# AN ECOLOGICAL ASSESSMENT
# OF THE WATER RESOURCES
# at the
# GREAT MEADOW
# Tuftonboro, NH

## FINAL REPORT

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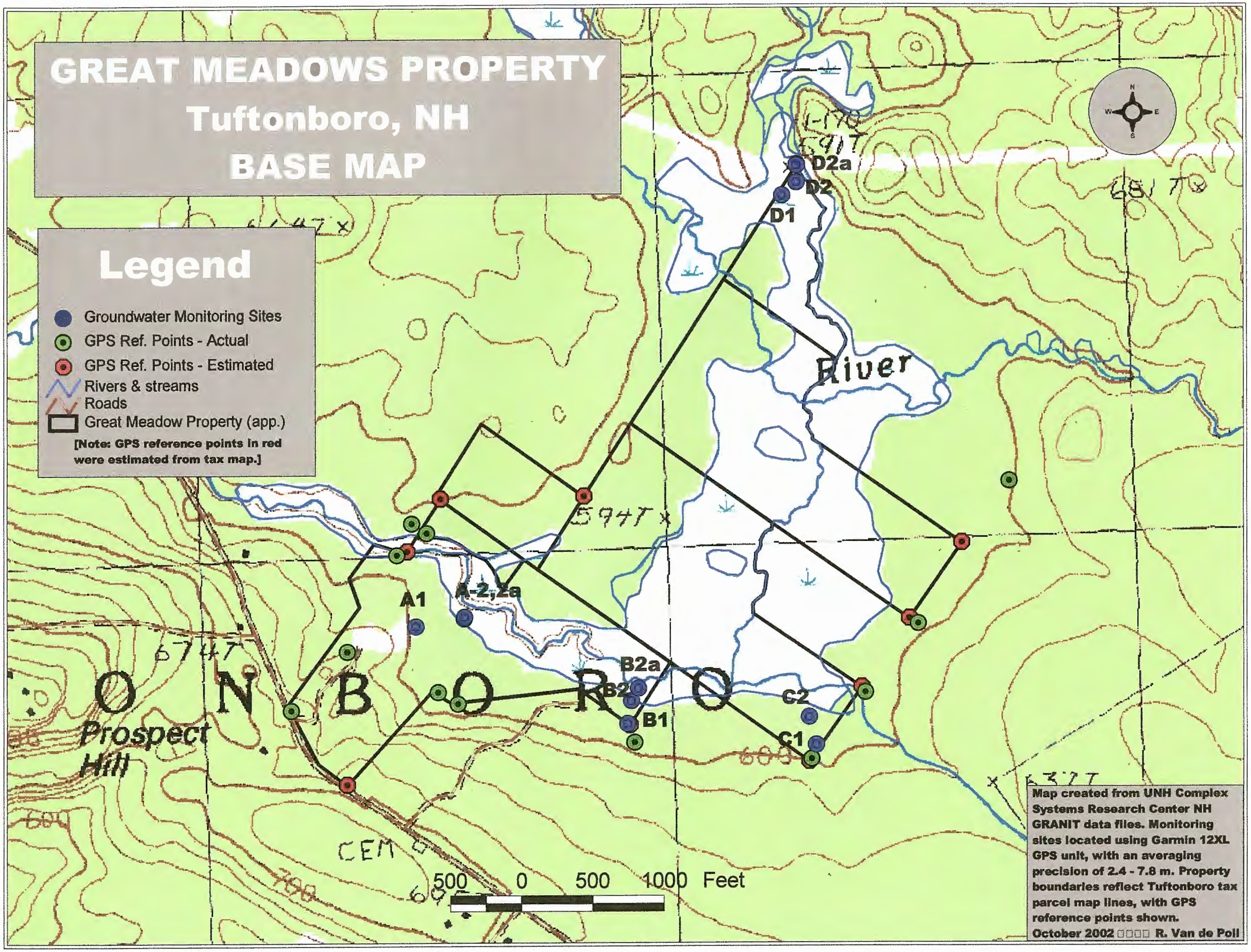

GREAT MEADOWS PROPERTY
Tuftonboro, NH
BASE MAP

Map created from UNH Complex Systems Research Center NH GRANIT data files. Monitoring sites located using Garmin 12XL GPS unit, with an averaging precision of 2.4 - 7.8 m. Property boundaries reflect Tuftonboro tax parcel map lines, with GPS reference points shown.
October 2002 □□□□ R. Van de Poll

# SUMMARY

A year-long ecological assessment of the water resources at the +/- 176-acre Great Meadow in Tuftonboro, New Hampshire has been completed. This 512.8-acre wetland arises from Field Brook, which drains the eastern of the Castle-in-the-Clouds property, and the Melvin River, which flows from the southwestern slopes of the Ossipee Mountains westerly towards Lake Winnipesauke. This pristine wetland overlies the largest aquifer in the Town of Tuftonboro, and is currently under consideration for conservation protection by the Tuftonboro Conservation Commission (TCC). This study completes an ecological inventory that began in June of 2001 and ended in June of 2002. Two oral presentations in January and October 2002, as well as this report, provides the TCC with a synopsis of ecological condition, water quality, and relative value for the benefit of the users of the wetland area.

Eight water quality monitoring wells (GWMW's) were established and monitored between October 2001 and June 2002 for water level, temperature, dissolved oxygen (DO), pH, electro-conductivity (EC), total dissolved solids (TDS), and turbidity (FTU's). In addition, 3 ambient sites adjacent to the existing wells were monitored as well. Fifteen Routine Wetland Delineation forms were completed at the GWMW transects and submitted in the January 2002 interim report. The entire wetland boundary within the Town property was delineated according to the standards of the 1987 Army Corps of Delineation Manual. In addition, a comprehensive evaluation of wetland function was performed according to the 'NH Method.' During the study year, a total of roughly 256 vascular plants, 93 species of birds, 33 species of mammals, 15 species of amphibians and reptiles, 3 species of fish, 55 taxa of insects, 3 molluscs, and 22 natural community types were observed and recorded. The Great Meadow property contains roughly 89% wetland, or roughly 38% of the total wetland complex. Ten NWI wetland types have been identified, which represents most of the 22 different natural communities in the Great Meadow area. As of this date, no rare or endangered species have been uncovered, although several natural communities are considered uncommon by the state Natural Heritage Program.

The Great Meadow property represents the largest and one of the most pristine wetland complexes in Tuftonboro, and overlies the second largest and most productive aquifer in Town. It also contains excellent potential for a perimeter trail system, a portion of which has been identified and described in this report. Some of the proposed trail is currently being used by hunters, fishermen, and other recreational trail users. Difficult terrain and poor access to the western side of the wetland area has restricted the possibility of trail development in this area. The remarkable beauty of the pristine scrub-shrub wetland and surrounding fens, as well as its wildlife inhabitants make this area a superb natural resource for residents of the region.

# CONTENTS

## INTRODUCTION

This project involved an ecological assessment of the 176-acre Great Meadow property in Tuftonboro, New Hampshire. The study began in June of 2001 and fieldwork ended one year later in June of 2002. On January 21, 2002, an interim report was submitted to the Tuftonboro Conservation Commission (TCC) that summarized the findings to date. This report was followed by an oral presentation to the Town in February. In October of 2002, a second oral presentation was given to the Town on the final results of the study. The following report provides the written basis of these findings, and completes the terms of the agreement between the TCC and Ecosystem Management Consultants.

The emphasis of this study was on the water resources of this 176-acre property. It was conducted as a part of "Track III" grant through the Land and Community Heritage Investment Program (or "LCHIP"). As noted in the January 2002 interim report, the following project objectives were identified:

A) To serve the purpose and intent of the Track 3 Land and Community Heritage Investment Program award of June 8, 2001: (to) "study Tuftonboro's largest wetland... to determine its values and establish a basis for further land acquisition."
B) To complete a detailed water quantity and water quality analysis that provides base line information on the water resources of the Great Meadows.
C) To complete an Army Corps Routine On-Site wetland delineation, as well as a wetland evaluation according to the "NH Method," in order to better understand the unique wetland attributes of the Great Meadows.
D) To document animals, plants, and other organisms which contribute to the biological diversity of this area.
E) To determine the presence of rare and endangered species (if any) in the Great Meadows area.
F) To assess the feasibility of a trail system around the Great Meadows.
G) To provide the Town of Tuftonboro with a written report complete with up-to-date GIS maps to promote the conservation of the Great Meadows and surrounding lands critical to its functioning as a unique ecosystem in the Town of Tuftonboro.

Tasks A through E were partially complete at the time of the January 2002 interim report. Between January and June 2002, the 8 groundwater monitoring wells continued to be monitored, the wetland boundary delineation was completed within the all of the Great Meadow parcels, the 'NH Method' wetland assessment was completed, and the plant and animal surveys were updated. A possible trail route around Great Meadow was followed and mapped using a GPS unit, and an overall assessment of land use surrounding the

Great Meadow wetland was conducted. The following report contains a synopsis of the methods used in completing the January to June 2002 tasks, the overall findings of the study, and recommendations for further conservation and education activities for the Town of Tuftonboro. Since the interim report contained a considerable amount of detail on the groundwater monitoring wells and the wetlands delineation, this report will focus on the wetlands assessment and trail feasibility study. Findings on all aspects of the study are presented in the form of charts, maps, species lists, and data sheets. A narrative text accompanies these data in the order of the tasks presented above.

## METHODS

### A) Water Resources

Water resources were initially analyzed from remote data sources, as supplied in digital form by the NH GRANIT Geographic Information System (GIS) database. An aquifer map was developed using ArcView 3.2 for the Town of Tuftonboro and presented in large format at the January 2002 presentation. It contained a depiction of the Town boundaries, the Great Meadow property, the two principal aquifers according to their rates of transmissivity, and the watershed boundary for the Great Meadow above its outflow point. A second map was developed for the October 2002 presentation that contained the final wetland boundary line for the Great Meadow, as well as a closer view of the watershed area above Great Meadow. Copies of both of these maps can be found in the Appendix.

The 8 groundwater monitoring wells (GWMW) described in the January 2002 report were analyzed on a 3 to 4 week basis for the remainder of the study period. Water quality parameters that were quantified within these 2-inch x 60-inch peizometers included water level (in cms), temperature (in degrees C), dissolved oxygen (DO, in parts per millions or ppm), pH (in standard pH units), electro-conductivity (EC in micro-Siemans per cm), total dissolved solids (TDS in ppm), and turbidity (in Formazine Turbidity Units or

FTU's).[1] A detailed description of the materials used and the methods of sampling were presented in the January 2002 report.[2]

### B) Wetlands

As stated in the January 2002 report and presentation, the mapping of wetlands *within the Great Meadow property* was performed using the 1987 Army Corps of Engineers Wetlands Delineation Manual (Technical Report Y-87-1). The Routine On-site Method produced a set of 4 data points each for Transects A, B and C, and three data points for Transect D.[3] Each data point corresponded with the GWMW 's placed on the Great Meadow property. Soil analyses completed at each point informed the placement of these wells at suitably diverse locations within the wetland area. This process preceded the field reconnaissance of the wetlands boundary, which took place using pace and compass, and GPS technology. A Garmin 12XL GPS unit was employed at each angle point of the wetland line, wherein a single GPS reading was recorded and mapped. Average precision levels varied between 3.9 and 7.7 m, with >95% of the points recording <6 m precision.

Wetland delineation outside of the Great Meadow property followed the Routine *Off-site* Method of the Army Corps of Engineers. The most useful references for remote data on wetlands in this area were the USGS topographic map (1987), the National Wetlands Inventory map (NWI 1987), and the 1998 digital orthophotoquad (DOQ) provided by Complex Systems Research Center at UNH.[4] No precision levels were estimated on this portion of the map, although a copy of the NWI wetland boundary versus the actual field-determined wetland boundary is provided in the Appendix to illustrate the level of inaccuracy of the remote map data.

The wetland assessment, as noted above, followed the *Comparative Evaluation of Non-tidal Wetlands in New Hampshire* (Ammann and Stone 1991), otherwise referred to as the 'NH Method.' This wetland assessment technique was developed for municipalities in

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[1] Formazine Turbidity Units or FTU's are comparable to Nepheline Turbidity Units or NTU's.

[2] Winter freezing prevented the sampling of two wells, C-2 and D-2 during the Jan.-Feb. sampling session.

[3] Wetland data sheets for all points can be found in the January 2002 report.

[4] DOQ's can be purchased from UNH Complex Systems for ± $600 for the entire state.

the state for the purposes of wetland conservation and planning. It has been largely abandoned as a mitigation tool for wetland impacts, although it is still used in the designation of prime wetlands under Chapter 486-A:15 of the NH RSA's. The 'NH Method' is fully described in Ammann and Stone (1991), and can best be understood by reviewing the completed data forms in Appendix B of this report as well as the technical criteria under "Functional Value Specifications" also in Appendix B. The following functional value assessments were completed for the Great Meadow:[5]

1) Ecological Integrity
2) Wetland Wildlife
3) Finfish Habitat
4) Educational 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
12) Historical Site Potential
13) Noteworthiness

The 'NH Method' was designed to be a *comparative* method for use in assessing an entire set of wetlands within a given town. The drawback of using it for a single wetland is that such a comparison is not possible, thus the rationale for protecting a single wetland on the basis of it being more valuable than other wetlands is false. However, the use of the functional value indices contained within the method does provide a basis for assigning a specific value (on a 0 to 1.0 scale) and for monitoring such value assessments over time. It also provides more specific information on individual wetland attributes than most of the other wetland assessment methods available. I used this method in order to begin the process of evaluating all of Tuftonboro wetlands, as well as to provide the Town with a basis for designating the Great Meadow a "prime wetland" if desired.

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[5] Only Functional Value 12, Urban Quality of Life, was not evaluated owing to the rural nature of Tuftonboro.

## C) Plants and Animals

The qualitative recording of plant and animal species was maintained throughout the winter and spring season of 2002. The time period of winter snow allowed for a track frequency analysis of winter-occurring mammals, and offered a preliminary picture of distribution and abundance of this group of vertebrates. A single breeding bird point count was conducted at the 4 GWMW stations, and the data was compiled to estimate the distribution and abundance of breeding birds. The point count involved a ten-minute visual/aural observational count of vocalizing males at GWMW stations A-1, A-2, B-1, B-2, B-2a, C1, C-2, D-1, D-2, and D-2a. Since several of these point count stations were close enough to each other to include overlapping individuals, tallies at B-2, C-2, D-2, and D-2a only included individuals not previously recorded at the nearby stations. Point counts took place between (0612) and (0855) hrs on May 24, 2002.

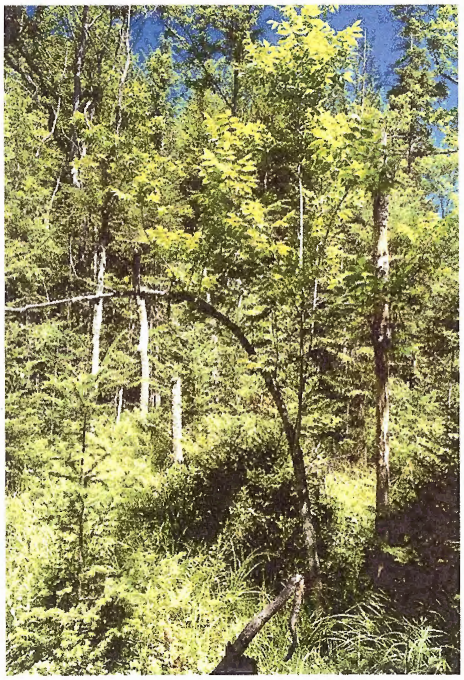
Amphibians, reptiles and fish were recorded when encountered. Amphibian eggs, larvae and adults were searched for in suitable habitats, including isolated pools of standing water in spring, river channels, riffles and pools, sphagnum-dominated forested swamps, and fast-running streams. Turtles were searched for in the open water and emergent vegetation edge sections of the Melvin River, and snakes were sought in sunny, basking sites along streambanks, in meadows, and in small woods openings. Riverine fish species were looked for in all stretches of running water. No attempt was made to trap, net, or catch individuals unless identification was not possible through direct observation.

**Two-lined salamander in upper Melvin Brook**

Invertebrate animal species were recorded on a sporadic basis and not ardently searched for. Most observations were made of butterflies and dragonflies/damselflies, as well as obvious true bugs and beetles. Plants were recorded regularly, and searched for in appropriate habitats of occurrence. Fungi and lichens were also noted, although insufficient attention was given to these groups to provide a rigorous accounting of species. Of the above groups of organisms, only plants are listed in the Appendix on account of the thoroughness of the listing.

### D) Rare and Endangered Species

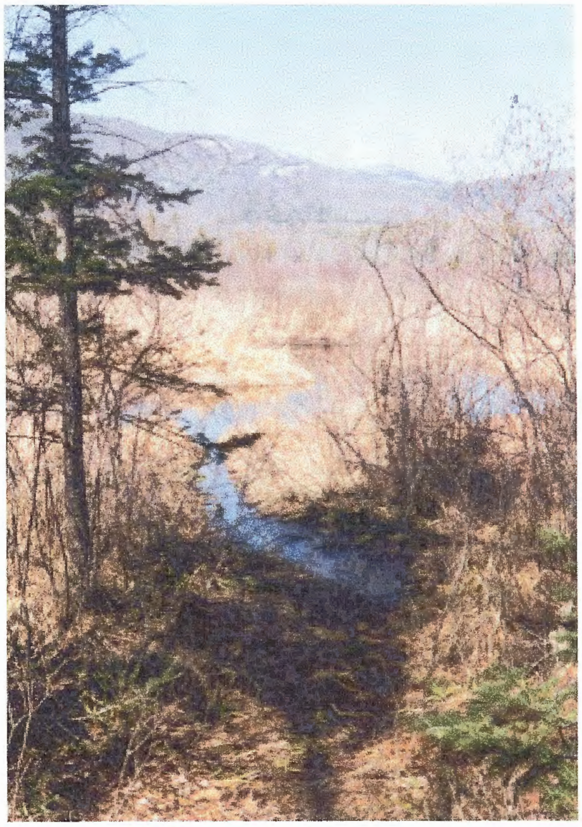
Plants and animals that are considered rare or threatened with extinction in the state of New Hampshire were initially researched through the NH Natural Heritage Program. As reported in the January interim report, no known records of plant or animal occurrences were discovered for the Great Meadow property. Two species of turtles, the spotted turtle (*Clemmys guttata*) and Blanding's turtle (*Emydoidea blandingii*), were identified for the surrounding area. Efforts to look for these two species were made during the month of June during both years. Positive breeding and feeding habitat was present on or near the Great Meadow property and therefore a search was warranted. Given the scope of the project, a limited time was spent on this endeavor, however.



**Northern Hardwood-Black Ash-Conifer Seepage swamp, one of the rarest natural community types on the Great Meadow property.**

### E) Trail Feasibility

Field notes were taken on the possible route of a nature trail around the Great Meadow. Observations were made of water tables, treadway, and existing game and human trails in order to assess the feasibility of establishing a recreational trail in the area. All of the abutting landowners were contacted in order to access their properties during the field survey. Positive responses were received from everyone, and conversations with several landowners suggested that the establishment of a non-motorized trail around and/or through the Great Meadow is a good possibility. Once most of the fieldwork was completed, an aggregation of GPS points was used to map out a trail route around the section of the Great Meadow with the greatest accessibility. The findings in the next section addresses the conditions of the proposed route, some of the natural resource attributes along this route, as well as the feasibility of establishing a trail in this area.



**An active beaver channel along the Melvin River, one of the point s of interest along the proposed trail route in the Great Meadow.**

## RESULTS / DISCUSSION OF FINDINGS

### A) Water Resources

The Great Meadow Base Map in the frontispiece of this report contains a depiction of the location of the 8 groundwater monitoring wells (GWMW's) and the 3 ambient surface water monitoring stations located on the Great Meadow property during the fall of 2001. The January 2002 interim report describes the process of the establishing the 2-inch diameter peizometers at the GWMW locations as well as the type of ambient surface water monitoring stations. The following table identifies the date of establishment, well type and depth of measurement for each well or ambient station:

**GROUNDWATER MONITORING WELL DATA LOG**

**GREAT MEADOW, TUFTONBORO, NH**

| Well # | Estab. Date | Soil Code | Drainage Class | Depth below surface (cms) | Height above ground (cms) | Total height (cms) |
|---|---|---|---|---|---|---|
| A-1 | 9/14/01 | 15 | VPD | 46 | 106 | 152 |
| A-2 | 9/14/01 | 395 | VPD | 60 | 92 | 152 |
| A-2a | 9/14/01 | 197 | VPD | N/A | N/A | N/A |
| B-1 | 10/1/01 | 214 | PD | 55.5 | 97.5 | 153 |
| B-2 | 10/1/01 | 295 | VPD | 79 | 72 | 149 |
| B-2a | 10/2/01 | 197 | VPD | N/A | N/A | N/A |
| C-1 | 10/13/01 | 347B | PD | 50 | 102.5 | 152.5 |
| C-2 | 10/13/01 | 395 | VPD | 45 | 107 | 152 |
| D-1 | 10/22/01 | 214 | PD | 63 | 81 | 144 |
| D-2 | 10/22/01 | 197 | VPD | 58 | 93.5 | 151.5 |
| D-2a | 10/24/01 | Open Water | (inund.) | N/A | N/A | N/A |

**Table 1. Well Data Log for Water Quality Monitoring sites at Great Meadow.**
**Soil Code and Drainage Classes described on page Appendix A-12.**

Each ground or surface water monitoring station was monitored at least once during consecutive months between the date of establishment and June 2002. The chart on the following page identifies the dates of monitoring for each station as well as the dates during which the stations were dry and/or frozen.

## GROUNDWATER MONITORING WELL DATA LOG - 2
## GREAT MEADOWS, TUFTONBORO, NH

"X" = water level & water quality taken; "x" = water level only

| **Well #** | 10/1/01 | 10/2/01 | 10/13/01 | 10/22/01 | 10/24/01 | 11/14/01 | 11/27/01 | 12/16/01 | 1/16/02 | 2/24/02 | 3/17/02 | 4/7/02 | 4/28/02 | 5/24/02 | 6/26/02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A-1** | x | X | X |  | X | X | X | X | X | X | X | X | X | X | X |
| **A-2** | x | X | X |  | X | X | X | X | frozen | X | X | X | X | X | X |
| **B-1** | dry | dry | dry |  | dry | dry | dry | dry | moist | saturated | saturated | X | X | X | X |
| **B-2** | x | X | X |  | X | X | X | X | X | X | X | X | X | X | X |
| **B-2a** |  | X | X |  | X | X | X | X | X | X | X | X | X | X | X |
| **C-1** |  |  | x |  | X | X | X | X | X | X | X | X | X | X | X |
| **C-2** |  |  | x |  | X | X | X | X | frozen | frozen | X | X | X | X | X |
| **D-1** |  |  |  | x | X | X | X | X | X | X | X | X | X | X | X |
| **D-2** |  |  |  | x | X | X | X | X | frozen | frozen | X | X | X | X | X |
| **D-2a** |  |  |  | x | X | X | X | X | X | X | X | X | X | X | X |

Note: Station A-2a involved a single surface water measurement adjacent to the pipe on 12-12-01, and an additional measurement 1.5 m N of the pipe on 1-16-02

**GWMW B-2 showing sampling equipment**

**GWMW A-1 before bear "rearrangement" of well**

A total of 97 water quality measurement sets were taken at 8 groundwater monitoring wells and 3 ambient open water stations during the study year. The first measurements were taken at station A-1, A-2, B-2, and B-2a on October 2, 2001 and the last set of measurements were taken at 10 stations on June 26, 2002. Station A-2a was only used twice: once on December 16, 2001 to monitor surface water condition adjacent to the frozen pipe at GWMW A-2, and once on January 16, 2002 to test surface water 1.5 m north of GWMW A-2 in an open seep. Other frozen well conditions were encountered as shown on page 9 on January 16 and February 24 at GWMW's C-2 and D-2.

The summary of water quality parameters is contained on pages A-1 to A-7 in the Appendix. The following contains a narrative synopsis of trends and highlights.

**Water levels** were generally low during the drought year of 2001 and mean high water (MHW) for each well was not reached until the spring of 2002. MHW depths were defined by soil characteristics in the soil profiles completed for the wetland delineation (see data sheets in the January 21, 2001 interim report). Looking at the range of soil water depths on page A-1, it is evident that a diversity of water levels was achieved across the 8

GWMW's. The highest well, B-1, was actually dry between October and April, and illustrated the abnormally low water levels at this time of year. The return of soil water to the upper zone of saturation (i.e. the top 10 inches) for greater than two weeks during the growing season testified to positive wetland hydrology at this station.[6] All other wells had sufficient water depths to allow for testing during the year, and virtually all of the wells (and ambient stations) contained water levels at or above the surface at least once during the study time period.

In terms of water level stability, the most uniform readings were obtained at GWMW's A-1 and A-2. Groundwater discharge at A-1 was quite regular throughout the year, and provided a rise and fall of less than 14.5 cms (5.7 inches). The building of a beaver dam just below GWMW A-2 also created a fairly uniform water level at this station, with a maximal amplitude of less than 9 cms (3.5 inches). These two wells stand in contrast to GWMW's B-1 and B-2, which rose over 60 cms (23.6 inches) and 49 cms 19.3 inches) respectively during the course of the year.

**Melvin River at flood stage in late May, 2002**

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[6] The Army Corps of Engineers Wetlands Delineation Manual and subsequent memoranda identify "positive hydrology" as being saturation to the surface for at least two weeks during the growing season. Growing season is defined as the time period when mean daily air temperatures exceed 28°F. Further, positive hydrology is usually present when saturation to the surface occurs between 5 and 12.5% of the growing season, and is always present when saturation to the surface is present for >12.5% of the growing season.

Discharge rates of the Melvin River tributary at the upper end of the Great Meadow property ranged from 28.0 to 52.5 cfs (cubic feet per second) or .8 to 1.5 cubic meters per second, with the lowest rates observed on November 14, 2001 and the highest on April 28, 2002. Discharge at the outflow point was only estimated on October 22, 2001, wherein rates of 36.5 cfs or 1.03 cubic meters per second were approximated. This measurement was clearly being affected by the series of beaver dams immediately upstream of this point.

**Water temperature** measurements provided a fairly stable reflectance pattern of decreasing temperature in the winter and a rapid warming after snowmelt. Although the graph on page A-2 does not illustrate summer temperature fluctuations, the clear difference between groundwater and surface water sites is quite apparent. The highest three temperature sets occurred at the two ambient sites (B-2a and D-2a), plus the GWMW site that was most affected by surface flows (D-2). There was also a greater degree of fluctuation at these three sites, most of which was attributed to fluctuating air temperatures. It should be also noted that those two wells that froze likely contained unfrozen water below the surface measurement depth since they did thaw out in less than a month's time.

**Dissolved Oxygen (DO)** measurements ranged between 0 ppm and 8.15 ppm with a mean of 4.83 (N = 105) and followed the general pattern of being lowest in the late summer and fall and highest during the winter months. A distinct variability existed between monitoring stations, with many stations being essentially anoxic (i.e. < 5.0 ppm)[7] for a significant period during the year. The return of seasonal groundwater after the late fall rains increased most sites to levels above 5.0 ppm, but these levels slowly decreased over the winter until snowmelt in late April. Continuous rains and snowfall events in April and May maintained high DO levels until growing season depletion of groundwater oxygen occurred through plant uptake and metabolism in June. The only clearly anoxic site was GWMW D-1, which only achieved DO levels above 5.0 ppm on

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[7] A DO level of 5.0 ppm has been identified by many biologists as the point of critical anoxia in the development of animal embryos and larvae.

the May 24, 2002 sampling session. The well's position next to a large root mound of a recently downed hemlock tree likely influenced the decompositional absorption of saturated oxygen in the area.

The measurement of **pH** helped indicate some of the unique water quality attributes of the groundwater in the Great Meadow area. PH ranged between 4.3 and 7.3 with a median of 6.7. This set of pH readings suggest that the Great Meadow has a fairly significant amount of groundwater discharge throughout the basin in which it lies. Swamp and marsh wetland pH's have been recorded by the author in a number of locales in the Lakes Region, and these typically vary between 4.3 and 6.0. The slightly elevated pH readings from Great Meadow are likely a result of its position below the Ossipee Mountain Range, which is well known to contain high amounts of calcium-rich bedrock. PH readings from the Ossipees have yielded measurements as high as 7.7, which is among the highest readings in the state (Jody Connor, NHDES, p.c.). At least 7 wells or ambient stations at Great Meadow had pH records at or above 7.0 (i.e. neutral). Notable among the set of readings taken were the strong influences of decomposing plant material at stations with muck and peat soils cores (e.g. A-2), and the "acid shock" of spring meltwater which depressed pH curves in nearly all of the monitoring sites.

