WOODSTOCK WETLANDS INVENTORY, ASSESSMENT & MAPPING PROJECT

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The Woodstock Conservation Commission

ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802) 434-7276 FAX: (802) 434-2102

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1.0 Introduction

A remote inventory of wetlands in the town of Woodstock, Vermont was undertaken by Arrowwood Environmental during 2003-2004. This inventory used Color-Infrared aerial photographs, digital Orthophotographs, NRCS soil survey maps, topographic maps, and Vermont Significant Wetlands Inventory maps to identify and map wetlands within the town. During this inventory 365 wetlands and potential wetlands were identified. Each wetland was given a provisional natural community name. Each wetland also received a remote functions and values analysis. A sub-set of these wetlands was identified for a more detailed field evaluation. Field sites were evaluated for quality assurance purposes as well as detailed functional assessment and natural community analysis. Subsequent to field evaluations, a digital wetlands map was created which incorporates data from the landscape analysis and field work.

2.0 Methodology

For the purposes of this inventory, a wetland is defined as an area that is inundated by surface or ground water with a frequency sufficient to support organisms that depend on saturated or seasonally saturated soil conditions for growth and reproduction. For any particular site to be considered a wetland, there needs to be the following three criteria present: 1) hydrophytic (wetland) vegetation, 2) hydric soils, and 3) wetland hydrology. The presence of boundaries of jurisdictional wetlands cannot, therefore, be determined remotely. The boundaries present on the attached inventory map are for planning purposes only; field work is required to determine the actual presence and extent of wetlands. The field work conducted during this study did not attempt to delineate the boundaries of any wetlands.

2.1 Landscape Analysis

The landscape analysis represents the first step in conducting an inventory of a Town's wetlands. As part of this Phase, Arrowwood Environmental identified and mapped the wetlands in the Town of Woodstock through a comprehensive review and interpretation of available paper and digital resource inventories, maps and photographs.

Information sources that were reviewed during the landscape analysis process include: 1:40,000 Color Infra-Red aerial photographs , Natural Resources Conservation Service soil survey maps,1990s Orthophotography (black and white), Vermont Significant Wetlands Inventory maps and U.S. Geological Survey (USGS) topographic maps.

In general, the process for identifying and mapping wetlands starts with the Color Infra-Red aerial photographs (CIR photos). Wetlands identified from the CIR photos were transferred directly to a

digital wetlands database created in an ArcView platform using the digital Orthophotographs as a base map. Polygon lines (approximate wetland boundaries) were drawn in this digital wetlands map using common landscape features present in both the CIR photos and the digital Orthophotographs. The digital Natural Resource Conservation Service (NRCS) hydric soils maps, Vermont Significant Wetlands Inventory (VSWI) maps, and U.S. Geological Survey (USGS) topographic maps were also consulted during this inventory. As each wetland was mapped, it was given a preliminary natural community name based on Wetland, Woodland, Wildland. A Guide to the Natural Communities of Vermont (Thompson and Sorenson 2000). In addition, the sources used to identify the wetlands and any comments about the wetlands ecology or the mapping process were included in the database accompanying the inventory map. Each of the data sources that were used during this inventory is described in detail below.

2.1.1 1:40,000 NAPP Color Infra-Red Aerial Photographs (CIR photos)

The CIR photos were the main data source used to identify wetlands for this inventory. The data sources described below were used to verify or confirm wetlands discovered using the CIR photos. This set of aerial photographs was flown in the spring (April-May) of 1992-1993 at a scale of 1:40,000. These are "false color" photos which combine infrared reflectance with the green and red visible bands. These photos were examined at 3X magnification under a stereoscope. The use of the stereoscope allows the photos to be viewed in three dimensions, thus enabling the interpreter to see elevation. These photos have proven to be the most useful tool for remotely identifying wetlands in Vermont. When evaluating aerial photographs, the most important characteristic is the "photosignature". The photosignature is the way that a feature, in this case a wetland, presents itself on the photograph. Water on the CIR photos presents a very clear, dark photosignature that is distinct from most other features in the photos.

Many wetlands, however, do not have standing water and the wetland photosignature may be unclear. In some cases, it was possible to confirm the presence of a wetland at these sites by using one of the other wetland data sources. At other sites, it was not possible to confirm or deny the presence of a wetland. In these cases, the site was included in the wetlands map but with a lower confidence score level (see Section 2.5).

2.1.2 Vermont Significant Wetlands Inventory Map (VSWI)

The VSWI map is based on the National Wetlands Inventory Map (NWI) and is used as the standard regulatory wetlands map for Vermont by the State Wetlands Office. For the purposes of this inventory, VSWI and NWI are used interchangeably. All wetlands that occur on the VSWI map appear on the attached Woodstock Wetlands Inventory Map. In many cases, the location of the wetland from the VSWI map is inaccurate and does not reflect the actual location of the wetland. Using the CIR photos and other map sources, these locations were corrected on the Woodstock Wetlands Inventory Map. In most instances, the wetlands on the VSWI map are indeed wetlands. There are a few instances where information from other map sources suggests that the site is not actually a wetland. In these situations, the wetland remained on the Woodstock Wetlands Inventory Map because it is a state regulated wetland and should be checked in the field. In the

Comments field of the database, however, it is noted that the site does not appear to be wet from other map sources.

All wetlands that appear on the VSWI are considered Class II wetlands, as defined in the State of Vermont Wetland Rules. These wetlands are offered a certain amount of regulatory protection. Wetlands that are not on the VSWI map and are not hydrologically connected to a Class II wetland are considered Class III wetlands and are not regulated by the State of Vermont Wetland Rules. Because remote sources cannot determine if one wetland is hydrologically connected to another wetland, the classification of the wetlands identified was not included in this inventory. However, all wetlands that are indicated to be VSWI wetlands in the wetland map can be considered Class II wetlands.

2.1.3 USGS Topographic Maps

The USGS topographic maps were used as a secondary map source to better understand a wetlands position on the landscape. The topographic position can give insight to the nature of a wetland and the potential for wetlands to occupy certain areas.

2.1.4 1:5,000 Digital Orthophotographs

Orthophotographs are 1:5000 aerial photographs that are geo-rectified and, in the case of this inventory, used in a digital format. Unlike the CIR photos, the photosignature of wetlands in orthophotographs is often unclear. Orthophotographs are important, however, because they are digitized and geo-rectified. This allows the photo interpreter to accurately (and digitally) map a wetland that was identified from the CIR aerial photos. These orthophotographs were therefore used as a base map and all mapping of wetlands was done based on common landscape features present in these photographs and the CIR photos.

2.1.5 Natural Resource Conservation Service (NRCS) Soil Survey

A digital copy of the Windsor County Soil Survey was used during this inventory. A map of all hydric soils in the town was used to identify areas that may contain wetlands. The hydric soils in the town consisted of the following soil types: Rumney, Cabot, Saco, Pondicherry, Wonsqueak, Raynham, and Grange soils. Each soil type forms under different environmental conditions and can give clues to the nature of the wetland or potential wetland site. An NRCS soil fact sheet for each of these soil types is presented in Appendix D for use with the Wetland Inventory Map.

As mentioned above, the presence of a wetland is dependent on hydric soils, wetland hydrology and wetland vegetation. Some areas of hydric soil, therefore, are not wetlands. Wherever hydric soils were present, other remote data sources were used to determine if the site likely contained a wetland. In many circumstances, other data sources led to the conclusion that wetlands occurred only in part of the hydric soil area. In these cases, polygon lines were redrawn to reflect probable

wetland boundaries. The NRCS hydric soils boundary and the approximate wetland boundary are therefore not identical. In most cases, the wetland areas are smaller than the hydric soil areas.

2.1.6 Wetland Inventories on Public Land

Previous inventories of wetlands on public land in Woodstock were consulted in order to add to the Woodstock Wetlands Inventory Map. A natural communities inventory of the Marsh Billings Park was conducted by Tom Lautzenhauser. The sites identified during that inventory were visited during the Woodstock wetlands inventory and given a field assessment. In some cases, wetland boundaries were redrawn based on field observations. In other cases and with permission from Marsh Billings Park, wetland boundaries were taken directly from the Lautzenhauser inventory and incorporated into the Woodstock Wetlands Inventory Map.

2.2 Remote Wetland Functions and Values Assessments

Wetlands were assessed remotely utilizing information available from the windshield survey and existing digital and paper databases. Nine of the eleven functional criteria were used in remotely assessing the wetland resources in the study area. The Hydrophytic Vegetation and Rare, Threatened and Endangered Species functions can only be accurately assessed from a field visit and were therefore not included in the remote assessment. Each of the identified wetland areas was evaluated for the presence of factors that would indicate that the wetland was serving a significant function as a productive ecosystem and/or a public resource. The wetland assessment methodology integrates information about a wetland's soils, vegetation, shape and size, habitat diversity and position in the landscape to produce a composite picture about a wetland's role in the larger ecosystem. The following nine functional criteria were selected for use in remote evaluation of wetlands in the town of Woodstock:

- Flood Control
- Water Quality (Nutrients)
- Sediment Retention
- Wildlife Habitat
- Fisheries Habitat
- Erosion Control
- Open Space
- Recreation
- Education

For an in-depth description of each of the functional assessment criteria, refer to Section 2.2.2.

2.3 Field Assessments

Field assessments of selected wetlands were conducted during the 2003 field season. The purpose of the field inventory was to assess the accuracy of the remote wetlands identification procedure and

to obtain more in depth data about a wetland's natural community and functions and values. Wetlands selected for a site visit were chosen with the intent of visiting a cross-section of wetlands in terms of natural communities, functions and values, and remote mapping confidence. Landowner permission for conducting field visits was obtained by the Woodstock Conservation Commission.

2.3.1 Natural Community Assessments

Each wetland that was visited received a natural community assessment. This assessment involves collecting data on wetland soils, vegetation structure and composition, topographic position and other relevant ecological information. Special attention was paid to noting factors that may degrade the quality of the wetland community such as invasion of exotic plants, disruption of local hydrology, surrounding landuse or direct development in the wetland. Together, this information was used to assign each community visited a final natural community name and give information about the current condition of the community. A sample Natural Community Assessment data form is presented in Appendix B.

2.3.2 Field-Based Functions and Values Assessment

Each wetland that obtained a field visit also received an in depth functions and values assessment. The functions and values assessment involves evaluating a wetland based on it vegetation, hydrology, habitat diversity, topographic position, shape, size and position in the watershed for certain functions and values. The Vermont Wetland Evaluation Form, US Army Corps of Engineers Highway Methodology Handbook and Golet Model Wetland Evaluation Form were used as guides for establishing the functions and values assessment. Sample field data evaluation sheets are included in the attachment. As a result of the assessment, each wetland is given a functional score based on a scale of 1-5. Each visited wetland was assessed for the following functions and values:

1. Floodwater Retention and Attenuation;
2. Water Quality (Nutrients);
3. Sediment Retention;
4. Wildlife Habitat;
5. Fisheries Habitat;
6. Hydrophytic Vegetation;
7. Rare, Threatened and Endangered Species;
8. Sediment Stabilization (Erosion Control);
9. Open Space;
10. Recreation; and
11. Education

The following is a description how wetlands perform the specified function and/or value listed above. The functional assessment is based upon whether the wetland has the capacity for the function or value and whether there is an opportunity for the wetland to perform the specific

function or value. For the specific criteria that was used in rankings each of the functions, please refer to the attached field data sheet (Appendix B).

Floodwater Retention

Wetlands that retain and slowly release floodwaters are usually associated with streams or rivers. In order for a wetland to perform this function, there must be an expandable basin present in the wetland that allows room for the floodwater to disperse. This expandable basin and the presence of persistent vegetation have the effect of slowing the water down and diffusing the energy of the floodwater.

The most significant wetlands for this function are located upstream of significant natural resources or human resources such as developed areas, culverts, and roads. In these circumstances, the upstream wetlands may be protecting these resources from floodwaters, such that any activity that impairs the wetland's ability to perform this function will often have serious impacts to downstream resources.

