIKING		
MAINTENANCE:	48 REPAIRS	49 CHAINSAWS	50 VEHICLES/FLEET	51 TOOLS	
OTHER	52 OTHER (include wildlife sightings!)				

USE THESE PARK NAMES TO STATE YOUR LOCATION, DEFINE SUBAREA OF PARK (ON REVERSE) IN YOUR OWN WORDS

Muskrat	No Forest	W Farms	Hunts Pt Riverside Park
Shoelace	Fr Charley	Starlight	Soundview
Ft Knox	So Forest	Concrete	other
Rosewood	River Pk	Garrison	



Muskrat 5
Muskrat 4
Muskrat 3
Muskrat 2
Muskrat 1
242ND
241ST
240TH
CARPENTER
RICHARDSON
BULLARD
WHITE PLAINS
GARDEN
239TH
FURMAN
NEREID
BRONX
MATILDA
237TH
GUNTHER
WHITEHALL
BOYD
PITMAN
BYRON
236TH
235TH
234TH
233RD
232ND
240TH
239TH
238TH
MARTHA
237TH
236TH
VIREO
235TH
234TH
PETERS
WEBSTER
0 50 100 150 200
Feet
N



Muskrat Cove
K
J
I
H
G
F
E
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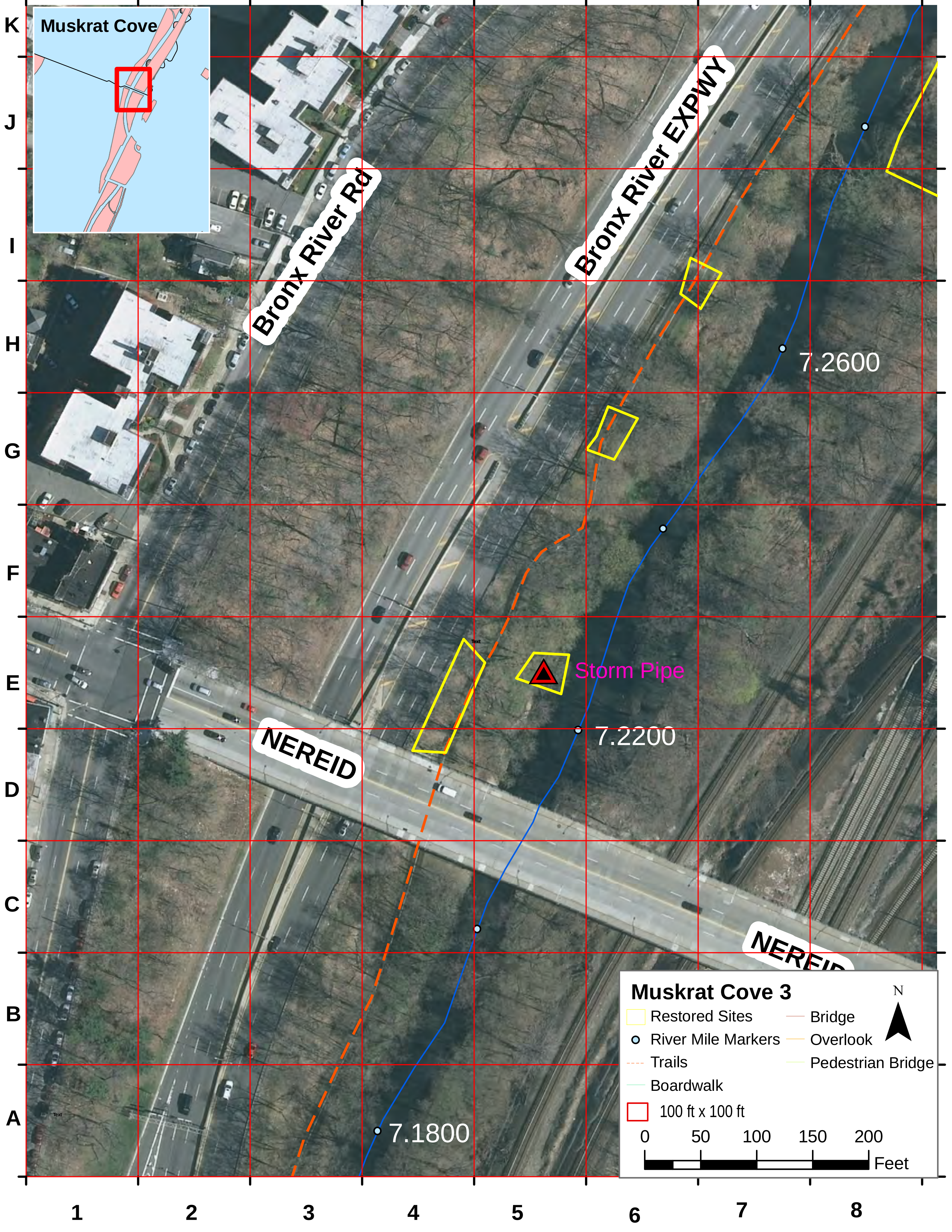
C
B
A
1
2
3
4
5
6
7
8
7.0600
236TH
Metro-North Station
7.0200
7.0000
Bronx River EXPWY
233RD
Muskrat Cove 1
N
Restored Sites
Bridge
River Mile Markers
Overlook
Trails
Pedestrian Bridge
Boardwalk
100 ft x 100 ft
0
50
100
150
200
Feet


Muskrat Cove
Webster
236th
7.1800
7.1400
7.1000
K
J
I
H
G
F
E
D
C
B
A
1
2
3
4
5
6
7
8
Muskrat Cove 2
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
100 ft x 100 ft
0
50
100
150
200
Feet
N


Muskrat Cove
Bronx River Rd
Bronx River EXPWY
7.2600
Storm Pipe
7.2200
NEREID
NEREID
7.1800
K
J
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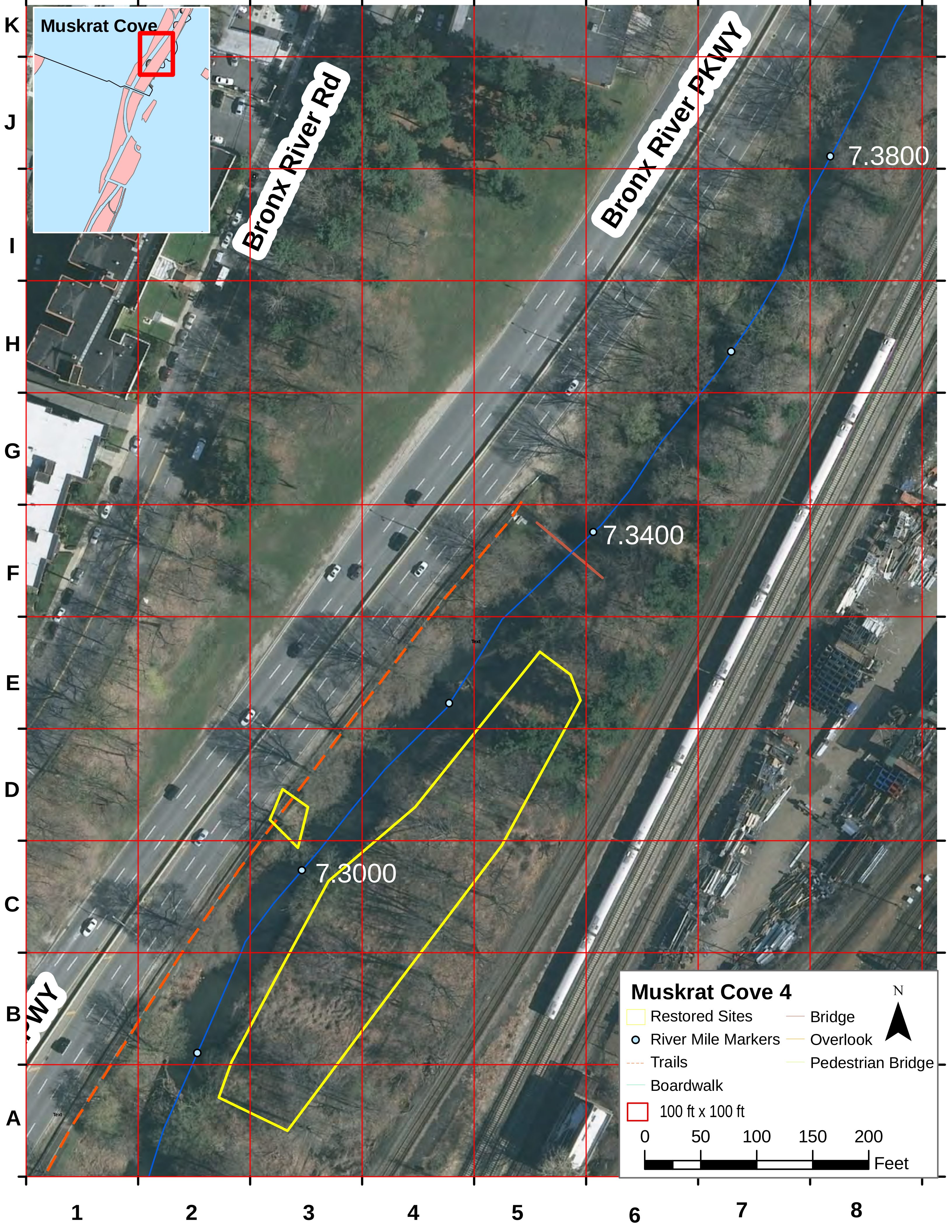
8
Muskrat Cove 3
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
100 ft x 100 ft
0
50
100
150
200
Feet
N



Muskrat Cove
Bronx River Rd
Bronx River PKWY
7.3800
7.3400
7.3000
PWY
Muskrat Cove 4
Restored Sites
Bridge
River Mile Markers
Overlook
Trails
Pedestrian Bridge
Boardwalk
100 ft x 100 ft
0
50
100
150
200
Feet
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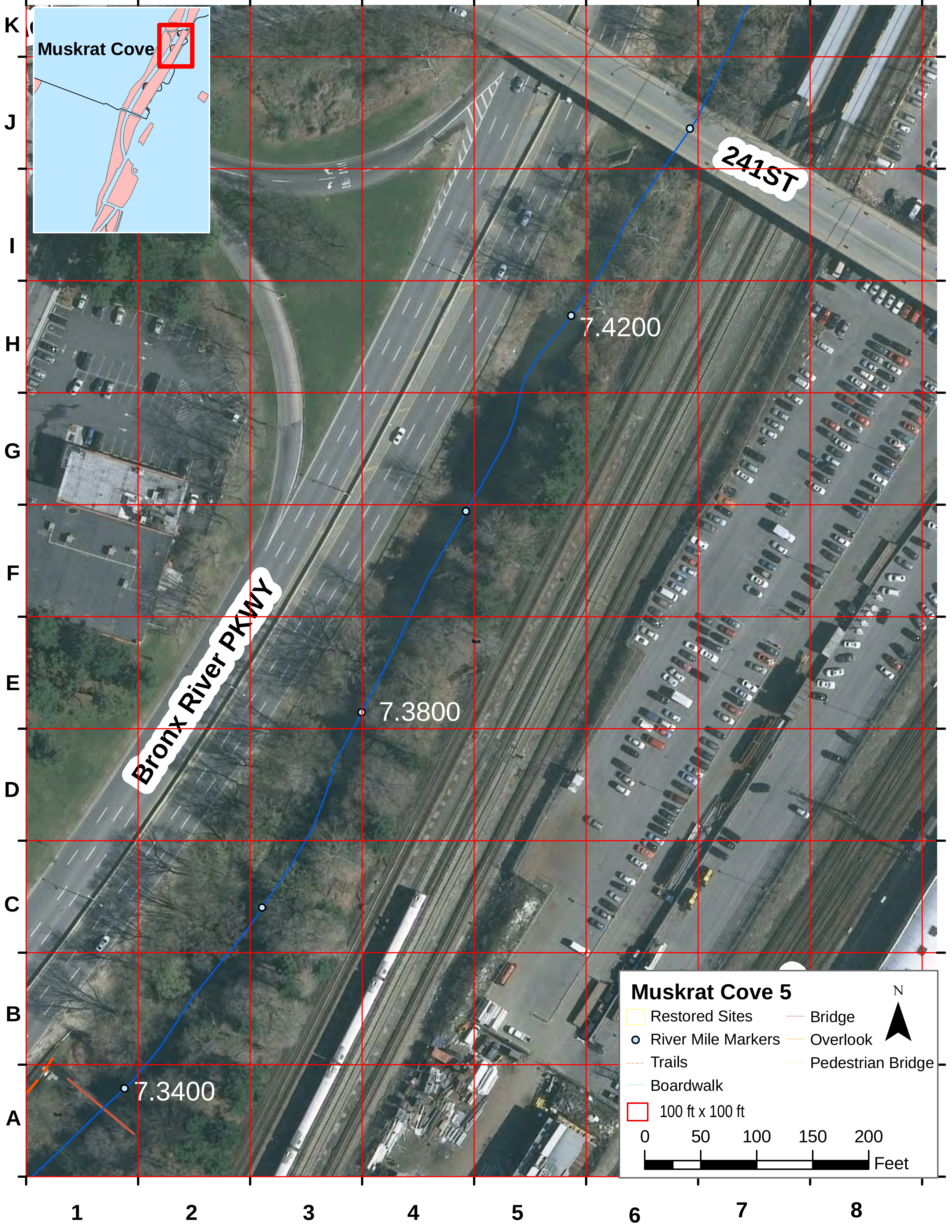

Muskrat Cove
241ST
7.4200
7.3800
7.3400
Bronx River PKWY
Muskrat Cove 5
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
100 ft x 100 ft
0
50
100
150
200
Feet
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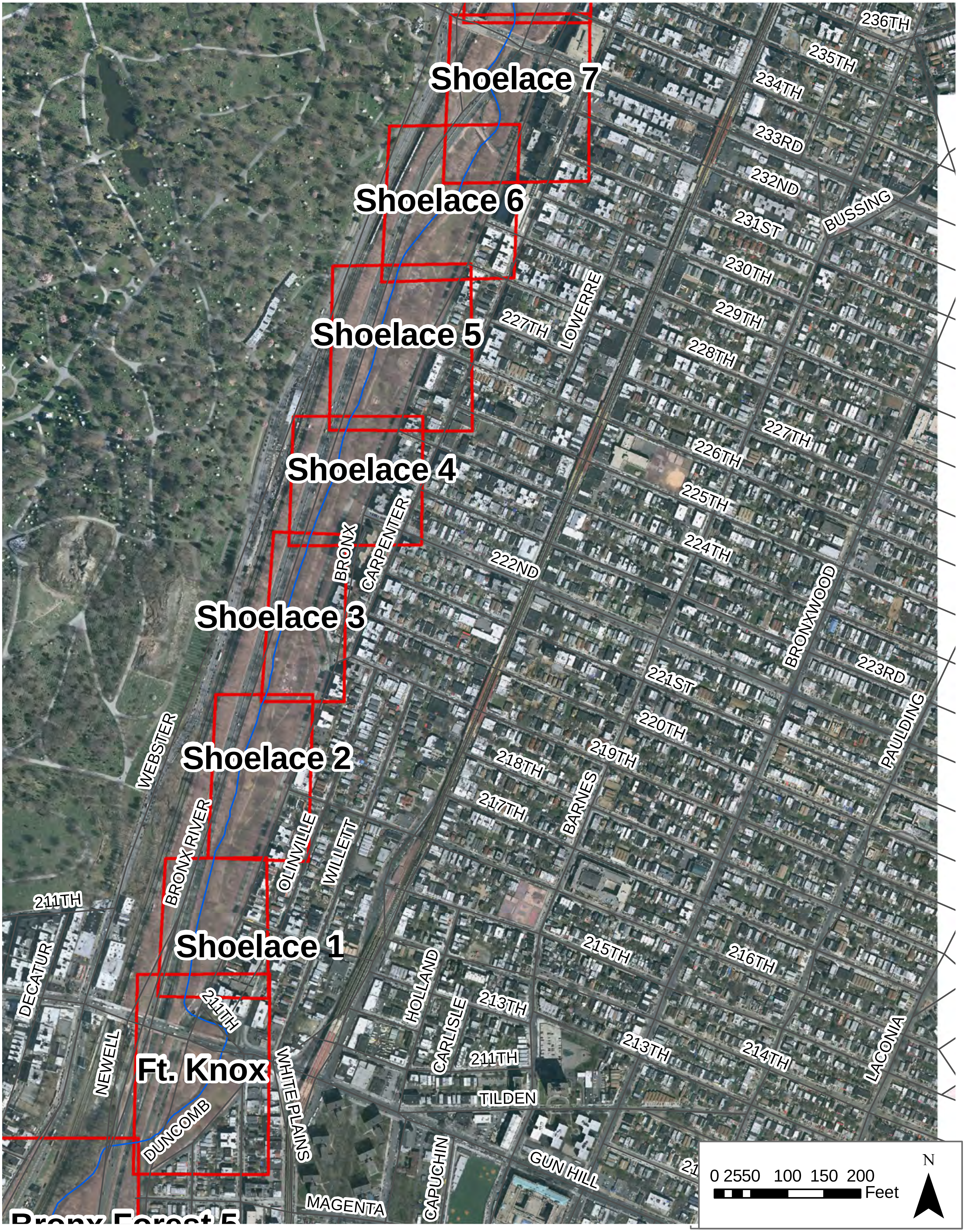

Shoelace 7
Shoelace 6
Shoelace 5
Shoelace 4
Shoelace 3
Shoelace 2
Shoelace 1
Ft. Knox
Bronx Forest 5
236TH
235TH
234TH
233RD
232ND
231ST
BUSSING
230TH
229TH
228TH
227TH
LOWERRE
227TH
226TH
225TH
224TH
222ND
BRONX
CARPENTER
BRONXWOOD
223RD
221ST
220TH
PAULDING
219TH
218TH
217TH
BARNES
WEBSTER
BRONX RIVER
OLINVILLE
WILLETT
211TH
DECATUR
215TH
216TH
HOLLAND
CARLISLE
213TH
211TH
213TH
214TH
LACONIA
NEWELL
WHITE PLAINS
TILDEN
DUNCOMB
GUN HILL
CAPUCHIN
MAGENTA
0 25 50 100 150 200
Feet
N

Shoelace 1
Canoe Access
Boardwalk
DOS-EPF Sites
Bridge
DOS-EPF Sites
Overlook
Restored Sites
Pedestrian Bridge
River Mile Markers
Trails
100 ft x 100 ft
N
0
50
100
150
200
Feet
5.4600
5.4200
5,3800
SL15
SL16
213TH
211TH
ronx Forest
223RD
222ND
221ST
220TH
219TH
218TH
217TH
216TH
215TH
214TH
213TH
212TH
211TH
WEBSTER
BRONX RIVER
BRONX
OLINVILLE
WILLETT
BARNES
HULL
DECATUR
PARKSIDE
BARKER
WHITE PLAINS
CRUGER
GUN HILL
TILDEN
MAGENTA
BARTHOLDI
BRONXWOOD
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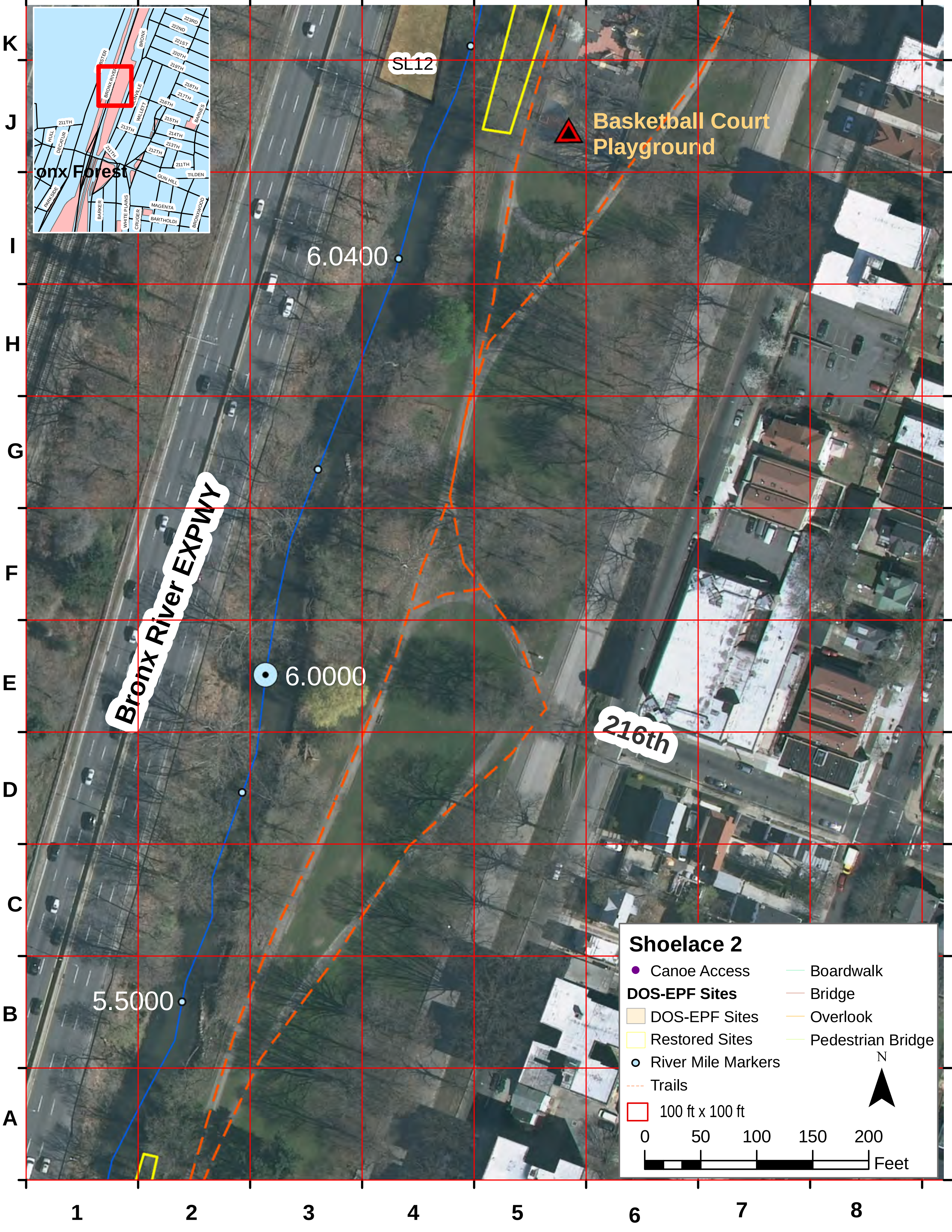

Shoelace 2
Canoe Access
DOS-EPF Sites
DOS-EPF Sites
Restored Sites
River Mile Markers
Trails
100 ft x 100 ft
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
0 50 100 150 200
Feet
Basketball Court
Playground
SL12
6.0400
6.0000
5.5000
Bronx River EXPWY
216th
ronx Forest
223RD
222ND
221ST
220TH
219TH
218TH
217TH
216TH
215TH
214TH
213TH
212TH
211TH
TILDEN
GUN HILL
MAGENTA
BARTHOLDI
BRONXWOOD
BARKER
WHITE PLAINS
CRUGER
PARKSIDE
HULL
DECATUR
WILLETT
BARNES
K
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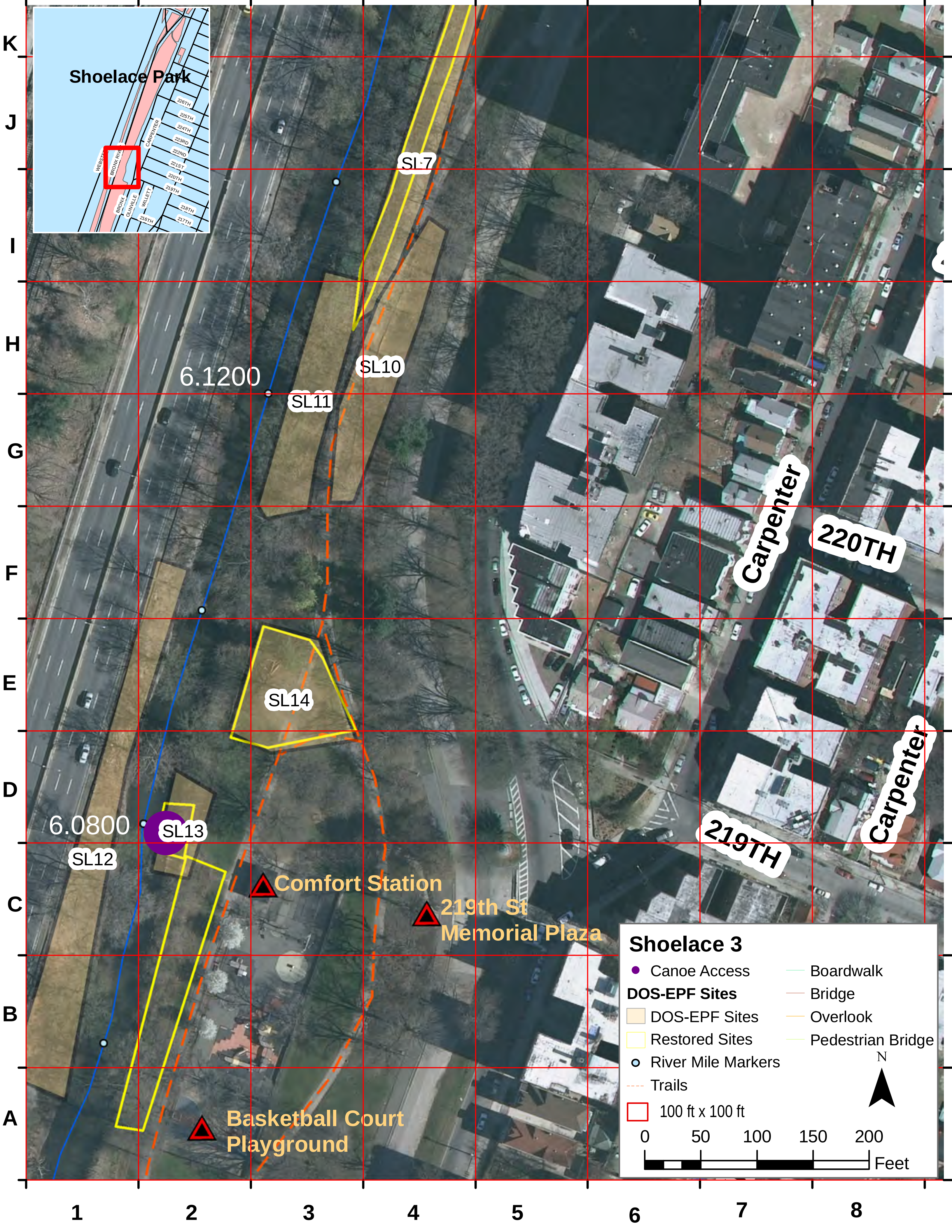

