FISH AND WILDLIFE RESOURCE IMPACT ANALYSIS

CROSS-COUNTY SANITARY/KESSMAN LANDFILL
286 CORNWALL HILL ROAD
PATTERSON, NEW YORK 12563
PUTNAM COUNTY
NYSDEC Site No. 340011
Work Assignment No. D009812-07

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
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JUNE 2020

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1.0 INTRODUCTION

This Fish and Wildlife Resource Impact Analysis (FWRIA) report has been prepared on behalf of the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER), for the Cross-County Sanitary / Kessman Landfill, located in the Town of Patterson, Putnam County, New York. The FWRIA was conducted in accordance with the guidance provided in Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (NYSDEC, 1994). The focus of this FWRIA is on a 1.3-acre wetland located to the east of the landfill (Site). Scott Heim (TRC Ecologist) conducted an inspection of the Site and vicinity on December 16, 2019. This report describes the first phase (Step 1) of the FWRIA.

Step 1 of the FWRIA involves preparation of descriptions of the Site and its surrounding area, including physical characteristics (e.g., topography, drainage, and habitat cover types) and wildlife resources. These descriptions are presented in **Section 2.0** of this report. **Section 3.0** identifies the fish and wildlife resources in the vicinity of the Site. **Section 4.0** identifies the applicable regulatory criteria to be used for this analysis. **Section 5.0** presents the contaminant migration and exposure pathways as well comparison of site-specific data to the applicable toxicity criteria. **Section 6.0** presents conclusions to be considered in development of further remedial investigations or remediation options.

2.0 SITE DESCRIPTION

As indicated in the introduction, the Site consists of a 1.3-acre wetland area located immediately east of the former landfill that is currently capped and maintained as a grassland community. The Site is bounded to the west (and south) by the former landfill, to the east by an active railroad, and to the north by a large, connected wetland that extends northward into a tributary to Muddy Brook.

The objectives of the Step 1 FWRIA are to describe the fish and wildlife resources and habitat that may exist in the vicinity of the Site, and assess the overall value of those resources to the surrounding human and wildlife communities. The following site-specific maps were created to illustrate important Site features, including fish and wildlife resources within the vicinity of the Site:

- **Figure 1** illustrates the Site location and the topography, streams, rivers and ponds within a two-mile radius of the Site;
- **Figure 2** identifies the type and location of Critical Environmental Areas (CEAs) within a two-mile radius of the Site;
- **Figure 3** identifies Significant Natural Communities within a two-mile radius of the Site;
- **Figure 4** identifies rare, threatened, and endangered (RTE) plant species and animal habitats within a two-mile radius of the Site;
- **Figure 5** illustrates the New York State regulated wetlands within a two-mile radius of the Site;
- **Figure 6** identifies existing ecological natural communities within a one-quarter-mile radius of the Site; and
- **Figure 7** illustrates existing stormwater drainage patterns present on the Site to evaluate whether the surrounding fish and wildlife habitat resources will be adversely impacted by site contamination.

Visible signs of stress to fish and wildlife resources were also evaluated at the Site and vicinity.

2.1 Streams, Rivers and Ponds

Several waterways and ponds are located within two miles of the Site (**Figure 1**). The East Branch Croton River is located approximately 3,500 feet to the east, and represents the largest flowing waterbody in the vicinity of the Site. Muddy Brook is present approximately 700 feet to the southeast, while a large tributary to this brook is present 1,000 feet north of the Site. Both the large tributary to Muddy Brook and the East Branch Croton River are classified as Class C(T), indicating a best usage for fishing, including trout. Muddy Brook is classified as Class C, indicating that its best usage is for fishing, but that it's generally unsuitable for trout.

Several additional streams and sources that are tributaries to Muddy Brook (including Mendel Pond) are present within two miles to the west and south of the Site. These tributaries are also classified as either C or C(T). Tributaries to the East Branch Croton River (including Stephens Brook and Mountain Brook) are also present within two miles of the Site to the east. Mountain Brook is a Class C stream while Stephens Brook is classified as C(TS), indicating that this stream is suitable for trout spawning.

2.2 Critical Environmental Areas

A review of the New York State Environmental Resource Mapper shows that the Site is located within a Critical Environmental Area (CEA) known as the Great Swamp (**Figure 2**). This CEA was designated due to its exceptional or unique characteristics. The Great Swamp consists of a 19.8-mile long, 6,000-acre riverine/wetland. The Site is associated with the South Flow portion of the Great Swamp, as the East Branch Croton River flows southward and eventually discharges into the East Branch Reservoir.

2.3 Significant Natural Communities

Several state-significant natural communities associated with the Great Swamp are present within the vicinity of the Site. These significant ecological natural communities include red maple-hardwood swamp and floodplain forest (see **Figure 3**). The floodplain forest community is associated with the East Branch Croton River while red maple-hardwood swamp is present adjacent to the Site to the east and north.

2.4 Rare Species Habitat

<u>*Plants*</u>
Several state-listed rare animal and plant species have been previously noted within one mile of the Site (see **Figure 4**). Based on recent correspondence with the New York Natural Heritage Program (see **Attachment A**), two plants, one reptile, and one mammal that are state-listed have been documented in the vicinity of the Site. In addition, based on comments provided by NYSDEC Division of Fish and Wildlife, seven additional species may be present in the vicinity of the Site.

The two rare plants are spreading globeflower (*Trollius laxus*) and fairywand (*Chamaelirium luteum*). Spreading globeflower is state-listed as Rare, while fairywand is state-listed as Endangered. Both of these species were previously noted within a nearby wetland located approximately 0.25 miles southwest of the Site. This nearby wetland is a rich, sloping fen that is associated with a stream that is a tributary to Muddy Brook.

Based on NYSDEC GIS records, the following listed species may also be present in the vicinity of the Site:

- Swamp birch (*Betula pumila*)
- Carolina whitlow grass (*Tomostina reptans*)
- Spotted pondweed (*Potamogeton pulcher*)
- Hop sedge (*Cyperus lupulinus*)
- Marsh horsetail (*Equisetum palustre*)
- Yellow wild flax (*Linum sulcatum*)
- Narrow-leaved sedge (*Carex amphibola*)

Animals

The bog turtle (*Glyptemys muhlenbergii*) has previously been documented within 0.6 miles of the Site. These turtles have the potential to be present at the Site, as individual turtles may travel up to one mile from documented locations. This species is state-listed as Endangered and is federally-listed as Threatened. Bog turtles occur within low-lying, open wetlands bordered by woodlands - particularly calcareous fens, herbaceous sedge meadows, and pastures. These wetlands are characterized by a continuous flow of water seeping through the saturated soil surface. Within these wetlands, bog turtles need a variety of micro-habitats for basking, foraging, nesting, shelter, and hibernation - including dry pockets, saturated areas, and areas that are subject to flooding. Hibernation occurs in more densely vegetated areas of the wetland complex, where turtles use channels beneath hummocks that are covered with small trees and shrubs. Individuals may also hibernate in the soft mud of spring-fed rivulets. Natural succession necessitates that bog turtles find new suitable habitat when wetlands become shrubby or are flooded due to extensive beaver activity. Bog turtles move between adjacent areas of suitable habitat. They are naturally limited by low rate of reproductivity, low juvenile survivorship, and a long maturation period. Sexual maturity is reached in 8 to 11 years. In New York, bog turtles are active from late April to mid-September. Clutches range from 1 to 5 eggs and average 3 to 5. In New York, eggs hatch in the fall and hatchlings begin growth during the following summer. Bog turtles are suspected to live 30 years. They are most seriously threatened by destruction and fragmentation of suitable wetland habitat from alterations in groundwater, nonpoint source pollution (fertilizer and septic runoff), invasive plant species (common reed, purple loosestrife), off-road vehicle traffic, and filling of wetlands.

A Phase 1 Bog Turtle Habitat Survey was performed on June 1, 2020, to determine whether or not the wetland is a potential bog turtle habitat, and to understand what (i.e., Phase 2, education, etc.), if anything, will need to be considered as part of the remedial plan for the wetland. As part of the Phase 1 survey, the following three criteria were evaluated at the Site, in accordance with the U.S. Fish and Wildlife Services (USFWS), Guidelines for Bog Turtle Surveys, to determine the potential for bog turtle habitat:

1. Suitable hydrology;
2. Suitable soils; and,
3. Suitable vegetation.

In summary, wetlands at the Site were regarded by the survey scientist as sub-optimal bog turtle habitat. The Site did not contain any seeps or springs which would provide oxygenated cold water upwelling and therefore potential hibernacula locations. The wetland did contain a shallow mucky peat as a substrate, but the underlying dense rocky mineral soil layer would inhibit the ability for bog turtles to dig deeply into the substrate. The wetland was also densely choked with invasive phragmites, purple loosestrife, and cattails, creating a dense, shaded understory, not conducive to bog turtle foraging, basking and nesting. Based on the Site history, presence of contamination, measured nitrogen levels (elevated), and pH measurements, the wetland does not provide the preferred conditions and alkaline pH normally associated with the species. In addition, the physical barrier created by the railroad makes seasonal movement to this wetland by bog turtles unlikely. Based on these findings, no further studies, investigations, or permitting (i.e., Article 11) are recommended related to the bog turtle.

New England Cottontail rabbits (*Sylvilagus transitionalis*) have also been previously documented within 0.5 miles to the north/northeast of the Site. This rabbit is state-listed as Special Concern. This species has disappeared from many historical locations in New York due to forest maturation, habitat loss, habitat fragmentation, and competition with Eastern cottontails. The New England cottontail is an early-successional species, preferring open woods, disturbed areas, shrubby areas, thickets, and marshes. Current populations in southeastern New York can be found in isolated habitat patches that have undergone some form of disturbance; such habitats include agricultural fields and edges, and occasionally brushy edges of transportation corridors.

In accordance with NYSDEC Department of Fish and Wildlife recommendations, the following preventative steps will be taken and/or incorporated into the remedial action:

1. Education and encounter planning for site workers: Based on Department recommendations, the elements of the education and encounter plan for contractors and workers would likely include training on identifying protected turtles (and other species) and steps to be taken if turtles (or other species) are encountered. As appropriate, the encounter plan would outline the steps to be taken if a turtle is encountered during construction (stoppage of work, required notifications, next steps including the potential need to move the turtle) and conditions under which work may resume in the area.
2. Silt fence will be installed as needed to both prevent sediment discharge to the downstream environment as well as in locations contiguous with the large DP-22 wetland complex as a barrier against non-resident turtles and New England Cottontail rabbit entering the construction area during the work.

Impacts on bog turtle and habitats found in the larger DP-22 complex would also be addressed with basic water quality/hydrology protection measures applied through Article 24/15 permitting review. Applicable requirements and standards would be incorporated into the design, as needed. It should be noted that the proposed project will not include construction of a perimeter security fence and will be relatively slow moving. The potential to trap rabbits and other species within the work area is therefore unlikely and preclearing the area unnecessary.

2.5 Regulated Wetlands

New York State regulates freshwater wetlands that are typically 12.4 acres or larger in extent. These wetlands are classified from Class 1 (which provide the most benefits) to Class 4 (which provide the least benefits). Six state-regulated freshwater wetlands are present within two miles of the Site (see **Figure 5**). The largest of these wetlands (DP-22) is a Class 1 wetland. It consists of approximately 5,513 acres, the vast majority of which is palustrine forested wetland (red maple-hardwood swamp) with areas of palustrine emergent marsh also present. The limits of wetland DP-22 are fairly consistent with the designated CEA associated with Great Swamp. A Class 1 wetland represents the highest level of wetland benefits based on providing habitat for rare species and/or hydrological/pollution control features.

Four of the six state-regulated wetlands (PA-2, PA-3, PQ-50, and PQ-51) are Class 2 wetlands, and range in size from 14.2 acres (PA-3) to 33.1 acres (PA-2). The final wetland (LC-10) is a

Class 3 wetland that is 21.4 acres in size. With the exception of PA-2, each of the six state-regulated wetlands is associated with small streams and includes areas of palustrine forested/scrub-shrub and palustrine emergent marsh. Wetland PA-2 is a seasonally-flooded, palustrine forested wetland that has previously been ditched (at least partially).

2.6 Ecological Communities

Based on aerial photographs and the Site inspection, a habitat cover assessment and classification was conducted using "Ecological Communities of New York State" (Edinger et al., 2014). In order to assist in the cover type mapping, some community cover types were combined (e.g., rural structures were combined with mowed lawn with trees). A map of the natural communities within a one-quarter-mile radius of the Site is depicted on **Figure 6**. A total of 11 different community types or community type combinations were identified and are listed and quantified in **Table 1** below.

TABLE 1. COVER TYPES IN VICINITY OF SITE

Natural Communities / Cover Types	Acres	Percent Cover Within ¼ Mile Radius
Shallow Emergent Marsh	1.35	0.83%
Red Maple – Hardwood Swamp	79.80	49.11%
Common Reed Marsh	1.27	0.78%
Red Maple – Common Reed Wetland	10.46	6.44%
Farm Pond	0.41	0.25%
Successional Old Field	9.34	5.75%
Successional Southern Hardwoods	7.61	4.69%
Allegheny Oak – Pine Forest	16.51	10.16%
Cropland / Field Crops	10.60	6.52%
Rural Structure / Mowed Lawn with Trees	21.51	13.24%
Paved Road	1.81	1.11%
Railroad	1.82	1.12%

The Site itself is covered primarily by shallow emergent marsh. Of the 11 community types surrounding the site, red maple – hardwood swamp covers nearly one-half of the area within a one-quarter-mile radius. The other communities in the vicinity of the Site include common reed marsh, red maple – common reed wetland, successional old field, successional southern hardwoods, Allegheny oak – pine forest, farm pond, rural exterior buildings/mowed lawn with trees, cropland/field crops, paved road, and railroad. The descriptions of the natural communities observed during the Site inspection are cited below. These descriptions are primarily from Edinger et al. (2014), and are supplemented with observations from the Site inspection.