Water Quality (Nutrients)

Many wetlands filter sediments and nutrients, such as phosphorus and nitrogen, from surface waters resulting in improved water quality. Wetlands that retain nutrients generally have diffuse or sinuous drainage pathways which slow down the flow of water. Slower water velocity provides more opportunity for nutrients to settle out and to be absorbed by vegetation. The velocity of the water moving through a wetland is determined by slope, landscape position and the outlet conditions in the wetland. Wetlands with constricted outlets generally have much slower water velocities and greater potential for nutrient removal. The presence of persistent vegetation is also important for slowing down water velocities.

The water quality function takes on particular importance in impaired watersheds where water and its uses are diminished. The opportunity for a particular wetland to perform this function is determined by the presence of agricultural lands, urban impervious surfaces, steep slopes, and areas of impaired water quality. Wetlands that recharge a wellhead protection area or contribute to the flows of Class A surface water may also be of particular importance.

Wildlife Habitat

Wildlife use of wetlands is widely variable and dependent upon the size, diversity and structure of the wetland. In general, the wetlands that are the most valuable for wildlife are those that have multiple community types, greater vegetative diversity, some open water and multiple layers of vegetation. The interspersion of the open water and different vegetation cover can also be important for determining wildlife use. In general, a greater diversity of wildlife is often found in wetlands that have open water that is extensively interspersed with vegetation. The interspersion of different vegetation or cover types is also important.

Large wetlands, with ample space and a variety of food and cover resources often harbor a greater diversity of wildlife. Smaller wetlands are also important for wildlife when viewed not as individual wetlands but as groups or clusters of wetlands on the landscape. These smaller wetlands often work in concert to provide habitat for species that utilize several different wetlands throughout their weekly or yearly movements on the landscape.

Sediment Retention

The sediment retention function is closely related to the Floodwater and Water Quality functions. The criteria that are used to evaluate this function, therefore, are very similar to those used for evaluating a wetland for Floodwater and Water Quality. Wetlands significant for this function are often lower in the watershed and associated with a stream or river. They have low water velocity through persistent, often woody, vegetation. They are characterized by diffuse sheet flow or sinuous channels and often show evidence of sedimentation. The opportunity for this function is based on the presence of erosion, steep slopes, development and/or logging in the watershed which could produce a sediment load upstream of the wetland.

Fisheries

The fisheries function is determined primarily upon a wetland's connection to a permanent surface water that could provide fish habitat. Wetlands that are associated with these permanent surface waters can increase the fisheries habitat by: 1) providing pools and refugia during periods of low water; 2) providing shade to the surface waters thereby lowering the temperature of the water (which is crucial to some species of fish); 3) providing stream bank stability thereby decreasing the amount of river clogging sediments in the water system; 4) providing undercut banks which offer spawning, nursery, feeding and cover habitat for fish and; 5) providing an input of cool, clean spring water into the surface water system.

Hydrophytic Vegetation

The hydrophytic vegetation function is meant to evaluate whether or not wetlands may harbor significant natural communities or vegetation. In general, wetlands of rare or unusual types, such as bogs, fens, alpine peatlands or black gum swamps are considered significant for this function. Also, any wetland which contains the best example of a particular natural community in the county or region is considered significant for this function. For the purposes of this study, any site that was considered locally (Woodstock and the immediate area) significant was also considered significant for this function.

In addition to natural communities, the Hydrophytic Vegetation function is meant to assess if the wetland contains rare or uncommon plants. Any wetland that harbors a rare plant or a plant at its range limit may be considered significant for this function.

Rare, Threatened and Endangered (RTE) Species

The presence of the RTE function is determined based upon the presence of a Federal or State listed Threatened and Endangered species of plant or animal. This includes the historic (within the last 10 years) presence of a rare element in the wetland. The opportunity for this function is based on the presence of appropriate habitat for RTE species. In some cases, wetlands in this study were given a low score for this function if the habitat was appropriate for RTE species. This was done because no RTE surveys were conducted during the field visits.

Sediment Stabilization (Erosion Control)

Many wetlands located in areas where erosive forces are present are important for this function. This includes wetlands along rivers and streams and wetlands along lakes and ponds where there is enough fetch to produce erosion along the shore. In Woodstock, wetlands found along streams with at least seasonally heavy, erosive flow are most important for this function. This tends to occur at low to middle watershed positions. The most important element in a wetland significant for this function is the presence of persistent vegetation, especially woody vegetation such as trees and shrubs. The roots of this vegetation act to bind the soil and prevent it from eroding. Wetlands that perform this function upstream of biologically significant areas such as spawning habitat, significant natural communities, or RTE element sites are very valuable.

Open Space

The Open Space function is determined primarily by a wetland's position in the landscape in relation to ease of public viewing. Wetlands that can be readily viewed by the public such as those on public lands or along the road network are often significant for this function. These wetlands are important because they enhance the likelihood of observing wildlife and colorful wildflowers. Open space becomes a particularly important function in more developed areas.

Recreation

The recreation function is determined based on the presence or likelihood of recreational activities occurring within the wetland or wetlands that provide economic benefits. This includes wetlands that provide habitat for species that can be fished, hunted or trapped and/or the presence of wild foods that are harvested.

Education/Research

Wetlands that are significant for Education and Research are generally those that have a history of use for these purposes or have the real potential to be used for these purposes. Publicly owned wetlands, wetlands with unique features and wetlands with RTE species are characteristics that may make a wetland significant for this function.

2.4 Windshield Assessments

As part of the inventory process, information on wetland boundaries and community types was gathered from points of public access such as public roads. These observations from the windshield survey were used to help refine the wetland map. A few sites for which permission could not be obtained received a more formal windshield assessment. This assessment is an abbreviated version of the natural community and functions and values evaluations described below and presented in the Appendix. A sample Windshield Assessment form is presented in Appendix B.

2.5 Wetlands Map Creation

Once field work was concluded, field data was compiled and integrated into the wetlands map. This involved adding wetlands that were discovered during the field inventory, changing wetland boundaries on the map and removing sites that were determined not to be wetlands. Data from the field visits were also incorporated into the attribute table which is linked to the map. The following attribute information is listed for each of the wetlands identified. The labels in bold are the attribute table titles. Accompanying each title below is an explanation of the attribute information.

Id A unique identification number

Nat_Com Natural Community. Lists the most likely or most dominant natural community for the site.

Nat_commII Secondary Natural Community. Lists the natural community(s) that may be co-dominant for the site.

Comments Comments. Comments on the ecology, hydrology or vegetation based on field or remote observations.

Confidence Confidence. A 1-3 scoring of the confidence that the site contains a wetland. A score of 3 denotes high confidence, 2 moderate confidence and 1 lower confidence.

VSWI Vermont Significant Wetlands Inventory. Y/N. Yes/No. A "Y" denotes that the wetland is found on the VSWI map and is therefore a Class II wetland.

CIR 1992 Color Infra-red Aerial Photographs. Y/N. Yes/No. A "Y" denotes that the main source used for identifying the site was the CIR Photographs. These sites are generally not found on the VSWI maps or the Hydric Soil maps.

Field_visi Field Visit. Y/N/D. Yes/No/Drive-by. A "Y" denotes that the site received a field visit. A "D" denotes that the site received a Drive-by (viewed from the road or other public access point). A "N" denotes that the site received neither a Drive-by nor a field visit.

Field Id The wetland number that corresponds to the number on the field data forms.

Hydric_soi Hydric Soil. NRCS Digital Soils Map. If the site contains hydric soils in any part of the wetland, the type of soils are listed in this attribute column. An NA denotes that the site does not contain hydric soil.

Flood	Floodwater Attenuation. Y/N. Yes/No. A "Y" denotes that the site likely performs floodwater control functions.
Wq	Water Quality. Y/N. Yes/No. A"Y" denotes that the site likely performs functions related to water quality such as filtering out nutrients from the water.
Sed_retent	Sediment Retention. Y/N. Yes/No. A "Y" denotes that the site likely performs functions related to retaining sediments in the water.
Wildlife	Wildlife. Y/N. Yes/No. A "Y" denotes that the site is likely significant for wildlife.
Fisheries	Fisheries. Y/N. Yes/No. A "Y" denotes that the site is likely significant for fisheries.
Vegetation	Hydrophytic Vegetation. Y/N. Yes/No. A "Y" denotes that the site likely contains significant hydrophytic vegetation. Only populated if site received a field visit.
Rte	Rare, Threatened or Endangered Species. Y/N. Yes/No. A "Y" denotes that the site does or does likely contain populations for Rare, Threatened or Endangered Species. Only populated if site received a field visit.
Erosion	Erosion Control. Y/N. Yes/No. A "Y" denotes that the site likely performs functions related to controlling erosion.
Open_space	Open Space. Y/N. Yes/No. A "Y" denotes that the site is likely significant as open space.
Recreation	Recreation. Y/N. Yes/No. A "Y" denotes that the site is likely significant for recreation.
Education	Education. Y/N. Yes/No. A "Y" denotes that the site is likely significant for use as an educational tool.
Acres	Acres. Lists the digitally calculated acreage for each site.

3.0 Woodstock Wetland Functions and Values Across the Landscape

It has been only recently that we have begun to understand the many ecological functions associated with wetlands and their benefits to society. Wetlands were once considered useless and disease ridden environments to be avoided or filled. We now know that wetlands provide many significant benefits to society including fish and wildlife habitats, water quality improvement, flood storage, shoreline erosion protection, opportunities for recreation and aesthetic appreciation, and natural products. It is in our own self-interest to protect wetlands to maintain a healthy environment.

Wetlands occur across the natural landscape, in many forms and sizes. It is helpful to think of the landscape in terms of watersheds. A watershed is a geographic area draining to a common stream, lake or river. Watersheds are delineated by topography. To determine the boundaries of a watershed, ask the question, if a raindrop lands at a particular location, which way will it go? Watersheds have upper, middle and lower reaches depending on the topography of the area. The upper reach is generally thought of as the higher elevation, steep headwaters area. The lower reach is thought of as the low elevation, flat, discharge (mouth) area. The middle reach is found in between and is generally moderate to mildly sloping.

In looking at the wetlands across the Woodstock landscape, the watershed concept was employed. There are four main watersheds in Woodstock as identified by the University of Vermont (UVM) and the Natural Resource Conservation Service (NRCS) (data from Vermont Center for Geographic Information). These watersheds are: 1) The Gulf Stream – headwaters to mouth; 2) The Ottauquechee – confluence with North Branch to confluence with Gulf Stream; 3) The Ottauquechee – confluence with Gulf Stream to mouth and; 4) The Kedron Brook – headwaters to mouth. The majority of the town and the majority of the wetlands occur within the Kedron Brook and Ottauquechee – North Branch to Gulf Stream watersheds.

If the distribution of wetlands is viewed from a landscape scale, it can be seen that within the Ottauquechee-North Branch to Gulf Stream watershed, most of the wetlands are associated with the Ottaquechee or one of its tributaries. The topography is fairly steep in this area with most of the wetlands confined to gullies and ravines where brooks and streams form, or the flat areas along the Ottauquechee. These surface waters connect the headwater Seeps to the Ottauquechee and eventually to the Connecticut River.

The topography in the Kedron Brook watershed, on the other hand, is much less steep and much more undulating. This topography is more conducive to the development of isolated wetlands, including ground water recharge wetlands. Ground water recharge wetlands are found across the landscape but are less common in areas with steep topography. In these circumstances, it is the ground water, not the surface water that connects these “isolated” wetlands to the rest of the landscape.

Another approach to looking at wetlands in Woodstock is to look at the distribution of wetlands within a watershed. The landscape position of wetlands within a watershed in presented in Table 1. Many of these wetland types can occur across the watershed, what is presented in this table is the most common landscape position of these types.