Shoelace Park
226TH
225TH
224TH
223RD
222ND
221ST
220TH
219TH
218TH
217TH
216TH
WEBSTER
BRONX RIVER
CARPENTER
BRONX
OLINVILLE
WILLETT
SL7
SL10
SL11
SL12
SL13
SL14
6.1200
6.0800
Comfort Station
219th St
Memorial Plaza
Basketball Court
Playground
Carpenter
220TH
219TH
Shoelace 3
Canoe Access
DOS-EPF Sites
DOS-EPF Sites
Restored Sites
River Mile Markers
Trails
100 ft x 100 ft
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
0
50
100
150
200
Feet
K
J
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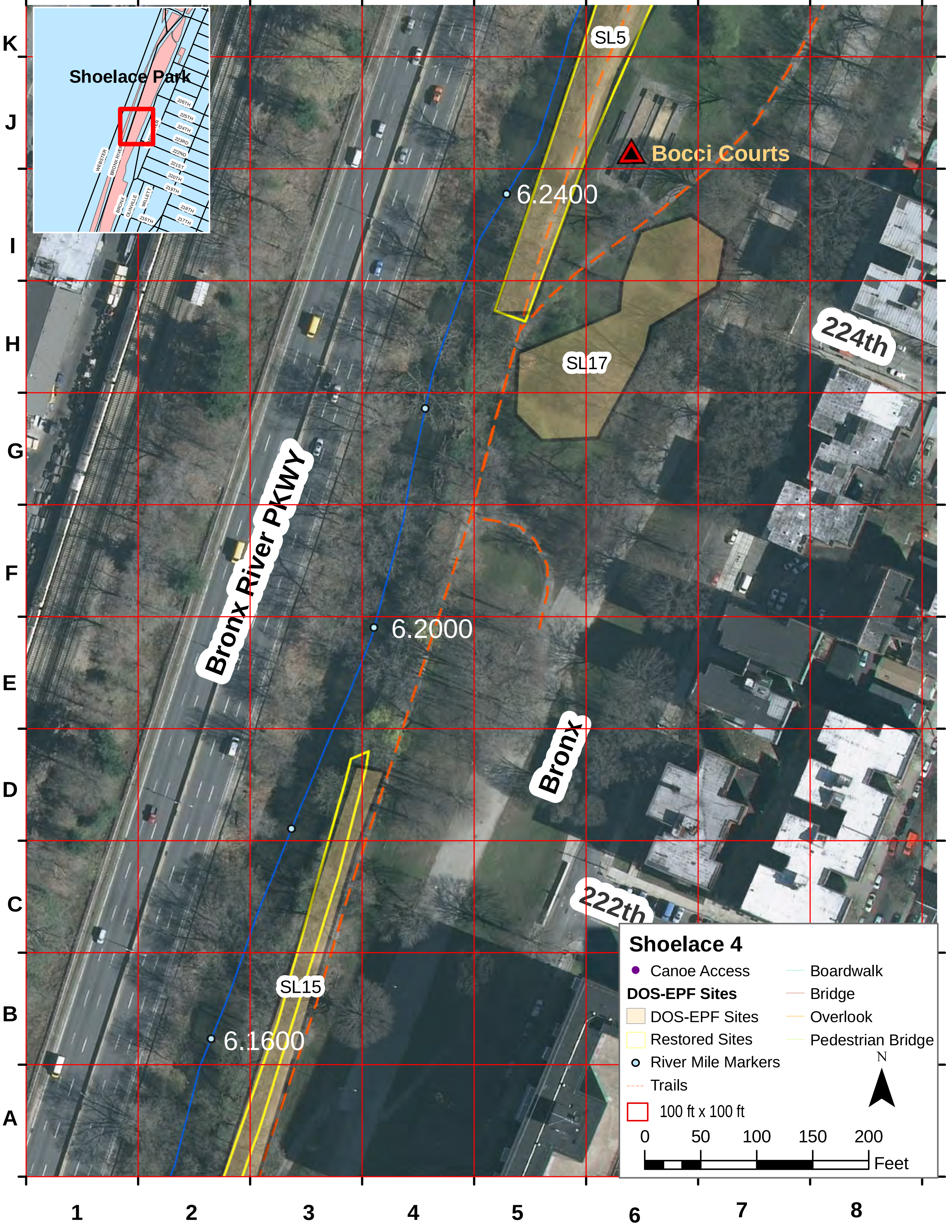
Shoelace Park
226TH
225TH
224TH
223RD
222ND
221ST
220TH
219TH
218TH
217TH
216TH
WEBSTER
BRONX RIVER
BRONX
OLINVILLE
WILLETT
SL5
Bocci Courts
6.2400
224th
SL17
Bronx River PKWY
6.2000
Bronx
222th
SL15
6.1600
K
J
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C
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7
8
Shoelace 4
Canoe Access
DOS-EPF Sites
DOS-EPF Sites
Restored Sites
River Mile Markers
Trails
100 ft x 100 ft
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
0
50
100
150
200
Feet

Shoelace 5
Canoe Access
DOS-EPF Sites
DOS-EPF Sites
Restored Sites
River Mile Markers
Trails
100 ft x 100 ft
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
0 50 100 150 200 Feet
Muskrat Cove
Shoelace Park
Bronx River EXPWY
Bronx
228th
226th
Playground
Comfort Station
Niles Triangle
Bocci Courts
SL3
SL4
SL5
SL6
SL16
SL17
6.3200
6.2800
6.2400
K
J
I
H
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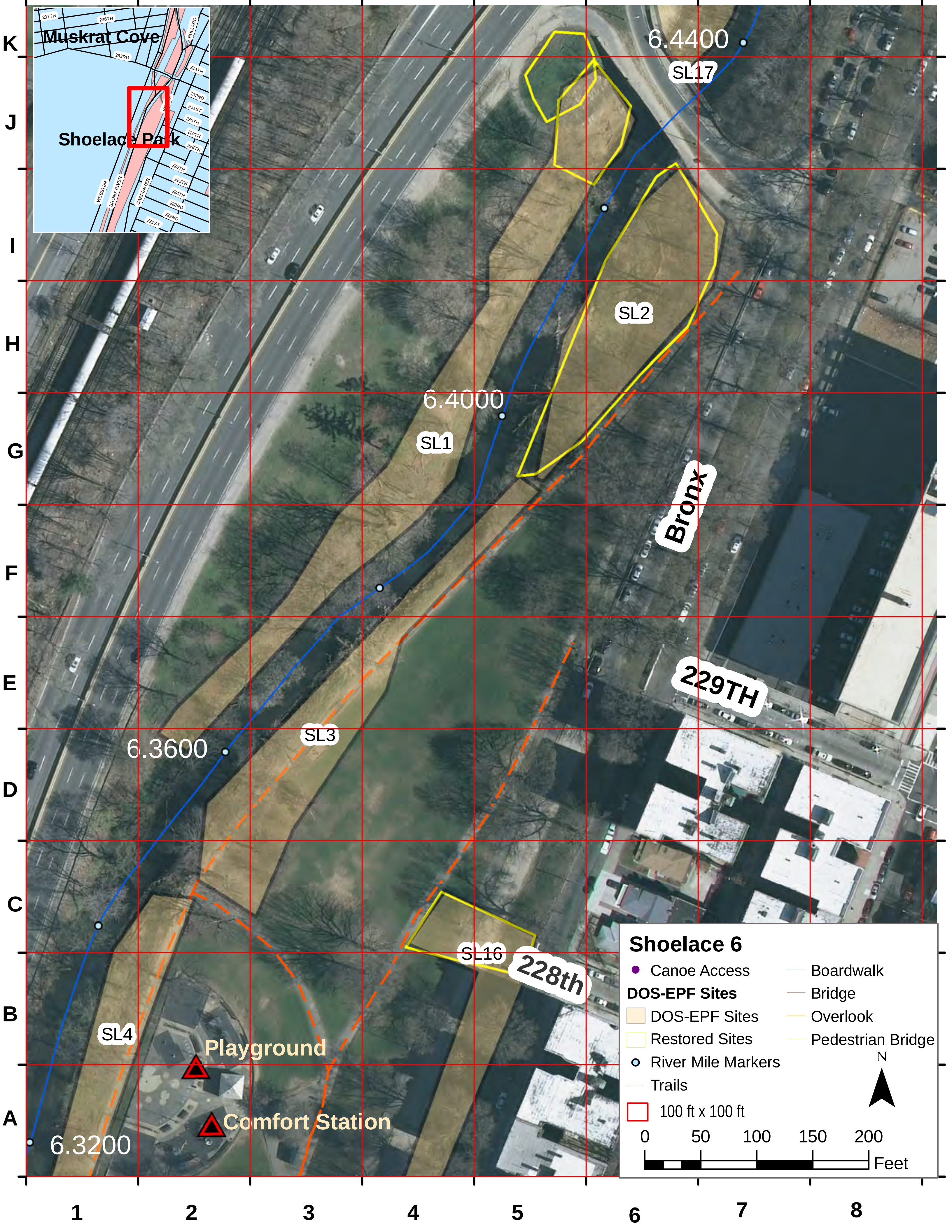

Muskrat Cove
Shoelace Park
237TH
236TH
233RD
234TH
232ND
231ST
230TH
229TH
228TH
226TH
225TH
224TH
223RD
222ND
221ST
BULLARD
WEBSTER
BRONX RIVER
CARPENTER
K
J
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D
C
B
A
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5
6
7
8
6.4400
SL17
SL2
6.4000
SL1
Bronx
229TH
6.3600
SL3
SL16
228th
SL4
Playground
Comfort Station
6.3200
Shoelace 6
Canoe Access
DOS-EPF Sites
DOS-EPF Sites
Restored Sites
River Mile Markers
Trails
100 ft x 100 ft
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
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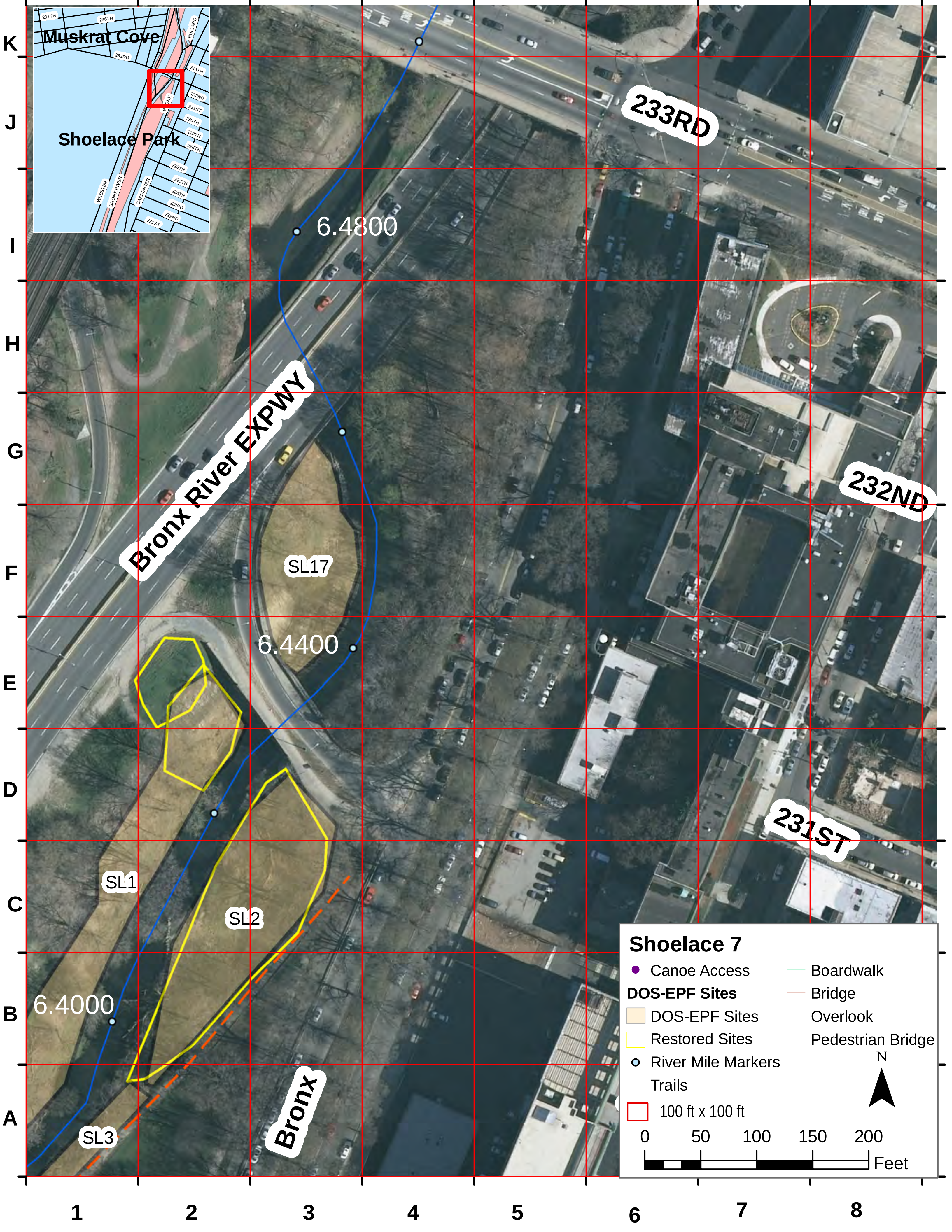
100
150
200
Feet



Muskrat Cove
Shoelace Park
Bronx River EXPWY
233RD
232ND
231ST
Bronx
6.4800
6.4400
6.4000
SL17
SL1
SL2
SL3
Shoelace 7
Canoe Access
Boardwalk
DOS-EPF Sites
Bridge
DOS-EPF Sites
Overlook
Restored Sites
Pedestrian Bridge
River Mile Markers
Trails
100 ft x 100 ft
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Feet
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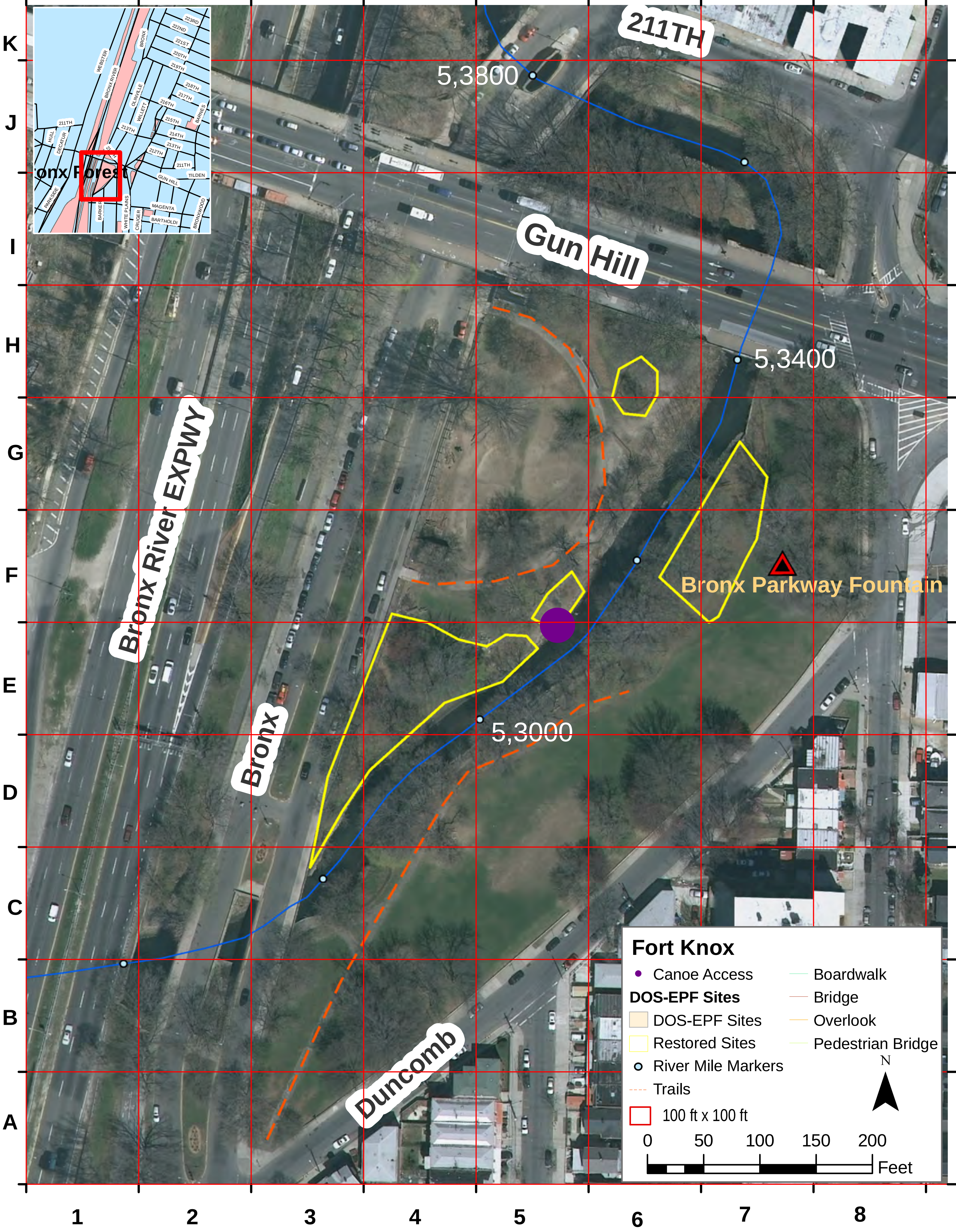

Fort Knox
Canoe Access
DOS-EPF Sites
DOS-EPF Sites
Restored Sites
River Mile Markers
Trails
100 ft x 100 ft
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
0 50 100 150 200
Feet
211TH
Gun Hill
Bronx River EXPWY
Bronx
Duncomb
Bronx Parkway Fountain
5,3800
5,3400
5,3000
ronx Forest
K
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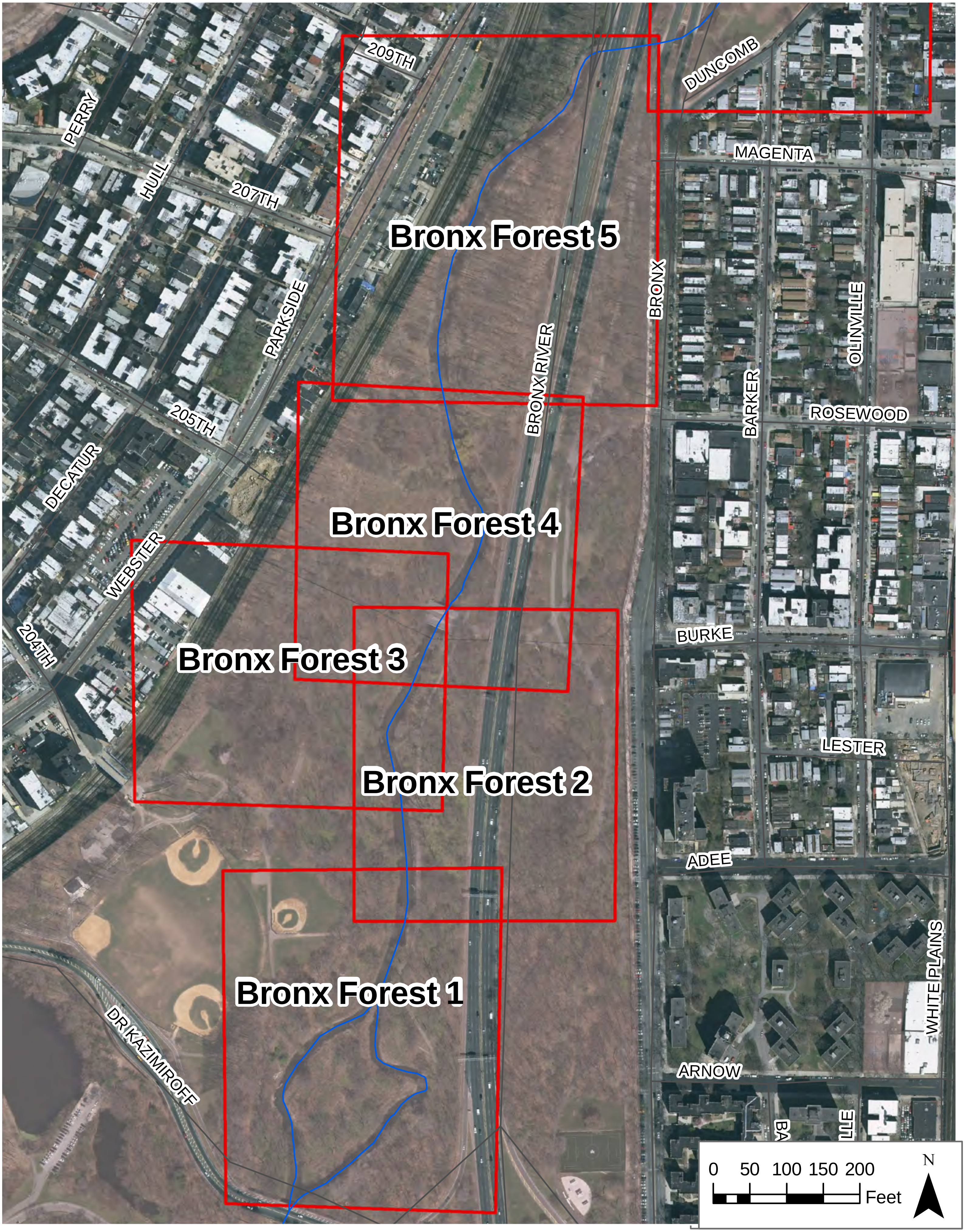
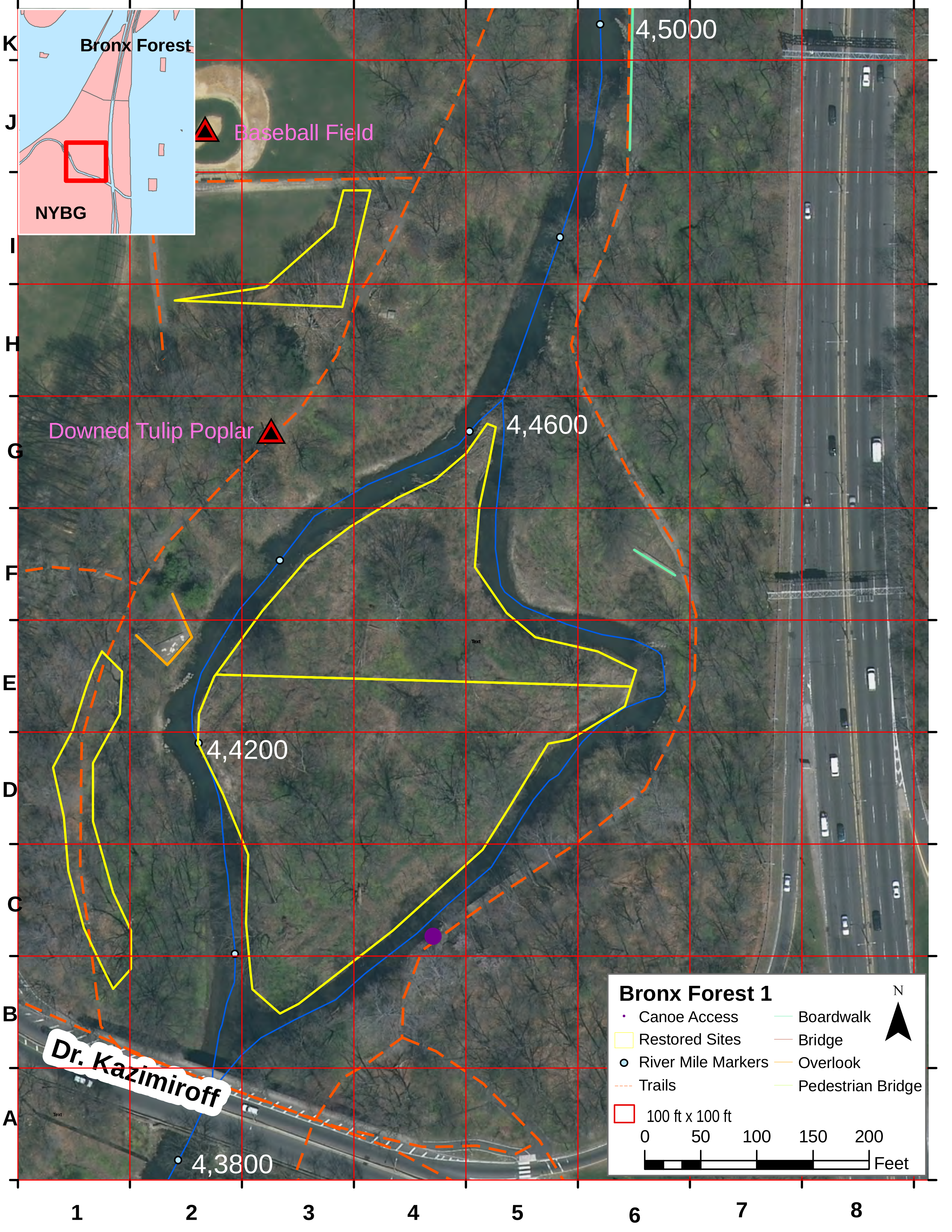


Bronx Forest 5
Bronx Forest 4
Bronx Forest 3
Bronx Forest 2
Bronx Forest 1
209TH
DUNCOMB
PERRY
HULL
207TH
MAGENTA
PARKSIDE
BRONX
OLINVILLE
BRONX RIVER
205TH
BARKER
ROSEWOOD
DECATUR
WEBSTER
204TH
BURKE
LESTER
ADEE
WHITE PLAINS
DR KAZIMIROFF
ARNOW
0 50 100 150 200
Feet
N


Bronx Forest
NYBG
Baseball Field
Downed Tulip Poplar
4,5000
4,4600
4,4200
4,3800
Dr. Kazimiroff
K
J
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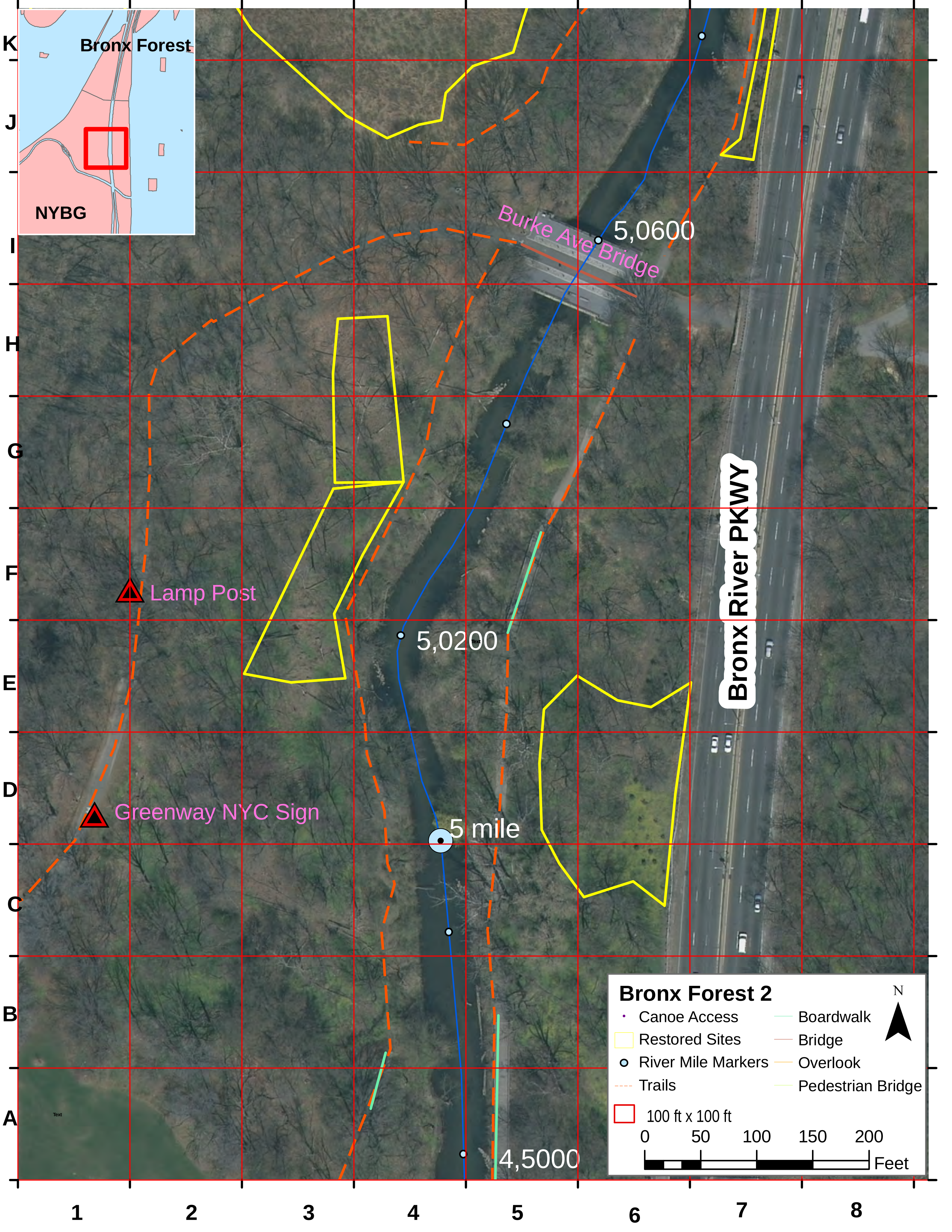
8
Bronx Forest 1
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
100 ft x 100 ft
0
50
100
150
200
Feet
N