Shallow Emergent Marsh: A shallow emergent marsh is a marsh meadow community that occurs on mineral soil or deep muck soils (rather than true peat), that is permanently saturated and seasonally flooded. This marsh is better drained than a deep emergent marsh; water depths may range from 6 inches to 3.3 feet during flood stages, but the water level usually drops by mid to late

summer and the substrate is exposed during an average year. This is a very broadly-defined type that includes several distinct variants and many intermediates. Shallow emergent marshes are very common and quite variable. They may be co-dominated by a mixture of species or have a single dominant species.

The most abundant herbaceous plant noted during the Site inspection were cattails (*Typha latifolia*), with purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) present along the periphery and within hummocks in the marsh. Those last two species are invasive, weedy, non-native species that are generally a result of previous disturbance. Royal fern (*Osmunda regalis*) was also noted within this cover type. Other common species that may be present, but that were not observed during the winter inspection, include sedges (*Carex* spp.), marsh fern (*Thelypteris palustris*), manna grasses (*Glyceria pallida, G. canadensis*), spikerushes (*Eleocharis palustris, E. obtusa*), bulrushes (*Scirpus cyperinus, S. atrovirens, Schoenoplectus tabernaemontani*), three- way sedge (*Dulichium arundinaceum*), sweetflag (*Acorus americanus*), tall meadow-rue (*Thalictrum pubescens*), marsh St. John's-wort (*Triadenum virginicum*), arrowhead (*Sagittaria latifolia*), goldenrods (*Solidago rugosa, S. gigantea*), spotted joe-pye-weed (*Eutrochium maculatum*), boneset (*Eupatorium perfoliatum*), smartweeds (*Persicaria amphibia, P. hydropiperoides*), marsh bedstraw (*Galium palustre*), jewelweed (*Impatiens capensis*), and loosestrifes (*Lysimachia thyrsiflora, L. terrestris, L. ciliata*).

Approximately 20 percent of the shallow emergent marsh was covered with open water/ice at the time of the site inspection. Iron staining was evident at the southwestern edge of the marsh, adjacent to the landfill toe of slope. Water quality within the shallow emergent marsh was evaluated during the inspection. The following measurements were collected:

Water Temperature	3.97° Celsius
pH	6.91 S.U.
Dissolved Oxygen	11.34 milligrams per liter (mg/L)
Conductivity	0.454 micro-Siemens per centimeter (uS/cm)
Oxidation-Reduction Potential (ORP)	-206.4 millivolts (mV)

Characteristic amphibians that breed in in shallow emergent marshes include frogs such as northern spring peeper, American toad, and wood frog. Characteristic birds with varying abundance include red-winged blackbird, marsh wren, swamp sparrow, and common yellowthroat. Waterfowl such as Canada goose and mallard may also nest in this habitat.

Shallow emergent marshes typically occur in lake basins and along streams, often intergrading with deep emergent marshes, shrub swamps, and sedge meadows These natural communities may occur together in a complex mosaic in a large wetland. It appears that hydroperiod may be an important factor in determining shallow emergent marsh species composition (e.g., permanently saturated and seasonally flooded vs. saturated and temporarily inundated).

Red Maple – Hardwood Swamp: Red maple (*Acer rubrum*) is the dominant overstory species for this cover type. Some ash (*Fraxinus nigra, F. pensylvanica*) are also present. Red maple - hardwood swamp generally occurs on inorganic soils in poorly drained depressions that may be saturated to the surface throughout the year. Understory vegetation is dense and includes the following shrubs and understory vegetation that were noted during the inspection: silky dogwood

(*Cornus amomum*), winterberry (*Ilex verticillata*), sensitive fern (*Onoclea sensiblis*), and jewelweed (*Impatiens capensis*). Additionally, bur-reed (*Spharganium americanum*) and cat-tail may be present within more open patches of this habitat.

Tree-dominated wetland ecosystems including this cover type support the greatest breeding bird diversity in the Great Swamp. Over 180 species have been noted within this community - over 60 of which are breeding species. Characteristic bird species in this habitat include wood duck, red-tailed hawk, cooper's hawk, pileated woodpecker, least flycatcher, veery, yellow-throated vireo, scarlet tanager, and rose breasted grosbeak. Other species typically present include river otter and mink. These swamps provide breeding habitat for many wetland-dependent species, such as northern spring peeper, American toad, wood frog, and spotted salamander. Species noted within this habitat during the Site inspection included pileated woodpecker, red-bellied woodpecker, downy woodpecker, song sparrow, black-capped chickadee, northern cardinal, and American crow.

Common Reed Marsh: This community represents a marsh that has been disturbed by draining, filling, road salts, etc. in which common reed has become dominant. In extreme examples, common reed forms monotypic stands, as is present around the periphery of the Site and to the south of the Site. Common reed marsh may form a mosaic with, or grade into, purple loosestrife marsh, or may occur as a patch within other palustrine communities. Although remnant native plants may be present, the abundance of common reed makes it impossible to classify the marsh as one of the palustrine natural communities. This community has much less value to wildlife than other wetland communities present in the vicinity.

Red Maple - Common Reed Wetland: This wetland area contains a dense common reed cover with scattered, red maple and ash trees present in the overstory. Although the understory contains a dense common reed stand, the overstory trees (including many dead trees or snags) provide nesting areas for a variety of avian species. Species noted within this cover type during the Site inspection included Carolina wren, song sparrow, black-capped chickadee, downy woodpecker and rusty blackbird.

Farm Pond: This aquatic community generally consists of a small pond constructed on agricultural or residential property. These ponds typically lack perennially flowing inlets and outlets. They are often eutrophic, and may be stocked with panfish such as bluegill and yellow perch. The biota is variable (within limits), reflecting the species that were naturally or artificially seeded, planted, or stocked in the pond.

Successional Old Field: Successional old field is a meadow dominated by forbs and grasses that occurs on sites that have been cleared and plowed (for farming or development), and then abandoned. The landfill cover itself, as well as fields that are mowed at an interval (e.g., less than once per year) that favor the reproduction of characteristic successional old field species, are considered successional old field. This is a relatively short-lived community that succeeds to a shrubland, woodland, or forest community unless maintained as forb/grassland by mowing (such as on the landfill cover). If the landfill cover is mowed several times each year, then it may be more representative of a mowed lawn community rather than a successional old field.

Characteristic herbs include goldenrods (*Solidago altissima, S. nemoralis, S. rugosa, S. juncea, S. canadensis*, and *Euthamia graminifolia*), bluegrasses (*Poa pratensis, P. compressa*), timothy (*Phleum pratense*), quackgrass (*Elymus repens*), smooth brome (*Bromus inermis*), sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), common chickweed (*Cerastium arvense*), common evening primrose (*Oenothera biennis*), old-field cinquefoil (*Potentilla simplex*), calico aster (*Sympyotrichum lateriflorum* var. *lateriflorum*), New England aster (*Sympyotrichum novae-angliae*), wild strawberry (*Fragaria virginiana*), Queen-Anne's-lace (*Daucus carota*), ragweed (*Ambrosia artemisiifolia*), hawkweeds (*Hieracium* spp.), dandelion (*Taraxacum officinale*), and ox-tongue (*Picris hieracioides*).

Shrubs may be present, but they collectively cover less than 50% of the community. Characteristic shrubs include gray dogwood (*Cornus racemosa*), silky dogwood (*C. amomum*), arrowwood (*Viburnum dentatum*), raspberries (*Rubus* spp.), sumac (*Rhus typhina, R. glabra*), and eastern red cedar (*Juniperus virginiana*). Shrub vegetation noted along the periphery of the landfill or recently cut on the landfill cover itself included Russian olive (*Elaeagnus angustifolia*).

Characteristic butterflies include black swallowtail, orange sulphur, eastern tailed blue, and copper. Characteristic birds include field sparrow, savannah sparrow, and American goldfinch. Characteristic mammals include meadow vole and woodchuck. Species noted within this cover type during the Site inspection included eastern meadowlark, white-tailed deer and woodchuck (burrow present).

Successional Southern Hardwoods: This forest type is a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed. Characteristic trees and shrubs include any of the following: American elm (*Ulmus americana*), slippery elm (*U. rubra*), white ash (*Fraxinus americana*), red maple, box elder (*Acer negundo*), silver maple (*Acer saccharinum*), sassafras (*Sassafras albidum*), gray birch (*Betula populifolia*), hawthorns (*Crataegus* spp.), eastern red cedar (*Juniperus virginiana*), and choke-cherry (*Prunus virginiana*). Certain introduced species are commonly found in successional forests, including black locust (*Robinia pseudo-acacia*) and buckthorn (*Rhamnus cathartica*). Any of these may be dominant or codominant in a successional southern hardwood forest. Southern indicators include American elm, white ash, red maple, box elder, choke-cherry, and sassafras. This is a broadly defined community and several seral and regional variants are known. A characteristic bird is chestnut-sided warbler.

Allegheny Oak – Pine Forest: This forest type is a mixed forest that occurs on sandy soils or on slopes with rocky soils that are well-drained. The canopy is dominated by a mixture of oaks and white pine (*Pinus strobus*). The oaks include one or more of the following: black oak (*Quercus velutina*), chestnut oak (*Q. montana*), red oak (*Q. rubra*), and white oak (*Q. alba*). Red maple, eastern hemlock (*Tsuga canadensis*), American beech (*Fagus grandifolia*), and black cherry *(Prunus serotina*) are common associates occurring at low densities.

The tall shrub layer includes saplings of canopy trees plus witch hazel (*Hamamelis virginiana*), serviceberry (*Amelanchier arborea*), and hazelnuts (*Corylus americana, C. cornuta*). The short shrub layer is predominantly ericaceous, usually with lowbush blueberries (*Vaccinium angustifolium, V. pallidum*) and black huckleberry (*Gaylussacia baccata*), but also includes maple-leaf viburnum (*Viburnum acerifolium*) and tree canopy seedlings.

The groundlayer is relatively sparse, and comprised of Pennsylvania sedge (*Carex pensylvanica*), Canada mayflower (*Maianthemum canadense*), star flower (*Trientalis borealis*), wild sarsaparilla (*Aralia nudicaulis*), common hairgrass (*Avenella flexuosa*), partridge berry (*Mitchella repens*), bracken fern (*Pteridium aquilinum var. latiusculum*), woodferns (*Dryopteris intermedia, D. marginalis*), and wintergreen (*Gaultheria procumbens*).

Cropland/Field Crops: Cropland/field crops are agricultural fields planted in field crops such as alfalfa, wheat, timothy, and oats. This community includes hayfields that are rotated to pasture. Characteristic birds with varying abundance include grasshopper sparrow, vesper sparrow, bobolink, and mourning dove.

Exterior Rural Structures/Mowed Lawn with Trees: Residential, recreational, or commercial land in which the groundcover is dominated by clipped grasses and forbs, and includes some cover of overstory trees are the basic characteristics of this land type. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing. Characteristic animals include gray squirrel, American robin, mourning dove, and mockingbird.

Paved Road: As the name indicates, this feature is a road that is paved with asphalt, concrete, brick, stone, etc. There may be sparse vegetation rooted in cracks in the paved surface. This cover type is associated with Cornwall Hill Road.

Railroad: Again as the name indicates, this feature is a permanent road having a line of steel rails fixed to wood ties and laid on a gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate along regularly maintained railroads. The railroad right of way may be maintained by mowing or herbicide spraying. Characteristic plants include invasive weeds such as spotted knapweed (*Centaurea stoebe* ssp. *micranthos)*, downy chess (*Bromus tectorum*), coltsfoot (*Tussilago farfara*), Cypress spurge (*Euphorbia cyparissias*), sheep sorrel (*Rumex acetocella*), and crown-vetch (*Coronilla varia*). The Metropolitan Transit Authority (MTA) railroad directly abuts the Site to the east.

2.7 Site Drainage

Field reconnaissance concluded that the shallow emergent marsh at the Site is relatively flat and generally enclosed within a shallow basin. During periods of heavy precipitation and during wetter periods of the year (e.g., spring), surface waters within the wetland may be discharged to the north toward a large tributary of Muddy Brook. This tributary then flows to the east under a bridge associated with the MTA railroad and eventually discharges into Muddy Brook approximately 2,500 feet downstream. **Figure 7** (Drainage Map) shows the current surface water drainage patterns associated with the Site.

2.8 Observation of Stress

Although iron staining was noted along the southwestern edge of the Site, signs of stress to vegetation and wildlife from site-related chemicals were not observed during the field reconnaissance conducted in December. However, it should be noted that evidence of vegetation stress would be difficult to determine at the time of year the inspection was conducted.

3.0 FISH AND WILDLIFE RESOURCE VALUE

3.1 Value of Habitat to Fauna

The description of fish and wildlife resources within the vicinity of the Site indicate that valuable resource areas are present. A CEA, a state-significant natural community, and several RTE species habitats exist within, adjacent to, and/or in close proximity to the Site. A 300-acre parcel of the Great Swamp Wildlife Management Area managed by the NYSDEC is present adjacent to the Site to the east and southeast. Wildlife previously identified as occurring within the Great Swamp are provided in **Attachment B**.

The Great Swamp and perhaps the Site itself provides habitat for several state-listed rare species including the bog turtle (also federally-listed as Threatened) and New England cottontail - as well as healthy populations of blue-spotted salamanders, wood turtles, painted turtles, and river otters. The Great Swamp has been designated an Important Bird Area by the National Audubon Society, as it supports an exceptional representative bird community and is important for migrating shorebirds including greater yellowlegs, solitary sandpipers, spotted sandpipers, Wilson's snipe, and American woodcock. Tree-dominated wetland ecosystems support the greatest breeding bird diversity in the Great Swamp. Many of these species are neotropical migrants that have experienced significant population declines.

