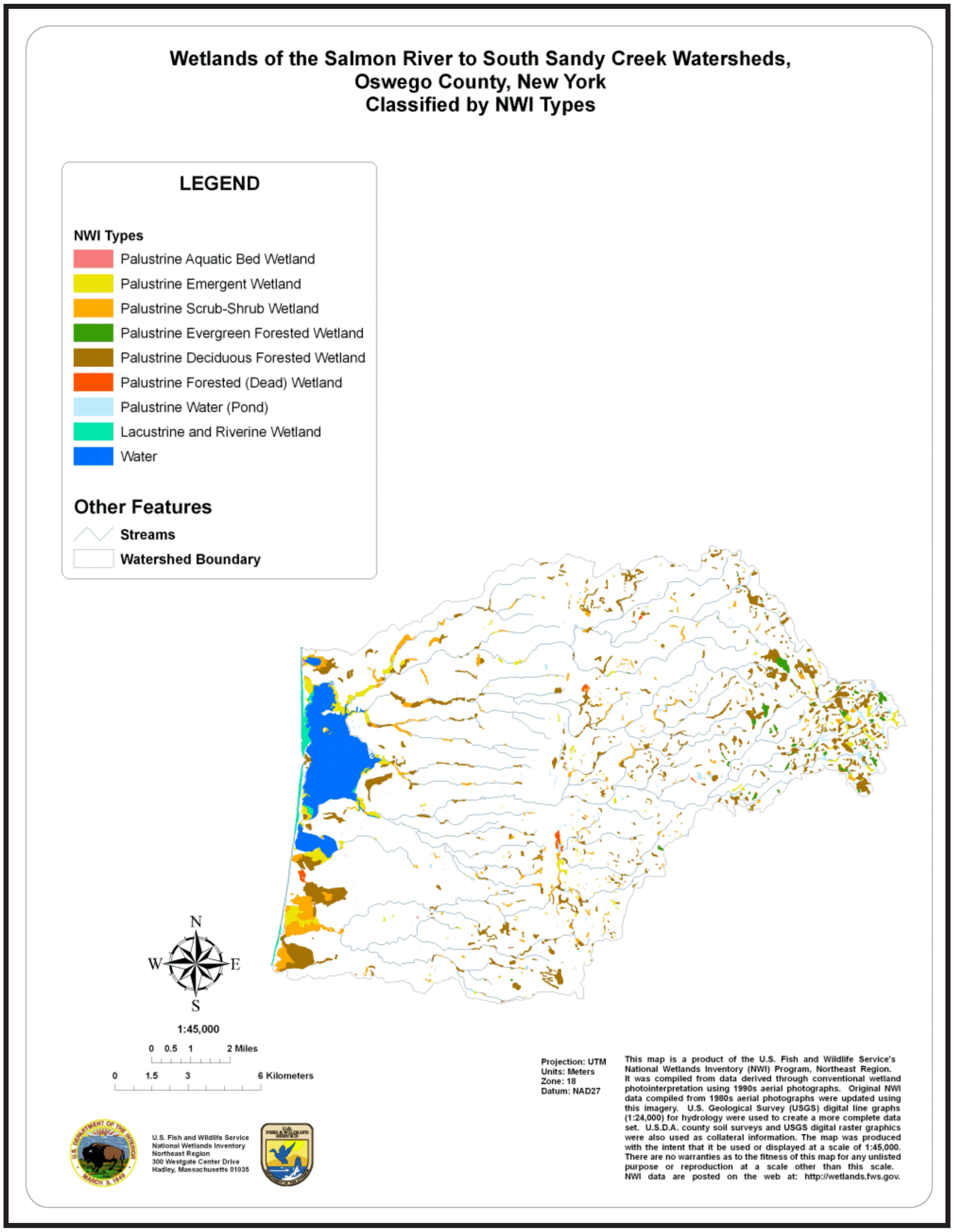
U.S. Fish & Wildlife Service

Wetlands of the Salmon River to South Sandy Creek Watersheds

Oswego County, New York

Ralph W. Tiner
Regional Wetland Coordinator
National Wetlands Inventory Program
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035

September 2006



This report should be cited as: Tiner, R.W. 2006. Wetlands of the Salmon River to South Sandy Creek Watershed, Oswego County, New York. U.S. Fish and Wildlife Service, National Wetlands Inventory, Northeast Region, Hadley, MA. Prepared for the New York State Department of Environmental Conservation, Division of Fish, Wildlife, and Marine Resources, Bureau of Habitat, Albany, NY. 21 pp.

Table of Contents

Introduction

Since the mid-1970s, the U.S. Fish and Wildlife Service (FWS) has been mapping wetlands through its National Wetlands Inventory Program (NWI). Wetlands are identified and delineated on aerial photographs with these data transferred to base maps at a scale of 1:24,000 for the coterminous United States (1:63,360 for Alaska). To date, wetland maps have been prepared for over 95 % of the coterminous United States and about 40% of Alaska. Nationwide, the focus of the inventory has been on producing these maps and digital data which can be used by the FWS, other government agencies, organizations, private industry, and the general public to locate wetlands when considering land development and natural resource conservation initiatives. The maps have been digitized for nearly 50% of the coterminous U.S. and about 20% of Alaska.