Bronx Forest
NYBG
Burke Ave Bridge
5,0600
Lamp Post
5,0200
Greenway NYC Sign
5 mile
4,5000
Bronx River PKWY
Bronx Forest 2
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0 50 100 150 200
Feet
K
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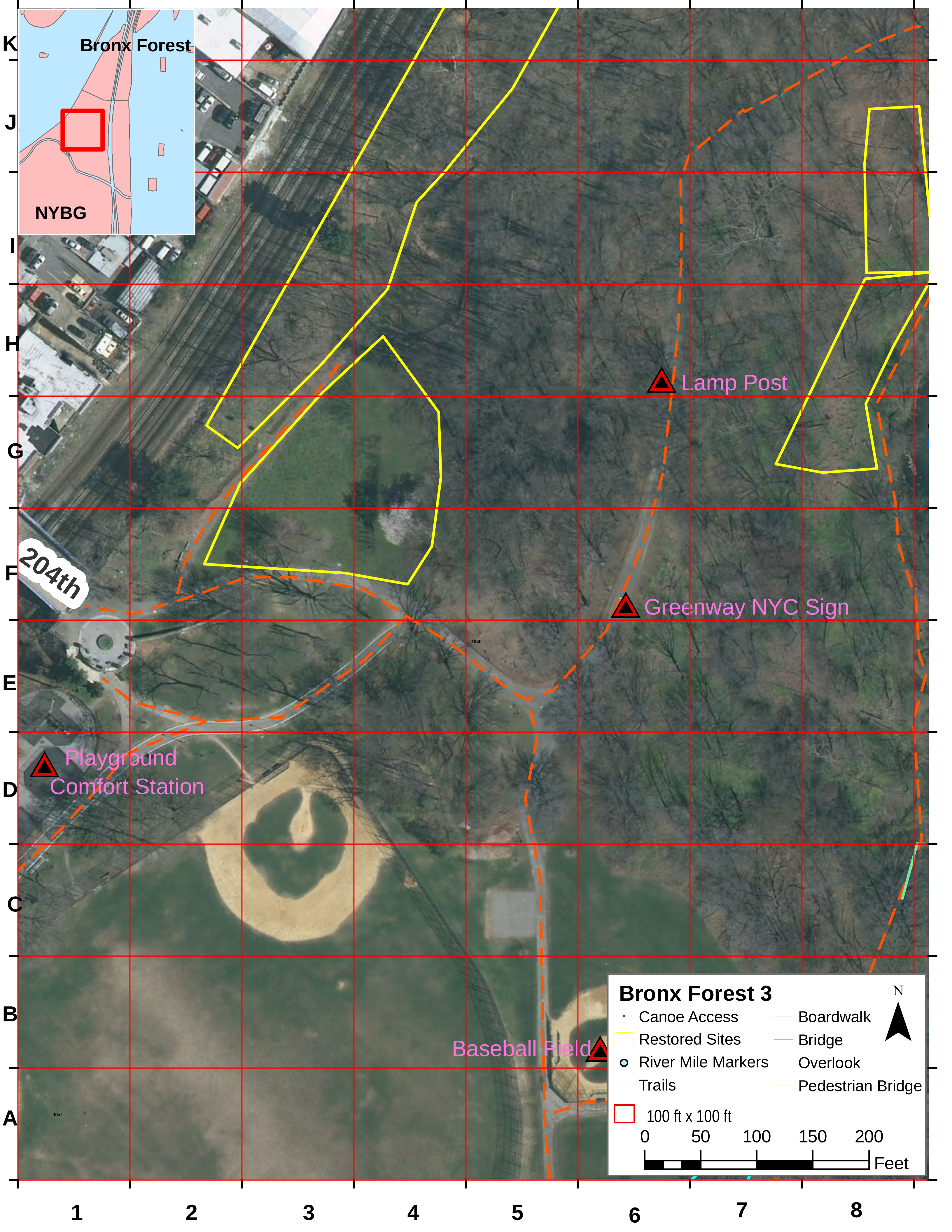
A
1 2 3 4 5 6 7 8



Bronx Forest
NYBG
204th
Lamp Post
Greenway NYC Sign
Playground
Comfort Station
Baseball Field
Text
Text
K
J
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D
C
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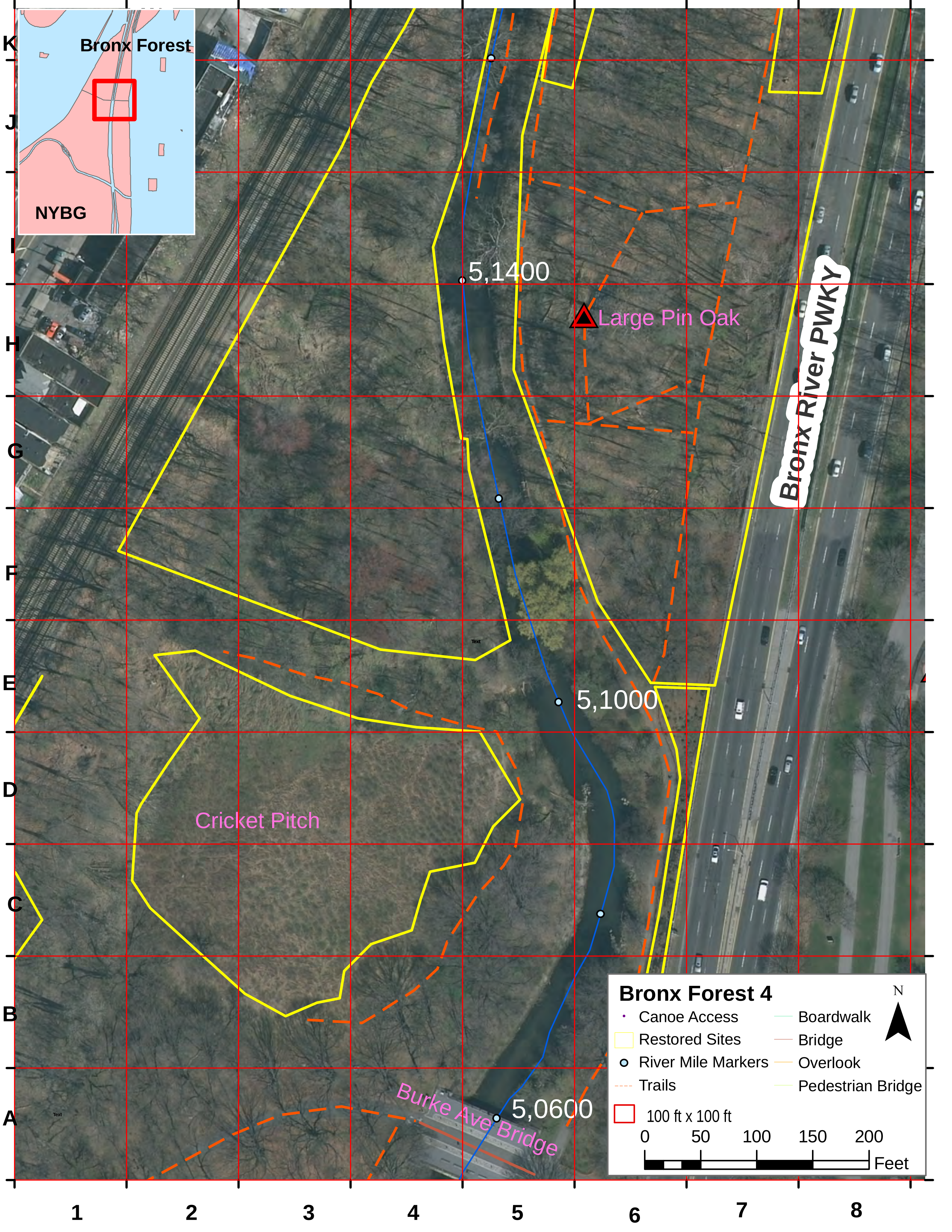
8
Bronx Forest 3
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet



Bronx Forest
NYBG
5,1400
Large Pin Oak
Bronx River PWKY
5,1000
Cricket Pitch
5,0600
Burke Ave Bridge
Bronx Forest 4
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
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Feet
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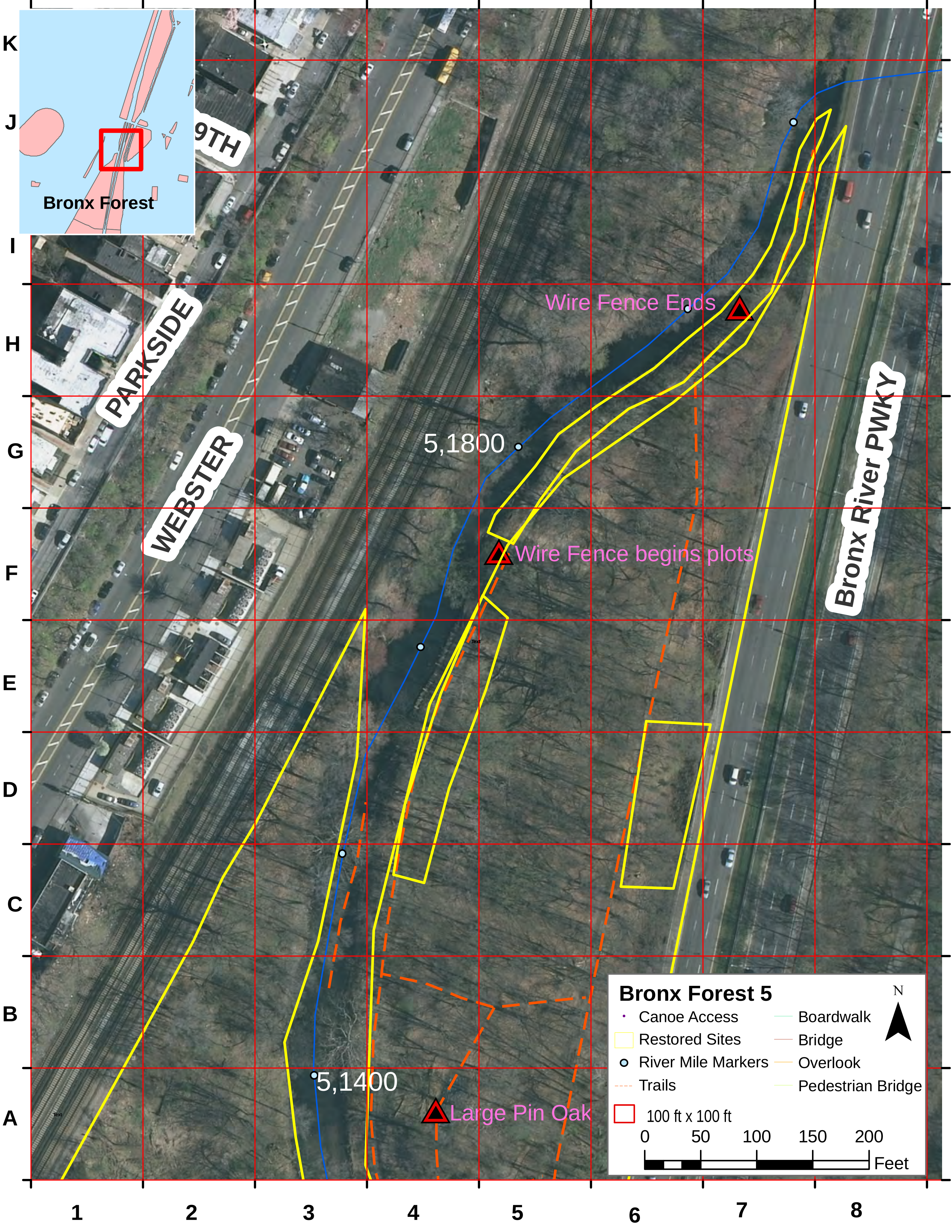

Bronx Forest
9TH
PARKSIDE
WEBSTER
Bronx River PWKY
Wire Fence Ends
5,1800
Wire Fence begins plots
5,1400
Large Pin Oak
Bronx Forest 5
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0 50 100 150 200
Feet
K
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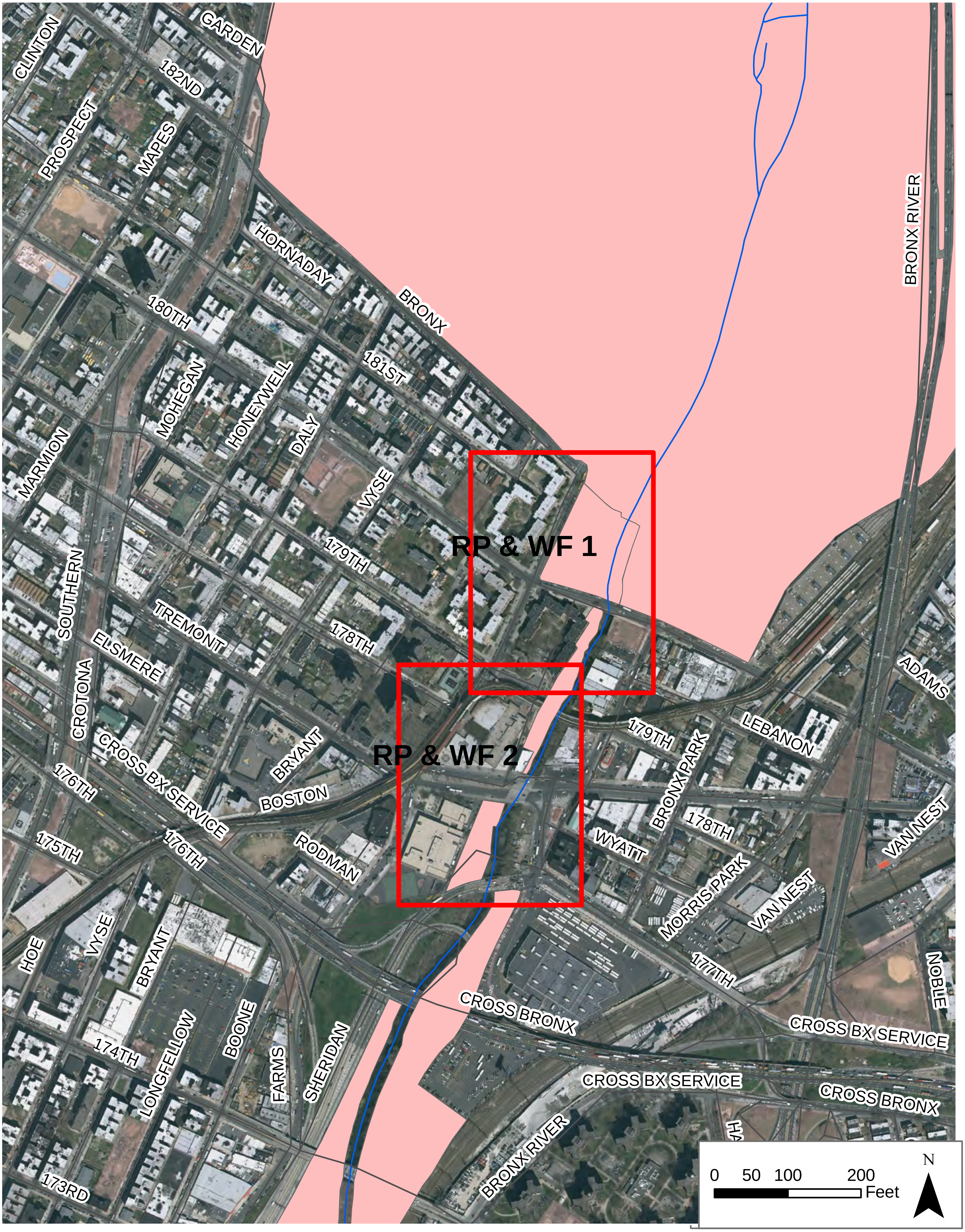
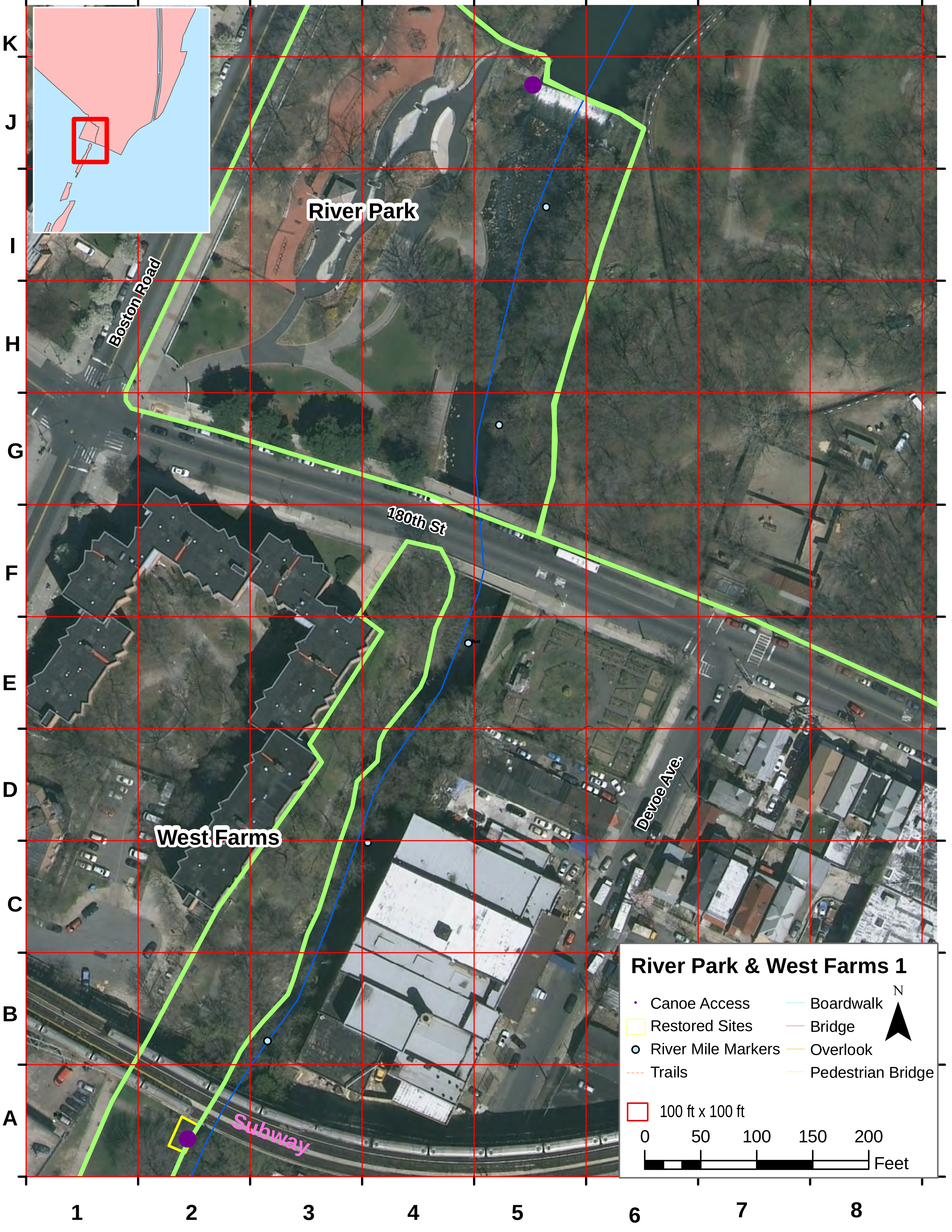
1 2 3 4 5 6 7 8


RP & WF 1
RP & WF 2
CLINTON
GARDEN
182ND
PROSPECT
MAPES
HORNADAY
BRONX
180TH
181ST
MOHEGAN
HONEYWELL
DALY
MARMION
VYSE
179TH
SOUTHERN
TREMONT
178TH
ELMERE
CROTONA
BRYANT
CROSS BX SERVICE
176TH
BOSTON
175TH
176TH
RODMAN
BRONX RIVER
ADAMS
LEBANON
179TH
BRONX PARK
178TH
WYATT
VAN NEST
MORRIS PARK
VAN NEST
177TH
NOBLE
HOE
VYSE
BRYANT
LONGFELLOW
BOONE
FARMS
SHERIDAN
174TH
CROSS BRONX
CROSS BX SERVICE
CROSS BX SERVICE
CROSS BRONX
BRONX RIVER
173RD
0 50 100 200
Feet
N


River Park & West Farms 1
River Park
West Farms
Boston Road
180th St
Devoe Ave.
Subway
K
J
I
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G
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D
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B
A
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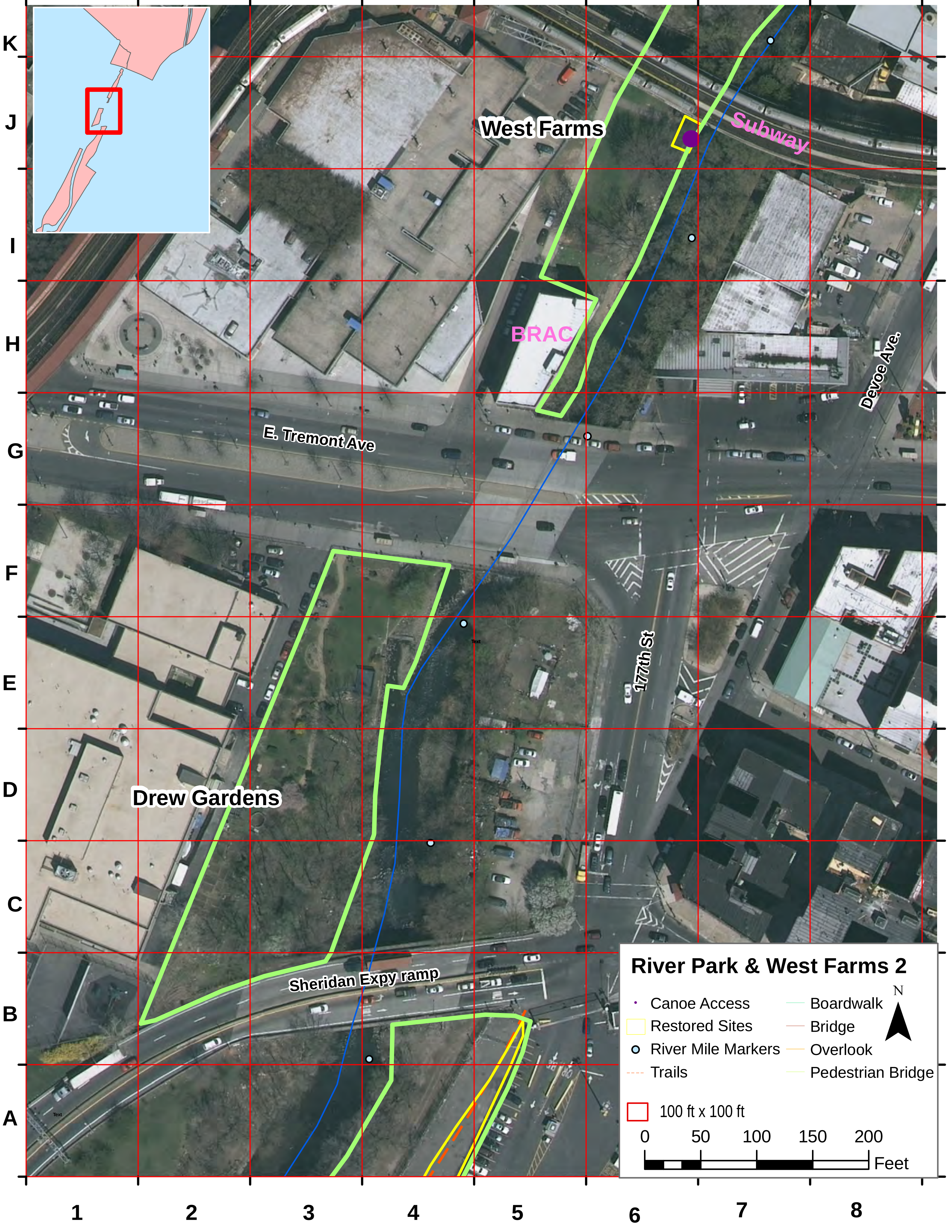
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet



