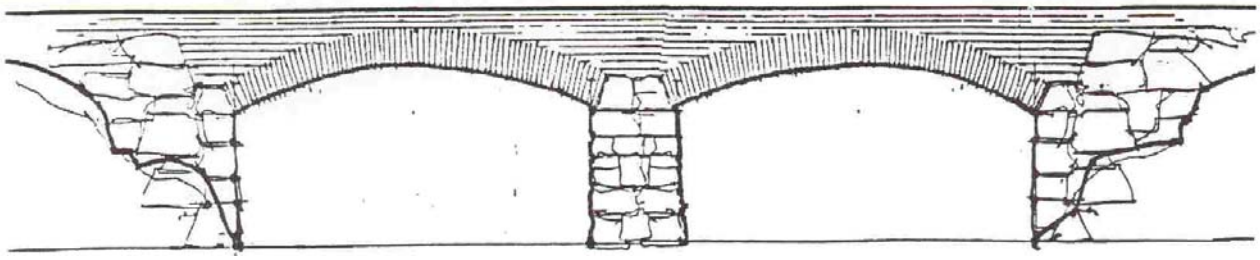

Quassaick Creek Estuary
Preserve and Trail Project

Biodiversity Survey and Natural Resources Inventory and Assessment Final Report

by
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1 October 2004
revised 7 December 2004

Acknowledgments

First and foremost I must thank Elizabeth McKean of the City of Newburgh Records Management for getting the project started, helping me find my way to the creek, bringing this final report to fruition, and for so much guidance and encouragement along the way. Betsy opened the records of the city for me and connected me to most of the other good people and organizations to which I express gratitude. To the New York State Department of Environmental Conservation (NYSDEC) for providing funding through a Hudson River Estuary Grant. To the City of Newburgh for being there, and for caring enough about the Quassaick Creek ecosystem to begin to preserve it. To members of the Quassaick Creek Coalition for all the groundwork and for additional guidance and information. To Daniel Muños and Jay Beaumont at Orange County Water Authority for GIS support and mapping assistance. The following people provided biological information or assisted me in the field. Karen Strong of the Region 3 office of NYSDEC provided expertise on damselflies and dragonflies, and searched with me for these insects along the creek corridor. Claudia Perretti of the Edgar J. Mearns Bird Club showed me places along the creek I might not have found on my own, and provided me with the Mearns Club bird records. Dr. Patrick DeLuca of Mount St. Mary College walked the trail route with me, recruited student volunteers to help with signs for a biodiversity walk, and told me fascinating things about history and architecture of the creek corridor. Daniel Miller (NYSDEC) related a wood turtle sighting and contributed a photograph of the turtle.

Special Thanks

The "artist's rough" artwork illustrating this report has been given to the Quassaick Creek Estuary Preserve and Trail project by the artist, Linda Thomas, through Don Watson of EarthRise. The scenic representation titled "The Gradient" represents the sensitive biological niche of the estuary, and the life it supports between fresh and salt water. We cannot thank Linda and Don enough for images that will promote the Quassaick project in innumerable ways!

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INTRODUCTION

In February of 2003 I began work on a yearlong biodiversity survey for the Quassaick Creek Coalition and the City of Newburgh. The Coalition and the City of Newburgh are interested in preserving, and possibly restoring and improving, the natural environment along the Quassaick Creek. A near-term goal is developing the lower portion of the Quassaick Creek corridor for public recreational use consistent with goals of natural resource preservation. This biodiversity survey and assessment provides baseline data and scientific guidance for management of the natural resources of Quassaick Creek, and for the development of portions of the creek corridor as a public preserve with nature trails. The first area planned for such development is the Quassaick Creek Estuary Preserve extending from the tidal mouth of the creek at the Hudson River upstream and generally west to Muchattoes Lake.

This report summarizes research and field survey work accomplished, and the results of that work, between March 1, 2003 and December 30, 2003.

As stated in the Scope of Work document (Appendix A of the consultant's contract), the work of information gathering consisted of two phases, a research phase to gather existing information on biological resources, and a field survey phase to gather information from direct observation during on-site surveys during the 2003 growing season. As stated in the Schedule of Tasks and Deliverables (Appendix B of the consultant's contract), the deliverables associated with these two phases of information gathering consist of two products or deliverables: A) an Interim Summary Report on the Research Phase, and B) an Interim (Mid-Season) Summary Report on Field Surveys. These two products were combined into one document delivered on 1 August 2003.

This draft final report consists of the following components: A) Research Phase, B) Field Survey Phase (through 2003), C) Areas of Quassaick Creek corridor and watershed surveyed, D) Significant species occurrences, E) Significant areas of biodiversity and large natural areas, F) Ecological Communities, G) Comments on environmental conditions and quality, G) Analysis

and assessment of preservation and restoration needs and potential, H) Analysis and assessment of potential for public access and use, I. Recommendations. In addition, appended to the end of the report are the following appendices: Appendix I. Plant Species List, Appendix II. Animal Species List, Appendix III. Maps.

This survey was funded by a NYSDEC Hudson River Estuary Grant.

A. Research Phase

Information sought biota and environment of similar or nearby Hudson River tributaries, rare species records in survey area and similar nearby habitats, past biological surveys and environmental studies. I derived this information from the following sources: New York Natural Heritage Program rare plants and rare animals databases, New York State Museum Hudson Highlands and State Parks floristic surveys**,** fish and aquatic biota surveys of Quassaick Creek (Schmidt 1985, 1986, 1987; Lake, T. 2002, Lake, T. and R.E. Schmidt, 1997, 1998). The following people supplied biological information, such as species records, locations of special habitats, historical information, recent or current conditions, and access to the Quassaick Creek Corridor: Betsy McKean, Karen Strong, Claudia Perretti, Patrick DeLuca, Dan Miller and Scott Cuppett. Perretti provided lists of bird species recorded by the J. Edgar Mearns Bird Club on Christmas bird counts from 1991-2002. Sector C of the geographic area of these bird counts includes the City of Newburgh and the Quassaick Creek Estuary Preserve. Dr. Gary Seymour of Hudson Valley Wildlife provided records of bird species he observed within the Quassaick Creek corridor. Dr. Michael W. Klemens did a herpetological assessment of Quassaick Creek (Klemens 1985), but did not perform on-site surveys. Historical records in the archives of the City of Newburgh provided information on past land use, history of ownership, and environmental impacts.

B. Field Survey Phase

I performed field surveys along approximately seven linear miles of the Quassaick Creek watershed from April to December 2003. My main biological focus was on plant species and plant communities. The overall number of species, and the ratio of native to non-native species, were used as indices of actual and potential biodiversity. Presence of rare species may indicate unusual environmental conditions, high environmental quality, or a low level of past and present disturbance. Plant communities and assemblages are strong indicators of soil conditions, microclimate, past and current land use, and general environmental quality. Presence of non-native species, especially those considered invasive, indicates disturbance. I considered all these factors in assessing environmental quality along the Quassaick Creek corridor.

I employed methods I used in floristic surveys of the Hudson Highlands from 1992 until the present. This methodology consists of walking and recording every vascular plant species observed and recognized, and collecting voucher specimens of uncommon species and species not recognized. These undetermined specimens were numbered, placed in a plant press, and later taken out for careful examination and determination through the use of taxonomic keys. Specimens that could not be determined in this way have been set aside for determination by expert botanists specializing in particular plant groups.

Plant lists were maintained according to date, location and habitat. The master plant

species list (Appendix 1) shows the number of vascular plant species known from the Quassaick Creek corridor as 293. Two of these species are considered rare in New York State (New York Natural Heritage Program 2003). Seventeen (17) plant species found in the Quassaick Creek corridor are regionally rare in my experience. These include woodland spring ephemerals such as cut-leaf toothwort, bloodroot, trout lily, and wild ginger; stream bank specialists such as wild yam lizard-tail, and water-willow; wet meadow plants such as squarrose sedge, common teasel, ditch stonecrop and lakeside sedge, and upland shrubs such as beaked hazel and downy arrowwood.

All animal species observed during the 2003 field surveys were noted as to date, time of day, location, habitat and activity at the time of observation. With one exception, no particular animal groups were emphasized or selected as the object of intensive surveys. The exception is Odonata, the insect order consisting of dragonflies and damselflies. Karen Strong (NYSDEC) and I surveyed selected portions of the Quassaick Creek corridor for dragonflies and damselflies in June and July 2003, and will be continuing these surveys through August and September. Odonates are important indicators of the quality of aquatic environments, and are relatively easy to observe and document. (See Appendix B: Animals List.)

C. Area Surveyed

An important goal of the field survey has been to identify areas of biological significance along the Quassaick Creek corridor, and to survey each of these areas at least three times during the growing season, roughly spring (May-June), summer (July-August) and fall (September-October). This schedule was designed to yield the most complete possible species database by capturing species at times of the year when a given species is most easily recognized, or when it bears those features (e.g. flowers, fruit) that most facilitate identification.

The following segmentation scheme for sections of the Quassaick Creek corridor is based upon watershed geography, and also upon the planning process developed by the Quassaick Creek Coalition. Each segment, in sequence upstream, is bounded by roads or streets. There are also landscape and ecological justifications for this scheme; each segment has its distinctive environmental own character. These segments are described below.

Segment 1: Lower Quassaick Creek, from Hudson River east to Mill Street.

This first segment corresponds to Phase 1 of the Quassaick Creek Estuary Preserve. In this report it is described and discussed in greater detail than other segments of the corridor. This is because it is the first portion of the corridor for which public use is anticipated. Segment 1 contains the tidal mouth of Quassaick Creek and a length of stream with both low and steep gradients. Except where dams block water flow, the stream in Segment 1 flows over stony bottoms, either gravel or bedrock. Much of the stream

margin is forested. The width of this vegetated corridor (on one side of the stream or the other) varies from a minimum of 25 feet on the north side of the creek just west of the South Water Street bridge, to a maximum of about 700 feet on the south side of the creek about 1000 feet south of the Mill Street bridge. The width of the entire vegetated corridor (the creek and both sides) varies from 190 feet at the Mill Street bridge to about 1200 feet 1000 feet south of the bridge.

Habitats

On both sides of the creek, there is a substantial (over 200 feet) forested corridor along most of the segment. Forest communities here include floodplain forest, rich mesophytic forest, upland oak forest and young forest, the last typically disturbed and with a high number of non-native species. The more mature forests (primarily on the north side of the creek just west of South Water Street) contain large individuals (50-90 cm diameter at breast height [dbh]) of many native tree species, including sycamore (*Platanus occidentalis*), eastern cottonwood (*Populus deltoides*), tuliptree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), bitternut hickory (*Carya cordiformis*), red mulberry (*Morus rubra*), black willow (*Salix nigra*), white oak (*Quercus alba*) and northern red oak (*Q. rubra*). This high-quality forest is a mosaic of rich mesophytic forest and floodplain forest. This distinction reflects hydrology (where flooding occurs), has little to do with species content, and may be ignored for purposes of description and ecological characterization. I call this forest “streamside mesophytic forest.”

Curiously, in contrast to the great age and high quality of the tree component in the creekside mesophytic forest, the shrub and herb layers contain many exotic plant species. The most abundant of these weedy species are Morrow honeysuckle (*Lonicera morrowii*), Oriental bittersweet (*Celastrus orbiculatus*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*) and mugwort (*Artemisia vulgaris*). There are, however, a number of native shrubs and herbs in this assemblage. Notable among these are skunk cabbage (*Symplocarpus foetidus*), wild ginger (*Asarum canadense*), cut-leaf toothwort (*Cardamine concantenata*), rattlesnake fern (*Botrychium virginianum*), zigzag goldenrod (*Solidago flexicaulis*) and Canada moonseed (*Menispermum canadense*). These species are typically found in rich, undisturbed forest environments. State-rare woodland agrimony (*Agrimonia rostellata*) also occurs in this forest

(see Rare Plants). Mature mesophytic forest is absent from the Quassaick corridor west of Walsh Road.

There is a forested slope, steep in places, north of the streamside lowland, extending from the edge of the tractor-trailer storage yard on the west side of South Water Street north to residences and other buildings and grounds along Bayview Terrace, Monument Street, Overlook Place and Bridge Street. I examined this area on 9 September 2003. This slope forest, though somewhat disturbed, included a significant number of large trees. The most common species were eastern cottonwood, black locust (*Robinia pseudo-acacia*), ash-leaf maple (*Acer negundo*), Norway maple (*Acer platanoides*) and tree-of-heaven (*Ailanthus altissima*). The last two tree species are non-native. There were also a fair number of large oaks and a few large tuliptrees and sycamores. White mulberry (*Morus alba*), winged spindle-bush (*Euonymus alatus*) and common buckthorn (*Rhamnus cathartica*) were common understory trees. Morrow honeysuckle (*Lonicera morrowii*), wineberry (*Rubus phoenicolasius*) and multiflora rose (*Rosa multiflora*) were common shrubs in the understory and in open thickets. Of the above, only white mulberry is native. The herbaceous flora also contained a high number of exotic species, including motherwort (*Leonurus cardiaca*), Asiatic dayflower (*Commelina communis*) and foxtail grass (*Setaria glauca*). Native herbs included jumpseed (*Polygonum virginianum*), orange touch-me-not (*Impatiens capensis*) and tall goldenrod (*Solidago gigantea*). Most of these herbs are good indicators of high ground moisture. Such moisture was not evident at the time I inspected the slope. Probably the moisture is seasonal, from groundwater seeps that flow primarily in spring.

North of the railroad were also a few depressions below the level of the rail bed, at the base of the slope. The largest of these basins had a pair of large cottonwood trees, each about 1 m dbh. There was no apparent evidence that water fills the basin to any significant depth for more than a day or so. Along the upper rim of the forested slope just behind the South Union Junior High School, I found a limestone rock outcrop with small hackberry trees (*Celtis occidentalis*). Hackberry is the larval host plant of three rare butterflies – hackberry emperor (*Asterocampa celtis*), tawny emperor (*A. clyton*) and snout butterfly (*Libytheana carinenta*). I did not observe any of these butterflies. I did not observe any of these butterflies during the survey, but they could occur here and in other places along Quassaick Creek.

The extent and quality of forest on the south side of the creek was significantly lower than on the north side. Between South Water Street and American Felt and Filter there was only a thin (20-40 ft.) forested margin. West of American Felt and Filter there was a wider margin of mostly

disturbed forest on mostly steep slopes, with only a small area of floodplain. The forest canopy consisted mostly of medium-sized (15-30 cm dbh), with an understory of small (5-15 cm dbh) trees and large shrubs. A mix of native and non-native species indicated recent disturbance. Notable, however, was the diversity of tree species, including sugar maple (*Acer saccharum*), ash-leaved maple, Norway maple, American elm (*Ulmus americana*), white ash, black walnut (*Juglans nigra*), northern red oak, tree-of-heaven (*Ailanthus altissima*) and heart-leaf linden (*Tilia cordata*). The herb community included species not observed north of the creek, including tall boneset (*Eupatorium altissimum*), Joe-Pye-weed (*E. fistulosum*), Siberian geranium (*Geranium sibericum*), and white vervain (*Verbena urticifolia*).

Infrastructure and Disturbance Features

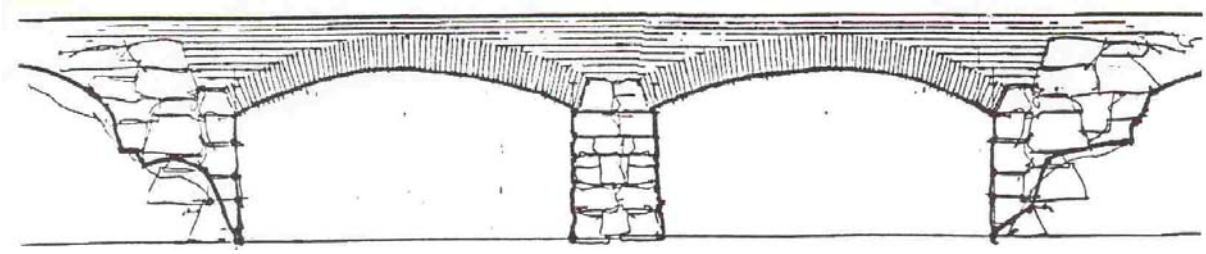
A spur of the Consolidated Rail Corporation railroad runs parallel to the creek on its north side along this segment. The rail bed, consisting of crushed stone, is well drained and usually dry east of Bridge Street. Just west of NYS Rt. 9W, spring seeps emanating from the slope north of the railroad form water-filled basins and intermittent east-tending flows along and across the railroad bed, terminating just east of the Rt. 9W overpass. There is one dam in Segment 1, 0.25 mi. east of Bridge Street, under 1 m in height. North of the rail bed and approximately due south of the Junior High School I found two concrete foundations with partial walls, apparently associated with the railroad in earlier times. On the slope behind the school were well-worn footpaths and a fair amount of trash.