The availability of NWI digital data makes it possible to analyze the wetland data for large geographic areas and facilitate compilation of acreage summaries for inventory reports. It also allows for data integration with other digital datasets that result in more complex analyses and interpretations. As a result of the increasing available of digital data from other sources such as U.S. Geological Survey's (USGS) digital line graphs (DLGs) for hydrology data (location of streams) and digital raster graphics (DRGs) for topographic map information and U.S.D.A. Natural Resources Conservation Service's (NRCS) soil data, the FWS can improve its wetland inventory by adding presumably undrained hydric soil map units from the latter source and better represent linkages between wetlands connected by streams through use of the former.

With the explosion of digital geospatial data on natural resources and the increased knowledge of wetland characteristics related to wetland functions (e.g., Brinson 1993), the NWI developed a procedure for expanding the classification of wetlands to include variables on landscape position, landform, water flow path, and waterbody type.[1] Armed with this information plus the original NWI data (following the Cowardin et al. 1979 wetland classification system) permits the FWS to predict wetland functions for large geographic areas. These techniques have been developed by the Northeast Region of the FWS recognizing the need for information on wetland functions by government agencies, the private sector, and the general public. Once these other attributes are added to the NWI database, wetland functions can be predicted for watersheds and other large geographic areas through procedures called "Watershed-based Preliminary Assessment of Wetland Functions" (W-PAWF).

The New York State Department of Environmental Conservation (NYSDEC) has regulatory responsibilities for managing the state's wetland resources outside of the Adirondack Park. The Landscape Conservation Section of the Division of Fish, Wildlife, and Marine Resources, Bureau of Habitat, was interested in having the NWI conduct

[1] These attributes have been applied to wetlands across the Northeast (e.g., Maine, Massachusetts, New York, Pennsylvania, New Jersey, Maryland, and Delaware) and in selected areas elsewhere as part of special NWI projects. The State of Michigan is applying them to select watersheds.

pilot studies in various regions of New York State. Consequently, they secured funding from the U.S. Environmental Protection Agency to have the FWS expand the classification of existing NWI mapping and apply the W-PAWF techniques to several small watersheds.

This report describes the basic mapping, classification, and evaluation techniques used in these studies and specifically describes the findings for the Salmon River to South Sandy Creek watershed. Similar reports are available for the other study areas.

Study Area

The study area is the Salmon River to South Sandy Creek watershed in Oswego County, New York. It covers a land area approximately 117 square miles in size, represented by the following U.S. Geological Survey 11-digit hydrological unit code: 04140102070. The watershed lies north of the Salmon River and the town of Pulaski and south of the South Sandy Creek It contains two coastal ponds - North Pond and South Pond, and numerous streams - Big Deerlick Creek, Skinner Creek, Lindsey Creek, Jacobs Brook, South Branch, Mud Creek, Blind Creek, Little Sandy Creek, Deer Creek, Little Deer Creek, and Alder Creek. Deer Creek Marsh is the largest wetland complex in the watershed; it is located in southwestern portion of the watershed, just south of South Pond.

Methods

Classification and Characterization

The first task was to enhance the existing NWI dataset by adding LLWW attributes to each mapped wetland and deepwater habitat, as appropriate. Existing NWI maps and digital data for the study area were the primary base data for this characterization. These data were based on interpretation of early 1980s 1:58,000 color infrared photographs. The minimum mapping unit was 1-3 acres in size and in general, drier-end wetlands (e.g., seasonally saturated types) and evergreen forested wetlands were conservatively mapped.[2] USGS digital data for streams and NWI linear data were used to determine linkages among wetlands and between wetlands and deepwater habitats. No attempt was made to improve the geospatial or classification accuracy of the original data. The existing NWI database contains geospatial information on both wetlands and deepwater habitats. Since ultimate objective of this study is to use the inventory data for wetland assessment, wetlands had to be separated from deepwater habitats. Ponds were then separated from other wetlands, so that additional descriptors could be added.

Three main descriptors (landscape position, landform, and water flow path) were applied to each wetland by interpreting map information and consulting aerial photos where necessary. "Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors" (Tiner 2003a) was used to classify these features. Other modifiers were added to depict features such as headwater, drainage-divide, and human-impacted wetlands.

Landscape position defines the relationship between a wetland and an adjacent waterbody if present. For this watershed, three landscape positions were possible:

1) lotic (along rivers and streams and on their active floodplains),
2) lentic (along lakes and reservoirs), and
3) terrene (more or less surrounded by upland).

Lotic wetlands are divided in lotic river and lotic stream wetlands by their width on a 1:24,000-scale map. Watercourses mapped as linear (single-line) features on NWI maps and on a USGS topographic map (1:24,000) were designated as streams, whereas two-lined channels (polygonal features on the maps) were classified as rivers. Lotic wetlands were also subdivided into gradients for perennial waters: high (e.g., shallow mountain streams on steep slopes), middle (e.g., streams on moderate slopes), and low (e.g., mainstem rivers with considerable floodplain development or streams in flat sections in higher terrain), and intermittent gradient for waters not flowing year-round. Lentic wetlands were divided into two categories: natural and dammed, with the latter type separating wetlands associated with reservoirs from those along other controlled lakes, when possible.