Table 1. Most Common Landscape Position of the Different Wetland Natural Communities

Upper Watershed	Middle Watershed	Lower Watershed
Seep	Red Maple-Black Ash Swamp	Emergent Marsh
Fen	Northern Hardwood Seepage Forest	Alluvial Shrub Swamp
Northern Hardwood Seepage Forest	Alder-Willow Swamp	Silver Maple Riverine Floodplain Forest
	Beaver Pond Complex	Agricultural field
	Seep	
	Emergent Marsh	

As can be seen from this table, three wetland community types were identified within the upper reaches of watersheds in Woodstock. Those community types include: Seep, Fen, and Northern Harwood Seepage Forest. The wetlands found in these higher elevation, headwater areas are typically significant for water quality (nutrient removal) and floodwater attenuation. Fens and seeps have also been identified as significant habitat for wildlife, hydrophytic vegetation and rare, threatened and endangered species. Given the important headwaters location in the watershed of these wetland communities, it is not surprising they play such a significant ecological role. These communities provide clean water to many of the surface waters that flow through the town as well as cleansing waters of phosphorus and nitrogen.

Seven wetland community types were identified within the middle reaches of watersheds in Woodstock. Those community types include: Red-Maple Black Ash Swamp, Spruce-Fir-Tamarack Swamp, Northern Hardwood Seepage Forest, Alder-Willow Swamp, Beaver Pond Complex, Seep, and Emergent Marsh. Given the topographic location of these wetlands, the natural communities found with the middle reaches can also be found in the upper and lower reaches of the watershed. This overlap of communities is to be expected of the middle reaches. Wetlands found within the middle reaches generally exhibited significant functions and values for floodwater attenuation, water quality (nutrient removal), and sediment retention. Wetland communities, such as seeps, emergent marsh, and Red-Maple Blach Ash Swamps were found to be significant for wildlife habitat.

Four wetland community types occur most commonly in the lower reaches of watersheds in Woodstock. Those community types include: Emergent Marsh, Alluvial Shrub Swamp, Silver Maple Riverine Floodplain Forest and Agricultural Fields. With the exception of agricultural fields, the wetlands found in these low elevation, bottomland areas are typically significant for floodwater attenuation, water quality (nutrient removal), sediment retention and wildlife habitat. Wetlands located next to streams also provide a significant function for erosion control and fisheries.

The wetlands inventory clearly demonstrates that Woodstock has a wealth of wetland resources, most of which are performing important ecological functions within the landscape. Within the thirteen community types identified, wetlands range in size from a .01 acre Seep to a 23 acre Alder-Willow Shrub Swamp. The diversity of community types and sizes lends to an ecologically rich assortment of wetland resources.

4.0 Wetland Natural Community Analysis and Functional Assessment by Natural Community Type

This section presents the data on the Natural Community Analysis that was performed for each of the wetlands visited during this study. This data was used to develop a description of each community and is presented in the sub-section *Natural Community Characteristics.* The functions and values data was also analyzed for each natural community and is presented in the subsection *Functional Assessment.* Finally, *Management Recommendations* are given for each community and are based on the data collected and on the known threats to these wetlands.

Table 2 shows the most significant functions and values of each of the wetland Natural Communities in Woodstock. An in depth discussion of these functions is presented by community type below.

Table 2. Most Significant Functions and Values of Wetlands by Natural Community Type in Woodstock, Vermont

Natural Community	Most Significant Functions and Values
Agricultural Field	None
Alder-Willow Shrub Swamp & Alluvial Shrub Swamp	Floodwater Attenuation Water Quality (Nutrient Removal) Sediment Retention Sediment Stabilization (Erosion Control)
Emergent Marsh	Floodwater Attenuation Water Quality (Nutrient Removal) Wildlife Sediment Retention
Northern Hardwood Seepage Forest	Floodwater Attenuation Water Quality (Nutrient Removal)
Old Field	Water Quality (Nutrient Removal)
Pond	Floodwater Attenuation Sediment Retention Fisheries Open Space Recreation
Red Maple-Black Ash Swamp	Floodwater Attenuation Water Quality (Nutrient Removal) Wildlife
Fen	Floodwater Attenuation Water Quality (Nutrient Removal) Hydrophytic Vegetation RTE Species
Seep	Water Quality (Nutrient Removal) Wildlife
Silver Maple Riverine Floodplain Forest	Floodwater Attenuation Water Quality (Nutrient Removal) Wildlife Sediment Retention Fisheries Sediment Stabilization (Erosion Control)
Vernal Pool	Wildlife Open Space Education

During the course of this inventory, three-hundred and sixty-five (365) different wetlands were identified, evaluated and mapped. Twelve (12) wetland natural community types were identified within the town. The

abundance and size of these community types is outlined in Table 3. An in depth natural community and functional analysis for each of these wetland types is provided below

Table 3. Number and Size of Natural Community Types in Woodstock, Vermont

Natural Community Type	Number of Occurrences	Average Size in Acres	Total Acreage
Agricultural Field	38	3.8	145
Alder-Willow Shrub Swamp	30	5.7	172
Alluvial Shrub Swamp	2	1.1	1.2
Beaver Pond Complex*	6	3.7	22
Emergent Marsh	23	1.8	44
Northern Hardwood Seepage Forest	12	5.8	69
Old Field	21	4.1	86
Pond	149	0.6	97
Red Maple-Black Ash Swamp	15	3.9	58
Fen	5	1.4	7
Seep	28	0.9	25
Silver Maple Riverine Floodplain Forest	14	5.1	72
Vernal Pool	13	0.3	4
Total Wetland Acreage			**807**

* The Beaver Pond Complex is a mapping unit and consists of an assemblage of natural communities. See notes below.

As can be seen from this table, human created and impacted wetlands such as ponds and agricultural fields make up the largest number of wetlands in the town. This is a reminder that the wetland systems in the town (and in much of the state) are very heavily influenced by human activities. As such, the healthy functioning of many systems is dependent on active management and conservation. Specific management recommendations for each community are also presented in Section 4.0.

Aside from ponds and agricultural lands, the wetland types with the highest number of occurrences include the Alder-Willow Shrub Swamp, the Seep, and the Emergent Marsh. In terms of total acreage, the Alder-Willow Shrub Swamps are the most abundant wetlands in the town. This community forms fairly large stands in old beaver meadows, in flat areas along streams and rivers and on the edges of larger wetland complexes. Some of this total acreage, however, may include examples of Alluvial Shrub Swamps. The low acreage for the Alluvial Shrub Swamps is the result of the sampling technique rather than of the actual number of acres present in the town. This community can only be mapped from field work. There are likely many more acres of this community that are currently mapped as Alder-Willow Shrub Swamps that did not obtain a field assessment. There are also likely many more examples of Vernal Pools and Seeps present in the town. These communities are usually very small and difficult to map from remote sources. Field work is the best way to find these important wetlands. Fens may also be underrepresented in this inventory. While

these sites are usually easy to identify as wetlands, the presence of a fen is not detectable from remote sources. It is likely that a small amount of acreage currently listed as Emergent Marsh or Old Field contains Fens as well.

Though the Beaver Pond Complex type is listed as a natural community in Table 3, it is not a single natural community. The Beaver Pond Complex is a mapping unit used to describe areas that typically contain multiple natural communities. It is often not possible to determine which natural communities exist at the site because the types change as beaver activity ebbs and flows. The most common natural communities occurring at these sites include Alder-Willow Shrub Swamps, Ponds, and Shallow Emergent Marshes. The functional analysis for a site mapped as Beaver Pond Complex is found under the appropriate natural community sub-section below.

4.1 Seeps

Natural Community Characteristics

The Seep natural community is a fairly widespread community both in Woodstock and throughout Vermont. There were 28 examples of this type found during the wetland inventory phase of this project, but many more undoubtedly exist that were not detected by remote sources. Seeps are formed when ground water rises to the surface creating a small, wet opening in the forest canopy. These wet areas are frequently associated with small streams or brooks, often forming the headwaters of these water courses. They are usually fairly flat but can also be slightly sloping. Field work in Woodstock and elsewhere has indicated that there may be variants of the seep community relating to slope, bedrock and water input. In examples that sit on a slight slope, much of the organic material is washed down slope leaving the soils dominated by mineral material. Seeps that occur on flatter topography often build up a layer of organic soil on top of the mineral soil. Coupled with differences in bedrock and the amount of groundwater input, the soils in seeps can vary widely. Whether or not this leads to significant differences in vegetation requires further study.

The typical Seep community is dominated by wetland herbs such as sensitive fern (*Onoclea sensibilis*), sedges (*Carex spp*.), slender manna grass (*Glyceria striata*), and spotted touch-me-not (*Impatiens capensis*). Other species such as scouring rush (*Equisetum fluviatile*), turtle head (*Chelone glabra*) or cinnamon fern (*Osmunda cinnamomea*) may also be locally abundant. These sites are often too wet to support woody vegetation. In some cases, however, there may be upland hummocks or drier areas that harbor willow (*Salix spp*.) or alder (*Alnus incana*) shrubs or any number of hardwood or conifer tree species. In circumstances where upland tree species grow throughout a seepage area, the site is considered a Northern Hardwood Seepage Forest.

Functional Assessment

The summary functional assessment data is shown in Table 4. Seeps appear to have low to moderate functionality for many of the functions assessed. This is in part related to this community's wide ranging topographic positions and community characteristics. Perhaps the most significant function of these wetlands is their relation to wildlife. Because seeps are groundwater driven, many of them do not freeze during the winter months; this makes them important as watering holes for many species. This also allows herbaceous vegetation (especially sedges) to emerge very early in the spring making them important spring feeding areas for species such as black bear. Wild turkey, white-tailed deer, and moose also utilize these areas extensively. Their unique environmental conditions make them prime habitat for salamanders such as the northern dusky, the two-lined and the elusive spring salamander. They are also important habitat for the rare, gray petalwing dragonfly.

Many of the other functions of seeps are related to the association that this community has with streams. Seeps that are located in mid-stream positions can often hold water at high water levels and retain some sediment from these high waters. They perform limited sediment stabilization (erosion control) function by

providing persistent vegetation along stream flows. Another significant function that these communities perform is related to water quality. Seeps provide clean, cold ground water to many of the surface waters that flow through the town as well as cleanse waters of phosphorus and nitrogen. Disturbance or disruption of these communities can cause changes in the local hydrology resulting in an increase in erosion and sedimentation of the downstream waters.

Table 4. Functional Assessment of Seep Communities

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	2	3	2	2	1	1	0	1	2	2	2
% with Fxn	75%	100%	75%	100%	25%	50%	75%	100%	0%	50%	75%
Combined Assessment[2]											
% with Fxn	36%	43%	93%	25%	14%	7%	4%	32%	14%	4%	11%

1 Sample size= 4
2 Sample size=28
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Because the soils in this community often remain wet throughout the year, they are very susceptible to disturbance from heavy equipment. Logging operations involving heavy equipment should maintain a 50 foot natural buffer around seeps to prevent disruption of the soils. Disrupting the soils can change the local hydrology resulting in sedimentation of the water systems downstream. This has the potential of decreasing the wildlife habitat not only of the seep community but of the stream that is associated with the seep. Invasive species are not usually a problem in these communities because most examples are situated in remote locations within a forested matrix. However, disruption of the soil, especially by heavy equipment, has the potential to open up the site to colonization by exotics such as reed canary grass (*Phalaris arundinacea*) or purple loosestrife (*Lythrum salicaria*). Colonization of a site by these or other invasives significantly decreases the quality of the natural community and the functions and values that it performs.

4.2 Red Maple-Black Ash Swamp

Natural Community Characteristics

The Red Maple-Black Ash Swamp community type is a widespread and extremely variable type in Vermont. This analysis includes sites that also have conifers such as hemlock or red spruce in the canopy. The classification has recently been updated and 6 subtypes and variants of this community are now recognized. The swamps that were visited during this inventory are classified as Red Maple Seepage Swamps, though there may be other sub-types present as well. These sites are all rather small, shallow depressions in the landscape that are usually associated with mineral rich ground water upwelling. They are dominated by hardwood trees, especially red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), and yellow birch (*Betula alleghaniensis*). These species may also make up a significant tall and short shrub layer as well. The herbaceous layer is usually diverse and can include lake sedge (*Carex lacustris*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), and poison ivy (*Rhus radicans*). The soils are typically well decomposed (hemic to sapric) peats ranging from 2-4 feet in depth.