American Felt and Filter on the south side of the creek, and Mid-Valley Petroleum on the north side, are currently operating industrial facilities near the east end of Segment 1. Immediately south of Wash Road and American Felt and Filter is a soil mine owned by Land Designs Excavating. Immediately north of Mid-Valley Petroleum is an industrial yard used as storage of old tractor-trailer bodies. Aside from simply occupying space, neither operation appears currently to be having a significant effect on adjacent terrestrial habitats. Northwest of the A. F. and F. factory were paved and unpaved roads that appeared to be no longer in use. West of these roads much of the forest consisted of small trees, including a lot of tree-of-heaven, an exotic invasive species. The ground here appeared to be largely industrial fill. The subsidence of this fill has created deep pits, some concealed under dead leaves, woody debris or lighter discarded materials (lumber scraps, containers, etc.). I found similar conditions south of the creek east of Wash Road (see Section 2).

Since mine was a purely biological survey with no documentation of stream chemistry, including industrial discharges, I cannot provide an assessment of the effects of these industries on the biota of the creek itself. Past research has identified sources of industrial contaminants along Quassaick Creek (Schmidt and Kiviat, 1986; Schmidt, 1987).

The bridge over Quassaick Creek at Bridge Street (“Mill Street” on some older maps) is a fine example of architecture and construction no longer in common use. This was pointed out to me by Patrick DeLuca (Professor of Biology and Medical Technology, Mount Saint Mary College) while walking Section 1 in preparation for a special tour of the proposed trail. In September 2003 I discovered a unique construction under the bridge on the south side of the creek. This appeared to be an old workshop built into the bridge. It had a garage door facing west. Inside were a bench, old barrels and an old gas-powered lawnmower with a push-mower design. Beneath the arch of the bridge away from the stream was a large grid-like metal structure with a fuse box, and a wood-and-wire-mesh box on legs similar to a chicken coop.East of the

bridge were a couple of old concrete foundations. I was puzzled by this set of structures, particularly since I could see no way for a vehicle to get to the garage door, nor any sign of a former lawn. The wooden chicken coop-like structures and associated machinery are especially baffling.



Another picturesque and historically significant feature of Segment 1 is the Twin Arches Foot Bridge, with its unusual brick construction, which crosses the creek at a diagonal angle just west of the pump station dam. I am curious about the history of this bridge, when it was regularly used, and which roads or streets connected to it, whether it was used only for walking or also for carriages. At the time I wrote this report, restoration of the Twin Arches Bridge was under way. As a biological note, it was on a gravel bar near this bridge that Dan Miller (NYSDEC) observed an adult wood turtle (*Clemmys insculpta*) on 8 June 2003.

Segment 2: Lower Quassaick Creek, Bridge Street to Walsh Avenue.

The width of the vegetated corridor in Section 2 varies from a minimum of 60 feet at Bridge Street to a maximum of 700 feet west of John Street Pond (see below). New York State Rt. 9W crosses the creek about 0.1 mi. west of Bridge Street, and Walsh Avenue crosses about 0.4 mi. east of Rt. 9W. Quassaick Creek is fairly steep and fast along this segment, except where dams impede its flow. There are two dams in Segment 2, the first about half way between Bridge Street and Rt. 9W, and the second about 0.15 mi. west of 9W. The first dam is under 1 m in height, the second dam is nearly 3 m high. Behind the dam is a deep pond, called John Street Pond in this report, for the street immediately south of the pond and flood plain area. These dams are described in detail in Allen & Cook (2002).

As in Segment 1, the railroad runs parallel to the creek on its north side, and crosses the creek just west of the Walsh Road crossing (in Section 3). There is a significant groundwater input from the south-facing slope bordering the railroad just west of Rt. 9W. This groundwater surfaces at the base of the slope, and flows along the north side of the tracks immediately north

of the John Street Pond. Karen Strong and I observed green frogs (*Rana clamitans*) and three species of damselfly (eastern red damsel, powdered damsel and fragile forktail) at this site on 30 June 2002 (see Appendix I: plant list and Appendix II: animal list).

Habitats

The land along the creek corridor in this segment was mostly forested. The floodplain forest west of the John Street pond and north of the creek had relatively few non-native plants, indicating a lack of disturbance over a significant length of time, perhaps 30 years or more. Another sign of this lack of disturbance was the presence in this forest of red maple (*Acer rubrum*) and black oak (*Quercus velutina*) trees over 40 cm dbh, and a few in the 50-60 cm range.

The widest forested margin south of the creek was northeast of Plympton House, on a steep slope. The tree canopy here had large openings, and many large trees were festooned with grape vines. Large grape vines tend to cut off light to tree leaves, and can sometimes weigh trees down so much as to cause them to collapse. I found a small floodplain pool in this forest, covered with duckweed (*Lemna minor*) at the time of my observation (6 October 2003). The forest around the pool consisted mostly of cottonwood and black locust. This pool may have value for wildlife in the area, especially reptiles and amphibians.

Infrastructure and Disturbance Features

Structures included the Walsh Avenue Bridge over Quassaick Creek, and the railroad overpass of Walsh Avenue and the creek. Built land on the south side of Quassaick Creek east of Walsh Avenue appeared to be composed of construction debris from old industries. Soil, fallen leaves and vegetation concealed deep holes and unstable surfaces over hard or sharp fragments of concrete, old wood, metal and other industrial materials. This area will remain unsafe for visitors and unsuitable for public access until the hazardous ground conditions are corrected. The largely artificial substrate here supported a young forest of Norway maple, box elder, cottonwood and sycamore.

Segment 3: Little Falls Watershed

This is a largely undeveloped portion of the Quassaick Creek watershed draining into Segment 3 from the south, connecting to the main corridor just west of Walsh Road. This area contains a large pond (here called Little Falls Pond) and a fairly large wetland below the pond's dam. Drainage empties directly into Quassaick Creek via a short sequence of seepage wetlands and intermittent streams. Little Falls Pond is within 50 feet of Little Falls Park, a City recreation area. On 2 July 2003, Claudia Perretti and I observed an adult wood turtle basking on a log in the outlet stream north of Little Falls Pond. There is a fairly large marsh along the margin of this stream, a rich area for birds and other wildlife.

Snake Hill Area

Looming above and to the east of Snake Hill Pond is Snake Hill (elev. 714 ft.), a largely undeveloped and mostly forested rock ridge. I investigated Snake Hill on 2 July 2003. Forests were mostly oak-dominant, with different associate species at different elevations and in different moisture regimes. Tulip tree, sugar maple and sassafras (*Sassafras albidum*) were common associates in mesic oak forest on lower slopes, while upper slopes had hickories and black cherry were co-dominant with oaks on the summit and upper slopes. The east slope had areas of cliff and talus, with calcium-loving plants such as hackberry, downy arrowwood (*Viburnum rafinesquianum*) and bladdernut (*Staphylea trifolia*). On one talus slope I found a stand of black cohosh (*Cimicifuga racemosa*), a regionally rare herb standing as tall as 6 feet, with spires of small white flowers in early summer. On 3 plants I found a total of 9 caterpillars (6 on one plant) of state-rare Appalachian azure (*Celastrina neglectamajor*), the largest of the group of gossamer-wing butterflies called "blues."

Waters draining the northwest slope of Snake Hill form a small stream dammed in two places to form two ponds, the uppermost here called "Snake Hill Pond" and the lowermost known as Crystal Lake. Crystal Lake appears to have been used in the past for recreation or possibly as a reservoir. From the northern and larger pond, this water apparently enters Quassaick Creek via groundwater flow and an intermittent stream. The overland hydrological connection is tenuous at best.

Segment 4: Walsh Avenue to Lake Street

This segment had a higher level of development, and a more constricted natural corridor, than Segments 1 and 2. Though it contained a number of dammed ponds and patches of undeveloped, forested land, these areas were more difficult to access than similar areas of Segment 1. The largest undeveloped patch surrounded Harrison Pond west of Little Britain Road (NYS Rt. 207) and east of Brook View Lane. I accessed the Harrison Pond area from the driveway to Herr's Foods just east of the pond. Wild habitat around Harrison Pond was disturbed but not seriously degraded. Cottonwood, black willow, black locust, catalpa (*Catalpa speciosa*) and common buckthorn grew around the edge of the pond. South and northwest of Harrison Pond there were oak-dominant woods with a few trees in the 40-60 cm dbh range, and few herbs in the understory. Exotic trees and shrubs such as Ailanthus, common buckthorn, Morrow honeysuckle and multiflora rose were common here. The upland forest area south of the pond had small limestone ledges and boulders. One ledge offered a view west with the Quassaick Creek the dominant feature. The creek here was split into two channels around a large boulder, a pleasing, picturesque view.

Just east of Harrison Pond, the dam of a smaller pond is visible from Little Britain Road. Just east of this dam the creek crosses beneath Little Britain Road and then beneath an old industrial building that once housed the Stroock "bleachery." The built channels beneath this building and others nearby represents an unusual engineering solution to accommodate the flow of the stream. The segment ends at Lake Street, where for about 120 feet a concrete slab covers the creek.

The corridor east of Walsh Road south of the creek had a steep slope ascending about 6-8 feet above the mean water level of the creek to a terrace (40-60 feet wide) composed

largely of industrial fill. South of the terrace was a steep slope about 20-25 feet high behind formerly used and currently operating industrial properties. Vegetation along the streamside slope consisted of a few large trees, but mostly medium and small trees, shrubs and sparse herbs, all common species. The terrace had small individuals of non-native species such as Norway Maple, tree-of-heaven, common buckthorn and Morrow honeysuckle.

Segment 5: Muchattoes Lake to NYS Rt. 17K.

Muchattoes Lake is entirely surrounded by development – a small shopping center on the east side, and a housing complex on the west side. The east side of Muchattoes Lake behind the commercial zone of Lake Street was buffered to some degree by a zone of shore vegetation. This vegetated margin included small trees, dense shrubs and herbs, the last mostly along the water's edge and between the vegetated shore and bare ground or pavement at the rear of the shopping area. Trees included eastern cottonwood, white willow (*Salix alba*), catalpa (*Catalpa speciosa*), tree-of-heaven and silver maple (*Acer saccharinum*). Shrubs included wineberry, common buckthorn, silky dogwood (*Cornus amomum*), cranberry-bush (*Viburnum opulus*) and black cherry (*Prunus serotina*). Herbs along the shore included purple loosestrife (*Lythrum salicaria*), clearweed (*Pilea pumila*), arrow-arum (*Peltandra virginica*), water-purslane (*Ludwigia palustris*) and frog's-hair (*Eleocharis acicularis*). Herbs along the shopping area margin included moth mullein (*Verbascum blattaria*), mugwort (*Artemisia vulgaris*) and common evening primrose (*Oenothera biennis*). Aquatic vegetation in the lake consisted chiefly of duckweed and European water chestnut (*Trapa natans*), an invasive exotic plant and a pest in the Hudson River and other waters of the region.

The dam at the southeast corner of Muchattoes Lake is semicircular, with overflow through a culvert under Lake Street (see Section 3). North of the dam was a 50 x 150 ft. patch of wooded habitat with trampled ground and a number of trash items, including an old mattress.

Northwest and upstream from Muchattoes Lake there is only a very thin margin of vegetated stream corridor, most of it severely disturbed. On 30 June 2003, Karen Strong and I observed a number of dragonflies and damselflies in an open, weedy area between the creek and the parking lot of Bambino's restaurant on the south side of Rt. 17 K. This is approximately the northwest terminus of this segment.

Segment 6: NYS Rt. 17K N to Interstate Rt. 84.

This segment contains substantial areas of floodplain swamp, floodplain forest and freshwater marsh, along with smaller areas of swamp and upland forest. The most significant aquatic feature is Brookside Pond and the surrounding marsh and shrub swamp. I performed an early summer reconnaissance and plant species inventory of the terrestrial habitats in this segment. I have investigated only the periphery of the pond and marsh. The marsh is a significant habitat for waterfowl and migrating songbirds (Claudia Perretti, personal communication).

The floodplain forest north of Rt. 17K and west of Quassaick Creek is perhaps the largest area of relatively undisturbed floodplain in the corridor. Areas bordering industrial properties along Rt. 17K contain many exotic plant species, but farther from these sites, non-native species decline and native species increase. Access to this area is difficult, and there are few signs of human presence in the interior. It is worth noting the irony of a wild area being cut off, and in fact protected from some sources of degradation, by industrial development.

Most of the forest north of Rt. 17K and east of Quassaick Creek is in an earlier stage of succession, with few trees over 25 cm diameter-at-breast-height (dbh). An exception is an area of upland forest behind residences west of DuPont Avenue, a mature oak forest with trees in the 40-60 dbh range. This area contained a number of trails made by all-terrain-vehicles (ATVs), entering the forest from the back yards of houses along its east boundary.

Segment 7: I 84 N to Powder Mill Road.

This segment contains several dammed water bodies, confluences of branches of Quassaick Creek, and vegetated stream margins interspersed with areas of residential and recreational development. About 0.2 mi north of I 84 the Quassaick Creek is dammed to form Winona Lake, a large, deep pond surrounded by low-density residential development. Between DuPont Avenue (NYS Rt. 52) and the east side of the creek is a forested corridor (not yet surveyed at the time of this report) running north to Algonquin Park.

Algonquin Park is lightly developed, with picnic facilities and walking paths. It contains the remains of buildings, foundations of a mill, and ponds with intact stone and concrete dams. The northwest corner of the park is undeveloped and forested. A tributary enters Quassaick Creek from the west through this forest. The main stem of the creek flows from north to south through the park. At the south end of the park there are floodplain wetlands along both sides of the creek. These floodplain areas are semi-open marshes with scattered shrubs.

Segment 8: North of Algonquin Park and Powder Mill Road.

I have not yet investigated this area. A map in Schmidt (1987) shows a “grassland” area bordering the creek northeast of Powder Mill Road (NYS Rt. 52). This may be a significant habitat worthy of protection.

D. Significant Areas of Biodiversity or Large Natural Areas

The following areas of Quassaick Creek Corridor, which I have examined thoroughly and carefully, are in my view important as actual or potential reservoirs of biodiversity, or resources for resident and itinerant wildlife:

Lower Quassaick Creek (Segment 1)

Values of this habitat include mature mesophytic forest with large trees, slopes with spring seeps, native spring-blooming herbs and two state-rare species – woodland agrimony and wood turtle. The forest canopy could support regionally-rare species such as breeding cerulean

warbler (*Dendroica cerulea*) and tuliptree silk moth (*Callosamia angulifera*). Quassaick Creek below the first dam upstream provides breeding habitat for anadromous fishes, and the tidal mouth of the creek may be an important refuge for young fish of species inhabiting the Hudson River.

John Street Pond and Floodplain (Segment 2)

The pond is potential breeding habitat for some amphibians such as red-spotted newt, green frog, pickerel frog and bullfrog. Wood turtles may use this pond for hibernation, summer foraging, courtship and mating, and drought refuge. The floodplain forest provides upland habitat for amphibians and reptiles, and a vegetated buffer between the pond and developed areas. Tall trees provide potential habitat for canopy-breeding birds, but the area is probably not large enough to support forest interior bird species. The forest here is potential habitat for some state-rare plants, including narrow-leaf sedge and woodland agrimony, found elsewhere in the Quassaick Creek corridor in forested habitat.

Little Falls Watershed

The main general value of the Little Falls area is the continuity of undeveloped habitat and direct connection to the Quassaick Creek corridor. Wood turtle occurs in this area, and probably so do other turtles (e.g. common snapping turtle, eastern painted turtle, perhaps spotted turtle), due to the variety of aquatic and upland habitats (ponds for hibernating and aquatic foraging, marshes for foraging and refuge, second-growth forest for upland foraging and movement, and areas of disturbed soil for nesting). Small patches of emergent marsh are good resources for wetland birds such as rails and bitterns; though these patches may not be large enough for breeding, they do provide foraging space for these and other marsh birds.