**Conductivity (EC)** and **Total Dissolved Solids (TDS)** readings were essentially reflective of one another as they relate the amount of dissolved solids to both a parts per million and electric conductance ratio. Both sets of readings showed a wide variation in patterns among the 10 monitoring sites shown in the graph on page A-5. The mostly widely fluctuating readings were obtained at GWMW's A-1, A-2, B-2a and D-2a. The variability at the latter two stations can be explained by the ambient nature of these sites, wherein rainfall and other surface water disturbance events (e.g. beaver activity) could be directly correlated to variable levels of EC and TDS. The variability of wells A-1 ands A-2 is a little harder to explain. As stated during the October 2002 presentation, it is suspected that the higher than normal EC and TDS readings at well A-1 could have resulted from its position below the old town debris dump. A disturbed soil profile indicated previous filling, and the adjacent stump and garbage dump is likely still influencing the presence of solutes in the groundwater. The higher than normal readings at A-2 was more likely a result of beaver activity, which took place during the fall and early winter of 2001 less than 50 m away. The fact that this was not likely a result of the dump upslope is borne out by the contrasting pattern this site reveals against site A-1. The fall spike in EC and TDS corresponded with intense beaver lodge and caching activity at a time when EC and TDS levels at A-1 were at their yearly low.

The measurement of **turbidity** (in **FTU's**) assessed the amount of undissolved particulates in the water column at 4 sites: groundwater wells A-2 and D-2, and ambient stations B-2a and D-2a. In all cases, the level of undissolved solids reflected rainfall and/or beaver activity events. Most levels were below 10 ppm, but on two occasions, beaver activity near the groundwater wells caused an elevation in reading to between 10 and 15 ppm. In one extreme case, D-2 on May 24, 2002, turbidity levels exceeded 500 ppm! The presence of an abundant bloom of Leptococcus bacterium was responsible this unusually high reading.[8]

**Great Meadow panorama from southeast corner**

## B) Wetlands

A significant portion of the water resource value of the Great Meadow is tied to its wetland attributes. At 512.8 acres, the Great Meadow is the largest wetland complex in Tuftonboro outside of the open water areas of Lake Winnipesauke, Mirror Lake, and Dan

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[8] Leptococcus is a rapid growing bacterium that increases its population geometrically in warm weather in the presence of ample water-borne nutrients. Its presence can usually be detected by the "oil slick" and rust coloration of the water. Although usually associated with pollution, it does occur naturally in groundwater seepages with ample dissolved oxygen, iron and temperature.

Hole Pond. It contains the highest diversity of wetland plant communities of any area on the east side of Lake Winnipesauke, and is perhaps one of the richest groundwater discharge wetlands for the reasons stated above. This study performed an Army Corps of Engineers delineation of the wetland, as well as 'NH Method' evaluation of wetland functions. The following discussion treats both of these tasks in that order.

The **wetland delineation** was completed between the months of September to November 2001, and May to June of 2002. As described in the January 2002 interim report, a total of 4 transects were employed at the four principal forest cover types at the Great Meadow: mixed conifer-hardwood forest (hardwood dominant), mixed conifer-hardwood forest (softwood dominant), conifer forest, and deciduous forest. Each transect also sampled the four principal soil types: glacial till with mineral hydric soils, glacial till with histic (muck & peat) epipedons, glacial outwash with mineral hydric soils, and glacial outwash with histic epipedons. These four types roughly correlated with the soil series known as Lyme & Moosilauke, Chocorua, Naumberg, and Searsport.

At each transect a plot point was established above the wetland boundary in the upland, at the approximate wetland boundary and one immediately below the wetland line. An additional plot was placed in very poorly drained soils well below the wetland line at three locations in order to characterize soils at the corresponding GWMW's. Owing to the very abrupt wetland boundary at transect D, no wetland boundary point was needed.

Wetland delineation procedures followed standard protocols for mapping wetlands on the ground for non-development projects. A hand-held Silva Ranger compass was sighted along the approximate wetland boundary and the pace method employed to provide an approximate distance to the next angle point or bend in the wetland line. A Garmin 12XL GPS unit recorded the latitude/longitude at each angle point, and the resulting series of GPS points and sketched lines was transformed into a wetland boundary map in ArcView 3.2. The compass and pace measurements provided a back-up for the somewhat variable GPS points, especially in areas where conifer cover prevented precise lat/long locations.

**Hydric soil core showing the reduced mineral soils at the uppermost layer (bottom of picture) and the very dark, gray-mottled lower mineral horizon. This soil core was taken along the Melvin River and denoted a Rippowam soil, on account of the lack of surface organic matter and the variable particle sizes in the layered mineral horizons (i.e. from past flooding events).**

For areas outside of the Great Meadow property, only the use of remote data sources was used for determining the wetland boundary. The three sources described in the methods section above, the USGS topographic map, the NWI map, and the aerial photograph (DOQ) were essential in this process. Because an *off-site* method was used, the wetland line should be considered approximate, and may vary considerably upon field inspection. This method of identifying the total extent of the Great Meadow wetland also followed the guidance of Ammann and Stone (1991), which relies on remote sensing in order to identify and characterize the boundary of the each assessed wetland. While potentially inaccurate, this process does provide great accuracy than that provided by relying on a single source such as the National Wetlands Inventory map. This is well illustrated on page A-10, which shows the field and office delineated wetland versus the NWI map delineated wetland.

As a part of the **'NH Method' wetland evaluation**, three additional maps were prepared. The first, shown on page A-11, illustrates the approximate land use in the 500-foot buffer surrounding the Great Meadow wetland. Information for this map was taken from the NH GRANIT database, aerial photograph interpretation (DOQ 1998), and from a windshield survey of buildings and land use surrounding the Great Meadow. This map also contains a depiction of the aquifer, which underlies the wetland in order to illustrate where potential pollution problems may occur that could contaminate this aquifer.

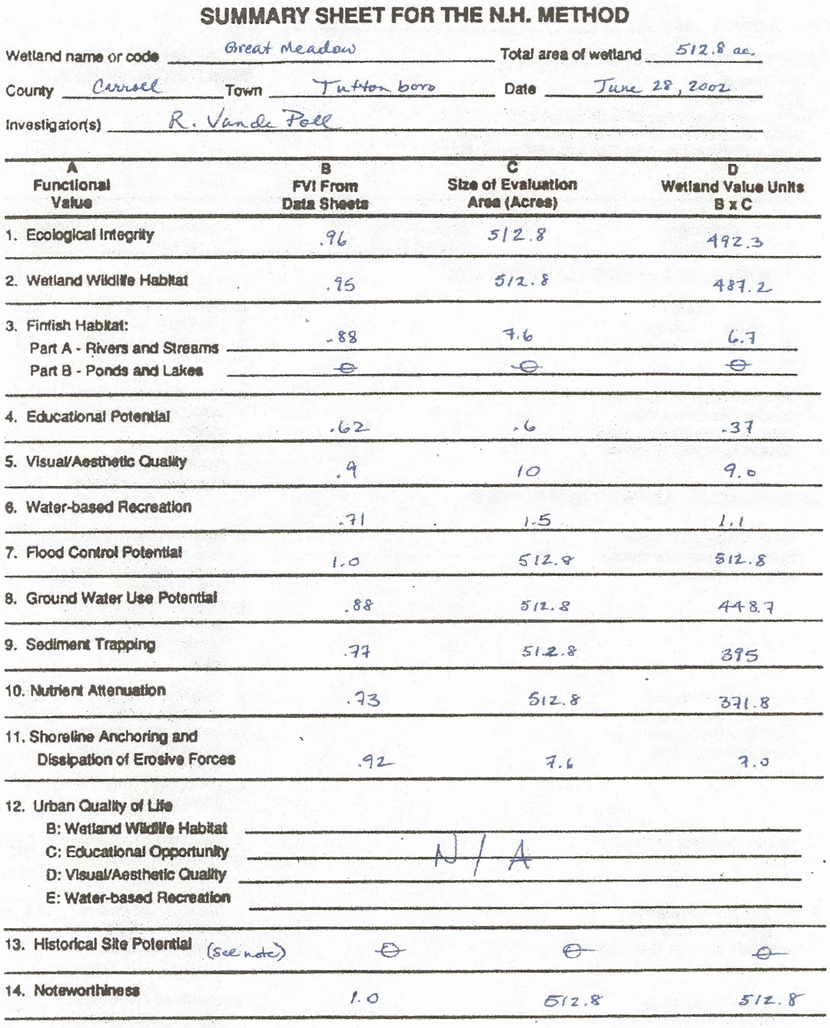
The second map (page A-13) that was prepared prior to the functional evaluation was the hydric soils map. This one provided the basis for concluding that greater than 50% of the Great Meadow wetland contains hydric A (very poorly drained) soils. Soil data for this map was largely derived from the 1977 Soil Survey of Carroll County, as made available in digital form by Complex Systems Research Center at UNH Durham. Some soil type revisions were made on the portion of the Great Meadow wetland that underwent field inspection. The third map on page A-15 includes the classification of wetland types according to the Cowardin system of wetland classification (Cowardin et al. 1979). This map was derived from field records and a careful review of the DOQ's. The table on page A-14 and the chart of page A-16 shows the number of wetland classes and their amounts (in acres) for the entire wetland. All three maps were essential in the preparation of the functional evaluation of the Great Meadow wetland.

**View of one of the upland islands in the Great Meadow wetland (seen at a distance). The number of islands is critical to the evaluation of wetland class interspersion, which is assumed to be directly related to the value of the wetland for wildlife species. Islands were confirmed on the ground through visual inspection of their upland soils and plant communities.**

Other wetland attributes that were observed in the field included the appropriate place for viewing and learning about the wetland, the level of human disturbance in and around the wetland, the number of invasive species, the number of road crossings, the amount of fill in the wetland, the quality of the wildlife habitat, and the wetland control structure

(WCL). The WCL is the structure of the landform at the outflow point of the wetland. Using the guidance of the 'NH Method,' this point occurs at an obvious natural or artificial dam or culvert, or at a point where the wetland was less than 50 feet in width. This point was observed to occur just below the Lovett's house, where the Melvin River takes a sharp bend and drops over some cascades. The WCL is directly related to the ability of the wetland to control flooding, and therefore required a careful measurement in the field (see Appendix B-20).

The following sheet summarizes the functional value assessment of the 13 wetland functions identified in the methods section above:



**SUMMARY SHEET FOR THE N.H. METHOD**

Wetland name or code Great Meadow Total area of wetland 512.8 ac.

County Carroll Town Tuftonboro Date June 28, 2002

Investigator(s) R. Vande Poll

| A<br>Functional Value | B<br>FVI From Data Sheets | C<br>Size of Evaluation Area (Acres) | D<br>Wetland Value Units B x C |
|---|---|---|---|
| 1. Ecological Integrity | .96 | 512.8 | 492.3 |
| 2. Wetland Wildlife Habitat | .95 | 512.8 | 487.2 |
| 3. Finfish Habitat: | | | |
| Part A - Rivers and Streams | .88 | 7.6 | 6.7 |
| Part B - Ponds and Lakes | 0 | 0 | 0 |
| 4. Educational Potential | .62 | .6 | .37 |
| 5. Visual/Aesthetic Quality | .9 | 10 | 9.0 |
| 6. Water-based Recreation | .71 | 1.5 | 1.1 |
| 7. Flood Control Potential | 1.0 | 512.8 | 512.8 |
| 8. Ground Water Use Potential | .88 | 512.8 | 448.7 |
| 9. Sediment Trapping | .77 | 512.8 | 395 |
| 10. Nutrient Attenuation | .73 | 512.8 | 371.8 |
| 11. Shoreline Anchoring and Dissipation of Erosive Forces | .92 | 7.6 | 7.0 |
| 12. Urban Quality of Life | | | |
| B: Wetland Wildlife Habitat | | N/A | |
| C: Educational Opportunity | | | |
| D: Visual/Aesthetic Quality | | | |
| E: Water-based Recreation | | | |
| 13. Historical Site Potential (see note) | 0 | 0 | 0 |
| 14. Noteworthiness | 1.0 | 512.8 | 512.8 |

**Summary sheet for the 'NH Method'**

Column B above shows the "FVI," or functional value index for each of the 13 functions that were assessed. It contains the most valuable data since this assessment only included a single wetland. As mentioned above, the 'NH Method' was primarily developed as a *comparative* method that looks at several wetlands. In the absence of such a comparison, the strength of the assessment lies in the relative values of the individual functional indices. Column B shows that the Great Meadow wetland has a fairly high rating in each of the 12 categories that received a value (on a 0 to 1.0 scale). While the reader may not have the experience of conducting or reviewing other 'NH Method' wetland evaluations, it is the opinion of the author that this set of FVI's is very high when compared to other wetlands in the state. This assessment is based on the completion of over 500 wetland evaluations in 4 towns in southern and central New Hampshire.

Relatively speaking, the only low FVI rating is the one for Educational Potential, which is restricted because of the current inaccessibility of the Great Meadow wetland to the public – i.e. school children. The lack of a parking area and adequate trails currently limit the use to which this wetland can serve as an educational facility. Second to this, the water-based recreation function is not as high as it would have been if the wetland had a greater amount of open water in which to operate a boat. This does not detract from the value that this wetland has in terms of providing nature-based recreational activities, but it may not value as highly as, for example a lakeshore wetland along Lake Winnipesauke.

Both Flood Control Potential and Noteworthiness received the maximum score of 1.0. The Great Meadow wetland is a superb flood control wetland, and the fact that the FVI yielded a 1.0 value does not accurately portray the ability of this wetland to function better than most wetlands in the region in this capacity. A series of beaver dams and sharp stream course changes help desynchronize floodwater events, as well as protect the downstream water quality of the Melvin River. The Noteworthiness function, one that was designed to capture wetland functional value among wetlands that may otherwise be overlooked on account of their small size, also identifies the most salient ecological attributes of a given wetland. In the case of the Great Meadow, the singular high score of 1.0 was attained for the presence of outstanding natural communities. The list of 22 natural communities recognized in the January 2002 interim report illustrates the tremendous diversity of plant and animal community types that this wetland holds. Among these, the most rare type is the northern hardwood-black-ash-conifer seepage swamp, as depicted on page 6 of this report. This natural community is ranked "S3" by the state Natural Heritage Program, meaning that there are less than 100 occurrences of this type in the state. The quality of this community is deserving of an "A" rank, which means it is of the highest quality based on size, structure, age, and other characteristics. The list of natural communities is reproduced herein to demonstrate this Noteworthiness attribute:

1) Hemlock-Spruce-Northern Hardwood Forest
2) Hemlock Forest
3) Hemlock-Beech-Oak-Pine Forest
4) Low Hemlock-Hardwood/Cinnamon Fern Forest
5) Undifferentiated Seepage Marsh
6) Reed Bent-grass-Goldenrod-Clematis Meadow/Shrubland
7) Alder-Dogwood-Meadowsweet-Viburnum Riverside Shrub Thicket
8) Tall Graminoid Emergent Marsh
9) Mixed Tall Graminoid/Medium to Tall Shrub Marsh
10) Short Graminoid-Forb Emergent Marsh/Mud Flat
11) Graminoid-Aerenchymatous Medium-depth Emergent Marsh
12) Open Basin Cattail Marsh
13) Highbush Blueberry-Winterberry Tall Shrub Thicket
14) Speckled Alder Basin/Seepage Shrub Thicket
15) Sweet Gale-Meadowsweet/Tussock Sedge Streamside/Pond-Border Fen
16) Highbush Blueberry/Sweet Gale-Meadowsweet Shrub Thicket
17) Red Maple/Sphagnum Saturated Basin Swamp
18) Red Maple/Lake Sedge Streamside/Seepage Swamp
19) Northern Hardwood-Black Ash-Conifer Seepage Swamp
20) Red Maple/Sensitive Fern-Tussock Sedge Basin/Seepage Swamp
21) Subneutral Forest Seep
22) Seasonally Flooded Red Maple Swamp

The above list of natural community types on the Great Meadow wetland is among the highest of any wetland complex in the Lakes Region. Part of this is attributable to the ample amounts of nutrient-rich groundwater, which support a diverse of array of seepage swamps. Another significant factor is the size of the watershed above it, which gives rise to both Field Brook and the Melvin River. The presence of beavers, which have had an indelible influence over the Great Meadow for many years, has also diversified the types of natural communities and wildlife habitat in this area. The following section discusses the plant and animal portion of the ecological assessment, and offers more credence to the relatively high wetland wildlife value listed above.

## C) Plants and Animals

A total of 12 species of amphibians, 3, reptiles, 3 fish, 93 species of birds, 33 species of mammals, and 256 species of plants were observed during the 12-month time period at Great Meadow. On account of the wetland habitat, **amphibians** were well represented. The list on page A-17 illustrates the observational records of 1 Ambystomid salamander, 1 Salamandrid salamander, 3 Plethodontid salamanders, 1 toad, 1 treefrog, 1 chorus frog, and 4 true frogs. The Ambystomid, a spotted salamander was recorded on the basis on an egg mass that was seen in a small depressional pool along the Melvin River floodplain in April. Its presence suggests that there are likely other floodplain ponds or sloughs that support this obligate vernal pool species. The primarily riverine two-lined and northern dusky salamanders were common associates with the Melvin River and its western tributary. Their habit of resting under rocks in the riffles and pools of streambeds made these animals easy to locate. The semi-aquatic red-spotted newt was relatively abundant, particularly on wet field days. The adult form of this species very frequent in the Melvin River and the newt or eft stage was common in moist conifer woods. The latter was seemingly as abundant as the redback salamander, a terrestrial species that can be found under moist logs and leaf litter.

**Reptiles** were not common on the Great Meadow property, and only 4 of the possible 14 species were observed. Garter snakes were the most abundant, and these were seen frequently in almost all open sunny spots during good basking days during the growing season. Garter snakes were found from the wet meadow areas to sphagnum swamps to adjacent upland forests. Eastern painted turtles were not common, and only a couple were seen in the deeper water sections of the Melvin River. This normally pond-associated species does travel along riparian corridors in search of food sources in beaver-dammed pools and ponds. The number of aquatic invertebrate larvae no doubt provides an ample supply of food for this short-migratory species. Evidence of the snapping turtle was found in the form of mud tracks in the lower Melvin River. This species also prefers lakes and ponds, although the Melvin River provided enough water for dispersing adults to feed and migrate upstream from Lake Winnipesauke or the beaver ponds in between.

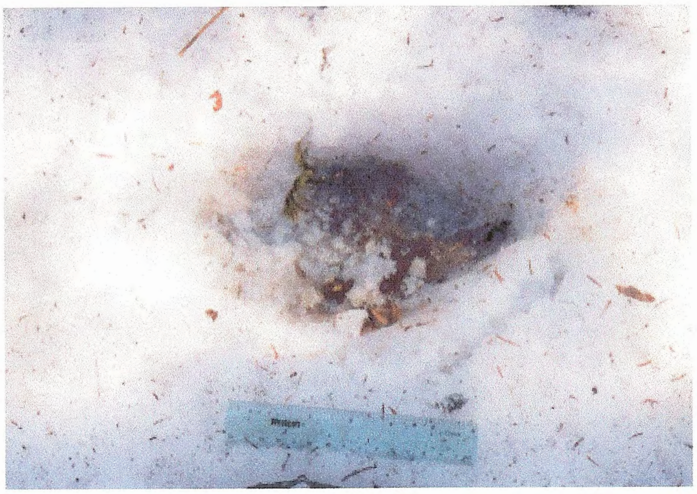
**Fish** species were not actively sampled as much as they could have been. Only three species were found, although no doubt several other exist. The most notable species was the brook trout, which provided an additional indication of clean water. The "brookie" was seen along virtually all of the stretches of stream within the Great Meadow wetland during the survey. In addition, a dead redbelly dace was observed being eaten by a Limnephilid caddisfly larva in the lower Melvin River. This is one of the most common species of dace in New Hampshire (Scarola 1987), although it tends to be more common in the western part of the state. It is uncertain whether the Great Meadow represents an unusual occurrence of this lover of small, clean streams. The third species, the slimy sculpin, also prefers small, fast-running streams with little to no pollution. One individual was quickly seen in the lower Melvin River stretch while conducting the WCL assessment described above.

The January 2002 report listed a total of 83 species of **birds** for the Great Meadow property. Since that date, an additional 10 species were added both from migration records and breeding bird surveys. The former included several waterfowl observations during the late winter time period, wherein a small of wood ducks was observed on February 24. Three weeks later, a flock of snow geese was observed flying over the Great Meadow although they did not land. Also in migration was a rough-winged swallow, which was seen near GWMW C-2 on April 28. A northern goshawk stooped overhead on February 24, and both northern cardinals and house finches were on the move from winter feeders on that date. The remaining additions occurred during the breeding bird survey on May 24, wherein eastern wood peewees, great-crested flycatchers, and Baltimore orioles were heard vocalizing. The tenth species, a blackpoll warbler, was also heard calling on May 24, although its status as a breeder is extremely unlikely, as it prefers nesting in montane spruce-fir forests.

Perhaps the most interesting bird observations included the high number of red-winged blackbirds, common yellowthroats, and American goldfinches, which all registered double-digit numbers of vocalizing males during the May 24th BBS (see page A-18-19).

At face value, this more than anything else depicted an open wetland condition at the Great Meadow. The presence of a single rusty blackbird was also indicative of a large wetland complex, although this species tends to prefer boreal wetlands to ones in temperate zones. The high number of balsam fir and red spruce trees (and black spruce in the upper part) may have been enough to "fool" this species into nesting much farther south than it is normally recorded (Foss 1994). This may have also been the cause of the highly irregular appearance of the boreal chickadee in November 2001.

Thirty-three species of **mammals** (inclusive of two domestic species) were recorded during the survey by virtue of their sign and/or direct sighting. This diversity represents over 95% of the mammal diversity that could be detected in the area without a specialized sampling survey effort. Small mammal live trapping, bat netting, and flying squirrel photo-trapping would be required to enhance this list. Over half of the species were directly sighted, and many of these are quite common to the casual observer. Owing to the largely undeveloped nature of the Great Meadow wetland, as well as its excellence of wildlife habitat, the most important attribute of this diversity was the relatively high concentration of selected species that require unfragmented open space.



**Fresh black bear track along the south wetland edge in a late winter snow.**

Perhaps the most significant mammal species observed on the Great Meadow property was black bear. Its sign was found throughout the area, and several well-used trails passed through the mature hemlock and pine stands along the wetland edge. Both cubs and adults were seen on several occasions, and some territorial behavior was expressed, both in the form of a fake charge and the "rearrangement" of one of the monitoring wells. The cap of GWMW A-1 was removed and chewed up and the standing pipe was pushed over slightly by a very muddy individual. Actively clawed territory trees were found on all sides of the wetland, and several day beds in the long marsh grass were found during the summer and fall.

In terms of feeding and resting, the Great Meadow serves as a critical winter and local migration habitat for black bear as well as a host of other species. Moose were quite common heard and/or seen, and the use of common game trails often contained the sign of this animal. Only the white-tailed deer was apparently more prevalent in terms of the sign it left behind. Trails, scraped hemlock saplings, browsed hobblebush stems, bedding forms, and antlers were among the sign of deer regularly seen. Both ungulates were utilizing all areas of the Great Meadow quite heavily; moose were most active during the summer and fall months and deer during the winter and spring months. Although the snow depths did not warrant the concentrated use of dense softwood cover by deer during the winter of 2001-2002, snow depths during deeper snow winters no doubt support the use of much of the Great Meadow as a deer wintering area. The wetland complex holds all of the attributes required by deer during deep snow winters, and the presence of browse, cover and well-used trails suggest that this is the case.

**Well-used deer trail from sunlit opening in the forest into dense low hemlock area. The use of the Great Meadow wetland as a wintering deer area cannot be under-estimated within the surrounding fragmented landscape.**

All of the major predator species were present at the Great Meadow property, inclusive of bobcat, coyote, red and gray fox, otter, fisher, mink, and ermine. The diversity and abundance of these species attests to the abundance of prey species that were observed to be present as well. Squirrels and mice were extremely common, as were shrews, voles, flying squirrels, snowshoe hare, beaver, and muskrat. Although no formal track transects were completed, a quantitative tally of track intercepts along the routes to the 4 groundwater monitoring stations indicated an above average track intercept interval of 12.5 m per individual[9] for medium to large mammals (i.e. bigger than squirrel). The clear dominant track maker was deer, followed by snowshoe hare, coyote and fisher.

**Alder flowers (L), lungwort lichen (below) and classic old growth wetland (R) at the Great Meadow. Over 250 plant and 150 fungi species were observed during the course of the year.**

Plant species diversity was fairly high for a single wetland area. The total species count of 256 species included approximately 10% non-native species. The latter were mostly found in disturbed areas, such as along the ATV trail / powerline and around the old town dump off Sodom Road. At the first site, purple loosestrife was beginning to take hold along the banks of the Melvin River. Scattered patches of it were found along its entire length within the Great Meadow property. At the second site, both Japanese knotweed and European buckthorn were well established after many years of artificial disturbance. The old dump had the highest concentration of invasives, wherein greater than 90% of the current plant cover is composed of non-native species.

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[9] Track intercept intervals represent the average distance between tracks in a given stretch of land. For example, if 10 animals crossed a 100 m long imaginary line in the woods, the track interval would be 10 m.

Native plant species were mostly hydrophytes, or plants that are adapted for life in saturated soil conditions. The diversity of sedges, rushes and grasses indicated the open, wet quality of the plant communities. Beaver-mediated wetlands created large expanses of cat-tails, beaked sedge, and tussock sedge. Flooded forests were found with standing dead trees, scattered red maples, or a mix of maples, birch, fir and spruce. Several speckled alder seepages were found that remained inundated all year in spite of the drought. Sphagnum moss cover at these sites exceeded 95%. Groundwater discharge provided an ample amount of nutrient-rich water to support *Sphagnum squarrosum*, a fairly common indicator of relatively high pH.

The relatively high number of fungi, while not listed in this report, was also composed of those species that prefer moist to wet conditions. The genus *Hygrophorus* was well represented, especially since members of this group (in the sub-genus Hygrocybe) are recognized as wooded swamp associates. These bright red to orange or yellow fungi stand out brilliantly against the dark green mosses of the forest floor. One uncommon species, the parrot waxy cap (*Hygrophorus psittacinus*), actually turns from a bright emerald green to deep crimson red and finally to pale orange yellow in a matter of a few hours. Likely because of the dry year, several unusual waxy caps that are normally flooded out were observed in profusion, such as *Hygrophorus aurantiocephalus* and *H. cuspidatus*.

Lichen species were only casually inventoried and therefore not listed in the Appendix. The above-pictured lungwort lichen (*Lobaria pulmonaria*) was the most noteworthy find at the Great Meadow. This species is well known as an air pollution indicator in the sense that it cannot tolerate even low levels of carbon monoxide. The fact that the Great Meadow held one of the highest regional populations of this species suggests that the air quality in this area is very high. The presence of *Physcia rubropulchra*, *Flavoparmelia caperata*, and *Evernia mesomorpha* also indicated a moisture-laden air mass free from standard industrial pollutants. Lichen diversity, while not rigorously tallied, contributed over 25% to the fungal diversity yet likely exceeded 100 species if carefully identified.

## D) Rare and Endangered Species

No known rare or endangered species were located on the Great Meadow property during the study time period. As stated above, the NH Natural Heritage database was checked at the Program office in Concord. Nearby EO's (element occurrences) were reviewed to determine if species requirements were similar to what is present at the Great Meadow. In spite of the presence of good habitat for several species, such as the spotted and Blanding's turtle, no rare species were encountered. The Melvin River was large enough and contained adequate feeding and resting habitat for the spotted turtle, and the fact that it was not discovered does not mean it was not there. Because of the proximity of the nearest spotted turtle population (Ossipee), and because of the suitability of the Great Meadow habitat, it is quite possible that this species exists on Town land. Further searches are warranted, either in the form of active turtle trapping at or near the many beaver impoundments or through active searches in the tall sedge areas of the streamsides.

