



*Preliminary Review of
Open Space and Natural Resources
for the City of Kingston, NY*

DRAFT December 3, 2013 DRAFT

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Introduction

The intention of this document is to summarize natural resource and open space considerations in order to inform the Comprehensive Plan. This document is neither a full natural resource inventory nor an open space inventory. It is a preliminary document to provide information to the comprehensive plan update process. Understanding the natural resources and open areas is an essential part the process of developing the Comprehensive Plan as these resources provide a framework for considering all parts of the City in regards to significant and sensitive areas and connection between other areas. This document covers some of the concerns of Goal 6 and Goal 10 of the October 9, 2013 final draft of the *Vision for the Future and Planning Needs*, a preliminary document of Kingston 2025.

- Goal 6: Preserve constrained lands as open space, agriculture or very low-density residential clustered development as appropriate.
- Goal 10: Improve public infrastructure including City Streets, water and sewer infrastructure, as well as enhanced park facilities.

Sources of information for this document include personal knowledge, the City of Kingston, NY Parks and Recreation Master Plan, Kingston Land Trust and other references cited or listed in the reference list. Maps in the appendix were created with funding and support of the NYSDEC Hudson River Estuary Program. The layered map of Significant Habitats in Selected Areas of Kingston prepared by Hudsonia, Ltd. was informed by biodiversity mapping carried out by members of the Kingston Conservation Advisory Council (CAC). A map of the Regional Context for the City of Kingston, NY was prepared by Hudson River Estuary Program staff, who are also in the process of preparing a habitat summary based on published sources and databases. The CAC has obtained geographic information from Ulster County which, with more resources and time, can enhance our understanding of the natural resources and open space of Kingston and inform the Comprehensive Plan.

What is Open Space?

Open Space is land that is not intensively developed for residential, commercial, industrial or institutional use. It serves many purposes, whether it is publicly or privately owned. It includes agricultural and forest land, undeveloped shorelines, undeveloped scenic lands, public parks and preserves. It also includes water bodies such as lakes and bays. What is defined as open space depends in part on its surroundings. A vacant lot, community garden or small marsh can be open space in a big city. A narrow corridor or pathway for walking or bicycling is open space even though it is surrounded by developed areas. Historic and archeological sites are often associated with significant open spaces and are a part of our common heritage.¹

Open Space Objectives

An open space preservation program considers water resources protection, preservation of wildlife habitat, the identification and retention of historic resources and the management of parks and recreation facilities and the management of community and urban forestry and agriculture. This comprehensive approach is reflected in the open space objectives.

Goal 1: Preserve and enhance the natural and cultural features that form Kingston's unique qualities.

Goal 2: Promote a land use development pattern that is consistent with the carrying capacity of natural resources and the ability to provide services.

¹ *Local Open Space Planning Guide (2004 reprinted 2007) page 3. NYSDEC and NYS DOS.*

Goal 3: Ensure the quality of Kingston’s water resources.

Goal 4: Protect and promote urban agriculture, community and urban forests and forested land.

Goal 5: Retain forested areas, stream corridors, wetlands and other open spaces to the maximum extent practical, so as to establish and preserve buffers between developed areas.

Goal 6: Provide increased protection for environmentally sensitive areas such as wetlands, flood plains, steep slopes, ridges, wildlife habitat areas and corridors, and unique geological formations and features.

Goal 7: Preserve the character of historical sites and structures.

Goal 8: Protect, expand, connect and create active and passive recreational facilities and opportunities.

Goal 9: Identify and protect scenic views as seen from roadsides, parks, waterfronts, and other areas frequented by the public.

Goal 10: Preserve and enhance key entryways or gateways to Kingston.

Types of Open Space

Open space helps connect people to the natural and cultural environment in our community. The quality of the space is more important than the size of the parcel. The location of the space, whether it is visible and is proximate to neighborhoods, whether the space has access to water or has special ecological value are all quality criteria that should be considered in identifying open space. The table below categorizes open space into publicly and privately owned, natural resources and environmentally-sensitive lands, natural, scenic and historic features, cultural and historic resources and corridors, greenways and blueways that connect open space within the city and to neighboring communities.

<i>Publicly & Privately Owned Open Space</i>	<i>Natural Resources and Environmentally-Sensitive Lands</i>	<i>Natural, Scenic and Historic Features</i>
<i>undisturbed</i>	<i>floodplains</i>	<i>mines and caves</i>
<i>traditional day use municipal parks</i>	<i>wetlands</i>	<i>views</i>
<i>school grounds</i>	<i>steep slopes</i>	<i>escarpments</i>
<i>athletic complexes</i>	<i>water resources</i>	<i>ridges</i>
<i>cemeteries</i>	<i>agriculture</i>	<i>water</i>
<i>vacant land</i>	<i>forests – community and large plots</i>	<i>Cultural and Historic Structures</i>
<i>golf courses</i>	<i>significant habitat</i>	<i>historic</i>
	<i>aquatic habitat</i>	<i>archeological</i>
<i>Corridors, Greenways & Blue & Green-infrastructure</i>		<i>kilns</i>
<i>trails</i>		
<i>utility and highway right of ways</i>		
<i>built & natural green infrastructure</i>		

