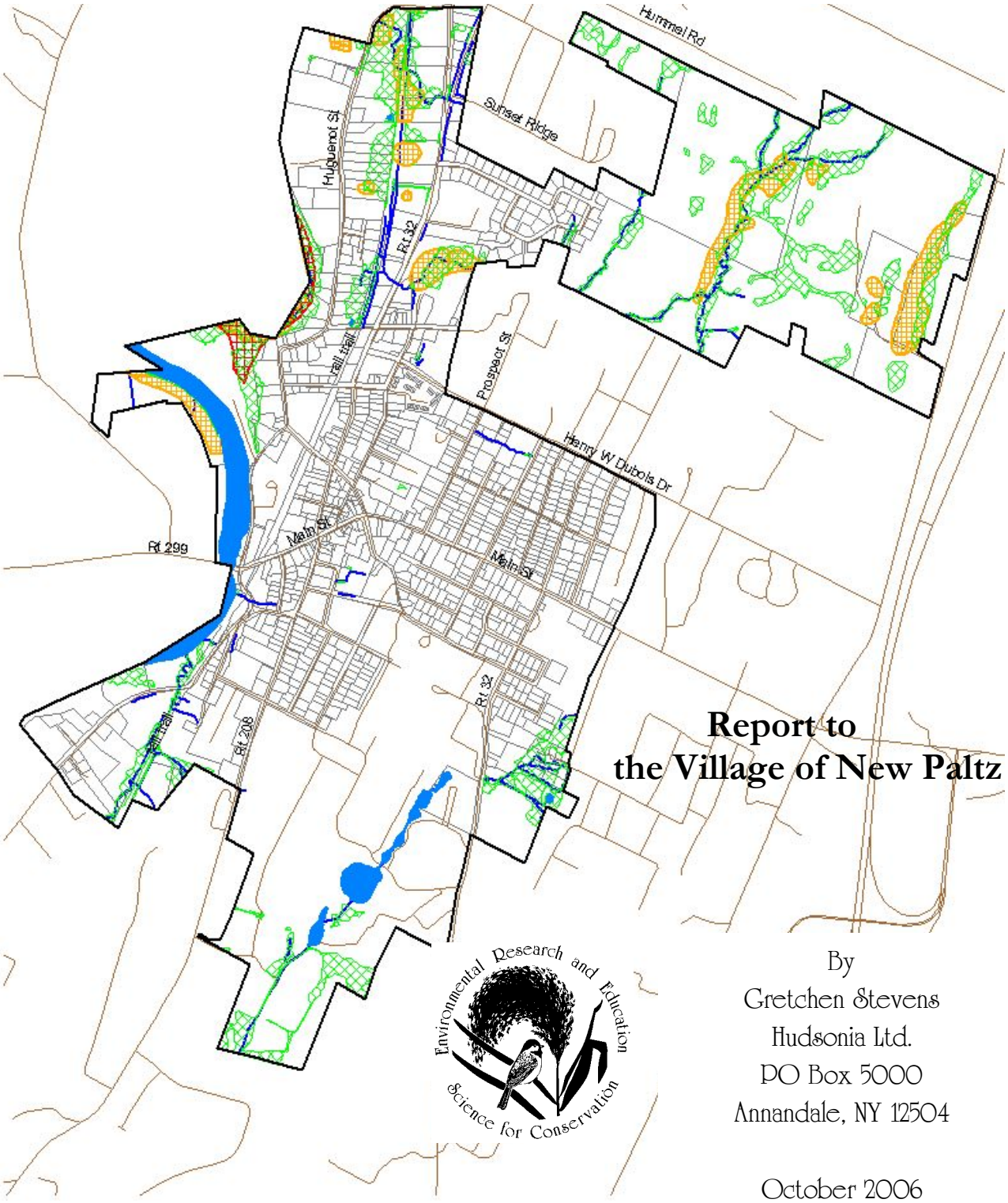
Wetlands in the Village of New Paltz,
Ulster County, New York