A number of rare plants could also exist on the property, as indicated by two species mentioned in the January 2002 interim report, the water avens (*Geum rivale*) and the early coralroot (*Corallorhiza trifida*). Both prefer circumneutral seepage swamps (i.e. with groundwater pH levels above 6.0), and both have occurred with rare species such as small yellow lady's-slipper (*Cypripedium parviflorum*) and marsh bellflower (*Campanula uliginosa*). The lady's-slipper has been found in Alton and the marsh bellflower has been found in Moultonborough. A third state listed species, the ram's-head lady's-slipper (*Cypripedium arietinum*), has also been found nearby (Moultonborough) and could occur on some of the islands in the Great Meadow. It is a less predictable species in terms of soil conditions, and the three or four known populations around Lake Winnipesauke reflect this fact.

Perhaps the most significant rarity on the Great Meadows property is its general unfragmented forest condition. Not only are some of the wetland plant communities uncommon (such as the northern hardwood-black ash-conifer seepage swamp mentioned above), but the condition of many of these communities are about as pristine as one can find in the surrounding region. Old growth characteristics of many of these stands was discussed in the previous report, yet it is important to emphasize that rarity and ecosystem value lies not only in species diversity, but in the condition of those species assemblages as well. The old growth scrub-shrub and forested swamps on the Great Meadow warrant special protection as biological reserves due to their microhabitat and genetic diversity.

### E) Trail Feasibility

During the course of the field study, possible trail routes in or around the Great Meadow were noted during each site visit. Existing trails and byways were "pointed in" by GPS, and integrated with field data. The map on page A-16a defines the proposed trail route around the Great Meadow property. It should be noted that due to dense brushy habitat as well as deepwater wetlands, only 20% of the proposed trail lies on Town property. It should also be noted that the western part of the property was deemed too remote and difficult to traverse to suggest a trail route in that location. The avoidance of difficult terrain as well as the adherence to existing trails suggested a location that would provide a relatively easy-to-follow treadway for public visitors as well as a minimization of construction costs. The following includes a discussion of the feasibility of constructing and utilizing a trail that crosses private land in this manner.

**ATV crossing of a wetland near the Melvin River, a possible source of concern for multiple trail users.**

Beginning at the roadside pull-off on the Town land near the Town Garage, the proposed trail descends an existing access road to the old Town dump. This dump has been described as a site for road waste, stumps, and other debris that was used by the Town road crews for many years. At least 10 years ago it was capped with fill and left alone. The access road into the site is still in good shape, and other than having to cut away a few downed logs, the trailway would be easy to resurrect. Once at the old dump site, the proliferation of buckthorn and Japanese knotweed would require some initial clearing and maintenance in order to cross the now semi-open field. Keeping this site brush-hogged is suggested in order to provide the visitor with an open field habitat as well as enhance the wildlife diversity in the area. Open uplands are very scarce on the Great Meadow property, and keeping this open would benefit the deer, moose, bear, skunks, meadow voles, hawks and other wildlife species that require open habitats. The proposed trail route currently follows the main game trail across this meadow.

The proposed trail then descends the far bank of the old dump site and enters the sloping wetland. This first stretch is stony enough to allow for limited treadway improvements beyond clearing and careful placement of the trail. Some low log platforms may be required in the wetter spots, but reaching the level conifer-dominated wetland area should be relatively easy to effect. Once there, the suggested trail route follows a northwesterly path along a well-used game trail. The latter extends to an upland island (see page A-15) and then cuts back easterly along the wetland edge roughly 20 feet from the open wetland border. The suggested route follows this game path, crosses a mucky seep area (which would require two small bridges) and extends as far as the end of a skid trail. From here the proposed route follows old logging skid trails all the way to edge of the property line below Meadow Lane.

Recent logging activity below Meadow Lane has nearly obliterated the boundary line, but yellow-green flagging has been hung along the approximate Town boundary. The skid trail crosses this boundary, enters the Meadow Brook subdivision land and then re-enters the Town land for a short stretch in the southeast corner of Lot 30-3-4. Here the proposed trail enters the Mancuso Land (Lot 30-3-2), which is currently posted. While I did not discuss the possibility of crossing this private lot with the landowners, they did welcome my presence for the purposes of doing the wetland inventory.[10] The proposed trail route follows the old farm path and logging road through the Mancuso land onto the Helen Bradley land (Lot 30-3-7) and then onto the land of Mary Adjutant. At the old "hay meadow path" (that comes in from Sodom Road) the proposed trail turns north and forks northwest after crossing the main tributary that feeds the southeast corner of Great Meadow. It descends through mixed conifer woods and just reaches the northeast corner of the John Edgerly (now Steve Berry) land before curving northwards along the wetland edge (still on the Adjutant land). Up until this point, the trail has followed well-used skid roads and old byways that would only need minor maintenance and ditching around low wet spots.

**View of previously forested beaver swamp next to Melvin River**

The suggested trail route then follows game trails just upslope of the wetland edge and just below a recent logging job. It re-enters the wetland forest at a point where an old road heads north-northeast towards the Sargent land. Here the proposed route crosses a mature conifer wood through the land of Dorothy Fabian (Lot 31-5) and swings northwesterly back towards the Melvin River. It then follows the wetland edge along game trails on the southeast and south sides of the Melvin River. It enters the Fred Sargent land (Lot 31-2) and finally crosses the Melvin River at a point where the river exits a steep ravine. A bridge would be required here for a proper crossing.

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[10] The Mancuso family did state that they had posted their land when they bought it (in 2002) to prevent the usage of their skid roads by ATV's and snowmobiles.

The last stretch of the proposed trail follows the wetland edge north and east of the Melvin River and passes through mixed woods that have been cut over in selected locales. Where the trees have not been cut the path could be easily established by using existing game trails. In areas where recent logging has taken place (i.e. at the point of land just before reaching the powerlines) more significant clearing of slash would be required. The use of existing skid trails is suggested, although these will soon grow up into sapling birch paths and would require yearly maintenance for the next 10-12 years. The final trail segment leads from the recent cut area to the powerline ATV/snowmobile trail via a fairly steep white pine stand above the Melvin River floodplain. Some sidebank cutting would be required in this stretch.

There are a large number of ecological attributes that this proposed trail passes by. Should the proposed trail be approved and constructed, greater detail on these attributes can be provided. The general purpose of the trail route is, as stated above, to provide the user with an opportunity to experience the Great Meadow without having to slog through deep water and muck. That said, there are a number of places where a side trail into the actual meadow is possible. This would require the construction of a boardwalk, but if placed strategically, would add to the overall value of the nature trail tremendously. A side trail already exists near the northeast corner of the Mancuso lot, although this is currently used by ATV's and snowmobiles and completely inundated up to the forest edge. A second side trail/boardwalk is possible at the point where the old hay path reaches the open water edge. Following the old route into the meadow would provide the viewer with an exception view of the eastern side. The third and last side trail is suggested from the point of land in the northeast corner where the recent logging has taken place. A boardwalk in this vicinity could actually reach the Melvin River tributary itself and provide a sweeping view to the south along the major axis of the wetland. Each of these sites holds unique wildlife, plant community and/or riparian characteristics that would be worthy of interpretation. A booklet could be drafted that would aid the visitor in understanding the dramatic landscape around them.

## SUMMARY

The 176-acre Great Meadow property lies within the largest wetland complex in the Town of Tuftonboro. It also sits above the largest aquifer (in terms of productivity) in town. It contains an exquisite mosaic of inundated beaver meadows, scrub-shrub wetlands, seepage swamps, and riverine channels. It has a tremendous groundwater discharge rate, which has kept its water levels high during the 2001 drought year. The pH levels of the water are higher than most other wetland systems in the region, and nutrient-loving vegetation adorns much of the saturated soil borders. These characteristics are responsible for the rich diversity of plants and animals that were found at the Great Meadow, most of which survive in a relatively undisturbed environment free from the effects of forest fragmentation.

In spite of the fact that this study focused on the Great Meadow Town property, the outstanding biological and hydrological attributes of the remainder of this 512.8-acre wetland were easy to discern. During one site visit in October a unique black spruce fen/bog was traversed along the powerlines upstream of the Town property. On another occasion, a number of bobcat and snowshoe hare trails were crossed between the current Town dump and the Melvin River tributary bridge. Black ash-dominated seepage swamps were observed at the northernmost edge of the wetland on the north side of Route 171. And pH readings from the Castle-in-the-Clouds property, part of which lies within the watershed above the Great Meadow were found to be among the highest in the state.

Protecting the Great Meadow wetland ought to be one of the highest land conservation priorities for the Town of Tuftonboro. At both the January and October 2002 presentations, I suggested that the Town of Tuftonboro Conservation Commission seek the establishment of a conservation easement that spells out the long-term protection of the Town lands. A second recommendation was made to actively seek the protection of the wetland areas <u>not</u> within the Town's ownership. Less than 30% of the Great Meadow wetland is publicly owned, and lands that surround the wetland complex are steadily being subdivided and sold for housing development. A third recommendation was to establish, through a town-wide vote, an aquifer and/or groundwater protection district around the Great Meadow aquifer that restricts certain land uses such as the storage of hazardous materials or development of industries that produce water-borne toxins on-site. Although the current population of Tuftonboro does not necessarily warrant the drilling of public water wells, this may become a distinct possibility within the next 50 years. Permanently protecting the sources of clean drinking water should be in the highest interest of the Town.

A watershed approach to this protection effort would enhance the overall effect of the land conservation that is enacted. The Castle-in-the-Clouds portion of the watershed is already under conservation ownership and protective covenants are being planned. Such protection should also be sought for the remaining lands on the steep side slopes of the Ossipee Mountains in order prevent the upstream degradation of both the surface water and groundwater that moves through the Great Meadow. Agricultural lands should have pesticide application restrictions, and old and current dump sites should be carefully capped and monitoring for groundwater contamination. Road salt should be minimized along the stretch of Route 171 within the watershed to extent that is safely practical. Old junk yards should be cleaned up and existing automotive repair facilities should be monitored for potential petroleum product leakages.

The single greatest tool for affecting the above land protection initiatives is education. The above-mentioned presentations offered the Town an opportunity to learn more about the Great Meadow area on a short-term basis. Longer term educational outreach efforts by the TCC are possible through the publication of promotional literature on the area, continued research and field trips by area schools, long-term monitoring projects that re-use the existing groundwater monitoring wells, the solicitation and acquisition of land use agreements by abutting landowners, and town-wide promotion of the Great Meadow through the creation and establishment of a nature trail. Historical use of the area could be researched and integrated into a long-term view of changes in the landscape. Guided walks on the Town lands could focus on history as well as some of the biological aspects described in this report. Articles in the local paper could provide a regular column of 'happenings' at the Great Meadow for nature buffs and trail users alike.

This report represents a first step in the long-term planning and protection effort for the Great Meadow wetland. The foresight of the Tuftonboro Conservation Commission, as well as the Land and Community Heritage Investment Program, which helped fund this study, will continue to provide benefits to the residents of Tuftonboro for years to come. The conservation action steps suggested above will certainly help ensure the long-term survival of the wetland ecosystem for human use, but it must also not forget the wildlife and plant populations that depend upon such vision and foresight for their long-term survival as well.

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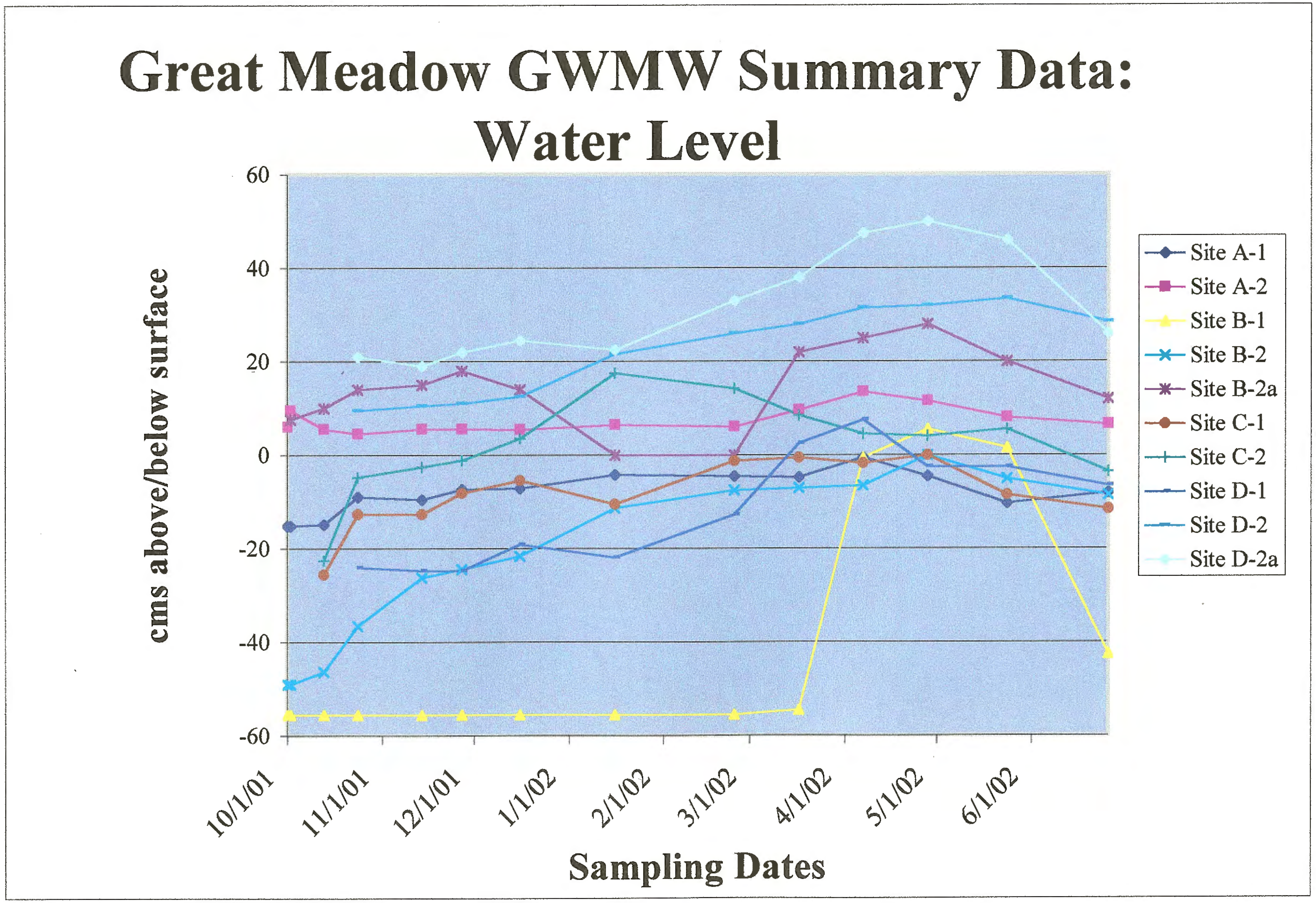
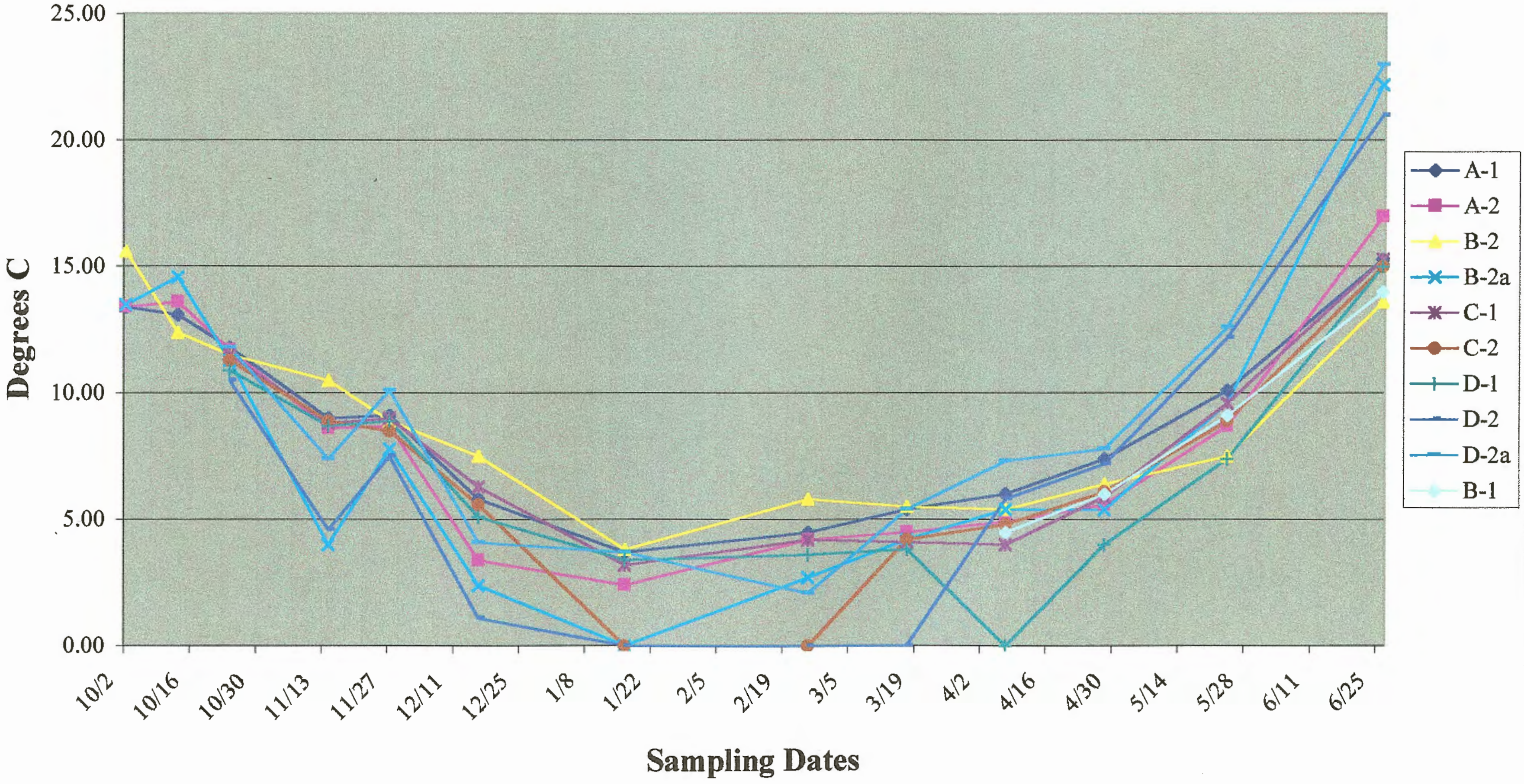
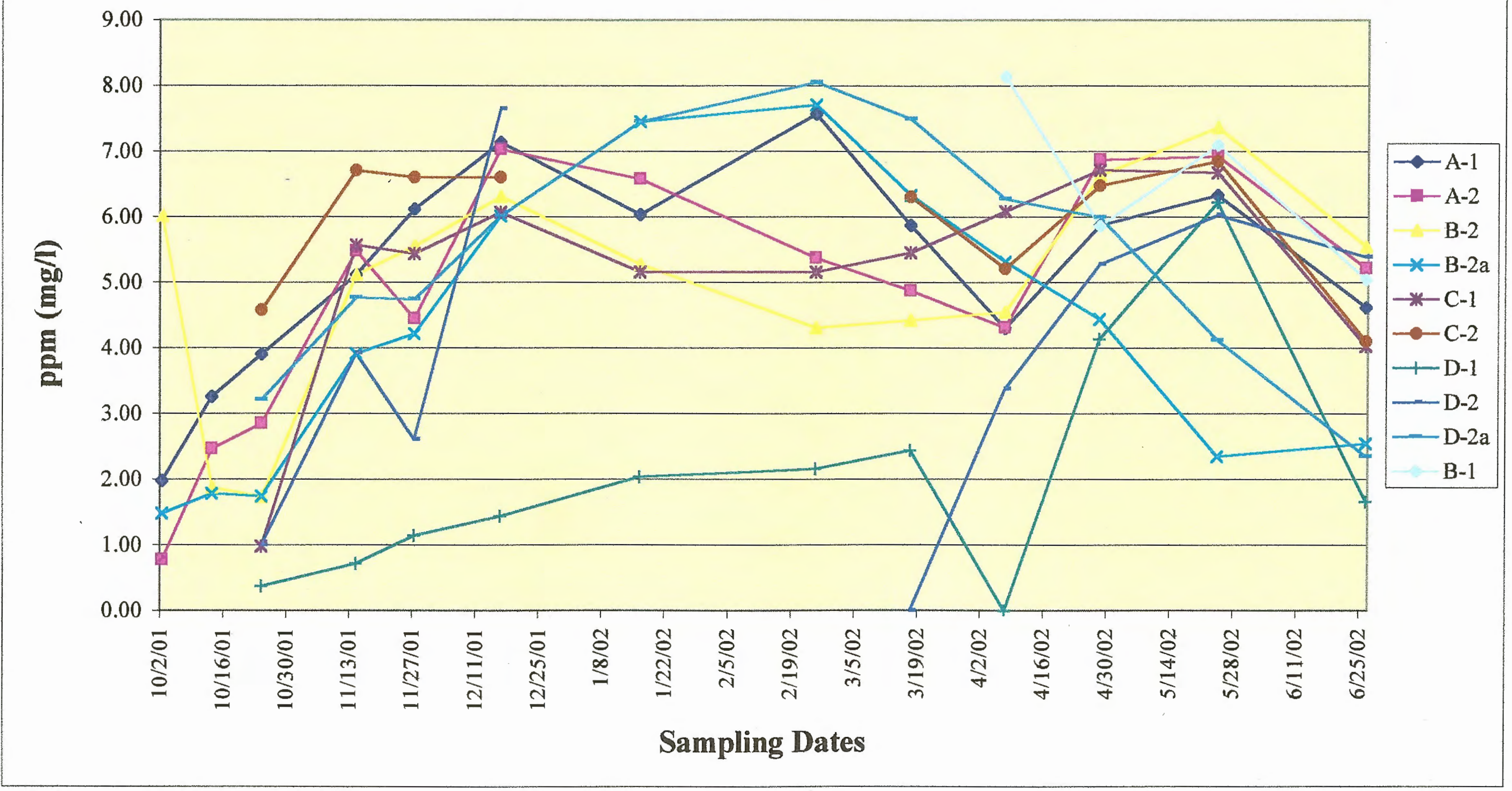
# Appendices


Great Meadow GWMW Summary Data: Water Level
cms above/below surface
60
40
20
0
-20
-40
-60
10/1/01
11/1/01
12/1/01
1/1/02
2/1/02
3/1/02
4/1/02
5/1/02
6/1/02
Sampling Dates
Site A-1
Site A-2
Site B-1
Site B-2
Site B-2a
Site C-1
Site C-2
Site D-1
Site D-2
Site D-2a

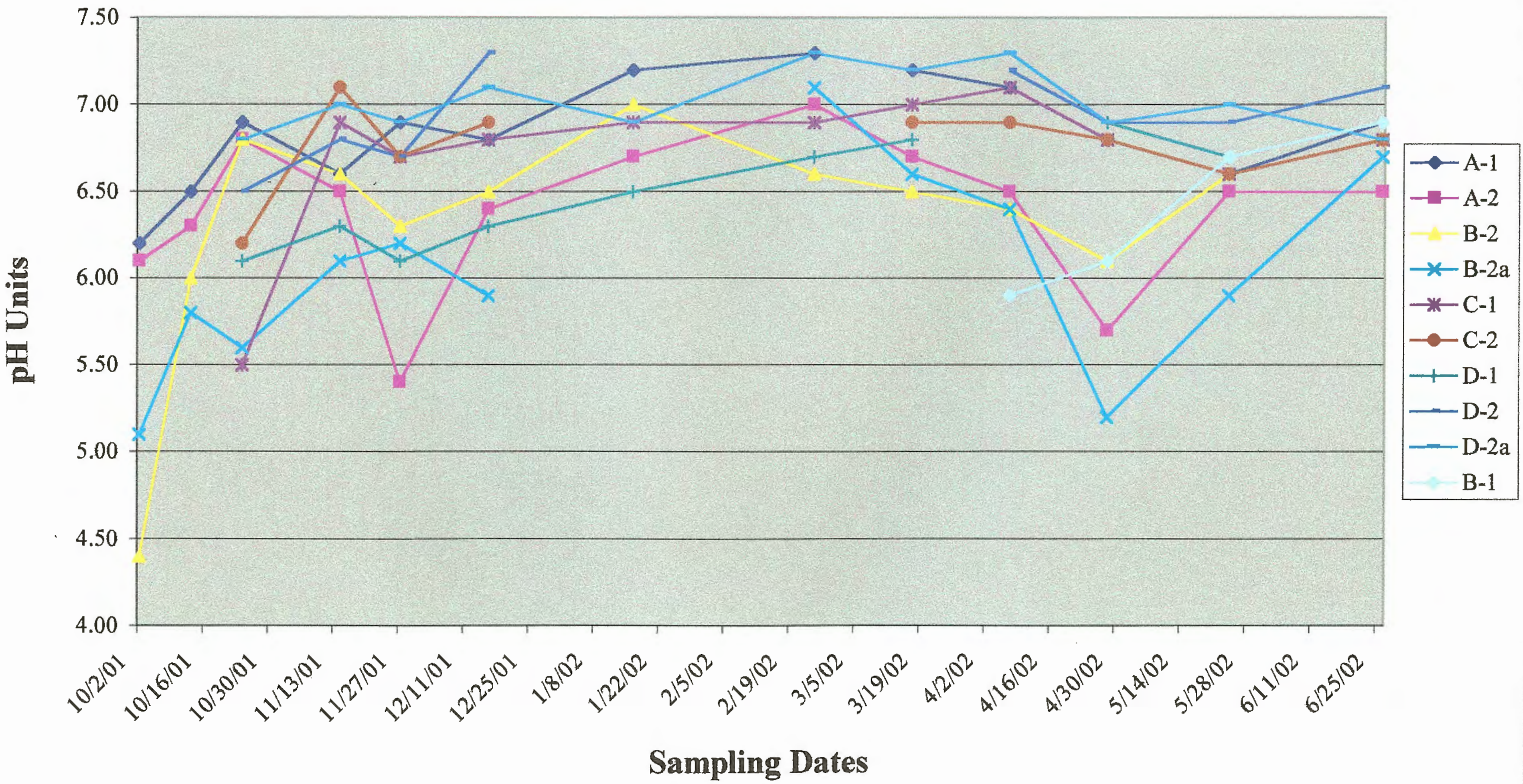
# Great Meadows GWMW Summary Data: Temperature



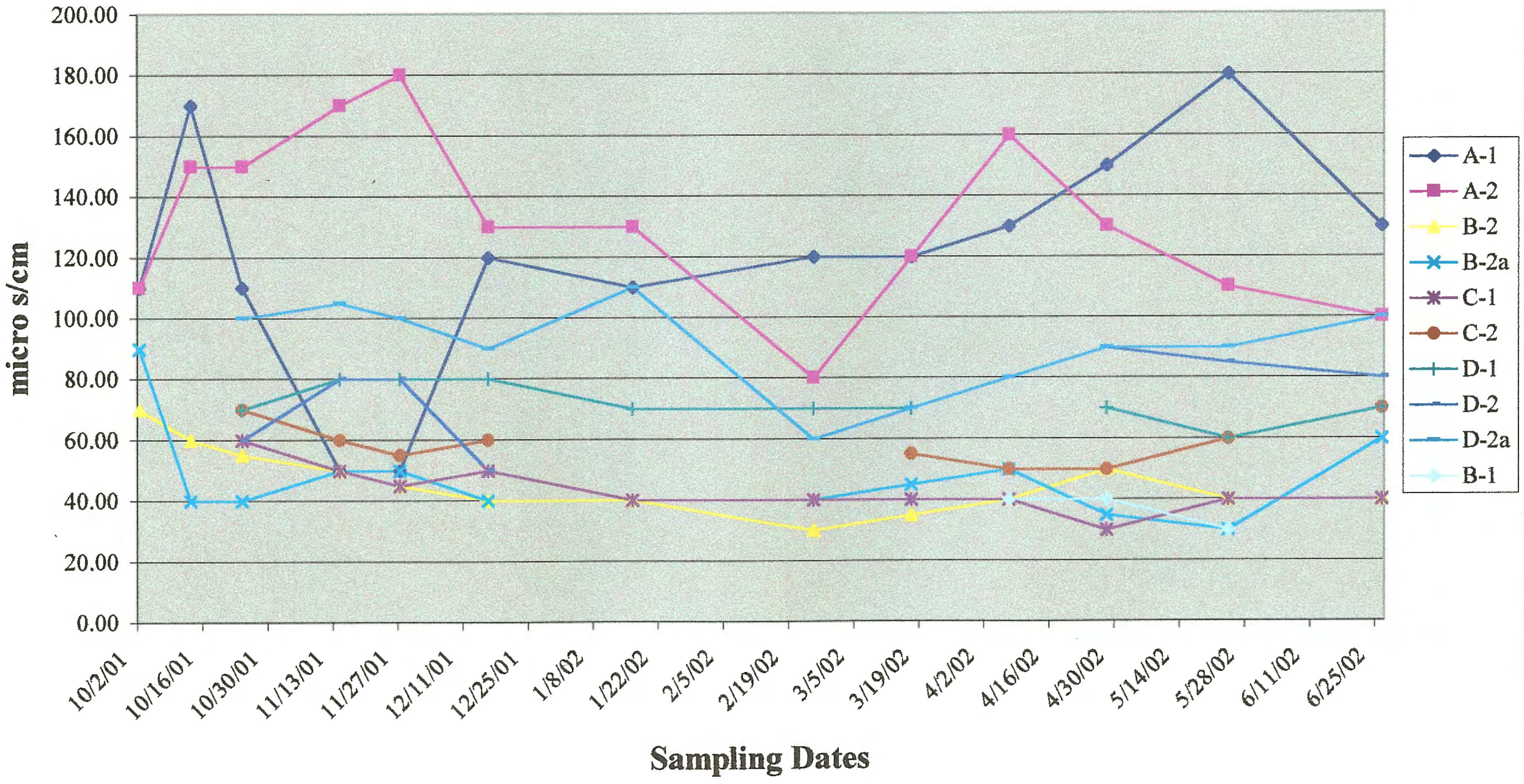
# Great Meadows GWMW Summary Data: Dissolved Oxygen