In the absence of disturbance, some Alder-Willow Shrub Swamps may eventually become colonized by trees and be classified and Red Maple-Black Ash Swamps. There were a number of these communities in transition that were visited during this inventory. Beaver flooding is the most common natural disturbance to this community, often resulting in the replacement of a hardwood swamp with a beaver pond.

Functional Assessment

As can be seen from Table 5, Red Maple-Black Ash Swamps generally have moderate function for many of the criteria assessed. The highest average value from the field assessments was given to the Wildlife function. This is largely due to the fact that many hardwood dominated swamps contain habitat for vernal pool species within them. The nature of the community often results in a well developed hummock and hollow complex. This micro topography leads to areas of temporary standing water in the hollows which are the conditions favorable to vernal pool dependent species. Red Maple-Black Ash Swamps are also utilized by raccoon and white-tailed deer.

All of the swamps that were visited were rated for moderate functionality in floodwater attenuation. All of these sites were associated with a surface water drainage and have the potential to contain floodwaters but the swamps themselves are relatively small and the nature of the community resulted in only moderate functionality. These swamps probably act in concert with other wetlands that also exist along the drainages in controlling floodwaters. Many of the swamps that are associated with waterways are also significant in reducing nitrogen and phosphorus in surface waters. The Red Maple-Black Ash swamps that occur on the Marsh-Billings property are particularly important for open space and their potential for recreation and use as educational tools.

Table 5. Functional Assessment of Red Maple-Black Ash Communities

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	3	3	3	2	1	1	0	2	2	1	2
% with Fxn	100%	100%	100%	100%	40%	60%	20%	60%	100%	20%	60%
Combined Assessment[2]											
% with Fxn	44%	63%	67%	53%	20%	27%	7%	40%	47%	20%	33%

1 Sample Size=5
2 Sample Size=15
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

The greatest management concern regarding this community type is the disruption of local hydrology due to heavy logging equipment. Some of these swamp types can contain trees of marketable size. Because of the nature of the soils, however, it is recommended that heavy equipment be excluded from these sites. As in many wetlands, heavy equipment can disrupt local hydrology, disturb and compact the soil and possibly open up the site to invasion by exotic plant species. These factors are particularly important in Red Maple-Black Ash Swamps where an undisturbed soil and intact hydrology are critical for maintaining the important amphibian habitat that these communities provide.

4.3 Alder-Willow Swamp

Natural Community Characteristics

The Alder-Willow Shrub Swamp community as defined in this study represents two different but closely related types. As outlined in Wetland, Woodland and Wildland (Thompson and Sorenson. 2000), these two types are the Alluvial Shrub Swamp and the Alder Swamp. The Alluvial Shrub Swamp occurs exclusively along rivers and streams. The ecology of these communities is driven by the flooding of the site by the associated waterway. The soils tend to be mineral soils and the vegetation has much in common with riverine floodplain areas. The Alder Swamp community can occur along streams but is also common in more isolated basins. The soils of the Alder Swamp tend to be organic because of the lack of flooding that would wash away fine organic sediments. The majority of the shrub swamps in Woodstock are the non-alluvial type.

A sparse canopy of scattered trees occasionally grows above the shrubs that dominate the Alder-Willow Shrub Swamps. This "emergent" layer is usually comprised of red maple (*Acer rubrum*) and black ash (*Fraxinus nigra*). In some situations, the emergent layer becomes dense enough to suggest that the site may be succeeding to a Red Maple-Black Ash Swamp. This transition happens slowly over time and can be interrupted by beaver activity. The shrub layer in the undisturbed community is commonly dominated by speckled alder (*Alnus incana*) and various willow species (*Salix spp*.). In many cases, willow shrubs can dominate the entire wetland while alder may be only a minor component. For this reason, the title "Alder-Willow Shrub Swamp" seems more appropriate for this region than the "Alder Swamp" title adopted by Thompson and Sorenson (2000). These tall shrubs comprise anywhere from 30-95% cover. In some situations, these shrubs can grow so thick that travel through these areas is quite difficult. The herbaceous layer can be just as thick. Here, the dominant plant species include blue joint grass (*Calamagrostis canadensis*), sensitive fern (*Onoclea sensibilis*), marsh marigold (*Caltha palustris*) and spotted touch-me-not (*Impatiens capensis*). In the wetter situations, lake sedge (*Carex lacustris*) and cattails (*Typha latifolia*) are common.

Functional Assessment

Alder-Willow Shrub Swamps occur in a wide variety of landscape positions in Woodstock. They can be found along the margins of ponds, as isolated basins, as small headwater wetlands or associated with the wetlands influenced by beaver. The most common landscape position, however, is along streams where the topography flattens out and the soil drainage is poor. Since they are often associated with stream flows, the opportunity for them to perform floodwater control functions is typically high. Due to the presence of persistent woody vegetation during periods of high water, the shrub swamp acts as a storage area for floodwaters. The mixture of vegetation often slows the water movement and decreases the energy of the floodwaters. Data presented in Table 6 shows floodwater control to be one of the most significant functions of this community type. These communities can also provide shade for the stream thereby cooling waters and increasing the quality of fish habitat. The persistent vegetation along the stream stabilizes the stream banks and prevents erosion. Finally, Alder-Willow Shrub Swamps can be important for wildlife as a food source and for use as cover and travel corridors. These areas are heavily utilized by species such as weasels, muskrat and moose.

The larger Alder-Willow Shrub Swamps tend to occur at the lower elevations. It is here that the topography is conducive to wider valleys and flatter areas. In some cases, Alder-Willow Shrub Swamps can occur adjacent to agricultural fields where they often remain undisturbed because of their wetness. In these circumstances, these wetlands are extremely important in filtering out excessive nutrients and sediment from agricultural activities before surface water runoff enters associated waterways.

Table 6. Functional Assessment of Alder-Willow Shrub Swamp Communities

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	4	3	3	3	2	0	0	2	2	0	0
% with Fxn	100%	100%	100%	100%	67%	22%	0	89%	100%	22%	33%
Combined Assessment[2]											
% with Fxn	70%	80%	53%	70%	43%	3%	0%	80%	57%	23%	13%

1 Sample Size=9
2 Sample Size=30
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Like all wetlands, heavy machinery should be excluded from Alder-Willow Shrub Swamps. These shrub swamps that are fed by ground water may not completely freeze in the winter, making them very susceptible to soil disturbance. Because of their importance as wildlife travel corridors, a minimum buffer zone of 50' is recommended. Development into this buffer zone should be discouraged. In some circumstances, a buffer zone of greater than 50ft should be maintained to protect the wildlife habitat and landscape movements. If encroachment into the buffer zone is unavoidable, plantings that shelter the natural community from the development should be considered. In addition, because many of these wetlands serve important flood storage functions, any impact such as filling should be avoided. Filling even small examples of these wetlands often has the effect of eliminating the flood storage function at the site and sending high energy floodwaters downstream.

4.4 Fens

Natural Community Characteristics

For the purposes of mapping and the functional analysis, the Intermediate Fen and the Rich Fen communities were combined. These two communities are very similar, both in terms of their ecology and their flora. As their names imply, they differ mainly in degree of richness. Richness is a function of the amount of nutrients, mainly calcium, contained in the groundwater which rises up into these wetlands. Nutrient-rich ground water is the driving ecological force behind the formation of Fen communities. Because of this, fens are limited in distribution to those areas in which ground water flows through nutrient rich bedrock.

Fens can be found in a variety of landscape positions. One common situation occurs when groundwater is discharged at the surface into a small wetland basin. Other situations include seepy, sloped, "old field" type habitats, fens on the margins of other wetland types and small wet areas along streams (all of which were found in Woodstock). These different landscape positions often lead to very different soil development. The soils in the wetland basins, for example, usually consist of somewhat deep peat (organic) soils over clay whereas the sloped fens may only have a thin layer of peat over gravel.

Regardless of the different landscape positions and soils, fens in Woodstock usually have similar vegetation structure and composition. This includes a short shrub layer dominated by shrubby cinquefoil (*Potentilla fruticosa*). Other shrubs such as meadowsweet (*Spiraea alba*) and willow (*Salix spp.)* are sometimes present. The herbaceous layer is usually dominated by sedges such as *Carex hystericina*, *Carex vesicaria*, *Carex interior* and *Carex flava*. Other herbs include cottongrasses (*Eriophorum spp.),* spikerushes (*Eleocharis spp.)* and horsetails (*Equisetum spp.).* Fens are often considered botanical hot spots because of the wide variety of calcium-loving plants that are found only in these specialized habitats.

Functional Assessment

Fens are important habitats for rare, threatened and endangered plant species, although this is not reflected in the data presented in Table 7. Because of the ecology of these communities, these sites often harbor rare species. Time constraints did not allow for a full rare plant survey in these habitats, but all of the fens that were assessed were given a low score for this function because of their potential. Therefore, among the communities inventoried in Woodstock, the intermediate and rich fens are the most significant for rare, threatened and endangered species habitat potential.

Table7. Functional Assessment of the Intermediate and Rich Fen Community

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	3	3	2	2	2	3	1	2	2	0	1
% with Fxn	100%	100%	100%	100%	100%	100%	100%	50%	100%	0%	50%
Combined Assessment[2]											
% with Fxn	100%	100%	100%	100%	100%	100%	80%	60%	100%	0%	60%

1 Sample Size=4
2 Sample Size=5
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Intermediate and Rich Fens are communities that are driven by very specialized hydrology. Any disruption to this hydrology could be detrimental to the quality of these communities. Any development (such as quarries) that may have a significant impact on the ground water should therefore be carefully studied. Disruption of the surface waters (such as damming) near the outflow of these communities could also have a negative impact on these habitats. Situations in which fens have developed in or near agricultural fields should be excluded from cutting for hay or grazing as pasture. In addition, all heavy machinery, including tractors and ATVs, should be excluded from these habitats. The wet soils can be easily rutted and compacted resulting in a disruption of the local hydrology and a decrease in the quality of the community.

4.5 Northern Hardwood Seepage Forests

Natural Community Characteristics

The Northern Hardwood Seepage Forest is a community that is closely related to the Seep community. The Seep community tends to be well defined, open wetlands dominated by groundwater discharge. The Northern Hardwood Seepage Forest is also dominated by groundwater discharge but occurs in a more diffuse situation where openings are mixed with areas of closed canopy. Because they occur in a more diffuse pattern, these sites are generally much larger than the well-defined Seeps. The most common canopy trees include sugar maple (*Acer saccharum*) and white ash (*Fraxinus americana*). White pine (*Pinus strobus*) and green ash (*F. pennsylvanica*) may also be present in lower abundance. These upland trees generally occupy the higher hummocks where conditions are more favorable for their growth. A shrub layer composed of any of the canopy species is common. In some cases, invasive species such as morrow's honeysuckle (*Lonicera morrowii),* buckthorn (*Rhamnus cathartica*), or barberry (*Berberis spp.)* may also be present. The herbaceous strata is most commonly dominated by wetland plants such as cinnamon fern, interrupted fern and royal fern (*Osmunda cinnamomea, O. claytonia, O. regalis*), sensitive fern (*Onoclea sensibilis*), spotted touch-me-not (*Impatiens capensis*) and white-topped aster (*Aster umbellatus*).

These sites can be relatively flat to slightly sloping and often occur within a matrix of larger upland Northern Hardwood Forest. Soil conditions are often extremely variable within the community as drier areas are interspersed with wetter areas. The soils in the wetter areas often contain a thin layer of peat whereas the drier areas are wholly mineral in nature. In both cases, the subsoils usually show significant redoximorphic features illustrating the wet nature of the site. These sites often form the headwaters of small streams which . often spread out and create the wetland conditions within these communities.

Functional Assessment

The results of the functional analysis for this community are presented in Table 8. The functioning of these communities on the landscape is very similar to that of the Seep communities. Both community types arise under similar environmental conditions and occupy similar positions on the landscape. Often forming the headwaters of small streams, these sites are critical for maintaining water quality. Some sites that are associated with larger streams may also be important for retaining sediment from the stream flow, controlling floodwaters and increasing the quality of the fisheries habitat by providing cold, clean water to the stream. The examples of this community that are more open may also be important for wildlife food in the early spring (see discussion under Seep communities).

