Functional Assessment of Wetlands Throughout the Israel River Area of Randolph, NH

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Report Prepared for:
The Town of Randolph
Conservation Commission

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Executive Summary

Five wetlands throughout the Israel River area in the Town of Randolph have been identified, inventoried, and assessed as part of an initiative to maintain good water quality and habitat diversity throughout the Town of Randolph.

Goal and Objectives

The goal of this project is to provide the Town of Randolph with the ability to work towards protecting or conserving several diverse and critical wetland complexes along the Israel River portion of Town. The objectives are to:

1. Provide the Town with biological data to help create linkages between the Randolph Community Forest to the north of Route 2 and the Presidential Range of the WMNF to the south of Route 2.
2. Increase public awareness and education in relation to the importance of protecting wetlands and high water quality through data generated, maps, a written report, and a public presentation.
3. Generate biological data to equip the Town of Randolph to work with private landowners in the Israel River watershed area to protect wetlands on their property.
4. Provide data and information on wetland protection to the Randolph Conservation Commission, which will equip the Town to implement a program to adopt ordinances and Prime Wetland designations for protection of wetlands.

Summary of value, area, and rank of wetlands inventoried in Randolph, New Hampshire along the Israel River Subwatershed

Wetland Complex Name	Functional Value	Number of Acres	Wetland Value Units	Rank
Valley Road	n/a	7.11	n/a	**Not Ranked**
Baillargeon Road	8.25	3.62	29.87	**4**
Bowman Divide	9.25	4.96	45.88	**3**
Israel River Headwaters	13.25	13.49	178.74	**2**
Central	12.25	46.46	569.14	**1**

Conclusion

Although five wetland areas were separated and compared relatively with each other, four of the five wetlands are connected hydrologically by the Israel River, its tributaries, hydric soils, and a stratified drift aquifer (Central, Israel River Headwaters, Bowman Divide, and Baillargeon Road Wetlands). In fact, if this study had been done at a larger scale (e.g., town-wide or region-wide), the Israel River wetlands would have been assessed as one contiguous area. The size of the combined wetland would not only increase the acreage of the area, but also the functional score, determined during field work. The overall wetland value would be even higher than the combined totals of the four wetlands ranked in this study.

These wetlands are not isolated from each other, but connected. Impact to any one of the wetlands, will impact the others. Furthermore, detrimental impact to these wetlands will affect wetlands and groundwater downstream. Given that these wetlands are in the headwaters region, the downstream area expands into large subwatershed and watershed areas. The Mystic-South Branch Subwatershed is a total of 12,939 acres. It is part of a much larger watershed called the Upper Connecticut Watershed, which is 715,642 acres. Degradation of water quality in these headwater regions will not only affect water quality and wetland function immediately downstream, but could potentially affect a much larger area. Currently, these wetlands are in good shape. The ecological diversity is high, and water quality is good. Now is the time to work towards ensuring these wetlands continue to function at a high quality.

> "Unlike many rivers in the state, the Israel River is in a fortunate situation of being in such good shape that the challenge is not to restore a river that has been degraded, but to keep the river in the good conditions it is in." (Ted Walsh, NH DES)

This quote was made by Ted Walsh of NH DES during a Volunteer River Assessment Program (VRAP) for the Israel River. It summarizes the present condition and hopeful future of the study area.

Fortunately, protecting wetlands in this study area is doable and moving forward at this time! The wetlands in this study area range from nearly 5 acres to 46.46 acres. The entire study area is 708+ acres. The general area of intensive field work (the Israel River, its tributaries, associated wetlands inventoried) is south of US Route 2, and 348 acres. Furthermore, when a polygon is drawn around the wetlands and the Israel River in town with buffers, total acreage of high value wetland area is less than 140 acres. This should be a manageable area to focus on wetland and river protection. Already, some Randolph residents are highly motivated to help protect these wetlands. It is an exciting start, and could be expanded, with willing landowners and potential funding.

The five wetland complexes inventoried are all valuable to the Town of Randolph. Randolph has a rare opportunity compared to many towns in other parts of the state – an ability to proactively protect wetland areas and diverse natural resources before development, fragmentation, and degradation occurs.

Introduction

Five wetlands throughout the Israel River area in the Town of Randolph have been identified, inventoried, and assessed as part of an initiative to maintain good water quality and habitat diversity throughout the Town of Randolph.

Randolph, NH is a mostly forested, mountainous community. To the south lies the Presidential Range of the White Mountains with 5,000-foot peaks and alpine environment above tree-line. To the north of the town is the smaller Crescent Range, with two 3,000-foot mountains. Beyond the Crescent Range, lies the Kilkenny Unit of the White Mountain National Forest (WMNF). In December 2001, the Town became the owner of the largest town forest in New Hampshire, acquiring a tract of over 10,000 acres of land (roughly 1/3 of the town's total land base). The Randolph Community Forest is owned by the Town of Randolph and subject to a conservation easement held by the State of NH. This land is permanently conserved as a working, multi-use forest, which will never be subjected to pressures of development and subdivision.

Volunteers from Randolph have been actively involved in the Volunteer River Assessment Program run by the NH Department of Environmental Services for several consecutive years. The goals of this project are to establish long-term data sets, identify sites within or outside of expected natural temperature regimes, and assist in establishing water temperature criteria. Results of this study along the Israel River in Randolph are shown in the summary table below.

APPENDIX A: 2009 ISRAEL RIVER WATERSHED VRAP DATA

Measurements not meeting New Hampshire surface water quality standards
Total Phosphorous measurements exceeding NHDES level of concern
Measurements not meeting NHDES quality assurance/quality control standards

20-ISR, Valley Road Bridge, Randolph

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	(µS/cm as chloride surrogate)	Narrative	<406	<126	Narrative
06/19/2009	14:06	9.24	86.7	6.25	1.06	25.9	12.6			
06/30/2009	06:30							93		
07/11/2009	11:20	9.83	95.5	6.14	0.11	24.2	14.0			
07/21/2009	06:45							25		
08/18/2009	06:42							31	42	
08/19/2009	13:20	8.65	95.1	6.44	0.50	31.0	19.6			0.007
10/02/2009	12:00	10.06	86.8	6.58	0.75	34.0	8.4			
10/29/2009	11:25	11.64	93.0	6.09	0.38	37.7	5.8			

Results in this table illustrate that water quality in the Israel River in the Town of Randolph is very good overall. Although, the pH level is considered lower than the healthy range, it is hard to determine if this occurs for man-made reasons, or if it is due to the geology, soils, and vegetative types common in the area, or perhaps a combination of both.

A stratified drift aquifer lies beneath much of this study area. This potential drinking water source, further highlights the importance of maintaining high water quality and limiting development. This large aquifer contains porous sand, and is 314 acres within the Town of Randolph. It continues into Jefferson with a total area of 618 acres.