Snake Hill

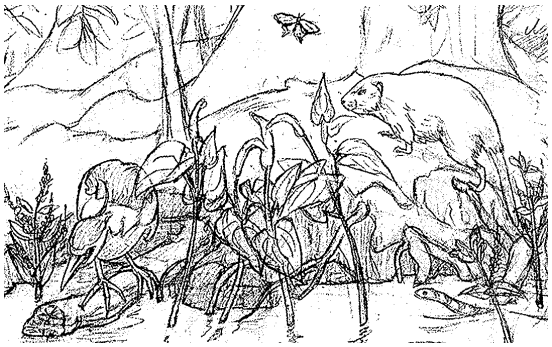
The largest and highest upland area with a hydrologic connection to the Quassaick Creek corridor, Snake Hill is important ecologically as a complex of upland habitats distinct from lower, moister habitats along the Quassaick Creek corridor. The northwest slope of Snake Hill contributes to a small watershed similar to the Little Falls watershed. Unfortunately, a developed area forms a potential barrier to animal dispersal between the northwest Snake Hill watershed and the Quassaick Creek corridor. Despite this discontinuity, some animals may move between the Snake Hill watershed and Quassaick Creek.

Harrison Pond

Harrison Pond and its surroundings form an isolated oasis of undeveloped habitat surrounded by commercial and industrial development. The habitat quality is not especially high, but it is not without value to wildlife. This relatively small area contains features not found elsewhere along Quassaick Creek: forested limestone outcrops and upland oak forest. These habitats were somewhat disturbed, but in fairly good condition, when I visited the area in December 2003. Harrison Pond has potential to support common fish, amphibian and reptile species, and many aquatic invertebrate species. Nearby developed areas do not come within less than 30 feet of the shore of the pond, and only on the west side.

Brookside Pond

A large area of emergent marsh, floodplain forest and upland forest surrounds Brookside Pond, north of NYS Rt. 17 K and south of Interstate Rt. 84. A contiguous assemblage of strikingly different but well-connected habitats and plant communities, the Brookside Pond area is potentially a very significant resource for many species of plants and animals. There is some disturbance and degradation, and developed areas along the edge of the wild area, but the impacts of these conditions appeared to be minor. Road overpasses break continuity between adjacent terrestrial habitats along the Quassaick Creek corridor, but the stream itself provides a continuous water corridor. Some animals may use the stream to pass from one wild area to another.



Algonquin Park

This neighborhood park encompassing a section of Quassaick Creek includes small two dammed ponds, patches of forest and streamside wetlands interspersed with mowed lawns, paths, sports fields and other light recreational facilities. The Algonquin Park area may be important as a semi-wild refuge for wildlife in a suburban residential area.

E. Biological Resources

Rare Plants

Historic Records

The New York Natural Heritage Program (NYNHP) rare plants database contained no records from Quassaick Creek as of July 2003. The only rare plant record in the NYNHP database from the Town and City of Newburgh is Bradley's spleenwort (*Asplenium bradleyi*) from 1864, a species now ranked extirpated in New York State. The Heritage database contains records of rare plants from nearby Hudson River tributaries, including Moodna Creek (2.4 mi. south of Quassaick Creek). The most recent record is a 1990 occurrence of spongy arrowhead (*Sagittaria montevidensis* var. *spongiosa*) from Moodna Creek mouth, Town of New Windsor (confirmed by Barbour and Mitchell in 2002). Also from the tidal Moodna Creek are historical (before 1980) records of northern estuary beggar-ticks (*Bidens hyperborea* var. *hyperborea*), estuary hatpins (*Eriocaulon parkeri*), river quillwort (*Isoetes riparia*) and American waterwort (*Elatine americana*).

New York State Museum records of state-rare plants in the vicinity of Newburgh include Long's bittercress from tidal Moodna Creek, and yerba-da-tago (*Eclipta prostrata*) and winged monkeyflower (*Mimulus alatus*) from upper (non-tidal) Moodna Creek. There is also a State Museum record of riverweed (*Podostemum ceratophyllum*) from Popolopen Brook (10 mi. south of Quassaick Creek.).

Quassaick Creek Biodiversity Survey Records (2003)

Surprisingly in such a highly urbanized area, I found two state-rare plant species in the Phase 1 segment of Quassaick Creek corridor north of the Creek and west of South Water Street. On 9 September 2003 I found three plants of woodland agrimony (*Agrimonia rostellata*) (S2) within a meter of the proposed walking trail route. A sedge I collected on 28 June 2003 in young forest west of NYS Rt. 17 K was later identified as narrow-leaved sedge (*Carex amphibola*) by David Werier (Cornell University, Ithaca NY).

Woodland agrimony (*Agrimonia rostellata*)

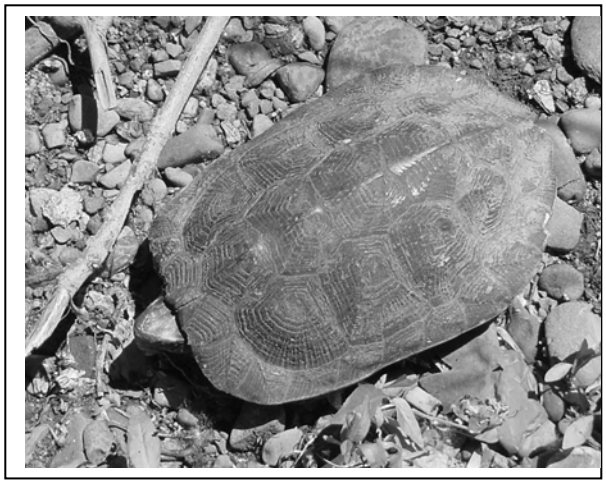
Most locations for this rare herb, the smallest of New York's 5 agrimony species, are on sparsely wooded, calcareous slopes. The Quassaick Creek occurrence, in damp ground fed by a spring seep, is only the second occurrence I have found in this kind of habitat. The other such occurrence was along a spring seep at the edge of a swamp in Putnam County.

Narrow-leaved sedge (*Carex amphibola*) S1

Narrow-leaf sedge is found in moist woodlands of valleys, flats and moderate lower slopes of hills and ridges. It is historically known from 18 counties in New York, but appears to have declined, as it is presently known to occur only in four New York Counties. I found narrow-leaf sedge in a patch of young floodplain forest on the west side of Quassaick Creek just north of NYS Rt. 17 K.

Rare Animals

Wood turtle (*Clemmys insculpta*) S3



There were no records of state-rare animal species in the NYNHP database, but wood turtle (*Clemmys insculpta*),a species designated Special Concern by NYSDEC, was observed at least twice in or near Quassaick Creek during the 2003 growing season. Dan Miller (NYSDEC) observed an adult female wood turtle about 20 yards downstream of the double-arch brick bridge on the north bank of the creek on 8 June 2003. Claudia Perretti and I observed an adult wood turtle in an open marsh south of Little Falls Pond in August 2003. This is a very interesting and important occurrence of a species listed as Special Concern by the NYSDEC Office of Endangered Species. I know of no other occurrence of wood turtle in an urban stream corridor in New York State.

Immediately south of Wash Road and American Felt and Filter is a soil mine owned by Land Designs Excavating. Open, unvegetated areas with loose soil are potential nesting sites for turtles, including wood turtle. To reach the mine site from the creek, turtles would have to cross Walsh Road. There is a risk of injury or death to any turtles that may be using this site for nesting.

Appalachian Blue (*Celastrina neglectamajor*) S2

This pale blue butterfly of the Lycaenidae family (gossamer wings) flies in May and early June on rich wooded slopes and woodland clearings with its larval host plant, black cohosh (*Cimicifuga racemosa*). Caterpillars reach full growth in late June or early July, and may be seen at that time feeding on the flowering spires and sometimes on the leaves of the plants. Their depredations on the buds and flowers are conspicuous as brown shreds mixed with droppings, often suspended in silk webbing. In some places the caterpillars are guarded by ants, which feed on sweet secretions exuded by the caterpillars. I have found Appalachian blue in Ulster, Orange, Dutchess and Putnam Counties. The species is moderately rare, but seems to be found in most places where the host plant grows. I found it only on the east slope of Snake Hill, but it may occur more widely in the Quassaick Creek watershed, depending upon the frequency and distribution of black cohosh.

Fauna

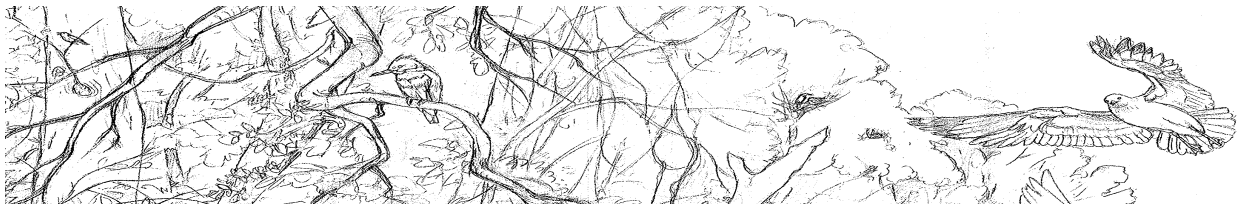
Fish

The fish community of Quassaick Creek has been documented fairly thoroughly, particularly by Tom Lake (NYSDEC) and Robert E. Schmidt (Hudsonia, Ltd., Simon's Rock College) (Schmidt 1985; Lake & Schmidt, 1997; 1998). A total of 44 fish species have been recorded from Quassaick Creek (Lake 19xx; Schmidt 1985; Lake & Schmidt,1997; 1998). Karen Strong and I observed only very small fish (not identified) in low numbers in lower Quassaick Creek. Schmidt (1985) found fish colonization of the lower creek to be primarily from upstream.

Birds

The J. Edgar Mearns Bird Club has performed Christmas bird counts for the National Audubon Society along the Quassaick Creek for the past 12 years. Claudia Perretti kindly provided the records from these bird counts for this inventory. Because the counts were performed in December they do not include records of summer resident birds or breeding birds. Over the 11-year period from 1991 to 2002 the Mearns survey recorded a total of 115 species in Block C, which includes the City of Newburgh and most of the Quassaick Creek watershed. Block C had the highest number of bird species in all years except 2001 and 2002. The highest number for any single year was 60 in 1998. The results of these surveys do not permit an assessment of bird species diversity in the Quassaick Creek corridor, since the area of the count extends outside the corridor.

Dr. Gary Seymour, Wildlife Zoologist for Hudson Valley Wildlife of Newburgh, provided a list of 23 species of birds seen along the lower creek (corresponding to Segment 1 of this report). Seymour walked the trail 36 times in all seasons over a three-year period (Seymour 2003). Linda Thomas reported black-crowned night heron nesting near the creek mouth in May 2003 (L. Thomas, personal communication). Though I did not perform a breeding bird survey in 2003, I made observations of bird species while performing the natural resources inventory. One difficulty inherent to any bird surveys close to Quassaick Creek is the loudness of the rushing water. The sound of the creek made hearing bird songs very difficult. My impression was that I was not able to hear any but the loudest and nearest birds. Species with soft, high-pitched raspy songs, such as many warblers and wrens, would no doubt be lost in the din of the water noise. The breeding status of a number of bird species that could nest in the tall forest canopy of Lower Quassaick Creek may be nearly impossible to determine using standard survey methods. An example is cerulean warbler (*Dendroica cerulea*), which is rarely seen, but frequently heard, and often documented by song alone.



Reptiles and Amphibians

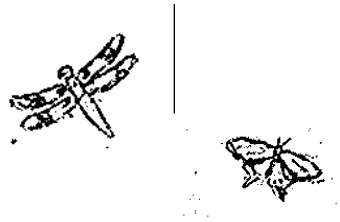
Wood turtle has been discussed in "Rare Animals." Few other reptiles and amphibians were observed in the course of the survey. Karen Strong and I observed a northern water snake basking on a rock wall of a pond in Algonquin Park. Claudia Perretti and I saw several painted turtles basking on logs in Little Falls Pond. I observed a common snapping turtle on a road in the vicinity of Brookside Pond. I saw or heard green frogs in or near most of the ponds I visited, and found several pickerel frogs along the creek and in the floodplain swamp near Brookside Pond.

Mammals

I observed few mammals in the Quassaick Creek corridor, and only common species. These included gray squirrel along the railroad and in upland forest habitat in Section 1 north of the railroad, on the west slope of Snake Hill, near Harrison Pond, east of Brookside Pond and in Algonquin Park; eastern cottontail along the railroad west of NYS Rt. 9W, and a white-tailed deer in the floodplain swamp north of NYS Rt. 17K.

Invertebrates

Karen Strong (NYSDEC) and I made observations of damselflies and dragonflies in the following portions of the Quassaick Creek corridor: Segment 1, Segment 2 near John Street Pond and Walsh Road Pond, Segment 5 south of NYS Rt. 17K, Segment 6 north of Brookside Farm Road, and Segment 7 in Algonquin Park. I made observations of dragonflies and damselflies at Little Falls Pond, Snake Hill Pond and Brookside Pond.



During the course of my survey I made observations of other insects, including butterflies and moths, and observations of other invertebrates. Karen Strong and I briefly sampled macro invertebrates in the Walsh Street Pond and found few individuals of few groups: crayfish, a hellgrammite (immature dobsonfly), caddisfly larvae and physid snails.

F. Ecological Communities

Different physical conditions of the landscape (e.g. soil depth, texture, chemistry and moisture; elevation and topography; natural and human-caused disturbance) tend to favor particular species of plants over others. Consequently, landscapes with similar characteristics tend to support the same plant species so that we find certain species assemblages in certain kinds of landscape conditions. Areas with similar conditions exist as large or small patches across the larger landscape. Ecologists call these patches plant communities (or ecological communities if characteristic animal species are included).

The New York Natural Heritage Program recognizes over 200 kinds of ecological communities in New York State (Reschke 1990). Recording, locating and mapping ecological communities has become standard practice in biological inventories and assessments. For the Quassaick Creek corridor I identified 16 communities. In this account I characterize each

community type and describe the character and landscape position of each community. I did not attempt for this survey the highly technical and often laborious process of mapping communities.

Subtidal Aquatic Beds

The mouth of Quassaick Creek contains subtidal aquatic vegetation typical of Hudson River estuarine shallows. The flora consisted mostly of water celery (*Valisneria americana*), Eurasian water milfoil (*Myriophyllum spicatum*), and curly pondweed (*Potamogeton crispus*). European water chestnut (*Trapa natans*), though present, appeared to consist of loose fragments rather than rooted plants, probably transported from other locations in the river.

Rocky Intertidal Shore

This is the zone in which tide waters intermittently cover rock substrates along the shore. Substrates may be natural (bedrock, boulders or smaller rock fragments) or artificial (rip-rap, imported stone or gravel). Rocky intertidal shore along lower Quassaick Creek consisted mostly of artificial substrate (rip-rap, stone-and mortar, and concrete walls), and was either unvegetated or had a few plants of common species.

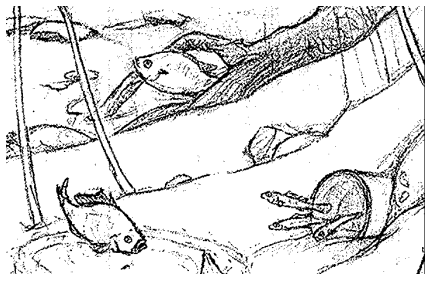
Permanent Stream

Quassaick Creek may be the only truly permanent stream in the study area. Tributaries I examined appeared to be at least partially intermittent, as in streams connecting dammed ponds or streamside wetlands. Though Quassaick Creek has several dammed ponds along its course, the stream is large enough to remain flowing throughout its course (below headwaters) under all but perhaps the most severe drought conditions.

Intermittent Stream

Probably most of the tributary streams I examined are intermittent, their water flow interrupted by drought conditions. Because water flow may be greatly reduced downstream from dams, sections of streams immediately below dams tend to dry up in summer and fall. Cases in point are the northwest Snake Hill drainage and the Little Falls drainage. Both include dammed ponds.