Report to the Village of New Paltz

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October 2006

ABSTRACT
Hudsonia identified and mapped wetlands in the Village of New Paltz using remote sensing and field observations. We found over 40 wetlands within the village boundaries. Twenty-three of these appear to meet the federal jurisdictional requirements, including a demonstrable connection to navigable waters. Others meet the federal wetland definition, but due to their hydrologic isolation are unlikely to be regulated under the current federal policy. Three wetlands appear to meet the state jurisdictional requirements but only one of these is depicted on the NYS Freshwater Wetland Map. We found several wetlands of special biological interest, including the Wallkill oxbow wetlands, where we found two endangered plant species—the grass *Diarrhena obovata* and the dodder *Cuscuta obtusiflora*—a high-quality intermittent woodland pool, and a sprawling diverse wetland in the northeast lobe of the village. The latter had beaver ponds, forested and shrub swamps, perennial and intermittent streams, and a seepage clay meadow and pond complex with an unusual plant community and high potential for supporting rare species of plants and animals. This report offers recommendations for protecting wetlands in the village from adverse effects of human activities, and for enhancing their value to the human community and the ecosystem.

INTRODUCTION

Hudsonia Ltd. was asked by the Village of New Paltz, Ulster County, New York, to identify and map wetlands within the municipal village boundaries. The work was carried out in the summer and fall of 2006. This report describes our methods and findings, and includes some recommendations for conservation and restoration of wetlands and streams. A large-format wetland map has been provided to the village with this report.

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BACKGROUND

Wetlands are defined by the Army Corps of Engineers and the US Environmental Protection Agency as:

> *"Those areas that are unundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions"* (Federal Register 1980; Federal Register 1982).

The State of New York regulates wetlands of 12.4 ac (5 ha) and larger, and a few smaller wetlands of special local importance. The state also regulates activities in a 100-ft (30-m) wide "adjacent zone" outside a regulated wetland. The federal government regulates wetlands of any size if there is a demonstrated hydrologic connection to "navigable waters."

The federal government and New York State have set forth similar methods for identifying jurisdictional wetland boundaries on the basis of positive indicators of hydric soils, hydrophytic vegetation, and wetland hydrology (Environmental Laboratory 1987, Browne et al. 1995). The local

code of the Village of New Paltz has no wetland definition, and the "Wetland and Watercourse Protection Law" of the Town of New Paltz does not extend to the village.

State and federal jurisdictional wetland boundaries are identified by examining vegetation, near-surface soil profiles, and readily visible indicators of surface hydrology. The presence or absence of hydrophytic vegetation is assessed by referring to the National List of Plant Species that Occur in Wetlands (Reed et al. 1988) and revisions, which rank the affinities of plant species for wetland or upland conditions. Wetland (hydric) soils are identified by examining the upper approximately 1-1.5 ft (0.3-0.5 m) of the soil profile, and evaluating color, texture, and other features for indicators of prolonged saturation. Wetland hydrology is identified by visible indicators such as drift lines, sediment deposits, or visual observations or records of saturation or inundation.

The New York State Department of Environmental Conservation (NYSDEC) has published a series of New York State Freshwater Wetland maps depicting the recognized state-regulated wetlands, and the US Fish and Wildlife Service (USFWS) has published the National Wetland Inventory map series for federally-regulated wetlands. Both sets of maps are prepared primarily by remote sensing, and both the NYSDEC and the US Army Corps of Engineers (ACOE)—which administer the state and federal wetland regulatory programs—readily acknowledge that the maps are incomplete and inaccurate. Those agencies will take jurisdiction over wetlands that are shown to meet the state or federal jurisdictional criteria even if the wetlands do not appear on the state or federal wetland maps. When land disturbance is proposed in or near wetlands, the agencies typically require that jurisdictional wetland boundaries be delineated in the field by a wetland scientist, surveyed by a land surveyor, and drawn on a site plan.

The scope of work for this project in the Village of New Paltz included identifying wetlands by remote sensing and by quick-assessment field observations, sketch-mapping wetland locations and extent, and preparing a large-format wetland map and a written report. The scope did not include examination of soil profiles, collection of other detailed field data, or surveying of wetland boundaries with GPS or other land surveying equipment. For these reasons, and because all wetland areas were not seen in the field, the wetland map should be considered an approximation. The map is suitable for general planning purposes but not for detailed site planning or for jurisdictional wetland determinations. Jurisdictional boundaries must be identified and surveyed on a site-by-site basis.