Special concern species that are presumed to be breeding in the Great Swamp include red shouldered hawk, black billed cuckoo, yellow billed cuckoo, cerulean warbler, and Canada warbler. Many additional at-risk species utilize the Great Swamp as breeding areas, during spring/fall migrations and during the winter. At-risk breeding species include American bittern, Cooper's hawk, American woodcock, willow flycatcher, wood thrush, blue-winged warbler, cerulean warbler, worm-eating warbler, and Canada warbler. Large numbers of black ducks, mallards, wood ducks, and Canada geese use the Great Swamp during migration. The area also provides significant breeding habitat for wood ducks, mallards, and Canada geese during all times of year except winter, when the East Branch Croton River channel is frozen.

The Site itself is a shallow emergent marsh that provides habitat for a variety of aquatic plants and invertebrates, which may subsequently be consumed by herbivorous and insectivorous wildlife such as waterfowl, various songbirds (e.g., swallows, warblers, sparrows), mammals such as muskrats and bats, various amphibians (e.g., frogs, salamanders), and reptiles (e.g., snakes, turtles). This aquatic habitat may also provide breeding habitat for amphibians such as the American toad and leopard frogs.

The nearest surface waterway to the Site is a perennial stream tributary to Muddy Brook that is located approximately 1,000 feet to the north. This stream is located downgradient of the Site and provides habitat for various fish, including trout. Piscivorous wildlife including herons, mink, and otter may forage within this portion of the stream.

3.2 Value of Resources to Humans

The Great Swamp is the second largest freshwater wetland in New York State. Surface water within the South Flow associated with the East Branch Croton River is very important to the supply of drinking water to Putnam and Westchester counties, as well as to New York City. The East Branch Croton River is located approximately 3,500 feet east of the Site.

The tributary to Muddy Brook located approximately 1,000 feet north of the Site and the East Branch Croton River both provide suitable habitat for trout, which provide opportunities for recreational fishing.

Overall, the Site and aquatic/wetland habitats present nearby provide significant value to society, which is reflected in the designation of these areas as a state-listed CEA. Site-related contaminants could result in exposure to wildlife and fish populations that are present in the aquatic and wetland communities within and/or adjacent to the Site. Therefore, a contaminant-specific impact assessment that includes identification of exposure pathways and applicable regulatory criteria is warranted, and is presented in the sections that follow.

4.0 APPLICABLE FISH AND WILDLIFE REGULATORY CRITERIA

Early sediment and surface water investigation activities were undertaken between 2002 and 2013. During these early investigation phases, a total of 70 sediment samples were collected from 0-3 inches below sediment surface (bss) and submitted for analysis of polychlorinated biphenyls (PCBs). PCBs were detected in all sediment samples ranging in concentration from 0.11 milligrams per kilogram (mg/kg) to 130 mg/kg. In addition, during these early investigations, a total of 7 surface water samples were collected (including one sample from the landfill perimeter drain manhole) and analyzed for PCBs. PCBs were detected in all samples (except for the sample from the perimeter drain manhole) at concentrations ranging from 0.28 micrograms per liter (µg/L) to 40 µg/L.

Additional investigation and delineation activities commenced in 2016 and continued through 2018. In 2016, 30 surface water samples were collected along two parallel lines transecting the pond, and one surface water sample was collected at a location north (downstream) of the Site. The surface water samples were collected approximately five feet apart along each line/transect. Surface water samples were collected as "grab" type samples and submitted for laboratory analysis of PCBs. Nineteen (19) of the surface water samples contained PCB concentrations above the NYSDEC TOGS 1.1.1 Class A surface water standard of 0.09 µg/L (ranging from 0.2 µg/L up to 1.5 µg/L). PCBs were not detected at twelve (12) sampling locations (including the additional location to the north), however, the detection limit for each of these samples exceeded 0.09 µg/L. All of the surface water PCB detections were Aroclor-1242.

Additional sediment samples were collected from the Site during three subsequent sediment investigation phases in October 2016, November 2017, and September 2018. Throughout these investigations, a total of 129 sediment samples were collected from 47 locations and various depth intervals. Each of these sediment samples was analyzed for PCBs by SW-846 method 8082A. Two of the sediment samples collected were also analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, per- and polyfluoralkyl substances (PFAS), and inorganics.

PCBs were detected at 43 of 47 shallow sediment sample locations (0 to 6 inches bss), which represents the primary exposure depth for ecological receptors. Concentrations of PCBs ranged from 0.14 mg/kg up to 23,000 mg/kg in these surface sediment samples. VOCs, pesticides or PFAS were not detected in either of the sediment samples where these constituents were analyzed. Polycyclic aromatic hydrocarbons (PAHs) were the only SVOCs detected in the two sediment samples. Cyanide and 19 metals were also detected in these samples.

4.1 Contaminant-Specific Regulatory Criteria

Surface Water

Results for concentrations of PCBs detected in surface water samples can be compared to New York State ambient water quality standards in Title 6 of New York Code, Rules, and Regulations (6 NYCRR) Part 703. Comparisons in this section were limited to those samples collected during the 2016 to 2018 timeframe. Standards are available for protection of human health via consumption of

fish and protection of wildlife from ingestion of contaminated prey (i.e., fish). These standards are presented in **Table 2** along with a comparison of sampling results.

TABLE 2. FRESHWATER SURFACE WATER-SPECIFIC STANDARDS

Constituent	Standard	# Samples > Standard
Total PCBs	0.000001 µg/L - H(FC)	19 of 31 samples
	0.00012 µg/L - W	19 of 31 samples

Notes: H(FC): Human Consumption of Fish; W: Wildlife Protection

As noted in **Table 2**, 19 of 31 surface water samples collected at the Site contained PCB concentrations that exceed the standards protective of both human health and that of wildlife. Considering that the detection limit for the remaining 12 samples (0.20 µg/L) exceeds the standards, it would be reasonable to assume that all samples exceeded these standards.

Sediment

The sediment analytical results for PCBs, PAHs, and metals can be compared to the NYSDEC Division of Fish, Wildlife and Marine Resources Bureau of Habitat Screening and Assessment of Contaminated Sediment Class A, Class B and Class C Freshwater Sediment Guidance Values (SGVs). These categories are defined as (NYSDEC, 2014):

- Class A - If the concentration of a contaminant in sediment is below the SGV that defines this class, the contaminant can be considered to present little or no potential for risk to aquatic life. For equilibrium partitioning-based SGVs, the Class A threshold concentrations were derived using chronic ambient water quality standard/guidance values (AWQS/GVs). For empirically-based SGVs, the Class A threshold was derived from the threshold effects concentration (TEC).
- Class B - If the concentration of a contaminant lies between the SGVs that define Class A and Class C, additional information is needed to determine the potential risk to aquatic life. For equilibrium partitioning-based SGVs, the contaminant concentration is greater than the SGV derived from a chronic AWQS/GV but less than the SGV derived from an acute AWQS/GV. For empirically-derived SGVs, the contaminant concentration is between the TEC where toxicity is observed infrequently, and the probable effects concentration (PEC), where toxicity is observed frequently. The potential for risk to aquatic life cannot be ascertained from contaminant concentration data alone.
- Class C - If the concentration of a contaminant is above the SGV that defines this class, there is a high potential for the sediments to be toxic to aquatic life. For equilibrium partitioning-based SGVs, the Class C threshold concentrations were derived using acute AWQS/GVs. For empirically-based SGVs, the Class C threshold was derived from the PEC.

The TEC and PEC values for metals from MacDonald, et al. (2000) are adopted by NYSDEC (2014) as the Class A and C SGVs in sediments from freshwater. In general, these values represent a 75% likelihood that toxicity will not be observed if the concentration of a metal is below the Class A SGV, and a 75% likelihood that that toxicity will be observed if the contaminant

concentration exceeds the Class C SGV. Exceeding an SGV for a metal provides only limited information on the type, magnitude, or extent of toxicity that could be observed. The Class A SGV (i.e., TEC) for mercury could be under-protective, as it only correctly identified sediments as toxic 35% of the time, instead of 75%, and should be used with caution.

Similarly, Long and Morgan (1991) compiled a database of numerous sediment contaminant concentrations from both fresh waters and marine waters across the United States, and compared those contaminant concentrations to the observed, associated biological effects. The 10th percentile concentration associated with adverse effects was designated as the effects range – low (ERL), and 50th percentile concentration was designated as the effects range – median (ERM). Contaminant concentrations for which no effects were associated were not used. The ERL and ERM were selected by NYSDEC as the Class A and C SGVs in freshwater sediments for total PAHs, respectively.

The ecological risk associated with PCBs is generally not associated with toxicity to benthic organisms or fish exposed directly to these constituents, but to wildlife that occupy the upper levels of the food chain that consume invertebrates and fish that have accumulated body burdens of PCBs. These higher-order consumers can experience significant adverse impacts from PCBs at concentrations lower than those that produce impacts in organisms directly exposed to these compounds.

The NYSDEC has had significant experience with the assessment and remediation of PCB-contaminated sites. While addressing known PCB-contaminated sediment problems, the NYSDEC identified a set of values to assess risks to aquatic life and animals higher on the food chain (through bioaccumulation). When the concentration of total PCBs in sediment was less than 100 micrograms per kilogram (µg/kg), or 0.1 mg/kg, ecological risk has generally been considered acceptable. Conversely, a concentration of total PCBs in sediment exceeding 1,000 µg/kg, or 1.0 mg/kg, is likely to be harmful to aquatic organisms or organisms exposed through the food chain. These values were subsequently proposed by NYSDEC to represent the Class A and C SGVs for PCBs. **Table 3** presents the contaminant specific criteria for Class A, B and C SGVs.

TABLE 3. NYSDEC CONTAMINANT-SPECIFIC SGVs

Constituent	Class A	Class B	Class C
Total PCBs	< 0.1	0.1 – 1.0	> 1.0
Total PAHs	< 4	4 - 35	> 35
Arsenic	< 10	10 - 33	> 33
Cadmium	< 1	1 - 5	> 5
Chromium	< 43	43 - 110	> 110
Copper	< 32	32 - 150	> 150
Lead	< 36	36 - 130	> 130
Mercury	< 0.2	0.2 - 1	> 1
Nickel	< 23	23 - 49	> 49
Zinc	< 120	120 - 460	> 460

Note: All concentrations in mg/kg or parts per million (ppm).

One of the outcomes of the screening and classification process should be the elimination of all contaminant concentrations classified as B. This is accomplished by integrating additional information, evidence, and testing into the process until Class B contaminant concentrations are re-classified to either Class A or Class C. If the assessment procedures do not result in a Class B contaminant being reclassified as acceptable (Class A) or toxic (Class C), then determining the appropriate actions for addressing the contaminants at that station becomes a part of the overall sediment project management for the site.

A comparison of the SGVs listed above with the detected concentrations of constituents in the Site sediment is presented in **Table 4**. An additional 12 inorganics were detected in one or both of the two sediment samples, but a corresponding SGV is unavailable.

TABLE 4. SITE SEDIMENT COMPARISON TO SGVs

Constituent	Total # Samples	# Class A Samples	# Class B Samples	# Class C Samples
Total PCBs	47	4	22	21
Total PAHs	2	1	1	0
Arsenic	2	2	0	0
Cadmium	2	2	0	0
Chromium	2	2	0	0
Copper	2	1	1	0
Lead	2	2	0	0
Mercury	2	2	0	0
Nickel	2	1	1	0
Zinc	2	2	0	0

Note: Sampling results from 0 to 6 inches only.

In one of the two samples analyzed for metals, copper and nickel were detected at concentrations equal to the threshold concentration between Class A and Class B SGVs. As these concentrations represent the corresponding TECs, it would appear unlikely that these constituents present a significant risk to ecological receptors at the Site.

The total PAHs concentration at one of two sediment samples analyzed for PAHs was nearly 6.0 mg/kg. This is slightly above the classification for the Class B SGV. Therefore, additional information (e.g., total organic carbon content of sediment) is needed in order to reclassify these constituents as either Class A or Class C.

Total PCB sediment results are classified as Class B or C sediment at all but four sampling locations where they were not detected. Three of these four locations are situated east of the MTA railroad (i.e., outside the Site boundary), while the remaining sample is located just west of the railroad.

In addition to the ecological SGVs identified above, NYSDEC (2014) has also developed bioaccumulation-based sediment guidance values (BSGVs) for the protection of human health (fish consumption) and wildlife for several constituents detected in Site sediment (total PCBs and

benzo(a)pyrene). However, unlike the SGVs discussed above, the BSGVs are not intended to be used to classify sediment. Instead, they are intended to indicate the risk potential of food chain bioaccumulation to humans and/or wildlife. The BSGVs are normalized to the organic carbon content of sediment and are presented below in **Table 5**, assuming that organic carbon is at 2 percent for the Site sediment. Note that BSGVs are only available for two constituents (total PCBs and benzo(a)pyrene) detected within the Site sediment samples.

TABLE 5. NYSDEC CONTAMINANT-SPECIFIC BSGVs

Constituent	Human Health BSGV	Wildlife BSGV
Benzo(a)pyrene	0.018	NA
Total PCBs	0.0002	0.0041

Note: All concentrations in milligrams per kilogram (mg/kg) or parts per million (ppm) assuming 2 percent organic carbon.

The concentrations of total PCBs and benzo(a)pyrene exceed their respective BSGVs in all samples where these constituents were detected. Therefore, a potential risk exists if exposure pathways are present between the Site sediment and human and wildlife receptors.

4.2 Site-Specific Regulatory Criteria

Surface water bodies located in the vicinity of the Site include Muddy Brook, a tributary to Muddy Brook, and the East Branch Croton River. Muddy Brook is designated as a Class C Water, while its tributary and East Branch Croton River are Class C(T) Waters. Class C waters are defined by the State of New York as water that shall be suitable for fish propagation and survival, as well as primary and secondary contact recreation. Class C(T) waters are suitable for trout (cold-water fishery). Class C(T) streams are regulated under New York's Environmental Conservation Law (ECL) under Title 5 of Article 15. A Protection of Waters Permit would be required if any remediation activities proposed disturbance to the streambed or its banks.