Regional Context

It is important to consider Kingston in a regional context. The figure Regional Context for the City of Kingston, NY² in the appendix shows that Kingston lies in the watersheds of the Rondout and Esopus Creeks and the Hudson River. Forest blocks and linkages lie to the south and west. Significant biodiversity areas nearby include the Catskill Mountains, Esopus/ Lloyd wetland and ridges, the Hudson Valley Limestone and Shale Ridges and the Rosendale Limestone Cave Complex. The areas of steep slope are contiguous with those in the Town of Ulster to the west and north. The Esopus Creek and its floodplains and marshes form the boundary with the Town of Ulster, which draws some of its drinking water from wells adjacent to the Esopus. The Town of Esopus and Town of Ulster share the tidal Rondout Creek, which supports important fisheries and tidal wetlands. The Rondout Creek and Hudson River connect Kingston by water for commerce, and recreational travel. Rail trails connect people and wildlife with nature and to communities to the south, west and to the Catskills.

Publicly and Privately Owned Open Space

Recreational spaces

The reader is referred to the City of Kingston *Parks and Recreation Master Plan* (Draft January 2013³) for a thorough description of the traditional day use municipal parks, school grounds and athletic complexes in Kingston. The Plan's Table 3 reproduced below lists all these parks and facilities.

² Map provided by NYSDEC Hudson River Estuary Program, September 25, 2013.

³ *City of Kingston, NY Parks and Recreation Master Plan, Draft January 2013* is cited in this document, but the Final is expected to be adopted by Common Council on December 3, 2013

Table 3 – Parks Inventory

PARK / FACILITY <i>Special Purpose = Blue (1-9); Community = Green (10-12); Neighborhood = White (13-23); Other = Orange (24-29)</i>	ACRES	FEATURE	OTHER FEATURES	Playgrnd (L = large)	'Bat'ball field	Tennis	Basketball	Volleyball
1. Andretta Pool	1.4	Pool facility	Picnic					
2. Andy Murphy Midrwn Cnter	1.1	Indoor court	Meeting room, stage				1/2	1/2
3. Dietz Stad(fball, fieldh, lax)	12.1	Multipurpose field	Track				1	
4. Forsyth Nature Center		Zoo (part of Forsyth Park)						
5. Hodge Center	0.2							
6. Kingston Point Beach	10.6	Bathing beach	Car-top boat launch	1				4
7. Roundout Center	0.3	Indoor court					1	
8. Roundout Lighthouse	84.7	Iconic structure	Dike					
9. TR Gallo Park	1.4	Waterfront	Linear park					
10. Forsyth Park	18.5	Lawn field		1L	2L	6		
11. Hasbrouck Park	45.0	Rec Court		1	1S		1	
12. Kingston Point	87.4	Field lighting; BMX course	Trails; picnic		1S			
13. 4th Ward Memorial Park	0.9							
14. Academy Green	1.5							
15. Block Park	7.1	Field lighting		1	1S		1	
16. Cornell Park	3.0							
17. Gill St. Playground	0.2			1				
18. Hurton Park	6.0	Lawn/ Rec field		1		2	1	
19. J.R. Schultz Complex	18.7	Lawn/ Rec field			2L			
20. Loughran	7.5			1	1B	4	1	
21. Murray St. Courts	1.7		Open space				2	
22. Peace Park & Chapel St. Park	1.8		2 sites / each passive					
23. Van Buren Park	0.1			1				
24. Bailey & Edson Schools	5.0	High/low ropes			1L		1	
25. G.W. School	0.5			1			1	
26. Kingston High School	3.0	Small rec field				4		
27. B's/G's Clubs & Metro' Park	2.8			1	1L		2	
28. YMCA	1.0	Small rec field		1			3	
29. Ballfield @ Kingston Plaza	3.3				1B			
TOTALS				11	11	16	15.5	4.5

Publicly owned open space and connections are included in the *Recreation Master Plan*. The plan has a section on greenways, linear parks and open space planning on pages 57 to 60. Page 9 of the *Master Plan* summarizes recommendations for natural resource management:

- Use a triple bottom line approach in investments and operations
- Given extensive open space, promote landscape ecology
- Use parks and greenways as incubators of 'green infrastructure' and invasive species management
- Advance stream and wetland management
- Conserve large contiguous open spaces
- Plan for sea-level rise and design resilience in capital projects
- Push state of the art for energy management and facilities design

Cemeteries and golf courses

Cemeteries and a golf course located southwest of Marys Avenue form a continuous greenway from West Chester Street to Wilbur Avenue. Patches and large tracts of upland forest combine with this cultural greenway to form an important corridor trending west and east.

Undisturbed and vacant land

Vacant parcels throughout the city are potentials sites for community gardens, pocket parks and other uses which provide a bit of nature in an otherwise urban area. Large residential and

commercial properties provide yards with shrubs, trees and forests which offer wildlife habitat and other ecological services.

Undisturbed public lands include the tidal wetland and aquatic lands at Kingston Point Park and the mouth of the Rondout Creek.