The Town of Randolph's Conservation Commission (RCC) contracted Watershed to Wildlife, Inc. (WTW) to assist them in assessment and functionality rating of wetlands, riparian zones, and uplands in the portion of the Israel River Watershed that is not in conserved lands

throughout Randolph. Watershed to Wildlife is a natural resource consultant company with wetland expertise. WTW provides natural resource inventories for municipalities, watershed management plans, wetland identification, assessment, classification, delineating and impact permitting, educational workshops, and wildlife studies. “It is the mission of WTW to help maintain the integrity of ecosystems while still achieving land management goals; as well as to promote an understanding of wetland and wildlife ecology, environmental impact, sustainable yield, adaptive management, and short and long-range planning.” Both co-owners of WTW are NH Certified Wetland Scientists: Elise Lawson – CWS #233 and John Severance – CWS #240.

The Israel River begins near the base of Mount Adams in the Presidential Range of the White Mountains just south of Randolph’s Town Boundaries. It begins with the joining of the Mystic, Cascade and Castle Brooks, which form along the side of Mount Adams and Mount Jefferson. It enters Randolph south of Bowman and flows west parallel to Route 2. From its headwaters, the Israel River runs approximately 24 miles in a general northwest direction, traversing the towns of Randolph, Jefferson, and Lancaster, before its confluence with the Connecticut River in Lancaster. Within the Town of Randolph, most of the Israel River is not in conserved or protected land thereby creating a potential for impaired buffers, wetlands, and overall water quality.

Goal and Objectives

The goal of this project is to provide the Town of Randolph with the ability to work towards protecting or conserving several diverse and critical wetland complexes along the Israel River portion of Town. The objectives are to:

1. Provide the Town with biological data to help create linkages between the Randolph Community Forest to the north of Route 2 and the Presidential Range of the WMNF to the south of Route 2.
2. Increase public awareness and education in relation to the importance of protecting wetlands and high water quality through data generated, maps, a written report, and a public presentation.
3. Generate biological data to equip the Town of Randolph to work with private landowners in the Israel River watershed area to protect wetlands on their property.
4. Provide data and information on wetland protection to the Randolph Conservation Commission, which will equip the Town to implement a program to adopt ordinances and Prime Wetland designations for protection of wetlands.

Data generated from this study will enable the Town of Randolph to work towards conserving wetlands along the Israel River and adjacent areas. Another possibility is that the information gathered will garner support for purchase of property from landowners willing to sell. This study is also a major step to enabling the Town of Randolph, if they choose, to designate Prime Wetlands through methods provided by the State of NH Department of Environmental Services, Wetlands Bureau. The New Hampshire Code of Administrative Rules sets standards for designating Prime Wetlands, using those wetlands that are worthy of extra protection because of their uniqueness, fragility and/or unspoiled character. Chapter Wt700 of these Administrative Rules set the guidelines for designation as well as the permitting process for impacting of a designated Prime Wetland.

Methodology

Evaluating Existing Digital Data

Existing digital data was analyzed to determine which wetlands were to be evaluated in the field. Data evaluated included:

- 1992, 1998, 2003, and 2009 Digital Orthophoto Quadrangles
- United States Geologic Survey Topographic Maps (Digital Raster Graphics)
- Natural Resource Conservation Service (NRCS) soil maps
- U.S. Fish and Wildlife – National Wetland Inventory (NWI) data
- NH Fish and Game – Wildlife Action Plan

Using the above data sets, wetlands were assessed and ranked in the office to determine whether they should be inventoried further in the field.

A combination of NRCS soils maps, NWI wetland maps, and aerial photography were used to identify the outer perimeter borders of continuous hydric soil units (soils that are poorly and very poorly drained). Internal units of non-hydric soil units were broken out in determining wetland acreages, but were included in the inventory and assessment of functionality of the wetland complex as a whole. In areas where the NWI and aerial photographs depicted additional areas of wetlands contiguous to the NRCS hydric soils maps, the wetland area was enlarged to incorporate those additional wetland areas. For example, in some cases portions of Palustrine emergent or Palustrine Scrub-shrub wetlands were not classified by the NRCS as hydric soils due to inherent errors in soils mapping. The areas were obvious continuations of the wetlands, so they were incorporated into the wetland polygon, in some cases increasing the area of wetlands beyond the NRCS hydric soil areas.

Very poorly drained soils are typically very soft, mucky, organic soils, with a depth of greater than 60” to bedrock, moderate to rapid permeability, high water potential, and a water table ranging a maximum of 12” below the surface to 12” above the surface. These characteristics make these soils unsuitable sites for agriculture and development, but there can be limited potential for timber harvesting. Due to the deep, soft, wet soil conditions, heavy equipment can only successfully access these sites during winter months when the ground is frozen. These soil conditions also create high potential for wind throw and seedling damage. Very careful planning and proper permitting must take place in order for timber harvesting to be successful on these sites.

Poorly drained soils are firmer soils, but generally still have moderate to rapid permeability, moderate to high water potential, and have seasonal high water table levels that range from 0 to 18 inches below the surface. Some of these soils have periods throughout the year when they are drier, giving them potential for pasture land and developable sites. If development is to occur on these soils, careful, planning must include detailed information on drainage, topography, and septic systems. These soils typically have the same limitations for forestry practices as very poorly drained soils, so access during the winter months or dry periods are recommended. Again careful planning and proper permitting must take place for intense activity to be productive on these soil types.

Prior to conducting field work, WTW consulted with the RCC so the Town would be aware of where fieldwork would be done. Local knowledge, experience, and input from the RCC and community members were a valuable asset to the project. In addition, permission was sought from landowners before field work began. Investigators respect the rights of landowners and

their decision to deny open access to their property. The majority of the wetland complexes were on areas where landowner permission was obtained, on a public rail trail, or on public lands.

Field Work

On June 15, 2011, WTW conducted field work throughout the study area. Several members of the Randolph Conservation Commission participated in the field work, which greatly enhanced the day due to local knowledge of the area as well as historical data: RCC chair Bruce Kirmmse; RCC member Jim Meiklejohn; and RCC member James Hunt. Four wetlands identified from the maps were scheduled for field onsite assessment. A fifth wetland was found during the GIS analyses, and was included because it contained a large area of very poorly drained soils. This site was not visited during field work. Wetlands ranged from 3.62 to 46.46 acres. Digital photography, global positioning system (GPS) points, soil auguring, and field notes were used to document spatial and attribute data at all sites observed.