River Park & West Farms 2
West Farms
Subway
BRAC
Devoe Ave.
E. Tremont Ave
177th St
Drew Gardens
Sheridan Expy ramp
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0 50 100 150 200
Feet
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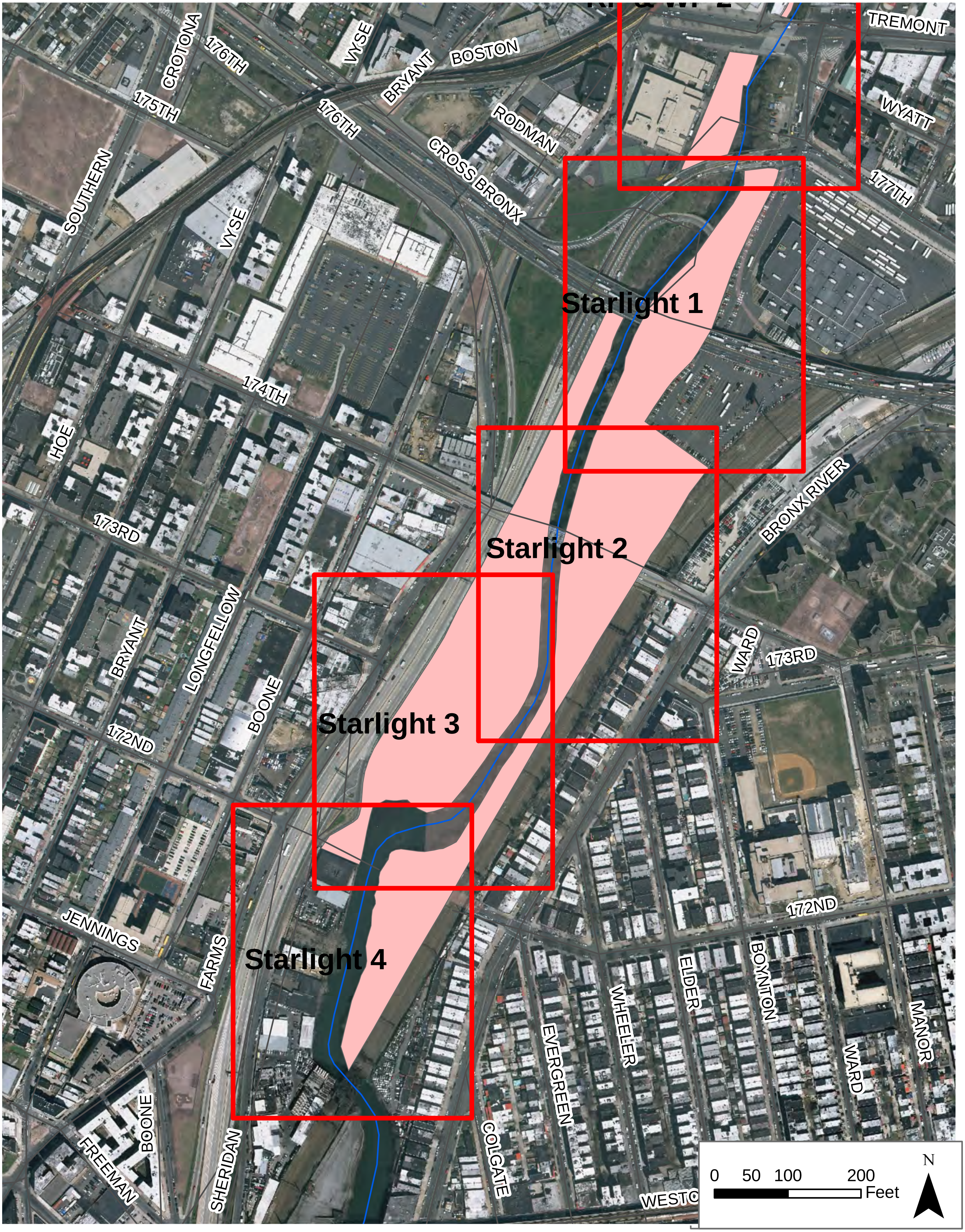
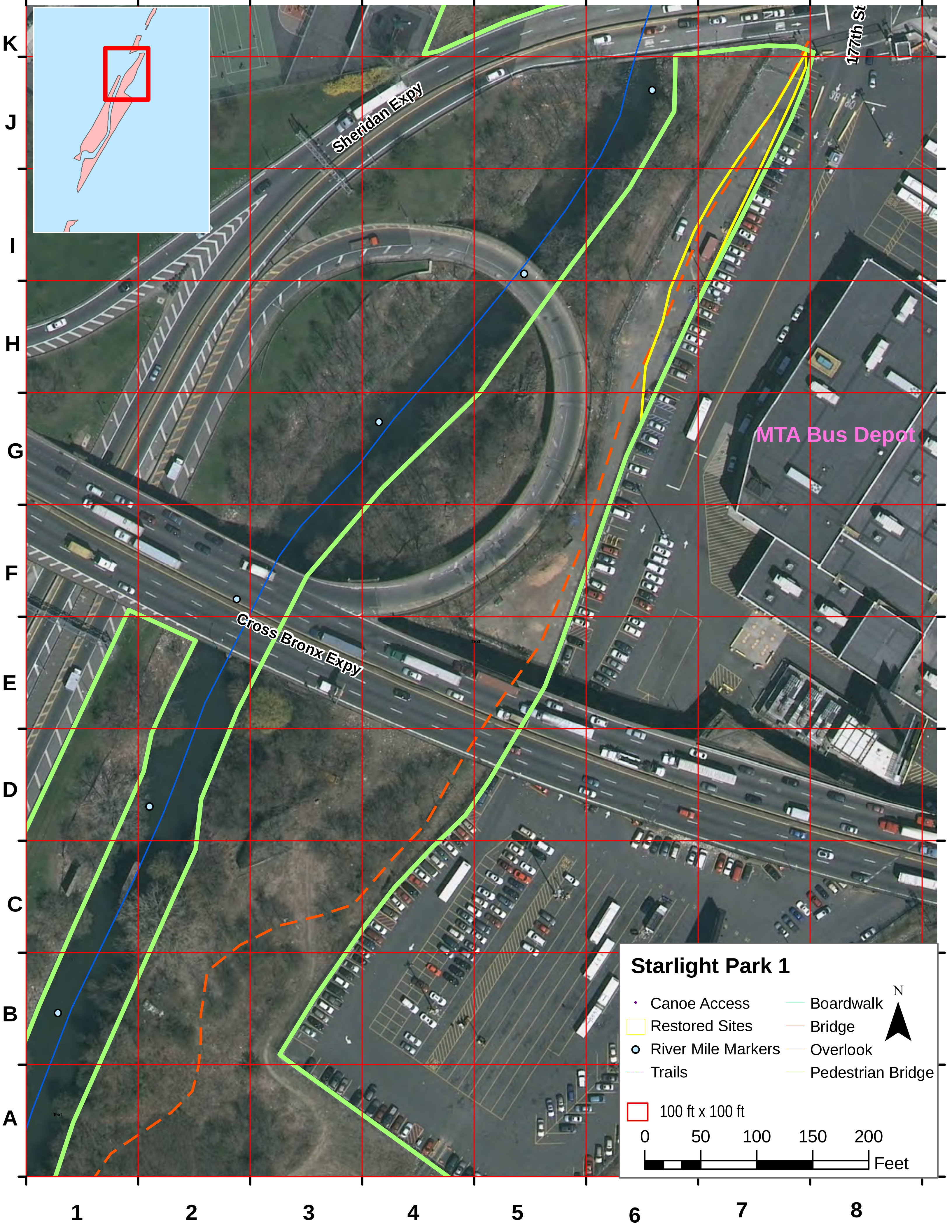
1 2 3 4 5 6 7 8


Starlight 1
Starlight 2
Starlight 3
Starlight 4
TREMONT
WYATT
177TH
CROTONA
176TH
VYSE
BRYANT
BOSTON
175TH
176TH
RODMAN
CROSS BRONX
SOUTHERN
VYSE
174TH
HOE
173RD
BRONX RIVER
WARD
173RD
LONGFELLOW
BRYANT
BOONE
172ND
172ND
JENNINGS
FARMS
WHEELER
ELDER
BOYNTON
EVERGREEN
WARD
MANOR
BOONE
FREEMAN
SHERIDAN
COLGATE
WESTC
0 50 100 200
Feet
N



K
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Sheridan Expy
Cross Bronx Expy
177th St
MTA Bus Depot
Starlight Park 1
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
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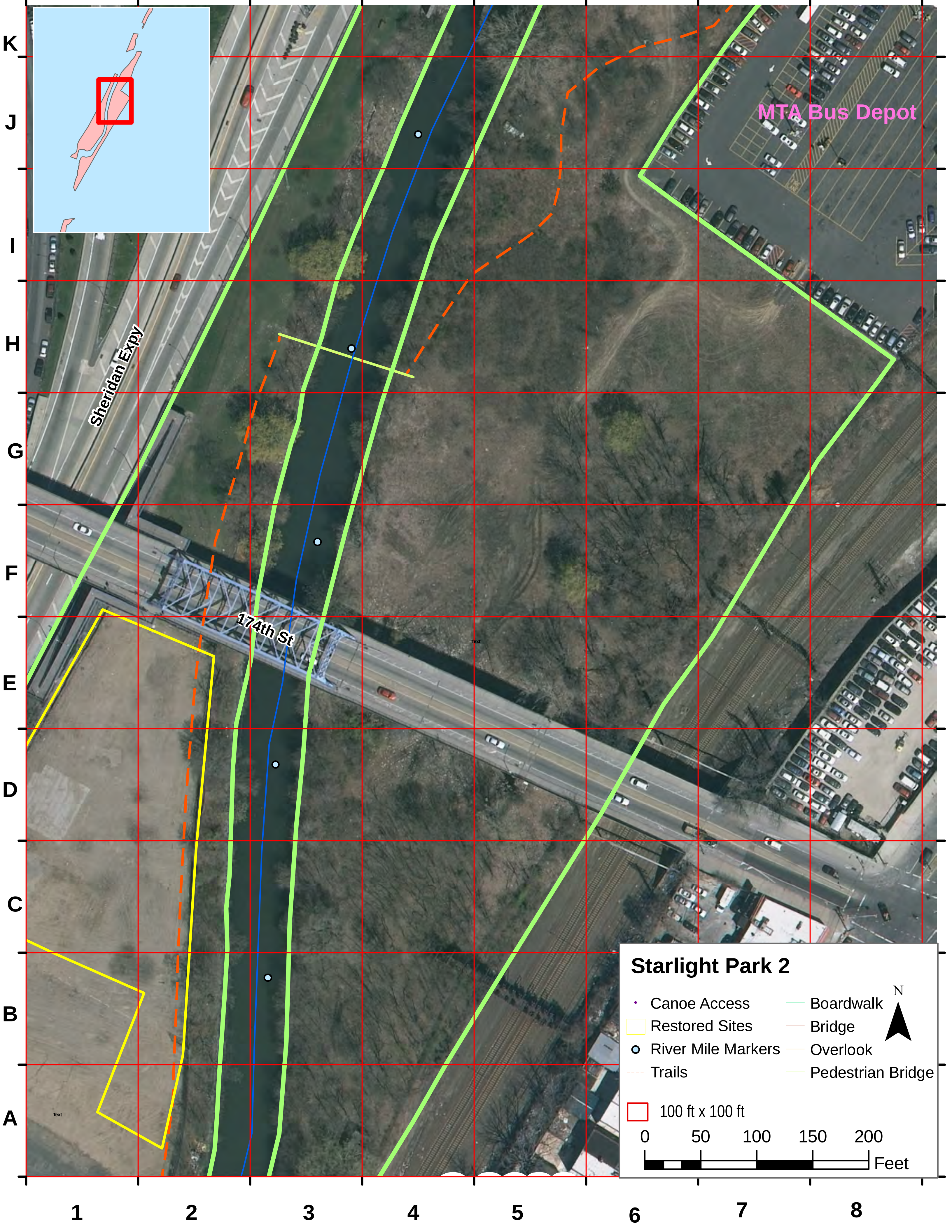
200
Feet



K
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8
MTA Bus Depot
Sheridan Expy
174th St
Starlight Park 2
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
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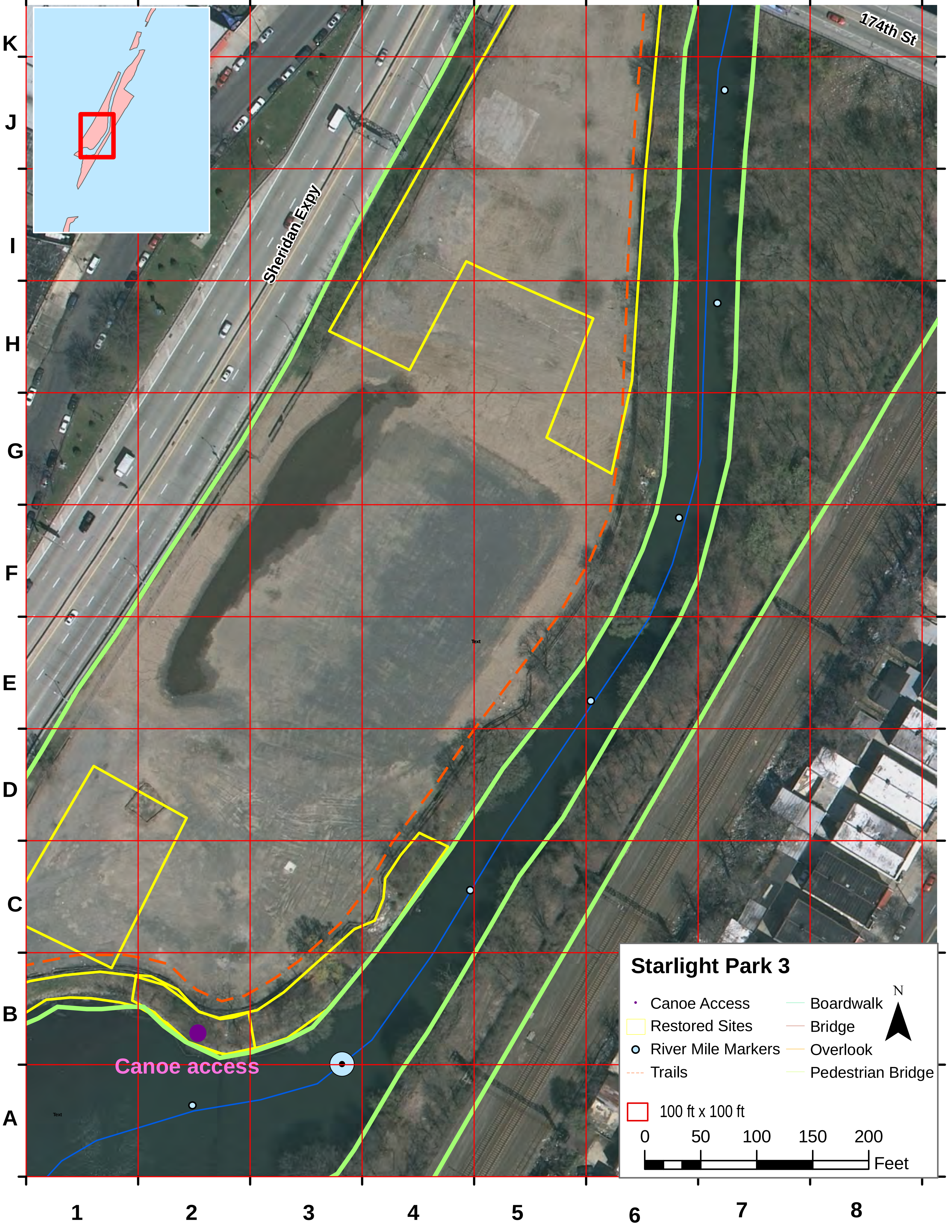
200
Feet


Starlight Park 3
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet
Canoe access
Sheridan Expy
174th St
K
J
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H
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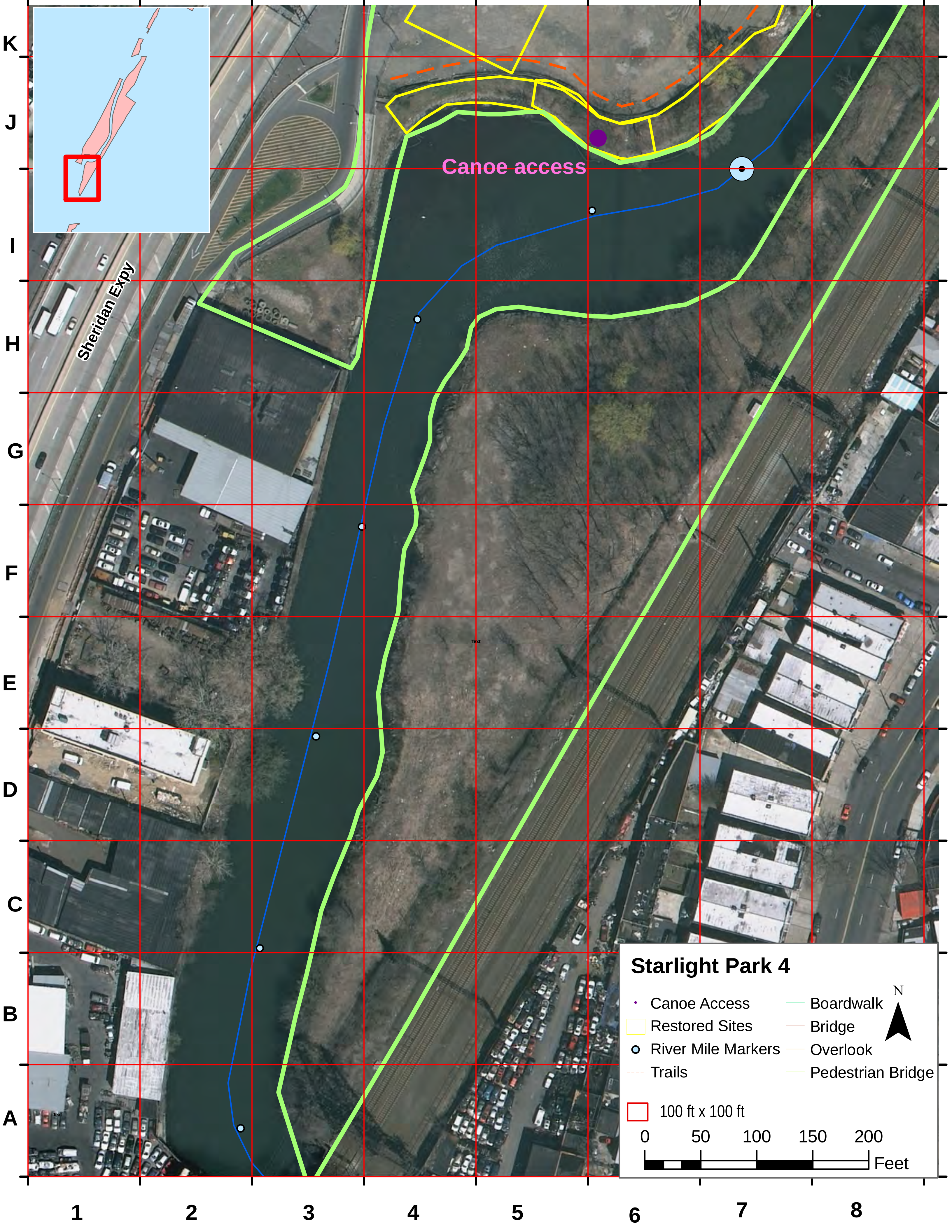

K
J
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8
Sheridan Expy
Canoe access
Starlight Park 4
N
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
100 ft x 100 ft
0
50
100
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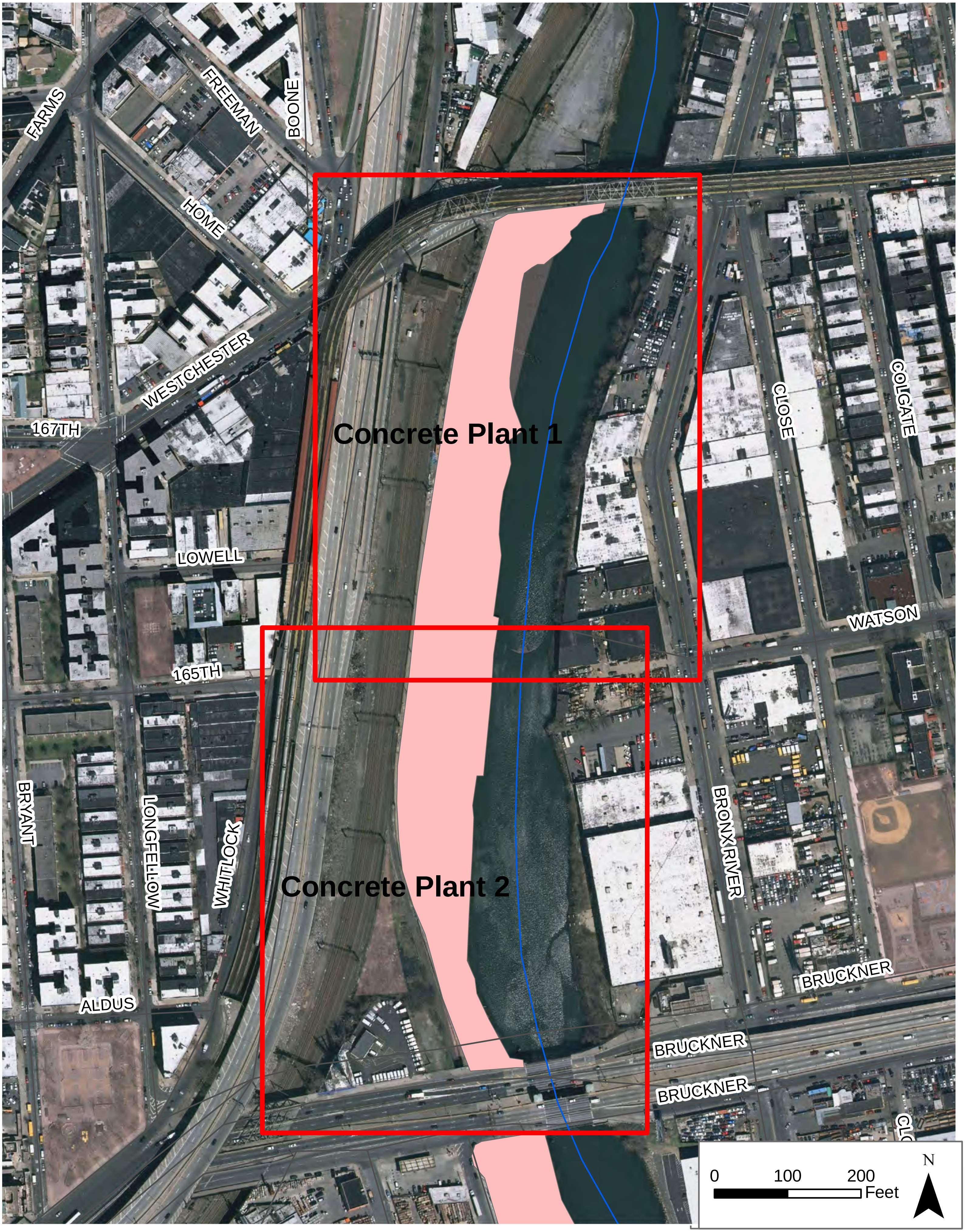
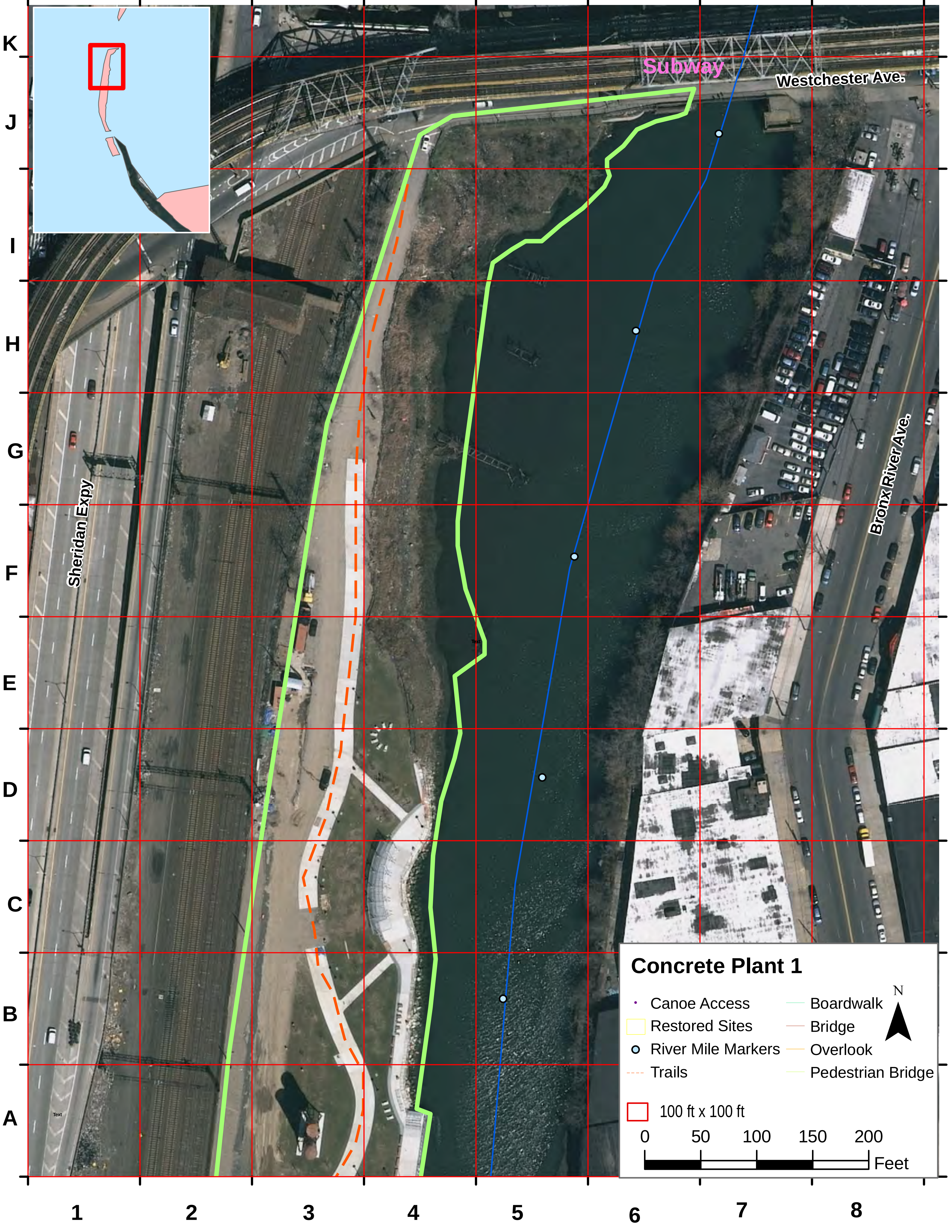
200
Feet



Concrete Plant 1
Concrete Plant 2
FARMS
FREEMAN
BOONE
HOME
WESTCHESTER
167TH
LOWELL
165TH
BRYANT
LONGFELLOW
WHITLOCK
ALDUS
CLOSE
COLGATE
WATSON
BRONX RIVER
BRUCKNER
BRUCKNER
BRUCKNER
0
100
200
Feet
N



Subway
Westchester Ave.
Sheridan Expy
Bronx River Ave.
K
J
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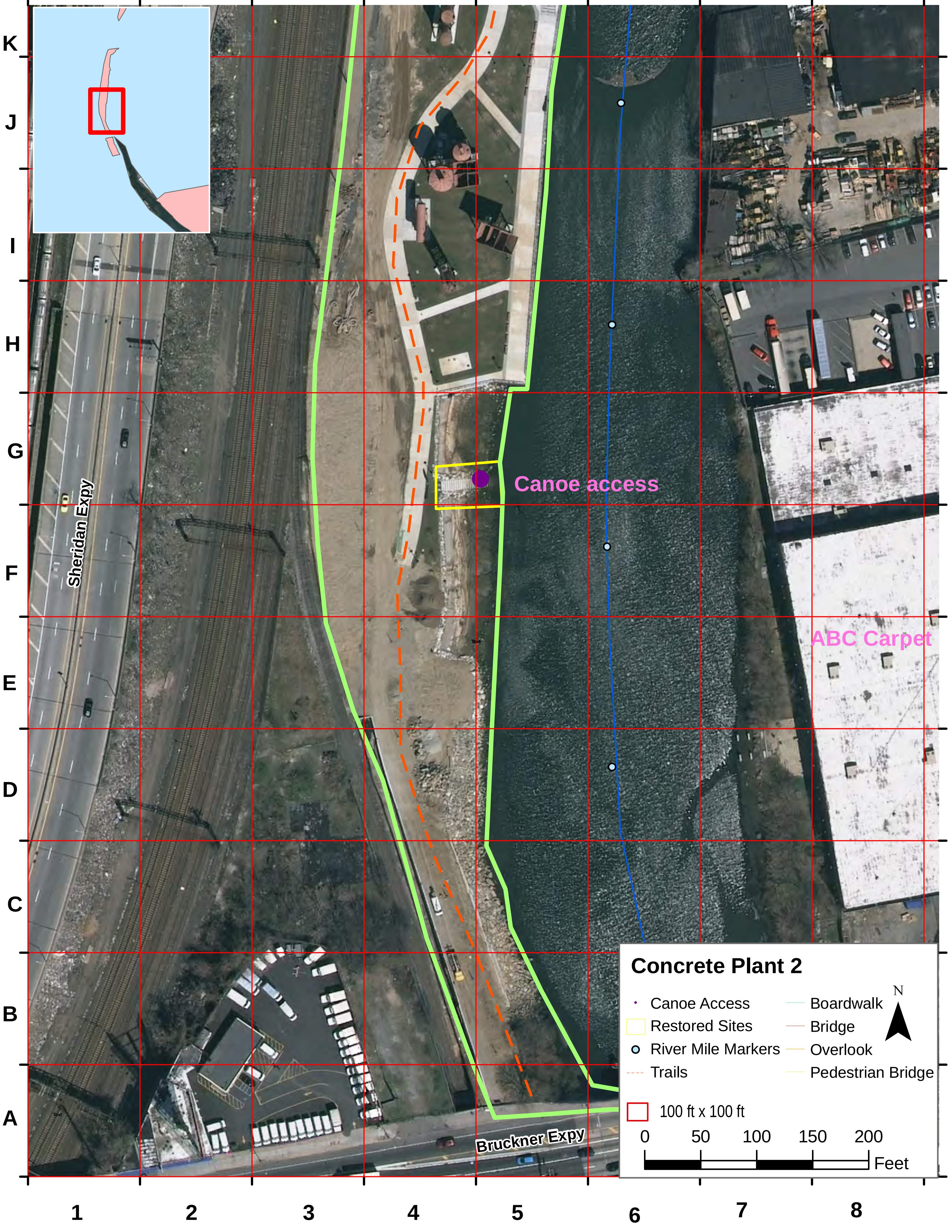
Concrete Plant 1
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet



K
J
I
H
G
F
E
D
C
B
A
1
2
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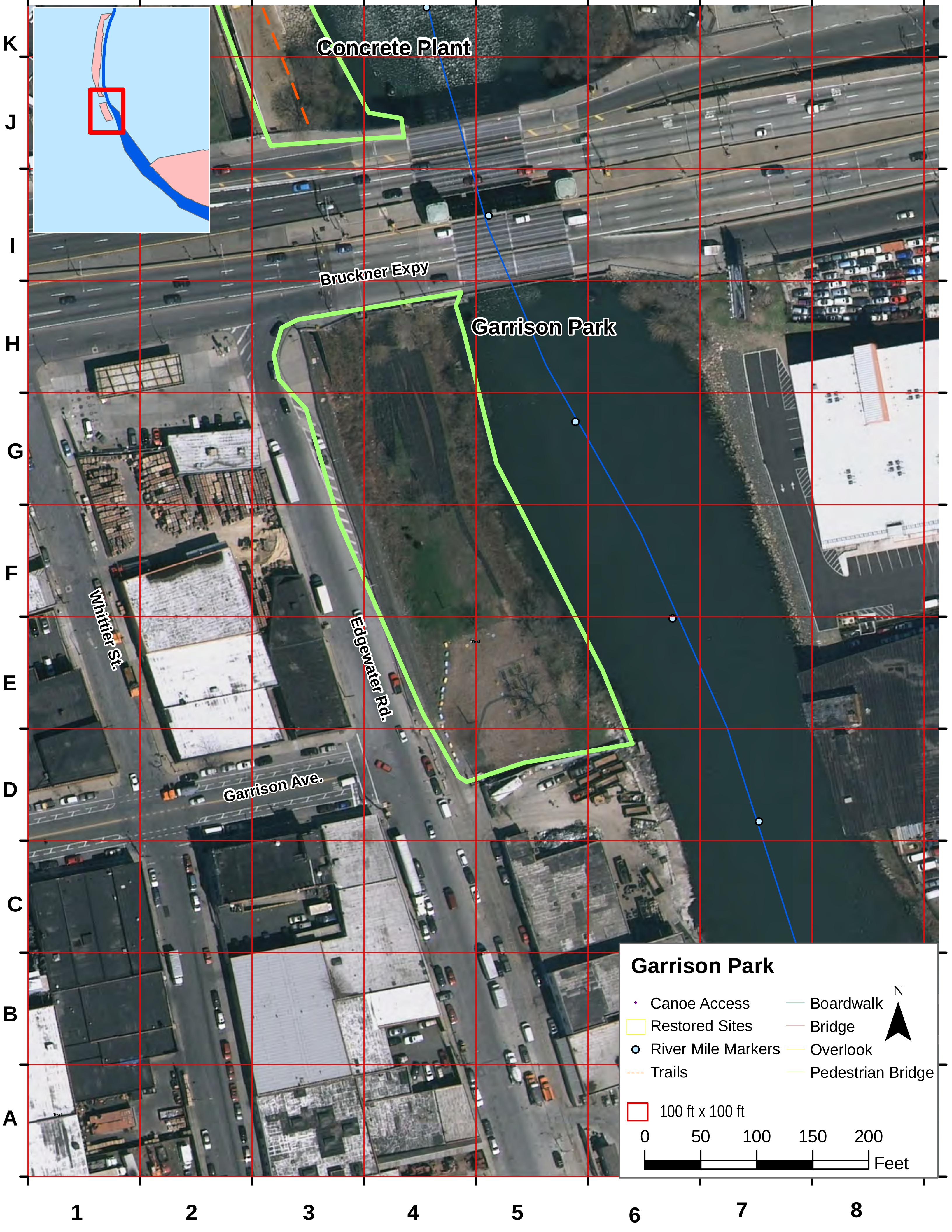
4
5
6
7
8
Sheridan Expy
Canoe access
ABC Carpet
Bruckner Expy
Concrete Plant 2
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet



K
J
I
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G
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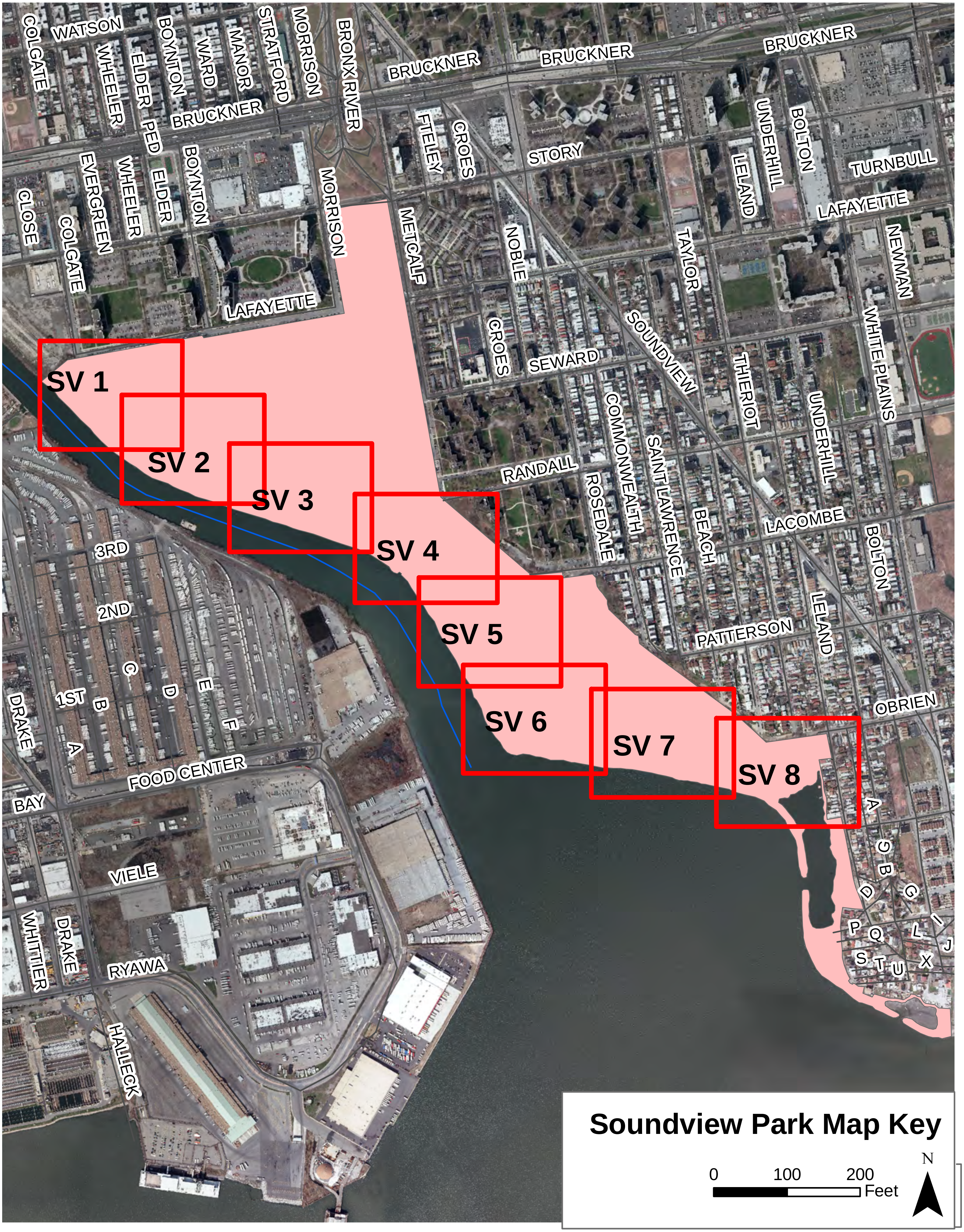
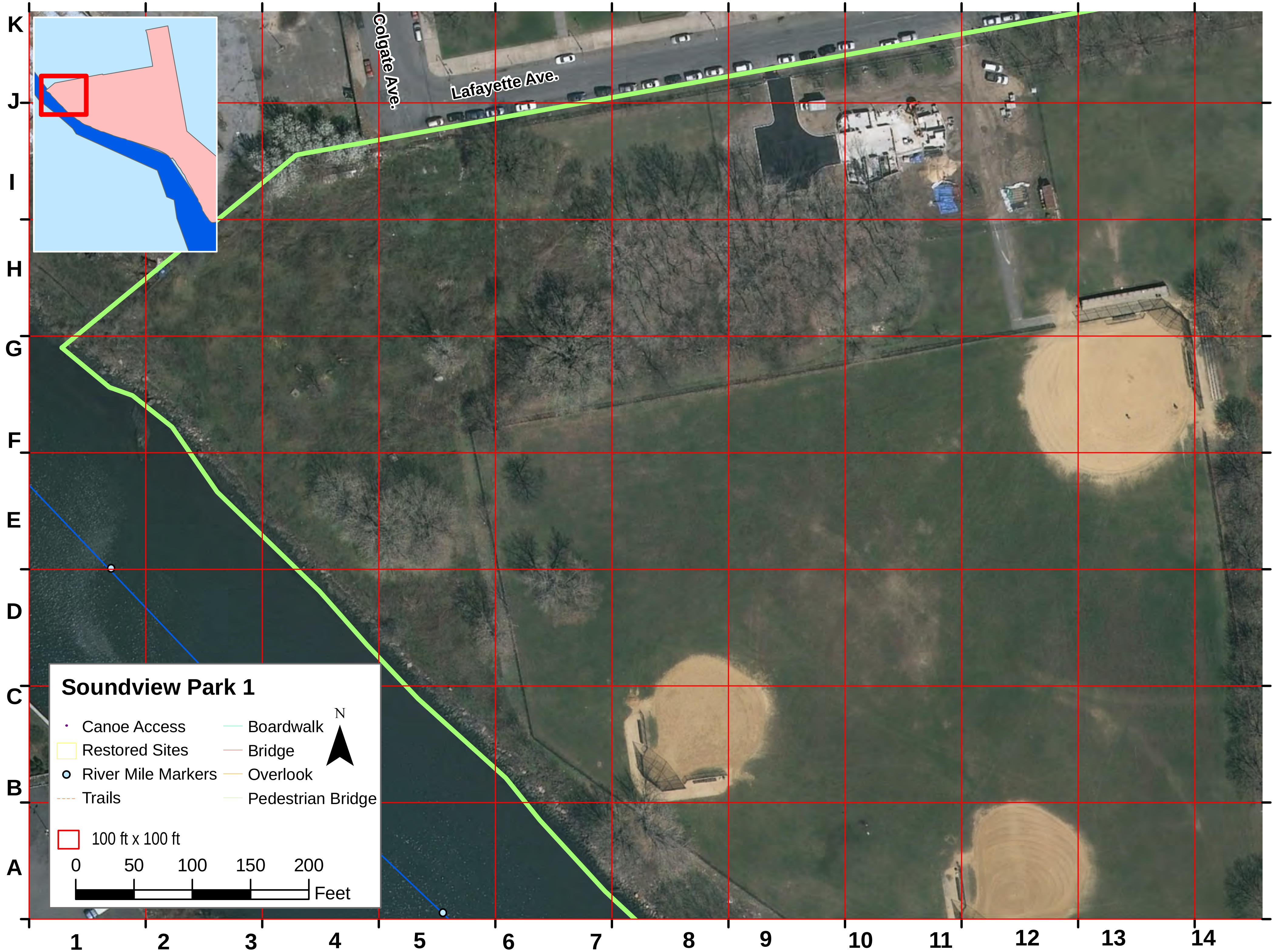
E
D
C
B
A
1
2
3
4
5
6
7
8
Concrete Plant
Bruckner Expy
Garrison Park
Whittier St.
Edgewater Rd.
Garrison Ave.
Garrison Park
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet



SV 1
SV 2
SV 3
SV 4
SV 5
SV 6
SV 7
SV 8
BRUCKNER
WATSON
COLGATE
WHEELER
ELDER
BOYNTON
WARD
MANOR
STRATFORD
MORRISON
BRONX RIVER
STORY
TURNBULL
LAFAYETTE
METCALF
NOBLE
TAYLOR
SOUNDVIEW
SEWARD
CROES
RANDALL
ROSEDALE
COMMONWEALTH
SAINT LAWRENCE
BEACH
THIERIOT
UNDERHILL
LELAND
BOLTON
WHITE PLAINS
NEWMAN
LACOMBE
PATTERSON
OBRIEN
3RD
2ND
1ST
FOOD CENTER
BAY
DRAKE
VIELE
RYAWA
WHITTIER
HALLECK
Soundview Park Map Key
0
100
200
Feet
N



Soundview Park 1
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet
Colgate Ave.
Lafayette Ave.
K
J
I
H
G
F
E
D
C
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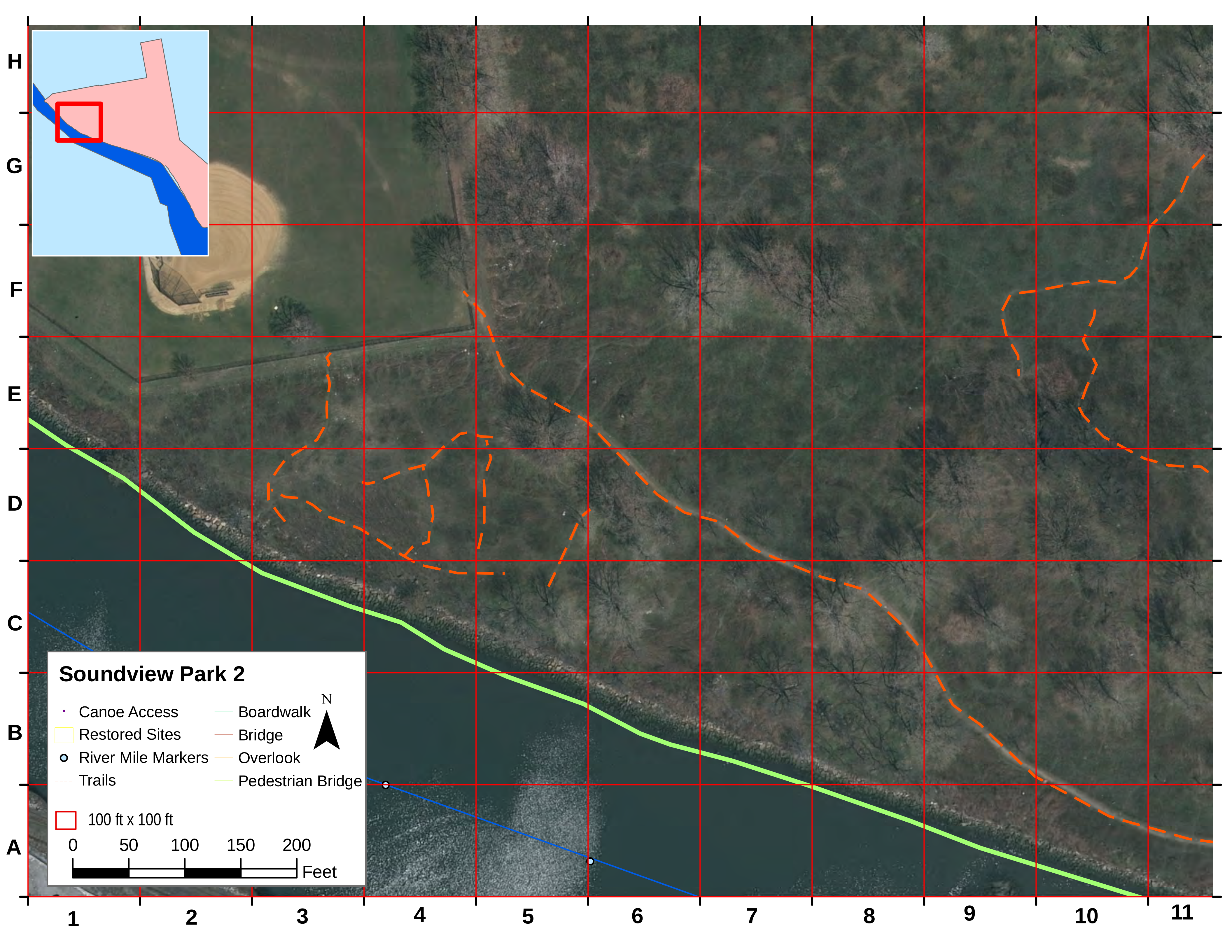
11
12
13
14



Soundview Park 2
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet
H
G
F
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C
B
A
1
2
3
4
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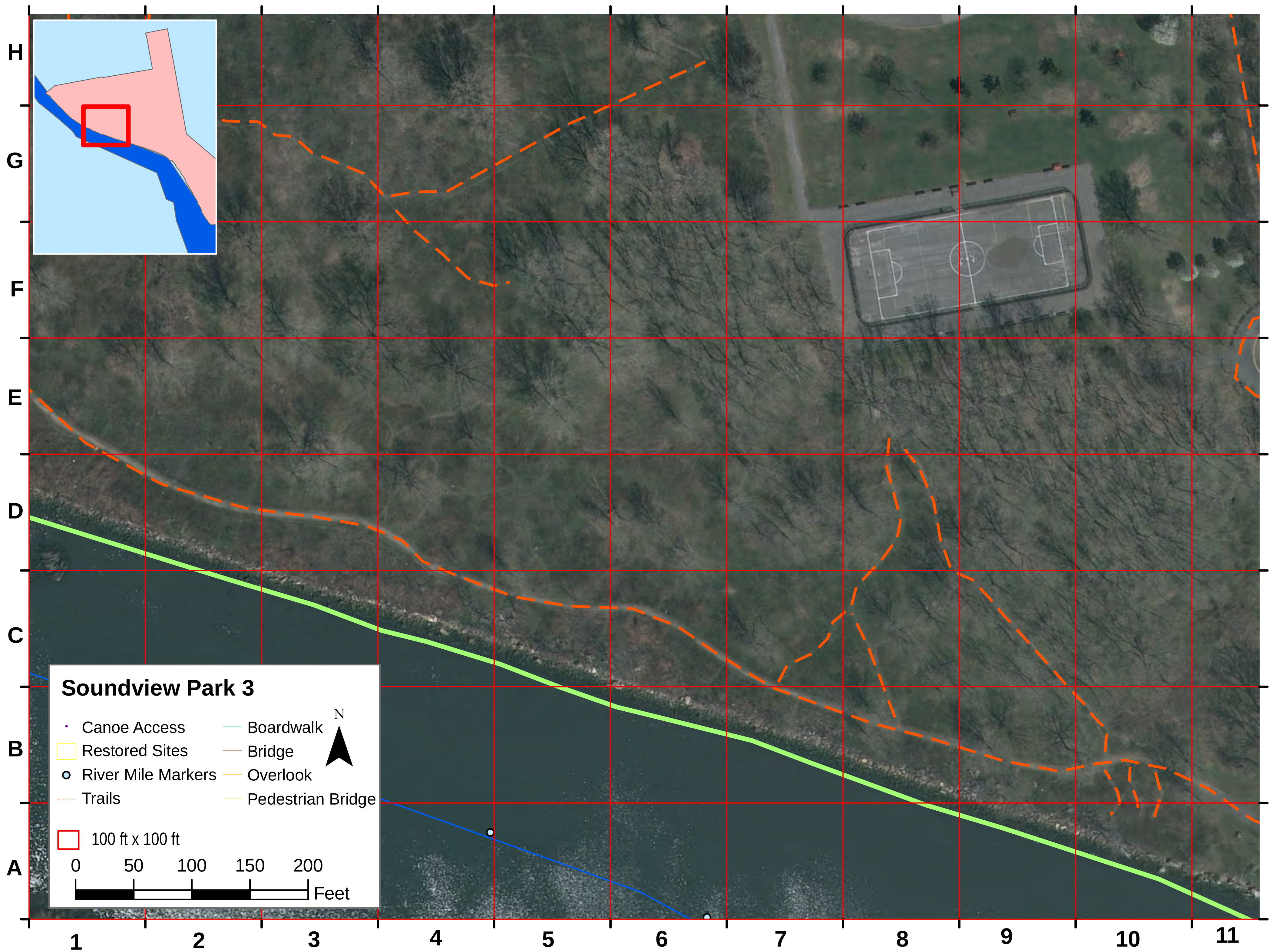
7
8
9
10
11


Soundview Park 3
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet
H
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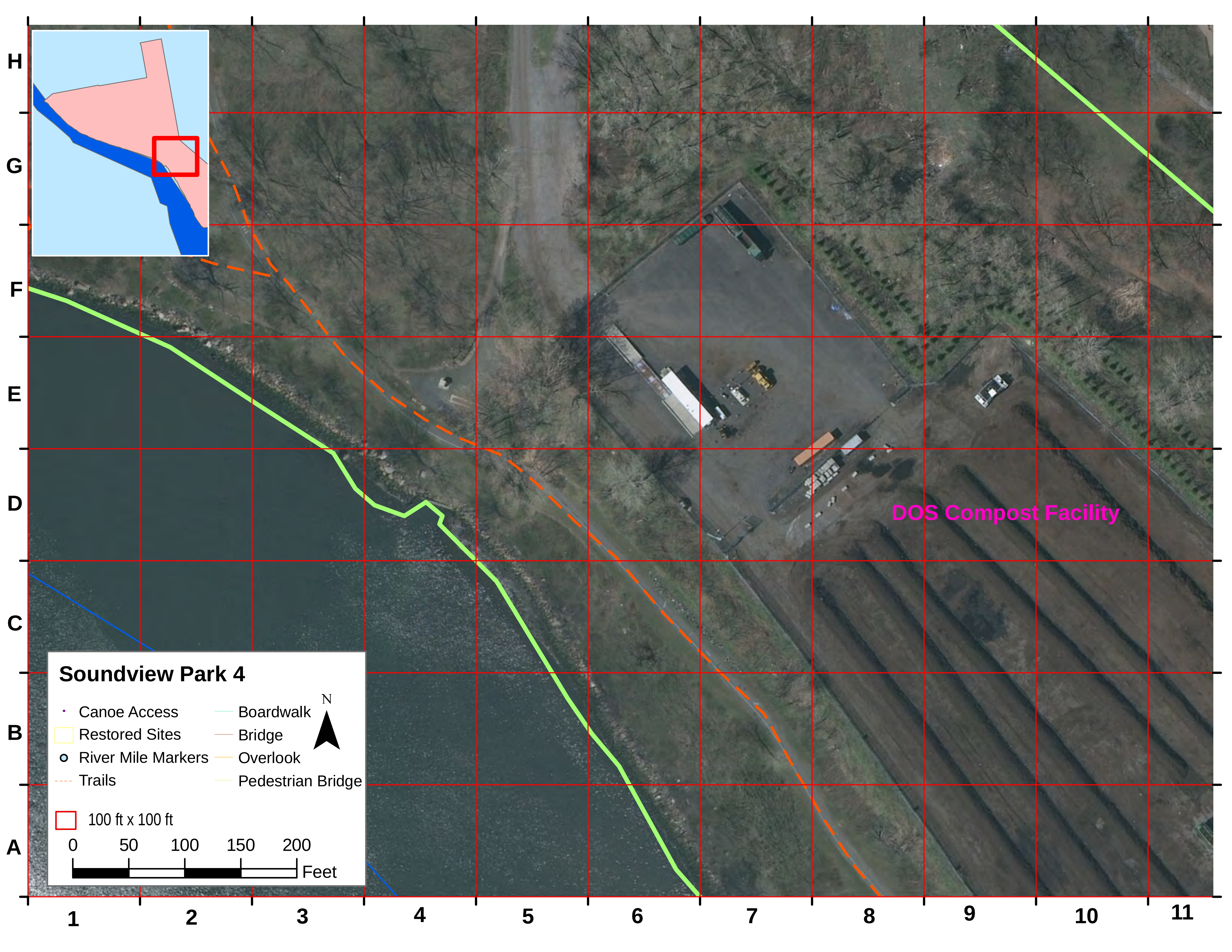
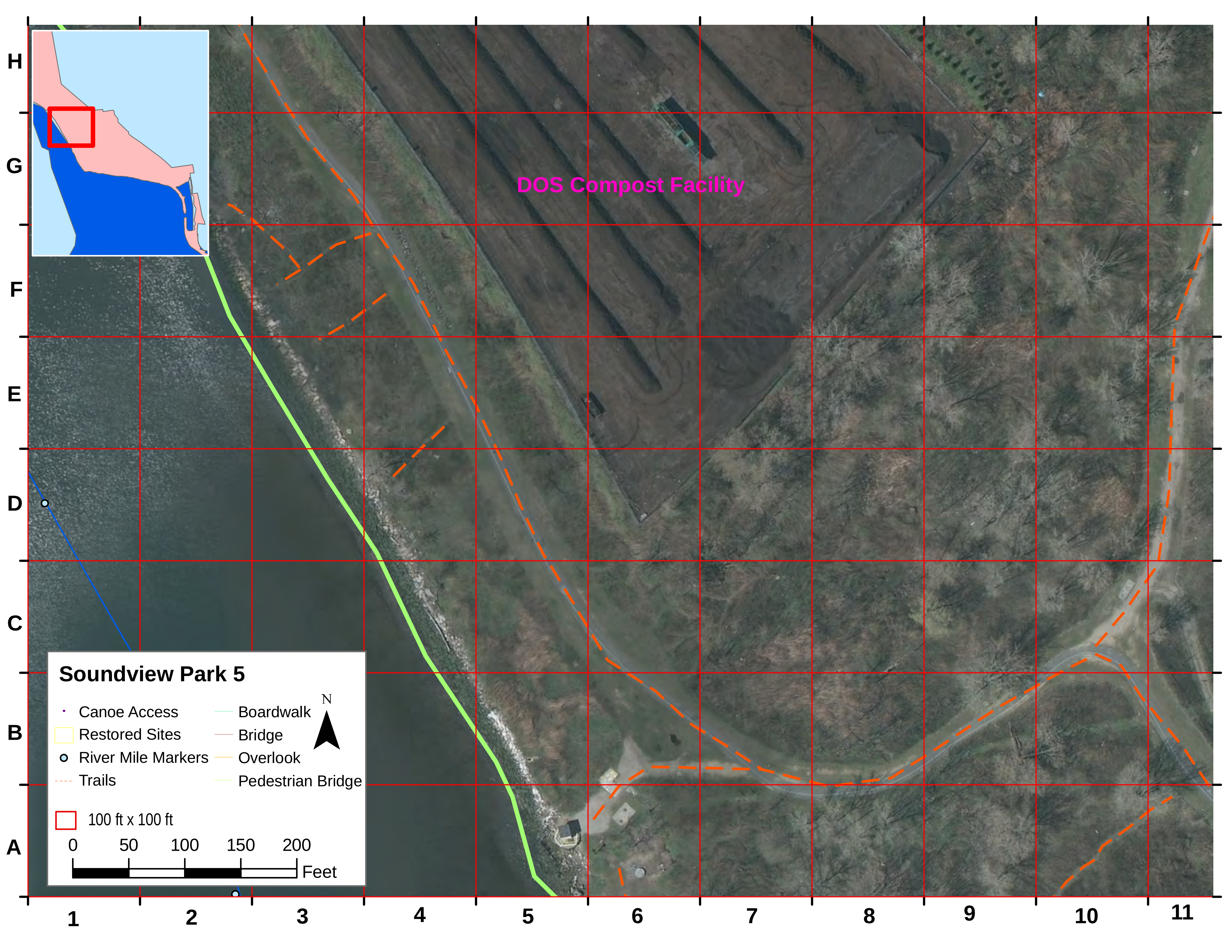