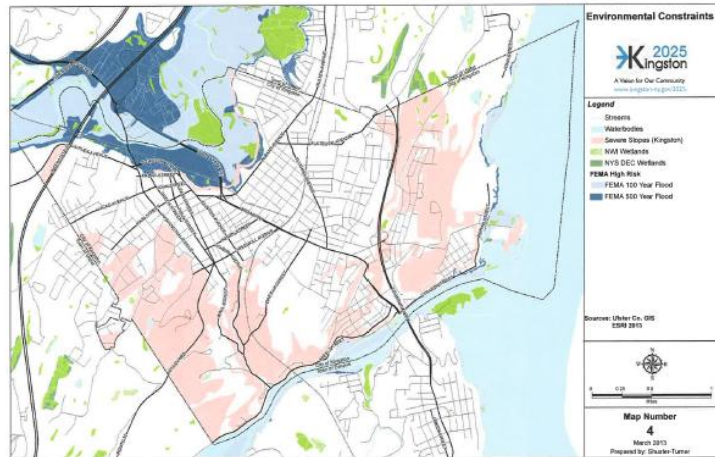
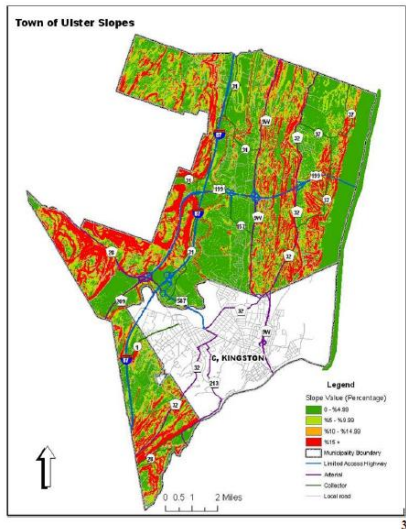
Natural Resources and Environmentally-Sensitive Lands

Significant and aquatic habitat

Hudsonia, Ltd., funded by NYSDEC Hudson River Estuary Program, mapped significant habitats in selected areas of Kingston (November 2013) (see Appendix). The areas mapped include 1) the riparian zone of the Esopus Creek, 2) the land on either side of the Twaalfskill Creek, and 3) much of the land east of Route 9W. The calcareous crests and ridges in the latter two areas continue on to the south into the Town of Esopus and on the east and north to the Town of Ulster and beyond. This area is characterized by both cultural open space (cemeteries and golf courses) and by upland hardwood forests (uhf), upland mixed forest (umf) and hardwood and shrub swamps (hs). The area adjacent to the Esopus Creek is characterized by floodplain forests (ff), hardwood and shrub swamps (hs), upland meadows (um) and wet meadows (wm). Tidal aquatic habitats include submerged aquatic vegetation and lower and upper intertidal mix of vegetation and beds of cattail, common reed and the invasive water chestnut.

Steep slopes

According to the October 9, 2013 *Vision for the Future and Planning Needs*, “physically constrained lands include steep slopes, existing flood hazard areas, wetlands and low lying areas along the Rondout and Hudson. These significantly constrained lands would be best limited to use for agriculture, open space, recreation and rural density residential development.” These areas are mapped on the Vision’s Figure 6, Map 4, reproduced below. The maps below, which show steep slopes in red for the Town of Ulster and in pink for Kingston, show the continuation of steep slopes in the two towns, along the Flatbush Ridge and along Kingston’s western boundary. These steep slopes are important areas for wildlife corridors and connected open space along the rocky barren calcareous crest, ledge and talus.



Water resources including water courses, floodplains and wetlands

Water resources include the Hudson River, creeks, streams and wetlands. The tidal Rondout Creek, tidal Hudson River and the Esopus Creek are three natural municipal boundaries. Consulting engineers Milone and MacBroom are presently developing a Tidal Rondout Creek Watershed Management Plan which will include its major tributary, the Twaafskill Creek. Tannery Brook and Main Street Brook drain to the Esopus and are partially channelized and buried. Other unnamed streams are shown on the habitat map.

Wetlands are found along the Esopus Creek floodplain. There are wetlands and intermittent woodland pools in areas north of Delaware Avenue. There are sizeable tidal mudflats and marsh at the mouth of the Rondout Creek. The trolley track causeway partially impounds the tidal marsh at Kingston Point.

Urban and community forests

According to the NYSDEC,

All of the trees within a town, village, or city make up the "community forest". The community forest can include street and yard trees, parks, cemeteries, school grounds, and undeveloped green spaces. Urban and Community Forestry is the management of community forests to establish and maintain healthy trees for air and water quality benefits, energy savings, environmental health, as well as to enhance the quality of life for urban residents. The urban and community forest also contains wildlife, waterways, built roads and structures, and people.⁴

Kingston has large expanses of forests, for an urban area. In the Twaalfskill/ Wilbur area upland hardwood forests (uhf), upland mixed forest (umf) and hardwood and shrub swamps (hs) are all present. The Esopus Creek flood plain has floodplain forests (ff) and hardwood and shrub swamp (hs). The ridge north and south of Delaware Avenue (including Hasbrouck Park) is dominated by upland

⁴ <http://www.dec.ny.gov/lands/4957.html>

hardwood forests (uhf). as does Hasbrouck Park, south of Delaware Avenue. Smaller forest tracts are located in other areas of Kingston, including Forsyth Park and areas near Linderman Avenue.