---

[2] Many of the maps were updated after the subject study classification and analysis were completed. In some areas more wetlands were located due to more reliance on hydric soil map units to identify drier-end wetlands.

Landform is the physical form or shape of a wetland. Six landform types were recognized in the study area: 1) basin, 2) flat, 3) slope, 4) floodplain, 5) island, and 6) fringe (Table 1). Wetlands associated with ponds were highlighted in the database; all but the ones associated with floodplains and former floodplains were assigned a "pd" (pond) modifier. Floodplain wetlands already had a sub-landform modifier (e.g., basin or flat) representing the physical form of the wetland on the floodplain.

Water flow path descriptors characterize the flow of water associated with wetlands. Seven patterns of flow are recognized for wetlands in the watershed:

1) throughflow,
2) throughflow-intermittent,
3) outflow,
4) outflow-intermittent,
5) inflow,
6) bidirectional flow, and
7) isolated.

Throughflow wetlands have either a perennial watercourse (e.g. stream) or another type of wetland above and below it, so water passes through them (usually by way of a river or stream, but sometimes by ditches). The water flow path of lotic wetlands associated with perennial streams is throughflow. Throughflow-intermittent was applied to identify wetlands along intermittent streams. Where a streamside wetland has intermittent inflow and perennial outflow, the water flow path was classified as throughflow and the landscape position was labeled as lotic stream intermittent gradient. Lentic wetlands crossed by streams were designated as throughflow.

Outflow wetlands have water leaving them, moving downstream via a watercourse (e.g., stream) or a slope wetland, with outflow-intermittent designating an intermittent stream as the outflow source.

Inflow wetlands are sinks where no outlet exists, yet water enters via an intermittent stream or an upslope wetland.

Bidirectional-nontidal wetlands are lentic wetlands where fluctuating lake or reservoir level appears to be the primary surface water source for raising and lowering water levels (including water tables) in them.

Isolated wetlands are essentially closed depressions (geographically isolated) where water comes from surface water runoff and/or groundwater discharge, but they also include other wetlands that are sources of streams (lacking stream inflow), or wetlands along streams that are not subject to frequent overflows (i.e., generally hydrologically decoupled from stream bank flooding). For this project, surface water connections are emphasized, since it is not possible to determine ground water linkages (especially outflow) without hydrologic investigations.

All NWI mapped wetlands in the watershed were reviewed, classified by landscape position, landform, water flow path and waterbody type (LLWW descriptors), and given an LLWW code. Table 2 provides simplified keys to the first three descriptors. Classifications were reviewed by the lead project scientist. The geographic information system (GIS) used for this project was ArcGIS 3.0 and updates.

Upon completion of the database, several analyses were performed to produce a preliminary assessment of wetland functions for the watershed. The following functions were evaluated using the database:

1) surface water detention,
2) streamflow maintenance,
3) nutrient transformation,
4) sediment retention,
5) shoreline stabilization,
6) provision of fish habitat,
7) provision of waterfowl and waterbird habitat, and
8) provision of other wildlife habitat.

A series of maps for the study area was prepared to highlight wetland types that may perform these functions at significant levels (high or moderate). Statistics and thematic maps for the study watersheds were generated by ArcGIS software.

Table 1. Definitions and examples of landform types (Tiner 2003a). Map codes in parentheses.

Landform Type	**General Definition**	**Examples**
Basin* (BA)	a depressional (concave) landform	lakefill bogs; wetlands in the saddle between two hills; wetlands in closed or open depressions, including narrow stream valleys
Slope (SL)	a landform extending uphill (on a slope)	seepage wetlands on hillside; wetlands along drainageways or mountain streams on slopes
Flat* (FL)	a relatively level landform, often on broad, level landscapes	wetlands on flat areas with high seasonal ground-water levels; wetlands on terraces along rivers and streams; wetlands on hillside benches; wetlands at toes of slopes
Floodplain (FP)	a broad, generally flat landform occurring on a landscape shaped by fluvial or riverine processes	wetlands on alluvium; bottomland swamps
Interfluve (IF)	a broad, level to imperceptibly depressional poorly drained landform occurring between two drainage systems (on interstream divides)	flatwood wetlands on coastal or glaciolacustrine plains
Fringe (FR)	a landform occurring along a flowing or standing waterbody (lake, river, stream) and typically subject to permanent, semipermanent, or tidal flooding	buttonbush swamps; aquatic beds; semipermanently flooded marshes; wetlands in river channels; salt and brackish marshes with unrestricted tidal flow
Island (IL)	a landform completely surrounded by water (including deltas)	deltaic and insular wetlands; floating bog islands

*May be applied as sub-landforms within the Interfluve (IFba, IFfl) and Floodplain (FPba, FPfl).