METHODS

Hudsonia biologists Gretchen Stevens and Laura Heady identified wetlands by analyzing maps and aerial photographs, and by field observations in the summer and fall of 2006. Map and photo resources included:

- Soil Survey of Ulster County, New York (Tornes 1979).
- USGS 7.5 minute Rosendale and Clintondale topographic map quadrangles, 20-ft contours.
- 1:40,000 scale color infrared aerial photograph stereographic prints from the National Aerial Photography Program series taken in April 1994, obtained from the US Geological Survey.
- High-resolution color infrared digital orthophotos (NY State Plane, NAD 83), taken spring 2001, obtained from the New York State GIS Clearinghouse.

- Topographic and federal wetlands survey map, and conceptual site plan for the "Woodland Pond at New Paltz" project on the Shawangunk Reserve parcel, prepared by Chazen Engineering and Land Surveying Co., P.C., February 2002.

For producing the final map we also used the following digital data layers obtained from David Clouser and Associates:

- USFWS National Wetland Inventory map, Rosendale and Clintondale 7.5 minute quadrangles.
- New York State Freshwater Wetland Map, Rosendale and Clintondale 7.5 minute quadrangles.
- Roads, streams, and tax parcels.

We also referred to a report prepared by Hudsonia (Kiviat 2003) describing observations on the proposed "Mill Brook Greenway" development site in the northeastern part of the village.

We predicted the occurrence of wetlands by analysis of topographic and soils maps listed above, and by interpretation of aerial photo prints using a Geoscope Mirror Stereoscope with 4.3x magnification, and with 4x pocket stereoscopes. We digitized predicted wetlands onto color printouts of orthophoto images, and used these preliminary wetland maps as worksheets to guide our field assessments.

Stevens and Heady conducted field work during the period June – October 2006. We obtained permission from landowners before walking onto private land, and also viewed many areas from public access locations (e.g., public lands, roads, rail trail, SUNY campus). On private parcels where we did not obtain permission and could not see the land from adjacent areas, we identified wetlands through remote sensing alone.

In the field, we identified wetlands by the presence of hydrophytic vegetation, and by readily observable indicators of wetland hydrology (e.g., drift lines, water marks, shallow roots of woody plants, saturated soils). We assessed soil conditions on the basis of visible surface features only; we did not use spades or augers to examine near-surface soil profiles.

We were able to see all or parts of most of the wetlands that we mapped. Some notable exceptions were the wetlands on the parcels belonging to Sunset Ridge LLC, The Lane Group, Inc., and Stephen Erman in the northeast part of the village, where we did not obtain walking access, and were unable to see the wetlands from adjacent properties. We have placed questions marks (?) on the wetland map in Figure 1 for these and other areas where we are especially uncertain of the presence or extent of wetlands.

In addition to wetlands, we also mapped streams and open (substantially unvegetated) water bodies in the village. We identified streams (intermittent and perennial) by field observations and on aerial photos. The stream coverage includes recognizable roadside drainage ditches, but we mapped only the above-ground portions of streams and ditches. Those that discharge to the subsurface stormwater system appear as stream fragments on the map. We believe that the stream coverage may still be incomplete, but it is much more complete and accurate that the digital coverages available from the state or county.

We digitized streams and wetland boundaries onscreen over digital orthophoto images, typically at scales of approximately 1:2000 to 1:3000. Two large-format versions of the final wetland map were prepared for the village—one on an aerial photo image base, and one on a base map of roads and tax parcels. These maps were printed at a scale of approximately 1:4000 using a Hewlett-Packard DesignJet 800PS plotter. We will also convey to the village the digital wetland and streams data created for this project.

RESULTS AND DISCUSSION

We found over 40 wetlands in the village. Wetland locations and extent are shown in Figure 1 of this report, and on the large-format maps accompanying the report.

Three wetlands were large enough to be regulated by New York State, but only one of these, the oxbow wetland, appears on the New York State Freshwater Wetland Map (Rosendale quadrangle) (Figure 1). Most or all of the mapped wetlands meet the federal wetland definition but only these three and perhaps 20 of the other mapped wetlands are jurisdictional wetlands under the current federal policy. The remaining 20 or so have no obvious surface-water connections to other wetlands or waterways so may be unregulated. Only 14 wetland areas appear on the National Wetland Inventory maps (Figure 1). It is common that many wetlands are omitted from these maps, but this has no bearing on the actual jurisdictional status of the included or omitted wetlands. The determination of state or federal wetland jurisdiction is ultimately made by the ACOE or by NYSDEC if called upon to do so in the course of environmental or permit reviews.