Street and yard trees and trees and shrubs in other publicly and privately owned open space provide habitat and contribute to the overall quality of life and of the environment. Stewardship of street trees is under the auspices of the Tree Commission. Land owners are the stewards of the community and urban forests.

Agriculture

Citizens and organizations in the City of Kingston, NY have been engaged in urban agricultural activities for a number of years and these activities are integrated into the fabric of the community, not just on the outskirts. Urban agriculture includes backyard food gardens, small animal husbandry, community gardening and for-profit agriculture. Common Council Resolution #138 of 2011 recommends the support for Community Gardens and recognizes the opportunity for citizens to grow their own healthy food while showing intent to support the local food economy. It is critical that the City continue to promote urban agricultural activities.

An Urban Agriculture Committee formed in 2013 is developing a zoning plan with the intention of having it incorporated into the Comprehensive Plan and zoning revision. The following information has been provided by the Committee. The primary objectives of this work will be to:

- Update and catalog factual information about the City's current urban agriculture activities and related food system;
- Conduct a survey of properties utilizing real property data and GIS mapping to identify and classify potential types of urban agricultural sites and uses in conjunction with zoning and property classifications;
- Identify best practices for learning and reference;
- Propose language to be incorporated into the comprehensive plan that establishes goals, objectives, metrics and strategies for the City to increase local food production;
- Provide general recommendations for zoning updates; and
- Based upon the results of the Kingston Urban Ag Initiative, prepare a model local food production comprehensive plan component that can be tailored by other New York municipalities for use in their communities.

After working to incorporate local food production into the Comprehensive Plan update, the core team will begin the process of identifying changes to be made to the City's zoning code that will encourage urban agricultural activities on both municipally-owned and private property. This work will be based upon the local food production goals, objectives, metrics and strategies established in the Kingston 2025 Comprehensive Plan.

Corridors, Greenways and Green and Blue Infrastructure

Corridors serve to connect both people and wildlife to other areas. Corridors include interconnected areas of open space and green space, right of ways for utilities and transportation and paths for non-motorized transportation. Rivers and streams and their riparian areas are important corridors for fish and wildlife.

Greenways and non-motorized paths are covered generally in the *Parks and Recreation Master Plan*. The Rail Trail Committee of the Kingston Land Trust has been working since 2010 to repurpose existing railbeds in Kingston to create a trail network and “hub” of the many rail trails in Ulster County. According to their webpage, “The Kingston Greenline is a vision for a network of urban trails, bikeways, water-trails, walkable sidewalks and complete streets that provides residents and visitors a healthy, fun and sustainable way to connect with our City’s rich cultural, historical, commercial and recreational resources. The Greenline also serves as an important hub for the growing system of rail trails throughout Ulster County and beyond, eventually linking from the Catskill Mountains and the Hudson River Valley to New York City... The Greenline is made up of several important pieces. The “spine” of the envisioned network consists of key segments of important regional rail trails that enter the city: the Wallkill Valley Rail Trail, the O&W Rail Trail (aka the D&H Canal Heritage Corridor, or the Hurley/Marbletown Rail Trail), the proposed Catskill Mountain Rail Trail and the proposed Kingston Point Rail Trail. The spine of the system will provide protected, non-motorized trails that traverse the city through a series of linear parks along the former rail beds... Where gaps in the railroad corridors exist, and to provide linkages from the spine to the City’s diverse recreational, cultural, historical and commercial offerings, we envision a more bike- and pedestrian-friendly street network, incorporating bike lanes, “sharrows,” handicapped-accessible sidewalks and crossings, and “complete streets.” These feeders and connectors bring the Greenline into Kingston’s neighborhoods, connect residents with local parks, and help visitors navigate between trails and commercial areas.”

Green infrastructure has a variety of definitions. We will use the definition of natural green infrastructure as defined by McMahon and Benedict (2006)⁵ “an interconnected network of green space that conserves natural ecosystems values and functions and provides assorted benefits to human populations.” The riparian areas of the Esopus, floodplains of the Hudson, and the large expanses of forests and other open space in the Wilbur/Twaafskill and Flatbush Ridge/ Delaware area are green infrastructure systems in Kingston

Kingston also has “blue infrastructure,” in the nearshore coastal zone of the Rondout and Hudson, which affords fish habitat, tidal wetlands and submerged aquatic vegetation. The Hudson River Watertrail Association has a guide of kayak and canoe day and overnight stops along the Hudson. Kingston, with its beach on the Hudson and kayak docks and restaurants on the Rondout, is an attractive stop for recreational paddlers.