Artificial Pond



Ponds created by excavating a basin or damming a stream may be equal to natural ponds in value to wildlife and plant life, especially as they age and come more to resemble natural ponds. The ponds along Quassaick Creek and its tributaries are all artificial, dammed ponds with flow-through, at least during periods of high water.

Vegetated wetlands with deeper waters (generally 1-4 ft.) tend to have submerged aquatic plants and floating leaved plants such as water lilies and pondweeds. There may also be rushes and broad-leaved plants such as arrowheads, arrow-arum and pickerelweed with leaves protruding above the water surface. Usually in a deep emergent marsh, vegetation is not dense, and there is a lot of open water or a mix of submerged, floating-leaved and taller plants. In many wetlands deep emergent marsh grades into or forms a patchwork with shallow emergent marsh, shrub swamp or swamp forest. This is the case with the Brookside Pond wetland complex.

Shallow Emergent Marsh

In shallow water (generally a few inches to a foot) plants tend to grow more densely, and to form stands of one or just a few species. Examples are cattail marsh, bulrush marsh, reed (Phragmites) marsh and purple loosestrife marsh. The largest area of shallow emergent marsh in the study area lies to the west of Brookside Pond (Segment 5), where the vegetation is mostly cattail and common reed (Phragmites australis). The Little Falls area (Segment 3) also contains patches of shallow emergent marsh. This is the primary habitat for many marsh birds such as bitterns and rails, and many specialized songbirds such as marsh wren, redwing blackbird and vesper sparrow.

Groundwater Seep

Lower Quassaick Creek (Segments 1 & 2) has an abundance of groundwater seeps emanating from slopes of the creek valley. Most of the seeps here are on the north side of the stream, where the slope is higher. These groundwater seeps run nearly year-round, perhaps continuously in some years. Seeps may contribute significant amounts of water to lower Quassaick Creek. Where water from seeps is blocked by the railroad berm, there were pools and flowing channels with aquatic life forms, including immature forms of insects and amphibians. Thus the seep pools and streams are significant reservoirs of biodiversity. Seeps also supply water to patches of floodplain swamp on level land between the creek and the railroad.

Floodplain Swamp

The largest area of floodplain swamp (streamside forest with perennially saturated ground) lies along both sides of Quassaick Creek north of NYS Rt. 17K. A modest-sized area (an acre or less) of floodplain swamp lies west of John Street Pond. Small patches of swamp are interspersed with floodplain forest along Segment 1.

Floodplain Forest

Floodplain forest is distinguished from floodplain swamp by drier soils and less frequent flooding or saturation. Floodplain forest soils are inundated or saturated only intermittently at times of very high water in the stream or copious groundwater output from seeps on streamside slopes. Floodplain forest soils are often built upon old stream deposits of gravel and sand which become less prone to flooding as the stream cuts deeper into the landscape. Water drains fairly rapidly from these porous substrates. Throughout the Quassaick Creek corridor floodplain forest is interspersed with rich mesophytic forest and floodplain swamp.

Rich Mesophytic Forest

These are mature forests, typically with large trees, found on deep, moderately well-drained soils of slopes and terraces above the level of the flood plain. Rich mesophytic forest is interspersed with floodplain forest and floodplain swamp along lower Quassaick Creek. Upstream this community type is rare. There are patches of it east of the creek floodplain north of NYS Rt. 17K (Segment 6) and in the western half of Algonquin Park.

Upland Oak Forest

This dry forest of ridges, high slopes and elevated glacial deposits is dominated by any of several common species of oak (e.g. northern red oak, chestnut oak, black oak, white oak). Because of the general wetness and low relief of the landscape it is rare in the Quassaick Creek Corridor. I found a hill with upland oak forest southwest of Harrison Pond, and small patches east of the floodplain north of NYS Rt. 17K. Upland oak forest is a common community on the upper slopes and summit ridge of Snake Hill.

Limestone Ledge

The only limestone ledge I found along Quassaick Creek was on the northwest corner of the oak forest hill southwest of Harrison Pond. Limestone ledges often support rich herb assemblages, including rare and uncommon species. I found only common ledge plants at the Harrison Pond limestone outcrop, but some of these (e.g. wild columbine, common polypody, maidenhair spleenwort) I found nowhere else along the stream corridor.

Disturbed Communities

Frequent in the Quassaick Creek corridor are plant communities developed after disturbance (e.g. abandoned industrial sites) or on periodically disturbed ground (e.g. railroad right-of-way). These habitats were in various stages of vegetational development ("succession") after disturbance, and varied considerably in vegetation structure and species composition. The two disturbance communities described below, disturbed weedy ground and young forest, in many locations were more or less interspersed or blended.

Disturbed Weedy Ground

Recently or frequently disturbed areas tend to have few or very young and small trees and shrubs. Vegetation typically consists of herbs, mostly weedy non-native herbaceous species such as common ragweed (*Ambrosia artemisifolia*), path smartweed (*Polygonum cespitosum*), white sweet clover (*Melilotus alba*) and many other pioneering species. Frequently disturbed corridors such as railroads and service roads tend to have plants which tolerate an ongoing regime of disturbance. Examples of such plants are non-native Japanese knotweed (*Polygonum cuspidatum*), mugwort (*Artemisia vulgaris*) and Siberian geranium (*Geranium sibericum*), and native Canada goldenrod (*Solidago canadensis*) and jewelweed (*Impatiens capensis*), all found

along the service road to the sewage treatment plant on the north side of Lower Quassaick Creek.

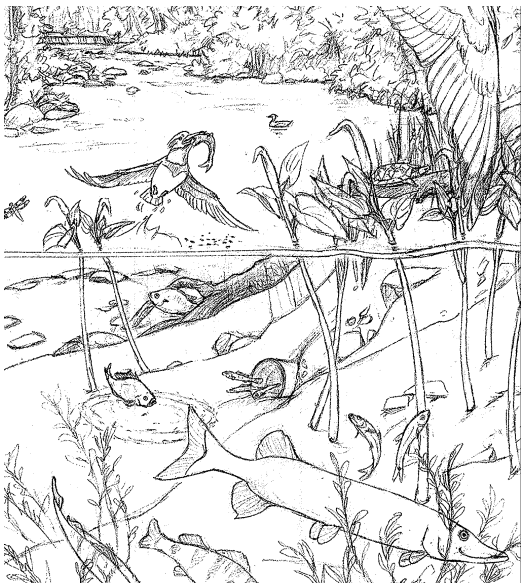
As trees and shrubs become established, disturbed weedy ground begins the transition to young forest.

Young Forest

This type of community has been called “success ional forest,” reflecting the concept of succession, which holds that the flora of a developing forest changes over time from early-stage pioneering species (with many non-native trees and shrubs) to a mature stage with native species replacing the non-natives, or with “climax” species replacing pioneering species. Having observed that in some developing forests time has not led to a significant change in tree species composition, in recent decades many ecologists have questioned the idea of succession and stopped using that term. So along with some other ecologists, I now use the term “young forest.”

Young forest patches I observed along Quassaick Creek had a mix of native and non-native trees. These mixes contained non-native species such as tree-of-heaven and Norway maple, but also native trees such as cottonwood, American elm and sycamore. Young forests tended not to have certain trees common in mature forests, such as tulip tree, basswood and bitternut hickory. These species may establish themselves as forest soils develop sufficiently to support their growth. If this proves true, then there may be in effect a “success ional” component to forest development.

G. Environmental Conditions and Quality



It became apparent to me after just a few visits that the quality of the natural ecosystem along Quassaick Creek ranges from very disturbed to moderately or slightly disturbed. In some places in the city, development extends to the margin of the creek, while elsewhere there are large vegetated corridors between the creek and the nearest developed land. Though there appear to be no areas entirely free from disturbance, many areas are largely recovered from past disturbance, and comparable in general appearance and apparent ecological health to non-urbanized habitats in the vicinity of the survey area. Disturbance varies in degree and in terms of the ecological components most affected. The lower creek (Segment 1) has a high-quality, undisturbed tree community, but a high number of invasive, exotic species in the shrub and herb layers. Segment 2 is the most highly developed, the downstream end surrounded by the old city, and the upstream end bounded by more recent suburban sprawl, including shopping areas, residential subdivisions and newer commercial facilities. Segments 3 borders commercial and industrial sites along Rt. 17K to the south and DuPont Avenue (Rt. 52) to the east. These developed areas do not penetrate deeply into the natural area of Segment 3, which contains relatively large areas of wild habitat, including floodplain areas, upland forests, ponds and wetlands. Segments 4 and 5 are considerably more constrained by residential, commercial and industrial development.

Stream pollution

Fourteen point sources of pollution from a total of twenty industrial sites have been identified along Quassaick Creek and its largest tributary, Gidneytown Creek (Schmidt 1987). These point sources are more or less evenly distributed along the entire length of the creek, with a slightly higher concentration (5 sources) between Muchattoes Lake and the Hudson River. I am not certain how many of these industrial sites are still operational: some have changed ownership and use; some have been abandoned. Pollution sources are not limited to the urban portion of the creek corridor. Schmidt reported aluminum sludge immediately downstream from the Newburgh Water Treatment Plant along Union Avenue north of Gardnertown.

Industrial fill may be a fairly significant source of pollution. At several points along lower Quassaick Creek I observed discarded construction materials on the ground surface, or making up a significant proportion of the substrate, apparently having accumulated to some depth over the lifetime of an industrial facility. The largest such area I observed was on the south side of the creek just east of Walsh Avenue. I suspect also that there may be buried industrial materials in the high bank north of the railroad, where flow from groundwater seeps was discolored or appeared to contain suspended solids. The slope just south of the Rt. 9W bridge had a lot of trash, apparently thrown down the slope from an industrial facility at the top of the slope.

Studies to date are inconclusive as to the effects of industrial pollution on the biota of Quassaick Creek. The fish community is not significantly less diverse than that of similar Hudson River Tributaries (Schmidt 1985, 1987; Schmidt and Kiviat 1986, Stevens, Schmidt, Roeder and Kiviat. 1994). Schmidt and Limburg (2003) concluded that the lack of submersed plants in the lower Quassaick Creek was typical of urban streams, and attributable to high-energy runoff from surrounding hard surfaces (pavement, railroad base, etc.). Nevertheless, it is almost certain that chemical pollution has had, and continues to have, an impact on the stream's biota. More information on these effects is needed.

Schmidt and Limburg (2003) concluded that the lower 1.5 km of Quassaick Creek (east of Muchattoes Lake) was a disturbed system in terms of water chemistry and stream productivity (which was found to be reduced by the degraded water quality). Schmidt and Limburg found water degradation reflected more in the paucity of the macro invertebrate community than in the fish community. Karen Strong and I sampled Walsh Avenue Pond for stream invertebrates and found very few, mainly small snails, crayfish, and larvae of common stream insects. We observed only very small fish (not identified) in low numbers.

Connectivity

In addition to water quality, an important measure of environmental quality in a riparian corridor is connectivity, or continuity of wetland and upland habitat along the margins of the stream. Connectivity is important to animals living both in the stream and its upland corridor, as well as to planners designing a trail system along the stream. A zone of nearly complete connectivity exists from the Hudson River to the southern end of the Little Falls tributary

corridor (Segments 1-3), with a very narrow vegetated corridor extending nearly to Lake Street (Segment 4). From Muchattoes Lake to NYS Rt. 17 K there are serious barriers to connectivity (e.g. Stroock building overpass, Lake Street concrete culvert, other constructed flow diversions), and a greatly narrowed vegetated streamside corridor. In Segments 6 and 7, north of NYS Rt. 17K and the urban center of the City of Newburgh, connectivity was good except for road crossings and some encroachment on the corridor by residential development.

In terms of corridor width or area, the lower reaches of Quassaick Creek within the City of Newburgh rank low compared to broad portions of the upper reaches without dense urban development (e.g. Brookside Pond and Algonquin Park). However, it was surprising and encouraging to discover that within the city, fairly large geographic and ecological components of the lower corridor are spatially uninterrupted. If the Little Falls Pond drainage (Segment 3) is included, the lower Quassaick Creek corridor (Segments 1, 2 and 3) contains about 9000 feet (1.5 mi) of contiguous riparian corridor habitat.

Invasive Plants

Aggressive, non-native plant species form a large component of the flora along most of the Quassaick Creek corridor covered by this survey. It is a fair conclusion that these invasive species have had a major impact on the plant communities in which they occur. This is reflected in the abundance relative to native species of invasive plants such as mugwort, garlic mustard, Japanese knotweed, morrow honeysuckle, Japanese honeysuckle, Oriental bittersweet and tree-of-heaven. Even in places where the upper layers of forest communities consist mostly of native trees, the lower shrub and herb layers have a very high non-native component, probably as a result of greater disturbance at ground level. It is likely that native forest herbs such as wild ginger and cut-leaf toothwort, now rare along lower Quassaick Creek, once occurred more widely and in greater numbers, and possible that other native herbs once occurred with these species in a more diverse native herbaceous community.

H. Preservation needs

Protection of Undeveloped Land

It is likely that some of the remaining undeveloped land adjacent to Quassaick Creek is under threat of development, or likely will be in the future. Lying within the heart of Newburgh in a zone of declining industrial development, lower Quassaick Creek (Segments 1 &2) is unlikely to be targeted for further development. Segments 4 and 5 are also maximally developed. However, outlying undeveloped areas in zones of increasing industrial, commercial and (potentially) residential development may be in danger. These areas include the Little Falls tributary corridor (Segment 3) and the wild lands around Brookside Pond (Segment 6). The undeveloped area surrounding Brookside Pond is one of the most important and significant ecological landscape resources in the Quassaick Creek Corridor. Its large size, relative secludedness and variety of habitats make it a significant reservoir of biodiversity. Rapid development along Rte. 17K puts pressure on the Brookside Pond habitat complex from the south. The Pepsico complex west of DuPont Avenue bordering the forested area northeast of Brookside Pond could expand in the future or attract associated businesses.

It would be prudent for the QCC and the City of Newburgh to keep abreast of development plans potentially affecting these areas, and perhaps even to take proactive steps to protect them. One such step might be the formation of a Quassaick Watershed Conservancy

(representing the City of Newburgh and other municipalities in the Quassaick Creek watershed) to actively facilitate protection of important parcels along the Quassaick Creek corridor and throughout the Quassaick Creek watershed. This conservancy could set priorities for acquisition or conservation easements on these parcels, and approach landowners to assess their willingness to participate in the preservation effort.

Protection of significant biological resources

It is important in planning public access and use of the Quassaick Creek corridor to protect fragile or sensitive natural areas, rare plants and animals and their habitats. Trails and other public use facilities should not be located within fragile habitats such as wetlands with soft, wet soils; steep, erosion-prone slopes, or areas with low-growing, fragile plants. Necessary crossings of fragile habitats should be constructed so as to avoid damage (e.g. plank bridges across wetlands, stepped paths with water diversions on sensitive slopes). Public facilities should be located a sufficient distance from rare plants to prevent any damage from foot traffic, and a sufficient distance from known paths and frequent haunts of rare or sensitive animal species so as not to alarm these animals or frighten them away from the area.

I. Restoration potential

There may be ways to redress effects of past disturbance and current negative impacts on the environment of the Quassaick Creek corridor. Water quality might be improved, habitat degradation might be intercepted and perhaps reversed, invasive plants might be eradicated or reduced in selected areas, allowing native species to compete more effectively. Any action designed to restore or improve natural habitat should be carefully analyzed and supported by detailed scientific information. No action should be undertaken without an adequate feasibility study.

Improvement of water quality

Water quality in Quassaick Creek could be improved by preventing further input of chemical pollutants into the stream, and by removing or detoxifying sources of pollution from active and inoperative industrial sites. The cooperation of polluting industries should be sought to help reduce water pollution. Stewards of the Quassaick Creek ecosystem could facilitate pollution control by seeking grants or other economic incentives available for industries, which adopt measures to curtail pollution.

Restoration of Natural Habitat and Ecosystem Function

Aside from improving water quality, there may be ways to restore or enhance biodiversity and ecosystem function of habitats bordering Quassaick Creek. These measures might include erosion control, control or removal of invasive plants, and removal of trash. QCC and associated organizations might sponsor, organize or simply encourage volunteer efforts toward these ends. Again, well-informed, cautious planning should precede any contemplated action. Research should be conducted into costs, current methodology, effective and appropriate procedures, the results of previous similar efforts and the lessons learned.

