CENTER HARBOR
PRIME WETLANDS COMPLETION PROJECT

SNAKE RIVER

Snake River in Fall

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February 2012

Submitted to:
Center Harbor Conservation Commission
NH DES Wetlands Bureau
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**SUMMARY**

Beginning in January 2011 a comprehensive inventory and evaluation was conducted on the Snake River wetland complex in Center Harbor, New Hampshire. Initial mapping indicated a 50+ acre wetland complex along the town line of New Hampton and Center Harbor between Winona Lake and Lake Waukewan. Updated color infrared aerial photography and selective field surveys were used to delineate and map the wetlands on the Center Harbor side, and later in the summer of 2011, on the New Hampton side.

Using the NH GRANIT data for the town line as the southern boundary, a total of 57.2 acres was mapped for the Snake River wetland complex, with 24.6 acres lying in Center Harbor and 32.6 acres lying in New Hampton. Based on conversations with the Center Harbor Conservation Commission, several lateral inflow seepage swamps were not included in the designation of the candidate prime wetland area.

Office–based assessments in February 2011 followed the *Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire*, or the ‘NH Method’ (N.H. Department of Environmental Services, 1991). The following functional values of wetlands were assessed:

1) Ecological Integrity
2) Wetland Wildlife
3A) Finfish – Rivers and Streams
3B) Finfish – Lakes and Ponds
4) Educational Site Potential
5) Visual/Aesthetic Quality
6) Water-based Recreation
7) Flood Control Potential
8) Groundwater Use Potential
9) Sediment Trapping
10) Nutrient Attenuation
11) Shoreline Anchoring and Dissipation of Erosive Forces
13) Historical Site Potential
14) Noteworthiness

Note that functional value #12, Urban Quality of Life, was not assessed owing to the rural character of Center Harbor at the time of the evaluation.

Field data was transferred to the NH Method data sheets in the office following the field surveys. GPS data was uploaded into ArcGIS 9.2 project files and individual maps prepared according to the specifications of the NH Method. In August 2011, based on an ARM Fund application opportunity, the New Hampton side of the Snake River complex was visited and evaluated.

The following report summarizes the findings of the field and map work, and provides a synopsis of the functional values that are latent within this remarkable wetland complex that spans two townships and provides the major inflow to the Lake Waukewan’s water supply.
Acknowledgments

The author would like to thank the following individuals and organizations for their support during this project:

Center Harbor Conservation Commission:
  Bruce Bond, Chair
  Gwen Bronson
  Maureen Criasia-Volz
  Karen Karagozian
  Randy Mattson, Selectmen’s Representative
  Harry Viens
  Joann Wood
Ralph Kirshner, Chair, New Hampton Conservation Commission
Lakes Region Planning Commission
Squam Lakes Conservation Society (for digital approximations of tax parcels)
Lakes Region Conservation Trust (for conservation parcel data)
NH Natural Heritage Program (for rare plant information)
NH Fish & Game Department (for rare animal information)
I. Overview

Between January 2011 and December 2011 a field and office-based assessment was undertaken of the Snake River wetland complex in Center Harbor and New Hampton, New Hampshire. This study was requested by the Center Harbor Conservation Commission (CHCC) subsequent to the submission of the Center Harbor Prime Wetlands Completion Project that was conducted by the author in 2008 and 2009. The final report for this project noted the extremely high value of the Snake River wetland complex and suggested that it be the subject of an expanded prime wetland study in town. The value of this wetland complex for wildlife, recreation, water supply protection, and special habitat for rare species was well known within the region, especially among residents of New Hampton who shared fifty percent of the wetland complex with Center Harbor.

Beginning in March, 2011, several site visits were conducted to identify the salient ecological attributes and fulfill the field portion of the Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire, or the ‘NH Method’ (N.H. Department of Environmental Services, 1991). Some of these site visits were completed as a part of the concurrent Center Harbor NRI project, which was also being conducted by the author. In August 2011, the New Hampton Conservation Commission (NHCC) also requested assistance in identifying the wetland and buffer attributes of the Snake River and additional fieldwork was completed on the New Hampton side. Subsequent to the completion of the Center Harbor NRI project in December 2011, the final analyses of the Snake River complex was completed.