A *Wetland Function – Value Evaluation Form* was filled out onsite as a comparative means for each wetland. The matrix allowed for relative and objective comparison between different wetlands in the study area. Appendix A displays a blank Evaluation Form used at each wetland inventoried and assessed in Randolph. Functional values evaluated included:

1. groundwater recharge/discharge
2. floodflow alteration
3. fish and shellfish habitat
4. sediment/toxicant retention
5. nutrient removal
6. production export
7. sediment/shoreline stabilization
8. wildlife habitat
9. recreation
10. education/scientific value
11. uniqueness/heritage
12. visual quality/aesthetics
13. endangered species habitat
14. other (additional noteworthy qualities - buffers)

Mapping Analysis

Field data was processed as point and polygon data with linked attribute tables and photography using ArcMap 9.1 software. Polygons and points of new coverages were digitized using aerial photography (DOQs), topographic maps, NRCS soil maps, FWS NWI maps, processed GPS points, and field notes.

Analysis of wetland function and value were conducted by following and modifying the *Method for Comparative Evaluation of Nontidal Wetlands in New Hampshire*, March 1991 by Alan P. Ammann and Amanda Lindley Stone. For each wetland inventoried and rated during field work, a *Wetland Function – Value Evaluation Form* was completed. The matrices and ranking in each evaluation form allowed for side-by-side comparison of the wetlands in Randolph. Total Wetland Value Units for a wetland were calculated on these data sheets using average Functional Value.

(Average Functional Value) x (Acres of Evaluation Area) = Wetland Value Units

Wetland Value Units were compared for each wetland: the higher the number, the higher the wetland ranks within the Town.

Public Workshop Presentation

At the completion of the fieldwork and GIS analyses, Watershed to Wildlife, Inc. will hold a public presentation/workshop in Randolph's Town Hall to discuss results of the study and future planning options for the Town. The goal of this meeting is to increase public awareness of the importance of sustainable conservation or protection of some of the Town's wetlands and associated wildlife habitat. In addition, work from this project will be available for public viewing via printed report, D-size plotted maps, and 8½ by 11 paper handouts as requested through proper venues.

Results

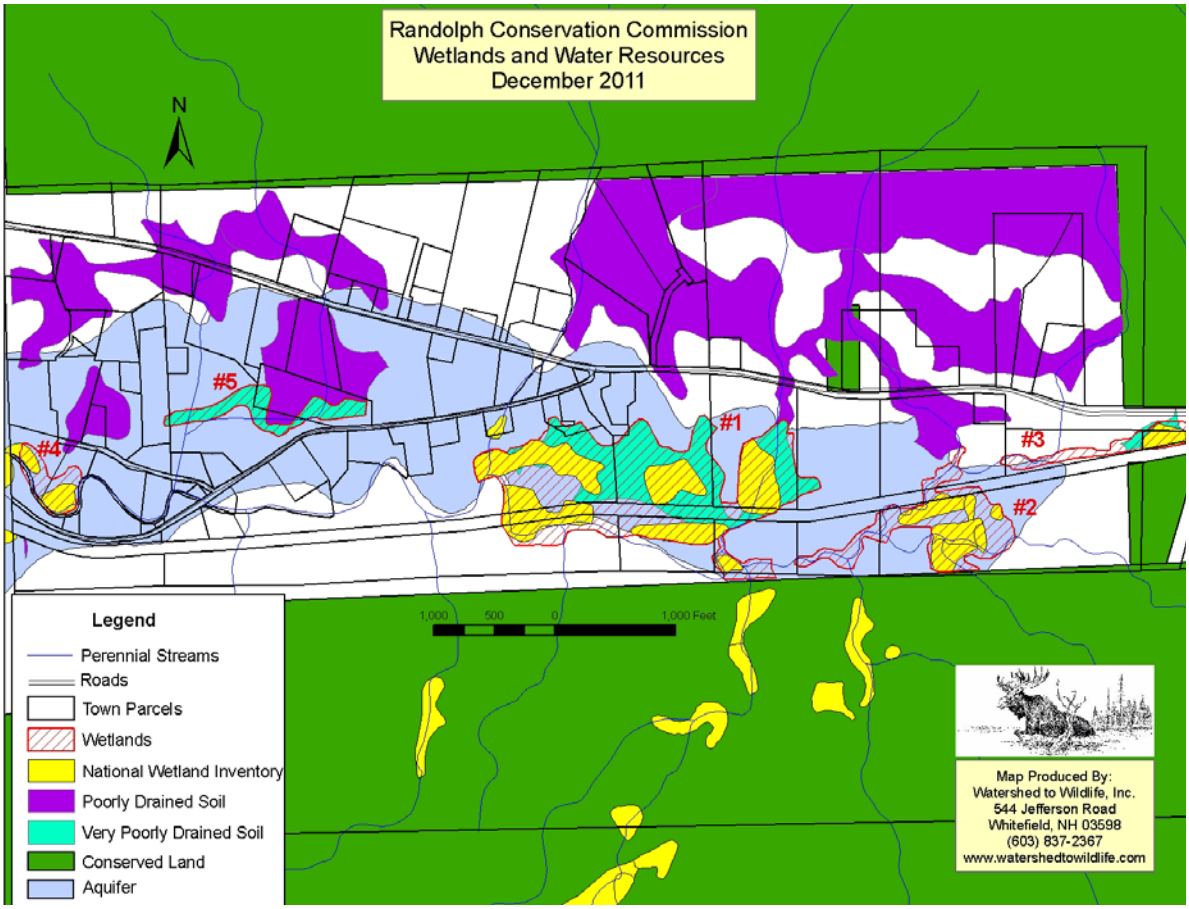
Five wetland complexes were identified as potential areas for further field inventory. There are many more wetlands throughout Randolph, but these were not inventoried for one or more of the following reasons:

1. Wetlands located in areas already containing conserved land (Randolph Community Forest or White Mountain National Forest)
2. Wetlands located outside of the Israel River subwatershed area
3. Size of wetland was under 2 acres

As with many towns in mountainous areas, wetland complexes are generally smaller and found in valley bottoms. There are relatively fewer wetlands in Randolph compared to neighboring municipalities in Coos County including Jefferson, Whitefield, and Berlin. However, wetlands in mountainous areas such as Randolph are at or near the headwaters, thus contributing to downstream rivers and wetland complexes. Impairment of these wetlands and streams will lead to accumulated problems further downstream.

Several colonies of sundews (*Drosera rotundifolia*) were found among the sphagnum in some of the wetlands assessed. The leaves are covered with gland-tipped hairs whose secretion of sticky fluid traps insects, which are then digested by enzymes. This flower's ability to extract nutrition from insects helps it survive in nutrient-poor bogs and marshes.

The five wetland complexes ranged in size from 3.62 to 46.46 acres. All contained very poorly and poorly drained soils. Below is a map of the wetland areas in the Israel River area of Randolph where wetlands were assessed and evaluated. Each wetland is numbered in red.



(Please also refer to full-page printout of this map - an attachment at the end of this report)

All five wetland complexes share several features, which should be noted before describing individual wetlands. As designed by the study, they are in the same subwatershed called the Mystic-South Branch. This subwatershed is within a coarser one called the Israel River, which in turn is within the Upper Connecticut River Watershed as listed below.