J. Public Use Potential

Potential environmentally appropriate uses of the Quassaick Creek corridor include light recreation, nature appreciation, art and photography, education, and scientific research. Potential users of the corridor include the general public, local schools and universities, nature study groups (e.g. birding societies) and hiking organizations. Public use should be carefully monitored for adverse impacts to the creek corridor environment.

Development of Public Access

Public access and use will no doubt entail some degree of alteration to the corridor environment. In considering such changes, the effects on the natural ecxosystem and its resident organisms should be carefully considered. Development of a plan for public access should precede the preparation of the landscape for public use.

Trails

Quassaick Creek Coalition has developed plans for a walking trail along lower Quassaick Creek, beginning at South Water Street and running west to the Bridge Street (Mill Street) overpass. Extensions to this trail are contemplated, including a side trail across the Twin Arches footbridge, possibly connecting to a trailhead along Walsh Avenue. Eventually the main corridor trail might be extended through areas of blocked access or narrowed corridor space by weaving the trail between creek corridor wild habitat and city sidewalks and other developed public access areas.

Other parts of the creek corridor should be studied to determine the feasibility of public access development. For example, the Little Falls Park area might be expanded to include a trail around Little Falls Pond. Another trail might be feasible along the downhill drainage of the Little Falls corridor, linking Little Falls Park to the Quassaick Creek Estuary Preserve trail. Ponds with easy access (e.g. John Street Pond, Harrison Pond) could be made accessible via short trails connecting to the main corridor trail or to city sidewalks or other public access areas. A short loop trail might be possible near Harrison Pond, taking advantage of the wooded hill and the view of the creek from the limestone ledge.

An area that might be opened for public access perhaps in the next decade is Segment 3 of this report, the creek corridor from NYS Rt. 17K north to Brookside Farm Road. Parts of this area are wetland, but there may be ways for a trail route to avoid wetlands. If this is not possible, boardwalks and bridges might be a solution.

Water Craft Access

At some time in the future there may arise the question of public access to Quassaick Creek and associated waters by watercraft such as canoes, kayaks and small boats. Except for the tidal mouth, Quassaick Creek in most of its length is too shallow and steep for watercraft use. Of the ponds along Quassaick Creek, probably only Brookside Pond has potential for non-powered watercraft use, as limited by environmental considerations. Before deciding the rules and restrictions on boating, a thorough study of the impacts on biological resources should be performed.

Education and Research

The Quassaick Creek corridor has great educational potential. The environment reflects a long history of interaction between the dynamics of human culture and those of the natural environment. Due to this history the present landscape and ecosystem shows with both vividness and subtlety the impacts of various human activities and the responses to those impacts by nature. Many subjects of study and instruction are available: landscape and general ecology, plants and animals, historical trends and their impacts on the environment, the relation of a stream to its surroundings, the concept and function of biological corridors, general natural history, plant communities and other areas of study. The corridor is a natural venue for natural history studies by elementary and high school classes, and for college & university students' science research projects. Aquatic resources – Quassaick Creek and its associated waters – corridor have particular educational significance, considering the crucial value of clean water for wild organisms and people alike.

For a walk along the proposed QCEP trail route in September 2003, I identified and marked selected points of biological interest along the trail. Volunteers placed numbered signs at these points, and on the day of the walks, interpreters provided information on each point of interest to attendees. QCC may eventually use information from this survey as the basis for a self-guided biodiversity tour, the points of interest correlated with an informational brochure. This and similar efforts will help to bring greater environmental awareness to urban residents, and illuminate the uniqueness of the Quassaick Creek corridor as an example of a wild preserve in an urban context.

Safety Issues

I offer just a few words on safety. Safety hazards in parts of the corridor (e.g. unstable ground on old industrial fill, unstable slopes, intermittently saturated soils) compel special consideration in terms of public access and use. Unless or until these areas are remediated and made safe, measures to exclude visitors need to be considered and chosen according to which are most appropriate to each hazardous area or situation. Remediation of hazardous areas may be costly, and some unsafe places and situations might best be kept permanently closed to the public. Areas with public use value might be prepared for public access as time and resources permit.

K. Recommendations

Aside from the efforts suggested in the foregoing discussion, I make the following more specific recommendations in regard to the development of a system of parks and preserves in the Quassaick Creek corridor and watershed.

1. The formation of a Quassaick Creek watershed coalition, including the City of Newburgh government, governments of neighboring municipalities, and other groups and individuals interested in preservation of the most significant natural resources of the watershed.

2. A feasibility study of the possible extension of the Quassaick Creek Estuary Preserve beyond the Phase 1 and Phase 2 areas identified by QCC. This extension would include places identified in this report as significant natural areas, including the Little Falls corridor, Snake Hill and the Brookside Pond natural area.

3. A survey of Brookside Pond and its inner marsh by canoe to assess the potential for boating, and the possible impacts of boating on the ecosystem and resident organisms.

4. Ecological community mapping of the larger ecologically significant areas (see Map 2).

5. Extension of the natural resources inventory north of Algonquin Park and Powder Mill Road, a potentially significant natural area. For example, this stretch of the corridor is shown as including"grassland" area (Schmidt 1987). Natural grassland communities are rare in our region.

L. Sources of Information and Assistance

Elizabeth McKean, City of Newburgh Records Management & Engineering Records

Hudsonia, Ltd.

New York State Department of Environmental Conservation (N.Y.S. D.E.C.)

Karen Strong, N.Y.S. D.E.C.

Scott Cuppett, N.Y.S. D.E.C.

Daniel Miller, N.Y.S. D.E.C.

Orange County Water Authority

Quassaick Creek Coalition

Claudia Perretti, Audubon Society, The J. Edgar Mearns Bird Club

Patrick DeLuca, PhD., Mount St. Mary College

Mount St. Mary College student volunteers

Gary Seymour, PhD., Hudson Valley Wildlife

M. Appendices

Appendix I. Maps

1. Segments of the Quassaick Creek Corridor
2. Ecologically Significant Areas
3. Ponds
4. Rare Species Locations

Appendix II. Plant Species List

Appendix III. Animal Species List

N. Literature cited

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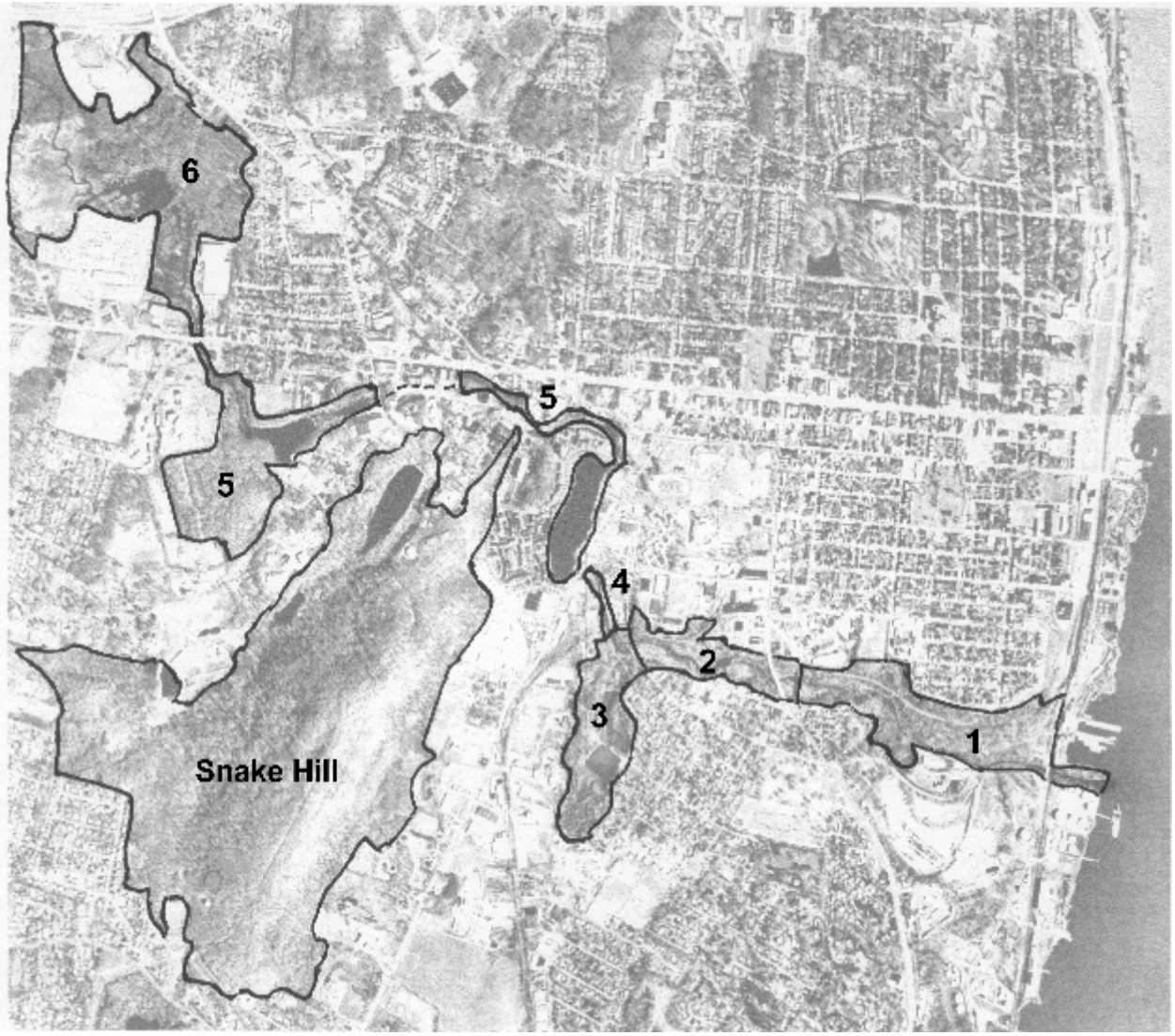
APPENDIX I. MAPS

Map 1. Segments of Quassaick Creek Corridor and adjacent natural areas



1. Segment 1: Lower Quassaick Creek, from Hudson River east to Mill Street.
2. Segment 2: Lower Quassaick Creek, Bridge Street to Walsh Avenue.
3. Segment 3: Little Falls Watershed.
4. Segment 4: Walsh Avenue to Lake Street.
5. Segment 5: Muchattoes Lake to NYS Rt. 17K.
6. Segment 6: NYS Rt. 17K to Interstate Rt. 84.

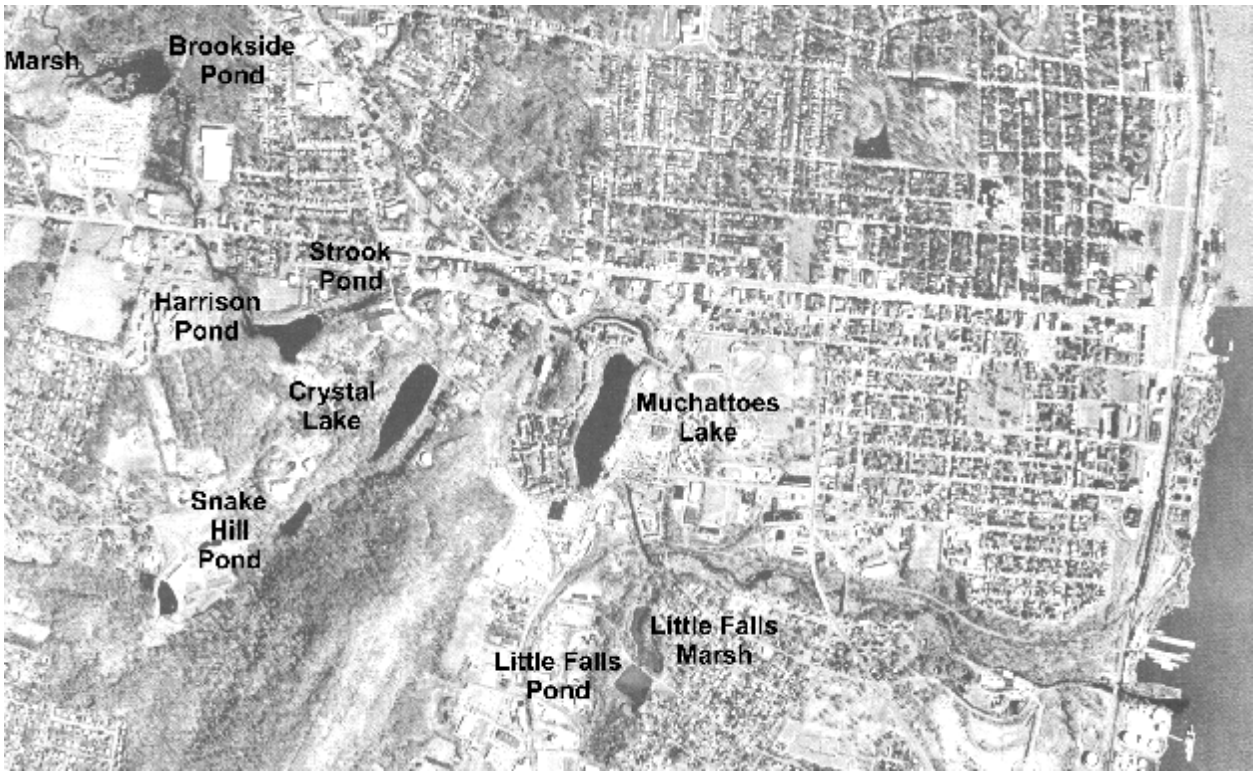
Snake Hill: Snake Hill contiguous undeveloped area.

APPENDIX I. MAPS

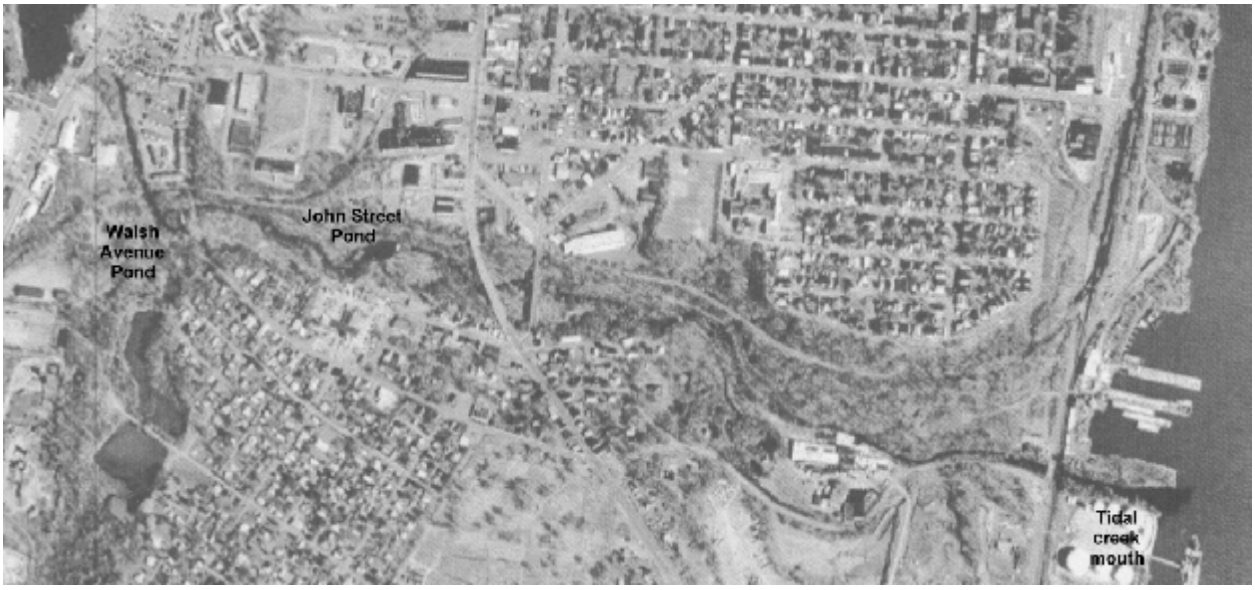
Map 2: Significant Natural Areas

1: Lower Quassaick Creek (Segment 1)
2: John Street Pond and Floodplain (Section 2)
3: Little Falls Watershed (Section 3)
4: Snake Hill
5: Harrison Pond Area (Section 5)
6: Brookside Pond Area (Section 6)