The following report summarizes the findings of the office and field-based evaluation of the Snake River wetland complex and includes a descriptive narrative of the highly ranked functions and value of this remarkable area. The requisite base maps showing NWI cover types and hydric soils are included as Appendix A of this report. The large format tax map sheets of the Snake River wetland as required by NHDES are provided under separate cover.

Fig. 1. Snake River from Waukewan bridge

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1 This project focused on five candidate prime wetlands that had been identified and studied by the CHCC over the past two decades but which had never been formally assessed and mapped. The town vote approving these five prime wetlands – Hale Swamp, Hawkins Pond, Johnson-Perkins Complex, Leroux Complex, and Paquette wetland – took place in 2006 and was in the affirmative for all five prime wetlands.

2 The Revised or ‘New’ NH method was still under peer review, hence the original method was used at that time.

3 The New Hampton effort involved the application to the NHDES ARM Fund, wherein project monies were awarded to help protect the final private Shorefront parcel along the Snake River on the New Hampton side.
II. Office and Field Methods

a. Office Methods

The first step in completing the prime wetlands survey was to review existing maps and data contained in the CHCC files. This included the original 1982 wetland map by Barry Keith, the revised mylar map and print maps containing the best known location and name of each of the designated wetlands, as well as a summary folder containing tabular descriptions and additional notes and sketches completed by volunteers in the 1980’s. The approximate location of the Snake River was compared against the latest version of the Center Harbor tax map, and the eight parcel owners identified where private property permission would need to be granted access on foot. Given the pre-existing access provided by the major property owner along the Snake River, it was determined that further property permissions were not required, especially since most of the wetland complex was easily accessible by boat.

Office work also included obtaining the pertinent GIS (Geographic Information System) data files from Complex Systems Research Center in Durham, NH, which houses the NH GRANIT GIS database. Most of the latter data had already been purchased by the author, although the new aerial photography flown by NHDOT had not yet been released. In May of 2011, the 1-foot pixel color infrared aerial photographs were released; therein providing high resolution, shade differentiated imagery of wetland areas throughout the study area. These were used extensively to corroborate GPS-based field data and to provide accurate map sequences among NWI cover types and “cool” versus “warm” soils.

b. Field Methods

Roadside surveys of the Snake River took place throughout the study time period, especially since Waukewan Road and Winona Road both traverse and border the Snake River. Visual checks were made in all seasons, notably in March when migratory waterfowl were at a peak. Part of the latter effort was to attempt to regain records of the one noteworthy wildlife species that formerly nested in the Snake River marsh, the pied-billed grebe. Not recorded as a nesting species since the 1970’s, this once common freshwater marsh obligate has all but disappeared from New Hampshire (Foss 1994, Hunt, 2011).

Wetland delineations for the Snake River were mostly conducted by remote interpretation of the above-described color infrared photography, although the entire New Hampton shoreline as well as portion of the northwestern Center Harbor shoreline was estimated using a Garmin 12XL hand-held GPS unit.\(^4\) GPS surveys took place on March 11, 28, August 2, and October 4, 2011. Wetland boundaries were mostly determined by the prevalence of hydrophytic

\(^4\) Precision on this unit varied between 2.9 and 6.8 m depending on cover and time of day.
vegetation, although hydric soils were confirmed on the
New Hampton side on August 2 using a Dutch soil auger
and Version 7 of the Field Indicators of Hydric Soils in the
United States (USDA NRCS 2010). Given the limitations of
time and the scope of the project no attempt was made
to perform a Route Onsite Method for delineating
wetlands associated with the Snake River complex.

Fig. 2. Most of the wetland edges of the Snake River, as depicted at right,
involved fairly distinct wetland boundaries, especially in Center Harbor.

c. Wetland Assessment

The wetland assessment utilized the Method for the
Comparative Evaluation of Non-tidal Wetlands in New
Hampshire (NHDES, Ammann and Stone 1991), or the “NH Method,” for evaluating the functions and
values of the Snake River wetland. This was the method used for the first five prime wetlands in Center
Harbor, and was appropriately applied to the Snake River evaluation in spite of it being a single wetland
complex. The ability to compare findings with the first five wetlands demonstrated the high functional
value of the Snake River relative to the highest valued wetlands in Center Harbor.