Many of the wetlands that we identified were small—e.g., less than 0.1 ac (0.04 ha); some were little more than vegetated ditches, but some were larger than 20 ac (9 ha) and extended well beyond the village boundaries. Several wetlands are described below; each of these is assigned a number for reference in Figure 1.

Wetland 1 (eastern swamp on Shawangunk Reserve)

This was a north-south oriented elongate hardwood swamp (wetlands "AA" and "AB" on the Chazen map and by Kiviat [2003]) near the eastern property boundary of the Shawangunk Reserve parcel in the northeastern part of the village. It was dominated by green ash, pin oak, and slippery elm, had a variably open or dense understory of wetland shrubs such as silky dogwood, nannyberry, and spicebush, and a ground layer of native graminoids and forbs such as fowl mannagrass, stout wood reedgrass, tussock sedge, soft rush, crested fern, sensitive fern, and grass-leaved goldenrod. Purple loosestrife was present in areas of open canopy. Although much of the swamp had little standing water at survey times (early and mid-August), some areas looked as though they would hold standing water into the early summer of most years. The good condition of the swamp, its location in a large forested area, and its proximity to Wetland 2, described below, enhance the ecological value of this wetland to wildlife.

Wetland 2 (intermittent woodland pool)

Wetland 2 was an intermittent woodland pool on a parcel owned by Stephen Erman in the northeastern part of the village. It is referred to as wetland AAA on the Chazen map and by Kiviat (2003). We did not have access to this property, but Kiviat (2003) described it as a high quality woodland pool with pin oak, buttonbush, and silky dogwood, and few invasive plant species. Due to the vegetation structure, intermittent surface water, isolation from other water bodies, and its location in the interior of a large

forested area, this wetland may provide good habitat for pool-breeding amphibians such as wood frog, spotted salamander, Jefferson salamander, and marbled salamander. Large areas of the surrounding forest would provide essential habitat for these species during the non-breeding season. Due to its small size and hydrologic isolation, the pool would probably not be regulated by the state or federal government. This was the only intermittent woodland pool that we identified in the village. Several other isolated wooded swamps may also provide breeding habitat for these amphibians in wetter years, but most appeared to have hydroperiods too short to sustain the salamanders through metamophosis. An exception may be Wetland 1 just east of Wetland 2, which had areas of deeper pools. It is possible that areas of Wetland 3 (described below) may also have suitable habitats for these species.

Wetland 3 (large Shawangunk Reserve/Sunset Ridge wetland)
Wetland 3 was a large wetland complex in the northeast portion of the village that extends into at least four properties in the village and several others outside in the village. It includes the wetland areas referred to on the Chazen maps and by Kiviat (2003) as wetlands A, ZA, ZB, ZC, and ZD. This appears to be a single contiguous wetland, including the mainstem of Tributary 13 and several feeder streams. I visited only the portions of Wetland 3 on the Shawangunk Reserve property, and rely here on Kiviat's descriptions of the areas of Wetland 3 on the Sunset Ridge property. Wetland 3 contained a diverse array of wetland habitats including shrubby and herbaceous wet meadows, a constructed pond bordered by clayey seepage meadows, wooded and shrubby seeps, beaver ponds, and wooded swamps.

The constructed pond and adjacent seepage meadows (at "Wetland ZB") had unusual plant communities. In early August the pond surface was 2/3 covered with watershield (*Brassenia schreberi*), a floating-leaved aquatic plant that is uncommon in the region. I found the liverwort *Riccia fluitans*, Nuttall's(?) waterweed (*Elodea nuttallii*), needle spikerush (*Eleocharis acicularis*), and cone-spur bladderwort (*Utricularia gibba*) in the pond shallows. The clayey seepage areas sloping toward the northeastern and eastern edges of the pond had knotted rush (*Juncus nodosus*), narrow-panicled rush (*Juncus brevicaudatus*), *Juncus secundus*, fimbry (*Fimbristylis autumnalis*), smooth panic-grass (*Panicum dichotomiflorum* var. *puritanorum*), beard-tongue (*Penstemon digitalis*), wandlike bush-clover, (*Lespedeza intermedia*), rose milkwort (*Polygala sanguinea*), seedbox (*Ludwigia alternifolia),* marsh speedwell (*Veronica scutellata*), gray goldenrod (*Solidago nemoralis*), and prairie willow (*Salix humilis*). The presence of these uncommon species suggests that further biological surveys might yield rare plants or animals using these habitats. Kiviat (2003) mentioned the possibility of northern cricket frog, wood turtle, spotted turtle, nesting pied-billed grebe, wood duck, and American black duck using the pond, and of Cecropia and Polyphemus moths, and sedge wren using the seepage meadows.