Table 8. Functional Assessment of the Northern Hardwood Seepage Forest Community

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	3	3	2	2	1	0	0	0	1	0	1
% with Fxn	100%	100%	100%	100%	50%	0%	0%	0%	50%	0%	50%
Combined Assessment[2]											
% with Fxn	17%	25%	50%	25%	25%	0%	0%	17%	8%	8%	17%

1 Sample Size=2
2 Sample Size=12
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Northern Hardwood Seepage Forests are similar to Seeps in that the soils often remain wet throughout the year. This is a result of the sites being areas of groundwater discharge. Logging in the Northern Hardwood Seepage Forests may be more of a concern because of the presence of marketable timber in them. Because of the fragile soils, however, these sites should be excluded from any logging operation. For a full discussion of the consequences of disrupting the soils in theses sites, see the Management Recommendations for the Seep Community.

4.6 Ponds

Natural Community Characteristics

During the remote mapping process it is sometimes difficult to determine if a particular site is natural or manmade. Therefore, for the purposes of creating the Woodstock wetlands map, ponds include both natural and manmade ponds. Included in this category are sites such as Vondell Reservoir and Carlton Reservoir. In the town of Woodstock, the vast majority of the ponds encountered were manmade. As such, these ponds are not considered natural communities. Some of them may have natural aquatic or emergent vegetation, and some even may be floristically diverse. They were not, however, assessed as natural communities for this study.

Functional Assessment

Though not considered a natural community, ponds often serve many functions and values as wetlands. The functional analysis of the ponds in Woodstock is presented in Table 9. Manmade ponds are somewhat difficult to assess as a group because of their high degree of variability. Unlike natural communities, they do not arise under similar environmental conditions across the landscape. Some generalization, however, can be made about their functionality. As can be seen from Table 9, ponds score highest functionally for water quality, sediment retention and floodwater attenuation. Floodwater attenuation occurs because many ponds have the capacity to hold large volumes of floodwater and release them slowly. This however, depends on the landscape position of the pond (especially whether or not it is associated with surface water) and the specific design of the pond. Other functions relating to ponds are largely dependent on the type of pond that is built. A pond that is a good swimming hole, for example, is usually not very good at performing many functions. Ponds that mimic more natural pond habitats, however, are often highly functional. These include having features such as shallow sloped sides, vegetation right up to the edge of the pond, emergent and aquatic vegetation in the pond, structure (such as boulders or logs) within the pond and small vegetated islands. These features highly increase the value of the pond for water quality, sediment retention, fisheries and wildlife. Ponds can often be built to incorporate these features as well as provide space for swimming and other water recreation.

Table 9. Functional Assessment of Ponds

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	4	2	2	4	3	0	0	0	3	3	0
% with Fxn	100%	100%	100%	100%	100%	0%	0%	0%	100%	100%	0%
Remote Assessment[2]											
% with Fxn	46%	75%	32%	95%	16%	0%	0%	15%	28%	14%	1%

1 Sample size=2
2 Sample size=149
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Man-made ponds are abundant throughout the town of Woodstock. Some of them appear to perform valuable functions and values while others do not. Even though these sites are man-made, many of them are still part of the wetland systems in the town. As such, special consideration should be given to the construction of new ponds, especially those associated with surface waters. Incorporating design features such as those described above will ensure that these sites do not have a negative impact on the wetland systems in Woodstock.

4.7 Silver Maple Riverine Floodplain Forests

Natural Community Characteristics

The classic Silver Maple Riverine Floodplain forest is one of expansive, towering trees, an open park-like understory and tall ostrich ferns covering the ground. Unfortunately the majority of these sites across the state have been plowed under and put into agriculture or development. What largely remains are forested fragments and patches of this community. In this regard, the abundance of this community in Woodstock is similar to that in other towns in Vermont. What is called the Silver Maple Riverine Floodplain Forest in this inventory is really a combination of this community and the Sugar Maple dominated types. Combining the communities was done because from remote sources, it is not possible to distinguish them. In addition, the functions and values that these two communities perform are essentially the same, sugar maple tends to be more common in Woodstock.

The canopy of these communities in Woodstock is highly variable. Some sites have approximately 25% cover while others have closer to 75% cover. Canopy species is also variable. Sugar maple *(Acer saccharum) tends to be more common than silver maple (Acer saccharinum), but box elder (Acer negundo*), trembling aspen (*Populus tremuloides*) and butternut (*Juglans cinera*) are also found. This variability, both in terms of species composition and canopy cover, is a result of a high level of disturbance in these communities. Box elder and aspen, for example, are indicative of early successional sites. These sites are either being reclaimed from agriculture or have some other drastic disturbance history. Common shrubs in this community include box elder and willows (*Salix spp.).* The herbaceous layer is dominated by sensitive fern (*Onoclea sensibilis*), ostrich fern (*Matteucia struthiopteris*), joe-pye-weed (*Eupatorium maculatum*) and spotted touch-me-not (*Impatiens capensis*). Vines such as riverbank grape (*Vitis riparia*) and clematis (*Clematis virginiana*) are also common at these sites.

Non-native invasive plant species have become well established at some of these sites because of the ecology of these communities,. This list of non-native species includes dame's rocket (*Hesperis matronalis*), moneywort (*Mimulus nummularia*), reed canary grass (*Phalaris arundinicaea*) and Japanese knotweed (*Polygonum cuspidatum*). Non-native species are commonly found at these sites because annual floodwaters typically scour the soil and deposit sediments. This not only brings in weed seed and plant fragments with the sediments but also disturbs the soil in such a way that favors the establishment of these plants. The establishment of these species often threatens plant diversity and some functioning of these sites.

A final note should be made regarding the soils of these communities. Given their landscape position and association with the river, the soils at these sites are usually sands or sandy loams. The build-up of organic matter that occurs in many wetlands does not occur in floodplain associated sites because fine particles are washed away during flood events. The sandy soils at some of these sites may not be technically hydric soils. This means that some floodplain forests are not considered jurisdictional wetlands under the current wetland rules. Only a site visit and a detailed soil description can determine if a specific site is a wetland. For the purpose of this inventory, any floodplain forest type was considered a wetland.

Functions and Values Assessment

The functional importance of these wetlands on the landscape is impressive in spite of the disturbed state of these sites from a natural communities perspective, Table 10 shows the results of the field and remote functional analysis. From this table it can be seen that the floodplain forests remaining in Woodstock are most significant for floodwater control, water quality, wildlife, sediment retention, fisheries, erosion control and, in some cases, open space. Most of these functions are the result of the floodplain forest's intimate relationships with the Ottauquechee River or a major tributary. Having a forested buffer along the river binds the soil preventing erosion, provides shade for the river thereby increasing the quality of the fish habitat, and provides a valuable travel corridor for many species of wildlife. As the river leaves it banks during a flood event, the floodplain forest acts to dissipate the energy of the floodwater. In addition to sediment that is deposited during flood events, nutrients that tied up with this sediment are often sequestered by plants in the floodplain forest. Because of their wide ranging importance on the landscape, floodplain forests are an incredibly valuable wetland resource.

Table 10. Functional Assessment of the Silver Maple Riverine Floodplain Forest Community

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	5	4	3	4	3	1	0	4	2	0	0
% with Fxn	100%	100%	100%	100%	100%	25%	0%	100%	100%	25%	0%
Combined Assessment[2]											
% with Fxn	100%	57%	57%	100%	79%	14%	0%	79%	64%	29%	7%

1 Sample Size=4
2 Sample Size=14
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Because of their importance on the landscape, the conservation and restoration of these communities in Woodstock is important. Like the rest of the state, the acreage of this community remaining compared to what was once present is quite small. If there is community interest, controlling the spread of non-native plants in some of these sites can be a good community project. It is recommended that realistic goals be set for controlling these plants as total eradication may not be feasible at some sites. It may be feasible, however, to keep non-natives out of the best areas within certain floodplain forests.

Another, more ambitious but worthwhile community project would be to restore a floodplain forest to a site that is no longer in agriculture (or other uses). The natural regeneration of these sites is very slow because of the constant disturbance. Actively restoring a floodplain forest speeds up this process considerably and can increase the functions and values of the site tremendously.

4.8 Agricultural Fields

Natural Community Characteristics

Agricultural fields are not natural communities and were not assessed as such during this inventory. They were included in the mapping process because many wetlands occur in agricultural fields. Fields used for row crops and for hay or pasture were included under this title. When it appeared that the field was no longer used for agricultural purposes and was being colonized by shrubs or trees, the site was classified as Old field. Many of the wetlands that were mapped in agricultural fields were low confidence wetlands (those that have a lower probability of actually containing a wetland). This is due to the fact that the native vegetation is gone and cannot be used as a remote indicator of the wetness present on the site. This disturbed vegetation in combination with the land use history (including, in some cases, drainage) make remote determination of wetlands in agricultural fields difficult.

Functions and Values Assessment

As can be seen from Table 11. Agricultural fields generally score low functionality for most criteria. This is due in large part to the fact that the natural processes of these systems were interrupted or drastically altered when the field was put into agriculture. The fields that retained any function were generally those kept in permanent sod, such as pasture or hayfields. Fields in row crops generally do not perform any of the functions using the study methodology.

Table 11. Functional Assessment of Agricultural Fields

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	0	2	1	0	0	0	0	0	1	0	1
% with Fxn	0	100	100	0	0	0	0	0	100	0	100
Combined Assessment[2]											
% with Fxn	11%	32%	16%	13%	8%	0%	0%	26%	5%	5%	3%

1 Sample Size=1
2 Sample Size=38
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Wetlands that occur in agricultural fields generally do not perform significant functions or values. Short of taking the entire site out of agriculture, there are a few management techniques that can enhance the functions of these sites. In situations where a drainage runs through an agricultural field, leaving a vegetated buffer along this drainage is an incredibly important first step in restoring the functions and values of the wetland. This vegetated strip would prevent erosion along the drainage, be used by a wide variety of wildlife, lessen the amount of nutrients that flow into the drainage from the agricultural field and, in some

cases, increase the quality of the fish habitat. In cases that do not involve drainages, the most important management technique is to keep the land sod at all times. Plowing a field that is wet increases the likelihood of soil erosion into nearby surface waters. Keeping the field in sod and avoiding driving heavy machinery during the wettest months will prevent erosion and prevent disruption of the local surface and subsurface hydrology.

4.9 Shallow Emergent Marsh

Natural Community Characteristics

In Woodstock (and throughout the state), the Shallow Emergent Marsh natural community is the most widespread and variable of any wetland natural community. It occurs in many different landscape and topographic positions and is dominated by a wide variety of vegetation. It can be found on the edges of ponds, lakes and streams, associated with beaver wetlands, in isolated basins, as oxbows and as part of larger wetland complexes.

It is the community classification assigned most frequently to wetlands dominated by mixed herbaceous flora (not all cattails or all sedges, for example). In Woodstock, the Emergent Marshes visited contained a sparse cover of willow (*Salix spp*.) or alder (*Alnus incana*) shrubs. This sparse cover is illustrative of the relationship that this community often has with the Alder-Willow Shrub Swamps. In many cases, Shallow Emergent Marshes will, over time, succeed to a Shrub swamp. In other cases, especially with marshes associated with beaver activity, the site may become disturbed before this transition takes place and remain herbaceous dominated. The common herbs found at these sites include sensitive fern (*Onoclea sensibilis*), cinnamon fern (O*smunda cinnamomea*), cattail (*Typha spp.).* bluejoint grass (*Calamagrostis canadensis*), and various sedges (especially *Carex lacustris, C. stricta, and C. crinita*). Some of these sites can be floristically diverse.

The soils at these sites are as widely variable as the situations in which they are found. Very often there is a layer of peat (muck) soil on the surface horizon that is very well decomposed. This peat layer can range in depth from a few inches to many feet depending on the ecology of the site. Some sites are ground water fed, while others rely on surface water or a shallow hardpan in the soil to retain moisture. A subsoil of anything ranging from dense clay to mixed gravel can be found.