As in the initial prime wetland completion project, the field analysis provided site specific information on
the character of the wetland buffer, the number of occupied residences within 500 feet of the wetland
boundary, the land use around and within the wetland, the nature of public access and proximity to
schools, the viewing points from roadside and off-road points, the types of plant communities present,
and the “wetland control length” or WCL. The latter is a term used in the method that describes the
type of constriction to the downstream flow of waters passing through the wetland, such as a culvert,
bridge, or beaver dam. These were measured in feet in the field, and used in the calculation of flood
storage potential.

In terms of the final configuration of the Snake River prime wetland relative to all of the contributing
surface waters in the vicinity, it was decided at one of the CHCC meetings to hold the edge of the to-be-
designated prime wetland to the downslope portions of the main river channel area. In three cases
adjacent seepage swamps were eliminated from the prime wetland boundary because of their low
relative value, the prevalence of poorly drained soils, and the previously impacted forest types. In one
case, it appeared that the powerline right-of-way had altered the hydrology to bring about the creation
of a forested and scrub-shrub swamp that eventually drained into the Snake River. Similarly, two other
seepage swamps were eliminated even though they were associated with small intermittent stream
systems that made their way to the main wetland basin at the bottom of the hill. Each of these areas is
depicted on the associated maps of the candidate prime wetland.

5 Since the 2nd edition of the NH Method came out in mid-2011, the wetland evaluation was redone (see below).
III. Results / Discussion of Findings

a. General Findings

The Snake River wetland complex is comprised of roughly 57.2 acres, 24.6 acres of which lies in Center Harbor with the balance, 34.6 acres, lying in New Hampton. It is largely comprised of open marsh with an aquatic bed and a slow, meandering stream. Scrub-shrub and forested swamps border both sides, although the edge along Fogg Hill in Center Harbor is fairly narrow. The table below summarizes the Snake River wetland complex in relation to the previously designated prime wetlands in Center Harbor:

Table 1. Prime Wetland Summary – Center Harbor

<table>
<thead>
<tr>
<th>CENTER HARBOR PRIME WETLAND INVENTORY - SIZE &amp; LOCATION</th>
<th>CODE</th>
<th>NAME</th>
<th>SIZE (ac)</th>
<th>SIZE - C.H.</th>
<th>TAX MAP #’s</th>
<th>NEAREST ROAD(S)</th>
<th>ZONING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>52</td>
<td>Paquette Wetland Complex</td>
<td>18.48</td>
<td>18.48</td>
<td>Sheet 4</td>
<td>Route 3</td>
<td>RR, C</td>
</tr>
<tr>
<td></td>
<td>54-55</td>
<td>Hale Swamp</td>
<td>123.17</td>
<td>96.68</td>
<td>Sheet 3</td>
<td>Route 3, Waukewan Road</td>
<td>RR</td>
</tr>
<tr>
<td></td>
<td>58a-d</td>
<td>Leroux Wetland Complex</td>
<td>17.52</td>
<td>17.52</td>
<td>Sheet 1, 3</td>
<td>McCrillis Hill Road</td>
<td>RR</td>
</tr>
<tr>
<td></td>
<td>79-80</td>
<td>Hawkins Pond</td>
<td>31.40</td>
<td>31.40</td>
<td>Sheet 1</td>
<td>Hawkins Pond Road, Piper Hill Road</td>
<td>RR</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>Johnson-Perkins Wetland Complex</td>
<td>26.30</td>
<td>26.30</td>
<td>Sheet 1</td>
<td>Piper Hill Road</td>
<td>RR</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>Snake River</td>
<td>57.2</td>
<td>24.6</td>
<td>Sheet 1</td>
<td>Waukewan Road, Winona Rd</td>
<td>RR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SUM</td>
<td>274.07</td>
<td>214.98</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The center of the Snake River wetland is comprised of a slow-moving, third-order stream meander. Although imprecisely delimited, the centerline of the meander forms the boundary between Center Harbor and New Hampton.
Thirteen functional values were initially calculated for the Snake River candidate prime wetland, as shown below and depicted in Appendix B. Since the evaluation method was completed last spring a new version of the NH Method has since been published and widely circulated in the state. The ‘new’ NH Method (Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire 2011, Stone et al. 2011) was published in July. For this reason, a comparative chart is provided below of the assessment results for the Snake River complex as a whole using the 1991 method versus the 2011 method. [Note that the range of scores for each function was changed from a 0 – 1 point scale in 1991 to a 0 – 10 point scale in 2011.]