1. Hydrologic Unit 12 name = Mystic-South Branch (12,939 total acres)
2. Hydrologic Unit 10 name = Israel River (86,149 total acres)
3. Hydrologic Unit 6 and 8 names = Upper Connecticut River (715,642 total acres)

A second similar feature of all 5 wetlands is that they are within the same aquifer, which encompasses most of the study area. There are three types of groundwater aquifers: stratified-drift; till; and bedrock. Stratified-drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are solid rock. In stratified drift aquifers, such as the ones shown above, the materials are sorted sand and gravel. In till aquifers, the material is a gravel, sand, silt and clay mixture. In bedrock aquifers, the rock is fractured.

Stratified-drift aquifers are an important source of ground water for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. Approximately 14% of land surface in the State is underlain with stratified-drift aquifers. In and around the Israel River they consist of stratified, sorted, principally coarse-grained sediments (sands and gravels) deposited by glacial melt-water during the time of deglaciation. This portion of the Town's aquifer represents potential usable water sources for municipal purposes and should be protected to insure their future quality and availability.

Thirdly, four of the five wetlands (#1, #2, #3, and #4 displayed on the map - page 8) are closely associated with the Israel River and flood plains. All are directly connected hydrologically by perennial streams, and the three closest to the rail trail (#1, #2, and #3) were hard to separate into distinct wetlands. These three wetlands all contained abundant beaver sign, indicating that beaver used the entire area throughout history. While beavers are considered to be pests by some, scientists actually have proven that beavers are a "keystone" species in North America. They play a crucial role in biodiversity. Innumerable species, many of them threatened or endangered, rely either partly or entirely on beaver ponds. Therefore, whenever we can coexist with beavers, we are providing the habitat necessary for supporting many other species.

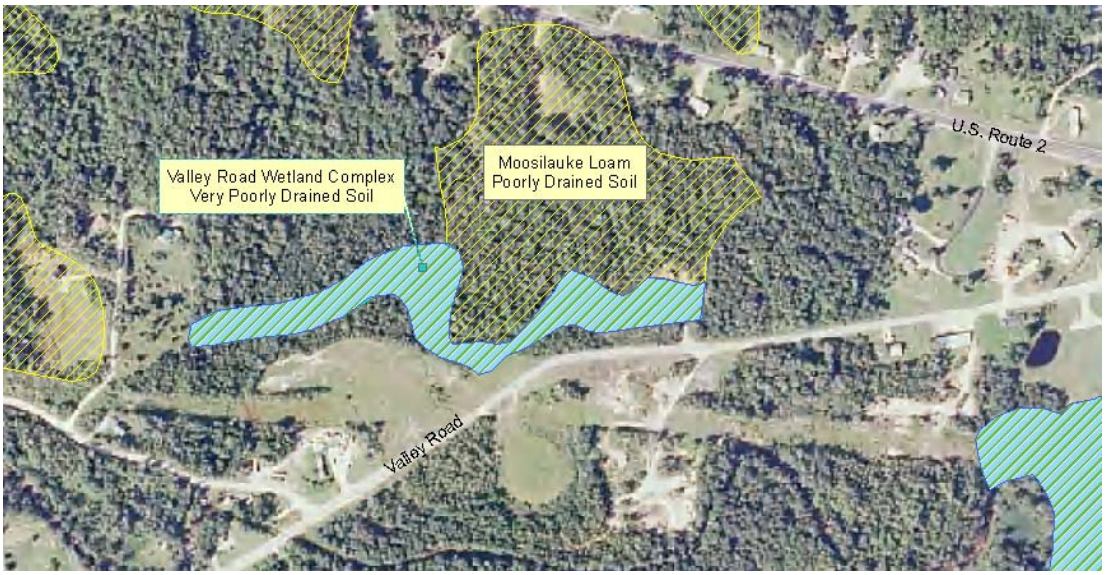
Lastly, there were several areas classified as vernal pools found throughout the study area. Vernal pools are distinct, often isolated, and important wetland types. Vernal pools provide essential breeding habitat for certain amphibians and invertebrates such as wood frogs (*Rana sylvatica*), spotted salamanders (*Ambystoma maculatum*), marbled salamanders (*A. opacum*), and fairy shrimp (*Branchinecta lynchi*). These creatures depend on vernal pools as breeding sites because they are only temporary water bodies, preventing fish and other aquatic predators from taking up residency. Reptiles such as wood turtles (*Glyptemys insculpta*) also rely on vernal pools as an important feeding area in early spring. Vernal pools fill annually from precipitation, runoff, and rising groundwater, typically in the spring and fall. By mid-summer, however, these wetlands are typically dry, making them a dynamic system inhabitable by specifically adapted plant and wildlife species. For this reason many unique, rare, threatened, and endangered species are linked to this wetland type. They are common in New Hampshire, and the State recognizes their value as important habitat.

Several vernal pools were documented throughout the subwatershed area. Although some were isolated pools, many were associated with the large wetland complexes discussed in this study.

Many areas of the wetland complexes in this study area provide breeding habitat for vernal pool species such as these wood frog tadpoles. Vernal pool species were found in isolate vernal pools such as this one, as well as pools part of larger wetland complexes.

Valley Road Wetland Complex #5

The Valley Road Wetland Complex is 7.11acres, containing forested wetlands. This wetland complex was not visited during fieldwork but is included in the study since the NRCS has mapped very poorly drained soils - Searsport mucky peat – 15A here. The poorly drained Moosilauke loam abutting to the north would probably expand this wetland's size, but it was not included due to the increased potential for upland inclusions. The Valley Road Wetland Complex did not receive a functional score as it was not visited during fieldwork. It is not as diverse as other wetlands assessed during field work; however, due to the size and classification of NRCS soils, it is noteworthy.



Valley Road Wetland Complex with poorly and very poorly drained soils displayed.

Valley Road Wetland Complex lies in the forested habitat just beyond this knoll of lupine and daylilies. The meadow is a reclaimed gravel pit off Valley Road.

Baillargeon Road Wetland Complex # 4

The Baillargeon Road Wetland Complex is at the downstream (western) town boundary of Randolph and continues into the town of Jefferson along the Israel River. It starts at a small tributary flowing under the Baillargeon Road, down a steep slope which changes abruptly to a wetland at the base of the hill. The wetland is also part of a floodplain along the Israel River. It is 3.62 acres within the town of Randolph and contains a scrub/shrub riparian wetland directly connected to the Israel River.

This wetland, though only a small portion in the Town of Randolph, is important as it serves high functionality for flood control, erosion mitigation, and excellent floodplain habitat along the Israel River.