Table 2. Simplified keys for classifying wetlands by landscape position, landform, and water flow path. (Adapted from Tiner 2003a)

Landscape Position

1. Wetland borders a waterbody (river, stream, lake, reservoir, estuary, or ocean)	2
1. Wetland does not border a waterbody; it is completely surrounded by upland	Terrene
2. Wetland lies along an ocean shore and is subject to tidal flooding	Marine
2. Wetland does not lie along an ocean shore	3
3. Wetland lies along an estuary (salt to brackish tidal waters) and is subject to tidal flooding	Estuarine
3. Wetland does not lie along an estuary or if so, it is not subject to tidal flooding	4
4. Wetland lies along a lake or reservoir or within its basin	Lentic
4. Wetland lies along a river or stream	5
5. Wetland is the source of a river or stream but does not flow through the entire length of the wetland	Terrene
5. River or stream flows through the wetland	6
6. Wetland is periodically flooded by river or stream overflow	Lotic[3]
6. Wetland is not periodically flooded by the river or stream	Terrene

Landform

1. Wetland occurs on a slope >2%	Slope
1. Wetland does not occur on a slope >2%	2
2. Wetland forms an island completely surrounded by water	Island
2. Wetland does not form on an island	3
3. Wetland occurs in the shallow water zone of a permanent nontidal waterbody, the intertidal zone of an estuary, or the regularly flooded (daily tidal inundation) zone of freshwater tidal wetlands	Fringe
3. Wetland does not occur in these waters or intertidal zones	4
4. Wetland forms a nonvegetated bank or is within the banks of a river or stream	Fringe
4. Wetland is not a nonvegetated river or stream bank or within the banks	5
5. Wetland occurs on an active alluvial plain	Floodplain*
5. Wetland does not occur on an active floodplain	6
6. Wetland occurs on a broad interstream divide (including headwater positions) associated with coastal or glaciolacustrine plains or similar plains	Interfluve*
6. Wetland does not occur on such a divide	7
7. Wetland occurs in a distinct depression	Basin
7. Wetland occurs on a nearly level landform	Flat

*Basin and Flat sub-landforms can be identified within these landforms when desireable.

[3] Lotic wetlands are separated into river and stream sections (based on watercourse width - polygon = Lotic River vs. linear = Lotic Stream at a scale of 1:24,000) and then divided into one of five gradients: 1) high (e.g., shallow mountain streams on steep slopes), 2) middle (e.g., streams with moderate slopes), 3) low (e.g., mainstem rivers with considerable floodplain development and slow-moving streams), 4) intermittent (periodic flows), and 5) tidal (hydrology under the influence of the tides).

Water Flow Path[4]

1. Wetland is typically surrounded by upland (nonhydric soil); receives precipitation and runoff from adjacent areas with no apparent outflow	Isolated**
1. Wetland is not isolated	2
2. Wetland is a sink receiving water from a river, stream, or other surface water source, lacking surface water outflow	Inflow
2. Wetland is not a sink; surface water flows through or out of the wetland	3
3.Wetland is subjected to tidal flooding	Bidirectional-Tidal
3. Wetland is not tidally influenced	4
4. Water flows out of the wetland, but does not flow into this wetland from another source	Outflow
4. Water flows in and out of the wetland	5
5. Water flows through the wetland, often coming from upstream or uphill sources	Throughflow
5. Wetland is along a lake or reservoir and its water levels are subjected to the rise and fall of this waterbody	Bidirectional-Nontidal

**Wetland is geographically isolated; hydrological relationship to other wetlands and watercourses may be more complex than can be determined by simple visual assessment of surface water conditions.

[4]Surface water connections are emphasized because they are more readily identified than groundwater linkages.

General Scope and Limitations of Preliminary Functional Assessment

At the outset, it is important to emphasize that the functional assessment presented in this report is a preliminary evaluation based on wetland characteristics interpreted through remote sensing and applying wetland characteristics-function correlations developed from previous work in the Northeast (Tiner 2003b). Wetlands believed to be providing potentially significant levels of performance for a particular function were highlighted. As the focus of this report is on wetlands, the assessment of waterbodies (e.g., lakes, rivers, and streams) at providing the listed functions was not done, despite their rather obvious significant performance of functions like fish habitat and surface water detention. No attempt was made to produce a more qualitative ranking for each function or for each wetland based on multiple functions since this was beyond the scope of the current study. For a technical review of wetland functions, see Mitsch and Gosselink (1993) and for a broad overview, see Tiner (2005).

Functional assessment of wetlands can involve many parameters. Typically such assessments have been done in the field on a case-by-case basis, considering observed features relative to those required to perform certain functions or by actual measurement of performance. The present study does not seek to replace the need for such assessments as they are the ultimate assessment of the functions for individual wetlands. Yet, for a watershed analysis, basinwide field-based assessments are not practical nor cost-effective or even possible given access considerations. For watershed planning purposes, a more generalized assessment is worthwhile for targeting wetlands that may provide certain functions, especially for those functions dependent on landscape position and vegetation lifeform. Subsequently, these results can be field-verified when it comes to actually evaluating particular wetlands for acquisition or other purposes. Current aerial photography may also be examined to aid in further evaluations (e.g., condition of wetland/stream buffers or adjacent land use) that can supplement the preliminary assessment.