The wetland within the Site is classified as a Class 1 wetland by NYSDEC. Wetlands within and adjacent to the Site are regulated under the Freshwater Wetlands Act by the NYSDEC under 6 NYCRR Part 663 and by the U.S. Army Corps of Engineers (USACE) under Section 404 of the U.S. Clean Water Act. Permits from both of these programs would be required if excavation or fill placement are proposed within the Site. The NYS Freshwater Wetlands regulations assign different levels of standards for projects, depending on the type of project and the wetland classification. For Class 1 wetlands, a permit shall be issued only if it is determined that the proposed activity satisfies a compelling economic or social need that clearly and substantially outweighs the loss of or detriment to the benefit(s) of the Class 1 wetland. Since the proposed work is likely to be limited to the Site area, it is unlikely that any proposed remedial activities would disturb any part of these waterbodies.

Since the Phase 1 Bog Turtle survey (habitat assessment) did not identify sufficient habitat to sustain the species, an Article 11 Endangered and Threatened Species Incidental Take Permit will not be required for the proposed work. However, as recommended by NYSDEC, the preventative steps listed above in **Section 2.4** will be incorporated into the remedial action and implemented in the field to ensure protection of the Bog Turtle (and other species).

5.0 POTENTIAL MIGRATION AND EXPOSURE PATHWAYS

The potential contaminant migration pathways present in the Site sediment are directly related to the Site drainage characteristics noted in **Section 2.7** and **Figure 7**. Topography and the existing MTA railroad largely mitigate the migration of Site contaminants to portions of the Great Swamp located to the east of the Site. However, during periods of high surface water, a potential intermittent migration pathway exists where surface water and sediment contaminants may be transported towards a large tributary stream of Muddy Brook located 1,000 feet north of the Site. It is unknown if Site-related contaminants have migrated to this tributary. Low concentrations of PCBs were detected in the most northerly surface water and sediment samples collected at the Site. If contaminants have been discharged to this tributary, then subsequent intermittent migration pathways would be to the east into Muddy Brook and eventually to the East Branch Croton River.

As described above, the direction of the stormwater flow is towards the large tributary to Muddy Brook located to the north. Therefore, the fish and wildlife resources in this stream and the Site itself are the subjects of the pathway analysis.

5.1 Site-Specific Exposure Pathways

Macroinvertebrates inhabiting the shallow emergent marsh at the Site would be exposed to sediment contaminants through direct contact and ingestion. Concentrations of total PCBs, and to a lesser extent, total PAHs, may result in direct mortality or reductions in growth and/or reproduction rates for benthic organisms. The shallow emergent marsh is not anticipated to support populations of fish given the shallow surface water depth that is present only intermittently during the drier portion of the year (late summer and fall). Therefore, exposure pathways at the Site from fish to humans or piscivorous wildlife are not present.

PCBs typically do not accumulate significantly within aquatic vegetation. However, the primary PCB Aroclors detected in Site sediment are Aroclor 1242 and to a lesser extent Aroclor 1232 and Aroclor 1254. These represent lower chlorinated isomers, which are more soluble in water and consequently, more likely to be taken up by plants present within the shallow marsh (Eisler, 1986). PCBs are expected to readily bioaccumulate within the tissues of aquatic invertebrates present at the Site.

Wildlife that forage on vegetation or prey upon aquatic invertebrates within the shallow emergent marsh at the Site may ingest PCBs through direct ingestion of plants or invertebrates or indirectly via incidental ingestion of sediment as they forage. Example receptors include waterfowl, shorebirds, songbirds such as red-winged blackbird and song sparrow, and mammals such as muskrat and Virginia opossum. In addition, the emerging adults of aquatic insect larvae (e.g., damselflies, mayflies, caddis flies, etc.) may be preyed upon by insectivores such as various warblers, swallows, and bats.

5.2 Off-Site Exposure Pathways

Exposure pathways described above for the Site would also apply to off-Site areas such as the large tributary to Muddy Brook, which is located approximately 1,000 feet north of the Site. In

addition, if Site-related contaminants have discharged to this stream, then bioaccumulation of PCBs (and PAHs to a much lesser extent) by fish present within this stream would represent another exposure pathway for humans and wildlife such as great blue heron, river otter, and mink that consume fish.

6.0 CONCLUSION

The results of the FWRIA indicate that there are significant ecological resources at and in the immediate vicinity of the Site that may be impacted by contamination associated with the Site. These resources include a CEA, a state-significant natural community (which is also a Class 1 Freshwater Wetland), potential habitat for multiple state-listed RTE species, and habitat for wildlife including amphibians, reptiles, birds, and mammals. In addition, a cold water fishery is located 1,000 feet north of the Site. Potentially affected resources at the Site and vicinity include components of the aquatic food chain that are directly associated with sediment (i.e., benthic macroinvertebrates) as well as higher trophic level receptors that may forage on vegetation and/or aquatic invertebrates that are present within the Site's shallow emergent marsh habitat. Both aquatic vegetation and invertebrates may bioaccumulate PCBs to levels that are potentially harmful to ecological receptors that forage within the Site. Based on the findings of this assessment, additional assessment should be conducted and/or remediation of the sediment exhibiting contamination is warranted.

7.0 REFERENCES

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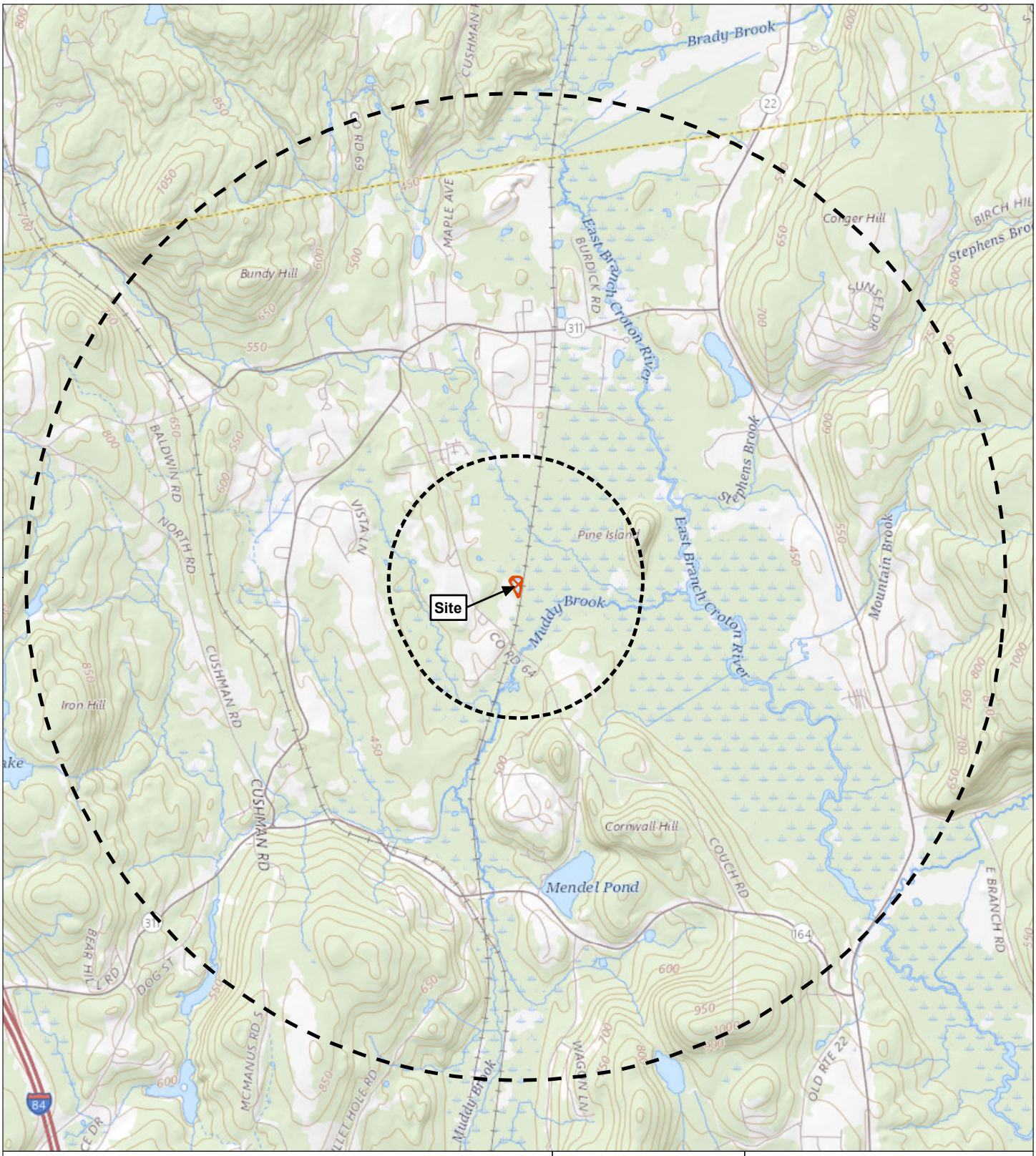
FIGURES


Brady Brook
Bundy Hill
Conger Hill
Pine Island
Site
Muddy Brook
East Branch Croton River
Stephens Brook
Mountain Brook
Iron Hill
Cornwall Hill
Mendel Pond
CUSHMAN RD
NORTH RD
BALDWIN RD
MAPLE AVE
BURDICK RD
VISTA LN
CO RD 64
COUCH RD
E BRANCH RD
OLD RTE 22
WAGNER LN
MCMANUS RD S
BEAR HILL RD
DOG ST
Project Area
Half Mile Buffer from Project Area
2-Mile Buffer from Project Area
USGS 24k Quadrangle
0
1,500
3,000
Feet
N
NY
MA
CT
RI
PA
NJ
Site Location
Data Sources: TRC, Esri
Base Map: USGS The National Map, "USGSTopo"
TRC
1430 Broadway
10th Floor
New York
NY 10018
SITE LOCATION
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL
286 CORNWALL HILL RD
PATTERSON, NEW YORK 12563
FIGURE 1
JANUARY 2020
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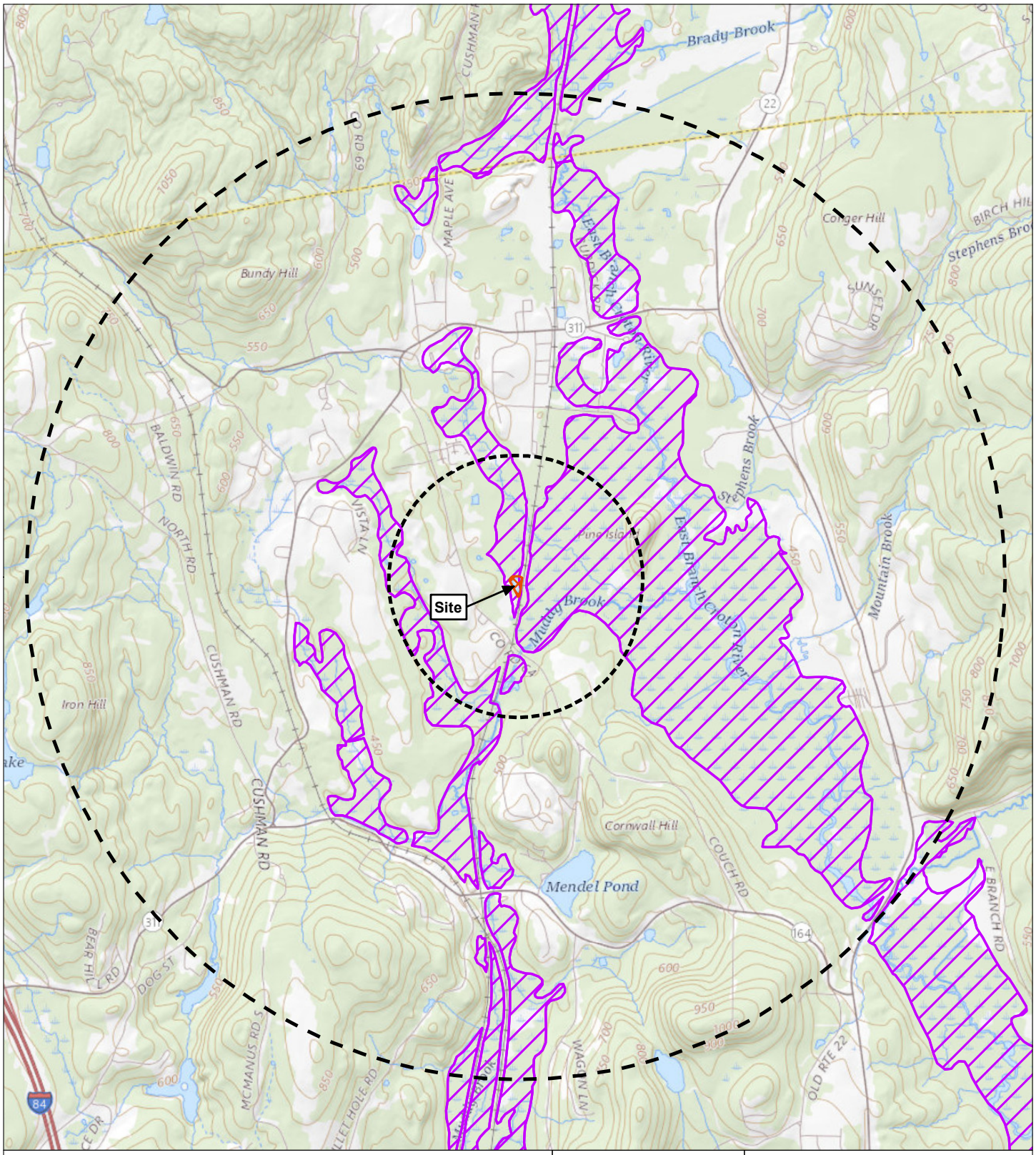
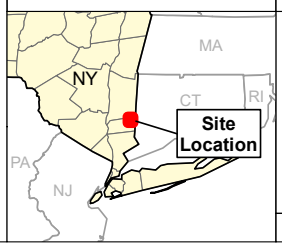


Project Area
Half Mile Buffer from Project Area
2-Mile Buffer from Project Area
Critical Environmental Areas (CEAs)