I have no first-hand knowledge of the beaver ponds and associated wetland areas ("ZC") on the Sunset Ridge parcel. Kiviat (2003) described both active and inactive beaver ponds with diverse wetland and pond habitats, and potential habitat for ribbon snake, wood turtle, spotted turtle, northern cricket frog, pied-billed grebe, great blue heron, American black duck, river otter, and bats in the beaver ponds, and blue-spotted and four-toed salamanders, red-shouldered hawk (nesting), American woodcock, and barred owl in the northern swamp.

The "ZD" portion of Wetland 3 (on the Shawangunk Reserve property) was mainly deciduous forested and shrub swamp bordering Tributary 13 and a small stream entering from the south. A wet meadow (apparently an old beaver flowage) just north of that stream junction had many standing snags. The streams were clear and cool in mid-September. The southern tributary, which appeared to be perennial or nearly so, had many small sandy-bottomed pools up to 3 ft (1 m) deep at survey time, and a broad floodplain that was variously wooded swamp and wet meadow. Both this stream and Tributary 13 had

several small colonies of water starwort (*Callitriche heterophylla*). Other parts of Wetland 3 had wet shrubby oldfield areas and wooded swamps bordering intermittent streams in complex configurations on the landscape.

The diverse array of habitats in Wetland 3 and its location in the interior of a large forest may make the wetland especially valuable for wildlife that are sensitive to human disturbance. The calcareous nature of some of the habitats, and especially of the "Wetland ZB" area, indicates the possibility of certain rare species of plants and animals.

Wetland 4 (northwest swamps and wet meadows)
Wetland 4 was a wetland of over 15 ac (6 ha) east and west of the rail trail in the northwestern corner of the village. The wetland contained large areas of wet meadow, hardwood swamp, and shrub swamp that extend northwest across Huguenot Street, outside the village boundary. The forested swamps were dominated by red maple, elms, pin oak, and green ash, and had shrubby understories of northern arrowwood, nannyberry, silky dogwood, and eastern red cedar. The northern-most swamp appeared to be of fairly high quality, with a diverse plant community, few non-native plants, and little other evidence of direct disturbance except for the ditching of Tributary 13 though the swamp. The shrub swamp areas had such species as nannyberry, northern arrowwood, Bell's honeysuckle, multiflora rose, and pussy willow. The wet meadows were quite variable—some were dominated by purple loosestrife and cattail; others had diverse oldfield plants such as goldenrods (*Solidago rugosa, S. gigantea*), purple loosestrife, clearweed, dotted smartweed, and scattered woody plants such as silky dogwood, slippery elm, eastern cottonwood, and Bell's honeysuckle. Wetland 4 was drained by Tributary 13 which flows across Huguenot Street and thence northwest into the Wallkill. The meadows are likely to provide foraging habitat for songbirds and small mammals, and may support a diverse invertebrate community including butterflies, moths, dragonflies, and damselflies. American woodcock (declining in the region) is likely to use the meadows and shrub swamps for courtship and foraging. The wetland probably serves an important role in improving the quality of water running off lawns and driveways before it enters Tributary 13. The wetland exceeds the 12.4 ac size threshold, so should be regulated by the New York State even though it does not appear on the NYS Freshwater Wetland Map (Rosendale quadrangle).

Wetland 5 (oxbow wetlands)
Approximately 11 ac (4.5 ha) of the wetland complex associated with the old Wallkill River oxbow lies inside the village boundary, and much larger areas are outside the village. This is an extraordinary expanse of diverse and apparently high quality wetland, including wooded swamps, shrub swamps, wet meadows, marshes, and open water. East of the village sewage treatment plant and municipal parking lot was a large hardwood swamp and wet meadow area. The swamp was dominated by silver maple, green ash, and slippery elm, and the ground layer had a diverse community of native wetland plants, including sensitive fern, fowl mannagrass, *Carex crinita*, *Carex annectans*, inflated sedge, skunk-cabbage, common jewelweed, beggarticks, halberd-leaved tearthumb, and bog-hemp. The wet meadow had a small stand of common reed, but was otherwise dominated by *Carex trichocarpa,* an uncommon sedge in the region. Other common plants in the wet meadow were rice-cutgrass, marsh wild-rye, a bur-reed, water-plantain, broad-leaved arrowhead, arrow-leaved tearthumb, purple loosestrife, and skunk-cabbage.