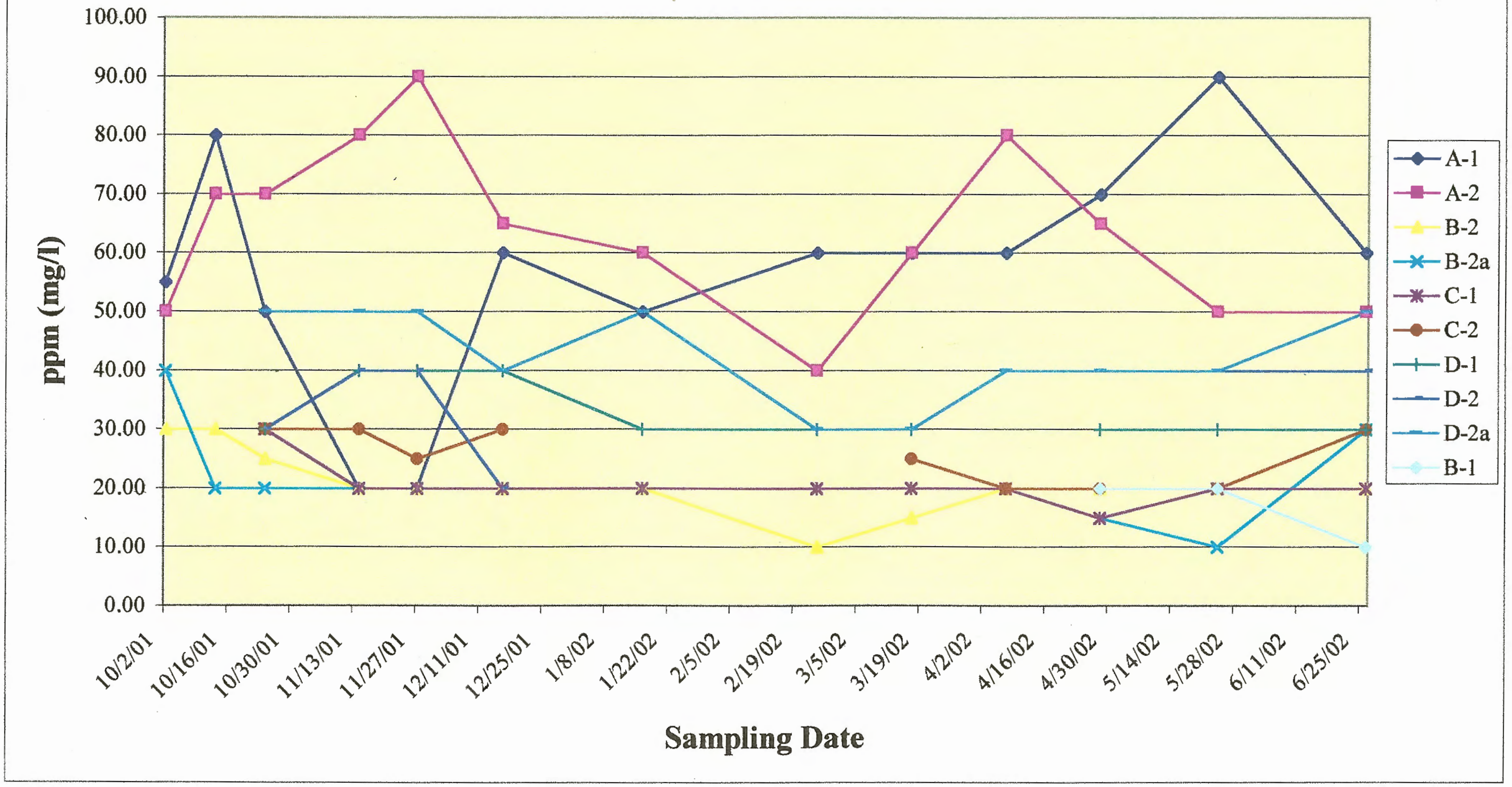
# Great Meadows GWMW Summary Data: pH



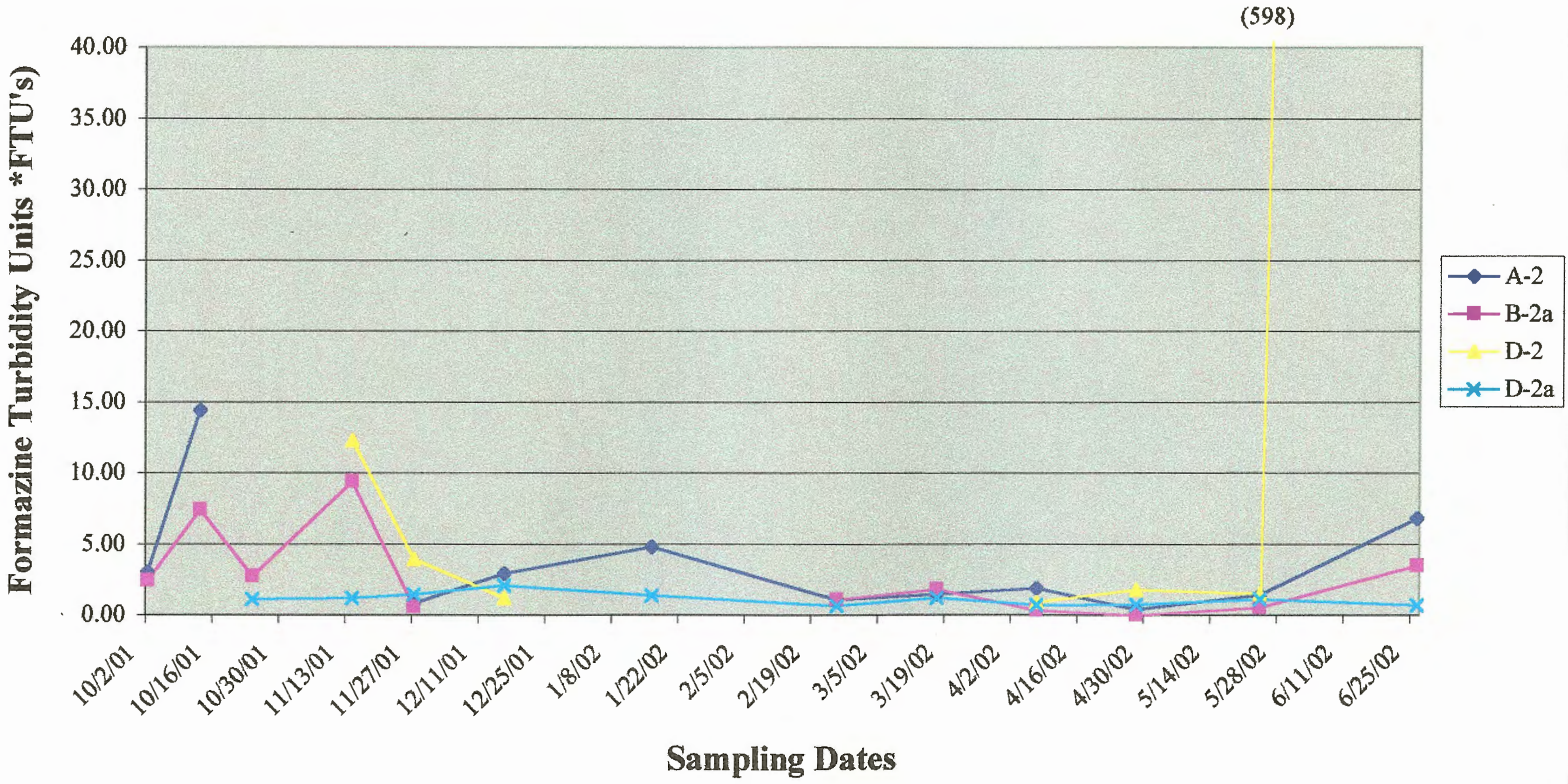
# Great Meadows GWMW Summary Data: Conductivity



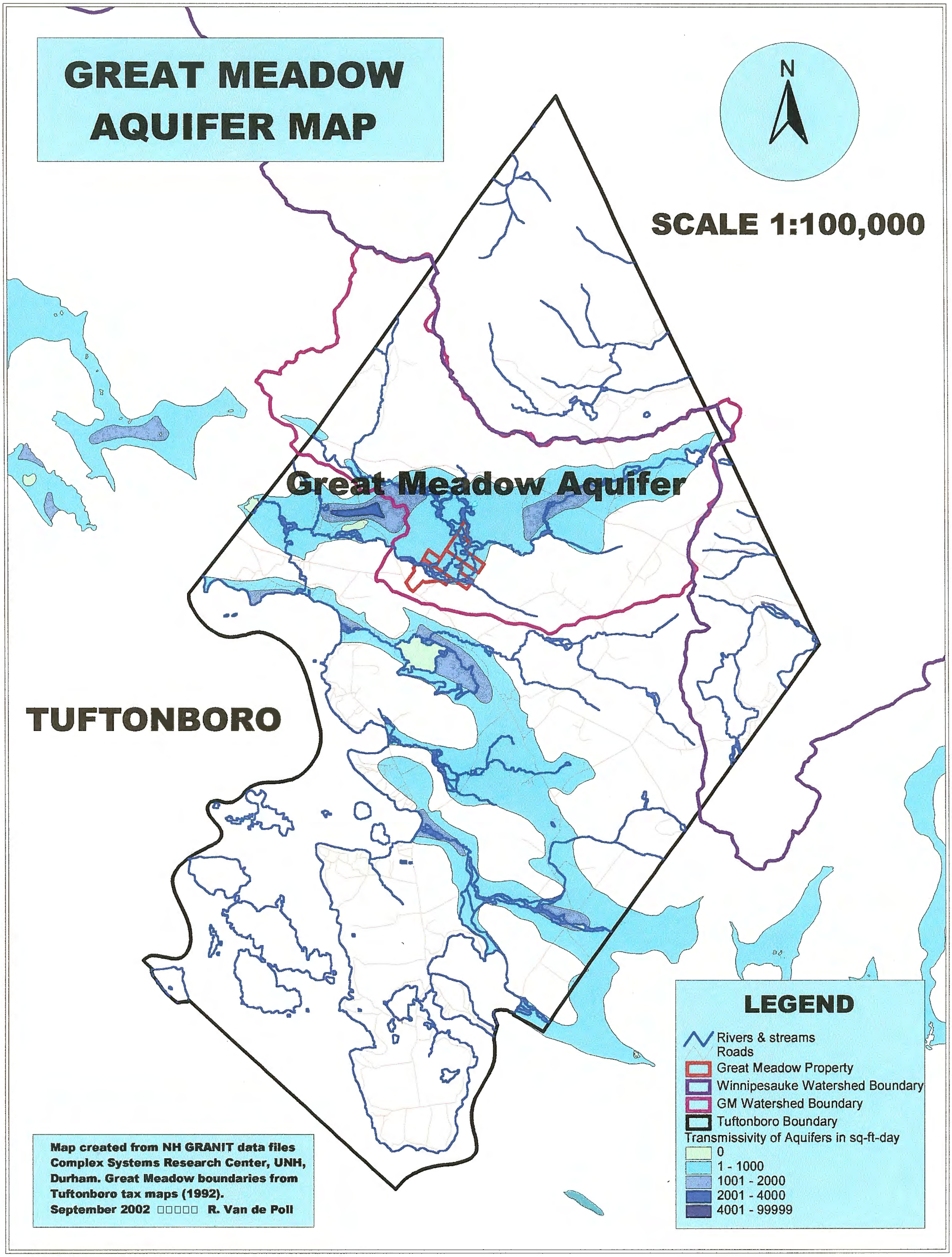
# Great Meadows GWMW Summary Data: Total Dissolved Solids



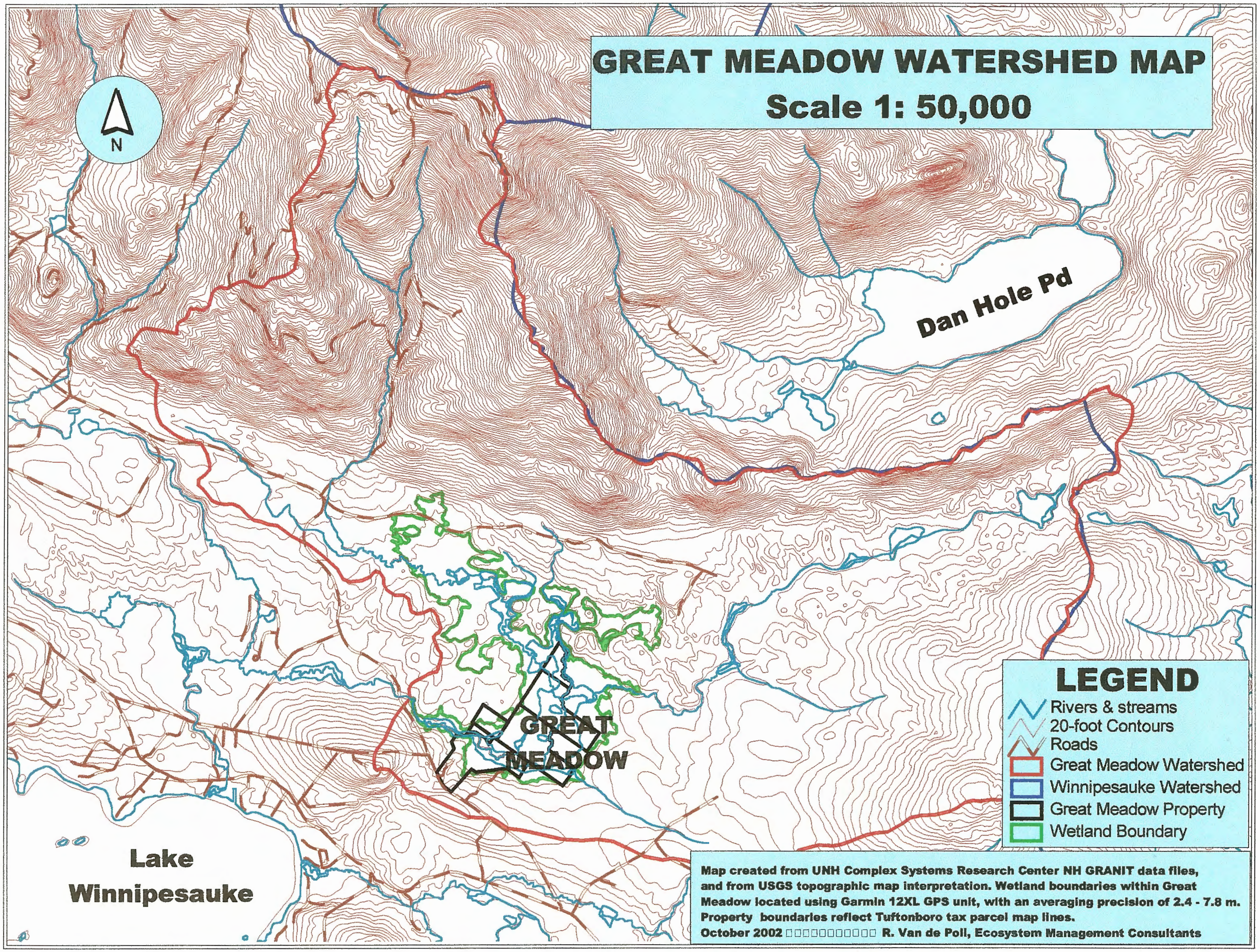
# Great Meadows GWMW Summary Data: Turbidity



# GREAT MEADOW AQUIFER MAP



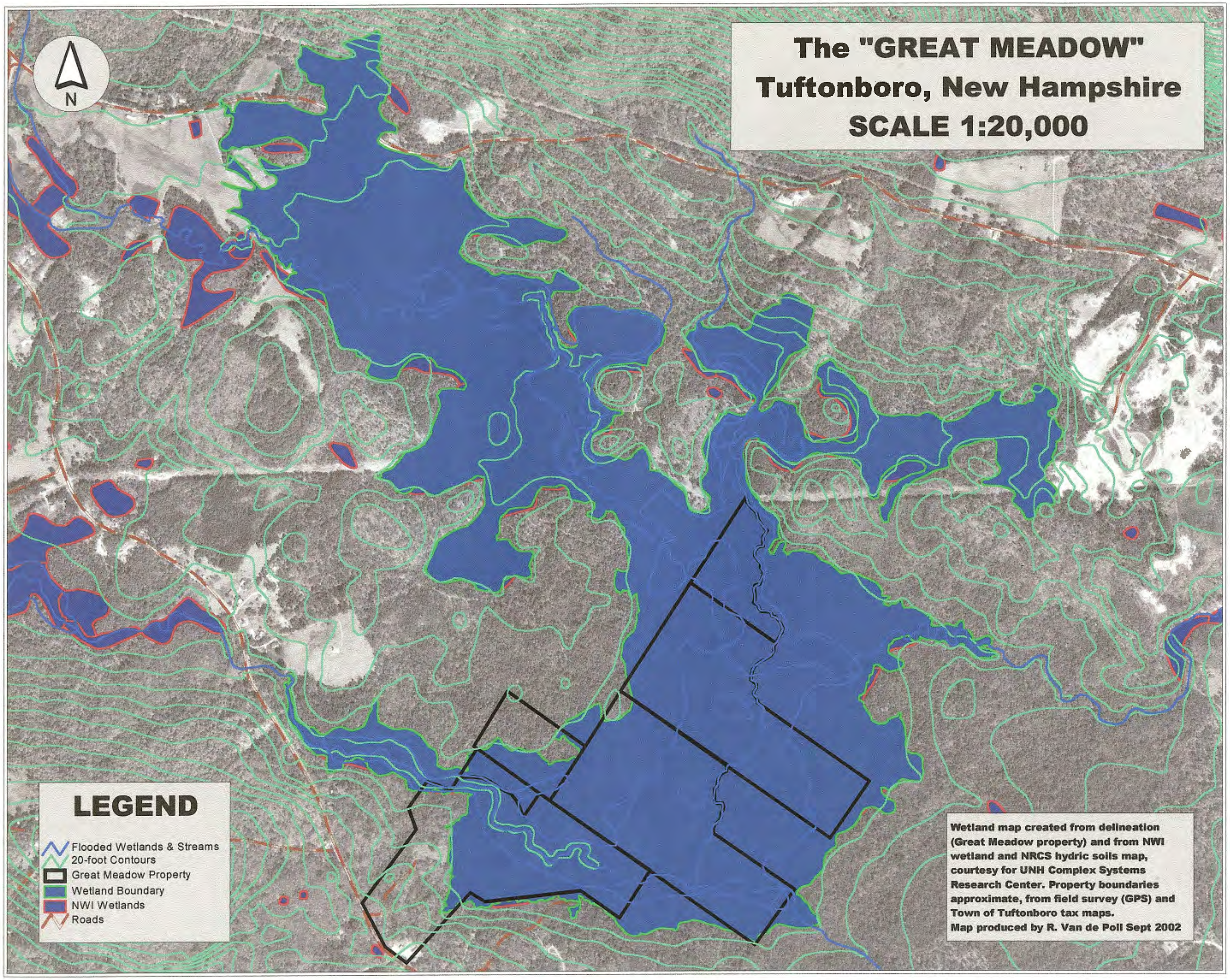
**Map created from NH GRANIT data files Complex Systems Research Center, UNH, Durham. Great Meadow boundaries from Tuftonboro tax maps (1992). September 2002 □□□□□ R. Van de Poll**



GREAT MEADOW WATERSHED MAP

Scale 1: 50,000

Map created from UNH Complex Systems Research Center NH GRANIT data files, and from USGS topographic map interpretation. Wetland boundaries within Great Meadow located using Garmin 12XL GPS unit, with an averaging precision of 2.4 - 7.8 m. Property boundaries reflect Tuftonboro tax parcel map lines.
October 2002 □□□□□□□□□□□ R. Van de Poll, Ecosystem Management Consultants

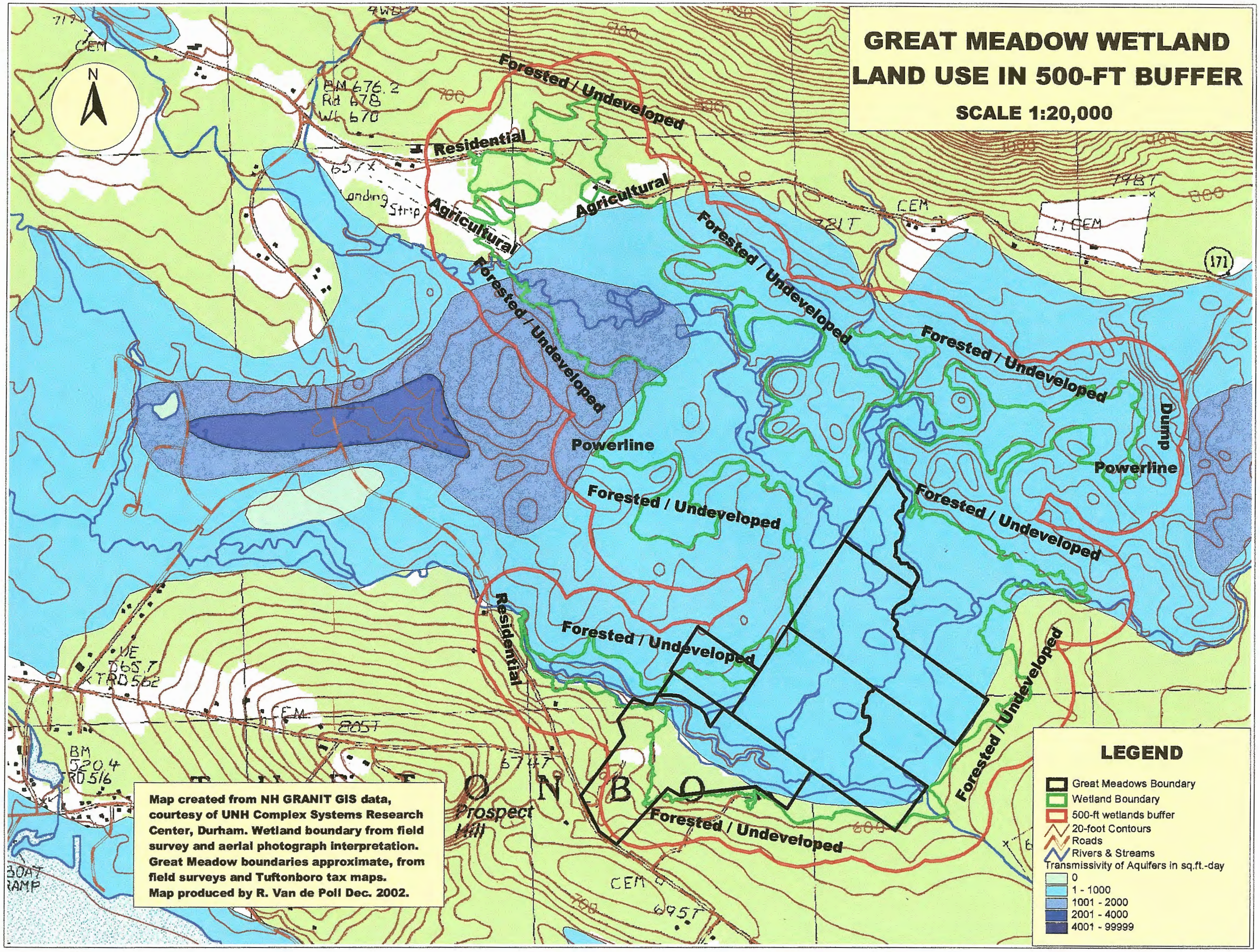


**The "GREAT MEADOW"**
**Tuftonboro, New Hampshire**
**SCALE 1:20,000**

**Wetland map created from delineation (Great Meadow property) and from NWI wetland and NRCS hydric soils map, courtesy for UNH Complex Systems Research Center. Property boundaries approximate, from field survey (GPS) and Town of Tuftonboro tax maps.**
**Map produced by R. Van de Poll Sept 2002**

# GREAT MEADOW WETLAND LAND USE IN 500-FT BUFFER

**SCALE 1:20,000**



**Map created from NH GRANIT GIS data, courtesy of UNH Complex Systems Research Center, Durham. Wetland boundary from field survey and aerial photograph interpretation. Great Meadow boundaries approximate, from field surveys and Tuftonboro tax maps. Map produced by R. Van de Poll Dec. 2002.**

## LEGEND

- ☐ Great Meadows Boundary
- 🟩 Wetland Boundary
- 🟥 500-ft wetlands buffer
- 20-foot Contours
- Roads
- Rivers & Streams

Transmissivity of Aquifers in sq.ft.-day

- 0
- 1 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 99999

# SOILS MAP LEGEND – GREAT MEADOW, TUFTONBORO

## SLOPE CLASSES

**A = 0-3%   B = 0 – 8%   C = 8 – 15%   D = 15 – 25%   E = > 25% (or > 35%)**

## PARTICLE SIZE GROUPS

**C = coarse   M = medium   F = fine   VF = very fine**
**L = loam   S = sand   Si = silt   LS = loamy sand   G = gravel**
**SiL = silt loam   SL = sandy loam   M&P = muck & peat**