“Built green infrastructure practices maintain or restore stormwater's natural flow pattern by allowing the water to slowly permeate into the ground and be used by plants, this can include street and yard trees, rain gardens, vegetated swales, green roofs and porous pavements. In addition to managing stormwater, green infrastructure can recharge groundwater, provide wildlife habitat, beautify neighborhoods, cool urbanized areas, improve air quality and reduce stress on combined sewer systems.”⁶ Rain gardens are on public land at Kingston Library⁷ and Ulster County Department of the Environment⁸ and planned at the Office Building. Porous pavement has been used at Forsyth Park⁹. In the past an effort led by the Hudson Valley Regional Council and

⁵ Benedict & McMahon (2006) *Green Infrastructure: Linking Landscapes and Communities*, Island Press

⁶ Modified from <http://www.dec.ny.gov/lands/58930.html>

⁷ <http://www.dec.ny.gov/lands/86684.html>

⁸ <http://www.dec.ny.gov/lands/79016.html>

⁹ <http://www.dec.ny.gov/lands/79021.html>

Clearwater came up with conceptual GI plans for about ten sites in Kingston. A SUNY Environmental Science and Forestry student, Kevin Pagini, conducted an analysis to look at how green infrastructure could mitigate the combine sewer overflow problems.

The preservation of land and aquatic corridors and both natural and built green infrastructure is important for the quality of life and environment of Kingston.

Natural, Scenic and Historic Features

The karst terrain in the area north of Delaware Avenue is an important karst aquifer recharge area.¹⁰ Caves are common in karst topography. Mines and caves can be located by the cool air emanating from within this areas in the summer. Escarpments and ridges along Abeel Street near Wilbur, Hasbrouck Park escarpment, and the Flatbush Ridge are all scenic and have little development because of steep slopes.

Scenic views are many and their aesthetics are in the eyes of the beholder. Scenic lookouts abound, from the views of the Catskills along the Broadway corridor and from the windows of City Hall, the County's Legislative Chambers, Benedictine Hospital and Sophie Finn playground the views from Hasbrouck Park of the Rondout Creek, Hudson River and Rondout Lighthouse, views from the 9W and Connelly Bridge of the waterfront, and the many views of the Hudson River from Kingston Point.

Access to water is part of the fabric of Kingston, especially along the Rondout Creek and Hudson River. Because of the extent of the Rondout Creek and its water-dependent uses and the inland turn of the West Shore (CSX) Railroad line in the Town Esopus, Kingston has one of the most accessible urban waterfronts on the Hudson River, encompassing XX miles of unhindered, direct access by foot and for boaters. Access to the Esopus Creek could be enhanced for fishermen, birders and kayakers.

Scenic gateways to Kingston include the view of Rondout from 9W bridge and Connely Bridge, the view of church steeple from 9W south at Delaware/ Visitors arriving by boat enjoy vistas of nature and built historic structures.

Cultural and Historic Structures

The City of Kingston abounds with historic and cultural structures and a discussion of these assets is beyond the scope of this document. few of note are cement kiln ruins, remnants of the garden pathways at Kingston Point and the arched bridges and tunnel of the Ulster and Delaware Railroad Corridor. Friends of Historic Kingston and the Kingston Landmarks Commission are instrumental in inventorying and conserving historic and cultural structures, including Kingston's blue stone sidewalks.

¹⁰ *Ruben et al. (2006)*

Recommendations

To be added.

Conclusions

To be added.

References and Additional Resources

Barbour, S., Rubin, P. and Kiyon, J. R. Ecological Assessment maps for Hudson Landing

City of Kingston Climate Action Plan (October 2012)

City of Kingston Local Waterfront Revitalization Program (LWRP). (1992)

<http://www.nyswaterfronts.com/LWRP/City%20of%20Kingston/City%20of%20Kingston%201993.pdf>

Esopus Valley Biodiversity Assessment Report October 28, 2009

Meyer, A., Schneller-MacDonald, K. and Stevens, G. A Preliminary Biodiversity Atlas for Flatbush Ridge, December 2010

New York State Open Space (2007)

Planning for Rising Waters: Final Report of the City of Kingston Tidal Waterfront Flooding Task Force (2013)

City of Kingston, NY Parks and Recreation Master Plan (Draft January 2013, Final expected December 3, 2013)

Rubin, P.A., Burmeister, K.C. and Folsom, M., 2006, Karst Resource Management: groundwater protection and developmental considerations in the Kingston-Rosendale aquifer system; Ulster County, N.Y., Report prepared for ScenicHudson.