Bordering the oxbow channel itself were areas of shrub swamp (buttonbush, willows) and emergent marsh (rice-cutgrass, bluejoint, *Carex comosa*, *Carex stipata*, water-smartweed, halberd-leaved tearthumb, spiny coontail, purple loosestrife, a watermeal, bulb-bearing water-hemlock). We heard bullfrog and

green frog calling, and saw green heron and great blue heron feeding and flying. The shrub swamp and marsh habitats that border most of the oxbow channel had the appearance of very good breeding, nursery, and foraging habitat for waterfowl, wading birds, and wetland-associated songbirds. Bordered on the north and west (outside the village) by agricultural fields, and on the south by the sewage treatment plant and community gardens, the wetlands were somewhat insulated from intensive human activity.

We found two state-listed endangered plants in this meadow and swamp area of the oxbow wetlands: the dodder *Cuscuta obtusiflora* var. *glandulosa,* and the grass *Diarrhena obovata*. Dodders were abundant in the meadow, but I collected only one specimen. Because they are not reliably identified in the field, I cannot say whether this dodder species was widespread or rare in the wetland. A fairly dense patch of diarrhena covered a slightly elevated mound measuring ca 25 ft (8 m) in diameter in the wooded swamp east of the sewage treatment plant. Specimens of both plants have been deposited in the Bard College Field Station Herbarium. The only other location that I know of for diarrhena in the Hudson Valley was also on the Wallkill.

Wetland 6 (southwest swamp and meadow)
Wetland 6 was an elongate wetland west of the rail trail in the southwest corner of the village. The wetland extends approximately 1200 ft (365 m) within the village, and continues south of the village boundary. It occurs along a stream that originates in the large stormwater/ornamental ponds on the SUNY campus, takes a long dip south, turns west and then north at Cedar Lane, and flows north along the rail trail until it enters the Wallkill at the municipal boat landing on Plains Road.

Much of the village portion of Wetland 6 was wet meadow and marsh, but there were areas of hardwood swamp and shrub swamp at the south end, and small shallow pools in the north. The stream channel was narrow and rocky north and south, but spread out in the interior into marshy meadow areas dominated by purple loosestrife and arrow-leaved tearthumb. Toward the south end, small areas of alder swamp gave way to forested swamp with maples, elms, willows, and eastern cottonwood.

The pools and deeply flooded meadow looked like good habitat for reptiles such as painted turtle, snapping turtle, and northern water snake, foraging habitat for herons and shorebirds, and resting and foraging for waterfowl. In late July we observed a basking painted turtle, and a spotted sandpiper feeding on the mudflat adjacent to one of the pools. Both the stream and the wetland probably serve to improve the water quality of runoff entering the stream from the SUNY campus and other sources, and thus help to protect the water quality of the Wallkill River. Fortunately, most of the residences on Plains Road east of Wetland 6 are set well back from the wetland, and have substantial forested buffers.

Wetland 7 (south swamp)
Much of Wetland 7 lies outside the village boundary, but the portion located south of the SUNY athletic fields appeared to be a good quality mature hardwood swamp dominated by pin oak, swamp white oak, green ash, and red maple, with an understory of native shrubs and herbs. The soil was mucky at the surface, and standing water was present in small pools at survey time (mid-July). An old silt fabric fence had been installed in the swamp, presumably to protect it from siltation from soil eroding from the disturbed knoll and fill just north of the swamp, but sediments collected at the fence had not been removed.

Wetland 8, (southeast swamp and meadow)
Wetland 8 contained wet meadow, wooded swamp, and two constructed pools, the larger of which appears on the 1957 USGS topographic map; the smaller may be much more recent. The central part of the wetland has been highly disturbed by fill deposition. Most of the property was still wetland despite all the filling. The wetland also extends onto the high school property to the north. The southern wet meadow was vegetated with weedy oldfield species, such as reed canary-grass, purple loosestrife, and soft rush; it also had some calcicoles including blue vervain and New York ironweed. An area of old fill has created an upland meadow island. A ditched stream flowed west across the south end of the meadow. The high school property had a good quality wet meadow vegetated with grasses and sedges, and bordered by swamp on all sides. Although Wetland 8 had been much disturbed, there is potential for restoration. I understand that a residential development has been proposed for the property. Any development of the site will require substantial wetland filling, but if development nonetheless proceeds, it may create an opportunity for restoration of certain parts of the remaining wetland.