APPENDIX I. MAPS
Map 3. Ponds and Wetlands



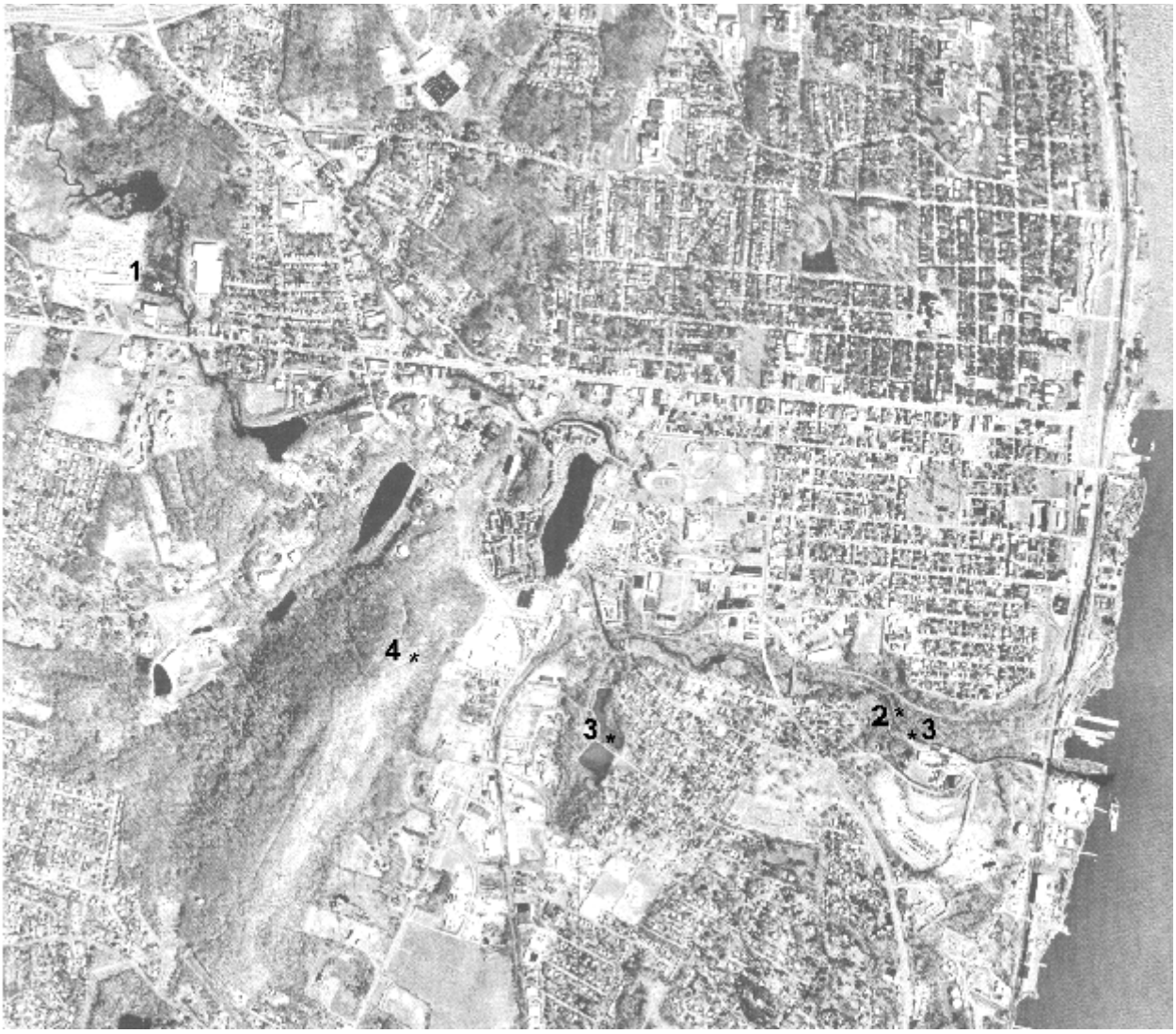
Middle Quassaick Creek (Sections 3-6)



Lower Quassaick Creek (Sections 1 & 2)

APPENDIX I. MAPS

Map 4. Rare Species Locations



1. Narrow-leaved sedge (*Carex amphibola*)
2. Woodland agrimony (*Agrimonia rostellata*)
3. Wood turtle (*Clemmys insculpta*)
4. Appalachian azure (*Celastrina neglectamajor*)

MASTER PLANT LIST

Acer negundo	Ash-leaf maple (Box elder)		
Acer platanoides	Norway maple	ex	
Acer pseudoplatnus	Sycamore maple	ex	
Acer rubrum	red maple		
Acer saccharinum	silver maple		
Acer saccharum	Sugar maple		
Agrimonia gryposepela	common agrimony		
Agrimonia rostellata	**woodland agrimony**	**S2**	trail
Agrostis gigantea	black bent		
Ailanthus altissima	tree-of-heaven	ex	
Alliaria petiolata	garlic mustard	ex	
Allisma sp.	water-plantain		
Allium canadense	wild onion		
Allium vineale	wild garlic		
Ambrosia artenisifolia	common ragweed		
Anthoxanthum odoratum	sweet vernal grass	ex	
Apios americana	ground nut		
Apocynum cannabinum	Indian hemp		
Arctium minus	common burdock	ex	
Arisaema triphyllum	Jack-in-the-Pulpit		
Arrhenatherum eliatus	tall oat grass		
Artemisia vulgaris	mugwort		
Asarum canadense	wild ginger	rr	
Asclepias incarnata	swamp milkweed		ML
Asclepias syriaca	common milkweed		
Aster divaricatus	white wood aster		
Aster sp.	aster		
Barbarea vulgaris	wintercress	ex	
Berberis thunbergii	common barberry	ex	
Betula lenta	black birch		
Bidens frondosa	bur-marigold		AP
Boehmeria cylindrica	false nettle		
Botrychium virginianum	rattlesnake fern		
Calistegia sepia	hedge bindweed		
Callitriche heterophylla	water-starwort		
Callitriche stagnalis	water-starwort		
Cardamine concantenata	cut-leaf toothwort	rr	
Carex albicans var. albicans	sedge		
Carex amphibola	**narrow-leaf sedge**	**S2**	N17K
Carex blanda	sedge		
Carex cephalophora	sedge		
Carex communis	sedge		
Carex crinita	sedge		
Carex cristatella	sedge		
Carex grisea	sedge		
Carex hirsutella	sedge		
Carex lacustris	lakeside sedge	rr	
Carex lupulina	sedge		
Carex pensylvanica	Pennsylvania sedge		
Carex rosea	sedge		
Carex scoparius	sedge		

sr: state-rare
rr: regionally-rare
ex: exotic

Carex sp.	sedge		
Carex sparganioides	sedge		
Carex squarrosa	squarrose sedge	rr	
Carex stipata	sedge		
Carex stricta	tussock sedge		
Carex tenera	sedge		
Carex tribuloides	sedge		
Carex vulpinoidea	fox sedge		
Carya cordiformis	Bitternut hickory		
Carya ovata	shagbark hickory		
Catalpa speciosa	catalpa		
Celastrus orbiculatus	Oriental bittersweet	ex	
Celtis occidentalis	hackberry		
Cephalanthus occidentalis	buttonbush		HP
Chelone glabra	turtlehead		
Cicaea lutetiana	enchanter's nightshade		
Cirsium arvense	Canada thistle		
Cirsium vulgare	field thistle		
Collinsonia canadensis	horse mint		
Conyza canadensis	horseweed		
Cornus amomum	silky dogwood		
Cornus florida	flowering dogwood		
Cornus foemina var racemosa	gray-stem goldenrod		
Coronilla varia	crown vetch	ex	
Corylus cornuta	beaked hazel	rr	
Cryptotaenia canadensis	honewort		
Cynanchum vincetoxicum	black swallowwort	ex	
Cyperus strigosus	common flatsedge		ML
Cystopteris tenuis	fragile fern		
Dactylus glomerata	orchard grass	ex	
Danthonia compressa	poverty grass		
Danthonia spicata	upland poverty grass		
Daucus carota	Queen Anne's lace	ex	
Decadon verticillata	water-willow	rr	
Dianthus armeria	Deptford pink	ex	
Dioscorea villosa	wild yam	rr	
Dipsacus fullonum	common teasel	rr	
Dryopteris carthusiana	common wood fern		
Eleocharis acicularis	frog's hair		ML
Epilobium coloratum	willow herb		ML
Epipactis helleborine	helleborine orchid		
Equisetum sp.	horsetail		
Equisetum arvense	field horsetail		
Erigeron annuus	daisy fleabane		
Erythronium americanum	trout lily	rr	
Euonymus alatus	winged spindle-bush	ex	
Eupatorium altissimum	tall boneset	rr	
Eupatorium rugosum	white snakeroot		
Euphorbia esula	sun spurge		
Fagus grandifolia	American beech		
Forsythia floribunda	Forsythia		HP

sr: state-rare
rr: regionally-rare
ex: exotic

Fraxinus americana	white ash		
Fraxinus pensylvanica	red ash		
Galium aparine	bedstraw		
Galium mollugo	common bedstraw		
Geranium maculatum	wild geranium		
Geranium sibericum	Siberian geranium	ex	
Geum allepicum	yellow avens		
Geum canadense	white avens		
Glechoma hedioides	ground ivy		
Gleditzia tricanthos	honey locust		
Glyceria melicaria	manna grass		
Glyceria striata	manna grass		
Hackelia virginica	Virginia stickseed		
Hamamelis virginiana	witch hazel		
Hamerocallis fulva	day lily	ex	
Hypericum punctatum	spotted St. Johnswort		
Impatiens capensis	spotted touch-me-not		
Iris versicolor	blue flag		
Juglans nigra	black walnut		
Juncus sp.	rush		
Juncus tenuis var. tenuis	path rush		
Juncus tenuis var. anthellatus	path rush		
Leersia virginica	white grass		
Lemna minor	duckweed		
Leucanthemum vulgare	ox-eye daisy		
Ligustrum sp.	privet	ex	
Lindera benzoin	spicebush		
Liriodendron tulipifera	Tuliptree		
Lolium perenne	English ryegrass	ex	
Lonicera japonica	Japanese honeysuckle	ex	
Lonicera morrowii	Morrow honeysuckle	ex	
Lonicera mackii	Mack's honeysuckle	ex	
Lotus corniculata	birdsfoot trefoil	ex	
Ludwigia palustris	water purslane		
Luzula campestris var. multiflora	common wood-rush		
Lysimachia ciliata	fringed loosestrife		
Lysimachia nummularia	moneywort		
Lythrum salicaria	purple loosestrife	ex	
Malus pumila	apple		
Melilotus alba	white sweet clover		
Menispermum canadense	Canada moon seed		
Mianthemum racemosum	false solomon seal		
Mikania scandens	climbing boneset		
Morus alba	white mulberry		
Morus rubra	Red mulberry		
Muhlenbergia frondosa	fluffy muhly		
Nuphar advena	spatterdock		
Nyssa sylvatica	black gum		HP
Oenothera biennis	common evening primrose		
Onoclea sensibilis	sensitive fern		
Ornithogalum XXXX	star-of-bethlehem	ex	

sr: state-rare
rr: regionally-rare
ex: exotic

Osmunda claytonii	sweet cicely		
Osmunda regalis	royal fern		
Ostrya virginiana	hop hornbeam		
Panicum latifolium	deer-tongue grass		
Parthenocissus quinquefolia	Virginia creeper		
Peltandra virginica	arrow-arum		ML
Penthorum sedoides	ditch stonecrop	rr	
Phalaris arundinacea	reed canary grass		
Philadelphus coronarius	mock-orange	ex	
Phleum pratense	timothy	ex	
Phragmites australis	common reed		
Phryma leptostachea	lopseed		
Pilea pumila	clearweed		
Plantago rugellii	common plantain	ex	
Platanus occidentalis	Sycamore		
Poa annua	annual bluegrass		
Poa compressa	Canada bluegrass		
Poa pratensis	Kentucky bluegrass		
Poa sp.	bluegrass?		
Polygonum cespitosum	path smartweed		
Polygonum cuspidatum	Japanese knotweed	ex	
Polygonum lapathifolium	prince's feather		
Polygonum pensylvanicum	Pennsylvania smartweed		AP
Polygonum robustius	smartweed		
Polygonum sagittatum	tear-thumb		
Polygonum scandens	climbing false buckwheat		
Polygonum virginianum	Virginia knotweed		
Populus deltoides	cottonwood		
Populus tremuloides	quaking aspen		
Potamageton crispus	curly pondweed		
Potentilla norvegica	Norway cinquefoil	ex	
Potentilla recta	tall cinquefoil		
Prenanthes altissima	tall white lettuce		
Prunus serotina	black cherry		
Quercus alba	white oak		
Quercus montana	chestnut oak		
Quercus palustris	pin oak		
Quercus rubra	northern red oak		
Quercus velutina	black oak		
Ranunculus sceleratus	buttercup		
Rhamnus cathartica	common buckthorn	ex	
Rhus glabra	smooth sumac		
Rhus typhina	staghorn sumac		
Ribes americana	American wild currant		
Robinia pseudo-acacia	Black locust		
Rorippa nasturtium-aquaticum	watercress		
Rosa multiflora	multiflora rose	ex	
Rubus pubescens	swamp dewberry		
Rubus allegheniensis	common blackberry		
Rubus occidentalis	black caps		
Rubus phoenicolasius	wineberry	ex	

sr: state-rare
rr: regionally-rare
ex: exotic

Rumex acetosella	sheep sorrel	ex	
Rumex crispus	curly dock	ex	
Rumex obtusifolius	common dock	ex	
Salix fragilis	Crack willow		
Salix nigra	black willow		
Sambucus canadensis	common elderberry		
Sanguinaria canadensis	bloodroot	rr	
Sanicula canadensis	common sanicle		
Saururus cernuus	lizard's tail	rr	
Scirpus hattorianus	bulrush		
Scrophularia marylandica	hound's tongue		
Senecio aureus	golden ragwort		
Solanum nigrum	black nightshade		
Solidago arguta	sharp-toothed goldenrod		
Solidago caesia	blue-stem goldenrod		
Solidago canadensis var. scabra	tall goldenrod		
Solidago flexicaulis	zig-zag goldenrod		
Solidago gigantea	tall goldenrod		
Solidago juncea	early goldenrod		
Solidago rugosa	rough goldenrod		
Sparganium americanum	American bur-reed		
Staphylea trifoliata	bladdernut		
Stellaria media	common starwort		
Strophostyles helvula	trailing wild bean		AP
Symplocarpus foetidus	skunk cabbage		
Tilia americana	Basswood		
Toxicodenron radicans	poison ivy		
Trapa natans	European water chestnut	ex	
Tridens flavus			AP
Trifolium hybridum	alsike clover	ex	
Trifolium pratense	red clover	ex	
Trifolium repens	white clover	ex	
Typha sp	cattail		
Ulmus americana	American elm		
Urtica dioica	stinging nettle		
Uvularia sessilifolia	sessile bellwort		
Verbascum blattaria	moth mullein		
Verbascum phlomoides	golden mullein		HP
Verbascum thaspus	common mullein		
Veronica americana	American water speedwell		
Viburnum acerifolium	maple-leaf viburnum		
Viburnum dentatum ssp lucidum	northern arrowwood		
Viburnum lantago	nannyberry		
Viburnum opulus	cranberry bush		
Viburnum prunifolium	black haw		
Vicia cracca	cow vetch		
Viola sororia	common blue violet		
Vitis riparia	River grape		

sr: state-rare
rr: regionally-rare
ex: exotic

SNAKE HILL	July 2		
Actaea pachypoda	doll's eyes		SH
Amphicarpaea bracteata	hog peanut		SH
Aralia nudicaulis	wild sarsaparilla		SH
Aster macrophyllus	large-leaved aster		SH
Cardamine parviflora	small-flowered bittercress		SH
Carya glabra	pignut hickory		SH
Cerastium arvense	field chickweed	ex	SH
Cerastium nutans	common chickweed		SH
Cimicifuga racemosa	black cohosh	rr	SH
Corydalis sempervirens	pale corydalis		SH
Dennstaedia punctiloba	hay-scented fern		SH
Deschampsia flexuosa	common hair grass		SH
Dryopteris intermedia	intermediate wood fern		SH
Dryopteris marginalis	marginal wood fern		SH
Euthamia gramminea	flat-topped goldenrod		SH
Helianthus divaricatus	woodland sunflower		SH
Juniperus virginiana	eastern red cedar		SH
Krigia virginica	one-flowered cynthia	rr	SH
Lysimachia quadrifolia	whorled loosestrife		SH
Panicum boscii	panic grass		SH
Panicum dichotomum	panic grass		SH
Paronychia canadensis	Canada knotweed		SH
Polgonatum pubescens	common solomon's seal		SH
Polygonum scandens	climbing false buckwheat		SH
Polypodium virginianum	common polypody fern		SH
Prunus avium	bird cherry	ex	SH
Prunus virginiana	choke cherry		SH
Rosa carolina	Carolina rose		SH
Rubus flagellaris	northern dewberry		SH
Rubus odoratus	purple-flowering raspberry		SH
Sanicula marylandica	Maryland sanicle		SH
Smilax herbacea	carrion flower		SH
Solidago bicolor	silver rod		SH
Solidago puberula	downy goldenrod		SH
Solidago ulmifolia	elm-leaved goldenrod		SH
Thalictrum dioicum	early meadow-rue		SH
Thelipteris novaboracensis	New York fern		SH
Tricophorum lancifolium	clubrush		SH
Triodanis perfoliata	Venus' looking glass		SH
Triosteum aurantiacum	wild coffee	rr	SH
Vaccinium pallidum	pale blueberry		SH
Verbena urticifolia	white vervain		SH
Viburnum rafinesquianum	downy arrowwood	rr	SH
Vitis aestivalis	summer grape		SH