Significant Coastal Fish and Wildlife Habitats - Kingston and Poughkeepsie Deep Water (2012)

http://www.dos.ny.gov/communitieswaterfronts/consistency/Habitats/HudsonRiver/Kingston_Poughkeepsie_Deepwater_FINAL.pdf

Significant Coastal Fish and Wildlife Habitats - Rondout Creek (2012)

http://www.dos.ny.gov/communitieswaterfronts/consistency/Habitats/HudsonRiver/Rondout_Creek_FINAL.pdf

Tidal Rondout Creek Watershed Management Plan (in progress) Milone and MacBroom

Town of Glenville Open Space Plan, May 2008

Town of Rosendale Natural Resource Inventory September 2010

Town of Ulster Comprehensive Plan July 2, 2007

Ulster County Open Space Plan (December 2007)

Organizations

There are many municipal, non-profit and volunteer organization which have some part in the conservation of open space. These include but limited to:

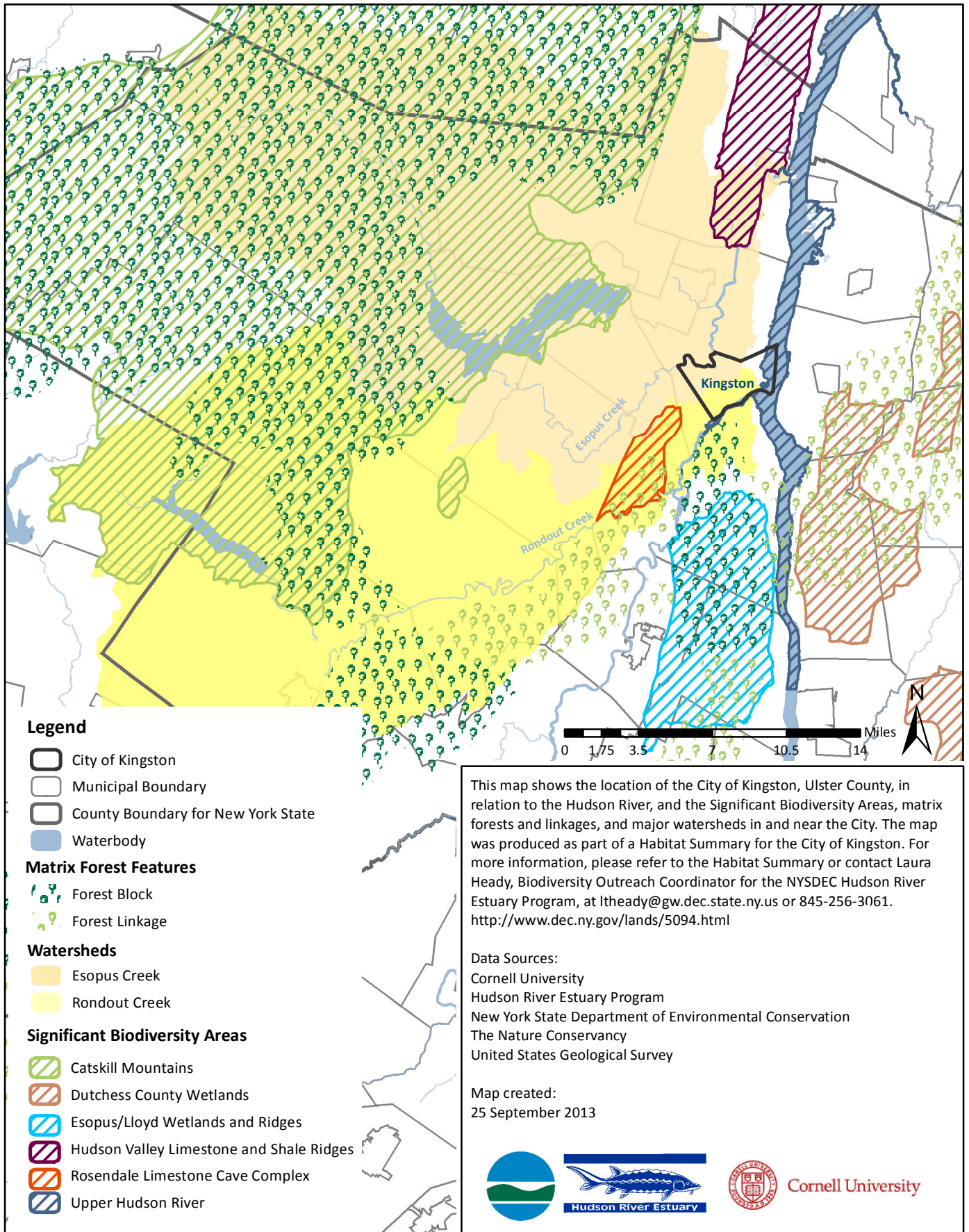
Live Well Kingston
Healthy Kingston for Kids
Kingston Land Trust
Urban Agriculture Committee
Lower Esopus Watershed Partnership
Scenic Hudson, Inc.
Friends of Historic Kingston
City Boards and Departments: Parks and Recreation, Public Works, Planning or Zoning.
Conservation Advisory Council
Comprehensive Plan Committee
Complete Streets Advisory Council
Kingston Tree Commission
Landmarks Commission
Complete Streets Advisory Council
Waterfront Advisory Committee