Functions and Values Assessment

As can be seen from Table 12 these sites generally score moderate to high for most functions. Most significant are sediment retention, floodwater control, water quality and wildlife. The Shallow Emergent Marshes that are associated with surface water tend to score the highest of these functions. This community type typically includes a mosaic of open water, emergent vegetation and, in some cases, scattered shrubs. This mosaic of open water and vegetation is ideal for the natural nutrient filtration process that occurs in wetlands. It also tends to slow down the movement of the surface water, allowing sediments and attached nutrients to settle out. Finally, a wide variety of wildlife including otter, mink, and muskrat thrive in this interspersion of open water and vegetation . Because they are so widely variable, it is difficult to accurately characterize these functions as a group. However, one common thread that these sites seem to share is the importance that they play on the landscape for many functions and values.

Table 12. Functional Assessment of the Shallow Emergent Marsh Community

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	3	3	3	3	2	1	0	2	2	1	1
% with Fxn	100%	100%	88%	100%	75%	50%	0%	75%	100%	63%	63%
Combined Assessment[2]											
% with Fxn	74%	77%	58%	81%	48%	13%	0%	68%	58%	29%	10%

1 Sample Size=8
2 Sample Size=31
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Like all wetlands, the best way to preserve the natural community and the functionality of the Shallow Emergent Marshes is to maintain an undisturbed, vegetated buffer around the wetland. This should be a buffer from any major disturbance such as development or logging activity. The recommended minimum buffer distance is 50 feet. For large, significant examples, the town should consider adopting a 100 foot natural buffer to provide added protection to the wetland resource. For beaver influenced wetlands, beaver activity is important in creating and maintaining this wetland system. In the case of beaver influenced wetlands, removal of beaver dams and trapped should be prohibited unless should not be removed and unless absolutely necessary to protect essential public or private buildings or roads.

4.10 Vernal Pools

Natural Community Characteristics

Vernal Pools occur in seasonally flooded depressions that hold water during the spring and early summer and then dry up during the late summer months. They differ from all other natural communities in Woodstock in that they are largely defined by the obligate wildlife assemblages that use them rather than a plant assemblage. This wildlife includes the Jefferson salamander (*Ambystoma jeffersoniana*), blue spotted samamander (*Ambystoma laterale*), spotted salamander (*Ambystoma maculatum*), wood frog (*Rana sylvatica*), fairy shrimp (*Eubranchipus spp*.) and fingernail clams (family *Sphaeriidae*). Not all vernal pools contain each of these species but each of these species relies upon vernal pools to complete part or all of their life cycle. The specific hydroperiod (period of time that the site retains water) of a vernal pool is especially important to the success of each of these species. If the vernal pool dries up too soon, many of the amphibians will not have time to complete their life cycle. If the pool retains water throughout the year, the site may become habitat for predators of amphibian eggs and tadpoles.

Since vernal pools are defined by their hydroperiod and the obligate wildlife that use them, they occur in a wide variety of landscape positions. The most common is small depressions and benches within upland forests. These sites typically exhibit a temporary perched water table from somewhat impermeable, shallow bedrock. Since very specific circumstances are required to form these sites (such as topography, soils, bedrock, and hydrology) a site that is favorable for one vernal pool is usually favorable for many. For this reason, pools can sometimes be found clustered on the landscape. There are many other wetland situations in which vernal pools can occur. The low areas (hollows) within hardwood swamps often have similar habitat characteristics as the classic vernal pool situation described above. The edges of larger Emergent Marshes or beaver dominated wetlands may also provide suitable habitat for obligate vernal pool wildlife, and therefore be considered vernal pools.

Functions and Values Assessment

The most obvious and significant function that vernal pools perform is that of wildlife habitat. As mentioned above, there is a whole suite of species that rely specifically on vernal pools to complete all or part of their life cycle. The presence of a functioning, undisturbed vernal pool can be essential to local populations of these species. Because some of these species may be rare or uncommon in the state, these sites may also be significant for rare, threatened and endangered species. The other, perhaps overlooked, functions of these sites are that of open space and education. These functions are especially significant for sites that occur on public land. The vernal pools that exist in the National Park and on Mt. Tom, for example, offer excellent opportunities for educating the public about these important natural resources.

Table 13. Functional Assessment of the Vernal Pool Community

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	0	0	4	0	0	1	1	0	3	0	2
% with Fxn	0%	0%	100%	0%	0%	50%	100%	0%	100%	0%	50%
Combined Assessment[2]											
% with Fxn	0%	0%	100%	0%	0%	8%	46%	0%	31%	0%	54%

1 Sample Size=2
2 Sample Size=13
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

As mentioned above, vernal pool habitat is formed only when very specific hydrologic conditions are met. Any disturbance of that hydrology can greatly decrease the quality of the habitat. Because these communities are defined by wildlife which are often not confined to the vernal pool, good management of vernal pools is likewise not confined to the boundaries of the pool itself. For sites that occur in a forested matrix, a buffer zone of at least 650 feet should be maintained in forest canopy. Specific forest management guidelines for preserving vernal pool habitat are outlined in Forest Habitat Management Guidelines for Vernal Pool Wildlife (Calhoun and deMaynadier, 2004). In general, within 100 feet of the vernal pool, only limited logging should occur, maintaining at least a 75% canopy cover. Within a buffer of 400 feet, partial harvest can occur but leaving at least 50% forest cover. In all cases, the vernal pool itself should be left undisturbed and logging should only occur on frozen ground. Care must be taken not to create deep ruts in the vicinity of vernal pools. Amphibians often lay eggs in these water-filled ruts. The ruts, however, rarely have long enough hydroperiods to support successful reproduction for these species. Any other disruption of local hydrology in the area of vernal pools should also be avoided.

Because vernal pools are usually small isolated wetlands, most of them are considered Class III wetlands. Since the state of Vermont only has jurisdiction over Class I and Class II wetlands, most vernal pools are not protected by the Vermont Wetland Rules. It is possible, however, to change the status of a wetland (from Class III to Class II, for example) by showing that it has special functional significance. Reclassifying a vernal pool (or vernal pools) from Class III to Class II would not only ensure their protection under the Vermont Wetland Rules, it would also set an important precedent in the state for vernal pool protection.

4.11 Old Field

Natural Community Characteristics

Like agricultural fields, Old fields are not natural communities. They are in many cases, however, reverting to natural communities after being in agricultural production. This process of succession usually involves the colonization of a field by trees and shrubs. The type of natural community that a site will become depends on the soils, topographic position, land use history and hydrology. Though not natural communities, these sites were mapped because many wetlands occur in old fields.

Functions and Values Analysis

Like agricultural fields, Old fields generally score low for most functions and values (Table 14). Water quality and erosion control were the most significant functions for these sites. The natural vegetation that has colonized these old fields plays an important role in filtering nutrients from surface water that moves through these sites. In some cases, the drainages that run through many of these fields experienced large amounts of erosion when used in agricultural. The natural vegetation that has colonized these sites is now extremely important for binding the soil and preventing further erosion along these drainages.

Table 14. Functional Assessment of Old Fields

	Flood Water	WQ	Wildlife	Sed Ret	Fish	Veg	RTE	Erosion	Open Space	Rec	Ed
Field Assessment[1]											
Average[3]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% with Fxn	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Combined Assessment[2]											
% with Fxn	29%	48%	10%	19%	14%	0%	0%	33%	14%	5%	0%

1 Sample size=0
2 Sample size=21
3 Based on a 1-5 scale. 1 being low functionality, 5 being high functionality

Management Recommendations

Since these sites are undergoing a natural process of succession, little active management is usually needed to enhance the functions and values of these areas. In some cases, if there is still active erosion along a drainage in an old field, some bank stabilization may be in order. For the most part, these sites are best left to revert to more fully functioning natural communities.

5.0 Conclusions

The Woodstock Wetlands Inventory, Assessment and Mapping Project is likely the most extensive wetland mapping and assessment project that has been conducted on a town-wide scale in Vermont. It has resulted in the identification of many significant wetland resources in the town of Woodstock. Three hundred and sixty-five (365) different wetlands and potential wetlands were identified from remote sources and field work. Approximately 50 different wetlands were visited during this inventory resulting in a large amount of valuable data from which to draw conclusions about wetland natural communities and functions and values.

Twelve (12) different wetland natural community types were identified and found to exist in a wide variety of landscape positions. Community types include small Seepage wetlands which act as the birth place (headwaters) for many small streams, all the way down the watershed to patches of Floodplain Forests along the Ottauaquechee River. The Vernal Pools, Emergent Marshes, Alder-Willow Swamps, forested swamps, Fens and Ponds all add an amazing amount of diversity to the Woodstock landscape.

These wetlands also serve the people of Woodstock (and many people downstream) by performing a wide variety of functions and values. These functions and values are all important not only for the ecology of the region but also for the healthy lives of the people that live there. Unlike other areas in the region with flatter topography, the wetlands in Woodstock do not occupy extensive areas or occur in large units. This study has shown, however, that these many small wetlands often act in concert when performing valuable functions and values. They are connected on the landscape by the ground water and surface waters that link them. With this in mind, there is really no such thing as an "isolated" wetland.

Wetlands have the potential to provide a variety of functions and values including water storage for floodwater and storm runoff, surface and ground water protection, fisheries habitat, wildlife and migratory bird habitat, hydrophytic vegetation habitat, threatened and endangered species habitat, education and research in natural science, recreational value and economic benefit, open space and aesthetics, and erosion control through binding and stabilizing the soil. Loss of wetland functions and values can result in flooding, diminished water quality, loss of aquatic and wildlife habitat, loss of rare species and/or their habitat, erosion and sedimentation of surface waters, and loss of open space, recreational and economic opportunities.

Disturbing the functions of a particular wetland has the capacity to not only affect that wetland but many of the surface waters, wetlands and uplands downstream. This could result in a degradation of the fish habitat of a stream, the degradation of someone's drinking water, and the flooding of roads or the loss of property from flood damage. Even wetlands such as the "isolated" Vernal Pools are connected to the larger landscape (including uplands and wetlands) by the movements of the wildlife that depend on them.

The Woodstock Wetlands Inventory, Assessment and Mapping Project provides the first steps in protecting and preserving valuable wetland resources in the town of Woodstock. This inventory identifies the wetland resources in the town and discusses their significance in the ecological and cultural landscape. In addition to identifying the wetland resources, management recommendations are provided to preserve and enhance the functionality of these resources. The recommendations are meant to provide the town with potential conservation projects and also specific language to incorporate in planning documents.

The Woodstock Wetlands Map was created from remote identification and a significant amount of field work. Wetland areas are located as accurately as possible given the available resources. However, not every wetland could be visited and because some wetlands are best found from field work, many more wetlands likely remain to be documented in the town. This map, therefore, should be considered a baseline map on which further work can build. This process of adding to and refining the map is an important undertaking

that can be carried out by interested townspeople, local naturalists, and knowledgeable landowners. Updating and refining the resource maps will result in the maintenance of this valuable planning tool into the future.

APPENDIX A

REFERENCES

Calhoun, A.J.K. and P. deMaynadier. 2004. Forestry habitat management guidelines for vernal pool wildlife. MCA Technical Paper No.6, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Thompson, E.H. and E.R. Sorenson, 2000. Wetland, Woodland and Wildland: A Guide to the Natural Communities of Vermont. Vermont Department of Fish and Wildlife and The Nature Conservancy. 456 pp.

APPENDIX B

SAMPLE DATA FORMS

Wetland Functions and Values Field Form

Name_____ Location_____Maps/Orthos_____Soils_____

Floodwater Retention and Attenuation

____ Expandable Basin (Rate 1-5)
____ Constricted or No Outlet (Width of expandable basin: outlet)
____ Larger Stream Order (>2, See USGS)
____ Stream/River Present
____ Beaver-created/dependent (history of flowages)
____ Contiguous to a major lake/pond
____ Storage capacity created primarily by beaver dams or other temporary structures
____ Stream banks downstream susceptible to scouring and erosion
____ Important habitat for aquatic life downstream
____ Dense, persistent, emergent vegetation or dense woody vegetation

Opportunity (Upstream from human or ecological resources; impervious surfaces/steep slopes in watershed)

_____

Surface and Ground Water: Nutrients

____ Wetland Lower in Watershed (shallow slopes; See USGS)
____ Constricted or no outlets
____ Water flow path generally < 1 meter in depth (or fluctuates)
____ Sinuous channels, many channels/sheet flow
____ Low water velocity through dense, erect vegetation
____ Fibric peat predominates (-)
____ Visible Evidence of sedimentation (mineral soils or m.s.lens)
____ Recharges wellhead protection area (no outlet, See GIS Data Layer)
____ Contributes to the flows of Class A surface waters

Opportunity: (ag lands, manure, pasture, urban/impervious surfaces, steep slopes, water-quality impaired?