This study employs a watershed assessment approach called "Watershed-based Preliminary Assessment of Wetland Functions" (W-PAWF). W-PAWF applies general knowledge about wetlands and their functions to develop a watershed overview that highlights possible wetlands of significance based on their predicted performance of various functions. To accomplish this objective, the relationships between wetlands and various functions must be simplified into a set of practical criteria or observable characteristics. Correlations have been developed by reviewing the scientific literature and through scientific peer review and a report on these relationships has been prepared (Tiner 2003b, see acknowledgments in this report for peer reviewers). Such assessments could also be further expanded to consider the condition of the associated waterbody and the neighboring upland or to evaluate the opportunity a wetland has to perform a particular function.

W-PAWF does not account for the opportunity that a wetland has to provide a function resulting from a certain land-use practice upstream or the presence of certain structures or land-uses downstream. For example, two wetlands of equal size and like vegetation may be in the right landscape position to retain sediments. One, however, may be downstream of a land-clearing operation that has generated considerable suspended sediments in the water column, while the other is downstream from an undisturbed forest. The first wetland is most likely actively trapping sediment, while the second wetland is not. The W-PAWF is designed to reflect the potential for a wetland to provide a function. W-PAWF also does not consider the condition of the adjacent upland (e.g., level of outside disturbance) or the actual water quality of the associated waterbody which may be regarded as important metrics for assessing the "health" of individual wetlands (not part of this study). Collection and analysis of these data were beyond the scope of the study.

This preliminary assessment does not obviate the need for more detailed assessments of the various functions. It should be viewed as a starting point for more rigorous assessments, as it attempts to cull out wetlands that may likely provide significant levels of performance for certain functions based on generally accepted principles and the source information used for this analysis. This type of assessment is most useful for regional or watershed planning purposes.

It is also important to recognize limitations derived from source data. These limitations include conservative interpretations of forested wetlands (especially evergreen types) and drier-end wetlands (e.g., wet meadows, especially those used as pastures; see Tiner 1997b for additional information), and the omission of small or narrow wetlands. Despite these limitations, the NWI dataset represents the most extensive and current database on the distribution, extent, and type of wetlands in New York state that can be used for these types of analyses. Local governments may have more detailed inventories that can be used as supplementary information that identify smaller wetlands or expanded boundaries for further analysis.

Preliminary Functional Assessment Correlations

The list of functions evaluated included eight functions: 1) surface water detention, 2) streamflow maintenance, 3) nutrient transformation, 4) sediment retention, 5) shoreline stabilization, 6) provision of fish habitat, 7) provision of waterfowl and waterbird habitat, and 8) provision of other wildlife habitat. The criteria used for identifying wetlands of significance for these functions were taken from Tiner (2003b; posted on the web at: http://www.fws.gov/nwi/Pubs_Reports/HGMReportOctober2003.pdf). A list of the wetland types designated as significant for each function is presented in Table 3. The listing does not include marine and estuarine wetlands since they are not present in the study watershed.

Table 3. List of wetlands of potential significance for eight functions. (Source: Adapted from Tiner 2003b).

Function/Potential Significance	**Wetland Types**
Surface Water Detention	
High	Lentic Basin, Lentic Fringe, Lentic Island (basin and fringe), Lentic Flat associated with reservoirs and flood control dams, Lotic Basin, Lotic Floodplain, Lotic Fringe, Lotic Island associated with Floodplain area, Lotic Island basin, Ponds Throughflow (in-stream) and associated Fringe and Basin wetlands, Ponds Bidirectional and associated wetlands
Moderate	Lotic Flat, Lotic Island flat, Lentic Flat, Other Terrene Basins, Other Ponds and associated wetlands (excluding sewage treatment ponds and similar waters)
Streamflow Maintenance	
High	Nonditched Headwater Wetlands (Terrene, Lotic, and Lentic), Headwater Ponds and Lakes (classified as PUB...on NWI) (Note: Lotic Stream Basin or Floodplain basin Wetlands along 2nd order streams should also be rated high; possibly expand to 3rd order streams in hilly or mountainous terrain.)
Moderate	Ditched Headwater Wetlands (Terrene, Lotic, and Lentic), Lotic (Nontidal) Floodplain, Throughflow Ponds and Lakes (classified as PUB on NWI) and their associated wetlands, Terrene Outflow wetlands (associated with streams not major rivers), Outflow Ponds and Lakes (classified as PUB... on NWI)

Special Note: All these wetlands should be considered to also be important for fish and shellfish as they are vital to sustaining streamflow necessary for the survival of these aquatic organisms.

Nutrient Transformation	
High	Vegetated wetlands (and mixes with nonvegetated wetlands or unconsolidated bottom; even where nonvegetated predominates) with seasonally flooded (C), seasonally flooded/saturated (E), semipermanently flooded (F), and permanently flooded (H) water regimes, vegetated wetlands with permanently saturated water regime (B)
Moderate	Vegetated wetlands with temporarily flooded (A) water regime

Table 3 (continued).