## DRAINAGE CLASSES

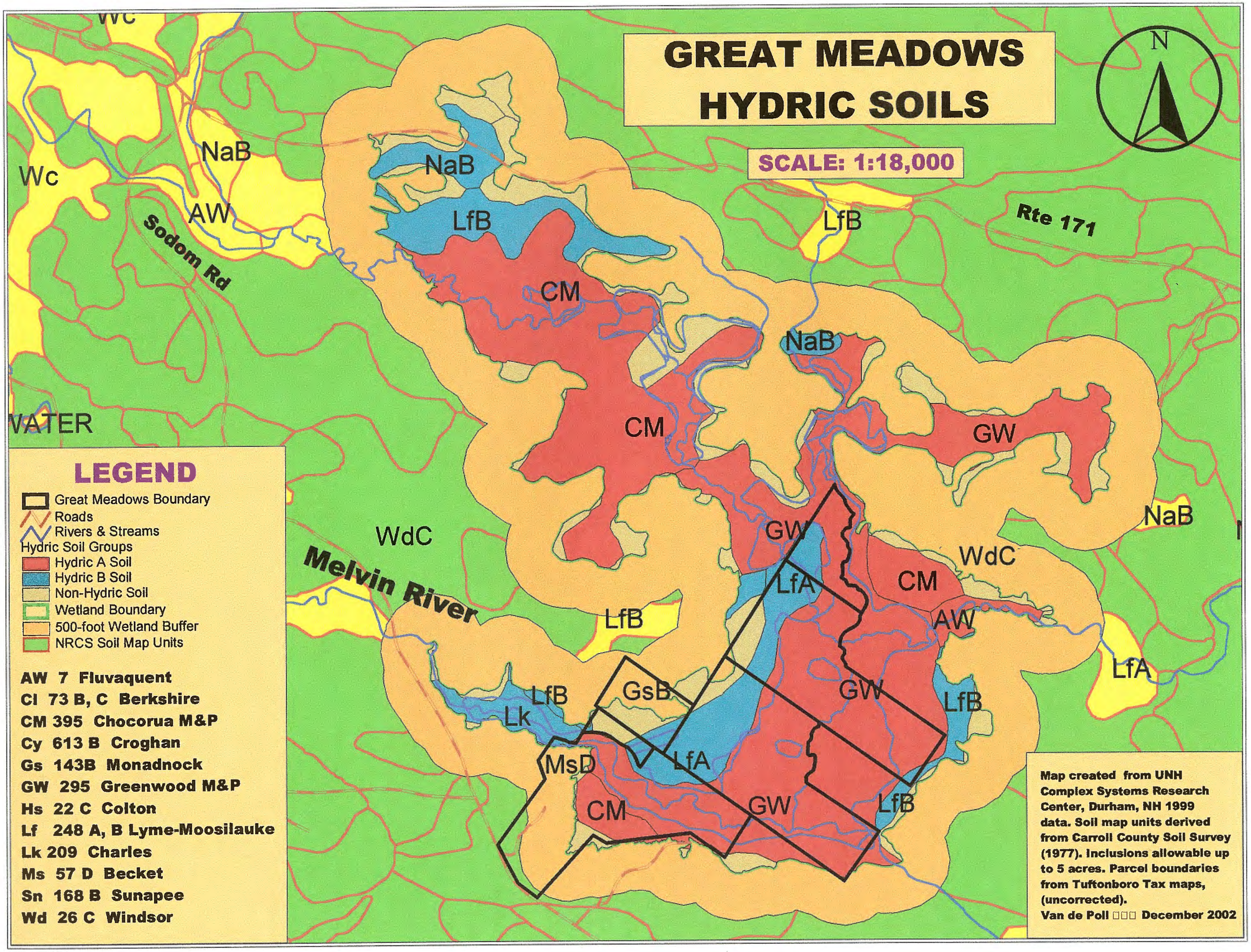
**VPD = very poorly drained**
**SPD = somewhat poorly drained**
**WD = well drained**
**ED = excessively drained**
**PD = poorly drained**
**MWD = moderately well drained**
**SED = somewhat excessively drained**

## SOIL TYPES

| Code | Number | Map Unit Name | Drainage Class |
|---|---|---|---|
| AW | 7 | Fluvaquent, mixed | SPD - VPD |
| Cl | 73 B, C | Berkshire VFSL, very stony | WD |
| CM | 395 | Chocorua M&P | VPD |
| Cy | 613 B | Croghan FS | MWD |
| Gs | 143B | Monadnock FSL, very stony | WD |
| GW | 295 | Greenwood M&P | VPD |
| Hs | 22 C | Colton SG | SED |
| Lf | 248 A, B | Lyme-Moosilauke complex VFSL/LS, very stony | PD |
| Lk | 209 | Charles SiL/VFSL, frequently flooded | PD |
| Ms | 57 D | Becket FSL/LS, very stony | WD |
| Sn | 168 B | Sunapee VFSL | MWD |
| Wd | 26 C | Windsor LFS/S | ED |

## UNMAPPED SOIL TYPES FOUND IN AREA

| | | | |
|---|---|---|---|
| FA | 197 | Borohemists, ponded | VPD |
| Md | 918 B | Madawaska VFSL/LFS | SPD |
| Na | 214 B | Naumberg LFS/S | SPD/PD |
| Sc | 15 | Searsport, VFSL | VPD |



# GREAT MEADOWS HYDRIC SOILS

SCALE: 1:18,000

Map created from UNH Complex Systems Research Center, Durham, NH 1999 data. Soil map units derived from Carroll County Soil Survey (1977). Inclusions allowable up to 5 acres. Parcel boundaries from Tuftonboro Tax maps, (uncorrected).
Van de Poll □□□ December 2002

## GREAT MEADOW WETLANDS
### Classification by NWI Type

| Type | NWI CODE | Number of Units in G.M. | Acres in G.M. | Number of Units not in G.M. | Acres not in G.M. | Total # of Units[1] | Acres Total |
|---|---|---|---|---|---|---|---|
| 1 Palustrine Aquatic Bed | PAB3Hb | 13 | 5.2 | 4 | 7.8 | 13 | 13.0 |
| 2 Palustrine Emergent | PEM1E&Hb | 23 | 21.4 | 13 | 57.3 | 20 | 78.7 |
| 3 Palustrine Scrub-Shrub | PSS1E&Hb | 27 | 54.9 | 28 | 61.4 | 17 | 116.3 |
| 4 Palustrine Forested - Decid | PFO1E&F | 15 | 12.9 | 17 | 43.3 | 20 | 56.2 |
| 5 Palustrine Forested - Mxd | PFO4/1E | 13 | 37.7 | 29 | 167.3 | 27 | 205.0 |
| 6 Palustrine Forested - Conif | PFO4E | 17 | 11.5 | 4 | 4.4 | 16 | 15.9 |
| 7 Palustrine Forested - Tamr. | PFO2E | 3 | 0.2 | 2 | 1.3 | 5 | 1.5 |
| 8 Palustrine For./Emergent | PFO5EM1Hb | 0 | 0.0 | 4 | 10.6 | 4 | 10.6 |
| 9 Riverine Aquatic Bed | R3AB3 | 8 | 4.4 | 6 | 3.2 | 2 | 7.6 |
| 10 Upland Islands | U | 9 | 4.0 | 4 | 4.0 | 13 | 8.0 |
| TOTAL | N = 10 | 128 | 152.16 | 111 | 360.64 | 137 | 512.8 |

Total Acreage of Great Meadow: 188.1 ACRES
Total Wetland Acreage of Great Meadow: 152.16 ACRES
Total Percent Wetland of Great Meadow: 80.9%
Total Wetland Acreage of Great Meadow Complex: 512.8 ACRES
Total Percent of Wetland Complex in Town Ownership: 29.67%

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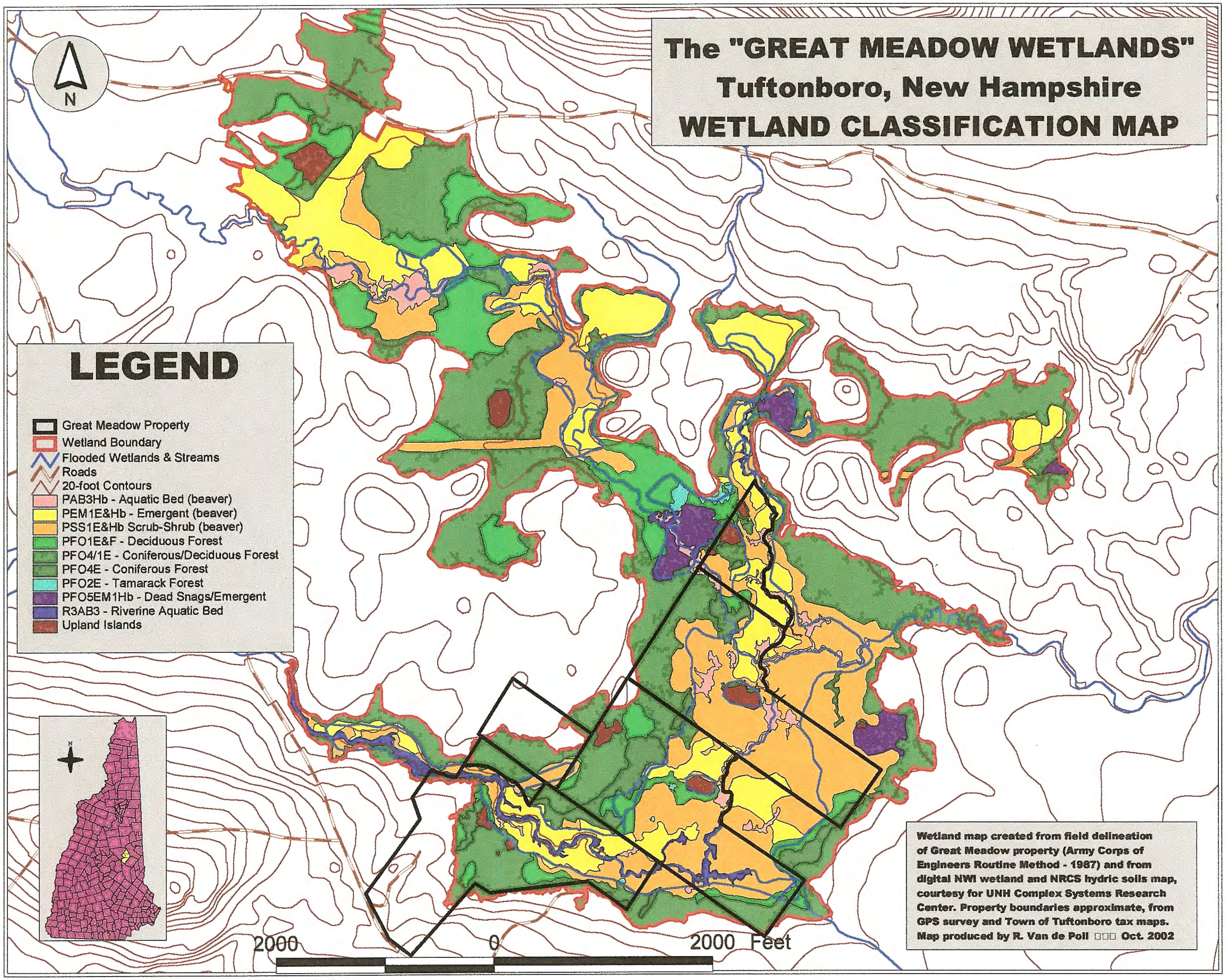
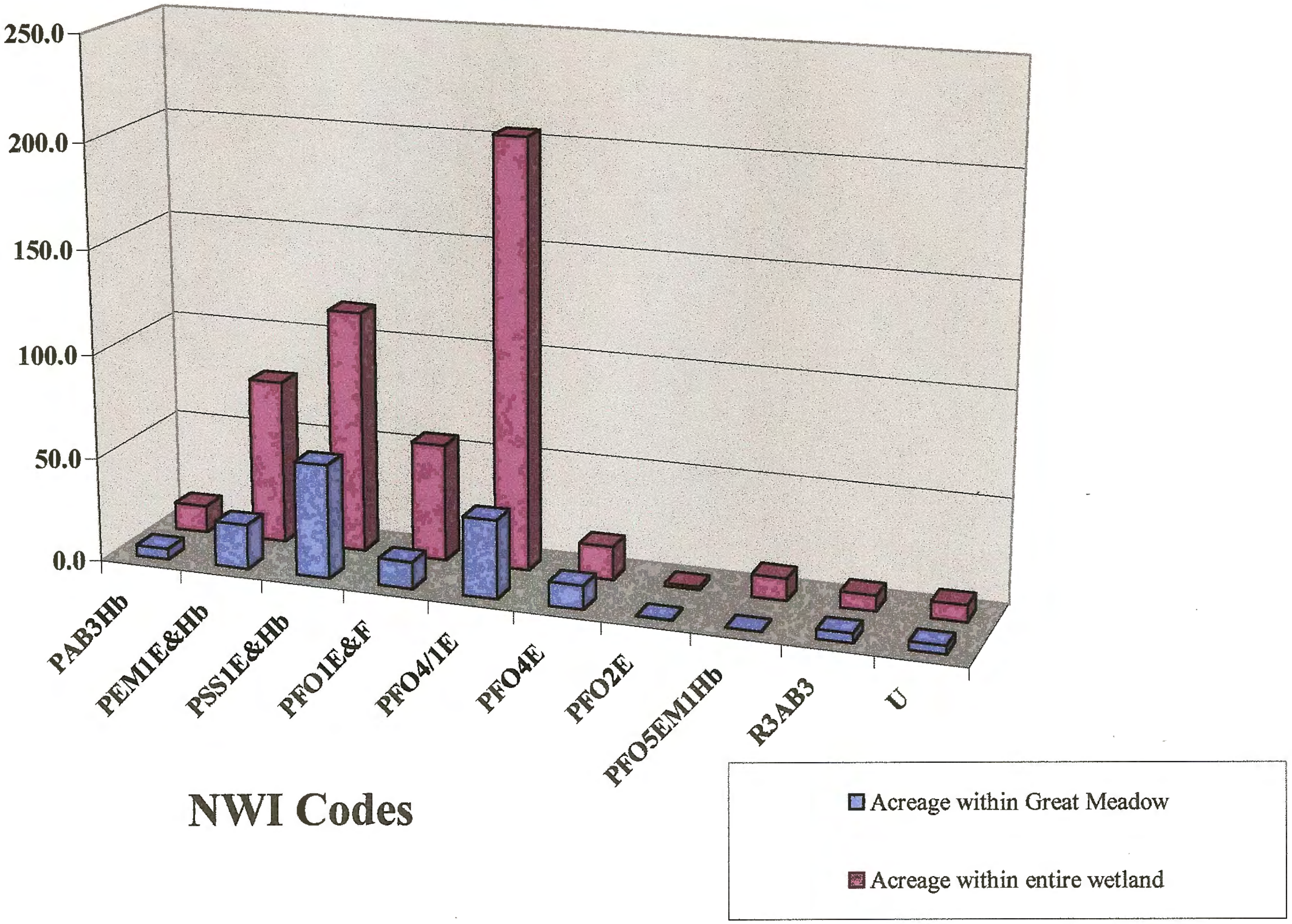
[1] Note: Total number of wetland units reflect contiguous nature of some types

# The "GREAT MEADOW WETLANDS"
## Tuftonboro, New Hampshire
## WETLAND CLASSIFICATION MAP

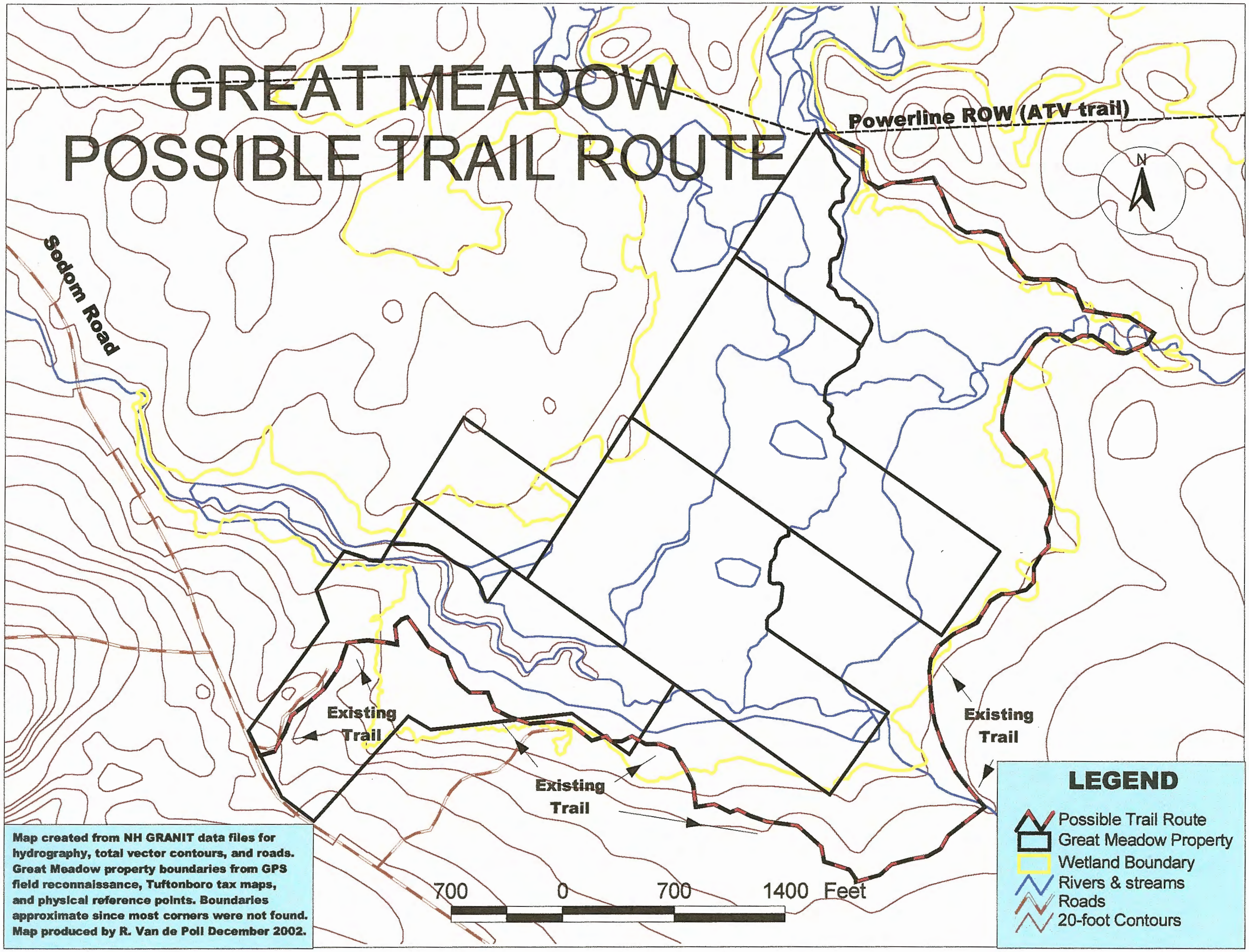


Wetland map created from field delineation of Great Meadow property (Army Corps of Engineers Routine Method - 1987) and from digital NWI wetland and NRCS hydric soils map, courtesy for UNH Complex Systems Research Center. Property boundaries approximate, from GPS survey and Town of Tuftonboro tax maps. Map produced by R. Van de Poll □□□ Oct. 2002

**Wetland Types in the Great Meadow Wetland Complex (based on field surveys; see codes on page A-14)**



# GREAT MEADOW POSSIBLE TRAIL ROUTE



Map created from NH GRANIT data files for hydrography, total vector contours, and roads. Great Meadow property boundaries from GPS field reconnaissance, Tuftonboro tax maps, and physical reference points. Boundaries approximate since most corners were not found. Map produced by R. Van de Poll December 2002.

## SPECIES LIST: AMPHIBIANS & REPTILES observed in the GREAT MEADOWS Area

**June 2001 – July 2002**

### Amphibians

| | | | |
|---|---|---|---|
| Am | Ambystoma maculatum | spotted salamander | eggs, larvae, adults |
| Nv | Notophthalmus viridescens | red-spotted newt | juveniles, adults |
| Df | Desmognathus fuscus | northern dusky salamander | juvenile, adult |
| Eb | Eurycea b. bislineata | northern two-lined salamander | juveniles, adults |
| Pci | Plethodon cinereus | redback salamander | juvenile, adult |
| Ba | Bufo americanus | eastern American toad | larvae, juveniles, adults |
| Pc | Pseudacris crucifer | northern spring peeper | adults |
| Hv | Hyla versicolor | gray treefrog | juvenile, adults |
| Rca | Rana catesbeiana | bullfrog | larvae, juveniles, adults |
| Rcl | Rana clamitans | green frog | larvae, juveniles, adults |
| Rs | Rana sylvatica | wood frog | larvae, juveniles, adults |
| Rp | Rana palustris | pickerel frog | adults |

### Reptiles

| | | | |
|---|---|---|---|
| Css | Chelydra serpentina | snapping turtle | adults |
| Cpp | Chrysemmys picta picta | eastern painted turtle | adults |
| Ts | Thamnophis sirtalis sirtalis | eastern garter snake | juvenile, adults |

### Fish

| | | | |
|---|---|---|---|
| Sf | Salvelinus fontinalis | brook trout | juveniles, adults |
| Cc | Cottus cognatus | slimy sculpin | adult |
| Pe | Phoxinus eos | redbelly dace | adults |

| ORDER | FAMILY | Sub-family | Scientific Name | Common Name | AOU Code | BBS Count 5/24/02 |
|---|---|---|---|---|---|---|
| GAVIIFORMES | GAVIIDAE | | Gavia immer | Common Loon | COLO | |
| CICONIIFORMES | ARDEIDAE | | Ardea herodias | Great Blue Heron | GBHE | |
| CICONIIFORMES | CATHARTIDAE | | Cathartes aura | Turkey Vulture | TUVU | 1 |
| ANSERIFORMES | ANATIDAE | Anserinae | Branta canadensis | Canada Goose | CAGO | |
| ANSERIFORMES | ANATIDAE | Anserinae | Chen caerulescens | Snow Goose | SNGO | |
| ANSERIFORMES | ANATIDAE | Anatinae | Anas rubripes | American Black Duck | ABDU | |
| ANSERIFORMES | ANATIDAE | Anatinae | Anas platyrhynchos | Mallard | MALL | |
| ANSERIFORMES | ANATIDAE | Anatinae | Aythya collaris | Ring-necked Duck | RNDU | |
| ANSERIFORMES | ANATIDAE | Anatinae | Aix sponsa | Wood Duck | WODU | 1 |
| ANSERIFORMES | ANATIDAE | Anatinae | Lophodytes cucullatus | Hooded Merganser | HOME | 1 |
| FALCONIFORMES | ACCIPITRIDAE | Accipitrinae | Accipeter gentilis | Northern Goshawk | NOGO | |
| FALCONIFORMES | ACCIPITRIDAE | Accipitrinae | Accipiter striatus | Sharp-shinned Hawk | SSHA | |
| FALCONIFORMES | ACCIPITRIDAE | Accipitrinae | Buteo lineatus | Red-shouldered Hawk | RSHA | |
| FALCONIFORMES | ACCIPITRIDAE | Accipitrinae | Buteo platypterus | Broad-winged Hawk | BWHA | |
| FALCONIFORMES | ACCIPITRIDAE | Accipitrinae | Buteo jamaicensis | Red-tailed Hawk | RTHA | |
| FALCONIFORMES | FALCONIDAE | Falconinae | Falco sparverius | American Kestrel | AMKE | |
| GALLIFORMES | PHASIANIDAE | Tetraoninae | Bonasa umbellus | Ruffed Grouse | RUGR | |
| CHARADRIIFORMES | CHARADRIIDAE | Charadriinae | Charadrius vociferus | Killdeer | KILL | |
| CHARADRIIFORMES | SCOLOPACIDAE | Scolopacinae | Gallinago gallinago | Common Snipe | COSN | |
| CHARADRIIFORMES | SCOLOPACIDAE | Scolopacinae | Scolopax minor | American Woodcock | AMWO | |
| COLUMBIFORMES | COLUMBIDAE | | Zenaida macroura | Mourning Dove | MODO | 2 |
| STRIGIFORMES | STRIGIDAE | | Bubo virginianus | Great Horned Owl | GHOW | |
| STRIGIFORMES | STRIGIDAE | | Strix varia | Barred Owl | BAOW | |
| APODIFORMES | TROCHILIDAE | Trochilinae | Archilochus colubris | Ruby-throated Hummingbird | RTHU | |
| CORACIIFORMES | ALCEDINIDAE | Cerylinae | Ceryle alcyon | Belted Kingfisher | BEKI | |
| PICIFORMES | PICIDAE | Picinae | Sphyrapicus varius | Yellow-bellied Sapsucker | YBSA | 1 |
| PICIFORMES | PICIDAE | Picinae | Picoides pubescens | Downy Woodpecker | DOWO | |
| PICIFORMES | PICIDAE | Picinae | Picoides villosus | Hairy Woodpecker | HAWO | |
| PICIFORMES | PICIDAE | Picinae | Colaptes auratus | Northern Flicker | NOFL | 2 |
| PICIFORMES | PICIDAE | Picinae | Dryocopus pileatus | Pileated Woodpecker | PIWO | 1 |
| PASSERIFORMES | TYRANNIDAE | Fluvicolinae | Contopus virens | Eastern Wood-Pewee | EWPE | 1 |
| PASSERIFORMES | TYRANNIDAE | Fluvicolinae | Empidonax alnorum | Alder Flycatcher | ALFL | 8 |
| PASSERIFORMES | TYRANNIDAE | Fluvicolinae | Empidonax minimus | Least Flycatcher | LEFL | 1 |
| PASSERIFORMES | TYRANNIDAE | Fluvicolinae | Sayornis phoebe | Eastern Phoebe | EAPH | |
| PASSERIFORMES | TYRANNIDAE | Tyranninae | Myiarchus crinitus | Great Crested Flycatcher | GRFL | 1 |
| PASSERIFORMES | TYRANNIDAE | Tyranninae | Tyrannus tyrannus | Eastern Kingbird | EAKI | 1 |
| PASSERIFORMES | VIREONIDAE | | Vireo solitarius | Blue-headed Vireo | BHVI | 1 |
| PASSERIFORMES | VIREONIDAE | | Vireo gilvus | Warbling Vireo | WAVI | |
| PASSERIFORMES | VIREONIDAE | | Vireo olivaceus | Red-eyed Vireo | REVI | |
| PASSERIFORMES | CORVIDAE | | Cyanocitta cristata | Blue Jay | BLJA | 5 |
| PASSERIFORMES | CORVIDAE | | Corvus brachyrhynchos | American Crow | AMCR | 10 |
| PASSERIFORMES | CORVIDAE | | Corvus corax | Common Raven | CORA | 1 |
| PASSERIFORMES | HIRUNDINIDAE | Hirundininae | Tachycineta bicolor | Tree Swallow | TRES | 1 |
| PASSERIFORMES | HIRUNDINIDAE | Hirundininae | Stelgidopteryx serrapen | Rough-winged Swallow | RWSW | 1 |
| PASSERIFORMES | PARIDAE | | Poecile atricapillus | Black-capped Chickadee | BCCH | 7 |
| PASSERIFORMES | PARIDAE | | PoecilePoecile hudsonicus | Boreal Chickadee | BOCH | |
| PASSERIFORMES | PARIDAE | | Baeolophus bicolor | Tufted Titmouse | TUTI | 1 |
| PASSERIFORMES | SITTIDAE | Sittinae | Sitta canadensis | Red-breasted Nuthatch | RBNU | 3 |
| PASSERIFORMES | SITTIDAE | Sittinae | Sitta carolinensis | White-breasted Nuthatch | WBNU | |
| PASSERIFORMES | CERTHIIDAE | Certhiinae | Certhia americana | Brown Creeper | BRCR | 2 |
| PASSERIFORMES | TROGLODYTIDAE | | Troglodytes troglodytes | Winter Wren | WIWR | |
| PASSERIFORMES | REGULIDAE | | Regulus satrapa | Golden-crowned Kinglet | GCKI | |
| PASSERIFORMES | REGULIDAE | | Regulus calendula | Ruby-crowned Kinglet | RCKI | |
| PASSERIFORMES | TURDIDAE | | Catharus fuscescens | Veery | VEER | 2 |
| PASSERIFORMES | TURDIDAE | | Catharus guttatus | Hermit Thrush | HETH | 4 |
| PASSERIFORMES | TURDIDAE | | Catharus olivaceus | Swainsons Thrush | SWTH | |
| PASSERIFORMES | TURDIDAE | | Hylocichla mustelina | Wood Thrush | WOTH | |
| PASSERIFORMES | TURDIDAE | | Turdus migratorius | American Robin | AMRO | 1 |
| PASSERIFORMES | MIMIDAE | | Dumetella carolinensis | Gray Catbird | GRCA | |
| PASSERIFORMES | PARULIDAE | | Vermivora ruficapilla | Nashville Warbler | NAWA | |
| PASSERIFORMES | PARULIDAE | | Parula americana | Northern Parula | NOPA | 1 |
| PASSERIFORMES | PARULIDAE | | Dendroica petechia | Yellow Warbler | YEWA | 6 |
| PASSERIFORMES | PARULIDAE | | Dendroica magnolia | Magnolia Warbler | MAWA | 3 |
| PASSERIFORMES | PARULIDAE | | Dendroica caerulescens | Black-throated Blue Warbler | BTBW | 1 |
| PASSERIFORMES | PARULIDAE | | Dendroica coronata | Yellow-rumped Warbler | MYWA | 2 |
| PASSERIFORMES | PARULIDAE | | Dendroica virens | Black-throated Green Warblei | BTGW | 2 |
| PASSERIFORMES | PARULIDAE | | Dendroica fusca | Blackburnian Warbler | BLAC | 4 |
| PASSERIFORMES | PARULIDAE | | Dendroica striata | Blackpoll Warbler | BLWA | 1 |

| ORDER | FAMILY | Sub-family | Scientific Name | Common Name | AOU Code | BBS Count<br>5/24/02 |
|---|---|---|---|---|---|---|
| PASSERIFORMES | PARULIDAE | | Mniotilta varia | Black-and-white Warbler | BAWW | 2 |
| PASSERIFORMES | PARULIDAE | | Setophaga ruticilla | American Redstart | AMRE | |
| PASSERIFORMES | PARULIDAE | | Seiurus aurocapillus | Ovenbird | OVEN | 4 |
| PASSERIFORMES | PARULIDAE | | Seiurus noveboracensis | Northern Waterthrush | NOWA | 1 |
| PASSERIFORMES | PARULIDAE | | Geothlypis trichas | Common Yellowthroat | COYE | 12 |
| PASSERIFORMES | PARULIDAE | | Wilsonia canadensis | Canada Warbler | CAWA | 7 |
| PASSERIFORMES | THRAUPIDAE | | Piranga olivacea | Scarlet Tanager | SCTA | |
| PASSERIFORMES | EMBERIZIDAE | | Melospiza melodia | Song Sparrow | SOSP | 8 |
| PASSERIFORMES | EMBERIZIDAE | | Melospiza georgiana | Swamp Sparrow | SWSP | 7 |
| PASSERIFORMES | EMBERIZIDAE | | Zonotrichia albicollis | White-throated Sparrow | WTSP | 7 |
| PASSERIFORMES | EMBERIZIDAE | | Junco hyemalis | Dark-eyed Junco | DEJU | |
| PASSERIFORMES | CARDINALIDAE | | Cardinalis cardinalis | Northern Cardinal | NOCA | 1 |
| PASSERIFORMES | CARDINALIDAE | | Pheucticus ludovicianus | Rose-breasted Grosbeak | RBGR | |
| PASSERIFORMES | CARDINALIDAE | | Passerina cyanea | Indigo Bunting | INBU | |
| PASSERIFORMES | ICTERIDAE | | Agelaius phoeniceus | Red-winged Blackbird | RWBL | 16 |
| PASSERIFORMES | ICTERIDAE | | Euphagus carolinus | Rusty Blackbird | RUBL | 1 |
| PASSERIFORMES | ICTERIDAE | | Quiscalus quiscula | Common Grackle | COGR | 1 |
| PASSERIFORMES | ICTERIDAE | | Molothrus ater | Brown-headed Cowbird | BHCO | 1 |
| PASSERIFORMES | ICTERIDAE | | Icterus galbula | Baltimore Oriole | BAOR | 2 |
| PASSERIFORMES | FRINGILLIDAE | Carduelinae | Carpodacus purpureus | Purple Finch | PUFI | 1 |
| PASSERIFORMES | FRINGILLIDAE | Carduelinae | Carpodacus mexicanus | House Finch | HOFI | |
| PASSERIFORMES | FRINGILLIDAE | Carduelinae | Loxia curvirostra | Red Crossbill | RECR | |
| PASSERIFORMES | FRINGILLIDAE | Carduelinae | Carduelis pinus | Pine Siskin | PISI | |
| PASSERIFORMES | FRINGILLIDAE | Carduelinae | Carduelis tristis | American Goldfinch | AMGO | 10 |
| PASSERIFORMES | FRINGILLIDAE | Carduelinae | Coccothraustes vespertinus | Evening Grosbeak | EVGR | |
| COUNT = 93 | | | | Total | | 161 |