_____

_____

Wetland/Wildlife

____ Wetland Class Diversity eq or > 3 (0.5 acres/approx. 200x200 ft)
____ Wetland Size > 5acres
____ Dominate Type: meadow, open water 100% (-) / marsh, fen, bogs, swamp (+)
____ Matrix: forest/wetland/old fields (+) row crops, roads, urban (-)
____ Vegetative Interspersion: see Gollet chart
____ Vegetative Cover Type: see Gollet chart
Species List-VT Wet Rules (see list)_____

_____

Waterfowl (breeding pair)	Beaver
Herons or egrets	Jeff, B- ,Y-spotted Salamanders
Birds (see VT list)	Dusky and 4-toed Salamanders
W.T. deer	Wood, Map, Stinkpot, Spotted Turtle
Black bear	
Moose	

Sediment Retention (Spring Flood Event Scenario)

____ Floodplain Wetland Type
____ Min. 10 feet width of vegetation and reduced flow velocity
____ High flood retention (flood storage/constricted or no outlets)
____ Sinuous/many channels/ sheet flow
____ Evidence of Sedimentation (mineral soils or mineral soil lens)
____ Good interspersion of persistent emergent vegetation and water along course of stream flow
____ Presence of dam(s) which retain water

Opportunity: (Erosion, steep slopes, development, logging):

_____
_____

Fisheries

____ Connected to open water-permanent (non-hypereutrophic)
____ Presence of springs (cold discharge from wetland)
____ Pools/refuge present at low water
____ Forbs/shrubs/trees on shore (stream bank stability)
____ Natural/Woody Riparian vegetation present (Shade)
____ Undercut Banks
____ Provides spawning, nursery, feeding or cover habitat for fish (documented or professionally judged)
____ Documented spawning habitat for northern pike

Hydrophytic Vegetation

____ Bog, Fen, Alpine Peat land, Black Gum Swamp
____ Best Example County: DM (cat, rush), SM, SS, and Forest Swamp
____ Habitat for rare species-hydrophytic vegetation (Sig. Unique wetland natural communities)
____ 1 or more RTE plant species at range limit (Distribution maps)
____ Disjunct RTE plant > 40 miles nearest population (Distribution maps)

_____
_____

Threatened & Endangered Species

____ Federal/State list of Threatened Endangered Species-plants/animal
____ T or E: w/in last 10 years

Name of Species and Ranking:

_____
_____

Sediment Stabilization (Erosion Control)

____ Fetch or Current Present/Erosive Forces
____ Good interspersion of persistent emergent vegetation and water along course of stream flow
____ Public Invest (culvert/bridges/houses/cities downstream)
____ Biologically Significant Areas Downstream (spawning, nat. comm., RTE element, herps)
____ Navigation or Water Source Downstream

_____

Open Space and Aesthetics

____ Distinct in Landscape
____ Can be readily observed by the public
____ Special Qualities (view, background)
____ Natural Setting (little/no development)
____ Open Water w/ Trees
____ Sinuous, windy channels (a sense of mystery)(+)

Recreation Value/Economic Benefits

____ Provides Economic or Recreational benefits
____ Habitat for F & W – Hunted Fished Trapped
____ Harvesting of Wild Foods

Education/Research Natural Science

____ Owned-Public Entity
____ History of Use –Education/Research
____ Characteristics-Unique/Valuable for Educ/Res

Other Comments _____

Natural Community Assessment Field Form

A. Identifiers 3/03

Community name:____

Location: ____

____

Survey date: ___.___.____ Surveyors ____________________________

B. Environmental Description

Topographic Position	Topographic Sketch:	Soil Texture/Description:
__ Interfluve __ High Slope __ High Level __ Midslope __ Low Level __ Other __ Backslope __ Step in Slope __ Lowslope __ Toeslope __ Channel Wall __ Basin Floor	Slope Degrees_____ Slope Aspect______ Elevation________ meters / feet	Soil Depth ______ Depth to Pan _____ Parent Material: Soil Drainage:
Environmental Comments:		
Plot representativeness:		

C. Vegetation Description

Total Tree Cover ________%

	Hght / % Cov		Hght / % Cov		Hght / % Cov
T1 Emergent Tree		S1 Tall Shrub		N Non-vascular	
T2 Tree Canopy		S2 Short Shrub		E Epiphyte	
T3 Tree Sub-canopy		H Herbaceous		V Vine/liana	

Dominant Species in each strata

		Current Condition of Community (circle one):	
		1=great, no signs of disturbance, no exotics	
		2=moderate, some signs of disturbance, exotics	
		3=poor, obvious signs of disturbance, lots of exotics	

Wetlands Windshield Survey Form

Site Location		
Date:	Dominant Tree Spp and Cover	Shrub/Herbaceous Spp.
Surveyor:		
Slope/Aspect:		
Total Canopy Cover:		
Hdwd:Con. Cover:		
Wetland Community Name(s):		
Wetland Structure:		
Hydrologic Regime:		
Surface Waters:		
Fisheries Potential:		
Erosion Potential:		
Water Storage Potential:		
Wildlife Potential:		
Surrounding Landuses (sources of pollution):		
Access/Recreation Potential:		
Surrounding Upland Community Types:		
Comments:		
Current Condition of Community (circle one): U= Unknown 1=Great 2=Moderate 3=Poor		

APPENDIX C: ONE PAGE ATTRIBUTE TABLE METADATA

Id A unique identification number

Nat_Com Natural Community. Lists the most likely or most dominant natural community for the site.

Nat_commII Secondary Natural Community. Lists the natural community(s) that may be co-dominant for the site.

Comments Comments. Comments on the ecology, hydrology or vegetation based on field or remote observations.

Confidence Confidence. A 1-3 scoring of the confidence that the site contains a wetland. A score of 3 denotes high confidence, 2 moderate confidence and 1 lower confidence.

VSWI Vermont Significant Wetlands Inventory. Y/N. Yes/No. A "Y" denotes that the wetland is found on the VSWI map and is therefore a Class II wetland.

CIR 1992 Color Infra-red Aerial Photographs. Y/N. Yes/No. A "Y" denotes that the main source used for identifying the site was the CIR Photographs. These sites are generally not found on the VSWI maps or the Hydric Soil maps.

Field_visi Field Visit. Y/N/D. Yes/No/Drive-by. A "Y" denotes that the site received a field visit. A "D" denotes that the site received a Drive-by (viewed from the road or other public access point). A "N" denotes that the site received neither a Drive-by nor a field visit.

Field Id The wetland number that corresponds to the number on the field data forms.

Hydric_soi Hydric Soil. NRCS Digital Soils Map. If the site contains hydric soils in any part of the wetland, the type of soils are listed in this attribute column. An NA denotes that the site does not contain hydric soil.

Flood Floodwater Attenuation. Y/N. Yes/No. A "Y" denotes that the site likely performs floodwater control functions.

Wq Water Quality. Y/N. Yes/No. A"Y" denotes that the site likely performs functions related to water quality such as filtering out nutrients from the water.

Sed_retent Sediment Retention. Y/N. Yes/No. A "Y" denotes that the site likely performs functions related to retaining sediments in the water.

Wildlife Wildlife. Y/N. Yes/No. A "Y" denotes that the site is likely significant for wildlife.

Fisheries Fisheries. Y/N. Yes/No. A "Y" denotes that the site is likely significant for fisheries.

Vegetation Hydrophytic Vegetation. Y/N. Yes/No. A "Y" denotes that the site likely contains significant hydrophytic vegetation. Only populated if site received a field visit.

Rte Rare, Threatened or Endangered Species. Y/N. Yes/No. A "Y" denotes that the site does or does likely contain populations for Rare, Threatened or Endangered Species. Only populated if site received a field visit.

Erosion Erosion Control. Y/N. Yes/No. A "Y" denotes that the site likely performs functions related to controlling erosion.

Open_space Open Space. Y/N. Yes/No. A "Y" denotes that the site is likely significant as open space.

Recreation Recreation. Y/N. Yes/No. A "Y" denotes that the site is likely significant for recreation.

Education Education. Y/N. Yes/No. A "Y" denotes that the site is likely significant for use as an educational tool.

Acres Acres. Lists the digitally calculated acreage for each site.

APPENDIX D

SOIL FACT SHEETS

(Data Sheets from the Natural Resource Conservation Service)

30B: Cabot loam, 0 to 8 percent slopes

CABOT SOILS are very deep to bedrock, shallow or moderately deep to dense basal till and poorly drained. These soils have a perched water table at depths of 0 to 1.5 feet below the surface from fall through late spring, and 1.0 to 2.5 feet below the surface during the summer months. Permeability is moderate in the solum and slow or very slow in the substratum.

This map unit is poorly suited to cultivated crops, hay and pasture because of the seasonal high water table. If adequately drained, it is suited to cultivated crops. Areas of this map unit may be classified as wetland and drainage may be regulated.

Important Farmland Classification: Statewide (b)	Potentially highly erodible land	Vermont Agricultural Value Group: 6d

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Cabot	0-10	L	5-12	5.1 - 7.3	0.6-2	4.0-12	.32	.32	3
	10-18	FSL	3-8	5.1 - 7.3	0.6-2	0.5-4.0	.28	.32	
	18-65	FSL	5-8	5.6 - 7.3	0.001-0.2	0.0-1.0	.28	.32	

WATER FEATURES | **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Cabot	D	0.0-1.5	None		Yes	---	3 w

LAND USE LIMITATIONS

Soil Name	Land Use	Rating	Reason **
CABOT	Pond reservoir area	Moderate:	slope
	Dwellings with basements	Severe:	wetness

AGRICULTURAL YIELD DATA

Crop Name	Yield / acre
Grass hay	4 Tons
Grass-clover	5.6 AUM
Grass-legume hay	3.5 Tons
Corn silage	13 Tons

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
CABOT	Severe	Slight	Severe	CABOT	Red maple	60

30C: Cabot loam, 8 to 15 percent slopes

CABOT SOILS are very deep to bedrock, shallow or moderately deep to dense basal till and poorly drained. These soils have a perched water table at depths of 0 to 1.5 feet below the surface from fall through late spring, and 1.0 to 2.5 feet below the surface during the summer months. Permeability is moderate in the solum and slow or very slow in the substratum.

This map unit is suited to cultivated crops if adequately drained. Erosion is a hazard. It is well suited to hay and pasture. A seasonal high water table may inhibit the establishment of some crops. Areas of this map unit may be classified as wetland and drainage may be regulated.

Important Farmland Classification: Statewide (b)	Highly erodible land	Vermont Agricultural Value Group: 7d

Vermont Residential On-site Waste Disposal Group and Subgroup:

IIId.- This unit is marginally suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. The depth to the seasonal high water table is the major limitation. A detailed, site-specific analysis is generally required. On-site groundwater level monitoring and determination of induced groundwater mounding is often necessary to establish the suitability of this unit. Curtain drains may help lower the water table to an acceptable level.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Cabot	0-10	L	5-12	5.1 - 7.3	0.6-2	4.0-12	.32	.32	3
	10-18	FSL	3-8	5.1 - 7.3	0.6-2	0.5-4.0	.28	.32	
	18-65	FSL	5-8	5.6 - 7.3	0.001-0.2	0.0-1.0	.28	.32	

WATER FEATURES **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Cabot	D	0.0-1.5	None		Yes	---	3 e

LAND USE LIMITATIONS

Soil Name	Land Use	Rating	Reason **
CABOT	Pond reservoir area	Severe:	slope
	Dwellings with basements	Severe:	wetness

AGRICULTURAL YIELD DATA

Crop Name	Yield / acre
Corn silage	13 Tons
Grass hay	4 Tons
Grass-clover	5.6 AUM
Grass-legume hay	3.5 Tons

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
CABOT	Severe	Slight	Severe	CABOT	Red maple	60

31B: Cabot loam, 0 to 8 percent slopes, very stony

CABOT SOILS are very deep to bedrock, shallow or moderately deep to dense basal till and poorly drained. These soils have a perched water table at depths of 0 to 1.5 feet below the surface from fall through late spring, and 1.0 to 2.5 feet below the surface during the summer months. Permeability is moderate in the solum and slow or very slow in the substratum.