Function/Potential Significance	**Wetland Types**
Retention of Sediments and Other Particulates	
High	Lentic Basin, Lentic Fringe (vegetated only), Lentic Island (vegetated) Lotic Basin, Lotic Floodplain, Lotic Fringe (vegetated), Lotic Island (vegetated), Throughflow Ponds and Lakes (in-stream; designated as PUB... on NWI) and associated vegetated wetlands, Bidirectional Ponds and associated vegetated wetlands
Moderate	Lotic Island (nonvegetated), Lotic Flat (excluding bogs), Lentic Flat, Other Terrene Basins excluding bogs), Terrene wetlands associated with ponds (excluding excavated ponds; also excluding bogs and slope wetlands), Other Ponds and Lakes (classified as PUB... on NWI) and associated wetlands (excluding bogs and slope wetlands)

Note: Ponds with minimal watersheds - possibly gravel pit ponds, impoundments completely surrounded by dikes, and dug-out ponds with little surface water inflow should be excluded.

Shoreline Stabilization	
High	Lotic wetlands (vegetated except island and isolated types), Lentic wetlands (vegetated except island types)
Moderate	Terrene vegetated wetlands associated with ponds (e.g., Fringe-pond, Flat-pond, and Basin-pond)
Provision of Fish Habitat	
High	Lacustrine Semipermanently Flooded (excluding wetlands along intermittent streams), Lacustrine Littoral Aquatic Bed, Lacustrine Littoral Unconsolidated Bottom/Vegetated Wetland, Lacustrine Littoral Vegetated Wetland with a Permanently Flooded water regime, Palustrine Semipermanently Flooded (excluding wetlands along intermittent streams; must be contiguous with a permanent waterbody such as PUBH, L1UBH, or R2/R3UBH), Palustrine Aquatic Bed, Palustrine Unconsolidated Bottom/Vegetated Wetland, Palustrine Vegetated Wetland with a Permanently Flooded water regime, Ponds (PUBH.. on NWI; not PUBF) associated with Semipermanently Flooded Vegetated Wetland

Table 3 (continued).

Function/Potential Significance	**Wetland Types**
Moderate	Lentic wetlands that are PEM1E, Lotic River or Stream wetlands that are PEM1E (including mixtures with Scrub-Shrub or Forested wetlands), Semipermanently flooded Phragmites wetlands (PEM5F) where contiguous with a permanent waterbody, Other Ponds and associated Fringe wetlands (i.e., Terrene Fringe-pond) (excluding industrial, stormwater treatment/detention, similar ponds in highly disturbed landscapes, and ponds with K and F water regimes)
Important for Stream Shading	Lotic Stream wetlands that are Palustrine Forested or Scrub-shrub wetlands (includes mixes where one of these types predominates; excluding those along intermittent streams; also excluding shrub bogs) (Note that although forested wetlands are designated as important for stream shading, forested upland provide similar functions)

Note: Many of these habitats are also important for wetland-dependent amphibians, reptiles, and aquatic invertebrates.

Provision of Waterfowl and Waterbird Habitat	
High	Lacustrine Semipermanently Flooded, Lacustrine Littoral Aquatic Bed, Lacustrine Littoral Vegetated wetlands with an H water regime, Lacustrine Unconsolidated Shores (F, E, or C water regimes; mudflats), Palustrine Semipermanently Flooded (excluding Phragmites stands, but including mixtures containing this species - EM5), Palustrine Aquatic Bed, Palustrine Vegetated wetlands with a H water regime, Palustrine Unconsolidated Shores (F, E, or C water regimes; mudflats), Seasonally Flooded/Saturated Palustrine wetlands impounded or beaver-influenced (all vegetation types [except PEM5Eh and PEM5Eb] and associated PUB waters), Lotic River or Stream wetlands that are PEM1E (including mixtures with Scrub-Shrub or Forested wetlands), Ponds associated with Semipermanently Flooded Vegetated wetlands, Ponds associated with all of the wetland types listed as high for this function

Table 3 (continued).

Function/Potential Significance	**Wetland Types**
Moderate	Phragmites wetlands that are Seasonally Flooded/Saturated and wetter (PEM5E; PEM5F; PEM5H) and contiguous with a waterbody, Other Lacustrine Littoral Unconsolidated Bottom, Other Palustrine Unconsolidated Bottom (excluding industrial, commercial, stormwater detention, wastewater treatment, and similar ponds), Palustrine Emergent wetlands (including mixtures with Scrub-shrub) that are Seasonally Flooded and associated with permanently flooded waterbodies
Significant for Wood Duck	Lotic wetlands (excluding those along intermittent streams) that are Forested or Scrub-shrub or mixtures of these types with C, E, F, or H water regime; Lotic wetlands that are mixed Forested/Emergent or Unconsolidated Bottom/Forested with a E, F, or H water regime
Provision of Other Wildlife Habitat	
High	Large vegetated wetlands (≥20 acres, excluding open water and nonvegetated areas), small diverse wetlands (10-20 acres with 2 or more covertypes; excluding EM5 or open water as one of the covertypes), areas with large numbers of small isolated wetlands (within an upland forest matrix and including small ponds that may be vernal pools)
Moderate	Other vegetated wetlands

Note: Athough in general, ponds are not listed here as important as significant for other wildlife, it should be recognized that species of frogs, turtles, and some other wildlife depend on these habitats; by and large, these wetlands have already been designated as important for fish and waterbirds, so they are not listed here.