Although relatively small, this wetland contains a variety of wetland types (Table 1) creating suitable habitat for a diversity of plant and wildlife species. The wetland is a typical floodplain wetland with a densely forested upland buffer to the north. Several areas have been impacted by beaver over the years and there is evidence that it contained areas with more open water habitat in the past.

Table 1: NWI and WTW Wetland Classifications for Baillargeon Road Wetland Complex - #4

NWI wetland code	NWI wetland name
PSS1c	Palustrine Scrub-Shrub, Broad-Leaved Deciduous, Seasonally flooded
R3UB3	Riverine Upper Perennial, Unconsolidated Bottom, Cobble, Gravel

This wetland contains one hydric soil type mapped by NRCS, but it is highly likely that there are small inclusions of very poorly drained soils within.

Table 2: Baillargeon Road Wetland Complex, Hydric Soils

Drainage Class	Soil Description	NRCS Soil Symbol	Acres
Poorly drained	Metallak very fine sand loam	504A	3.62

The NRCS lists several soil types that occur as inclusions. Within Metallak, there are also small areas of the poorly drained Charles, Rumney, and Cohas soils, and the very poorly drained Medomak soil in depressions and drainage-ways. Based on field work, this wetland contains the very poorly drained Medomak soil in the concave depressions on site.

The wetland complex is relatively undeveloped and well buffered. It has very abrupt boundaries to uplands along the north edges creating excellent opportunities for use by neotropic bird species and other wildlife as a travel corridor. Although important for flood control, this wetland is relatively small and not as diverse as other wetland complexes studied in this subwatershed.

The Baillargeon Road Wetland Complex is a floodplain wetland adjacent to the Israel River. The buffer to the north of the river and wetland is shown here and provides an excellent wildlife travel corridor.

The Baillangeon Road Wetland Complex received a functional score of 8.25 out of a potential 14, resulting in a wetland value unit of 29.87 (8.25 functional value x 3.62 acres = 29.87 wetland value).

Bowman Divide Wetland Complex #3

Portions of the Bowman Divide Wetland Complex are very close to Rte. 2 in Randolph.

The Bowman Divide Wetland Complex is between Rte. 2 and the rail trail. It flows west along a tributary that enters into Israel River. It parallels the south side of Route Rte. 2 for 2,000 feet and contains a variety of soil types, mapped as hydric and non-hydric by the NRCS. There are NWI wetlands listed as diked or impounded waters mapped for this wetland, and recent beaver activities have further extended this wetland complex enlarging the areas of open water habitat. During the time of the study, beaver were active in this wetland complex.

The variety of adjacent vegetation cover types (fields, shrubs and trees) along with the varying hydrology (seasonally flooded to permanently flooded) provide potential foraging, resting, and reproduction sites in this wetland complex. Although close to Route 2, vegetative cover on the southern side of this wetland allows for wildlife travel parallel to the wetland including bird, amphibian, reptile, fish, invertebrate, and mammal species. The tributaries with vegetative cover feeding this system provide cold water habitat for many fish species including eastern brook trout.

Beaver have enhanced the habitat and open water areas in the Bowman Divide Wetland Complex. This lodge, in the foreground was being used at the time of this study.

Based on the NRCS data there is one hydric soil mapped for this wetland. It is listed in the table #3 below.

Table 3: Bowman Divide Wetland Complex, Hydric Soils

Drainage Class	Soil Description	NRCS Soil Symbol
Very poorly drained	Searsport mucky peat	15

Searsport mucky peat is a nearly level, very poorly drained soil that occurs in sandy glacial outwash deposits near lakes, streams, and bogs. Searsport soils consist of very deep soils that formed in thick sandy deposits in pockets and depressions on outwash plains, deltas, and terraces. There are four other soil types mapped as part of this wetland complex. They are classified as non-hydric. However, three of the four soil types contain poorly drained inclusions in depressions and/or concave areas similar to this wetland complex. They are listed in Table 4.

Table 4: Bowman Divide Wetland Complex, Other NRCS Soils

Soil Description	NRCS Soil Symbol	Inclusions	Inclusion drainage class
Waumbek Sandy Loam	59B	Moosilauke sandy loam	Poorly drained – found in concave areas
Croghan Loamy Fine Sand	613B	Naumberg soils	Poorly drained – found in depressions
Sheepscot Cobbly Very Fine Sandy Loam	14B	Naumberg and Grange	Both Poorly drained – found in low spots

Data from the Fish and Wildlife Service – National Wetland Inventory are listed in Table 5 below. Of special note is the modifier "h" which illustrates that the wetland has been diked or impounded. The cause of this can be a man-made structure or beaver. In this case, we found that the beaver were the cause.

Table 5: NWI Wetland Classifications for Bowman Divide Wetland Complex - #3

NWI wetland code	NWI wetland name
PUBFh	Palustrine, Unconsolidated bottom, Semipermanantly flooded, Diked/Impounded (by beaver)
PSS1Eh	Palustrine, Scrub/Shrub, Broadleaved-deciduous, Seasonally flooded/saturated, Diked/Impounded (by beaver)

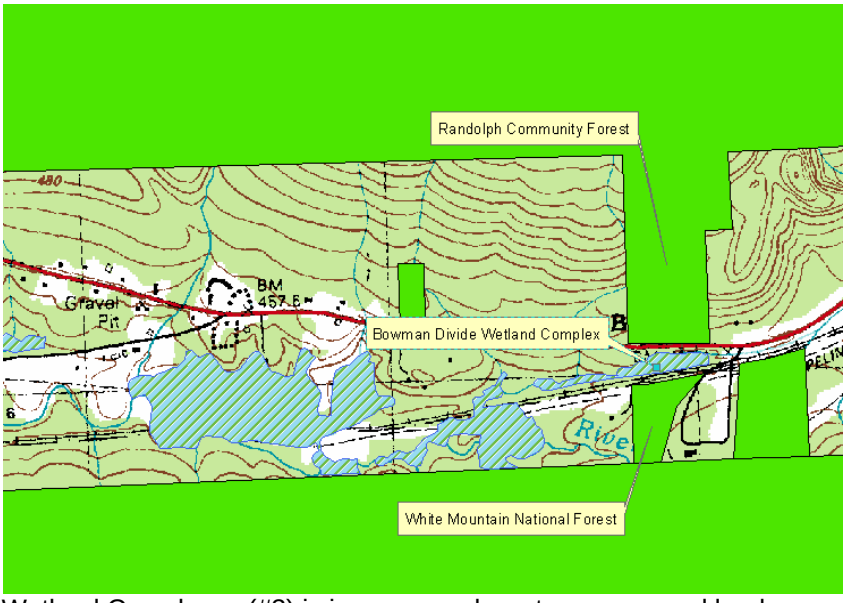
The Bowman Divide Wetland Complex has modest functional scores compared to other downstream wetlands ranked. Because of its size and area of very poorly drained soil, it was the third ranked wetland in Randolph. The small perennial stream with multiple beaver dams eventually flows into the Israel River. Although this wetland complex is sandwiched between Rte. 2 and the former railroad (now a rail trail), there was a diversity of wetland types observed with open water offering habitat for fish, amphibians, and shellfish. Recreation and education scored high due to easy access and visibility. The combination of open water, scrub-shrub, forested and riparian wetland habitat types, indicates that the area is undoubtedly used by many wildlife species for travel, food and cover.