## GREAT MEADOWS AREA MAMMAL SPECIES LIST – ALL SPECIES with OBSERVATIONAL SIGN

| Scientific Name | Common Name | Observational Sign |
|---|---|---|
| **MAMMALS** | (Taxonomy follows Zoological Record Volume 134) | |
| **Artidactyla - Cervidae** | | |
| Alces alces | Moose | sighting, track, wallow, barking, scat |
| Odocoileus virginianus | White-tailed deer | sighting, track, browse, scat |
| **Carnivora - Canidae** | | |
| Canis latrans sp. | Eastern coyote | sighting, track, voice, scat |
| Canis lupus familiaris | Domestic dog | track, scat |
| Vulpes vulpes | Red fox | track, scat |
| Urocyon cinereoargenteus | gray fox | tracks, scat |
| **Carnivora - Felidae** | | |
| Lynx rufus | Bobcat | track, scratch marks |
| Felis domesticus | house cat | tracks |
| **Carnivora - Mustelidae** | | |
| Mustela erminea | Ermine or Short-tailed weasel | track, voice |
| Mustela frenata | Long-tailed weasel | track, urine, scat |
| Mustela pennanti | Fisher | track, scat |
| Mustela vison | Mink | sighting, track, scat |
| Lutra canadensis | River Otter | sighting, track, scat |
| **Carnivora - Procyonidae** | | |
| Procyon lotor | Raccoon | sighting, den, track, scat |
| **Carnivora - Ursidae** | | |
| Ursus americanus | Black bear | sighting, track, claw marks, scat |
| **Insectivora - Soricidae** | | |
| Sorex cinereus | Masked shrew | sighting, track, tunnels |
| Sorex palustris | Northern water shrew | possible track |
| Blarina brevicauda | Short-tailed shrew | sighting, track, odor |
| **Insectivora - Talpidae** | | |
| Parascalops breweri | Hairy-tailed mole | tunnels & mounds |
| Chondylura cristata | Star-nosed mole | tunnels |
| **Lagomorpha - Leporidae** | | |
| Lepus americanus | Snowshoe Hare | sighting, forms, track, browse, scat |
| **Rodentia – Castoridae** | | |
| Castor canadensis | beaver | sighting, track, lodge, browse, musk pile |

**Rodentia - Erethizontidae**

| | | |
|---|---|---|
| Erethizon dorsatum | Porcupine | track, voice, browse, scat |

**Rodentia – Muridae**

| | | |
|---|---|---|
| Ondatra zibethicus | muskrat | tracks, lodge |
| Clethrionomys g. gapperi | Red-backed vole | track, tunnels |
| Peromyscus maniculatus | Deer mouse | sighting, track, tunnels, chew marks |
| Microtus pennsylvanicus | Meadow vole | tunnels, browse, tracks |
| Pitymus pinetorum | Woodland or Pine Vole | possible chew marks |

**Rodentia - Sciuridae**

| | | |
|---|---|---|
| Glaucomys spp | Flying squirrel | track, voice, chew marks |
| Sciurus carolinensis | Gray Squirrel | sighting, track, dreys |
| Tamias striatus | Eastern chipmunk | sighting, track, chew marks, tunnels |
| Tamiasciurus hudsonicus | Red squirrel | sighting, track, chew marks, tunnels |

**Chiroptera**

| | | |
|---|---|---|
| Myotis ludovicianus | Little brown bat | sighting |
| Eptesicus fuscus | Big brown bat | sighting |

## Great Meadow Vascular Plant Species List

| ALIEN | SCIENTIFIC NAME | COMMON NAME | FAMILY NAME | HABIT |
|---|---|---|---|---|
| | Abies balsamea | Fir, Balsam | Pinaceae | T |
| | Acer pensylvanicum | Maple, Striped | Aceraceae | S,T |
| | Acer rubrum | Maple, Red | Aceraceae | T |
| | Acer saccharum | Maple, Sugar | Aceraceae | T |
| | Acer spicatum | Maple, Mountain | Aceraceae | S |
| * | Achillea millefolium | Yarrow | Asteraceae | H |
| | Agrimonia gryposepala | Groovebur, Tall Hairy | Rosaceae | H |
| * | Agrostis capillaris (tenuis) | Bentgrass, Slender | Poaceae | H |
| | Agrostis gigantea | Grass, Red Top | Poaceae | H |
| | Agrostis perennans | Bentgrass, Perennial | Poaceae | H |
| | Alnus incana ssp. rugosa | Alder, Speckled | Betulaceae | S |
| | Ambrosia artemisiifolia | Ragweed, Annual | Asteraceae | H |
| | Amelanchier arborea | Serviceberry, Downy | Rosaceae | S,T |
| | Anemone quinquefolia | Thimble-weed, Woodland | Ranunculaceae | H |
| | Apocynum androsaemifolium | Dogbane, Spreading | Apocynaceae | H |
| | Aralia hispida | Sarsaparilla, Bristly | Araliaceae | H,S |
| | Aralia nudicaulis | Sarsaparilla, Wild | Araliaceae | H |
| * | Arctium minus | Burdock, Common | Asteraceae | H |
| | Arisaema triphyllum | Jack-in-the-Pulpit, Swamp | Araceae | H |
| | Aronia (Pyrus) arbutifolia | Chokeberry, Red | Rosaceae | S |
| | Aster divaricatus | Aster, White Wood | Asteraceae | H |
| | Athyrium filix-femina var. angustum | Lady Fern | Dryopteridaceae | F |
| * | Berberis vulgaris | Barberry, European (Common) | Berberidaceae | S |
| | Betula alleghaniensis | Birch, Yellow | Betulaceae | T |
| | Betula papyrifera | Birch, Paper or White | Betulaceae | T |
| | Betula populifolia | Birch, Gray | Betulaceae | T |
| | Bidens frondosa | Beggar-ticks, Devil's | Asteraceae | H |
| | Brachyelytrum erectum | Grass, Woodland | Poaceae | H |
| | Brasenia schreberi | Watershield | Nymphaeaceae | H |
| | Calamagrostis canadensis | Reedgrass, Bluejoint | Poaceae | H |
| | Calla palustris | Calla, Wild | Araceae | H |
| | Callitriche heterophylla | Water-starwort, Larger | Callitrichaceae | H |
| | Cardamine pennsylvanica | Bittercress, Pennsylvania | Brassicaceae | H |
| | Carex arctata | Sedge, Drooping Wood | Cyperaceae | H |
| | Carex atlantica | Sedge, Prickly Bog | Cyperaceae | H |
| | Carex canescens | Sedge, Hoary | Cyperaceae | H |
| | Carex crinita | Sedge, Fringed | Cyperaceae | H |
| | Carex debilis | Sedge, White-edge | Cyperaceae | H |
| | Carex echinata (=muricata) | Sedge, Little Prickly | Cyperaceae | H |
| | Carex folliculata | Sedge, Long | Cyperaceae | H |
| | Carex intumescens | Sedge, Bladder | Cyperaceae | H |
| | Carex lasiocarpa | Sedge, Woolly-Fruit | Cyperaceae | H |
| | Carex leptalea | Sedge, Bristly-stalk | Cyperaceae | H |
| | Carex pensylvanica (incl. C. lucorum) | Sedge, Pennsylvania | Cyperaceae | H |
| | Carex stricta | Sedge, Uptight or Tussock | Cyperaceae | H |
| | Carex tribuloides | Sedge, Blunt Broom | Cyperaceae | H |
| | Carex trisperma | Sedge, Three-Seed | Cyperaceae | H |
| | Cephalanthus occidentalis | Buttonbush | Rubiaceae | S |
| * | Cerastium fontanum ssp. vulgare | Chickweed, Mouse-Ear | Caryophyllaceae | H |
| | Chamaedaphne calyculata | Leatherleaf | Ericaceae | S |
| | Chelone glabra | Turtlehead, White | Scrophulariaceae | H |

T = Tree; S/S = Sapling or Shrub; H = Herbaceous; F = Fern or ally

| ALIEN | SCIENTIFIC NAME | COMMON NAME | FAMILY NAME | HABIT |
|---|---|---|---|---|
| | Chrysosplenium americanum | Golden-saxifrage, American | Saxifragaceae | H |
| | Circaea alpina | Nightshade, Small Enchanter's | Onagraceae | H |
| | Clematis virginiana | Virgin's-Bower, Virginia | Ranunculaceae | V |
| | Clintonia borealis | Bead-Lily, Blue | Liliaceae | H |
| | Comptonia peregrina | Sweetfern | Myricaceae | S |
| | Coptis trifolia (=groenlandica) | Goldthread | Ranunculaceae | H |
| | Corallorhiza maculata | Coralroot, Spotted | Orchidaceae | H |
| | Corallorhiza trifida | Coralroot, Early | Orchidaceae | H |
| | Cornus alternifolia | Dogwood, Alternate-leaved | Cornaceae | S |
| | Cornus amomum | Dogwood, Silky | Cornaceae | S |
| | Cornus canadensis | Bunchberry, Canada | Cornaceae | H |
| | Cornus sericea (= stolonifera) | Dogwood, Red-osier | Cornaceae | S |
| | Corylus cornuta | Hazelnut, Beaked | Betulaceae | S |
| | Crataegus spp. | Hawthorne | Rosaceae | S,T |
| | Cypripedium acaule | Lady's-Slipper, Pink | Orchidaceae | H |
| | Danthonia spicata | Wild Oat or Poverty Grass | Poaceae | H |
| * | Daucus carota | Queen Anne's Lace | Apiaceae | H |
| | Dennstaedtia punctilobula | Hay-scented Fern | Dennstaedtiaceae | F |
| | Dichanthelium (Panicum) acuminatur | Grass, Tapered Panic | Poaceae | H |
| | Dichanthelium (Panicum) clandestinu | Grass, Deer-tongue | Poaceae | H |
| | Diervilla lonicera | Honeysuckle, Bush- | Caprifoliaceae | S |
| | Diphasiastrum digitatum (= Lycopodi | Running-pine, Southern | Lycopodiaceae | F |
| | Doellingeria (Aster) umbellatus | Aster, Flat-Topped | Asteraceae | H |
| | Dryopteris carthusiana | Woodfern, Spinulose | Dryopteridaceae | F |
| | Dryopteris cristata | Shield-fern, Crested | Dryopteridaceae | F |
| | Dryopteris intermedia | Woodfern, Evergreen | Dryopteridaceae | F |
| | Dulichium arundinaceum | Sedge, Three-way | Cyperaceae | H |
| | Eleocharis palustris | Spikerush, Creeping | Cyperaceae | H |
| | Epigaea repens | Arbutus, Trailing | Ericaceae | H |
| | Epilobium ciliatum ssp. glandulosum | Willow-herb, Northern | Onagraceae | H |
| | Equisetum arvense (incl. var. boreale | Horsetail, Field | Equisetaceae | F |
| | Equisetum sylvaticum | Horsetail, Woodland | Equisetaceae | F |
| | Erigeron annuus | Fleabane, White-top or Daisy | Asteraceae | H |
| | Eupatorium maculatum | Joe-Pye-Weed, Spotted | Asteraceae | H |
| | Eupatorium perfoliatum | Boneset, Common | Asteraceae | H |
| | Euthamia graminifolia | Fragrant-Golden-Rod, Flat-Top | Asteraceae | H |
| | Fagus grandifolia | Beech, American | Fagaceae | T |
| | Festuca rubra | Fescue, Red | Poaceae | H |
| | Fragaria vesca | Strawberry, Wood | Rosaceae | H |
| | Fragaria virginiana | Strawberry, Virginia | Rosaceae | H |
| * | Frangula alnus (= Rhamnus f.) | Buckthorn, Glossy or European | Rhamnaceae | S |
| | Fraxinus americana | Ash, White | Oleaceae | T |
| | Fraxinus nigra | Ash, Black | Oleaceae | T |
| | Galium palustre | Bedstraw, Marsh | Rubiaceae | H |
| | Galium tinctorium | Bedstraw, Stiff Marsh | Rubiaceae | H |
| | Galium trifidum | Bedstraw, Small | Rubiaceae | H |
| | Gaultheria hispidula | Snowberry, Creeping | Ericaceae | H,S |
| | Gaultheria procumbens | Wintergreen | Ericaceae | H,S |
| | Gaylussacia baccata | Huckleberry, Black | Ericaceae | S |
| | Gentiana clausa | Gentian, Closed | Gentianaceae | H |
| | Geum laciniatum | Avens, Rough | Rosaceae | H |
| | Glyceria canadensis | Grass, Canada Manna | Poaceae | H |
| | Glyceria striata | Grass, Fowl Manna | Poaceae | H |

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| ALIEN | SCIENTIFIC NAME | COMMON NAME | FAMILY NAME | HABIT |
|---|---|---|---|---|
| | Goodyera pubescens | Rattlesnake-Plantain, Downy | Orchidaceae | H |
| | Gymnocarpium dryopteris | Fern, Oak | Polypodiaceae | F |
| | Hamamelis virginiana | Witch-hazel, American | Hamamelidaceae | S |
| * | Hieracium piloselloides (= H. florentin | Hawkweed, Smooth or King Dev | Asteraceae | H |
| | Houstonia caerulea | Innocence or Bluets | Rubiaceae | H |
| | Huperzia lucidula (= Lycopodium luci | Fir-moss, Shining | Lycopodiaceae | F |
| | Hydrocotyle americana | Water Pennywort | Apiaceae | H |
| | Hypericum canadense | St. Johnswort, Canada | Hypericaceae | H |
| | Hypericum ellipticum | St. Johnswort, Pale | Hypericaceae | H |
| * | Hypericum perforatum | St. Johnswort, Common | Hypericaceae | H |
| | Ilex verticillata | Winterberry, Common | Aquifoliaceae | S |
| | Impatiens capensis | Touch-me-not, Spotted | Balsaminaceae | H |
| | Iris versicolor | Blue flag | Iridaceae | H |
| | Juncus brevicaudatus | Rush, Narrow Panicle | Juncaceae | H |
| | Juncus canadensis | Rush, Canada | Juncaceae | H |
| | Juncus effusus | Rush, Soft | Juncaceae | H |
| | Juncus greenei | Rush, Greene's | Juncaceae | H |
| | Juncus pelocarpus | Rush, Brown-fruited | Juncaceae | H |
| | Juniperus communis | Juniper, Common | Cupressaceae | S |
| | Kalmia angustifolia | Laurel, Sheep | Ericaceae | S |
| | Lactuca biennis | Lettuce, Biennial (Tall Blue) | Asteraceae | H |
| | Larix laricina | Tamarack or Eastern Larch | Pinaceae | T |
| | Lechea intermedia | Pinweed | Cistaceae | H |
| | Leersia oryzoides | Cut-grass, Rice | Poaceae | H |
| * | Leontodon autumnalis | Dandelion, Fall | Asteraceae | H |
| | Linnaea borealis ssp. longiflora | Twinflower | Caprifoliaceae | H,S |
| | Lobelia cardinalis | Flower, Cardinal | Campanulaceae | H |
| | Lobelia inflata | Indian Tobacco | Campanulaceae | H |
| | Lonicera canadensis | Honeysuckle, American Fly | Caprifoliaceae | S |
| * | Lonicera morrowi | Honeysuckle, Morrow | Caprifoliaceae | S |
| | Ludwigia palustris | Seedbox, Marsh | Onagraceae | H |
| | Lycopodium annotinum | Club-moss, Stiff or Bristly | Lycopodiaceae | F |
| | Lycopodium clavatum | Club-moss, Common or Running | Lycopodiaceae | F |
| | Lycopodium dendroideum | Club-moss, Prickly Tree | Lycopodiaceae | F |
| | Lycopodium obscurum | Club-moss, Flat-branched Tree | Lycopodiaceae | F |
| | Lycopus americanus | Horehound, Water | Lamiaceae | H |
| | Lycopus uniflorus | Bugleweed, Northern | Lamiaceae | H |
| | Lyonia ligustrina | Maleberry | Ericaceae | S |
| | Lysimachia ciliata | Loosestrife, Fringed | Primulaceae | H |
| | Lysimachia quadrifolia | Loosestrife, Whorled | Primulaceae | H |
| | Lysimachia terrestris | Loosestrife, Swamp (Candles) | Primulaceae | H |
| * | Lythrum salicaria | Loosestrife, Purple | Lythraceae | H |
| | Maianthemum canadense | Lily-of-the-Valley, Wild | Liliaceae | H |
| * | Malus sylvestris (=pumila) | Apple | Rosaceae | T |
| | Medeola virginiana | Indian Cucumber Root | Liliaceae | H |
| | Mimulus ringens | Monkey-Flower, Allegany | Scrophulariaceae | H |
| | Mitchella repens | Partridgeberry | Rubiaceae | H,S |
| | Monotropa uniflora | Indian Pipe | Monotropaceae | H |
| | Myrica gale | Sweet Gale | Myricaceae | S |
| | Nemopanthus mucronatus | Holly, Mountain | Aquifoliaceae | S |
| | Nuphar variegata | Cow-lily, Yellow or Spadderdock | Nymphaeaceae | H |
| | Oclemena (Aster) nemoralis | Aster, Bog | Asteraceae | H |
| | Oclemenus (Aster) acuminatus | Aster, Whorled | Asteraceae | H |

T = Tree; S/S = Sapling or Shrub; H = Herbaceous; F = Fern or ally

| ALIEN | SCIENTIFIC NAME | COMMON NAME | FAMILY NAME | HABIT |
|---|---|---|---|---|
| | Oenothera biennis | Evening Primrose, Common | Onagraceae | H |
| | Onoclea sensibilis | Fern, Sensitive | Dryopteridaceae | F |
| | Oryzopsis asperifolia | Mountain Rice, White-fruited | Poaceae | H |
| | Osmunda cinnamomea | Cinnamon Fern | Osmundaceae | F |
| | Osmunda claytoniana | Interrupted Fern | Osmundaceae | F |
| | Osmunda regalis var. spectabilis | Royal Fern | Osmundaceae | F |
| | Oxalis montana | Woodsorrel, White | Oxalidaceae | H |
| | Oxalis stricta (incl. O. europaea) | Woodsorrel, Yellow | Oxalidaceae | H |
| | Persicaria (Polygonum) arifolia | Tearthumb, Halberd-Leaved | Polygonaceae | H |
| | Persicaria (Polygonum) sagittata | Tearthumb, Arrow-leaved | Polygonaceae | H |
| | Phegopteris connectilis (= Thelypteris | Fern, Long Beech | Thelypteridaceae | F |
| * | Phleum pratense | Timothy | Poaceae | H |
| | Photinia (Aronia) melanocarpa | Chokeberry, Black | Rosaceae | S |
| | Picea rubens | Spruce, Red | Pinaceae | T |
| | Pinus strobus | Pine, Eastern White | Pinaceae | T |
| | Poa palustris | Bluegrass, Swamp | Poaceae | H |
| | Poa pratensis | Bluegrass, Kentucky | Poaceae | H |
| | Polypodium virginianum | Polypody, Common | Polypodiaceae | H |
| | Pontederia cordata | Pickerel-weed | Pontederiaceae | H |
| | Populus grandidentata | Aspen, Bigtooth | Salicaceae | T |
| | Potamogeton epihydrus | Pondweed, Ribbonleaf | Potamogetonacea | H |
| | Potamogeton natans | Pondweed, Common Floating | Potamogetonacea | H |
| | Potentilla canadensis | Cinquefoil, Dwarf | Rosaceae | H |
| | Prenanthes alba | Rattlesnake-root, White | Asteraceae | H |
| * | Prunella vulgaris | Heal-all | Lamiaceae | H |
| | Prunus pensylvanica | Cherry, Fire | Rosaceae | T |
| | Prunus serotina | Cherry, Black | Rosaceae | T |
| | Pteridium aquilinum | Fern, Bracken | Dennstaedtiaceae | F |
| | Pyrola americana (= P. rotundifolia) | Pyrola, Roundleaf | Pyrolaceae | H |
| | Pyrola elliptica | Pyrola, Shinleaf | Pyrolaceae | H |
| | Quercus rubra var. ambigua | Oak, Northern Red | Fagaceae | T |
| * | Ranunculus acris | Buttercup, Tall | Ranunculaceae | H |
| | Ranunculus pensylvanicus | Buttercup, Bristly | Ranunculaceae | H |
| | Rhododendron prinophyllum (= R. ros | Azalea, Early | Ericaceae | S |
| | Rhus hirta (= R. typhina) | Sumac, Staghorn | Anacardiaceae | S |
| | Ribes glandulosum | Currant, Skunk | Saxifragaceae | S |
| | Ribes lacustre | Currant, Prickly | Saxifragaceae | S |
| * | Rorippa nasturtium-aquaticum | Water-cress, Common | Brassicaceae | H |
| | Rosa palustris | Rose, Swamp | Rosaceae | S |
| | Rubus (Dalibarda) repens | Robin-run-away | Rosaceae | H |
| | Rubus allegheniensis | Blackberry, Allegheny | Rosaceae | S |
| | Rubus hispidus | Blackberry, Bristly (Dewberry) | Rosaceae | S |
| | Rubus idaeus | Raspberry, Common Red | Rosaceae | S |
| | Rubus pubescens | Blackberry, Dwarf | Rosaceae | H |
| * | Rumex obtusifolius | Dock, Bitter | Polygonaceae | H |
| | Sagittaria latifolia | Arrow-head, Broad-leaf | Alismataceae | H |
| | Salix bebbiana | Willow, Bebb's | Salicaceae | S,T |
| | Salix discolor | Willow, Pussy | Salicaceae | S |
| | Sambucus canadensis | Elder, American | Caprifoliaceae | S |
| | Schizachyrium (Andropogon) scoparii | Bluestem, Little | Poaceae | H |
| | Schoenoplectus (Scirpus) subtermina | Bulrush, Subterminate | Cyperaceae | H |
| | Scirpus atrovirens | Bulrush, Green | Cyperaceae | H |
| | Scirpus cyperinus | Wool-grass | Cyperaceae | H |

T = Tree; S/S = Sapling or Shrub; H = Herbaceous; F = Fern or ally

| ALIEN | SCIENTIFIC NAME | COMMON NAME | FAMILY NAME | HABIT |
|---|---|---|---|---|
| | Scirpus expansus | Bulrush, Woodland | Cyperaceae | H |
| | Scutellaria lateriflora | Skullcap, Blue | Lamiaceae | H |
| | Senecio aureus | Ragwort, Golden | Asteraceae | H |
| | Sisyrinchium montanum | Blue-eyed Grass, Strict | Iridaceae | H |
| * | Solanum dulcamara | Nightshade, Climbing | Solanaceae | H |
| | Solidago canadensis | Goldenrod, Canada | Asteraceae | H |
| | Solidago gigantea | Goldenrod, Late | Asteraceae | H |
| | Solidago juncea | Goldenrod, Early | Asteraceae | H |
| | Solidago rugosa | Goldenrod, Wrinkled | Asteraceae | H |
| | Sparganium americanum | Bur-reed, American | Sparganiaceae | H |
| | Spiraea alba var. latifolia (= S. latifoli | Meadowsweet, Broad-leaf | Rosaceae | S |
| | Spiraea tomentosa | Steeplebush | Rosaceae | S |
| | Symphyotrichum (Aster) lanceolatum | Aster, Panicled | Asteraceae | H |
| | Symphyotrichum (Aster) lateriflorum | Aster, Calico | Asteraceae | H |
| | Symphyotrichum (Aster) puniceum | Aster, Swamp (Purple-stemmed) | Asteraceae | H |
| * | Tanacetum vulgare | Tansy | Asteraceae | H |
| | Taraxacum officinale | Dandelion | Asteraceae | H |
| | Taxus canadensis | Yew, Canadian | Taxaceae | S |
| | Thalictrum pubescens (= T. polygam | Meadow-rue, Tall | Ranunculaceae | H |
| | Thelypteris noveboracensis | Fern, New York | Thelpyteridaceae | F |
| | Thelypteris palustris var. pubescens | Fern, Marsh | Thelypteridaceae | F |
| | Tiarella cordifolia | Foamflower | Saxifragaceae | H |
| | Triadenum virginicum (= Hypericum | St. Johnswort, Marsh | Hypericaceae | H |
| | Trientalis borealis | Starflower | Primulaceae | H |
| * | Trifolium pratense | Clover, Red | Fabaceae | H |
| * | Trifolium repens | Clover, White | Fabaceae | H |
| | Tsuga canadensis | Hemlock, Eastern | Pinaceae | T |
| | Typha latifolia | Cattail, Broad-leaf | Typhaceae | H |
| | Ulmus americana | Elm, American | Ulmaceae | T |
| | Utricularia intermedia | Bladderwort, Flat-leaf | Lentibulariaceae | H |
| | Uvularia sessilifolia | Bellwort, Sessile-leaf | Liliaceae | H |
| | Vaccinium angustifolium | Blueberry, Lowbush | Ericaceae | S |
| | Vaccinium corymbosum | Blueberry, Highbush | Ericaceae | S |
| | Vaccinium macrocarpon | Cranberry, Large | Ericaceae | S |
| | Veratrum viride | False-hellebore, American | Liliaceae | H |
| * | Verbascum thapsus | Mullein, Common | Scrophulariaceae | H |
| ? | Veronica officinalis | Speedwell, Common | Scrophulariaceae | H |
| | Viburnum acerifolium | Viburnum, Maple-Leaved | Caprifoliaceae | S |
| | Viburnum dentatum var. lucidum (= V | Arrowwood | Caprifoliaceae | S |
| | Viburnum lantanoides (= V. alnifoliu | Hobblebush | Caprifoliaceae | S |
| | Viburnum nudum var. cassinoides (= | Witherod | Caprifoliaceae | S |
| * | Vicia cracca | Vetch, Cow or Tufted | Fabaceae | H |
| | Viola cucullata | Violet, Marsh Blue | Violaceae | H |
| | Viola macloskeyi ssp. pallens (= V. p | Violet, Northern White | Violaceae | H |
| | Viola sagittata (= V. fimbriatula) | Violet, Ovate-leaved | Violaceae | H |
| | Viola septentrionalis | Violet, Northern Blue | Violaceae | H |

**COUNT OF ALIEN:** 25

**COUNT OF SCIENTIFIC NAME:** 256

T = Tree; S/S = Sapling or Shrub; H = Herbaceous; F = Fern or ally

# SUMMARY SHEET FOR THE N.H. METHOD

Wetland name or code Great Meadow Total area of wetland 512.8 ac.