0 1,500 3,000
Feet

N



Data Sources: TRC, NYDEC
Base Map: USGS The National Map, "USGSTopo"

TRC

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New York
NY 10018

CRITICAL ENVIRONMENTAL AREAS

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL

286 CORNWALL HILL RD
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FIGURE 2	JANUARY 2020

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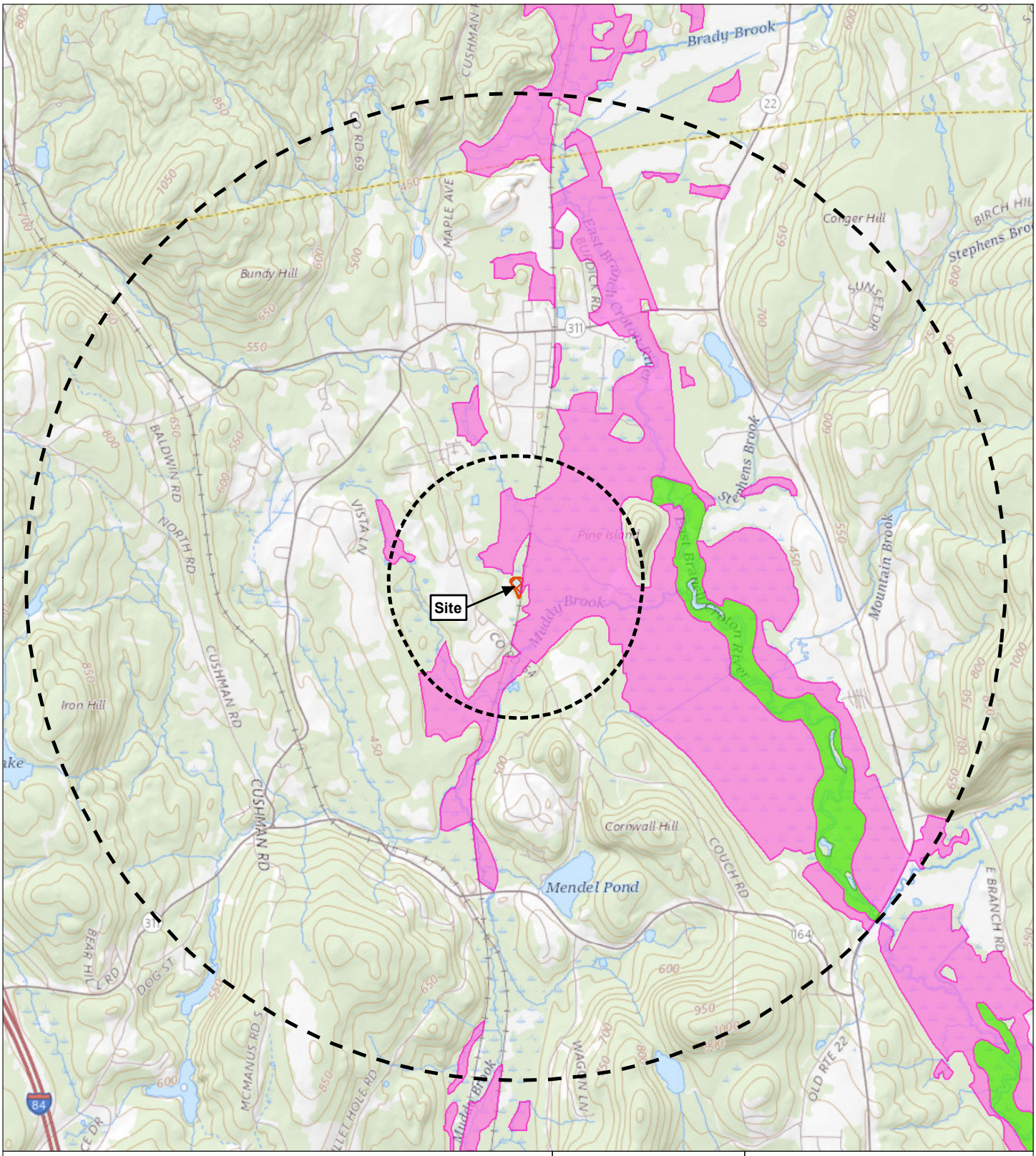

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SIGNIFICANT NATURAL COMMUNITIES

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL

286 CORNWALL HILL RD
PATTERSON, NEW YORK 12563

FIGURE 3	JANUARY 2020

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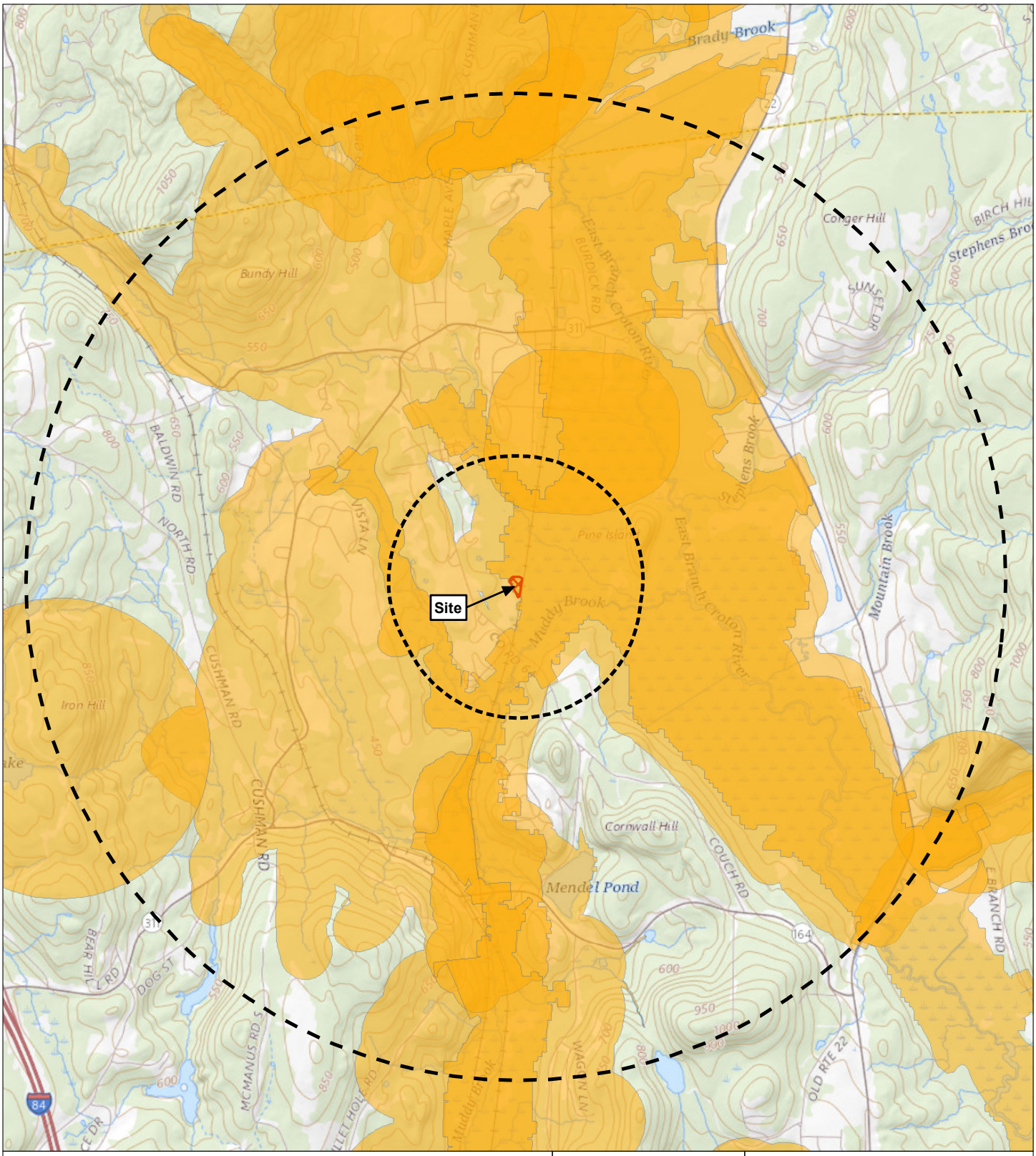
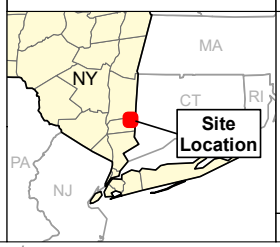


Project Area
Half Mile Buffer from Project Area
2-Mile Buffer from Project Area
Natural Heritage Areas for Rare Plants & Animals

N

0 1,500 3,000
Feet



Data Sources: TRC, NYDEC
Base Map: USGS The National Map, "USGSTopo"

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RARE PLANTS & ANIMALS

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL

286 CORNWALL HILL RD
PATTERSON, NEW YORK 12563

FIGURE 4	JANUARY 2020

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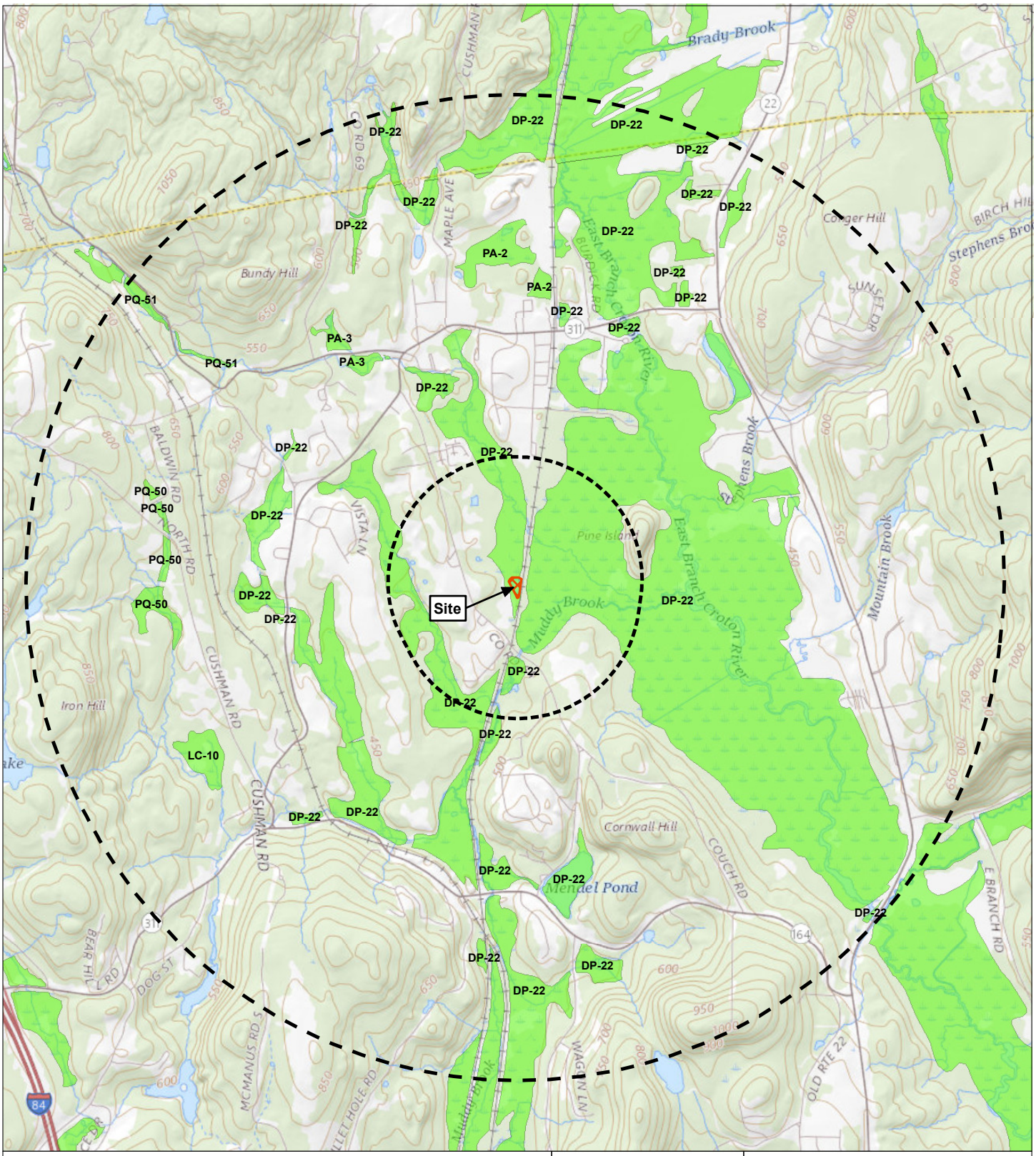
Brady Brook
DP-22
PA-2
PA-3
PQ-51
PQ-50
LC-10
Site
Bundy Hill
Iron Hill
Pine Island
Cornwall Hill
Mendel Pond
Muddy Brook
East Branch Croton River
Mountain Brook
Stephens Brook
CUSHMAN RD
MAPLE AVE
BALDWIN RD NORTH RD
VISTA LN
COUCH RD
E BRANCH RD
OLD RTE 22
MCMANUS RD S
BEAR HILL RD
DOG ST
WAGNER LN
Project Area
Half Mile Buffer from Project Area
2-Mile Buffer from Project Area
State Regulated Freshwater Wetlands
0 1,500 3,000
Feet
N
NY
MA
CT
RI
PA
NJ
Site Location
Data Sources: TRC, NYDEC
Base Map: USGS The National Map, "USGSTopo"
TRC
1430 Broadway
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STATE REGULATED FRESHWATER WETLANDS
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL
286 CORNWALL HILL RD
PATTERSON, NEW YORK 12563
FIGURE 5
JANUARY 2020
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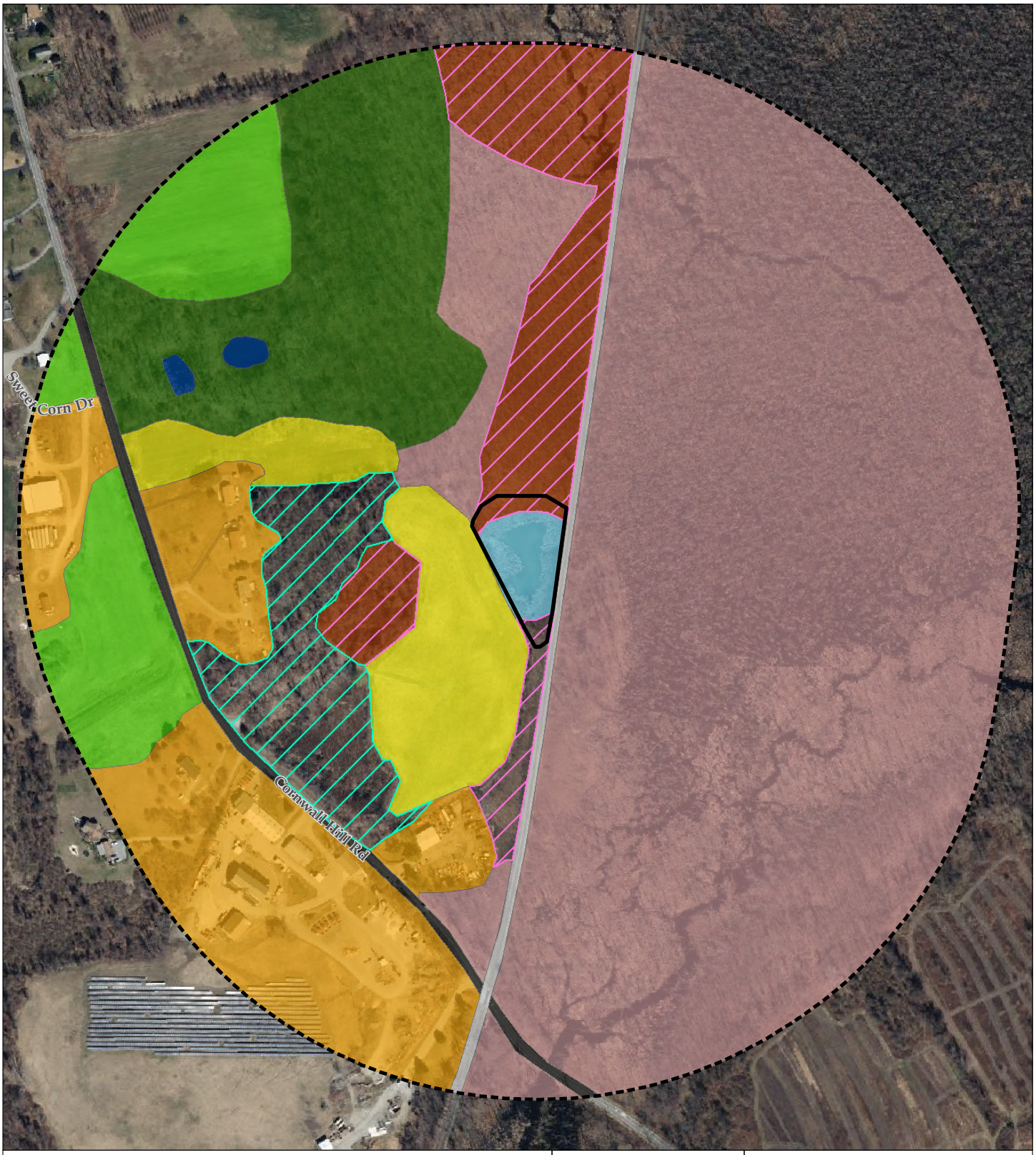