Appendices

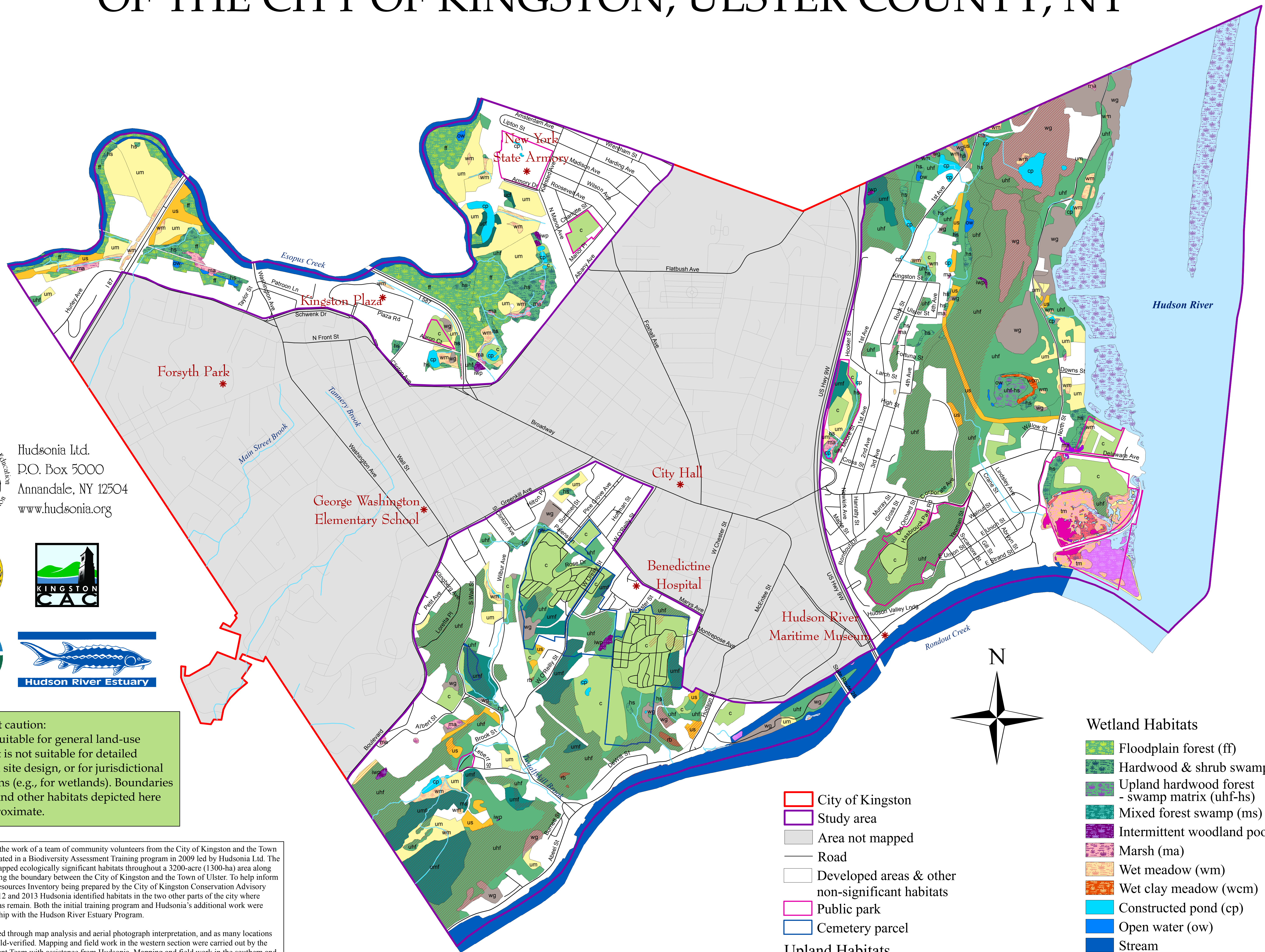
Regional Context for the City of Kingston, NY prepared by Hudson River Estuary Program

Significant Habitats in Selected Areas of Kingston prepared by Hudsonia, Ltd.

Figure 1: Regional Context for the City of Kingston, Ulster County, NY



SIGNIFICANT HABITATS IN SELECTED AREAS OF THE CITY OF KINGSTON, ULSTER COUNTY, NY



Hudsonia Ltd.
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An important caution:
 This map is suitable for general land-use planning, but is not suitable for detailed planning and site design, or for jurisdictional determinations (e.g., for wetlands). Boundaries of wetlands and other habitats depicted here are only approximate.