This wetland received a functional score of 9.25 and a total wetland value of 45.88 (9.25 functional value x 4.96 acres = 45.88 wetland value).

The Bowman Divide Wetland Complex lies in an area of Randolph where there are two large conserved properties close to Route 2. They are:

1. Randolph Community Forest north of Route 2
2. The White Mountain National Forest south of the Rail Trail

This offers an opportunity for connectivity between the two conserved properties, and likely increases its value beyond what was noted above. The protection of this wetland complex is important to maintaining a corridor and connectivity between two conserved areas. See the map below.



Bowman Divide Wetland Complexes (#3) is in an area where two conserved lands are close. Although a narrow connectivity, this wetland complex acts like a bridge for the White Mountain National Forest and the Randolph Community Forest.

Israel River Headwaters Wetland Complex #2

The Israel River Headwaters Wetland Complex is located on the southern side of the rail trail and abuts the White Mountains National Forest. The Israel River flows through this wetland complex and the beaver have impacted it throughout history. It is the second largest wetland complex in the study area and received the second highest total functional values with a score of 13.25 out of 14, combining for a total wetland value of 178.74 (13.25 functional value x 13.49 acres = 178.74 wetland value). Several perennial tributaries flow into the Israel River Headwaters Wetland Complex enlarging the main stem of the Israel River as it meanders through this area.

Excellent wildlife and plant life habitats were documented in the Israel River Headwaters Wetland complex, including coldwater habitat for eastern brook trout (*Salvelinus fontinalis*).

During field work we observed a diversity of wildlife species: through direct and indirect observations: beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), cedar waxwings (*Bombycilla cedrorum*), great blue heron (*Ardea herodias*), American bittern (*Botaurus lentiginosus*), and moose (*Alces alces*). Based on the diversity of this wetland, there are undoubtedly many more wildlife species that use or rely on this wetland. Plant life was lush and diverse as well with meadowsweet (*Spiraea latifolia*), arrowwood (*Viburnum recognitum*), low bush blueberry (*Vaccinium angustifolium*), speckled alder (*Alnus rugosa*), bluets (*Houstonia caerulea*), rhodora (*Rhododendron canadense*), sundew (*Drosera rotundifolia/intermedia*), and several sedge (*Carex spp*.) and rush (*Juncus spp*.) species to name a few.

The water system flowing through this wetland is coldwater habitat, and will support eastern brook trout among other species. Members of the Randolph Conservation Commission stated that trout fishing in the area was excellent, especially fly fishing in evenings in the active beaver ponds.

Ten species of NH birds excavate cavities for nesting and roosting. Another 15 birds and 18 mammals use natural or excavated cavities for nesting, roosting, or denning. Here, flooding from beaver have killed these trees, resulting in excellent habitat for wildlife and insects.

This wetland complex has not only a large diversity of plant community types, wetland types and wildlife habitat, but its proximity to the expansive WMNF further enhance its value to the area. The series of beaver ponds within this wetland complex are located along the riparian areas of the Israel River floodplain and its tributaries. Recreation and education scores are relatively high because of excellent access along the rail trail. There is a high potential for endangered species with such diverse and relatively remote habitat.

This wetland contains a large variety of wetland habitat types in Randolph, including open water, emergent wetlands, scrub-shrub wetland, forested wetland and perennial stream (Table 6). The Israel River which flows through this wetland complex transitions from a higher-

velocity, gravel and cobble river bed, to a slow, meandering river, dammed by beaver, and with mud and organic material subclass. It then transitions back to a faster-flowing, cobbly/gravelly river bottom in places where beaver dams have been breached. Therefore, habitat, endangered species habitat, fish and shellfish habitat, and visual quality/aesthetics received high scores. Floodwater control also received a higher score because of the flat floodplain topography. This wetland is also beneficial for functions such as groundwater recharge and discharge, nutrient removal and production export because it is so well vegetated. It received a high rank for uniqueness because of the diverse wetland types and adjacent unfragmented upland forest and its proximity to the WMNF.

Wetland Complex #2 facing the White Mountains to the south.

Table 6: NWI and WTW Wetland Classifications Israel River Headwaters Wetland Complex - #2

NWI wetland code	NWI wetland name
PFO1C	Palustrine forested, Broadleaved deciduous, Seasonally flooded,
PSS1C	Palustrine Scrub-Shrub, Broad-leaved deciduous Seasonally flooded Beaver impacted
PEM1Eb	Palustrine emergent, Broad-leaved deciduous, Seasonally flooded/saturated, Beaver impacted
R3UB3	Riverine Upper Perennial, Unconsolidated Bottom Cobble-Gravel

NWI wetland code	NWI wetland name
R2UB5/6	Riverine Lower Perennial, Unconsolidated Bottom, Mud/Organic

Interestingly the soils for this entire wetland complex are mapped as Sunday loamy fine sand, 102A, an excessively well drained soil. Soil inclusions within this soil type are scattered areas of well drained, moderately well drained, and poorly drained soils; areas on the sides of the channels with slopes greater than 3 percent; areas of Colton soils on the slightly higher parts of the landscape; and small scattered areas with cobblestones on the surface and in the substratum layers. Inclusions on this type of landscape may make up about 20 percent of the map unit. Field work indicated that this area is large enough (greater than 3 acres) to warrant having separate hydric soil mapped unit. We would recommend this area be revisited when soils are remapped in Randolph.

Central Wetland Complex #1

The Central Wetland Complex is the "gem" of the wetlands inventoried and assessed in Israel River subwatershed region of Randolph. It is the largest wetland complex at 46.46 ac. and received the highest total functional value with a score of 12.25 out of 14, combining for a total wetland value of 569.14 (12.25 functional value x 46.46 acres = 569.14 wetland value). The Israel River flows through this wetland along with at least four additional unnamed perennial streams. There are a series of beaver ponds, old and active creating a wide variety of diverse habitats.

This scrub-shrub and grass wetland meadow has been flooded by beaver in the past. It is one of several wet meadows within this wetland complex creating a variety of habitats as shown.