Appendix III.
QUASSAIC CREEK ESTUARY PRESERVE BIODIVERSITY SURVEY

MASTER ANIMALS LIST

FISHES	***all Lake 2002, except where noted***	
Anguilla rostrata	American eel	
Alosa aestivalis	blueback herring	
Alosa pseudoharengus	alewife	
Alosa sapidissima	American shad	
Carassius auratus	goldfish	
Cyprinus carpio	common carp	
Notemigonus crysoleucas	golden shiner	
Notropis cornutus	common shiner	Schmidt 1985
Notropis hudsonius	spottail shiner	
Rhinicthys cataractae	longnose dace	
Semotilus corporalis	fallfish	
Catostomus commersoni	white sucker	
Ameiurus catus	white catfish	
Ameiurus natalis	yellow bullhead	
Ameiurus nebulosus	brown bullhead	
Ictalurus punctatus	channel catfish	
Esox americanus americanus	redfin pickerel	
Esox niger	chain pickerel	
Salmo trutta	brown trout	
Salvelinus fontinalis	brook trout	
Fundulus diaphanus diaphanus	eastern banded killifish	
Fundulus heteroclitus	mummichog	
Morone americanus	white perch	
Morone saxatalis	striped bass	
Lepomis auritus	redbreast sunfish	
Lepomis gibbosus	pumpkinseed	
Lepomis macrochirus	bluegill	
Micropteris dolomieu	smallmouth bass	
Micropteris salmoides	largemouth bass	
Pomoxis saltatrix	black crappie	
Etheostoma olmstedi	tessellated darter	
Perca flavescens	yellow perch	
Pomatomus saltatrix	bluefish	
Trinectes maculatus	hogchoker	
Historic records		
*Cottus sp.**	sculpin	Towan 1952
Noturus gyrinus	tadpole madtom	Greely 1937
**** Schmidt (1985) believes this to be a misidentification***		
Unverified report		
	bluefish (fingerling)	unidentified fisherman 2003

QUASSAIC CREEK ESTUARY PRESERVE BIODIVERSITY SURVEY

MASTER ANIMALS LIST

BIRDS		
Aix sponsa	wood duck	Barbour 2003, Seymour 01-02
Quiscalus quiscula	common grackle	Barbour 2003, Seymour 01-02
Corvus brachyrhynchos	American crow	Barbour 2003
Agelaius phoeniceus	red-winged blackbird	Barbour 2003
Colaptes auratus	northern flicker	Barbour 2003, Seymour 01-02
Cygnus olor	mute swan	Barbour 2003
Icterus galbula	baltimore oriole	Barbour 2003
Melanerpes carolinus	red-bellied woodpecker	Barbour 2003
Turdus migratorius	American robin	Barbour 2003
Butorides striatus	green heron	Barbour 2003
Ardia herodias	great blue heron	Barbour 2003, Seymour 01-02
Hylocichla mustelina	wood thrush	Barbour 2003
Vireo olivaceus	red-eyed vireo	Barbour 2003
Contopus virens	eastern wood pewee	Barbour 2003
Anas platyrhynchos	mallard	Barbour 2003, Seymour 01-02
Cyanocitta cristata	blue jay	Barbour 2003, Seymour 01-02
Cardinalis cardinalis	northern cardinal	Barbour 2003
Branta canadensis	Canada goose	Barbour 2003
Columbia livia	rock dove (pigeon)	Barbour 2003, Seymour 01-02
Picooides villosus	hairy woodpecker	Barbour 2003
Tyrannus tyrannus	eastern kingbird	Barbour 2003
Parus atricapillus	black-capped chicadee	Barbour 2003
Parus bicolor	tufted titmouse	Barbour 2003
Dumetella carolinensis	gray catbird	Barbour 2003
Dendroica petechia	yellow warbler	Barbour 2003
Dendroica coronata	yellow-rumped warbler	Barbour 2003
Helmitheris vermivora	worm-eating warbler	Barbour 2003
Phalacrocorax auritus	double crested cormorant	Seymour 01-03
Buteo jamaicensis	red-tailed hawk	Seymour 01-03
Charadrius vociferous	killdeer	Seymour 01-03
Philohela minor	American woodcock	Seymour 01-03
Larus argentatus	herring gull	Seymour 01-03
Larus delawarensis	ring-billed gull	Seymour 01-03
Zanaida macroura	mourning dove	Seymour 01-03
Megaceryle alcyon	belted kingfisher	Seymour 01-03
Picoides pubescens	downy woodpecker	Seymour 01-03
Myiarchus crinitus	great crested flycatcher	Seymour 01-03
Corvus brachyrhynchos	American crow	Seymour 01-03
Thyrothorus ludovicianus	Carolina wren	Seymour 01-03
Mimus polyglottos	northern mockingbird	Seymour 01-03
Spizella pusilla	field sparrow	Seymour 01-03
Spizella passerina	chipping sparrow	Seymour 01-03
AMPHIBIANS		
Rana clamitans	green frog	Barbour 2003
Rana palustris	pickerel frog	Barbour 2003
Pseudacris crucifer	northern spring peeper	Barbour 2003
Eurycea bislineata	northern two-lined salamander	Schmidt 1985

MASTER ANIMALS LIST

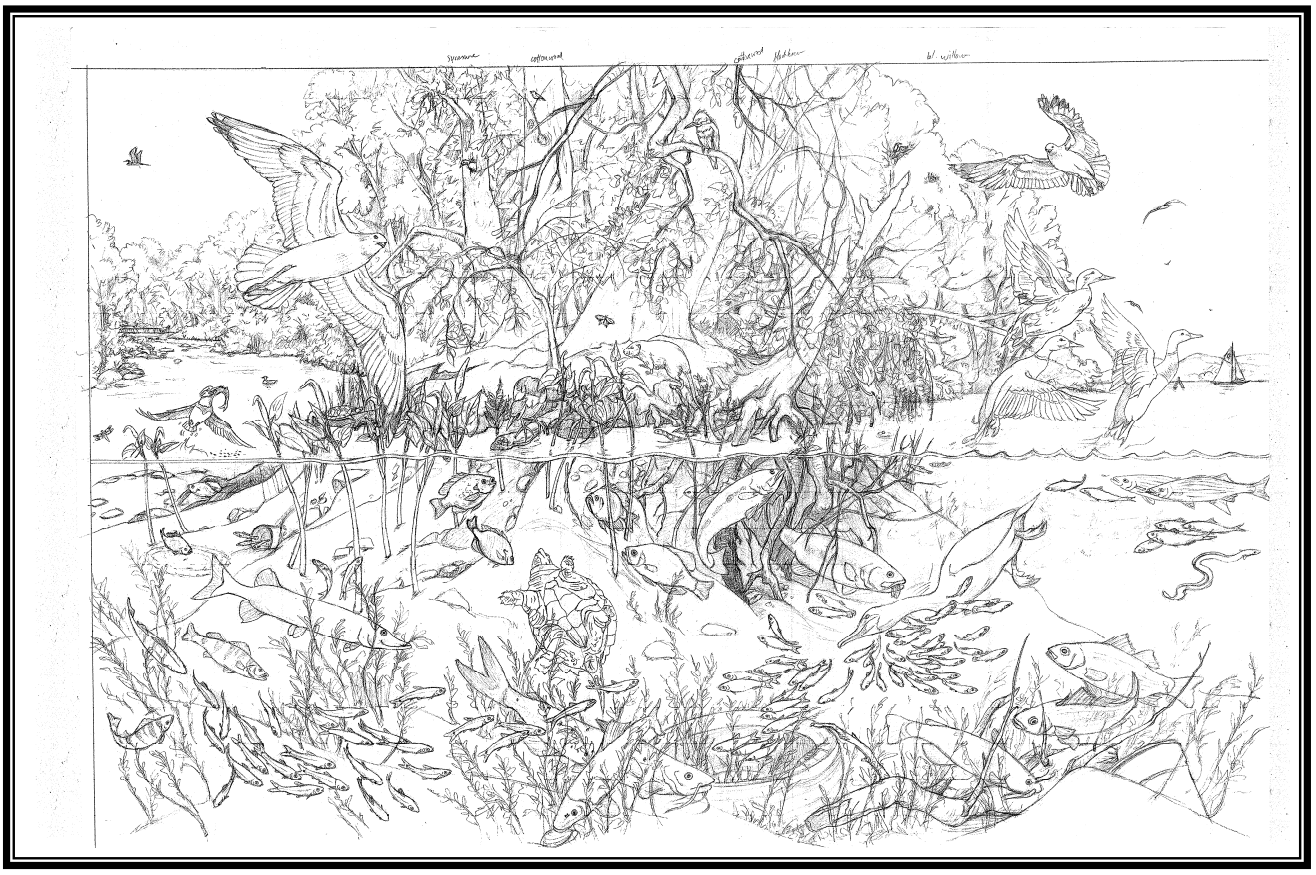
MAMMALS			
Marmota monax	woodchuck	Barbour 2003	
Sciurus carolinensis	gray squirrel	Barbour 2003	
Tamias striatus	eastern chipmunk	Barbour 2003	
Sylvilagus floridanus	eastern cottontail	Barbour 2003	
Microtus pennsylvanicus	meadow vole	Barbour 2003	
Ondatra zibethica	muskrat	Barbour 2003	
Castor canadensis	beaver	Barbour 2003	stumps
REPTILES			
Clemmys insculpta	wood turtle	Schmidt 1985	Miller 2003
Chrysemys picta picta	eastern painted turtle	Barbour 2003	
Chelydra serpentina	common snapping turtle	Barbour 2003	
Nerodia sipedon sipedon	northern water snake	Barbour 2003	
INSECTS			
LEPIDOPTERA			
Butterflies:			
Pieris rapae	cabbage white	Barbour 2003	
Colias protodice	clouded sulfur	Barbour 2003	
Papilio glaucus	eastern tiger swallowtail	Barbour 2003	
Papilio troilus	spicebush swallowtail	Barbour 2003	
Phyciodes tharos	pearl crescent	Barbour 2003	
Euphyes vestris	dun skipper	Barbour 2003	
Ancyloxypha numitor	least skipper	Barbour 2003	
Celastrina neglectamajor	**Appalachian azure**	Barbour 2003	SH, S2
ODONATA			
Damselflies:			.
Amphiagrion saucium	Eastern red damsel	Strong 2003	
Argia apicalis	blue-fronted dancer	Strong 2003	
Argia fumipennis	Violet dancer	Strong 2003	
Argia moesta	Powdered dancer	Strong 2003	
Enallagma sp.	bluets	Strong 2003	
Enallagma geminatum	skimming bluet	Strong 2003	
Ischnura posita	Fragile forktail	Strong 2003	
Ischnura verticalis	Common forktail	Barbour 2003	
Calopteryx maculata	ebony jewelwing	Barbour 2003	

MASTER ANIMALS LIST

Dragonflies:		
Aeshna sp.	darner	Schmidt 1985
Anax junius	Green darner	Strong 2003
Erythemis simplicicollis	Eastern pondhawk	Strong 2003
Libellula luctuosa	Widow skimmer	Barbour 2003
Libellula lydia	Common whitetail	Strong 2003
Libellula quadrimaculata	Four-spotted skimmer	Strong 2003
Libellula pulchella	12-spot skimmer	Strong 2003
Libellula incesta	slaty skimmer	Barbour 2003
Pachydiplax longipennis	Blue dasher	Strong 2003
Perithemis tenera	amber wing	Barbour 2003
Sympetrum obtrusum	white-faced meadowhawk	Strong 2003
Sympetrum rubicundulum	ruby meadowhawk	Strong 2003
AQUATIC INSECTS		
Notonectidae		Schmidt 1985
Ranatra sp.	water scorpion	Schmidt 1985
	caddis	Schmidt 1985
	stoneflies	Schmidt 1985
	mayflies	Schmidt 1985
Elmidae	riffle beetle	Schmidt 1985
	milkweed ladybug	Barbour 2003
Tipulidae	cranefly	Schmidt 1985
	dobsonfly	Schmidt 1985
Gyrinidae	whirligig beetle	Schmidt 1985
	water penny	Schmidt 1985
	water strider	Barbour 2003
Tibicen sp.	cicadas	
Orthoptera		
Scudderia sp.	bush katydid	
Hymenoptera		
Bombus sp.	bumblebee	

QUASSAICK CREEK ESTUARY PRESERVE AND TRAIL

SCENIC REPRESENTATION

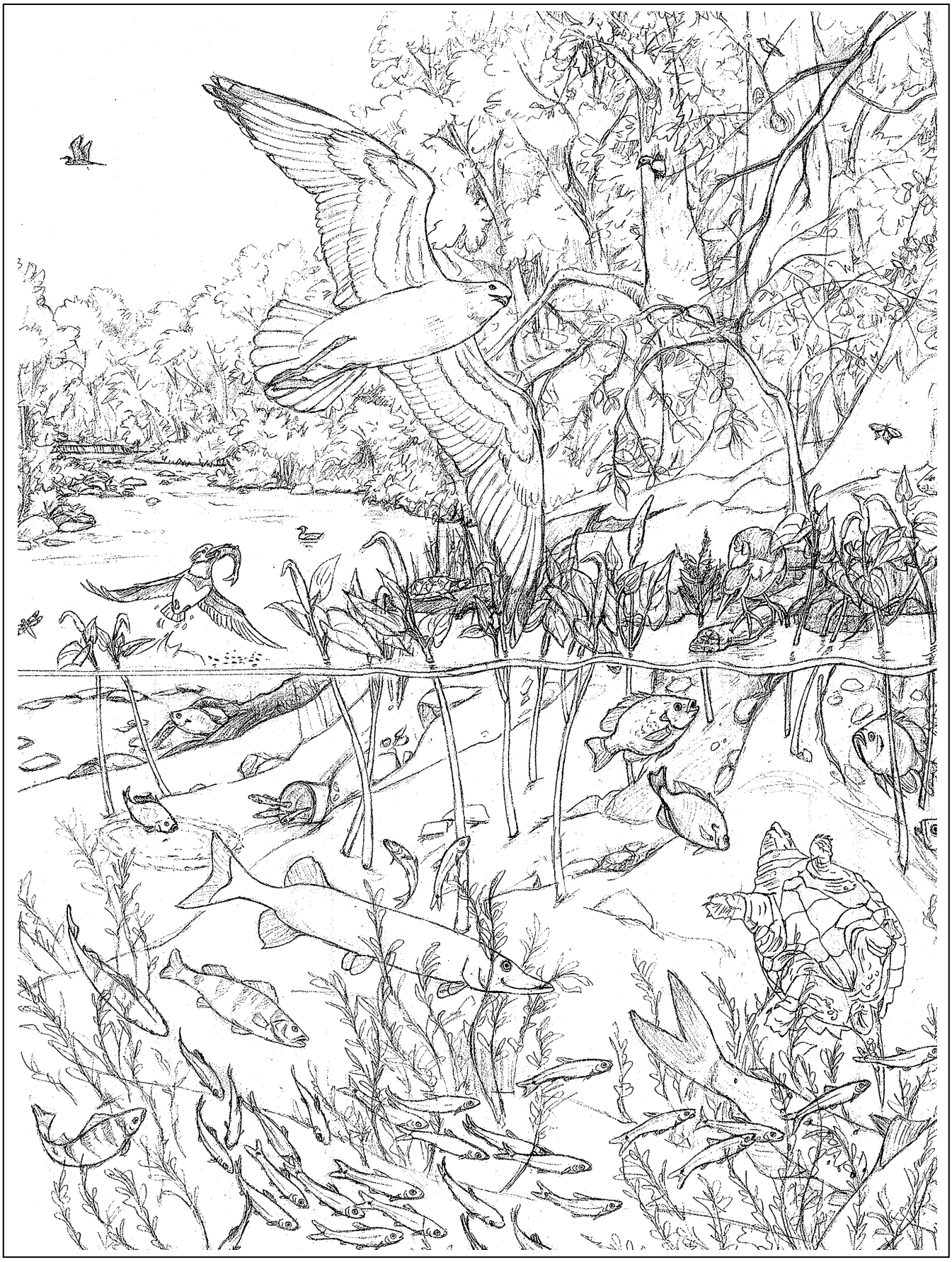


"The Gradient"