Table 2. Comparative values for the Snake River wetland complex using 1991 versus 2011 NH Methods

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Integrity</td>
<td>.83</td>
<td>7.5</td>
<td>Flood Control</td>
<td>1.0</td>
</tr>
<tr>
<td>Wetland Wildlife Habitat</td>
<td>.84</td>
<td>8.1</td>
<td>Groundwater Use</td>
<td>1.0</td>
</tr>
<tr>
<td>Finfish Habitat – Rivers &amp; Streams</td>
<td>.83</td>
<td>7.7</td>
<td>Sediment Trapping</td>
<td>.95</td>
</tr>
<tr>
<td>Finfish habitat – Lakes &amp; Ponds</td>
<td>.68</td>
<td>N/A</td>
<td>Nutrient Attenuation</td>
<td>.90</td>
</tr>
<tr>
<td>Educational Potential</td>
<td>.74</td>
<td>9.3</td>
<td>Shoreline Anchoring</td>
<td>1.0</td>
</tr>
<tr>
<td>Visual/Aesthetic Quality</td>
<td>.96</td>
<td>9.3</td>
<td>Historical Site</td>
<td>0.0</td>
</tr>
<tr>
<td>Water-based Recreation</td>
<td>.98</td>
<td>7.2</td>
<td>Noteworthiness</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The above values indicate a consistently high rating for ecological integrity, wildlife habitat, fish & aquatic life support, educational potential, scenic quality, water-based recreation, and shoreline anchoring. The ‘new’ NH Method indicates a slightly lower value for flood control, groundwater, sediment trapping, and nutrient transformation. Flood control (storage) was significantly modified in the 2011 version of the NH Method, hence the much lower score (4.6). Noteworthiness values between the two methods are incomparable since they were ranked on a very different basis.

b. Specific Findings

The following page provides a descriptive summary of the proposed Snake River prime wetland.

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6 The official publication date of the ‘new’ NH Method was July 11, 2011.
7 The Noteworthiness function aggregates 10 points each for every ‘yes’ answer and so can exceed 10 points.
CENTER HARBOR PRIME WETLANDS COMPLETION PROJECT
PRIME WETLAND SUMMARY

PRIME WETLAND: Snake River  #: 70  ACRES: 57.2 (24.6 in Center Harbor)

LOCATION: Off Waukewan Road just upstream from town line at Lake Waukewan

Elevation: 540 ft.  Flow Direction: Southeast  Ave. Slope: 0 - 1 %

% Forested: 24.9  % Emergent/Scrub-Shrub: 31.4  % Open Water: 43.7  %Upland Islands: 0

GENERAL LAND USE: Type: Rural Residential  Zoning: RR
Snake River sits between a moderately fragmented portion of the upper Lake Waukewan residential area and the southwest slopes of the undeveloped Fogg Hill. Waukewan Road and Winona Road borders the Snake River wetland complex on the south and west sides, respectively, and some lakeshore cottages are within 500 feet of the northwest (Lake Winona) and southeast (Lake Waukewan) part of the wetland. Almost the entire eastern and northern shoreline below Fogg Hill is undeveloped, however, and the general land use in the 500 foot buffer is light with sporadic forestry. The principal input of nutrients is from road salt along the aforementioned roadways, as well as probable discharges from Lake Winona septic systems, as noted in the latest VLAP report.

Prime Wetland Description: The Snake River wetland is the largest, naturally occurring aquatic bed marsh in Center Harbor. The water quality mediation function is extremely critical as the Snake River serves as the largest filtering wetland upstream of the Lake Waukewan water supply. The wetland also traps sediment and transforms road salt and other pollutants from the associated roadway run-off. It has incredibly high wildlife value (see below) and maintains an active warmwater fishery that is optimized by recreationists throughout the year. Canoeists and kayakers can be seen during all summer months as there is an excellent put-in and small parking area on the Center Harbor side of Waukewan Road. Its proximity to two main thoroughfares makes it an excellent education and research site for local townspeople and university students alike.