Portions of the Central Wetland Complex were highlighted by a study conducted through an EPA grant by NH-DES, contracted to Vanesse Hangen Burstin, Inc. (VHB). The *Upper Connecticut River Watershed Wetland Restoration Strategy* was completed to identify potential sites for use of the Aquatic Resource Mitigation (ARM) monies collected by NH-DES. An

approximate 2.5-acre gravel pit lies adjacent to a portion of this wetland, and was identified as one of the main concerns for potential impairment of this wetland. The plan is to close this gravel pit. **VHB and results from this study recommend increasing the vegetative buffer between the gravel pit and the wetland. It is also recommended that future development be limited to the upper portion of the area to minimize impact on this highly functional wetland.**

This recently inactive gravel pit that abuts the Central Wetland Complex to the northwest has not re-vegetated yet, and is one of the proposed future ARM project sites.

A possible Native American site on a high knoll on the north side of the Israel River and the rail trail was identified by a cultural resource expert. With landowner permission it would seem prudent to investigate this further, and temporarily protect this area until it can be properly examined. The New Hampshire Division of Historic Resources would have recommendations on how to examine this site.

This abrupt knoll located near the rail trail and Israel River has been identified as a possible historic site used by Native Americans and should be further investigated by archeologists.

The Central Wetland Complex is part of a large unfragmented area. Adjacent forest types in the area are primarily hardwood stands, with softwood along the flatter gently sloping riparian areas. Beaver ponds, old and new, have had a large influence on the dynamics and diversity of this wetland complex. The rail trail running through this area allows for easy access and increases the recreation and education functional scores. With such wide variety of habitat types, there is a high potential for the presence of exemplary (rare, threatened or endangered) species.

This wetland contains the largest diversity of wetland habitat types in the study area including open water, emergent wetlands, scrub-shrub wetlands, forested wetlands, and perennial streams (Table 7). It is further enhanced by adjacent unfragmented forests. Therefore habitat, endangered species habitat, fish and shellfish habitat, and visual quality, uniqueness, and aesthetics received top scores. Floodwater control also received a higher score due to wide, flat floodplain areas. It follows that the area is also beneficial for functions such as groundwater recharge and discharge as part of a large aquifer, nutrient removal and production export because it is so well vegetated.

Table 7: NWI Wetland Classifications Upper Mud Pond Wetland Complex - #1

NWI wetland code	NWI wetland name
R2UB5/6	Riverine Lower Perennial, Unconsolidated Bottom, Mud/Organic
R3UB3	Riverine Upper Perennial, Unconsolidated Bottom, Cobble-gravel
PSS1/EM1E	Palustrine scrub-shrub, Broad-leaved deciduous, Palustrine emergent, Broad-leaved deciduous, Seasonally flooded/saturated,
PSS1E	Palustrine scrub-shrub, Broad-leaved deciduous, Seasonally flooded/saturated
PSS1/PEM1C	Palustrine scrub-shrub, Broad-leaved deciduous, Palustrine emergent, Broad-leaved deciduous, Seasonally flooded
PFO1Eb	Palustrine forested, Broad-leaved deciduous, Seasonally flooded/Saturated Beaver impacted

The soils of this wetland are also diverse, with five different soil types. One of them is a very poorly drained soil called Pondicherry muck. This soil polygon is nearly 26 acres and all within the Central Wetland Complex. Pondicherry muck is described as a nearly level, very

poorly drained soil found in depressions on terraces, glacial till uplands, flat areas along streams and drainage ways, and along the edges of lakes, ponds, and marshes. It contains 16 to 51 inches of organic material underlain by sandy mineral material. All of the other soils are non-hydric soils, although they contain inclusions of hydric soil within this wetland complex. A list of the soils in the area is shown in Tables 8 and 9 below.

Table 8: NRCS soil types in the Central Wetland Complex

Drainage Class	Soil Description	NRCS Soil Symbol
Very poorly drained	Pondicherry Muck	992A

Table 9: Other NRCS soil types in the Central Wetland Complex

Drainage Class	Inclusion drainage (soil name)	Soil Description	NRCS Soil Symbol
Excessively well drained	Hydric soil-unnamed inclusion	Udorthents	400
Excessively well drained	Hydric soil unnamed inclusion	Sunday loamy fine sand	102A
Moderately well drained	Poorly drained Cohas, Rumney, Charles	Metallak very fine sandy loam	504A
Moderately well drained	Poorly drained Naumburg and Grange	Sheepscot cobbly very fine sandy loam	14B
Excessively well drained	Hydric soil-unnamed inclusion	Colton gravelly fine sandy loam	22B

Interestingly, while a little over half of the Central Wetland Complex is mapped by the NRCS as very poorly drained Pondicherry muck, the soils for a large portion of this wetland complex are mapped as Sunday loamy fine sand, 102A, an excessively well drained soil. Soil inclusions within this soil type are scattered areas of well drained, moderately well drained, and poorly drained soils; areas on the sides of the channels with slopes greater than 3 percent; areas of Colton soils on the slightly higher parts of the landscape; and small scattered areas with cobblestones on the surface and in the substratum layers. Inclusions on this type of landscape may make up about 20 percent of the map unit. Field work indicated that this area is large enough (greater than 3 acres) to warrant having separate hydric soil mapped unit. As with the Israel River Headwaters Wetland complex, we would recommend this area be revisited when soils are remapped in Randolph.

The majority of the Israel River is a well buffered upper perennial stream. However there are reaches that have been impacted by beaver dams classifying these reaches as lower perennial streams - where the flow rate is slow and a combination of mud and organic material has accumulated on the stream bed.

The Central Wetland Complex has a diversity of natural resource components including very poorly drained soils, several wetland types, proximity to large unfragmented areas, variety of wildlife and plant habitats, a large aquifer, over 15 tributaries, and the Israel River flowing through it. This wetland is the top ranked wetland complex in this study area and is an extremely valuable asset to the Town of Randolph. Maintaining its integrity and functionality will aid in maintaining good water quality downstream as well.

Summary of value, area, and rank of wetlands inventoried in Randolph, New Hampshire along the Israel River Subwatershed

Wetland Complex Name	Functional Value	Number of Acres	Wetland Value Units	Rank
Valley Road	n/a	7.11	n/a	**Not Ranked**
Baillargeon Road	8.25	3.62	29.87	**4**
Bowman Divide	9.25	4.96	45.88	**3**
Israel River Headwaters	13.25	13.49	178.74	**2**
Central	12.25	46.46	569.14	**1**

Wetland #1 (Central) and Wetland #2 (Israel River) received the highest scores during field assessment. The results are based on examining these wetlands individually. The two top ranked wetlands contained the highest diversity of plant community types, wetland types, diversity of wildlife habitat, potential for exemplary species, as well as capability of maintaining high water quality. It should be emphasized, that all four wetlands studied and ranked in the table above are connected hydrologically. If taken together as a single wetland complex from a broader regional view, the scores and values of the unit as a whole would increase.

Discussion and Future Applications

This project provides the Town of Randolph with the ability to work towards protecting or conserving several diverse and critical wetland complexes along the Israel River portion of Town. Moreover, this study is a step towards implementing Prime Wetland Designation if Randolph residents choose to do so. Based on field work results and GIS analyses, below are some of the options to help conserve this area.