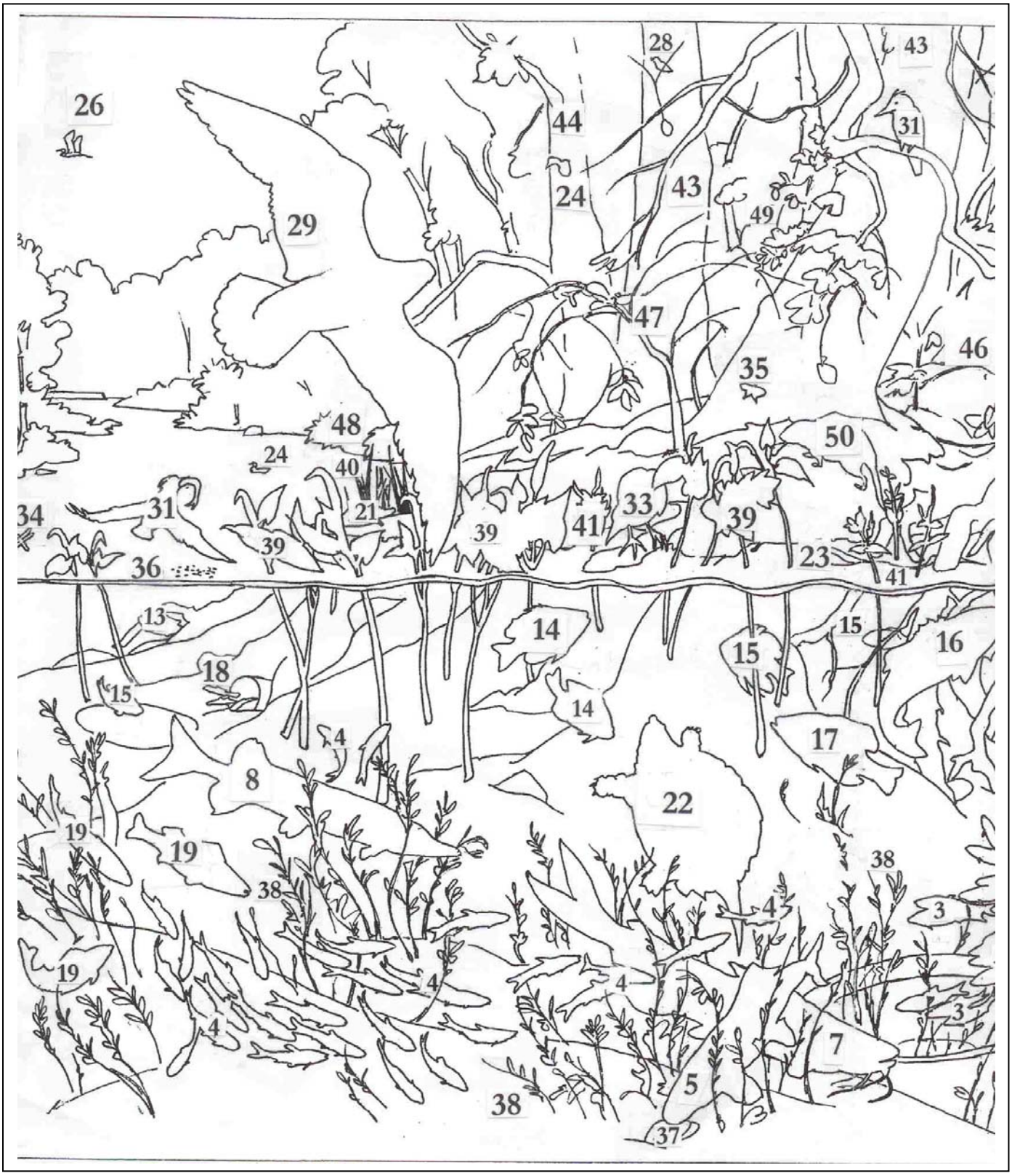
BY
LINDA THOMAS
ltartist@yahoo.com

2004

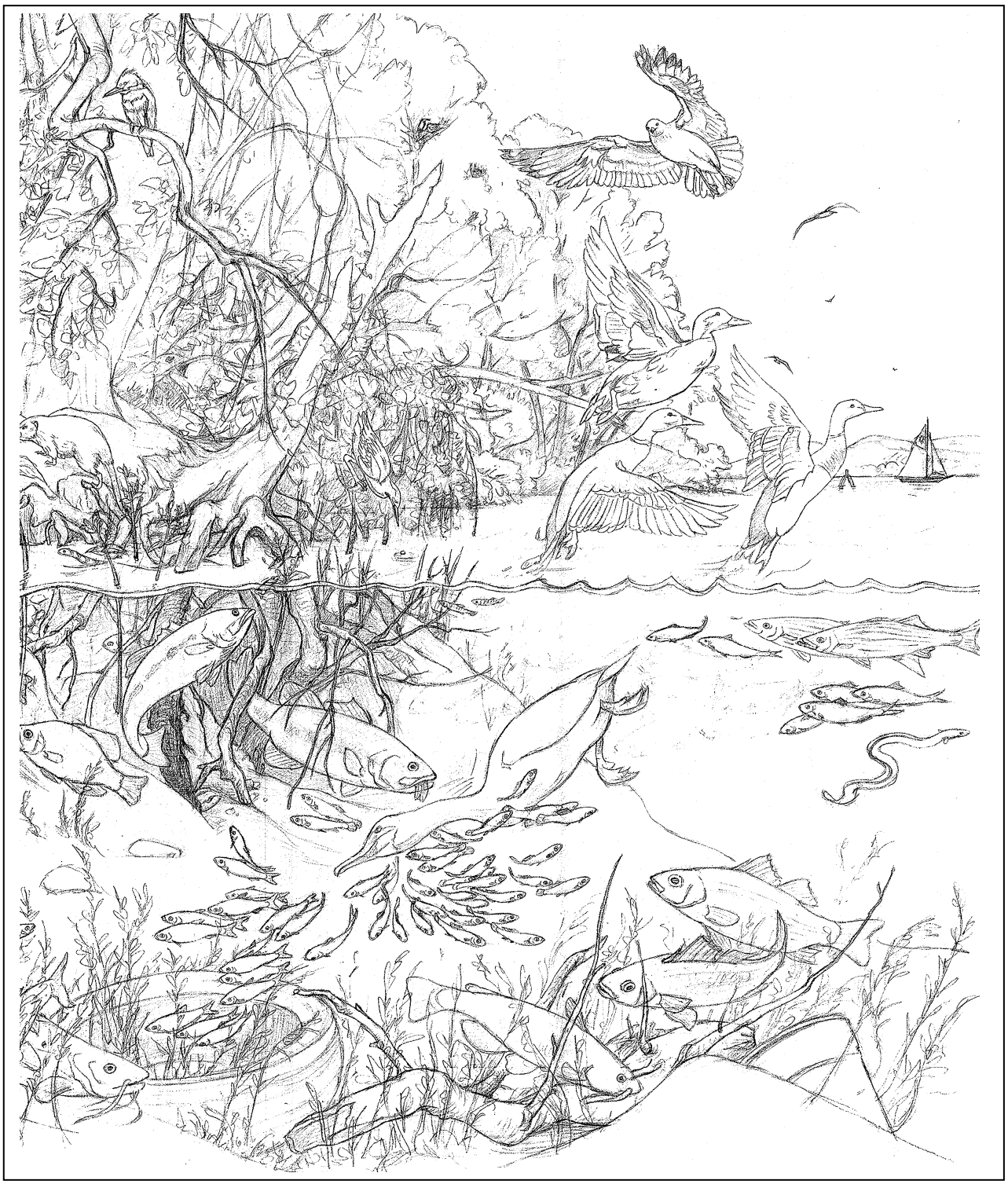
SCENIC REPRESENTATION – LEFTHAND DETAIL



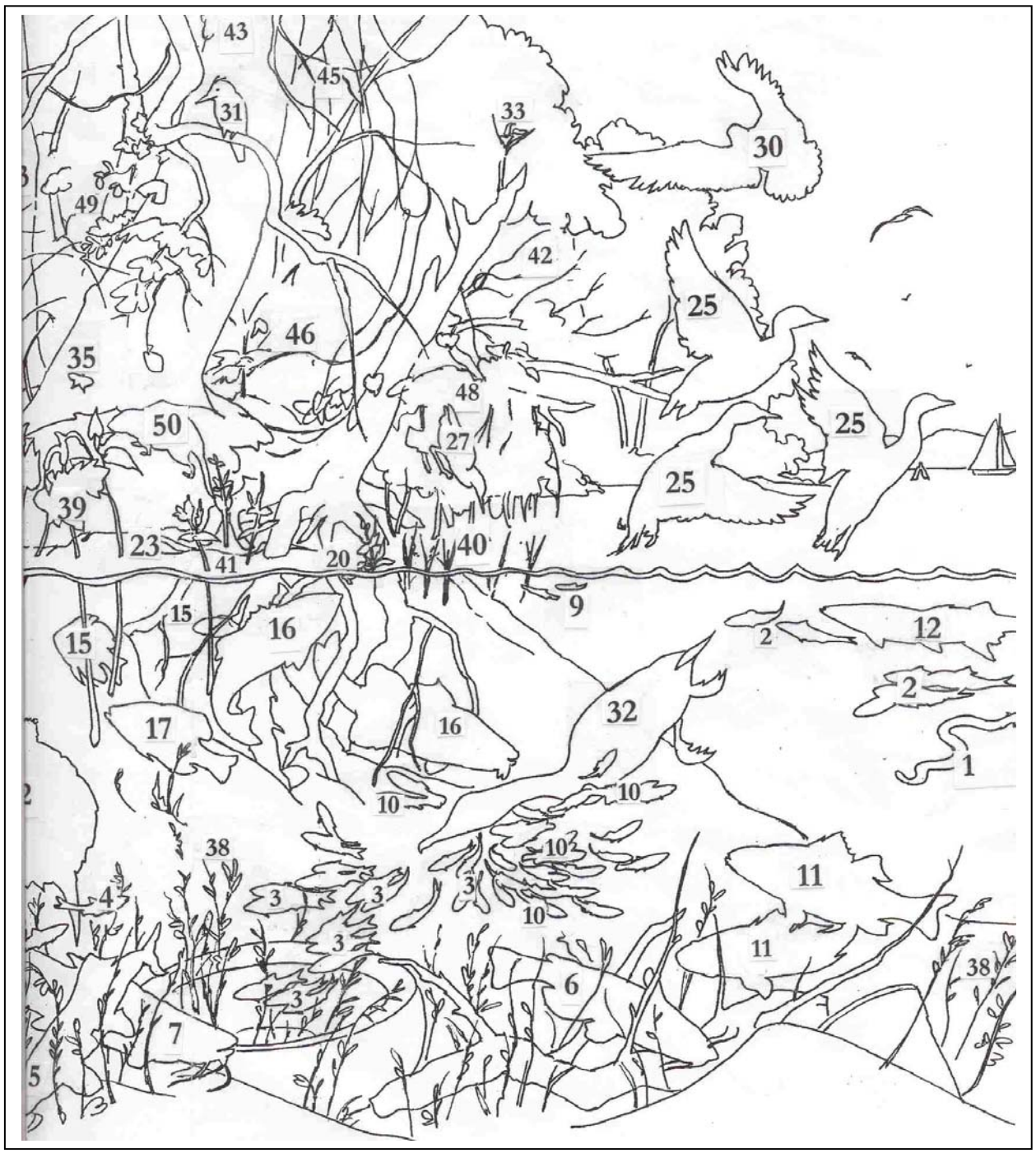
SCENIC REPRESENTATION – LEFTHAND DETAIL KEY MAP



SCENIC REPRESENTATION – RIGHTHAND DETAIL



SCENIC REPRESENTATION – RIGHTHAND DETAIL KEY MAP



SCENIC REPRESENTATION KEY

Fish

1. **American Eel; Anguilla rostrata**
2. **Alewife; Alosa pseudoharengus**
3. **Golden Shiner; Notemigonus crysoleucas**
4. **Spottail Shiner; Notropis husonius**
5. **White Sucker; Catostomus commersoni**
6. **Brown Bullhead; Ameiurus nebulosus**
7. **Channel Catfish; Ictalurus punctatus**
8. **Chain Pickerel; Esox niger**
9. **Eastern Banded Killifish; Fundulus diaphanous diaphanous**
10. **Mummichog; Fundulus heteroclitus**
11. **White Perch; Morone americanus**
12. **Striped Bass; Morone saxatalis**
13. **Redbreast Sunfish; Lepomis auritis**
14. **Pumpkinseed; Lepomis gibbosus**
15. **Bluegill; Lepomis macrochirus**
16. **Largemouth Bass; Micropteris salmoides**
17. **Black Crappie; Pomoris saltatrix**
18. **Tesellated Darter; Etheostoma olmstedi**
19. **Yellow Perch; Perca flavescens**

Amphibians

20. **Green Frog; Rana clamitans**

Reptiles

21. **Wood Turtle; Clemmys insculpta**
22. **Common Snapping Turtle; Chelydra serpentina**
23. **Northern Water Snake; Nerodia sipedon sipedon**

Birds

24. **Wood Duck; Aix sponsa**
25. **Mallard; Anas platyrhynchos**
26. **Great Blue Heron; Ardea herodias**
27. **Green Heron; Butorides striatus**
28. **Yellow Warbler; Dendroica petechia**
29. **Herring Gull; Larus argentatus**
30. **Ring-billed Gull; Larus delawarensis**
31. **Belted Kingfisher; Megaceryle alcyon**
32. **Double-crested Cormorant; Phalacrocorax auritus**
33. **Black-crowned Night Heron; Nycticorax nycticorax**

Dragonflies

34. **Common Whitetail; Libellula lydia**

Butterflies

35. **Spicebush Swallowtail; Papilio troilus**

Aquatic Insects

36. **Whirligig Beetle; Gyrinidae**

Mollusks

37. **Mussel; Unionidae**

Aquatic Plants

38. **Curly Pondweed; Potamageton crispus**

Stream Edge Plants

39. **Lizard's Tail; Saururus cernuus**
40. **American Bur-reed; Sparganium americanum**
41. **American Water Speedwell; Veronica americana**

Trees

42. **Black Willow; Salix nigra**
43. **Eastern Cottonwood; Populus deltoides**
44. **Sycamore; Platanus occidentalis**

Shrubs

45. **Black Haw; Virburnum prunifolium**
46. **Spicebush; Lindera benzoin**
47. **Common Chokecherry; Prunus virginiana**

Vines

48. **River Grape; Vitis riparia**
49. **Poison Ivy; Toxicodendron radicans**

Mammals

50. **Muskrat; Ondatra zibethica**