Results

Maps

A series of 12 maps was produced for the Salmon River to South Sandy Creek watershed. The first four maps depict wetlands by NWI types and by landscape position, landform, and water flow path. Each of the remaining maps (Maps 5 through 12) highlights wetlands that may perform each of the eight selected functions at a significant level. Electronic copies of the maps are included in the compact disk (CD) version of the report. A list of the 12 maps follows.

Map 1 - Wetlands and Deepwater Habitats Classified by NWI Types
Map 2 - Wetlands Classified by Landscape Position
Map 3 - Wetlands Classified by Landform
Map 4 - Wetlands Classified by Water Flow Path
Map 5 – Potential Wetlands of Significance for Surface Water Detention
Map 6 - Potential Wetlands of Significance for Streamflow Maintenance
Map 7 - Potential Wetlands of Significance for Nutrient Transformation
Map 8 - Potential Wetlands of Significance for Sediment Retention
Map 9 - Potential Wetlands of Significance for Shoreline Stabilization
Map 10 - Potential Wetlands of Significance for Provision of Fish and Shellfish Habitat
Map 11 - Potential Wetlands of Significance for Provision of Waterfowl/Waterbird Habitat
Map 12 - Potential Wetlands of Significance for Provision of Other Wildlife Habitat

Acreage Summaries

NWI Types

The Salmon River to South Sandy Creek watershed contained more than 6800 acres of wetlands (Table 4) which amounts to 9% of the watershed area. Palustrine wetlands predominated, occupying 6556 acres (96% of the wetlands). Lacustrine wetlands represented the remaining 4% of the wetlands. Forested wetlands comprised slightly more than half (58%) of the wetland acreage. Scrub-shrub wetlands were next ranked (19%). About 14% of the wetlands were emergent types (mostly persistent emergent ones, only 39 acres of nonpersistent emergents associated with lakes). Roughly 5% of the wetlands were ponds. Nearly all of the deepwater habitat was lacustrine (2516 acres, 99%), with the rest being 23 acres of riverine waters (1%); the acreage of linear streams was not calculated.

LLWW Types

Forty-six percent (or 2967 acres) of the wetlands (excluding ponds) was terrene that was either isolated or the source of a stream (Table 5). Lentic wetlands were second-ranked, accounting for 32% of the wetlands. The remaining 22% was lotic wetlands bordering streams. Seventy percent (4549 acres) of the wetlands were basin types (in distinct depressions). Over 1000 acres of flat wetlands were identified, accounting for 24% of the wetlands. Roughly 372 acres of ponds were inventoried. Over half (51%) were dammed/impounded and 21% were beaver-influenced. From 40 to 60 acres of ponds were excavated or natural, respectively.

Preliminary Functional Assessment[5]

Over 90% of the wetlands (including ponds) were predicted as significant habitat for non-aquatic wildlife (Table 6) and about 90% was important for nutrient transformation, surface water detention, and retention of particulates (including sediment). Over two-thirds of the wetlands were identified as significant for shoreline stabilization. Forty percent was important for stabilizing shorelines, while 30% has potential for being significant waterfowl and waterbird habitat. Eighteen percent was classified as having significant habitat potential for fish and shellfish, while another 18% provided shade for streams, also important for these organisms.

[5] Reference to percent of wetlands providing various functions is based on acreage, not the number of individual wetlands..

Table 4. Wetlands classified by NWI types for the Salmon River to South Sandy Creek watershed.

System	Class, Subclass	Acreage
Lacustrine (L2)	Emergent (EM)	39.05
	Unconsolidated Bottom (UB)	102.75
	Unconsolidated Shore (US)	127.19
	(Subtotal Lacustrine)	268.99
Palustrine (P)	Aquatic Bed (AB)	8.22
	Aquatic Bed (AB) / Unconsolidated Bottom (UB)	0.83
	(Subtotal)	9.05
	Emergent (EM)	818.81
	Emergent (EM) / Forested (FO)	24.42
	Emergent (EM) / Scrub-Shrub (SS)	42.19
	Emergent (EM) / Unconsolidated Bottom (UB)	23.30
	Emergent (EM) / Unconsolidated Shore (US)	0.57
	(Subtotal)	909.29
	Forested, Broad-leaved Decidious (FO1)	2811.49
	Forested, Neadle-leaved Evergreen (FO4)	276.05
	Forested, Dead (FO5)	86.83
	Forested (FO) / Scrub-Shrub (SS)	765.06
	(Subtotal)	3939.43
	Scrub-Shrub, Broad-leaved Decidious (SS1)	1316.47
	Scrub-Shrub, Neadle-leaved Evergreen (SS4)	9.62
	(Subtotal)	1326.09
	Unconsolidated Bottom (UB)	364.45
	Unconsolidated Bottom (UB) / Forest (FO)	2.75
	Unconsolidated Bottom (UB) / Scrub-Shrub (SS)	3.94
	Unconsolidated Shore (US)	0.52
	(Subtotal)	371.66
	(Subtotal Palustrine)	6555.52
	GRAND TOTAL	**6824.51**

Table 5. Wetlands classified by LLWW types for Salmon River to South Sandy Creek watershed.