Option #1

It is recommended that Randolph residents consider working with willing landowners to protect some of the wetlands along the Israel River subwatershed area. Protecting these wetlands will also help maintain connectivity and travel corridors between the Randolph Community Forest to the north and the White Mountain National Forest to the south. A combination of public meetings and public outreach can achieve these goals. There are two possibilities in this case:

1. Willing landowners can place their land in a conservation easement, where they continue to own the land. The terms of the conservation easement are transferred to new owners in this situation. Organizations such as land trusts generally hold and enforce conservation easements.
2. Willing landowners can sell their property or portions of it to interested parties including
    a. The Town of Randolph
    b. The White Mountain National Forest
    c. A state agency such as NH Fish and Game Department
    d. A land trust or similar organization which will conserve the area.

Conservation easements create a legally enforceable land preservation agreement between a landowner and a government agency (municipality, county, state, federal) or a qualified land protection organization (often called a "land trust") for the purposes of conservation. They restrict real estate development, commercial and industrial uses, and certain other activities on a property to a mutually agreed-upon level. The property remains the private property of the landowner. The decision to place a conservation easement on a property is strictly a voluntary one where the easement is sold or donated. The restrictions of the easement, once set in place are binding on all future owners of the property. The restrictions are spelled out in a legal document that is recorded in the local land records, and the easement becomes a part of the title and deed for the property.

Option #2

Another option is to establish Prime Wetlands as a means to help protect these areas from developmental pressures. This requires willing landowners followed by a town vote in favor of this special designation of wetlands. If the Town of Randolph decides to proceed with designating Prime Wetlands it must submit a report with appropriate maps to the State of New Hampshire, Department of Environmental Services - Wetlands Bureau. The Wetlands Bureau will review the submission, and grant the designation if the submission is complete. At the time of this report 31 towns in NH have designated prime wetlands: Andover, Atkinson, Barrington,

Bow, Brentwood, Brookline, Center Harbor, Derry, Enfield, Exeter, Fremont, Gilford, Goffstown, Hampton Falls, Hillsborough, Holderness, Hooksett, Meredith, Nashua, New Ipswich, New London, Newington, Newmarket, Northwood, Pelham, Salem, Sanbornton, Sandwich, Tamworth, Weare, and Wolfeboro.

Randolph officials and residents should evaluate the functions and values of the identified wetlands. If Randolph decides to select one or more wetlands to designate as prime, a public hearing must be held before the residents of the community vote on the designation. If the town approves the wetlands for designation as prime, the town provides to the DES Wetlands Program a copy of the study and tax maps with the designated prime wetlands identified. DES will review the submission from the municipality to ensure that it is complete and in accordance with Env-Wt 702.03.

Once the submission is considered complete, the rules and laws that are applicable will apply to any future projects that are in or within 100 feet of a prime wetland. All projects that are in or within 100 feet of a prime wetland are classified as major projects. All major projects require a field inspection by DES and all prime wetland projects require a public hearing to be conducted by DES.

Option #3

The Town of Randolph could write and adopt town-wide ordinances to offer protection of all or specific wetlands throughout the town. The purpose of the ordinances could be: to protect water quality and wildlife habitat, to control placement of structures and associated impervious surfaces, and/or to maintain the natural beauty and scenic views of wetland complexes. There are several sample wetland ordinances available which Randolph could use as a template. Many of these can be found online or at regional planning commissions (North Country Council in Randolph's case). Wetland ordinances have been used by several municipalities in New Hampshire.

Conclusion

Although five wetland areas were separated and compared relatively with each other, four of the five wetlands are connected hydrologically by the Israel River, its tributaries, hydric soils, and a stratified drift aquifer (Central, Israel River Headwaters, Bowman Divide, and Baillargeon Road Wetlands). In fact, if this study had been done at a larger scale (e.g., town-wide or region-wide), the Israel River wetlands would have been assessed as one contiguous area. The size of the combined wetland would not only increase the acreage of the area, but also the functional score, determined during field work. The overall wetland value would be even higher than the combined totals of the four wetlands ranked in this study.

These wetlands are not isolated from each other, but connected. Impact to any one of the wetlands, will impact the others. Furthermore, detrimental impact to these wetlands will affect wetlands and groundwater downstream. Given that these wetlands are in the headwaters region, the downstream area expands into large subwatershed and watershed areas. The Mystic-South Branch Subwatershed is a total of 12,939 acres. It is part of a much larger watershed called the Upper Connecticut Watershed, which is 715,642 acres. Degradation of water quality in these headwater

regions will not only affect water quality and wetland function immediately downstream, but could potentially affect a much larger area. Currently, these wetlands are in good shape. The ecological diversity is high, and water quality is good. Now is the time to work towards ensuring these wetlands continue to function at a high quality.

> "Unlike many rivers in the state, the Israel River is in a fortunate situation of being in such good shape that the challenge is not to restore a river that has been degraded, but to keep the river in the good conditions it is in." (Ted Walsh, NH DES)

This quote was made by Ted Walsh of NH DES during a Volunteer River Assessment Program (VRAP) for the Israel River. It summarizes the present condition and hopeful future of the study area.

Fortunately, protecting wetlands in this study area is doable and moving forward at this time! The wetlands in this study area range from nearly 5 acres to 46.46 acres. The entire study area is 708+ acres. The general area of intensive field work (the Israel River, its tributaries, associated wetlands inventoried) is south of US Route 2, and 348 acres. Furthermore, when a polygon is drawn around the wetlands and the Israel River in town with buffers, total acreage of high value wetland area is less than 140 acres. This should be a manageable area to focus on wetland and river protection. Already, some Randolph residents are highly motivated to help protect these wetlands. It is an exciting start, and could be expanded, with willing landowners and potential funding.

The five wetland complexes inventoried are all valuable to the Town of Randolph. Randolph has a rare opportunity compared to many towns in other parts of the state – an ability to proactively protect wetland areas and diverse natural resources before development, fragmentation, and degradation occurs.

Maps

References

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Appendix – Copy of Field Inventory and Assessment Form

WETLAND FUNCTION – VALUE EVALUATION FORM (draft 6/3/2004)

Wetland Description:	File Number:	
	Wetland Identifier:	
	Latitude:	Longitude:
	Preparer(s):	
	Date:	

Function/Value	Capability Y	Capability N	Summary	Principal Yes/No
Groundwater Recharge/Discharge				
Floodflow Alteration				
Fish and Shellfish Habitat				
Sediment/Toxicant Retention				
Nutrient Removal				
Production Export				
Sediment/Shoreline Stabilization				
Wildlife Habitat				
Recreation				
Educational/Scientific Value				
Uniqueness/Heritage				
Visual Quality/Aesthetics				
ES Endangered Species Habitat				
Other				

Notes:

*attach list of considerations