Wildlife Habitat Description: The Snake River’s relatively deepwater habitat is partly maintained by beaver, and large dam and lodge can be found about mid-way upstream. It is a very high value migratory waterfowl stop-over locale, and in spite of the recent absence of nesting pied-billed grebes and common loons, both species have been regularly seen in the Snake River marsh in migration, along with countless rafts of dabbling ducks, diving ducks, geese, and long-legged waders. The scrub-shrub and forested portion on the New Hampton side contains some excellent wildlife habitat, wherein evidence of moose, bear, deer, otter, mink, fisher, raccoon, weasel, coyote and fox has been recorded. The marsh supports a high diversity of invertebrates, including several uncommon dragonflies, marsh beetles, and snails.

Rare & Endangered Species / Exemplary Natural Communities: none of recent record

Issues of Concern:
- Increasing levels of TP & TN from upstream septic systems
- Increasing levels of chlorides from associated road salt inputs
- Degradation/overuse of parking area and canoe/kayak put-in
IV. Conclusions and Recommendations

The Center Harbor Prime Wetlands Completion Project (Van de Poll 2009) provided a field-based assessment of the five prime wetlands that were approved by town vote in 2006 and approved by NHDES in 2010. In the final section of that report a recommendation was made to expand the prime wetlands mapping and assessment effort to include some of the other noteworthy wetlands in Center Harbor. The first wetland candidate on the list was the Snake River. By a large measure this wetland complex provides some of the highest value functionality to the surface water systems of town. As noted above, it has incredible water quality enhancement value, very high wildlife habitat value especially for migratory waterfowl, as well as some of the highest values for education potential and scenic quality of all six wetlands that have been carefully analyzed.

Perhaps one of the most heartening attributes of nominating this wetland complex to the list of primes in Center Harbor is the fact that nearly 95% of the New Hampton side of the Snake River has been protected in perpetuity. With a cooperative effort between three towns and two watershed advisory groups, all but the very northwestern shoreline is now under a conservation easement. Plans are already underway to establish signage and a trail system through the upland buffer area, which include some high value black ash-red maple seepage swamps. Further, there are ongoing efforts to do the same on the Center Harbor side of the wetland in order to further protect this land from development. On the conservation side of this effort is the difficulty of access and the very steep, rocky slopes that characterize the southwestern base of Fogg Hill.

The Snake River, when compared to the five existing prime wetlands using the 1991 NH Method, scored as high or higher than any other wetland for the following functions:

a) Stream-related finfish habitat (.68)
   b) Education Potential (.74)
   c) Scenic / Aesthetic Quality (.96)
   d) Water-based Recreation (.98)
   e) Flood Control (1.0)
   f) Groundwater Use Potential (1.0)
   g) Sediment Trapping (.95)
   h) Nutrient Attenuation (.90)
   i) Shoreline Anchoring (1.0)
   j) Noteworthiness (1.0)
This represents 10 of the 13 functions assessed for the five existing prime wetlands. In terms of overall functionality of the wetland systems in Center Harbor, the Snake River complex tied for the highest scoring wetland overall. This fact is reflected in the point value sum ranking process that the initial five wetlands were subjected to during the initial assessment project. Based on cumulative point values that are directly reflected in the town’s master plan, the Snake River wetland was tied for first in the number of value points it generated. A visual depiction of this result can be seen in the chart on Appendix B-2.

A testament to the fact that the town understands the value of the Snake River wetland complex is the result of the March 2011 Town Warrant, wherein the results were 262 in the affirmative, and 71 in the negative. The margin of passage was extremely high and reflected the general support of the Planning Board, Conservation Commission, and the Board of Selectmen during the hearing process in 2010. Barring any concerns on the part of nominating a wetland that shares its boundary with another town (as was the case with Hale Swamp in 2009), it is apparent that the next and final step in the prime wetland designation process is in the hands of the State of New Hampshire.

Respectfully submitted;

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Ecosystem Management Consultants

Fig. 4 Snake River marsh from Waukewan Road showing Fogg Hill in distance
I. References


NH GRANIT. 2001. GIS data from Complex System Resources Center, Durham, NH.

NH Natural Heritage Bureau. 2011. Rare and endangered species list published by the NH Natural Heritage Inventory, Concord, NH. July.