Project
Quarter Mile Buffer from Project Area

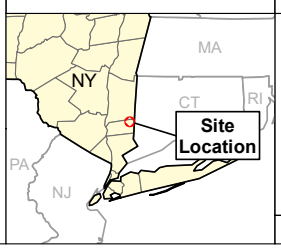
Ecological Community

- Appalachian Oak-Pine Forest
- Common Reed Marsh
- Cropland/ Field Crops
- Farm Pond
- Railroad
- Red Maple - Common Reed Marsh
- Red Maple - Hardwood Swamp
- Road
- Rural Structure/ Mowed Lawn with Trees
- Shallow Emergent Marsh
- Successional Old Field
- Successional Southern Hardwoods

Data Sources: TRC, NYDEC
Base Map: USGS The National Map, "USGSTopo"

0 200 400
Feet

N



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ECOLOGICAL COMMUNITIES

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL

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PATTERSON, NEW YORK 12563

FIGURE 6 | JANUARY 2020

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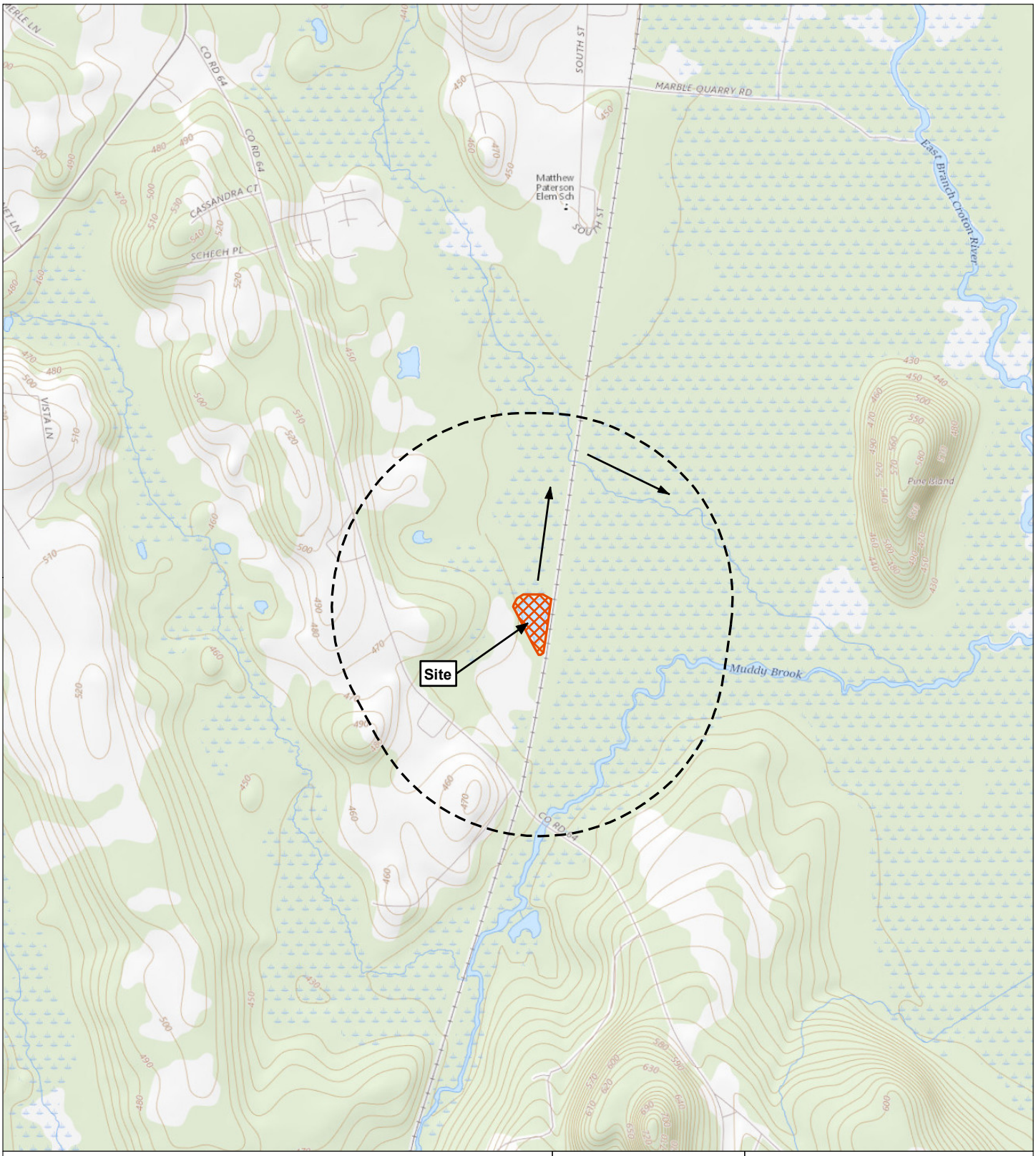
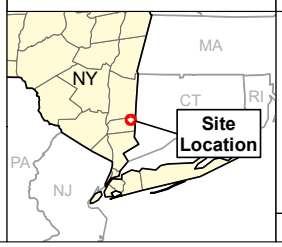


Project Area
Quarter Mile Buffer from Project Area
Direction of Surface Water Flow

0 500 1,000
Feet

N



Data Sources: TRC, Esri
Base Map: USGS The National Map, "USGSTopo"

TRC
1430 Broadway
10th Floor
New York
NY 10018

DRAINAGE PATTERN

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE NO. 340011 - CROSS COUNTY SANITARY/ KESSMAN LANDFILL

286 CORNWALL HILL RD PATTERSON, NEW YORK 12563

FIGURE 7 | JANUARY 2020

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ATTACHMENT A

NATURAL HERITAGE PROGRAM RESPONSE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, New York Natural Heritage Program
625 Broadway, Fifth Floor, Albany, NY 12233-4757
P: (518) 402-8935 | F: (518) 402-8925
www.dec.ny.gov

December 31, 2019

Scott Heim
TRC Environmental
650 Suffolk Street
Lowell, MA 01854

Re: Kessman Landfill
County: Putnam Town/City: Patterson

Dear Mr. Heim:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to the above project.

Enclosed is a report of rare or state-listed animals and plants, and significant natural communities that our database indicates occur in the vicinity of the project site.

For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our database. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or significant natural communities. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

Sincerely,

Nicholas Conrad
Information Resources Coordinator
New York Natural Heritage Program

1444

The following state-listed animals and plants have been documented in the vicinity of the project site.

For more information on state-listed animals, please contact the NYSDEC Region 3 Office.

The following species have been documented within 1/4 mile west/southwest of the project site, along a tributary to Muddy Brook.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Spreading Globeflower	*Trollius laxus*	Rare	Vulnerable in NYS and Globally Uncommon

1999-04-28: Diverse stream and spring-fed wetland (rich sloping fen) on gentle slopes intermixed with a higher area of old pastures and wet meadows with red cedars. Wetland has small pocket of elms in saturated soil with carpet of skunk cabbage.

Fairywand	*Chamaelirium luteum*	Endangered	Critically Imperiled in NYS

1990-08-22: An old pasture with red cedars on a small hillside near a small headwater stream. The area is a mosaic of old pasture, a wet meadow that has been grazed, artificial ponds, and a rich sloping fen.

This site also includes a state-significant natural community, **rich sloping fen**.

The following species has been documented within .6 mile of the project site. Individual animals may travel one mile from documented locations.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*FEDERAL LISTING*
Bog Turtle	*Glyptemys muhlenbergii*	Endangered	Threatened

The following species have been documented within 1/2 mile north/northeast of the project site. in and at the edge of the Great Swamp.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*FEDERAL LISTING*
New England Cottontail	*Sylvilagus transitionalis*	Special Concern	

Much of the Great Swamp is a state-significant natural community, **red maple-hardwood swamp**. This very large swamp with good diversity extends onto the northeastern portion of the project site.

This report only includes records from the NY Natural Heritage database.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the listed animals and plants in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, and from NYSDEC at www.dec.ny.gov/animals/7494.html.

ATTACHMENT B

ANIMALS, PLANTS AND NATURAL COMMUNITIES FOUND IN THE GREAT SWAMP (FROM SIEMANN, 1999)

II. Animals, Plants and Natural Communities Found in the Great Swamp

OCCURRENCE STATUS

A
Accidental occurrence with only one or two sightings in the past three years during the breeding season.

B
Breeding activity is confirmed or expected due to regular sighting during the breeding season.

M
Seen during the migration season in larger numbers than in breeding season.

I
Irregular occurrence during the non-breeding season.

PB
Possible breeder based on a few sightings during the breeding season.

R
Year round resident and breeder.

V
Visitor seen regularly during breeding season, but not showing any characteristics of breeding activity.

W
Overwinters in the Great Swamp in much greater or smaller numbers than in breeding season.

U
Unconfirmed

S
Found in the watershed but not the wetland

RARITY STATUS

E
Endangered

T
Threatened

SC
Special Concern

Source: NYS DEC 1998a

Birds The following list identifies 185 birds seen in the Great Swamp wetland and its 100 foot buffer zone only. Bird surveys were conducted by Dr. James Utter and William Wallace, Jr. of Purchase College, SUNY during 1997 and 1998. Sibyll Gilbert, Barbara Butler, Allan Michelin, and Helen Andrews also contributed occurrence records.