County Carroll Town Tuftonboro Date June 28, 2002

Investigator(s) R. Vande Poll

| A<br>Functional Value | B<br>FVI From Data Sheets | C<br>Size of Evaluation Area (Acres) | D<br>Wetland Value Units B x C |
|---|---|---|---|
| 1. Ecological Integrity | .96 | 512.8 | 492.3 |
| 2. Wetland Wildlife Habitat | .95 | 512.8 | 487.2 |
| 3. Finfish Habitat: | | | |
| Part A - Rivers and Streams | .88 | 7.6 | 6.7 |
| Part B - Ponds and Lakes | 0 | 0 | 0 |
| 4. Educational Potential | .62 | .6 | .37 |
| 5. Visual/Aesthetic Quality | .9 | 10 | 9.0 |
| 6. Water-based Recreation | .71 | 1.5 | 1.1 |
| 7. Flood Control Potential | 1.0 | 512.8 | 512.8 |
| 8. Ground Water Use Potential | .88 | 512.8 | 448.7 |
| 9. Sediment Trapping | .77 | 512.8 | 395 |
| 10. Nutrient Attenuation | .73 | 512.8 | 371.8 |
| 11. Shoreline Anchoring and Dissipation of Erosive Forces | .92 | 7.6 | 7.0 |
| 12. Urban Quality of Life | | | |
| B: Wetland Wildlife Habitat | | | |
| C: Educational Opportunity | | N/A | |
| D: Visual/Aesthetic Quality | | | |
| E: Water-based Recreation | | | |
| 13. Historical Site Potential (see note) | 0 | 0 | 0 |
| 14. Noteworthiness | 1.0 | 512.8 | 512.8 |

Wetland Name/Code: ______________________________

## NEEDED FOR THIS EVALUATION:

- Zoning map
- SCS soils map
- N.H. Water Quality Report to Congress 305(b)
- USGS topographic map or recent aerial photograph
- A method to calculate area (Dot grid, planimeter, etc.)
- Ruler or scale
- Map wheel (Optional)

## Functional Value 1
## *ECOLOGICAL INTEGRITY*

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **QUESTIONS TO ANSWER IN THE OFFICE:** | | | |
| 1. Percent of wetland having very poorly drained soils or Hydric A soils and/or open water. | | a. More than 50 percent | [✓ 1.0] |
| | | b. From 25 to 50 percent | 0.5 |
| | | c. Less than 25 percent | 0.1 |
| 2. Dominant land use zoning of wetland (see town zoning map). Use current land use if different from what is zoned. | | a. Agriculture, forestry, or similar open space zoning | [✓ 1.0] |
| | | b. Rural residential | 0.5 |
| | | c. Commercial/industrial, high density residential | 0.1 |
| **QUESTIONS TO ANSWER IN THE FIELD:** | | | |
| 3. Water quality of the watercourse, pond, or lake associated with the wetland. | | a. High: Minimal pollution. Actual water quality meets or exceeds Class A or B standards | [✓ 1.0] |
| | | b. Medium: Moderate pollution. Actual water quality is below Class B standards | 0.5 |
| 4. Ratio of the number of occupied buildings within 500 feet of the wetland edge to the total area of the wetland (acres). | | a. Less than 1 bldg: 10 acres (<0.10) | [✓ 1.0] |
| | | b. From 1 bldg: 10 acres to 1 bldg: 2 acres (0.10-0.50) | 0.5 |
| | | c. More than 1 bldg: 2 acres (>0.5) | 0.1 |
| 5. Percent of original wetland filled. | | a. Less than 10 percent | [✓ 1.0] |
| | | b. From 10 to 50 percent | 0.5 |
| | | c. More than 50 percent | 0.1 |
| 6. Percent of wetland edge bordered by a buffer of woodland or idle land at least 500 feet in width. | | a. More than 80 percent | [✓ 1.0] |
| | | b. From 20 to 80 percent | 0.5 |
| | | c. Less than 20 percent | 0.1 |
| 7. Level of human activity **WITHIN WETLAND** as evidenced by litter, bike trails, roads, residences, etc. | | a. Low level: Few trails in use and/or sparse litter | [✓ 1.0] |
| | | b. Moderate level: Some used trails, roads, etc. | 0.5 |
| | | c. High level: Many trails, roads, etc. within wetland | 0.1 |

*Continued on next page...*

Wetland Name/Code: ____________________

## Functional Value 1
## *ECOLOGICAL INTEGRITY*
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **QUESTIONS TO ANSWER IN THE FIELD** (continued): | | | |
| 8. Level of human activity IN UPLAND within 500 feet of the wetland edge as evidenced by litter, bike trails, roads, residences, etc. | | a. Low level: Few trails in use and/or sparse litter | [✓ 1.0] |
| | | b. Moderate level: Some trails, scattered residences, etc. | 0.5 |
| | | c. High level: Many trails, roads, etc. within upland | 0.1 |
| 9. Percent of wetland plant community presently being altered by mowing, grazing, farming, or other activity. (Include areas now dominated by phragmites or purple loosestrife). | | a. Less than 10 percent | [✓ 1.0] |
| | | b. From 10 to 50 percent | 0.5 |
| | | c. More than 50 percent | 0.1 |
| 10. Percent of wetland actively being drained for agriculture or other purposes. | | a. Less than 10 percent | [✓ 1.0] |
| | | b. From 10 to 50 percent | 0.5 |
| | | c. More than 50 percent | 0.1 |
| 11. Number of public road and/or railroad crossings per 500 feet of wetland (measured along long axis of wetland). | | a. None | 1.0 |
| | | b. One or fewer | [✓ 0.5] |
| | | c. Two or more | 0.1 |
| 12. Long-term stability. | | a. Wetland appears to be naturally occurring, not impounded by dam or dike | [✓ 1.0] |
| | | b. Wetland appears to be somewhat dependent on artificial diking by dam, road, fill, etc. | 0.5 |

AVERAGE FVI FOR FUNCTIONAL VALUE 1 = Average of column D = .96.

EVALUATION AREA FOR FUNCTIONAL VALUE 1 = Total area of wetland = 512.8 acres.

**Wetland Name/Code:** ______________________________

## NEEDED FOR THIS EVALUATION:

**Functional Value 2**
***WETLAND WILDLIFE HABITAT***

- USGS topographic map
- Land use map and/or recent aerial photographs
- Ruler or scale
- A method to calculate area (Dot grid, planimeter, etc.)
- N.H. Water Quality Report to Congress 305(b)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **QUESTIONS TO ANSWER IN THE OFFICE:** | | | |
| 1. Ecological integrity. | | Average FVI from Functional Value 1 | .96 |
| 2. Area of shallow permanent open water (less than 6 feet deep) including streams in or adjacent to wetland. | | a. More than 3 acres | [✓ 1.0] |
| | | b. From 0.5 to 3 acres | 0.5 |
| | | c. Less than 0.5 acre | 0.1 |
| **QUESTIONS TO ANSWER IN THE FIELD:** | | | |
| 3. Water quality of the watercourse, lake, or pond associated with the wetland. | | FVI from Question V.1.3 | 1.0 |
| 4. Wetland diversity. | | a. Three or more wetland classes present | [✓ 1.0] |
| | | b. Two wetland classes present | 0.5 |
| | | c. One wetland class present | 0.1 |
| 5. Dominant wetland class. | | a. Emergent marsh and/or shallow open water | 1.0 |
| | | b. Forested and/or scrub-shrub wetland | [✓ 0.5] |
| | | c. Scrub-shrub saturated (bog) or wet meadow | 0.1 |
| 6. Interspersion of vegetation classes and/or open water. | | a. At least two wetland classes highly interspersed. Areas of each class scattered within wetland like a patchwork quilt | [✓ 1.0] |
| | | b. Moderate interspersion of wetland classes | 0.5 |
| | | c. Low degree of interspersion. Each wetland class is more or less contiguous and separate from the other classes | 0.1 |

*Continued on next page...*

**Wetland Name/Code:** ______________________________

**NEEDED FOR THIS EVALUATION:**

**Functional Value 2**
***WETLAND WILDLIFE HABITAT***
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| 7. Wetland juxtaposition. | | a. Wetland connected to other wetlands within a 1 mile radius by perennial stream or lake | [✓ 1.0] |
| | | b. Wetland connected to other wetlands within a 1 to 3 mile radius by perennial stream or lake, OR other unconnected wetlands are present within a 1 mile radius | 0.5 |
| | | c. Wetland not hydrologically connected to other wetlands within 3 miles and no other unconnected wetlands within 1 mile | 0.1 |
| 8. Number of islands or inclusions of upland within wetland. | | a. Two or more | [✓ 1.0] |
| | | b. One | 0.5 |
| | | c. None | 0.1 |
| 9. Wildlife access to other wetlands (overland). Travel lanes should be 50-100 feet wide. | | a. Free access along well vegetated stream corridor, woodland, or lakeshore | [✓ 1.0] |
| | | b. Access partially blocked by roads, urban areas, or other obstructions | 0.5 |
| | | c. Access blocked by roads, urban areas, or other obstructions | 0.1 |
| 10. Percent of wetland edge bordered by upland wildlife habitat (brush, woodland, active farmland, or idle land) at least 500 feet in width. | | a. More than 40 percent | [✓ 1.0] |
| | | b. From 10 to 40 percent | 0.5 |
| | | c. Less than 10 percent | 0.1 |

AVERAGE FVI FOR FUNCTIONAL VALUE 2 = Average of column D = .95.

EVALUATION AREA FOR FUNCTIONAL VALUE 2 = Total area of wetland = 512.8 acres.

Wetland Name/Code: ______________________________

## NEEDED FOR THIS EVALUATION:

- N.H. Water Quality Report to Congress 305(b)
- USGS topographic map
- Recent aerial photographs
- Anadromous Fish Run information
- Fish stocking information

## Functional Value 3
## *FINFISH HABITAT*
Streams and Rivers

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|

**PART A - STREAMS AND RIVERS** **NOTE:** If investigation reveals no year-round stream is present, enter zero for this Functional Value (Column "D" on summary sheet) and proceed to Part B.

Name of stream (if applicable) Melvin River

## QUESTIONS TO ANSWER IN THE OFFICE:

| | | | |
|---|---|---|---|
| 1. Dominant land use in watershed above wetland. | | a. Woodland, wetland, or abandoned farmland | [✓ 1.0] |
| | | b. Active farmland or rural residential | 0.5 |
| | | c. Urban and heavily developed suburban areas | 0.1 |

## QUESTIONS TO ANSWER IN THE FIELD:

| | | | |
|---|---|---|---|
| 2. Water quality of the watercourse associated with the wetland. | | FVI from Question V.1.3 | 1.0 |
| 3. Barrier(s) to anadromous fish (such as dams, beaver dams, water falls, road crossings, etc.) along the stream reach associated with the wetland. | Some beaver dams present but passable as evidenced by brook trout running high water in spring | a. No barrier(s) present, or if present equipped with fish ladders or other provisions for fish passage, OR waterbody is beyond the range of anadromous fish | 1.0<br>0.5 |
| | | b. Artificial barrier(s) present without provision for fish passage, AND river/stream is within range of anadromous fish | 0.1 |
| 4. Stream width (bank to bank). | | a. More than 50 feet | 1.0 |
| | | b. From 2 to 50 feet | [✓ 0.5] |
| | | c. Less than 2 feet | 0.1 |

*Continued on next page...*

Wetland Name/Code: ______________________________

## Functional Value 3
## *FINFISH HABITAT*
Streams and Rivers
(continued)

**PART A - STREAMS AND RIVERS** (continued)

**QUESTIONS TO ANSWER IN THE FIELD** (continued):

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| 5. Available shade. | | a. Woodland, scrubland, or other tall vegetation provides shade to all or significant portions of the stream (>50% cover) | [✓ 1.0] |
| | | b. Portions of the stream bank unvegetated, OR vegetation too low (<6') to provide shade (25-50% cover) | 0.5 |
| | | c. Major portions of stream bank vegetation too low (<6') to provide shade, OR unvegetated (<25% cover) | 0.1 |
| 6. Physical character of stream channel associated with wetland. | | a. Stream is in a natural channel, either a meandering low gradient (less than 0.2 %) stream, OR moderate to high (0.2% or higher) gradient stream with pools and riffles | [✓ 1.0] |
| | | b. Portions of stream recently modified, OR stream formerly channelized but has regained some natural channel features through the onset of meandering, the regrowth of instream vegetation, or the addition of cover objects such as rocks or snags | 0.5 |
| | | c. Stream has recently been channelized, OR stream is confined in a nonvegetated chute or pipe | 0.1 |

*Continued on next page...*

**Wetland Name/Code:** ____________________

## Functional Value 3
## *FINFISH HABITAT*
### Streams and Rivers
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **PART A - STREAMS AND RIVERS** (continued): | | | |
| **QUESTIONS TO ANSWER IN THE FIELD** (continued): | | | |
| 7. Abundance of cover objects. | | a. Abundant: More than 70% of water area contains cover objects such as submerged logs, undercut banks, and floating or submerged vegetation (might be seasonal) | [✓ 1.0] |
| | | b. Moderately abundant: From 30 to 70% of water area contains cover objects | 0.5 |
| | | c. Scarce: Less than 30% of the water area contains cover objects | 0.1 |
| 8. Spawning areas. | | a. Low gradient, slow moving stream with abundant areas of grass and low growing emergent vegetation present which are flooded for several weeks in the spring, OR a medium or high gradient stream with abundant areas of gravel suitable for spawning | [✓ 1.0] |
| | | b. Moderate amount of spawning areas present | 0.5 |
| | | c. Few spawning areas present | 0.1 |

AVERAGE FVI FOR FUNCTIONAL VALUE 3, PART A = Average of column D for Part A = .88.

EVALUATION AREA FOR PART A: FUNCTIONAL VALUE 3 = Area of stream or river associated with wetland = 7.6 acres.

Wetland Name/Code: ______________________________

## NEEDED FOR THIS EVALUATION:

## Functional Value 3
## *FINFISH HABITAT*
Lakes and Ponds

- USGS topographic map
- Recent aerial photograph
- Water Quality Report to Congress 305(b)
- Anadromous Fish Run Information
- A method to calculate area (Dot grid, planimeter, etc.)

N/A

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| PART B - LAKES AND PONDS | Note: If no lake or pond is present enter zero for this Function (Column "D" on summary sheet) and proceed to next Functional Value. | | |
| **ALL QUESTIONS TO BE ANSWERED IN THE FIELD:** | | | |
| 1. Dominant land use in watershed above wetland. | | FVI for Question V.3.1A | ____ |
| 2. Water quality of pond or lake associated with wetland. | | FVI from Question V.1.3 | ____ |
| 3. Barrier(s) to anadromous fish (such as dams, beaver dams, waterfalls, road crossings). | | a. No barrier(s) present, or if present equipped with fish ladders or other provisions for fish passage, OR waterbody is beyond range of anadromous fish | 1.0 |
| | | b. Artificial barrier(s) present without provision for fish passage, and river/stream is within range of anadromous fish | 0.1 |
| 4. Total area of pond or lake, including areas of rooted, submerged, and emergent vegetation. | | a. More than 100 acres | 1.0 |
| | | b. From 10 to 100 acres | 0.5 |
| | | c. Less than 10 acres | 0.1 |
| 5. Abundance of cover objects. | | a. Abundant: More than 70% of area visible from shore contains cover objects such as submerged logs, rocks, etc. | 1.0 |
| | | b. Moderate: From 30% to 70% of area visible from shore contains cover objects | 0.5 |
| | | c. Scarce: Less than 30% of area visible from shore contains cover objects | 0.1 |
| 6. Percent of pond or lake having rooted submerged or emergent vegetation. | | a. From 15 to 50% | 1.0 |
| | | b. More than 50% or less than 15% | 0.1 |

AVERAGE FVI FOR FUNCTIONAL VALUE 3, PART B = Average of column D for Part B = ________.

EVALUATION AREA FOR PART B: FUNCTIONAL VALUE 3 = Area of pond or lake associated with wetland = ______________ acres.

Wetland Name/Code: ____________________

## NEEDED FOR THIS EVALUATION:

- USGS topographic map
- Land use map or recent aerial photograph
- Ruler or scale
- Method to calculate area (Dot grid or planimeter)
- Knowledge of any management activities by local nature centers, sanctuaries, scouting groups, garden clubs, etc.

## Functional Value 4
## *EDUCATIONAL POTENTIAL*

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|

Location of potential educational site: At outflow of Wetland along Melvin River

### QUESTIONS TO ANSWER IN THE OFFICE:

| | | | |
|---|---|---|---|
| 1. Ecological integrity. | | Average FVI from Functional Value 1 | .96 |
| 2. Wetland wildlife habitat. | | Average FVI from Functional Value 2 | .95 |
| 3. Proximity of potential educational site to schools. | | a. Within safe walking distance | 1.0 |
| | | b. Within 20 minutes drive | [✓ 0.5] |
| | | c. More than 20 minutes drive | 0.1 |
| 4. Presence of a nature preserve or wildlife management area. | | a. Wetland within an organized nature preserve or wildlife management area | 1.0 |
| | | b. Wetland in a conservation easement or district but not under active management | [✓ 0.5] |
| | | c. Area not under such management, or areas closed because of the presence of rare plants or other environmental considerations | 0.1 |

### QUESTIONS TO ANSWER IN THE FIELD:

| | | | |
|---|---|---|---|
| 5. Proximity of potential educational site to other plant communities. | | a. Upland forest or abandoned farmland in various stages of secondary succession within a short walk to potential educational site | [✓ 1.0] |
| | | b. Potential educational site is not within a short walk to other plant communities | 0.1 |
| 6. Off-road parking at potential educational site suitable for school buses. | | a. Wetland within walking distance, or a suitable parking area is in close proximity to the educational site | 1.0 |
| | | b. Moderate expense required to develop parking area within close proximity to the educational site | [✓ 0.5] |
| | | c. Parking within close proximity of the educational site not available, or expensive to develop because of traffic flow, soil suitability, or other problems | 0.1 |

*Continued on next page...*

**Wetland Name/Code:** ______________________________

## Functional Value 4
## *EDUCATIONAL POTENTIAL*
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **QUESTIONS TO ANSWER IN THE FIELD** (continued): | | | |
| 7. Number of wetland classes accessible or potentially accessible for study at potential educational site. | | a. Three or more classes | [✓ 1.0] |
| | | b. Two classes | 0.5 |
| | | c. One class | 0.1 |
| 8. Access to perennial stream at potential educational site. | | a. Direct access available | [✓ 1.0] |
| | | b. Water access not available but feasible to develop | 0.5 |
| | | c. Perennial stream not present, or access not feasible | 0.1 |
| 9. Access to pond or lake at potential educational site. | | a. Direct access available | 1.0 |
| | | b. Access not available but feasible to develop | 0.5 |
| | | c. Pond or lake not present, or access not feasible | [✓ 0.1] |
| 10. Student safety. | | a. No known safety hazards such as busy roads, steep embankments, railroad trestle, etc. within potential educational site | 1 0 |
| | Sodom Rd.<br>steep, brushy river banks | b. One or more safety hazards present which could be overcome at moderate expense | [✓ 0.5] |
| | | c. Obvious safety hazards which would be difficult and/or expensive to overcome | 0.1 |
| 11. Public access to potential educational site. | | a. Public access prohibited or controlled. Interference with study area or equipment unlikely | 1 0 |
| | | b. Some public access by general public, but at a level which will not greatly interfere with the study area | [✓ 0 5] |
| | | c. Unlimited public access that cannot easily be controlled and which would be likely to interfere with study area or equipment | 0.1 |

***Continued on next page...***

Wetland Name/Code: ______________________________

## Functional Value 4
## *EDUCATIONAL POTENTIAL*
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| 12. Visual/aesthetic quality of potential educational site. | | a. Undisturbed and natural. No aesthetic detractors such as litter, abandoned cars, land fills, road noise, etc. or if such detractors are present, they could be easily corrected | 1.0 |
| | road noise | b. Limited disturbance. Minor detractors present and difficult to correct | [✓ 0.5] |
| | | c. Severe disturbance. Major detractors present which would be difficult to correct | 0.1 |
| 13. Handicap accessibility. | | a. Yes | 1.0 |
| | | b. No | [✓ 0.0] |

AVERAGE FVI FOR FUNCTIONAL VALUE 4 = Average of column D = .62.

EVALUATION AREA FOR FUNCTIONAL VALUE 4 = AREA* of potential educational site = .6 acres.

---

* AREA - May represent the entire wetland, or if the wetland is quite large it is possible that only a portion of it will be used (that which is visible, accessible, etc.)

Wetland Name/Code: ____________________

## NEEDED FOR THIS EVALUATION:

## Functional Value 5
## *VISUAL/ AESTHETIC QUALITY*

- USGS topographic map
- Land use map or recent aerial photograph
- Ruler or scale
- Method to measure area (Dot grid or planimeter)
- Ability to make an on-site assessment of the best, most useable viewing area(s)

## ALL QUESTIONS TO BE ANSWERED IN THE FIELD:

Location of primary viewing site(s): Melvin R. Bridge, N apex

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| 1. Number of wetland classes visible from primary viewing location(s). | | a. Three or more classes | [✓ 1.0] |
| | | b. Two classes | 0.5 |
| | | c. One class | 0.1 |
| 2. Dominant wetland class visible from primary viewing location(s). | | a. Low growing wetlands such as marshes, bogs, and open water, or scrub-shrub having vegetation <3ft. in height | [✓ 1.0] |
| | | b. Wet meadow | 0.5 |
| | | c. Forested, scrub-shrub | 0.1 |
| 3. Noise level at primary viewing location(s). | | a. Low: Birds, wildlife and other naturally occuring sounds predominate | [✓ 1.0] |
| | | b. Moderate: Some traffic or other noise audible | 0.5 |
| | | c. Loud: Continuous traffic, factories, or similar noise | 0.1 |
| 4. Odors present at primary viewing location(s). | | a. Natural odors only (Note: some natural odors may be unpleasant) | [✓ 1.0] |
| | | b. Unnatural odors present at certain times such as auto exhaust or a sewage treatment plant | 0.5 |
| | | c. Unnatural odors distinct, more or less continuous and noticeably unpleasant | 0.1 |
| 5. Approximate extent of open water visible from primary viewing location(s). | | a. More than 3 acres of open water, or more than 300 feet of a stream | 1.0 |
| | | b. From 1 to 3 acres of open water, or 100-300 feet of a stream | [✓ 0.5] |
| | | c. Less than 1 acre of open water, or less than 100 feet of a stream | 0.1 |

*Continued on next page...*

**Wetland Name/Code:** ______________________

## Functional Value 5
## *VISUAL/ AESTHETIC QUALITY*
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **ALL QUESTIONS TO BE ANSWERED IN THE FIELD** (continued): | | | |
| 6. General appearance of the wetland and surrounding land use(s) visible from primary viewing location(s). | | a. Undisturbed and natural. No visual detractors present such as litter, abandoned cars, etc., or if such are present, they can be easily corrected | 1.0 |
| | powerlines & ATV trail | b. Limited disturbance in and/ or around wetland. Minor visual detractors present and difficult to correct | [✓ 0.5] |
| | | c. Severe detractors present and difficult to correct | 0.1 |
| 7. Landform contrast. | | a. Wetland provides dramatic visual contrast with surrounding topography | [✓ 1.0] |
| | | b. Wetland provides some visual contrast with surrounding topography | 0.5 |
| | | c. Wetland provides little or no visual contrast with surrounding topography | 0.1 |
| 8. Dominant surrounding land use visible from primary viewing location(s). | | a. Woodland, agricultural land, and/or well-landscaped residential or commercial areas | [✓ 1.0] |
| | | b. Other residential and commercial areas of ordinary visual quality | 0.5 |
| | | c. Urban and built up areas of low visual quality | 0.1 |
| 9. Area of wetland dominated by flowering trees or shrubs, OR trees or shrubs which turn vibrant colors in the fall. | | a. More than 5 acres | [✓ 1.0] |
| | | b. From 1 to 5 acres | 0.5 |
| | | c. Less than 1 acre | 0.1 |
| 10. Wetland wildlife habitat. | | Average FVI from Functional Value 2 | .25 |

***Continued on next page...***

Wetland Name/Code: ______________________

## Functional Value 5
## *VISUAL/ AESTHETIC QUALITY*
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| | | | |

AVERAGE FVI FOR FUNCTIONAL VALUE 5 = Average of column D = .90.

EVALUATION AREA FOR FUNCTIONAL VALUE 5 = Total area of wetland visible* from primary viewing location(s) = 10 acres.

*Visible - You may need to measure this area from the wetland base map as it may only be a percentage of the actual wetland size.

Wetland Name/Code: ______________________________

## NEEDED FOR THIS EVALUATION:

- N.H. Water Quality Report to Congress 305(b)
- Fish stocking information
- Anadromous Fish Run information
- Familiarization with watercourse through the seasons
- USGS topographic map, aerial photographs, or other means (including a field walk), to assess the length of canoeable stream

## Functional Value 6
## *WATER-BASED RECREATION IN WATERCOURSE ASSOCIATED WITH THE WETLAND*

(Canoeing, Non-powered Boating, Fishing, Hunting and Wildlife Observation)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|

NOTE: If no year round stream, pond or lake is present, enter zero for this Functional Value (Column "D" on the summary sheet) and proceed to the next Functional Value.

Evaluation area(s) Lower Melvin River

## QUESTIONS TO ANSWER IN THE OFFICE:

| | | | |
|---|---|---|---|
| 1. Fishing. | | a. Wetland located on state stocked and/or frequently fished stream or lake | [✓ 1.0] |
| | | b. Wetland located on stream or lake which is used occasionally for fishing | 0.5 |
| | | c. Wetland located on stream or lake which is seldom used for fishing because of poor water quality, lack of access, insufficient depth, etc. | 0.1 |
| 2. Hunting. | | a. Wetland is in an area where hunting is permited | [✓ 1.0] |
| | | b. Wetland is in an area where hunting is prohibited | 0.1 |
| 3. Opportunities for wildlife observation. | | Average FVI from Functional Value 2 | .95 |

## QUESTIONS TO ANSWER IN THE FIELD:

| | | | |
|---|---|---|---|
| 4. Water quality of watercourse, pond, or lake associated with wetland. (Previously determined in V.1.3). | | FVI from Question V.1.3 | 1.0 |

*Continued on next page...*

Wetland Name/Code: ______________________________

## Functional Value 6
## *WATER-BASED RECREATION IN WATERCOURSE ASSOCIATED WITH THE WETLAND*

(Canoeing, Non-powered Boating, Fishing, Hunting and Wildlife Observation)
(continued)

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| **QUESTIONS TO ANSWER IN THE FIELD** (continued): | | | |
| 5. Canoe and boat passage (average annual accessibility). | | a. Watercourse is at least 10 feet wide and one foot deep and is free of obstructions for canoeing and/or nonpowered boating | 1.0 |
| | Some canoe potential in lower reach at high water | b. Watercourse contains some year-round and/or seasonally exposed obstructions and/or shallow areas which hinder the use of canoes or nonpowered boats | 0.5<br>[✓ .25] |
| | | c. Watercourse is too small and shallow and/or contains obstructions which prohibit the use of canoes and/or nonpowered boats | 0.1 |
| 6. Off-road public parking at potential recreation site. | | a. Wetland within walking distance, or a suitable parking area is in close proximity to the recreational site | 1.0 |
| | | b. Moderate expense required to develop parking area within close proximity to the recreational site | [✓ 0.5] |
| | | c. Parking within close proximity of the recreational site not available, or expensive to develop because of traffic flow, soil suitability, or other problems | 0.1 |
| 7. Access to water at potential recreation site for canoeing or fishing (good site to launch a boat or stand to cast and fish). | | a. Direct access to water available or easily developed | 1.0 |
| | | b. Direct access to water would require moderate expense to develop | 0.5 |
| | | c. Direct access would require major expense to develop | [✓ 0.1] |

*Continued on next page...*

**Wetland Name/Code:** ______________________________

**Functional Value 6**
***WATER-BASED RECREATION IN WATERCOURSE ASSOCIATED WITH THE WETLAND***
(Canoeing, Non-powered Boating, Fishing, Hunting and Wildlife Observation)
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **QUESTIONS TO ANSWER IN THE FIELD** (continued): | | | |
| 8. Visual/aesthetic quality of potential recreation site. | | Average FVI for Functional Value 5 | .9 |

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AVERAGE FVI FOR FUNCTIONAL VALUE 6 = Average of column D = .71.