Soundview Park 4
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0 50 100 150 200
Feet
DOS Compost Facility
H
G
F
E
D
C
B
A
1 2 3 4 5 6 7 8 9 10 11



Soundview Park 5
DOS Compost Facility
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet
H
G
F
E
D
C
B
A
1
2
3
4
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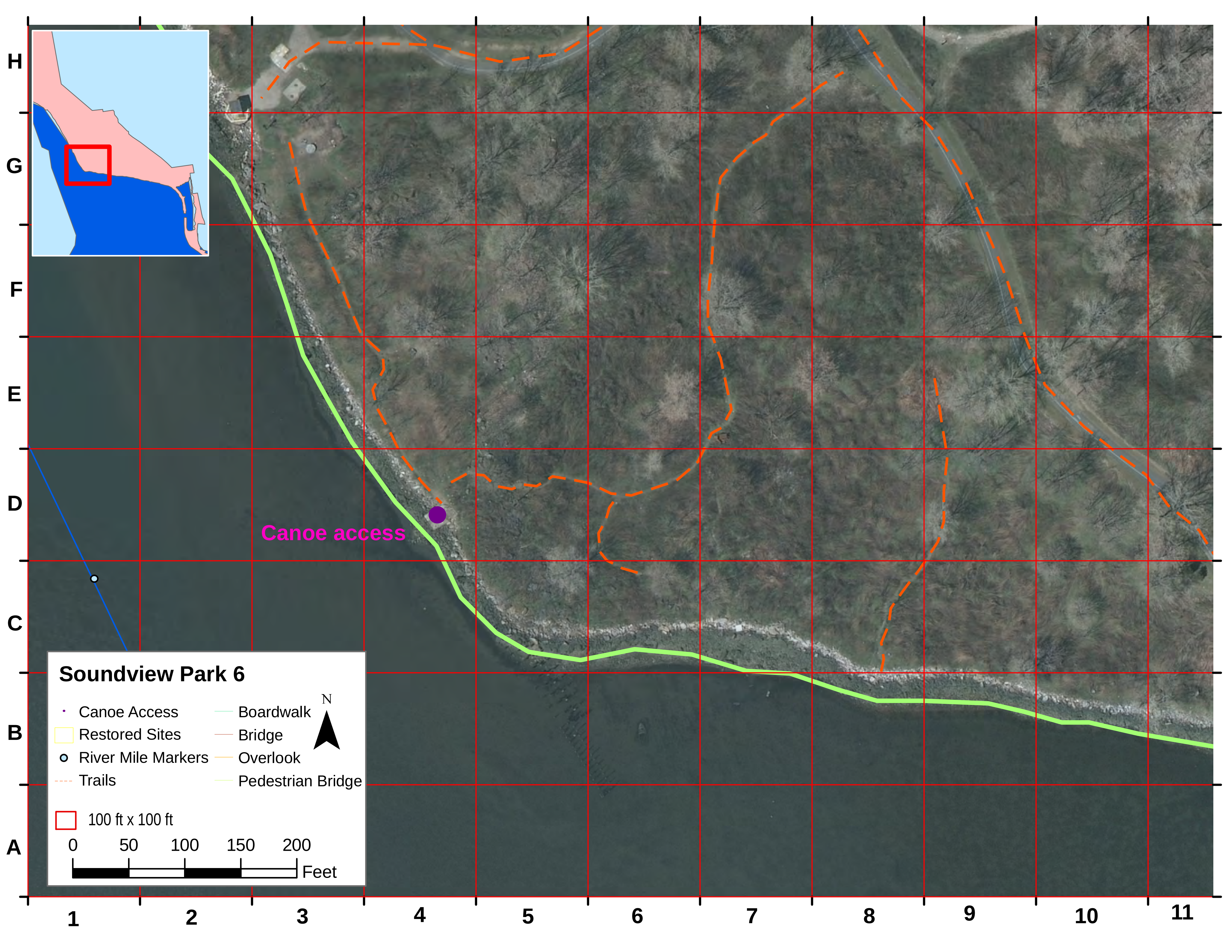
8
9
10
11



H
G
F
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D
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B
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1
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4
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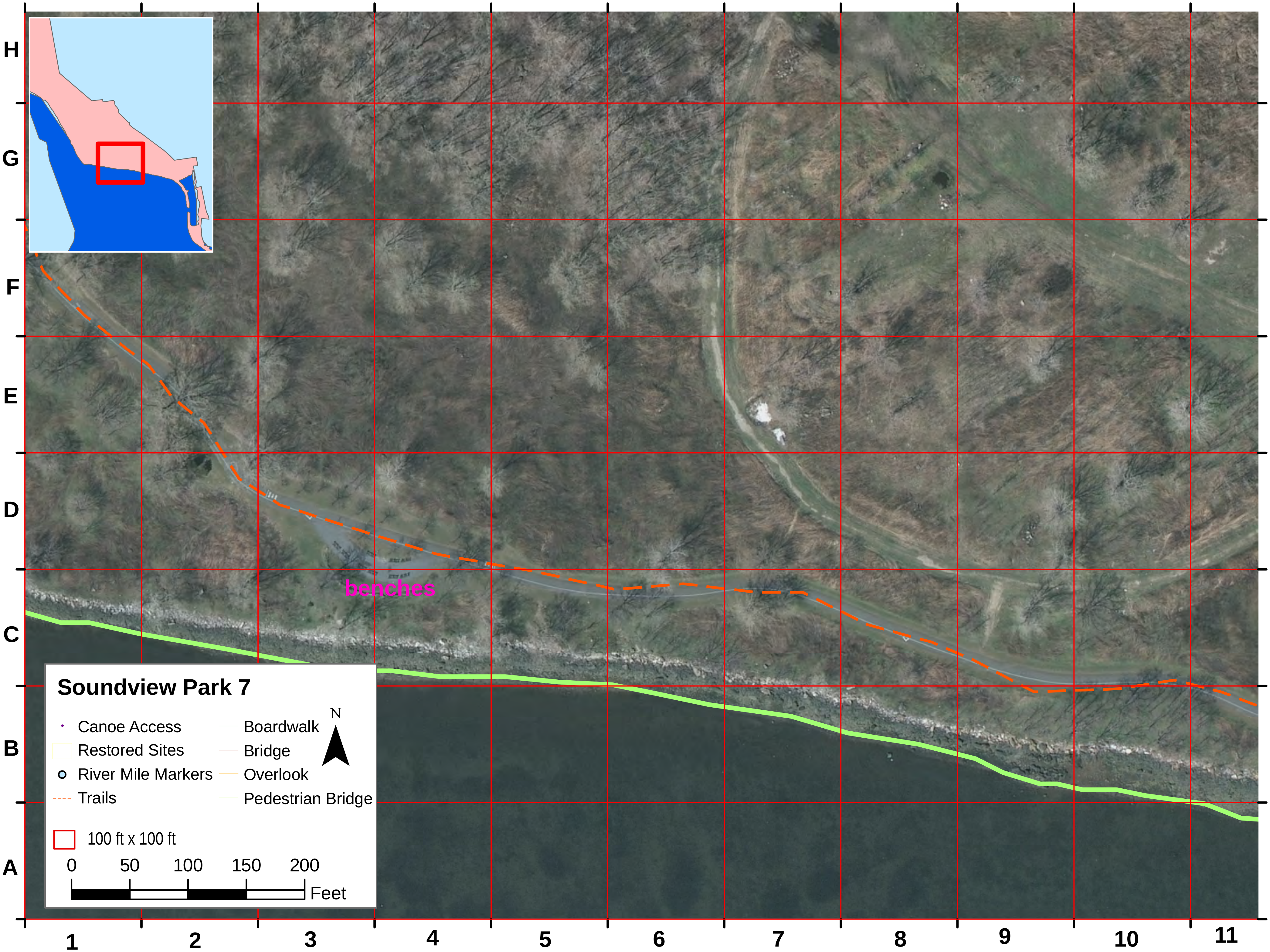
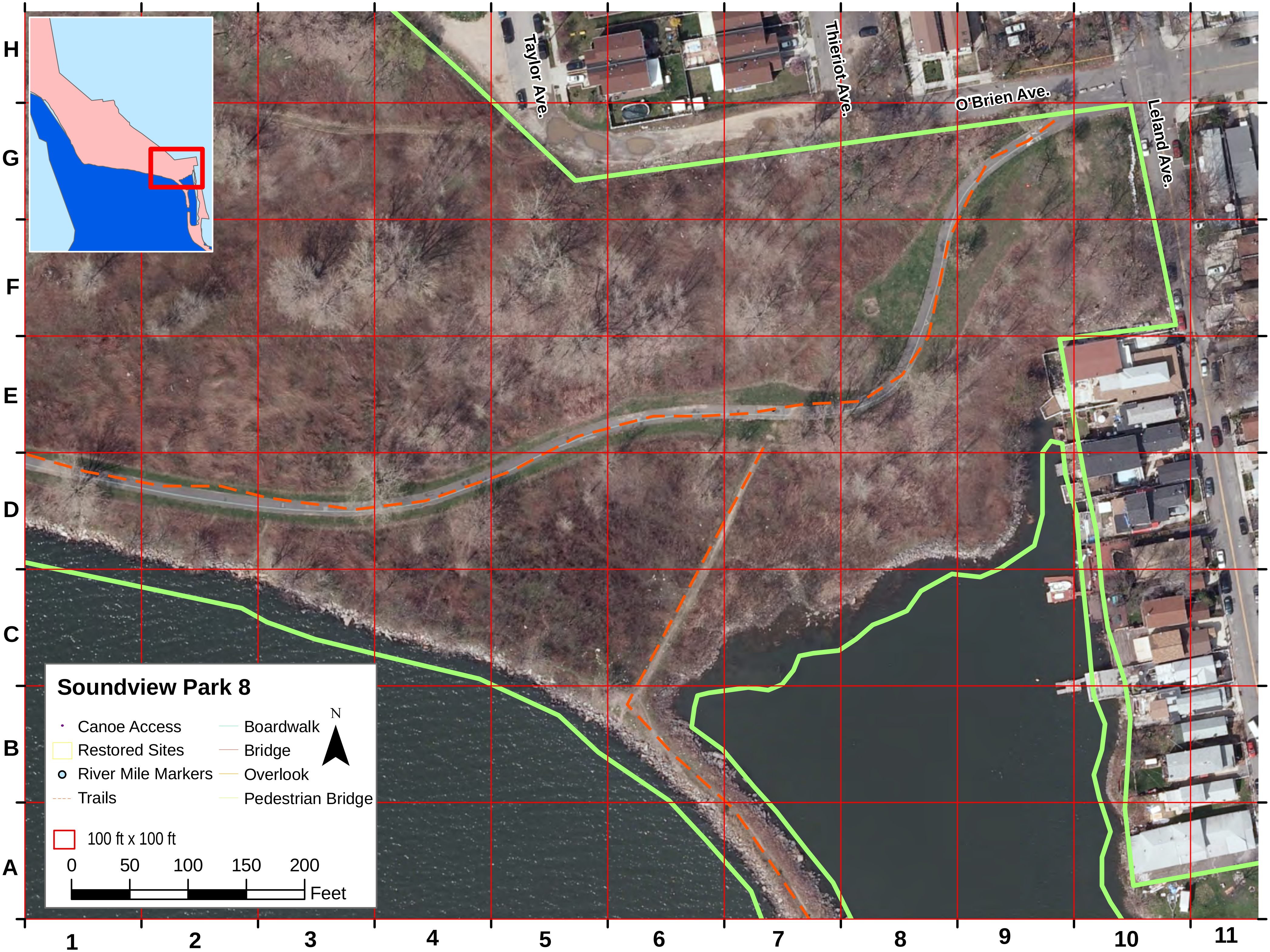
6
7
8
9
10
11
Canoe access
Soundview Park 6
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet



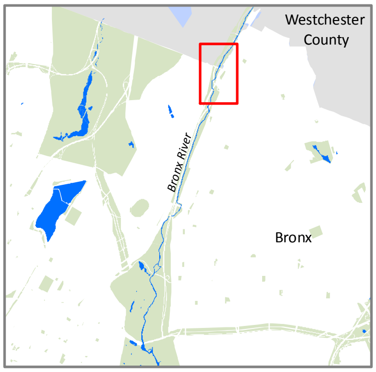
Soundview Park 7
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet
benches
H
G
F
E
D
C
B
A
1
2
3
4
5
6
7
8
9
10
11



Taylor Ave.
Thieriot Ave.
O'Brien Ave.
Leland Ave.
H
G
F
E
D
C
B
A
1
2
3
4
5
6
7
8
9
10
11
Soundview Park 8
Canoe Access
Restored Sites
River Mile Markers
Trails
Boardwalk
Bridge
Overlook
Pedestrian Bridge
N
100 ft x 100 ft
0
50
100
150
200
Feet

APPENDIX 6

Muskrat Cove



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

- Bridge
- Trail
- Bronx River
- Restored Sites*
- NYC Parkland

FAJA

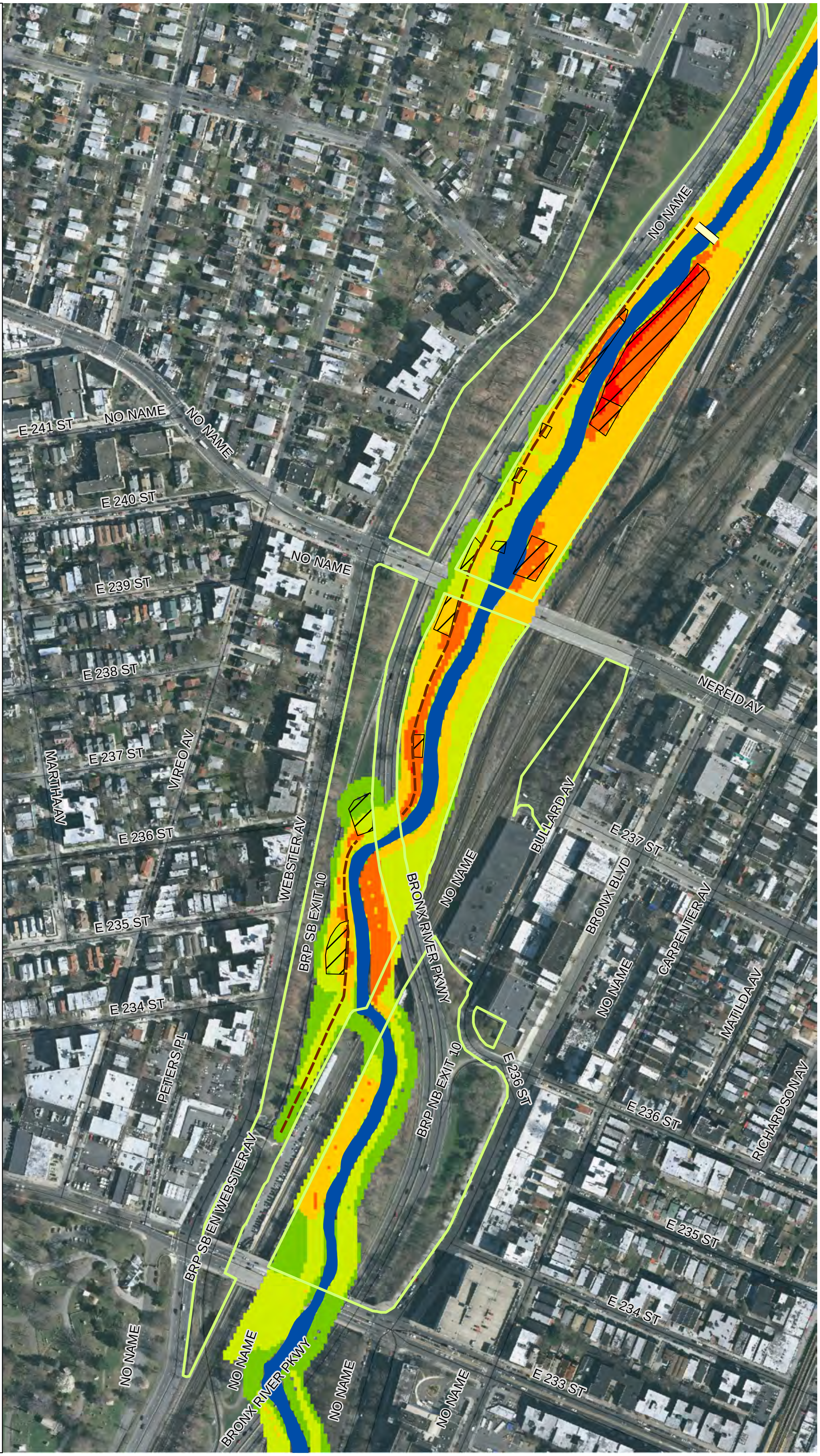
Priority Score Value

- 0
- 1
- 2
- 3
- 4
- 5

0 200 400 Feet

N

*Restored sites refer to sites restored since 2006.



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Adrian Benepe, Commissioner

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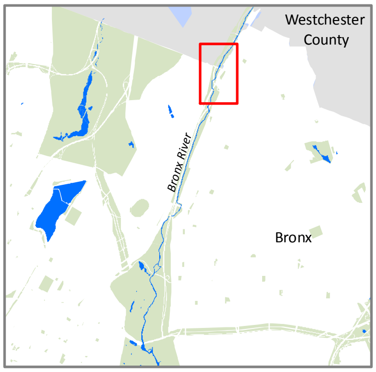
Muskrat Cove



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

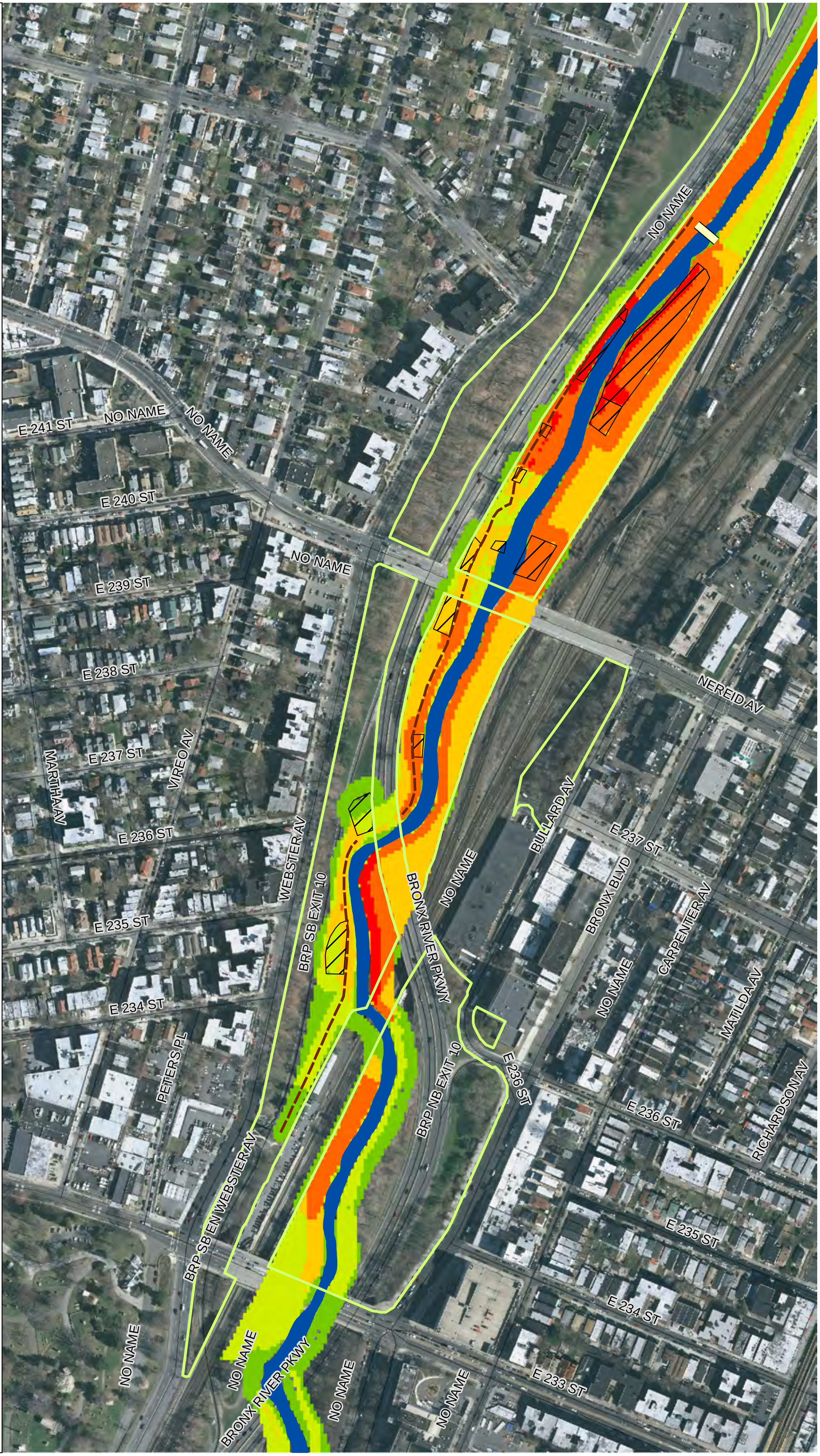
- Bridge
- Trail
- Bronx River
- Restored Sites*
- NYC Parkland

Priority Score Values
- 0
- 1
- 2
- 3
- 4
- 5

0 200 400 Feet

N

*Restored sites refer to sites restored since 2006.



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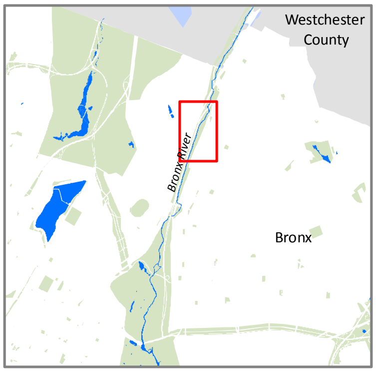
Shoelace Park North

220th St. to 233rd St.



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

NYC Parkland
Bridge
Trail
Restored Sites*
Bronx River

FAJA

Priority Score Value

0
1
2
3
4
5

0 200 400 Feet

N

*Restored sites refer to sites restored since 2006.

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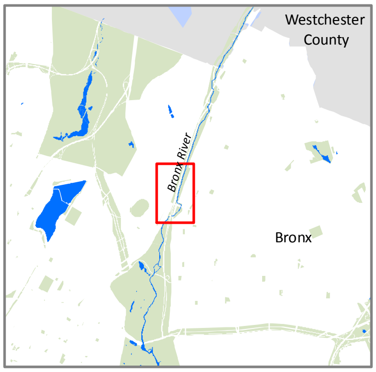
Shoelace Park South

Ft. Knox to 220th St.



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

NYC Parkland

Bridge

Trail

Restored Sites*

Bronx River

FAJA

Priority Score Value

0

1

2

3

4

5

0 200 400 Feet

N

*Restored sites refer to sites restored since 2006.

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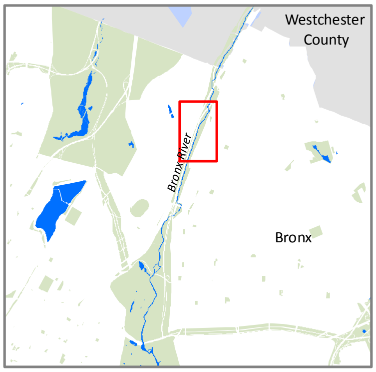
Shoelace Park North

220th St. to 233rd St.



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Bridge
Trail
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 200 400 Feet

N

*Restored sites refer to sites restored since 2006.

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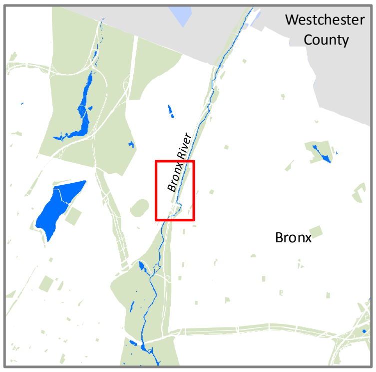
Shoelace Park South

Ft. Knox to 220th St.



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Bridge
Trail
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 200 400 Feet

N

*Restored sites refer to sites restored since 2006.

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Bronx Forest North

North of Burke Bridge

Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

- NYC Parkland
- Bridge
- Trail
- Restored Sites*
- Bronx River

FAJA

VALUE

- 0
- 1
- 2
- 3
- 4
- 5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.