COMMON NAME	SCIENTIFIC NAME	STATUS
Grebes		
Pied-billed Grebe	*Podilymbus podiceps*	M
Cormorants		
Double-crested Cormorant	*Phalacrocorax auritus*	V
American Bittern	*Botaurus lentiginosus*	M, PB
Least Bittern	*Ixobrychus exilis*	M, PB
Great Blue Heron	*Ardea herodias*	B, M
Great Egret	*Ardea alba*	I
Green Heron	*Butorides virescens*	B, M
Black-crowned Night-Heron	*Nycticorax nycticorax*	A
New World vultures		
Black Vulture	*Coragyps atratus*	V, M
Turkey Vulture	*Cathartes aura*	R, M
Waterfowl		
Canada Goose	*Branta canadensis*	R, M
Snow Goose	*Chen caerulescens*	I, M
Mute Swan	*Cygnus olor*	R
Wood Duck	*Aix sponsa*	B, M
American Black Duck	*Anas rubripes*	M, W
Mallard	*Anas platyrhynchos*	R, M
Blue-winged Teal	*Anas discors*	M, V
Green-winged Teal	*Anas crecca*	M, V
Ring-necked Duck	*Aythya collaris*	M, W
White-winged Scoter	*Melanitta fusca*	A
Bufflehead	*Bucephala albeola*	M
Common Goldeneye	*Bucephala clangula*	M
Hooded Merganser	*Lophodytes cucullatus*	M
Common Merganser	Mergus merganser	M, W
Hawks, Eagles and Kites		
Osprey	*Pandion haliaetus*	M
Bald Eagle	*Haliaeetus leucocephalus*	M, I
Hawks, Eagles and Kites cont'd		
Northern Harrier	*Circus cyaneus*	M, I
Sharp-shinned Hawk	*Accipiter striatus*	M, W
Cooper's Hawk	*Accipiter cooperii*	R, M
Northern Goshawk	*Accipiter gentilis*	M, W
Red-shouldered Hawk	*Buteo lineatus*	PB, M, W
Broad-winged hawk	*Buteo platypterus*	PB, M
Red-tailed Hawk	*Buteo jamaicensis*	R, M
Falcons and Caracaras		
American Kestrel	*Falco sparverius*	B, M
Merlin	*Falco columbarius*	M
Peregrine Falcon	*Falco peregrinus*	M
Pheasants, Grouse, Quail and Turkeys		
Ring-necked Pheasant	*Phasianus colchicus*	R
Ruffed Grouse	*Bonasa umbellus*	R
Wild Turkey	*Meleagris gallopavo*	R
Rails and Coots		
Virginia Rail	*Rallus limicola*	B, M
Sora	*Porzana carolina*	B, M
Common Moorhen	*Gallinula chloropus*	I
Plovers and Lapwings		
Killdeer	*Charadrius vociferus*	B, M
Sandpipers		
Greater Yellowlegs	*Tringa melanoleuca*	M
Lesser Yellowlegs	*Tringa flavipes*	M
Solitary Sandpiper	*Tringa solitaria*	M
Spotted Sandpiper	*Actitis macularia*	B, M
Semipalmated Sandpiper	*Calidris pusilla*	M
Least Sandpiper	*Calidris minutilla*	M
Pectoral Sandpiper	*Calidris melanotos*	M
Common Snipe	*Gallinago gallinago*	M
American Woodcock	*Scolopax minor*	B, M
Gulls and Terns		
Ring-billed Gull	*Larus delawarensis*	V
Herring Gull	*Larus argentatus*	V
Great Black-backed Gull	*Larus marinus*	V
Pigeons and Doves		
Rock Dove	*Columba livia*	R
Mourning Dove	*Zenaida macroura*	R
Old World Cuckoos		
Black-billed Cuckoo	*Coccyzus erythropthalmus*	B, M
Yellow-billed Cuckoo	*Coccyzus americanus*	B, M
Owls		
Eastern Screech-Owl	*Otus asio*	R
Great Horned Owl	*Bubo virginianus*	R
Barred Owl	*Strix varia*	R
Northern Saw-whet Owl	*Aegolius acadicus*	M, W?
Nightjars		
Common Nighthawk	*Chordeiles minor*	M
Swifts		
Chimney Swift	*Chaetura pelagica*	B, M
Hummingbirds		
Ruby-throated Hummingbird	*Archilochus colubris*	B, M
Kingfishers		
Belted Kingfisher	*Ceryle alcyon*	R
Woodpeckers		
Red-bellied Woodpecker	*Melanerpes carolinus*	R
Yellow-bellied Sapsucker	*Sphyrapicus varius*	M, W
Downy Woodpecker	*Picoides pubescens*	R
Hairy Woodpecker	*Picoides villosus*	R
Northern Flicker	*Colaptes auratus*	B, M, W
Pileated Woodpecker	*Dryocopus pileatus*	R
Tyrant Flycatchers		
Olive-sided Flycatcher	*Contopus borealis*	M
Eastern Wood-Pewee	*Contopus virens*	B, M
Yellow-bellied Flycatcher	*Empidonax flaviventris*	M

COMMON NAME	SCIENTIFIC NAME	STATUS
Tyrant Flycatchers cont'd		
Acadian Flycatcher	*Empidonax virescens*	M
Alder Flycatcher	*Empidonax alnorum*	B, M
Willow Flycatcher	*Empidonax traillii*	B, M
Least Flycatcher	*Empidonax minimus*	B, M
Eastern Phoebe	*Sayornis phoebe*	B, M
Great Crested Flycatcher	*Myiarchus crinitus*	B, M
Eastern Kingbird	*Tyrannus tyrannus*	B, M
Vireos and Allies		
White-eyed Vireo	*Vireo griseus*	B, M
Yellow-throated Vireo	*Vireo flavifrons*	B, M
Blue-headed Vireo	*Vireo solitarius*	M
Warbling Vireo	*Vireo gilvus*	B, M
Philadelphia Vireo	*Vireo philadelphicus*	M
Red-eyed Vireo	*Vireo olivaceus*	B, M
Crows and Jays		
Blue Jay	*Cyanocitta cristata*	R
American Crow	*Corvus brachyrhynchos*	R
Fish Crow	*Corvus ossifragus*	PB
Common Raven	*Corvus corax*	R
Larks		
Horned Lark	*Eremophila alpestris*	W
Swallows		
Purple Martin	*Progne subis*	M
Tree Swallow	*Tachycineta bicolor*	B, M
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	B, M
Bank Swallow	*Riparia riparia*	B, M
Cliff Swallow	*Petrochelidon pyrrhonota*	M
Barn Swallow	*Hirundo rustica*	B, M
Tits and Allies		
Black-capped Chickadee	*Poecile atricapillus*	R
Tufted Titmouse	*Baeolophus bicolor*	R
Nuthatches		
Red-breasted Nuthatch	*Sitta canadensis*	M, W
White-breasted Nuthatch	*Sitta carolinensis*	R
Creepers		
Brown Creeper	*Certhia americana*	R
Wrens		
Carolina Wren	*Thryothorus ludovicianus*	R
House Wren	*Troglodytes aedon*	B, M
Winter Wren	*Troglodytes troglodytes*	W
Marsh Wren	*Cistothorus palustris*	B
Kinglets		
Golden-crowned Kinglet	*Regulus satrapa*	M, W
Ruby-crowned Kinglet	*Regulus calendula*	M, W
Old World Warblers		
Blue-gray Gnatcatcher	*Polioptila caerulea*	B, M
Thrushes		
Eastern Bluebird	*Sialia sialis*	R
Veery	*Catharus fuscescens*	B, M
Swainson's Thrush	*Catharus ustulatus*	M
Hermit Thrush	*Catharus guttatus*	M
Wood Thrush	*Hylocichla mustelina*	B, M
American Robin	*Turdus migratorius*	B, M, W
Mockingbirds and Thrashers		
Gray Catbird	*Dumetella carolinensis*	B, M
Northern Mockingbird	*Mimus polyglottos*	R
Brown Thrasher	*Toxostoma rufum*	B, M
Starlings		
European Starling	*Sturnus vulgaris*	R, M, W
Waxwings and Silky-flycatchers		
Cedar Waxwing	*Bombycilla cedrorum*	R, M, W
New World Warblers		
Blue-winged Warbler	*Vermivora pinus*	B, M
Tennessee Warbler	*Vermivora peregrina*	M
Nashville Warbler	*Vermivora ruficapilla*	M

COMMON NAME	SCIENTIFIC NAME	STATUS
New World Warblers cont'd		
Northern Parula	*Parula americana*	M
Yellow Warbler	*Dendroica petechia*	B, M
Chestnut-sided Warbler	*Dendroica pensylvanica*	B, M
Magnolia Warbler	*Dendroica magnolia*	M
Black-throated Blue Warbler	*Dendroica caerulescens*	M
Yellow-rumped Warbler	*Dendroica coronata*	M
Black-throated Green Warbler	*Dendroica virens*	M
Blackburnian Warbler	*Dendroica fusca*	M
Pine Warbler	*Dendroica pinus*	M
Prairie Warbler	*Dendroica discolor*	B, M
Palm Warbler	*Dendroica palmarum*	M
Bay-breasted Warbler	*Dendroica castanea*	M
Blackpoll Warbler	*Dendroica striata*	M
Cerulean Warbler	*Dendroica cerulea*	B, M
Black-and-white Warbler	*Mniotilta varia*	B, M
American Redstart	*Setophaga ruticilla*	B, M
Worm-eating Warbler	*Helmitheros vermivorus*	B, M
Ovenbird	*Seiurus aurocapillus*	B, M
Northern Waterthrush	*Seiurus noveboracensis*	B, M
Louisiana Waterthrush	*Seiurus motacilla*	B, M
Connecticut Warbler	*Oporornis agilis*	M
Mourning Warbler	*Oporornis philadelphia*	M
Common Yellowthroat	*Geothlypis trichas*	B, M
Hooded Warbler	*Wilsonia citrina*	M
Wilson's Warbler	*Wilsonia pusilla*	M
Canada Warbler	*Wilsonia canadensis*	B, M
Yellow-breasted Chat	*Icteria virens*	M
Tanagers		
Scarlet Tanager	*Piranga olivacea*	B, M
Tanagers, Buntings, Sparrows and Allies		
Eastern Towhee	*Pipilo erythrophthalmus*	B, M
American Tree Sparrow	*Spizella arborea*	M, W
Chipping Sparrow	*Spizella passerina*	B, M
Field Sparrow	*Spizella pusilla*	B, M
Savannah Sparrow	*Passerculus sandwichensis*	PB, M
Fox Sparrow	*Passerella iliaca*	M, W
Song Sparrow	*Melospiza melodia*	R, M
Lincoln's Sparrow	*Melospiza lincolnii*	M
Swamp Sparrow	*Melospiza georgiana*	B, M, W
White-throated Sparrow	*Zonotrichia albicollis*	M, W
White-crowned Sparrow	*Zonotrichia leucophrys*	M
Dark-eyed Junco	*Junco hyemalis*	M, W
Cardinals, Grosbeaks and American Buntings		
Northern Cardinal	*Cardinalis cardinalis*	R
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	B, M
Blue Grosbeak	*Guiraca caerulea*	V
Indigo Bunting	*Passerina cyanea*	B, M
Troupials and Allies		
Bobolink	*Dolichonyx oryzivorus*	B, M
Red-winged Blackbird	*Agelaius phoeniceus*	B, M
Eastern Meadowlark	*Sturnella magna*	PB
Rusty Blackbird	*Euphagus carolinus*	M
Common Grackle	*Quiscalus quiscula*	B, M
Brown-headed Cowbird	*Molothrus ater*	B, M
Orchard Oriole	*Icterus spurius*	PB
Baltimore Oriole	*Icterus galbula*	B, M
Siskins, Crossbills and Allies		
Purple Finch	*Carpodacus purpureus*	PB, M
House Finch	*Carpodacus mexicanus*	R
Common Redpoll	*Carduelis flammea*	M, W
Pine Siskin	*Carduelis pinus*	M, W
American Goldfinch	*Carduelis tristis*	R
Evening Grosbeak	*Coccothraustes vespertinus*	M, W
Old World Sparrows		
House Sparrow	*Passer domesticus*	R

Reptiles and Amphibians (Herpetofauna) This list is based on surveys conducted by Dr. Michael Klemens and Diane Murphy of the Wildlife Conservation Society between 1992 and 1998.

COMMON NAME	SCIENTIFIC NAME	STATUS
Reptiles		
Snapping Turtle	*Chelydra s. serpentina*	
Painted Turtle	*Chrysemys picta*	
Spotted Turtle	*Clemmys guttata*	SC
Wood Turtle	*Clemmys insculpta*	SC
Bog Turtle	*Clemmys muhlenbergii*	E
Common Musk Turtle	*Sternotherus odoratus*	
Eastern Box Turtle	*Terrapene c. carolina*	SC
Copperhead	*Agkistrodon contortrix mokasen*	
Northern Black Racer	*Coluber c. constrictor*	
Timber Rattlesnake	*Crotalus horridus*	T
Northern Ringneck Snake	*Diadophis punctatus edwardsii*	
Black Rat Snake	*Elaphe o. obsoleta*	
Hognose Snake	*Heterodon platirhinos*	SC
Eastern Milk Snake	*Lampropeltis t. triangulum*	
Northern Water Snake	*Nerodia s. sipedon*	
Smooth Green Snake	*Opheodrys vernalis*	
Brown Snake	*Storeria d. dekayi*	
Redbelly Snake	*Storeria o. occipitomaculata*	
Ribbon Snake	*Thamnophis s. sauritus*	
Eastern Garter Snake	*Thamnophis s. sirtalis*	
Amphibians		
Jefferson Salamander	*Ambystoma jeffersonianum*	SC
Blue-spotted Salamander	*Ambystoma laterale*	SC
Spotted Salamander	*Ambystoma maculatum*	SC
Marbled Salamander	*Ambystoma opacum*	SC(proposed)
Northern Two-lined Salamander	*Eurycea bislineata*	
Four-toed Salamander	*Hemidactylium scutatum*	
Red-spotted Newt	*Notophthalmus v. viridescens*	
Redback Salamander	*Plethodon cinereus*	
Northern Slimy Salamander	*Plethodon glutinosus*	
American Toad	*Bufo americanus*	
Gray Tree Frog	*Hyla versicolor*	
Spring Peeper	*Pseudacris c. crucifer*	
Bullfrog	*Rana catesbeiana*	
Green Frog	*Rana clamitans melanota*	
Pickerel Frog	*Rana palustris*	
Wood Frog	*Rana sylvatica*	

Fish and Crayfish This list is based on surveys conducted in the Great Swamp and its tributaries by Dr. Scott Silver, Dr. Michael Klemens, Diane Murphy, Tracy Van Holt, and Kristi MacDonald of the Wildlife Conservation Society during the 1997 field season.