WETLAND PROTECTION AND CONSERVATION

It is well-established that wetlands provide an array of valuable services to the human community, and that they are often essential components of natural ecosystems. The importance of wetlands for absorbing flood flows, for water quality amelioration, for maintaining stream flows, and for providing wildlife habitat is the basis for most federal, state, and local wetland protection statutes. A wetland's ability to serve these functions is shaped by its non-biological (soils, geology, landscape setting) and biological attributes, and the condition of the wetland's watershed. Wetlands that occupy low areas of the local landscape often bear a disproportional share of adverse effects from natural and human disturbances in the landscape. Moreover, the ecology and quality of wetlands and streams can be strongly influenced by activities in distant parts of the watershed that disrupt wildlife habitats or alter the quality or quantity of groundwater and surface water flows.

Many of the wetlands in the central village, along the northern length of Route 32, and around the SUNY athletic fields were small vegetated swales designed to (or at least functioning to) collect and detain water from adjacent developed areas, and in some cases convey the water to other streams or to the subsurface stormwater system. Perhaps the most important functions served by these wetlands in the densely settled areas of the village are collection and retention of runoff, recharge of groundwater, dampening of flood-flows, and improvement of water quality in the Wallkill River. Enhancing and expanding these wetlands wherever possible will improve their ability to serve these functions.

Most of the other wetlands identified in this project were located in outlying areas of the village. While some of these were in somewhat natural (e.g., wooded) settings, all have been subject to fairly intensive direct or indirect disturbance from human activity in the past, including damming, ditching, filling, land clearing, and agriculture. Some still retain an apparently high-functioning biological community, and are probably providing high levels of other services to the natural and built landscape. Those wetlands adjacent to large undeveloped land areas have the greatest potential for continued biological health.

Maintaining the biological integrity of these wetlands will require not only maintaining a "buffer" (e.g. 100-300+ ft) around their edges, but also attention to activities in their entire watersheds. In particular, this will mean avoiding activities that might disrupt the quality and quantity of surface water or groundwater feeding the wetlands or the habitats available to wildlife that use the wetlands as part of a larger habitat complex. Wetland 3, for example, is likely to be used by a host of wide-ranging wildlife

species, such as turtles and salamanders, that need a variety of other wetland and non-wetland habitats, and safe travelways between them. Protecting only the wetland footprint and a narrow buffer zone would do little to protect the critical habitats for these species. Parts of Wetland 3 appear to be spring-fed, and this may help to account for the special plant community observed in the "ZB" portion of the wetland. Increased surface runoff and disruptions to groundwater recharge in the watershed of that wetland could significantly alter the physical and biological conditions that support unusual species. Land clearing, and construction of roads and buildings would tend to reduce groundwater infiltration in upland areas, and increase the volume, velocity, and temperatures of surface runoff. Also, runoff from paved areas, lawns, gardens, and other manicured areas would tend to be warmer and have higher concentrations of nutrients, sediments, and toxic pollutants than water running off a forested watershed.

Below I offer some general recommendations for measures in and near the village wetlands and streams, and also some specific recommendations for particular wetlands.

RECOMMENDATIONS

These recommendations are based on several precepts regarding the effects of water movement and landscape interactions on wetland functions.

-- Adequate groundwater volumes are essential to maintaining many wetlands as well as the base flows of streams.

-- In upland areas, allowing water to infiltrate the soil instead of running off the soil surface helps to maintain groundwater volumes, reduces pollution and siltation of streams and wetlands, and reduces "flashiness" and scouring of streams in response to precipitation events.

--Many of the beneficial water quality functions provided by wetlands and streams are attributable to processes related to water contact with vegetation and biologically active soil (within a few cm of the soil surface). Prolonging that contact is one of the best general strategies for stormwater management design in urban areas. Using vegetated swales and basins to hold stormwater runoff serves this purpose and also allows precipitation and snowmelt to infiltrate the soil.

--Maintaining wetland hydroperiods (depth, duration, seasonal and year-to-year fluctuations of surface water) is essential to maintaining the biological communities of wetlands.