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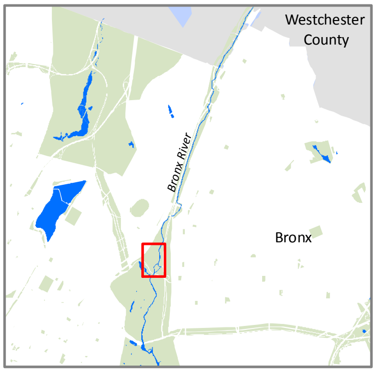
Bronx Forest South

South of Burke Bridge



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

NYC Parkland
Bridge
Trail
Restored Sites*
Bronx River

FAJA

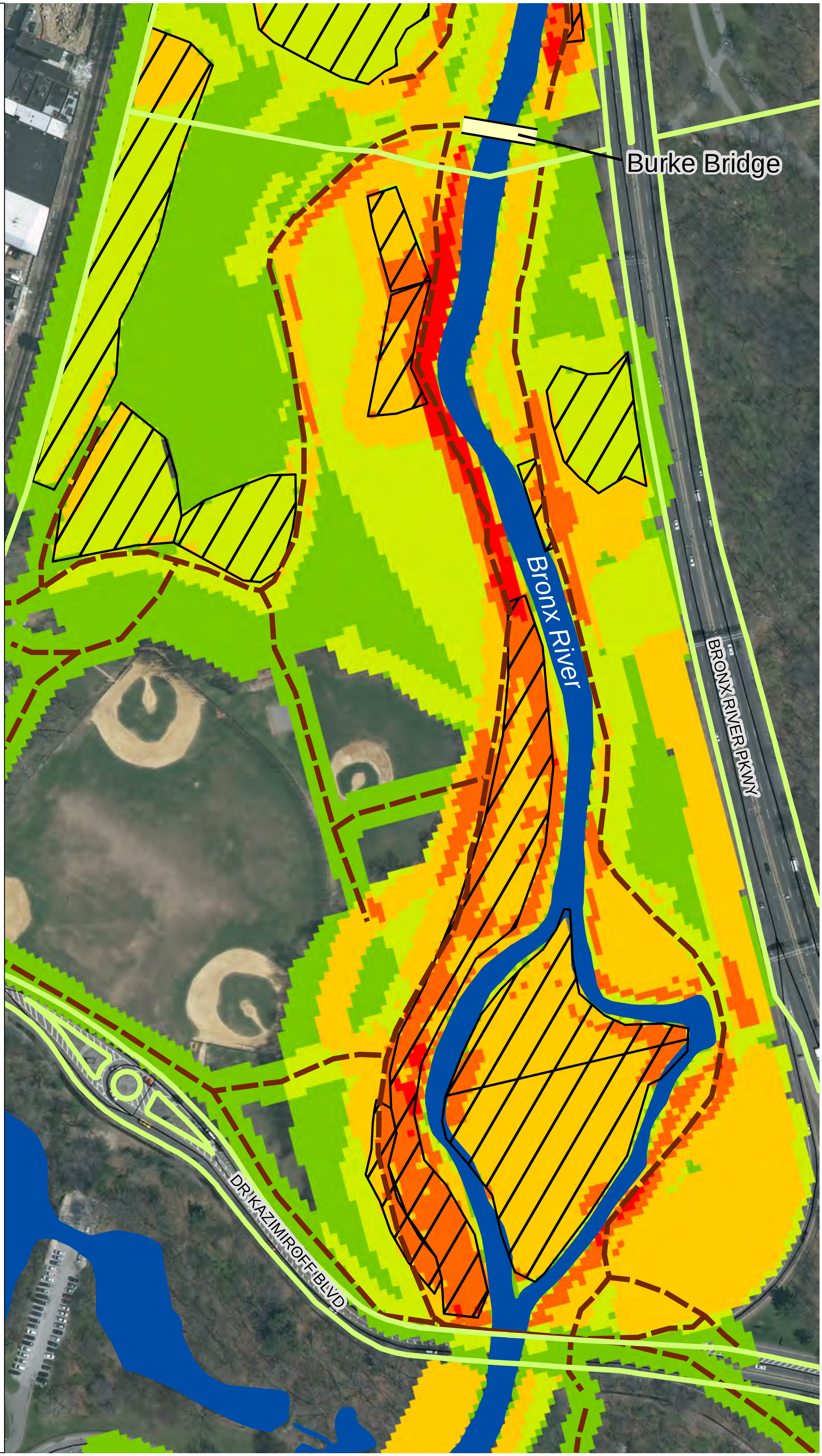
Priority Score Values

0
1
2
3
4
5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.



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Bronx Forest North

North of Burke Bridge

Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

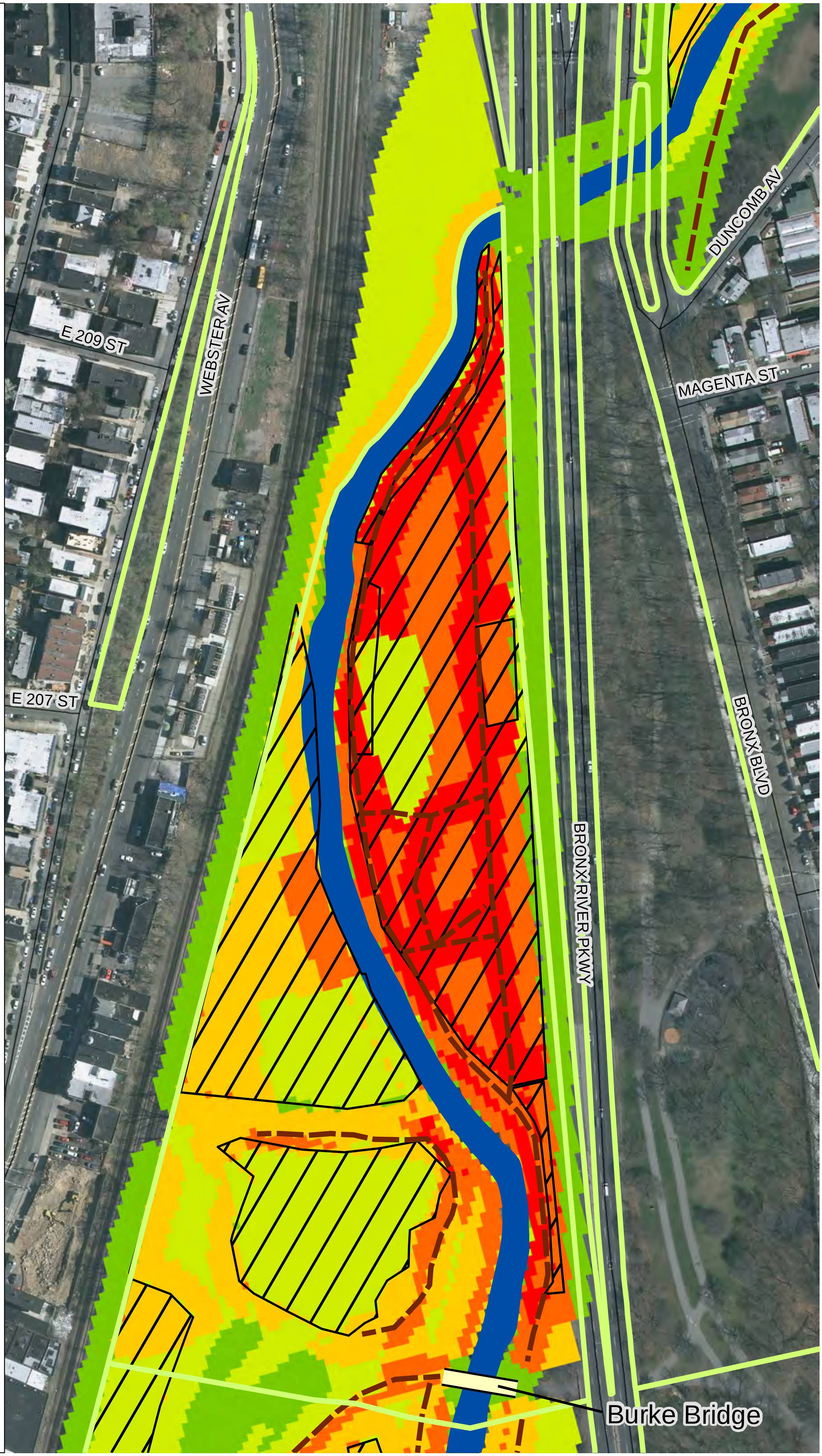
Legend

NYC Parkland
Bridge
Trail
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.



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Created by Ferdie Yau
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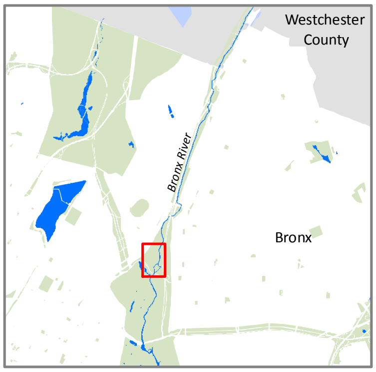
Bronx Forest South

South of Burke Bridge



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Bridge
Trail
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.

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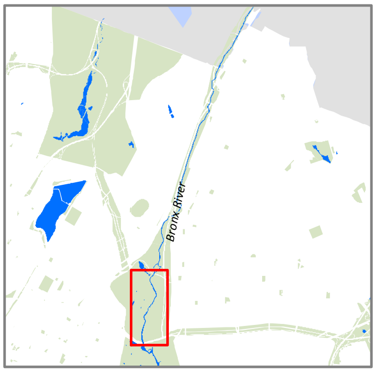
New York Botanical Garden



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

- NYC Parkland
- Restored Sites*
- Bronx River

FAJA

Priority Score Value

- 0
- 1
- 2
- 3
- 4
- 5

0 200 400
Feet

N

*Restored sites refer to sites restored since 2006.

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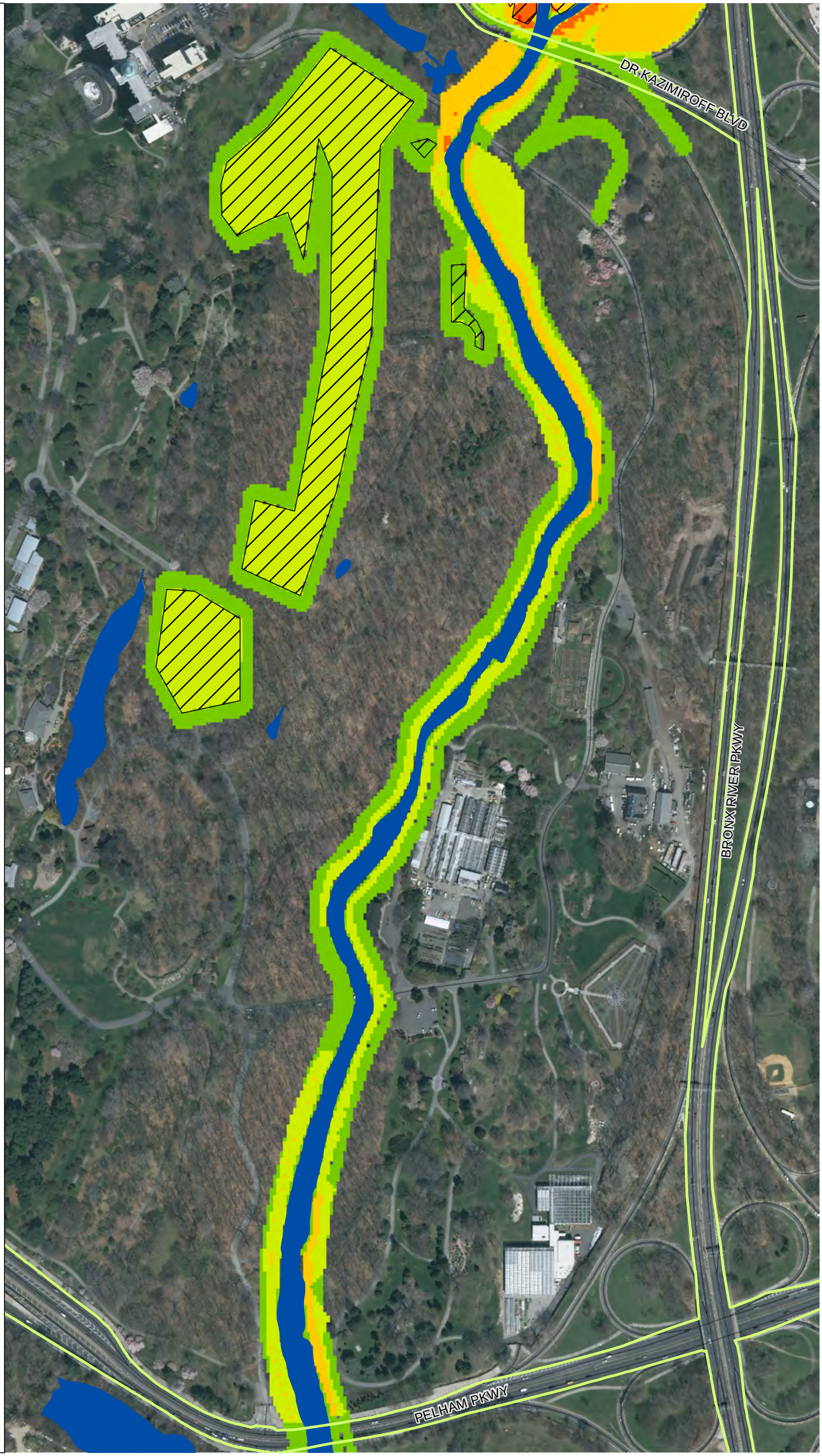
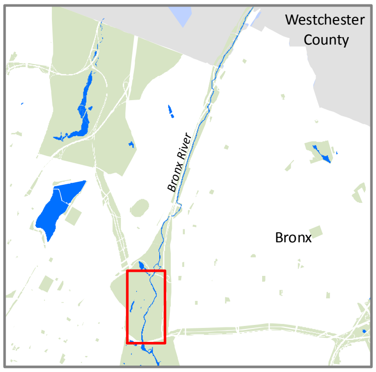


New York Botanical Garden



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 200 400
Feet
N

*Restored sites refer to sites restored since 2006.

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NYC Parks

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Created by Ferdie Yau
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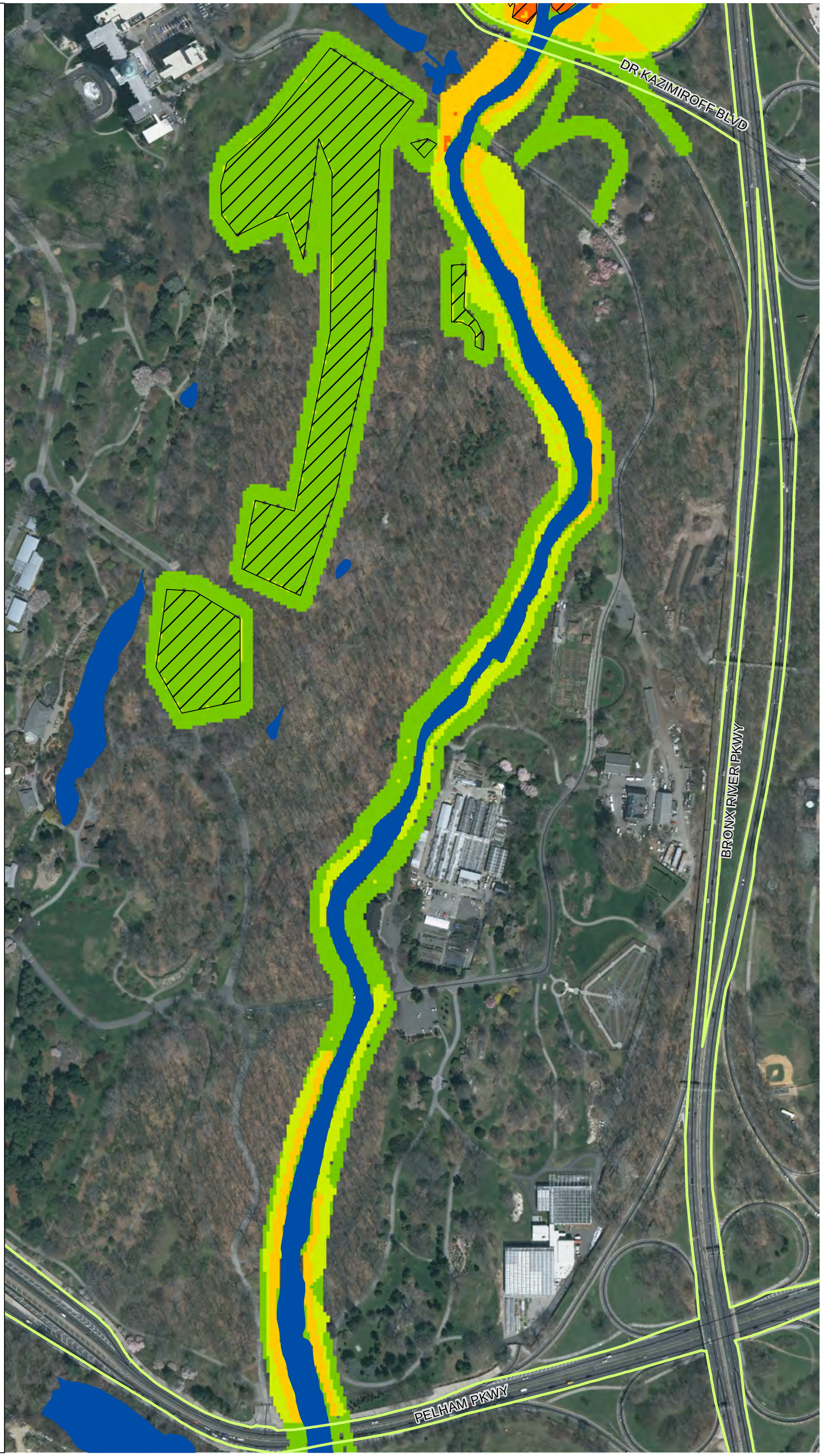


River Park and West Farms Rapids

Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

- NYC Parkland
- Restored Sites*
- Bronx River

FAJA

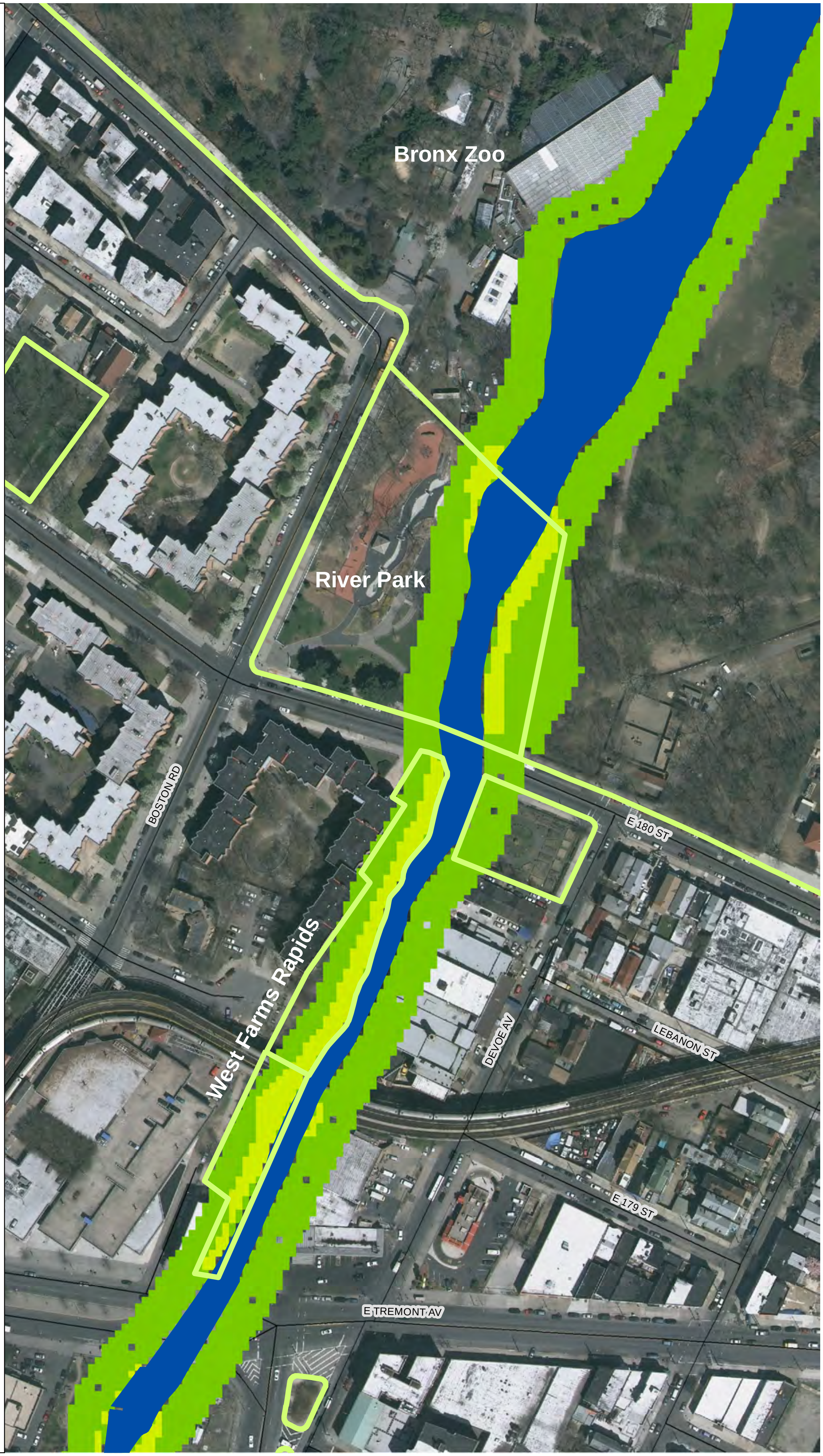
Priority Score Value

- 0
- 1
- 2
- 3
- 4
- 5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.



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Created by Ferdie Yau
NYC Department of Parks & Recreation, December 21, 2011.

River Park and West Farms Rapids

Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

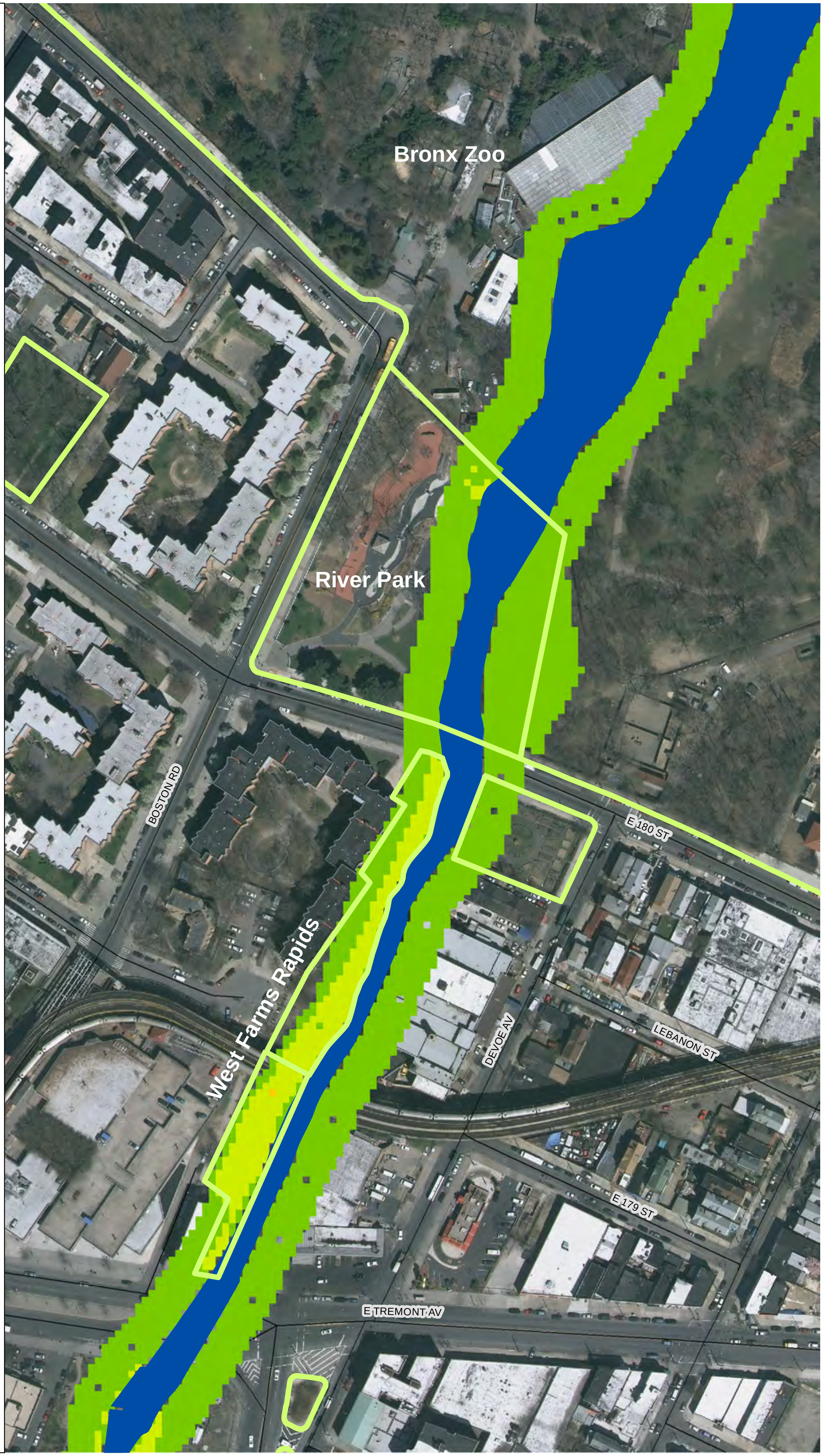
Legend

NYC Parkland
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.



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Created by Ferdie Yau
NYC Department of Parks & Recreation, December 21, 2011.

Drew Gardens

Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

Restored Sites*

FAJA

Priority Score Value

- 0
- 1
- 2
- 3
- 4
- 5
- Bronx River

0 40 80 Feet

N

*Restored sites refer to sites restored since 2006.