COMMON NAME	SCIENTIFIC NAME	STATUS
Fish		
Black Crappie	*Pomoxis nigromaculatus*	
Bluegill	*Lepomis macrochirus*	
Brook Trout	*Salvelinus fontinalis*	
Brown Bullhead	*Ameiurus nebulosus*	
Brown Trout	*Salmo trutta*	
Common Shiner	*Luxilus cornutus*	
Creek Chub	*Semotilus atromaculatus*	
Creek Chubsucker	*Erimyzon oblongus*	
Cutlips Minnow	*Exoglossum maxillingua*	
Eastern Blacknose Dace	*Rhinichthys atratulus*	
Fallfish	*Semotilus corporalis*	
Fathead Minnow	*Pimephales promelas*	
Fish cont'd		
Golden Shiner	*Notemigonus crysoleucas*	
Green Sunfish	*Lepomis cyanellus*	
Johnny Darter	*Etheostoma nigrum*	
Largemouth Bass	*Micropterus salmoides*	
Longear Sunfish	*Lepomis megalotis*	T
Longnose Dace	*Rhinichthys cataractae*	
Pickerel	*Esox americanus*	
Pumpkinseed	*Lepomis gibbosus*	
Redbreast Sunfish	*Lepomis auritus*	
Rock Bass	*Ambloplites rupestris*	
Slimy Sculpin	*Cottus cognatus*	
Smallmouth Bass	*Micropterus dolomieu*	
Spottail Shiner	*Notropis hudsonius*	
Tessellated Darter	*Etheostoma olmstedi*	
White Sucker	*Catostomus commersoni*	
Yellow Bullhead	*Ameiurus natalis*	
Yellow Perch	*Perca flavescens*	
Crayfish		
	Cambarus bartonii	
	Cambarus robustus	
	Orconectes immunis	
	Orconectes limosus	
	Orconectes robustus	
	Orconectes rusticus	
	Orconectes virilis	
	Procambarus acutus	

Butterflies (Lepidoptera) This list is based on surveys conducted by Dr. Scott Silver and Dr. Fred Koontz of the Wildlife Conservation Society in 1997.

Acadia Hairstreak	*Satyrium acadica*	
American Buckeye	*Junonia coenia*	
American Copper	*Lycaena phlaeas*	
American Lady	*Vanessa virginiensis*	
Aphrodite Fritillary	*Speyeria aphrodite*	
Appalachian Brown	*Satyrodes appalachia*	
Baltimore	*Euphydryas phaeton*	
Banded Hairstreak	*Satyrium calanus*	
Black Swallowtail	*Papilio polyxenes*	
Bronze Copper	*Lycaena hyllus*	
Broadwing Skipper	*Poanes viator*	
Cabbage White	*Pieris rapae*	
Clouded Sulphur	*Colias philodice*	
Cobweb Skipper	*Hesperia metea*	
Common Ringlet	*Coenonympha cymela*	
Common Wood Nymph	*Cercyonis pegala*	
Coral Hairstreak	*Satyriums titus*	
Crossline Skipper	*Polites origenes*	U
Delaware Skipper	*Atrytone delaware*	
Dion Skipper	*Euphyes dion*	
Dreamy duskywing	*Erynnis icelus*	
Dun Skipper	*Euphyes vestris*	
Eastern Comma	*Polygonia comma*	
Eastern-Tailed Blue	*Everes comyntas*	
Eastern Tiger Swallowtail	*Pterourus glaucus*	
European Skipper	*Thymelicus lineola*	
Eyed Brown	*Satyrodes eurydice*	
Falcate Orangetip	*Anthocharis midea*	
Great Spangled Fritillary	*Speyeria cybele*	
Harvester	*Feniseca tarquinia*	
Hobomok Skipper	*Poanes hobomok*	
Indian Skipper	*Hesperia sassacus*	
Juvenal's duskywing	*Erynnis juvenalis*	U
Least Skipper	*Ancyloxypha numitor*	

COMMON NAME	SCIENTIFIC NAME	STATUS
Butterflies cont'd		
Little Glassywing	*Pompeius verna*	
Little Wood Satyr	*Megisto cymela*	
Long Dash Skipper	*Polites mystic*	
Meadow Fritillary	*Boloria bellona*	
Monarch	*Danaus plexippus*	
Mourning Cloak	*Nymphalis antiopa*	
Mulberry Wing	*Poanes massasoit*	
Northern Broken Dash	*Wallengrenia egeremet*	U
Northern Cloudywing	*Thorybes pylades*	
Olive Hairstreak	*Callophrys gryneus*	
Orange Sulphur	*Colias eurytheme*	
Painted Lady	*Vanessa cardui*	
Pearl Crescent	*Phyciodes tharos*	
Peck's Skipper	*Polites peckius*	
Question Mark	*Polygonia interrogationis*	
Red Admiral	*Vanessa atalanta*	
Red-spotted Purple	*Basilarchia astyanax*	
Silver-bordered Fritillary	*Boloria selene*	
Silver-spotted Skipper	*Epargyreus clarus*	
Spicebush Swallowtail	*Pterourus troilus*	
Spring Azure	*Celastrina ladon*	
Summer Azure	*Celastrina ladon*	
Tawny edged Skipper	*Polites themistocles*	
Viceroy	*Limenitis archippus*	
West Virginia White	*Pieris virginiensis*	
Wild Indigo Duskywing	*Erynnis baptisiae*	
Zabulon Skipper	*Poanes zabulon*	

Damselflies and Dragonflies (Odonates) This list is based primarily on surveys conducted by Ken Soltesz during the 1997 field season with the Wildlife Conservation Society.

Damselflies: Suborder Zygoptera	
Broad-winged Damsels: Family Calopterygidae	
River Jewelwing	*Calopteryx aequabilis*
Ebony Jewelwing	*Calopteryx maculata*
Spreadwing Damsels: Family Lestidae	
Spotted Spreadwing	*Lestes congener*
Amber-winged Spreadwing	*Lestes eurinas*
Sweetflag Spreadwing	*Lestes forcipatus*
Elegant Spreadwing	*Lestes inaequalis*
Slender Spreadwing	*Lestes rectangularis*
Swamp Spreadwing	*Lestes vigilax*
Pond Damsels: Family Coenagrionidae	
Violet Dancer	*Argia fumipennis violacea*
Aurora Damsel	*Chromagrion conditum*
Azure Bluet	*Enallagma aspersum*
Familiar Bluet	*Enallagma civile*
Northern Bluet	*Enallagma cyathigerum*
Turquoise Bluet	*Enallagma divagans*
Stream Bluet	*Enallagma exsulans*
Skimmimg Bluet	*Enallagma geminatum*
Orange Bluet	*Enallagma signatum*
Fragile Forktail	*Ischnura posita*
Eastern Forktail	*Ischnura verticalis*
Dragonflies: Suborder Anisoptera	
Darners: Family Aeshnidae	
Canada Darner	*Aeshna canadensis*
Spatterdock Darner	*Aeshna mutata*
Black-tipped Darner	*Aeshna tuberculifera*
Shadow Darner	*Aeshna umbrosa*
Green-striped Darner	*Aeshna verticalis*
Green Darner	*Anax junius*
Springtime Darner	*Basiaeschna janata*
Fawn Darner	*Boyeria vinosa*

COMMON NAME	SCIENTIFIC NAME	STATUS
Darners: Family Aeshnidae cont'd		
Swamp Darner	*Epiaeschna heros*	
Harlequin Darner	*Gomphaeschna furcillata*	
Cyrano Darner	*Nasiaeschna pentacantha*	
Clubtails: Family Gomphidae		
Unicorn Clubtail	*Arigomphus villosipes*	
Black-shouldered Spinyleg	*Dromogomphus spinosus*	
Lancet Clubtail	*Gomphus exilis*	
Ashy Clubtail	*Gomphus lividus*	
Spiketails: Family Cordulegastridae		
Delta-spotted Spiketail	*Cordulegaster diastatops*	
Twin-spotted Spiketail	*Cordulegaster maculata*	
Emeralds: Family Corduliidae		
American Emerald	*Cordulia shurtleffi*	
Beaverpond Baskettail	*Epitheca canis*	
Common Baskettail	*Epitheca cynosura*	
Water Prince	*Epitheca princeps*	
Clamp-tipped Emerald	*Somatochlora tenebrosa*	
Skimmers: Family Libellulidae		
Calico Pennant	*Celithemis elisa*	
Halloween Pennant	*Celithemis eponina*	
Eastern Pondhawk	*Erythemis simplicicollis*	
Chalk-fronted Corporal	*Ladona julia*	
Dot-tailed Whiteface	*Leucorrhinia intacta*	
Spangled Skimmer	*Libellula cyanea*	
Slaty Skimmer	*Libellula incesta*	
Widow Skimmer	*Libellula luctuosa*	
Twelve-spotted Skimmer	*Libellula pulchella*	
Four-spotted Skimmer	*Libellula quadrimaculata*	
Painted Skimmer	*Libellula semifasciata*	
Blue Dasher	*Pachydiplax longipennis*	
Eastern Amberwing	*Perithemis tenera*	
Common Whitetail	*Plathemis lydia*	
Jane's Meadowhawk	*Sympetrum janeae*	
Band-winged Meadowhawk	*Sympetrum semicinctum*	
Yellow-legged Meadowhawk	*Sympetrum vicinum*	
Black Saddlebags	*Tramea lacerata*	

Bees and Wasps This list of bees (pollinators) and hunting wasps (predators) is based on surveys conducted by Dr. Parker Gambino in 1998 at three sites in the Great Swamp. Specimens were identified to the genus level.

COMMON NAME	SCIENTIFIC NAME	STATUS
Bees		
Plasterer bees	***Colletidae***	
Plasterer bees	*Colletes*	
Yellowfaced bees	*Hylaeus*	
Mining bees	***Andrenidae***	
	Andrena	
	Heterosarus	
Sweat bees	***Halictidae***	
	Augochlora	
	Augochlorella	
	Augochloropsis	
	Agapostemon	
	Halictus	
	Lasioglossum	
Leafcutter bees	***Megachilidae***	
	Coelioxys	
	Megachile	
	Anthophoridae	
Cuckoo bees	*Nomada*	
Small carpenter bees	*Ceratina*	
Large carpenter bees	*Xylocopa*	

COMMON NAME	SCIENTIFIC NAME	STATUS
Bees cont'd		
Social bees	***Apidae***	
Honey bees	*Apis*	
Bumble bees	*Bombus*	
Wasps		
Aphid wasps	***Sphecidae***	
	Sceliphron	
	Sphex	
	Isodontia	
Organ pipe mud daubers	*Trypoxylon*	
	Ectemnius	
beewolves or bee-killers	*Philanthus*	
beetle wasps	*Cerceris*	
	Astatinae sp.	
	Pemphredoninae sp.	
Potter wasps	***Eumenidae***	
	Ancistrocerus	
	Eumenes	
	Monobia	
	Parancistrocerus	
	Euodynerus	
Social wasps	***Vespidae***	
	Polistes	
	Vespula	
	Dolichovespula	

Ferns This list of ferns is based on surveys conducted in the Pawling area by Don Lubin of Allston Massachusetts on August 7 & 8 1996. The nomenclature and order follow that in the Flora of North America.

Rattlesnake	*Botrychium virginianum*	S
Cinnamon	*Osmunda cinnamomea*	
Interrupted	*Osmunda claytoniana*	
Royal	*Osmunda regalis*	
Maidenhair	*Adiantum pedantum*	
Hayscented	*Dennstaedtia punctilobula*	S
Bracken	*Pteridium aquilinum*	
New York	*Thelypteris noveboracencis*	
Marsh	*Thelypteris palustris*	
Broad Beech	*Phegopteris hexagonoptera*	
Ebony Spleenwort	*Asplenium platyneuron*	S
Walking	*Asplenium rhizophylum*	S
Ostrich	*Matteuccia struthiopteris*	
Sensitive	*Onoclea sensibilis*	
Silvery Glade	*Deparia acrostichoides*	
Lady	*Athyrium filix-femina*	
Bulblet	*Cystopteris bulbifera*	S
Fragile (Mackay's)	*Cystopteris tenuis*	S
Blunt-lobed Woodsia	*Woodsia obtusa*	S
Spinulose Woodfern	*Dryopteris carthusiana*	
Clinton's	*Dryopteris clintoniana*	
Crested	*Dryopteris cristata*	
Evergreen Woodfern	*Dryopteris intermedia*	
Marginal Woodfern	*Dryopteris marginalis*	
Christmas	*Polystichum acrostichoides*	
Rock Polypody	*Polypodium virginianum*	
Hybrids	*Dryopteris intermedia X marginalis*	
	Polypodium appalachianum X virginianum	
Allies		
Shining Clubmoss	*Huperzia lucidula*	
Common Horsetail	*Equisetum arvens*	
Scouring Rush	*Equisetum hyemale*	

Natural Communities Natural vegetation communities were identified and mapped in 1997-1998 by Adele Olivero of the New York Natural Heritage Program (1998). The community, system and subsystem classification is based on Reschke (1990).

SYSTEM	SUBSYSTEM	NATURAL COMMUNITY
Riverine	Natural Streams	Marsh headwater stream
Lacustrine	Natural Lakes and Ponds	Bog lake
		Eutrophic pond
Palustrine	Open Mineral Soil Wetlands	Deep emergent marsh
		Shallow emergent marsh
		Shrub swamp
		Sinkhole wetland
	Open Peatlands	Sedge meadow
		Rich sloping fen*
		Rich graminoid fen*
		Rich shrub fen*
		Inland poor fen
		Dwarf shrub bog*
		Highbush blueberry bog thicket
	Forested Mineral Soil Wetlands	Floodplain forest*
		Red maple-hardwood swamp*
		Vernal pool
		Hemlock hardwood swamp
	Forested Peatlands	Inland Atlantic white cedar swamp*
Terrestrial	Open Uplands	Cliff community
		Successional shrubland
	Barrens and Woodlands	Acidic talus slope woodland
		Pitch pine-oak-heath rocky summit*
		Successional red cedar woodland
	Forested uplands	Appalachian oak-hickory forest
		Chestnut oak forest
		Oak-tulip tree forest
		Appalachian oak-pine forest
		Beech-maple mesic forest
		Hemlock-northern hardwood forest
		Successional northern hardwoods

*Indicates significant occurrence