EVALUATION AREA FOR FUNCTIONAL VALUE 6 = Area of wetland evaluated for water-based recreation* = 1.5 acres.

*This may be all or part of the wetland. Birding, hunting, fieldwalks may use entire wetland.

Wetland Name/Code: ______________________

## NEEDED FOR THIS EVALUATION:

- A method to calculate area (Dot grid, planimeter, etc.)
- USGS topographic map and recent aerial photographs
- Ability to delineate a watershed (see Appendix E)
- Ability to understand elevations on a topographic map or site plan
- Tape measure or rope for measuring distance

## Functional Value 7
## *FLOOD CONTROL POTENTIAL*

---

## TO BE COMPLETED IN THE OFFICE:

1. Determine the area of the wetland in acres (WA). 512.8 acres. e.g. 2 acres
2. Determine the area of the watershed above the outlet of the wetland in acres (DA). 7123 acres. e.g. 50 acres
3. Determine the Wetland Control Length (WCL) in feet. 19 feet. e.g. 6 feet
4. Calculate the FVI for Flood Control Potential:

**Step 1** Ratio A = $\frac{\text{Area of watershed above outlet of wetland (DA)}}{\text{Area of Wetland (WA)}}$ = 13.9    e.g. $\frac{50}{2}$ = 25

**Step 2** Ratio B = $\frac{\text{Area of watershed above outlet of wetland (DA)}}{\text{Wetland Control Length (WCL)}}$ = 375    e.g. $\frac{50}{6}$ = 8

5. Read horizontally to the right from the appropriate Ratio B value to the column heading that most closely approximates the computed Ratio A value. Your answer, found at this intersection, is the FVI for this Functional Value. Following the example given above, where Ratio B = 8.0 and Ratio A = 25, the FVI would be 0.5.

| **RATIO B = $\frac{DA}{WCL}$** | **RATIO A = $\frac{DA}{WA}$** | | | | |
|---|---|---|---|---|---|
| | Ratio A < 10<br>FVI | 10 < Ratio A < 20<br>FVI | 20 < Ratio A < 50<br>FVI | 50 < Ratio A < 100<br>FVI | Ratio A > 100 |
| 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.4 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.8 | 0.5 | 0.3 | 0.0 | 0.0 | 0.0 |
| 1.0 | 0.6 | 0.3 | 0.0 | 0.0 | 0.0 |
| 2.0 | 0.8 | 0.5 | 0.1 | 0.0 | 0.0 |
| 4.0 | 1.0 | 0.7 | 0.3 | 0.1 | 0.0 |
| 8.0 | 1.0 | 0.9 | $\boxed{0.5}$ | 0.2 | 0.0 |
| 16.0 | 1.0 | 1.0 | 0.7 | 0.3 | 0.1 |
| 32.0 | 1.0 | 1.0 | 0.9 | 0.6 | 0.2 |
| 64.0 | 1.0 | 1.0 | 1.0 | 0.8 | 0.4 |
| 128.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.7 |
| 256.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

**Note:** FVI values of zero indicate the wetland has the potential to reduce a flood flow by 10% or less. FVI values of 1.0 indicate the wetland has the potential to reduce flood flows by 80% or more. Intermediate FVI values are interpolated between these two extremes.

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FVI FOR FUNCTIONAL VALUE 7 (from table) = 1.0.

EVALUATION AREA FOR FUNCTIONAL VALUE 7 = AREA OF WETLAND 512.8 acres.

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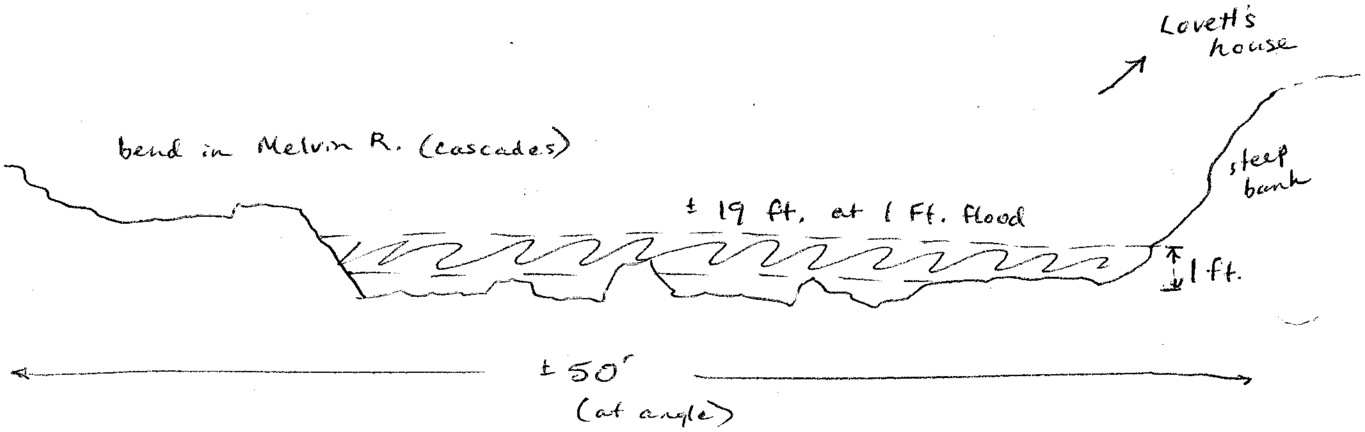
*Continued on next page...*

Wetland Name/Code: ______________________________

## Functional Value 7
## *FLOOD CONTROL POTENTIAL*

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|

6 Sketch of wetland.



**Wetland Name/Code:** ______________________

## NEEDED FOR THIS EVALUATION:

## Functional Value 8
## *GROUND WATER USE POTENTIAL*

- DES Well Inventory and Water User maps
- DES Ground Water Availability maps (Reconnaissance Maps) (early 1970's)
- DES Stratified Drift Aquifer Maps(when available)
- Surficial Geology maps
- SCS soils maps
- NH Water Quality Report to Congress 305(b)

**NOTE:** Evaluate this Function only if the wetland is upstream of, or overlying an aquifer. Otherwise, proceed to Functional Value 9.

### QUESTIONS TO ANSWER IN THE OFFICE: (Some field verification may be necessary.)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| 1. Existing public or private water supply wells. | | a. Public or private water supply well(s) located <0.5 miles downstream of wetland | 1.0 |
| | | b. Public or private water supply well(s) located 0.5 to 1 mile downstream of wetland | [✓ 0.5] |
| | | c. No public or private water supply well(s) within 1 mile downstream of wetland | 0.1 |
| 2. Potential public or private water supply. | | a. Stratified drift aquifer located <0.5 miles downstream of wetland | [✓ 1.0] |
| | | b. Stratified drift aquifer located 0.5 to 1 mile downstream of wetland | 0.5 |
| | | c. No stratified drift aquifer within 1 mile downstream of wetland | 0.1 |
| 3. Ground water quality of the stratified drift aquifer. | | a. Meets NH DES drinking water quality standards | [✓ 1.0] |
| | | b. Requires treatment to meet drinking water standards | 0.5 |
| | | c. Classified as saline or otherwise unsuitable for drinking water | 0.1 |

### QUESTION TO ANSWER IN THE FIELD:

| | | | |
|---|---|---|---|
| 4. Water quality of watercourse, pond, or lake associated with wetland. | | FVI from Question V.1.3 | 1.0 |

AVERAGE FVI FOR FUNCTIONAL VALUE 8 = Average of column D = .88.

EVALUATION AREA FOR FUNCTIONAL VALUE 8 = Total area of wetland = 512.8 acres.

**Wetland Name/Code:** ______________________________

## NEEDED FOR THIS EVALUATION:

- USGS topographic map
- Land use map or recent aerial photographs
- A method to calculate area (Dot grid, Planimeter, etc.)
- Knowledge or familiarity with the extent and type of current development in the study area
- Ability to calculate average slope (See Appendix F)

## Functional Value 9
## *SEDIMENT TRAPPING*

**PART A - OPPORTUNITY FOR SEDIMENT TRAPPING**

### QUESTION TO ANSWER IN THE OFFICE:

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| 1. Average slope of watershed above wetland. | | a. Steep: Greater than 8% | [✓ 1.0] |
| | | b. Moderate: From 3 to 8% | 0.5 |
| | | c. Low: Less than 3% | 0.1 |

### QUESTION TO ANSWER IN THE FIELD:

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| 2. Potential sources of excess sediment in the watershed above the wetland. | | a. Extensive areas of active cropland, construction sites, eroding road banks, ditches, and similar areas | 1.0 |
| | | b. Some areas of active cropland, a few construction sites, and similar areas | [✓ 0.5] |
| | | c. Land use in watershed predominantly forested, abandoned farmland or otherwise undeveloped | 0.1 |

AVERAGE FVI FOR FUNCTIONAL VALUE 9, PART A = Average of Column D for Part A = .75.

**PART B - OVERALL POTENTIAL FOR SEDIMENT TRAPPING BY WETLAND**

### QUESTIONS TO ANSWER IN THE OFFICE:

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| 1. Opportunity for sediment trapping. | | Average FVI from Part A above | .75 |
| 2. Effective floodwater storage of wetland. | | FVI from Functional Value 7 | 1.0 |

### QUESTIONS TO ANSWER IN THE FIELD:

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| 3. Wetland location in relation to an intermittent or perennial stream or a lake. | | a. Wetland forms a buffer more than 50 ft. wide between upland and stream or lake | [✓ 1.0] |
| | | b. Wetland forms a buffer from 20 to 50 ft. wide between upland and stream or lake | 0.5 |
| | | c. Wetland forms a buffer less than 20 ft. wide, or wetland not bordering a stream or lake | 0.1 |

*Part B continued on next page...*

Wetland Name/Code: ______________________________

## Functional Value 9
## *SEDIMENT TRAPPING*
(continued)

| A Evaluation Questions | B Computations or Actual Value | C Evaluation Criteria | D Functional Value Index (FVI) |
|---|---|---|---|
| 4. Dominant wetland class bordering a stream or lake. | | a. Scrub-shrub or dense stands of cattails or phragmites | [✓ 1.0] |
| | | b. Forested | 0.5 |
| | | c. Other types, or wetland does not border a stream or lake | 0.1 |
| 5. Areas of impounded open water (including beaver dams). | | a. Wetland contains permanently impounded open water greater than 5 acres in size | 1.0 |
| | | b. Wetland contains permanently impounded open water from 0.5 to 5 acres in size | 0.5 |
| | | c. Wetland contains permanently impounded open water less than 0.5 acres in size, or wetland does not contain open water | [✓ 0.1] |

AVERAGE FVI FOR FUNCTIONAL VALUE 9, PART B = Average of Column D for Part B = .77 = Average FVI for Sediment Trapping.

EVALUATION AREA FOR FUNCTIONAL VALUE 9 = Total area of wetland = 512.8 acres.

Wetland Name/Code: ______________________________

**NEEDED FOR THIS EVALUATION:**

## Functional Value 10
## *NUTRIENT ATTENUATION*

- USGS topographic map
- Land use map or recent aerial photographs
- Knowledge or familiarity with the area regarding extent and type of current development
- Ability to delineate a watershed (See Appendix E)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|

### PART A - OPPORTUNITY FOR NUTRIENT ATTENUATION

### ALL QUESTIONS TO BE ANSWERED IN THE OFFICE:

| | | | |
|---|---|---|---|
| 1. Opportunity for sediment trapping. | | Average FVI for Part A of FV 9 | .75 |
| 2. Potential sources of excess nutrients in watershed above wetland. | | a. Large areas of active cropland, pastureland, or urban land. Many dairies or other livestock operations, sewage treatment plants, or numerous on-site septic systems within 100 feet of stream | 1.0 |
| | | b. Watershed contains some areas of active cropland, pastureland, or urban land. A few dairies or other livestock operations or a few on-site septic systems within 100 feet of the stream | [✓ 0.5] |
| | | c. Watershed predominantly forested or otherwise undeveloped | 0.1 |

AVERAGE FVI FOR FUNCTIONAL VALUE 10, PART A = Average of Column D for Part A = .63.

### PART B - OVERALL POTENTIAL FOR NUTRIENT ATTENUATION

### QUESTIONS TO ANSWER IN THE OFFICE:

| | | | |
|---|---|---|---|
| 1. Opportunity for nutrient attenuation. | | Average FVI for Part A (above) | .63 |
| 2. Overall potential for sediment trapping in the wetland. | | Average FVI for Part B of FV 9 | .77 |

### QUESTIONS TO ANSWER IN THE FIELD:

| | | | |
|---|---|---|---|
| 3. Dominant wetland class. (Refer to Question V.2.4). | | a. Floating aquatic plants, emergent (marsh), forested, or scrub/shrub, except bogs | [✓ 1.0] |
| | | b. Bogs | 0.1 |

*Continued on next page...*

**Wetland Name/Code:** ______________________________

## Functional Value 10
## *NUTRIENT ATTENUATION*
(continued)

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| 4. Wetland hydroperiod. | | a. Wetland contains permanently impounded open water > 5 acres in size | 1.0 |
| | | b. Wetland contains permanently impounded open water from 0.5 to 5 acres in size, OR more than 5 acres of the wetland are flooded or ponded annually during a portion of the growing season | [✓ 0.5] |
| | | c. Above criteria are not met (e.g. the wetland has predominantly saturated soil conditions and is rarely ponded or flooded during the growing season.) | 0.1 |

AVERAGE FVI FOR FUNCTIONAL VALUE 10, PART B = Average of Column D for Part B = .73 = Average FVI for Nutrient Attenuation.

EVALUATION AREA FOR FUNCTIONAL VALUE 10 = Total area of wetland = 512.8 acres.

**Wetland Name/Code:** ______________________________

## NEEDED FOR THIS EVALUATION:

- USGS topographic map
- Recent aerial photograph
- Ruler or scale

## Functional Value 11
### *SHORELINE ANCHORING AND DISSIPATION OF EROSIVE FORCES*

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **ALL QUESTIONS TO BE ANSWERED IN THE FIELD:** | | | |
| 1. Wetland morphology. | mostly indistinct shoreline with abundant vegetation | a No distinct shoreline or bank evident between waterbody and wetland or upland. Wetland grades from aquatic bed and/or marsh (emergent vegetation) landward to shrub swamp or wooded swamp | 1.0<br>[✓ .75] |
| | | b. Distinct shoreline or bank evident between waterbody and wetland or upland. Shoreline or bank presently showing minimal signs of erosion | 0.5 |
| | | c. Distinct shoreline or bank evident between waterbody and wetland or upland. Shoreline or bank presently showing signs of severe erosion | 0.1 |
| 2. Width of wetland bordering watercourse, lake, or pond. | | a. More than 10 feet | [✓ 1.0] |
| | | b. From 3 to 10 feet | 0.5 |
| | | c. Less than 3 feet | 0.1 |
| 3. Vegetation density (shrubs or emergents) of wetland bordering watercourse, lake, or pond. | | a. High: More than 90 percent ground cover | [✓ 1.0] |
| | | b. Moderate: From 70-90 percent ground cover | 0.5 |
| | | c. Low: Less than 70 percent ground cover | 0.1 |

---

AVERAGE FVI FOR FUNCTIONAL VALUE 11 = Average of column D = .92.

EVALUATION AREA FOR FUNCTIONAL VALUE 11 = $\frac{\text{L x 10 feet}}{\text{43,560 sq. ft./acres}}$ = 7.6 acres.

Where: L = Length of shoreline (streams, lake, or pond) within wetland in feet.
(Shoreline of stream = length of stream x 2 (number of banks)).
10 feet = The minimum width of the wetland assumed to be actually anchoring the shore.
43,560 sq. ft. = one acre

Wetland Name/Code: ______________________________

**NEEDED FOR THIS EVALUATION:**

- USGS topographic map
- Recent aerial photographs
- Research of town historical map(s)/ town history
- National Register of Historical Places
- Local knowledge of historical sites

## Functional Value 13
## *HISTORICAL SITE POTENTIAL*

N/A although mill site & foundation downstream < 10 min. walk

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| **ALL QUESTIONS TO BE ANSWERED IN THE FIELD:** | | | |
| 1. Proximity of potential site to nearest perennial water-course. | | a. 0 to 50 yards | 1.0 |
| | | b. 51-100 yards | 0.5 |
| | | c. > 100 yards | 0.1 |
| 2. Visible stone or earthen foundations, berms, dams, standing structures, etc. | | a. Yes | 1.0 |
| | | b. No | 0.0 |
| 3. Existence of mill pond at site. | | a. Presence of pond or pond site **AND** remains of dam | 1.0 |
| | | b. Presence of pond or pond site **OR**, remains of dam | 0.5 |
| | | c. No apparent remains of pond or of dam | 0.1 |
| 4. Presence of historical buildings. | | a. Yes | 1.0 |
| | | b. No | 0.0 |

AVERAGE FVI FOR FUNCTIONAL VALUE 13 = Average of Column D = -0-.

**AVERAGE FVI FOR FUNCTIONAL VALUE 13 = 1.0 if the site has known or documented historical significance.**

EVALUATION AREA FOR FUNCTIONAL VALUE 13 = Area of potential site for Historical Significance = ______________ acres.

Wetland Name/Code: ______________________

**NEEDED FOR THIS EVALUATION:**

- List of federal and/or state endangered or threatened species
- Knowledge of any management activities by local nature centers, land protection groups, scouting programs, garden clubs, etc.
- Completed evaluations for all other wetlands in the study area

## Functional Value 14
## *NOTEWORTHINESS*

**ALL QUESTIONS TO BE ANSWERED IN THE OFFICE:**

| A<br>Evaluation Questions | B<br>Computations or Actual Value | C<br>Evaluation Criteria | D<br>Functional Value Index (FVI) |
|---|---|---|---|
| 1. Wetland contains critical habitat for a state or federally listed threatened or endangered species. | | a. Yes<br>b. No | 1.0<br>[✓ 0.0] |
| 2. Wetland is known to be a study site for scientific research. | | a. Yes<br>b. No | 1.0<br>[✓ 0.0] |
| 3. Wetland is a national natural landmark or recognized by NHNHI as an exemplary natural community. | | a. Yes<br>b. No | 1.0<br>[✓ 0.0] |
| 4. Wetland has local significance because it ranks among the highest number of WVU's within the study area for one or more Functional Values. | unknown | a. Yes<br>b. No | 1.0<br>[✓ 0.0] |
| 5. Wetland has local significance because it has biological, geological, or other features which are locally rare or unique. | largest aquifer in Tuftonboro surrounds wetland; large size + diversity unique in Town for wildlife, hunting, fishing & other forms of recreation | a. Yes<br>b. No | [✓ 1.0]<br>0.0 |
| 6. Wetland is known to contain an important archaeological site. | | a. Yes<br>b. No | 1.0<br>[✓ 0.0] |
| 7. Wetland is hydrologically connected to a state or federally designated river. | | a. Yes<br>b. No | 1.0<br>[✓ 0.0] |

AVERAGE FVI FOR FUNCTIONAL VALUE 14 = 1.0 if the FVI for any question is equal to 1.0, otherwise the average FVI for FUNCTIONAL VALUE 14 is 0.0 = 1.0

EVALUATION AREA FOR FUNCTIONAL VALUE 14 = Total area of wetland = 512.8 acres.

# FUNCTIONAL VALUE SPECIFICATIONS FOR THE NH METHOD

## FVI 1 – Ecological Integrity

1) Estimation of the amount of hydric a soil was field checked in the Great Meadow property only
2) Dominant land use zoning was identified as agriculture, forestry or similar open space zoning
3) Water quality was based on field testing of standard parameters
4) The density of buildings within the 500 ft buffer was also field checked from road-side surveys
5) The amount of fill was always estimated visually, and included only the amount of non-hydric fill
6) Woodland and idle land included all undeveloped, non-agricultural land
7) Level of human activity in the wetland was estimated after the entire Great Meadow property edge was walked
8) Level of human activity within the 500 ft buffer of the entire wetland was visually estimated based on the 1998 DOQ
9) Plant community impacts included logging; invasive species effects were estimated from presence/absence
10) Percent of wetland being drained was visually estimated from drainage ditch lines seen on aerial photographs
11) Number of public road crossings included those that ran along the edge of the wetland; however these were only counted once even if they extended beyond 500 feet in length along the edge of the wetland
12) Artificial dams that altered the flow of water yet supported sufficient flow through a culvert were assigned a .5 value; beaver dams were assigned a 1.0 value, whether active or not

## FVI 2 – Wetland Wildlife Habitat

1) FVI1 index derived from above
2) Area of shallow permanent water was always estimated in field based on high water condition
3) Water quality was based on field testing
4) Wetland classes were determined to be present only if in discernible amounts – i.e. >.01 acres
5) Dominant wetland class was determined areally; intergrades (e.g. PEM/SS) were allowed based on height
6) Minimum interspersion size was approximately .25 acres; at least 3 patches each of at least 2 wetland classes had to have been present
7) Wetland juxtaposition was based on perennial stream or other open water connectivity as determined in field; adjacency to other unconnected wetlands was based on NWI map

8) Island minimum size: .01 acres; did not have to be separated by open water
9) Wildlife access was present if at least one strip >50 feet wide existed to another wetland; however, the other wetland could have been hydrologically connected
10) Percent of wetland edge bordered by upland wildlife habitat was applicable to all non-developed lands (incl. agricultural)

FVI 3 – Finfish Habitat – Streams & Rivers

PART A – stream name (if any) based on USGS map; size in acres based on average width times length (checked against map units)

1) Dominant land use in watershed was based on USGS map and aerial photographs
2) Water quality was estimated based on field testing
3) Barriers to anadromous fish based on existing fish populations (brook trout)
4) Stream bank width was estimated as average width from beginning of wetland boundary to end
5) Available shade was visually estimated in field as described in method
6) Stream modification applicable mostly to estimated culverts and channels between hydrologically connected wetland units
7) Abundance of cover objects – included estimated presence of floating aquatic vegetation
8) Spawning areas were visually estimated based on all species of fish (i.e. not just stocked or anadromous)

1) PART B – not applicable to Great Meadow wetland

FVI 4 – Educational Potential

(Site located at easiest access point(s) and comprised area accessible within a 15-minute walk; only the Town property used)

1) Ecological Integrity FVI from above
2) Wetland Wildlife Habitat FVI from above
3) Proximity to schools based upon ability to walk to wetland, or of school bus to drive to wetland (i.e. not for 4WD drive vehicles)
4) Presence of nature preserve or other wildlife management areas based upon the fact that the Great Meadow is public land but is not under any conservation restriction or easement
5) Proximity to other plant communities always present; only condition otherwise would have been active farmland that immediately bordered the wetland on all sides
6) Off-road parking present (suitable for school buses) only if within 15 minutes walk of wetland; moderate expense assumed to develop parking

area unless wetland difficult to get to and more than a fifteen minute walk from the nearest access point

7) Number of wetland classes was tallied for area within 15 minute walk of primary access point
8) Access to perennial stream assumed to be present even if dry sometimes
9) Access to pond or lake not applicable
10) Student safety assessment based on attributes listed; bush-whacking not applicable; no .10 values assigned
11) Public access assumed to be of limited extent
12) Visual/aesthetic detractors primarily road noise
13) Handicap accessibility not present

### FVI 5 – Visual/Aesthetic Quality

(Viewing sites located at one of principal access points at north crossing of Melvin River, since it presented the greatest opportunity to view the entire wetland)

1) Number of wetland classes based on minimum size of .01 acres per wetland class
2) Dominant wetland class based on attributes listed; intergrades acceptable if clearly a mixture of visible classes
3) Noise principally from roads, based on winter or summer condition of surrounding vegetation
4) Odors present based on year-round condition; unnatural odors primarily due to vehicle exhaust
5) Visible open water extent based on visual estimate at time of assessment
6) Limited number of detractors principally the developed portions of the landscape
7) Landform contrast based on Ossipee Mountains backdrop
8) Dominant surrounding land use based on windshield survey
9) Area of flowering trees & shrubs, or those that turn vibrant colors in fall based on observed presence and amount of deciduous vegetation
10) Wetland Wildlife Habitat as above

### FVI 6 – Water-based Recreation in Watercourse Associated with Wetland

(Only evaluated for lower Melvin River portion)

1) Fishing based on observed and reported patterns of use by fishermen
2) Hunting – no posted signs seen in the field until latter part of study (one property only)
3) Wildlife as above
4) Water quality as above
5) Canoe and boat passage assumed, although the Melvin River had very small areas for passage
6) Off-road parking value assumed 4WD access as well; 15 minute walking limit used as in FVI4 and FVI5

7) Access assumed 4WD road usage only along powerlines
8) Visual/aesthetic quality from above

### FVI 7 – Flood Control Potential

(Wetland and watershed acreage derived from sources described above; Wetland Control Length (WCL) based on field observation below Lovett's)

1) Total wetland acreage as above
2) Total watershed size from ArcView calculation of watershed above outflow point below Lovett's
3) WCL measured in field at one foot flood stage at the outflow point as noted above
4) Calculations completed in office
5) FV index selected from table as given

(Sketch of the WCL was completed in the field)

### FVI 8 – Ground Water Use Potential

(Entire wetland was evaluated or this function)

1) The presence of public wells was determined from the NH GRANIT community well data; private wells were assumed to be present at all occupied residences observed within 1 mile downstream of the wetland
2) Stratified drift aquifers were determined from NH GRANIT data
3) Ground water quality was assumed to meet NH DES drinking water quality standards based on tested parameters
4) Water quality of watercourse as above

### FVI 9 – Sediment Trapping

PART A - Opportunity

1) Average slope of the watershed was calculated as described in the NH Method; at least 6 transverse lines both north-south and east-west were used
2) Potential sources of excess sediments were visually estimated based on observed and assumed land use in watershed

PART B – Overall Potential

1) Opportunity from Part A
2) Flood water storage from FVI 7
3) Average observed wetland border was used in this attribute
4) Dominant wetland class border was determined in the field as the class with the greatest amount of areal coverage; scrub shrub and dense cattails were assigned 1.0
5) Areas of impounded water included all non-flowing open water bodies

## FVI 10 – Nutrient Attenuation

PART A – Opportunity
1) Opportunity for sediment trapping from above
2) Potential sources of excess nutrients based on field and assumed conditions in the watershed

PART B – Overall Potential
1) Opportunity for nutrient attenuation from above
2) Overall potential for sediment trapping from above
3) Dominant wetland class determined in field as described
4) Area of water impoundment determined in the field as in FV 5 above

## FVI 11 – Shoreline Anchoring and Dissipation of Erosive Forces

1) Wetland morphology determined in the field, based on growing season condition; all distinct shorelines assessed and computed for evaluation area
2) Width of wetland border estimated for growing season condition
3) Vegetation density estimated in field from assumed summer condition

## FVI 12 – Urban Quality of Life

(Not assessed for the Town of Tuftonboro)

## FVI 13 – Historical Site Potential

(This function was not assessed because of the absence of observed historical features *on the Great Meadow property*, even though an acknowledged mill site and foundation was present off-site just downstream)

## FVI 14 – Noteworthiness

1) Determination of the presence of rare and endangered species was made through written communication with the NH Natural Heritage Program
2) Local knowledge (i.e. the Tuftonboro CC) was utilized for determining whether the wetland was used for scientific research
3) The NH Natural Heritage Program also provided information on rare or exemplary natural communities in the area
4) Local significance was undeterminable because only one wetland was ranked
5) Local significance assigned based on large size and unique diversity of cover, groundwater discharge, and position over aquifer
6) Archaeological information was lacking
7) Hydrologic connection to a federally designated river was not present