Landscape Position	Landform	Water Flow Path	Acreage
Lentic (LE)	Basin (BA)	Bidirectional (BI)	1269.37
		Throughflow (TH)	95.54
		(Subtotal)	**1364.90**
	Fringe (FR)	Bidirectional (BI)	639.91
		Throughflow (TH)	51.61
		(Subtotal)	**691.52**
	Island (IL)	Throughflow (TH)	3.66
		(Subtotal)	3.66
	(Subtotal Lentic)		2060.08
Lotic Stream (LS)	Basin (BA)	Throughflow (TH)	988.24
		(subtotal)	988.24
	Flat (FL)	Throughflow (TH)	349.48
		(subtotal)	349.48
	Fringe (FR)	Throughflow (TH)	90.79
		Bidirectional (BI)	4.92
		(subtotal)	95.71
	(Subtotal Lotic Stream)		1433.43
Terrene (TE)	Basin (BA)	Inflow (IN)	25.24
		Isolated (IS)	1271.35
		Outflow (OU)	899.12
		(subtotal)	2195.71
	Flat (FL)	Isolated (IS)	361.40
		Outflow (OU)	362.84
		(subtotal)	724.24
	Fringe (FR)	Isolated (IS)	1.70
		(subtotal)	1.70
	Slope (SL)	Isolated (IS)	9.58
		Outflow (OU)	35.35
		(subtotal)	44.92
	(Subtotal Terrene)		2966.57
	GRAND TOTAL		**6460.08**

Table 6. Preliminary wetland functional assessment findings for the watershed.

Function/Significance Level		**Acres**
Surface Water Detention		
	High (H)	3237.93
	Moderate (M)	2870.14
	(Total SWD)	*6108.07*
Streamflow Maintenance		
	High (H)	2556.86
	Moderate (M)	180.98
	(Total SM)	*2737.84*
Nutrient Transformation		
	High (H)	5298.48
	Moderate (M)	885.38
	(Total NT)	*6183.86*
Sediment and Other Particulate Retention		
	High (H)	3007.99
	Moderate (M)	2972.9
	(Total SR)	*5980.89*
Shoreline Stabilization		
	High (H)	3252.64
	Moderate (M)	1382.92
	(Total SS)	*4635.56*
Fish and Shellfish Habitat		
	High (H)	353.72
	Moderate (M)	873.15
	(Total FISH)	*1226.87*
Shade		
	Stream Shading (SS)	1216.38
	(Total SHADE)	*1216.38*
Waterfowl and Waterbird Habitat		
	High (H)	1002.09
	Moderate (M)	350.34
	Wood Duck (D)	746.09
	(Total PBIRD)	*2098.52*
Other Wildlife Habitat		
	High (H)	3569.9
	Moderate (M)	2767.09
	(Total PWILD)	*6336.99*

Acknowledgments

This work was funded by the New York State Department of Conservation (NYSDEC), Division of Fish, Wildlife, and Marine Resources through a grant from the U.S. Environmental Protection Agency. Patricia Riexinger of the Bureau of Habitat, Landscape Conservation Section was project officer for NYSDEC). Ralph Tiner was principal investigator for the U.S. Fish and Wildlife Service, responsible for project design, management, classification quality control, data interpretation, and report preparation.

Many people contributed to the production of data for this report including the following Herbert Bergquist (FWS), Matt Starr (FWS), Meaghan Shaffer (UMass), Craig Potzen (UMass), and Olga Tsvetkova (UMass). Their work is the foundation for this report. The first three were involved with classification, while the latter two were involved with GIS analysis and data compilation. Ms. Tsvetkova was responsible for the final analysis and statistics.

References

Brinson, M. M. 1993. A Hydrogeomorphic Classification for Wetlands. U.S. Army Corps of Engineers, Washington, DC. Wetlands Research Program, Technical Report WRP-DE-4.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31.

Mitsch, W.J. and J.G. Gosselink. 1993. Wetlands. Van Nostrand Reinhold Company, Inc., New York, NY.

Tiner, R.W. 1997b. NWI Maps: What They Tell Us. National Wetlands Newsletter 19(2): 7-12. (Copy available from USFWS, ES-NWI, 300 Westgate Center Drive, Hadley, MA 01035)

Tiner, R.W. 2005. In Search of Swampland: A Wetland Sourcebook and Field Guide. Rutgers University Press, New Brunswick, NJ.

Tiner, R.W. 2003a. Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors. U.S. Fish and Wildlife Service, Northeast Region, Hadley, MA. September 2003.

Tiner, R.W. 2003b. Correlating Enhanced National Wetlands Inventory Data With Wetland Functions for Watershed Assessments: A Rationale for Northeastern U.S. Wetlands. U.S. Fish and Wildlife Service, Northeast Region, Hadley, MA.