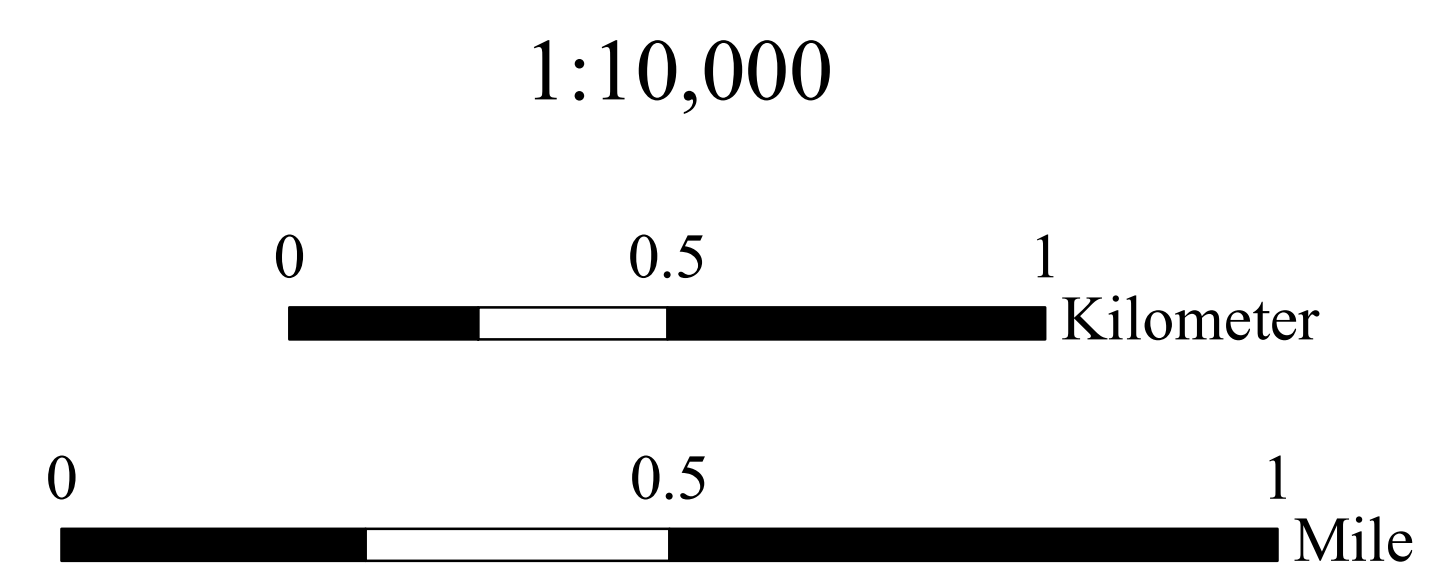
This map grew out of the work of a team of community volunteers from the City of Kingston and the Town of Ulster who participated in a Biodiversity Assessment Training program in 2009 led by Hudsonia Ltd. The team identified and mapped ecologically significant habitats throughout a 3200-acre (1300-ha) area along Esopus Creek straddling the boundary between the City of Kingston and the Town of Ulster. To help inform a city-wide Natural Resources Inventory being prepared by the City of Kingston Conservation Advisory Council (CAC), in 2012 and 2013 Hudsonia identified habitats in the two other parts of the city where substantial habitat areas remain. Both the initial training program and Hudsonia's additional work were carried out in partnership with the Hudson River Estuary Program.

Habitats were identified through map analysis and aerial photograph interpretation, and as many locations as practicable were field-verified. Mapping and field work in the western section were carried out by the Biodiversity Assessment Team with assistance from Hudsonia. Mapping and field work in the southern and eastern sections were carried out by Hudsonia biologists Ingrid Haeckel, Chris Graham, and Gretchen Stevens. Color infrared photographs in the USGS NAPP series, taken in spring 1994 (scale 1:40,000), were used for stereoscopic photointerpretation. Habitats were digitized onscreen over color infrared orthophoto images taken in spring 2001 and 2009 obtained from the New York State GIS Clearinghouse. Habitat data for Hudson River submerged aquatic vegetation (2007) and tidal wetlands (2007) produced by the NYSDEC Hudson River Estuary Program were obtained from the Hudson River National Estuarine Research Reserve.

The report prepared by the Biodiversity Assessment Training team in conjunction with the western portion of the map (Budziak et al. 2009, "Esopus Valley Biodiversity Assessment Report") explains the habitat identification and mapping methods, describes the ecological significance of many of the habitat types shown on this map, and offers conservation recommendations.

This project has been funded by the New York State Environmental Protection Fund through the Hudson River Estuary Program of the New York State Department of Environmental Conservation.

For more information, contact Julie Noble, City of Kingston Conservation Advisory Council (Julie.Noble@Kingston-ny.gov), or Gretchen Stevens, Hudsonia Ltd. (845-758-7053).



- Wetland Habitats**
- Floodplain forest (ff)
 - Hardwood & shrub swamp (hs)
 - Upland hardwood forest - swamp matrix (uhf-hs)
 - Mixed forest swamp (ms)
 - Intermittent woodland pool (iwp)
 - Marsh (ma)
 - Wet meadow (wm)
 - Wet clay meadow (wcm)
 - Constructed pond (cp)
 - Open water (ow)
 - Stream
 - Stream
- Upland Habitats**
- Upland hardwood forest (uhf)
 - Upland mixed forest (umf)
 - Upland conifer forest (ucf)
 - Rocky barren (rb)
 - Upland shrubland (us)
 - Upland meadow (um)
 - Cultural (c)
 - Waste ground (wg)
 - Calcareous crest, ledge, & talus
- Tidal Habitats**
- Hudson River
 - Submerged aquatic vegetation
 - Lower intertidal mix
 - Upper intertidal mix
 - Water chestnut
 - Common reed
 - Cattail
- Other Symbols:**
 City of Kingston (Red outline)
 Study area (Purple outline)
 Area not mapped (Grey)
 Road (Black line)
 Developed areas & other non-significant habitats (White)
 Public park (Pink outline)
 Cemetery parcel (Blue outline)