--Wetlands in less developed settings are often part of large complexes of habitats used by mobile wildlife. To sustain the wetlands' value to wildlife, broad connections to other habitats must be preserved.

<u>General Recommendations</u>

- Maintain broad buffer zones of undisturbed soils and vegetation at the edges of good quality wetlands, and maintain broad corridors connecting those wetlands to other wetland and upland habitats.
- Maintain and expand vegetated buffers of wetlands and streams. Encourage or plant native woody vegetation wherever possible and practical without damaging infrastructure or compromising human safety.

- In developed areas, increase onsite retention of surface runoff and maximize opportunities for onsite groundwater infiltration. On undeveloped land, design any new construction such that runoff during and after construction does not exceed pre-construction volumes.
- Collect stormwater runoff in settling basins before discharging to streams.
- Where ditching is necessary to convey surface water short distances, create vegetated or rock-lined swales instead of exposed ditches. This will minimize the streambank erosion potential, help to reduce streamwater velocity, and increase the duration of water/soil contact.
- Minimize or avoid applications of pesticides and fertilizers.
- Avoid directing stormwater from developed areas into good quality wetlands. Use vegetated swales and constructed vegetated basins to treat water before allowing it discharge to streams or wetlands.

Site-Specific Recommendations

Wetland 1 (eastern swamp on Shawangunk Reserve): Maintain a broad, undisturbed buffer zone, a large surrounding forested area, and broad forested connections with other wetlands, including (and especially) Wetland 2.

Wetland 2 (intermittent woodland pool): Maintain a broad, undisturbed buffer zone, and consider establishing a 750-ft-wide "conservation zone" around the pool to maintain upland forested habitat for pool-breeding amphibians. Within this zone, up to 25% of the land could be developed as long as the development is located and designed to minimize forest disturbance, and maximize the area of contiguous undisturbed land connecting the pool to other upland and wetland habitats (Calhoun and Klemens 2002). Design stormwater systems so that quantity or quality of surface or groundwater feeding the pool is not disrupted.

Wetland 3 (large Shawangunk Reserve/Sunset Ridge wetland): Avoid any disturbance of the steep slopes adjacent to the wetland. If proposed development of the properties proceeds, design the project such that quality and quantity of groundwater and surface water feeding Wetland 3 are not disrupted. Maintain as much undisturbed vegetation and soil in the watershed as possible. Concentrate development in ways to maximize broad contiguity of Wetland 3 with other undeveloped wetland and upland habitats, both onsite and offsite. Pay special attention to protection of the beaver flowages on the Sunset Ridge parcel, and the "ZB" pond and clayey seepage meadow. Alert NYSDEC to the presence of a potential state-jurisdictional wetland in this area; ask them to confirm, and to amend the state wetland map accordingly at the next opportunity.

Wetland 4 (northwest meadows and swamps): 'Soften" the entire ditched reach of Tributary 13 west of Route 32 by adding rock rubble to the stream bottom and banks where possible, and find means upstream to reduce stormwater volumes feeding the stream. Educate Huguenot Street landowners about the importance of minimizing application of pesticides and fertilizers to the manicured areas on their properties (and to the wetland areas themselves). Alert NYSDEC to the presence of a potential state-jurisdictional wetland in this area; ask them to confirm, and to amend the state wetland map accordingly at the next opportunity.

Wetland 5 (oxbow wetlands): Avoid any further physical encroachment (e.g., filling) on the oxbow wetlands, and expand the vegetated buffer wherever possible. Educate Huguenot Street landowners

about the importance of avoiding soil disturbance, and maintaining woody vegetation on the steep slopes abutting the oxbow. Prohibit new construction of buildings, roads, or other impervious surfaces on lands adjacent to the oxbow.

Wetland 6 (southwest meadow and swamp): Maintain and increase woody vegetation between the rail trail and the wetland to help minimize disturbance to wildlife from rail trail users. Educate Plains Road landowners about the importance of maintaining undisturbed soils and forested slopes leading down to the wetland.

Wetland 7 (south swamp): Avoid further filling or soil disturbance of the wetland. Minimize or eliminate applications of fertilizer and pesticides on the athletic fields.

Wetland 8 (disturbed southeast swamp): Should the development proposed for this wetland proceed, I recommend that the stream be well-buffered by a broad zone of undisturbed soils and vegetation, that new development be concentrated in existing fill areas as much as possible, and that the areas of least-disturbed wetland be retained in as natural a state as possible.

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