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Created by Ferdie Yau
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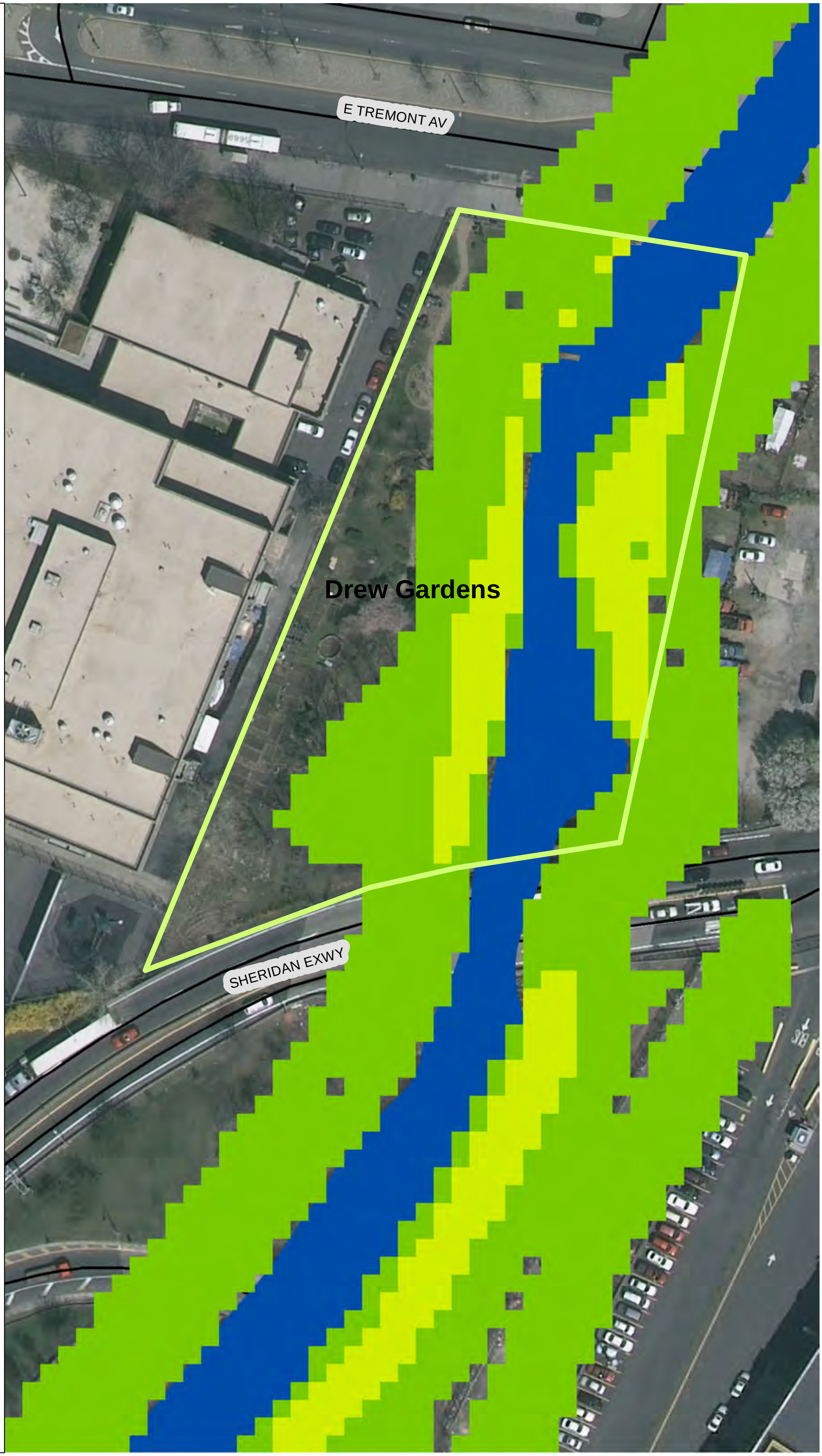


Drew Gardens

Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

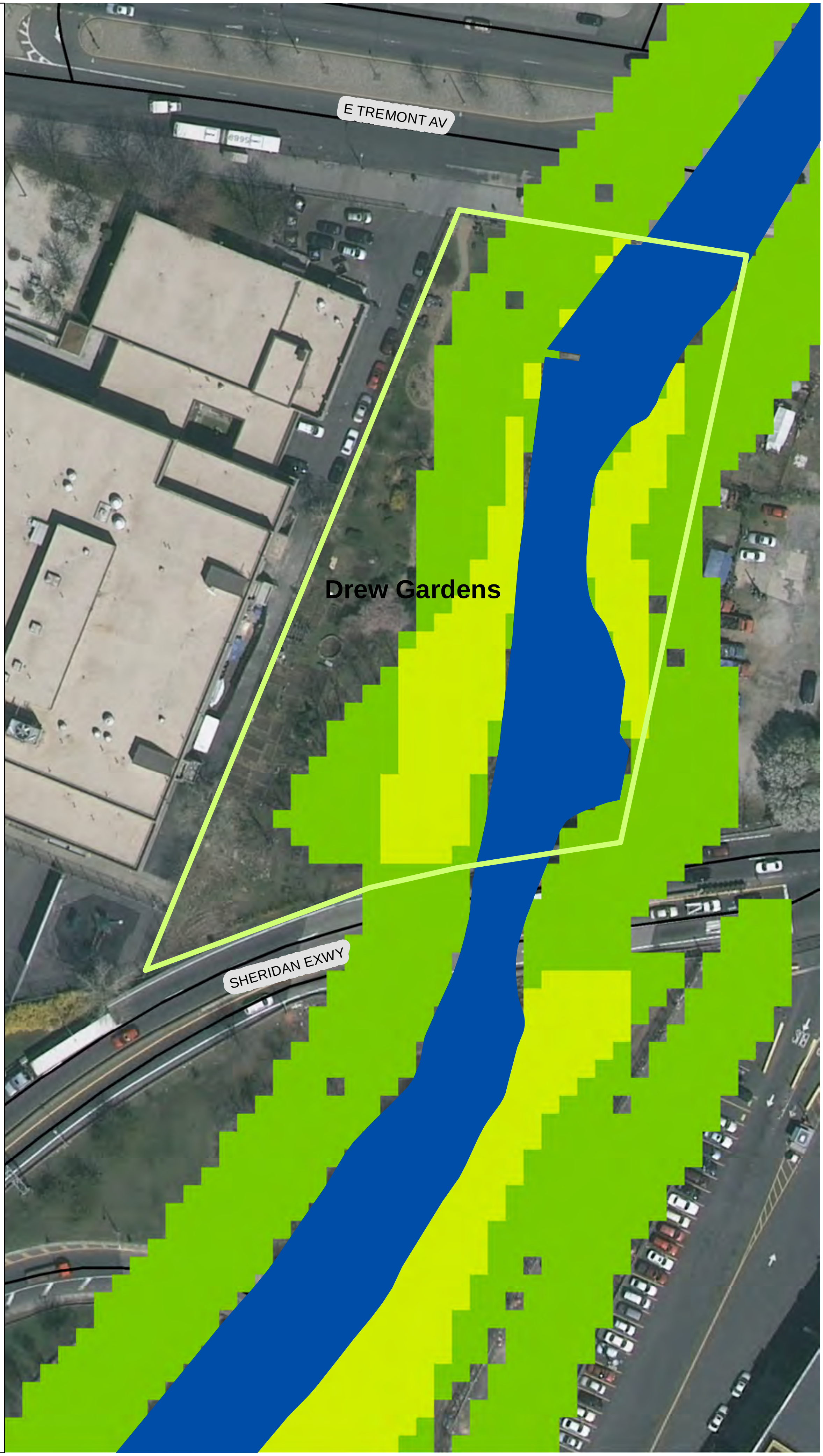
Legend

- Restored Sites*
- Bronx River

Priority Score Values
- 0
- 1
- 2
- 3
- 4
- 5

0 40 80 Feet
N

*Restored sites refer to sites restored since 2006.



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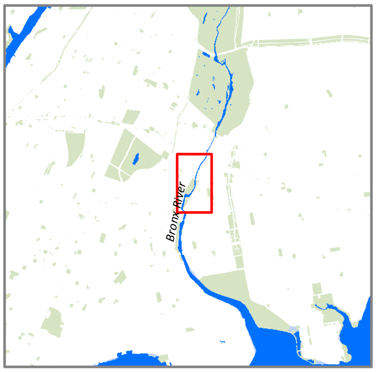
Adrian Benepe, Commissioner

NYC Parks

Division of Central Forestry, Horticulture & Natural Resources.
Created by Ferdie Yau
NYC Department of Parks & Recreation, December 21, 2011.

Starlight Park



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

- NYC Parkland
- Bridge
- Trail
- Restored Sites*
- Bronx River

FAJA

Priority Score Value

- 0
- 1
- 2
- 3
- 4
- 5

0 150 300 Feet

N

*Restored sites refer to sites restored since 2006.

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Adrian Benepe, Commissioner

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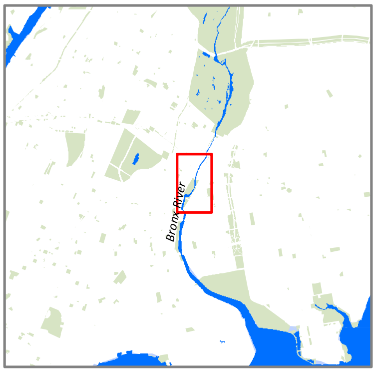
Starlight Park



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

- NYC Parkland
- Bridge
- Trail
- Restored Sites*
- Bronx River

Priority Score Values
- 0
- 1
- 2
- 3
- 4
- 5

0 150 300 Feet

N

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Concrete Plant Park

Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

NYC Parkland
Trail
Restored Sites*
Bronx River

FAJA

Priority Score Value

0
1
2
3
4
5

0 100 200 Feet

N

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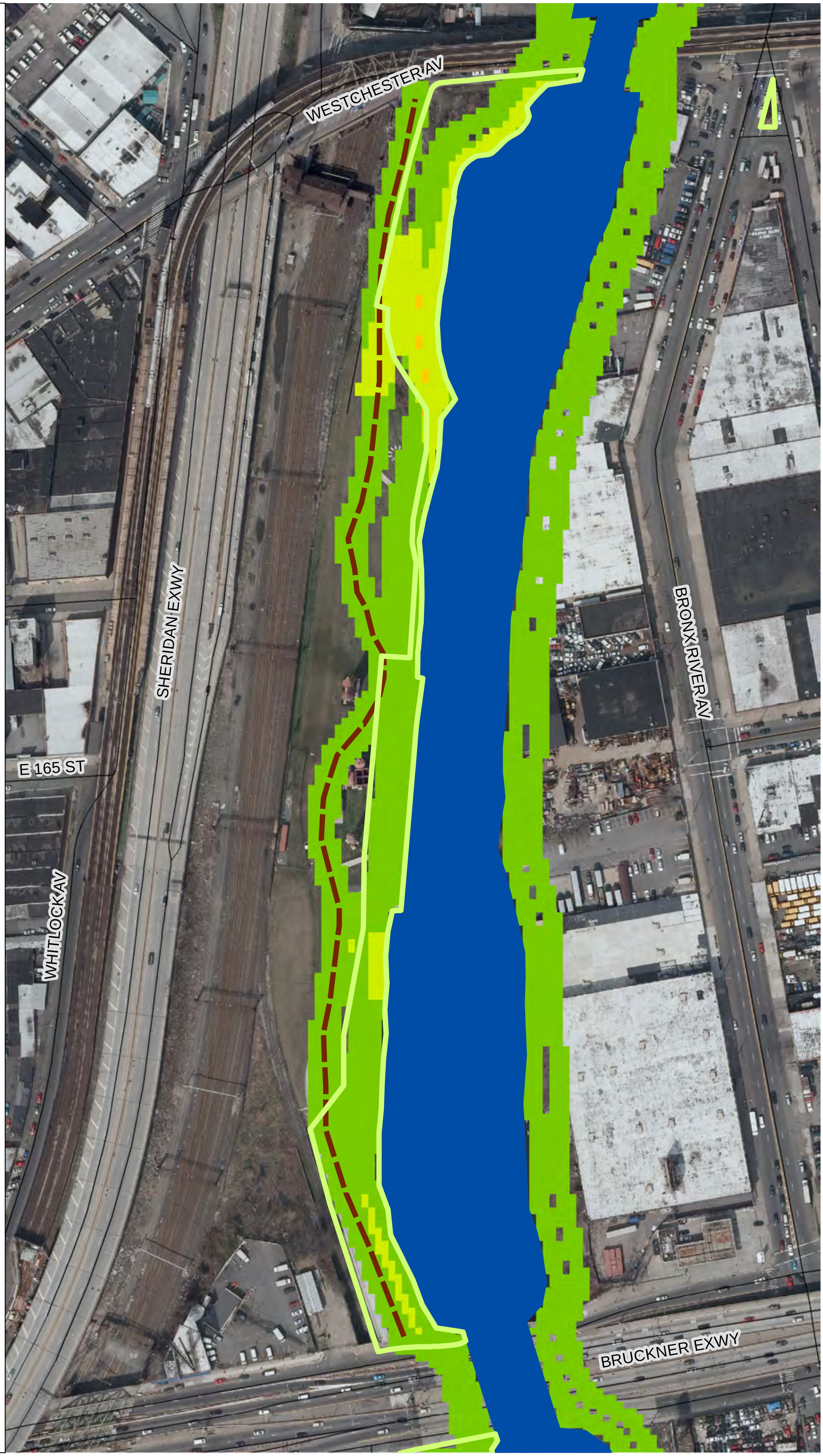


Concrete Plant Park

Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Trail
Restored Sites*
Bronx River

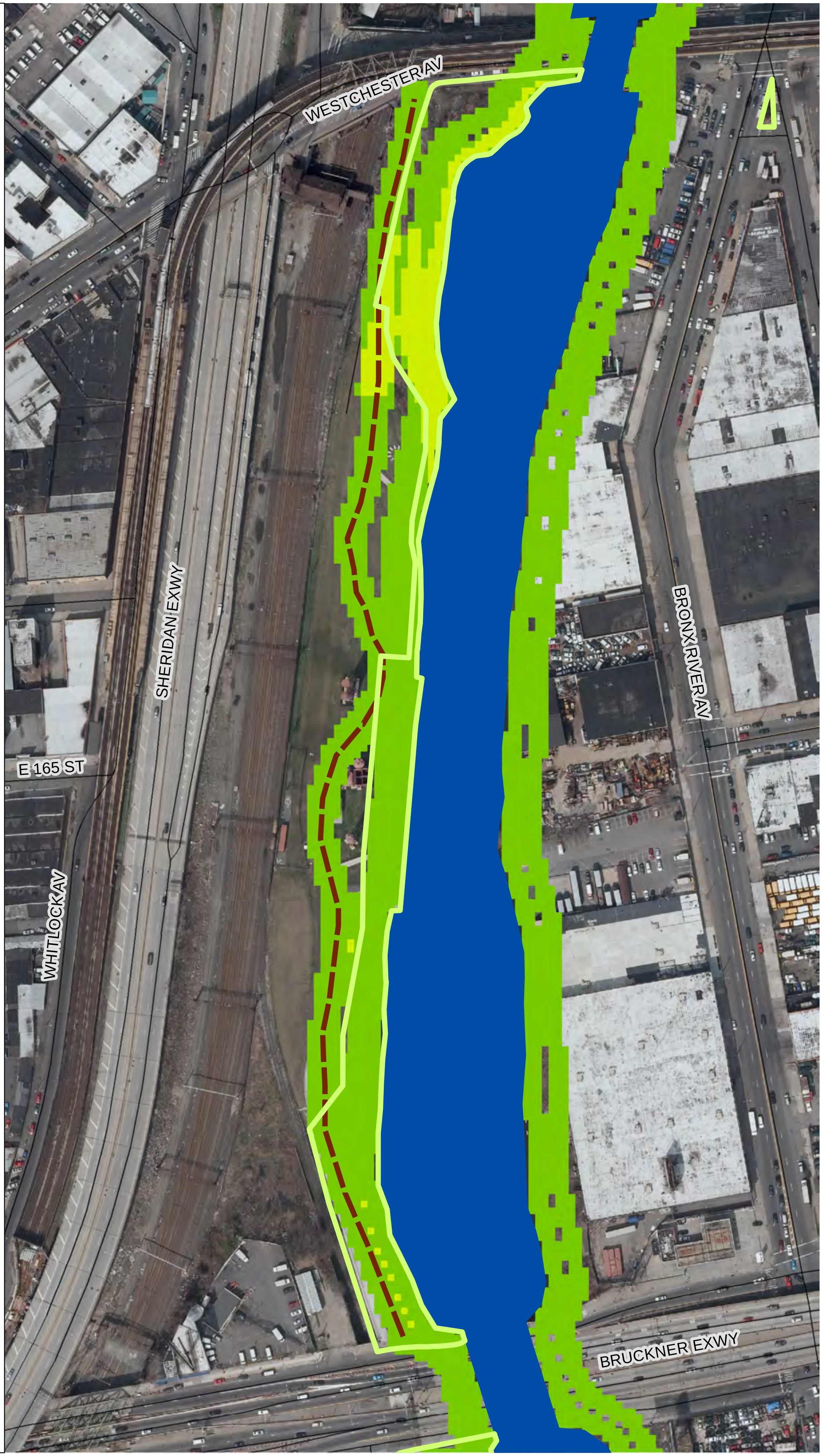
Priority Score Values

0
1
2
3
4
5

0 100 200 Feet

N

*Restored sites refer to sites restored since 2006.



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Garrison Park

Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

NYC Parkland
Restored Sites*
Bronx River

FAJA

Priority Score Value

0
1
2
3
4
5

0 25 50
Feet

N

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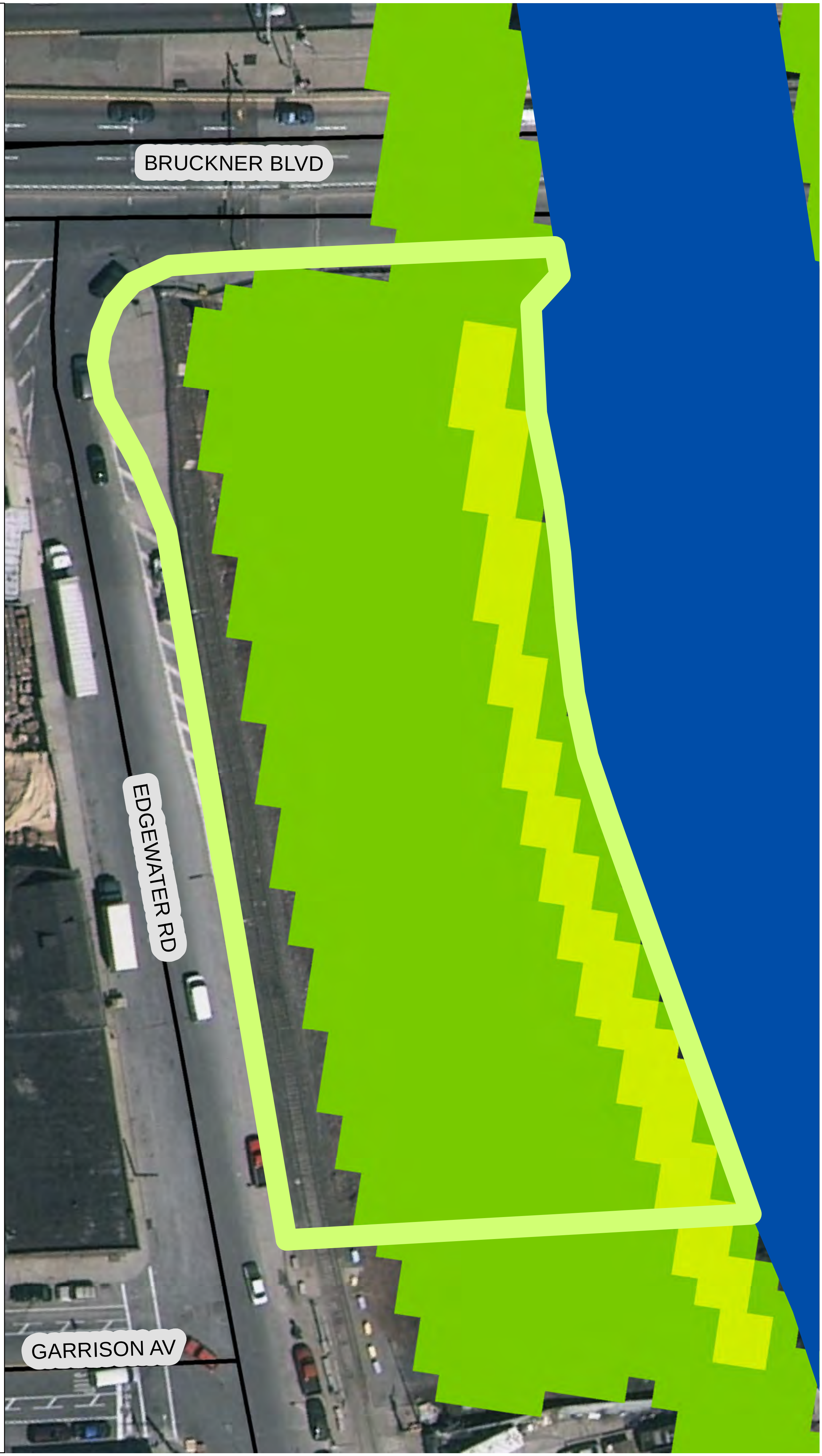

Garrison Park

Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Restored Sites*
Bronx River
Priority Score Values
0
1
2
3
4
5

0 25 50
Feet

N

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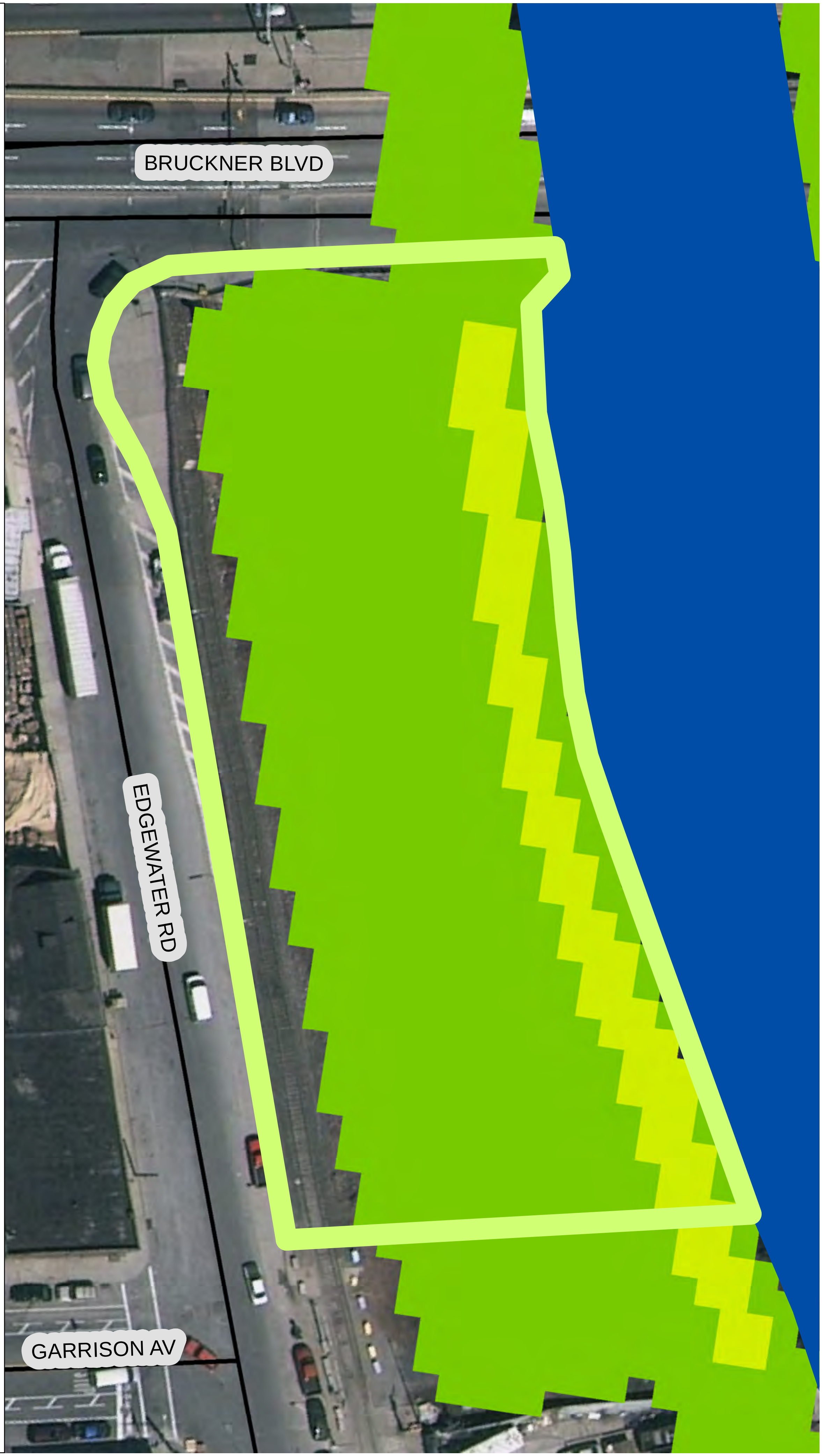
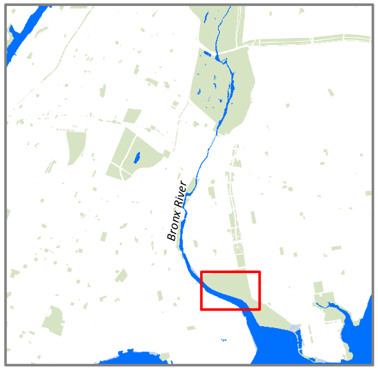


Soundview Park North



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

- NYC Parkland
- Restored Sites*
- Trail
- Bronx River

FAJA

Priority Score Value

- 0
- 1
- 2
- 3
- 4
- 5

0 200 400 Feet

N

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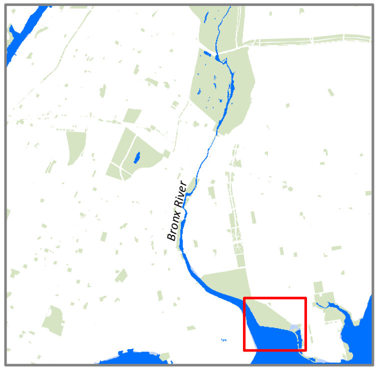
Soundview Park South



Prioritization analysis model includes the following species:

Fallopia japonica

Date: December 21, 2011

Legend

Restored Sites*
Trail
Bronx River

FAJA

Priority Score Value
- 0
- 1
- 2
- 3
- 4
- 5

0 200 400 Feet

N

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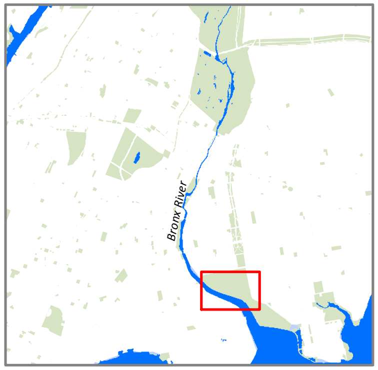
Soundview Park North



Prioritization analysis model includes the following species:

Fallopia japonica
Ampelopsis brevipenduculata
Celastrus orbiculatus
Convolvulus arvensis
Humulus japonica

Date: December 21, 2011

Legend

NYC Parkland
Restored Sites*
Trail
Bronx River

Priority Score Values
0
1
2
3
4
5

0 200 400
Feet
N

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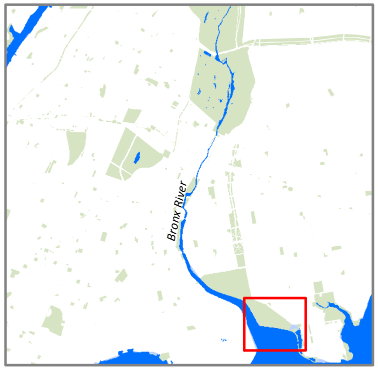
Soundview Park South



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Humulus japonica

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- Restored Sites*
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APPENDIX 7

Site Inspections Form

Park Name:	**Site Name:**
Date:	**Inspectors:**
Fence Installed: Y / N **Condition of Fence:**	**Sign Installed:** Y / N **Condition of Sign:**
Evidence of Herbivory: Y / N (Rabbit, Deer, Muskrat, Insect, Beaver, other)	**Evidence of Vandalism:** Y / N

	Tree Species Name:	No. of Individuals:	Condition (Excellent, Good, Poor, Dead) :
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

	Shrub Species Name:	No. of Individuals:	Condition (Excellent, Good, Poor, Dead) :
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Invasive Species Present:	Dead/Alive (D/A):	Percent Cover:	Size: (seedling, <1" diameter, 1-2", >2")	Distribution: (I, S, or L – see below)
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		
		<10 % 11-25 % 26-50 % 50-75% >76%		

Total Percentage of Site with Invasives Present:

Manual Removal Required: Y / N	**Staff hours Needed :** (# of people X # hrs)	**Method/Equipment Needed:** (In house, volunteer) (Hand pull, cut, dig, power tools))
Chemical Treatment Required: Y / N	**Staff hours Needed :** (# of people X # hrs)	**Method/Equipment Needed:**

Site Inspections Form

Additional Site Notes: (Note if there is evidence of fabric, erosion control, and flagging)	
Canopy Cover:	**< 25%, 25-50%, 50-75%, >75%**
Number of Photos Taken:	

Tree/Shrub Condition Key:

Excellent	Full crown no signs of disease or insect damage/herbivory, free of cavities, cracks and fire injury, twigs and branches are strong, foliage is full and green.
Good	2/3 of crown still alive, minor damage on leaves and branches from disease/herbivory, minor leave discoloration, some damage to twigs and branches .
Poor	More than 1/3 crown is dead, more than 1/3 stems and twigs are dead, insect damage and herbivory evident, more than 50% leaves discolored, tree may have been burned or uprooted
Dead	Dead

Distribution Key:

I = Plant occurs in **Isolated** or **small patches** in the site
S = Plant occurs in **Small patches scattered throughout** the site
L = Plant occurs in **Large patches scattered throughout** or is **pervasive throughout** the site