This map unit is poorly suited to cultivated crops, hay and pasture because of the stones and boulders on the surface and the seasonal high water table.

Important Farmland Classification: NPSL	Potentially highly erodible land	Vermont Agricultural Value Group: 10

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Cabot	0-10	L	5-12	5.1 - 7.3	0.6-2	4.0-12	.28	.32	3
	10-18	FSL	3-8	5.1 - 7.3	0.6-2	0.5-4.0	.28	.32	
	18-65	FSL	5-8	5.6 - 7.3	0.001-0.2	0.0-1.0	.28	.32	

WATER FEATURES / **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Cabot	D	0.0-1.5	None		Yes	---	6 s

LAND USE LIMITATIONS / **AGRICULTURAL YIELD DATA**

Soil Name	Land Use	Rating	Reason **	Crop Name	Yield / acre
CABOT	Pond reservoir area	Moderate:	slope	Pasture	2.7 AUM
	Dwellings with basements	Severe:	wetness		

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
CABOT	Severe	Slight	Severe	CABOT	Red maple	60

31C: Cabot loam, 8 to 15 percent slopes, very stony

CABOT SOILS are very deep to bedrock, shallow or moderately deep to dense basal till and poorly drained. These soils have a perched water table at depths of 0 to 1.5 feet below the surface from fall through late spring, and 1.0 to 2.5 feet below the surface during the summer months. Permeability is moderate in the solum and slow or very slow in the substratum.

This map unit is poorly suited to cultivated crops, hay and pasture because of the stones and boulders on the surface and the seasonal high water table.

Important Farmland Classification: NPSL	Potentially highly erodible land	Vermont Agricultural Value Group: 10

Vermont Residential On-site Waste Disposal Group and Subgroup:

IIId.- This unit is marginally suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. The depth to the seasonal high water table is the major limitation. A detailed, site-specific analysis is generally required. On-site groundwater level monitoring and determination of induced groundwater mounding is often necessary to establish the suitability of this unit. Curtain drains may help lower the water table to an acceptable level.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Cabot	0-10	L	5-12	5.1 - 7.3	0.6-2	4.0-12	.28	.32	3
	10-18	FSL	3-8	5.1 - 7.3	0.6-2	0.5-4.0	.28	.32	
	18-65	FSL	5-8	5.6 - 7.3	0.001-0.2	0.0-1.0	.28	.32	

WATER FEATURES / **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Cabot	D	0.0-1.5	None		Yes	---	6 s

LAND USE LIMITATIONS / **AGRICULTURAL YIELD DATA**

Soil Name	Land Use	Rating	Reason **	Crop Name	Yield / acre
CABOT	Pond reservoir area	Severe:	slope	Pasture	2.7 AUM
	Dwellings with basements	Severe:	wetness		

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
CABOT	Severe	Slight	Severe	CABOT	Red maple	60

29A: Grange very fine sandy loam, 0 to 3 percent slopes

GRANGE SOILS formed in loamy over sandy glaciofluvial deposits on terraces. They are very deep to bedrock and poorly and somewhat poorly drained. These soils have a water table at depths of 0 to 1.5 feet below the surface from late Fall through late Spring. Permeability is moderate in the solum and moderately rapid to rapid permeability in the substratum.

This map unit is poorly suited to cultivated crops. If adequate drainage is provided, it is suited to hay and pasture. A seasonal high water table is a management concern. Areas of this map unit may be classified as wetland and drainage may be regulated.

Important Farmland Classification: Prime (b)	Potentially highly erodible land	Vermont Agricultural Value Group: 3d

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Grange	0-1	HPM	---	3.6 - 5.5	2-6	25-100	---	---	4
	1-6	VFSL	1-10	5.1 - 6.5	0.6-2	2.0-7.0	.43	.43	
	6-22	FSL	1-10	5.1 - 6.5	0.6-2	0.5-2.0	.43	.43	
	22-65	S	1-5	5.1 - 7.3	2-20	0.0-0.5	.10	.15	

WATER FEATURES **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Grange	C	0.0-1.5	None		Yes	---	4 w

LAND USE LIMITATIONS **AGRICULTURAL YIELD DATA**

Soil Name	Land Use	Rating	Reason **	Crop Name	Yield / acre
GRANGE	Pond reservoir area	Severe:	seepage	Grass-legume hay	2.5 Tons
	Dwellings with basements	Severe:	wetness	Grass hay	3 Tons

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
GRANGE	Severe	Slight	Severe	GRANGE	Eastern white pine	65

47: Pondicherry and Wonsqueak mucks, ponded

Pondicherry soils formed in organic deposits 16 to 51 inches thick overlying sandy deposits and Wonsqueak soils formed in organic deposits 16 to 51 inches thick over loamy mineral material in depressions. PONDICHERRY SOILS are very deep to bedrock and very poorly drained. These soils have a water table that is ponded on the surface to 1.0 feet below the surface. Permeability is moderately slow to moderately rapid in the organic layers and rapid in the sandy substratum. The organic deposits are primarily derived from herbaceous plants. WONSQUEAK SOILS are very deep to bedrock and very poorly drained. These soils have a water table that is ponded on the surface to 1.0 feet below the surface. Permeability is moderately slow to moderately rapid in the organic deposits and moderate or moderately slow in the underlying mineral material.

This map unit is poorly suited to cultivated crops, hay and pasture because of the seasonal high water table.

Important Farmland Classification: NPSL		Vermont Agricultural Value Group: 11

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Pondicherry	0-24	MUCK	---	5.6 - 7.3	0.2-6	25-100	---	---	2
	24-65	LFS	0-10	5.6 - 7.3	6-20	0.0-0.5	.10	.15	
Wonsqueak	0-36	MUCK	---	4.5 - 6.5	0.2-6	80-99	---	---	2
	36-65	SIL	5-30	5.1 - 7.3	0.2-2	0.0-2.0	.49	.49	

WATER FEATURES / **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Pondicherry	D	0.0-1.0	None		Yes	---	7 w
Wonsqueak	D	0.0-1.0	None		Yes	---	7 w

LAND USE LIMITATIONS / **AGRICULTURAL YIELD DATA**

Soil Name	Land Use	Rating	Reason **	Crop Name	Yield / acre
PONDICHERRY	Pond reservoir area	Severe:	seepage		
	Dwellings with basements	Severe:	subsides		
WONSQUEAK	Pond reservoir area	Severe:	seepage		
	Dwellings with basements	Severe:	ponding		

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
PONDICHERRY	Severe	Slight	Severe	PONDICHERRY	Quaking aspen	45
WONSQUEAK	Severe	Slight	Severe	WONSQUEAK	Black spruce	20

4A: Raynham silt loam, 0 to 3 percent slopes

RAYNHAM SOILS formed in loamy glaciolacustrine deposits on lake plains and terraces. They are very deep to bedrock and poorly drained and somewhat poorly drained. These soils have a water table at depths of 0 to 1.5 feet below the surface from late Fall through late Spring. Permeability is moderate or moderately slow in the solum and slow in the substratum.

This map unit is poorly suited to cultivated crops. If adequate drainage is provided, it is suited to hay and pasture. A seasonal high water table is a management concern. Areas of this map unit may be classified as wetland and drainage may be regulated.

Important Farmland Classification: Prime (b)	Potentially highly erodible land	Vermont Agricultural Value Group: 3d

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Raynham	0-3	SIL	3-16	5.6 - 7.3	0.2-2	3.0-10	.49	.49	5
	3-22	SIL	3-16	5.6 - 7.3	0.2-2	0.5-2.0	.64	.64	
	22-65	SIL	3-16	6.6 - 7.8	0.06-0.2	0.0-0.5	.64	.64	

WATER FEATURES / **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Raynham	C	0.0-1.5	None		Yes	---	4 w

LAND USE LIMITATIONS

Soil Name	Land Use	Rating	Reason **
RAYNHAM	Pond reservoir area	Moderate:	seepage
	Dwellings with basements	Severe:	wetness

AGRICULTURAL YIELD DATA

Crop Name	Yield / acre

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
RAYNHAM	Severe	Slight	Severe	RAYNHAM	Eastern white pine	65
					Red maple	65
					Red spruce	45

33: Rumney fine sandy loam, 0 to 2 percent slopes, frequently flooded

RUMNEY SOILS formed in loamy over sandy alluvial deposits on flood plains that are frequently flooded for brief duration from Fall through late Spring. They are very deep to bedrock and poorly drained. These soils have a water table at depths of 0 to 1.5 feet below the surface from late Fall through late Spring. Permeability is moderate or moderately rapid in the solum and rapid or very rapid in the substratum.

This map unit is poorly suited to cultivated crops and suited to hay and pasture. A seasonal high water table may inhibit the establishment of some crops. Flooding is a hazard, but is of short duration and usually occurs in the spring. Tillage operations may be delayed in some years. Areas of this map unit may be classified as wetland and drainage may be regulated.

Important Farmland Classification: Statewide (b)	Not highly erodible land	Vermont Agricultural Value Group: 4d

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Rumney	0-3	FSL	1-9	5.1 - 7.3	0.6-6	4.0-8.0	.24	.24	3
	3-21	FSL, SL	1-9	5.1 - 7.3	0.6-6	0.0-2.0	.37	.37	
	21-28	FSL	1-9	5.1 - 7.3	0.6-6	0.0-2.0	.37	.37	
	28-65	LS	0-3	5.1 - 7.3	6-20	0.0-1.0	.20	.24	

WATER FEATURES **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Rumney	C	0.0-1.5	Frequent	Brief	Yes	---	3 w

LAND USE LIMITATIONS **AGRICULTURAL YIELD DATA**

Soil Name	Land Use	Rating	Reason **	Crop Name	Yield / acre
RUMNEY	Pond reservoir area	Severe:	seepage	Grass-legume hay	2.5 Tons
	Dwellings with basements	Severe:	flooding	Grass hay	3 Tons

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
RUMNEY	Severe	Slight	Severe	RUMNEY	Red maple	65

41: Saco silt loam, 0 to 2 percent slopes, frequently flooded

SACO SOILS formed in loamy over sandy alluvial deposits on flood plains that are frequently flooded for brief duration from Fall through late Spring. They are very deep to bedrock and very poorly drained. These soils have a water table at depths of 0 to 0.5 feet below the surface from Fall through early Summer. Permeability is moderate in the surface layer and loamy part of the substratum and rapid or very rapid in the sandy part of the substratum.

This map unit is poorly suited to cultivated crops, hay and pasture because of the seasonal high water table and the flooding hazard. If adequately drained, it is suited to cultivated crops. Areas of this map unit may be classified as wetland and drainage may be regulated.

Important Farmland Classification: NPSL	Not highly erodible land	Vermont Agricultural Value Group: 8d

Vermont Residential On-site Waste Disposal Group and Subgroup:

IVa.- This unit is generally not suited as a site for on-site sewage disposal, based on a review of criteria set forth in the Vermont 2002 Environmental Protection Rules. Excessive soil wetness in association with the minimal slope is the limiting condition. Prolonged periods of saturation at or near the soil surface do not allow for the proper functioning of septic systems. Locating the septic system in a more suitable unit is recommended.

PHYSICAL and CHEMICAL PROPERTIES

Soil Name	Depth (In)	Typical Texture	Clay (Pct)	Soil Reaction (pH)	Permeability (In/Hr)	Organic Matter (Pct)	EROSION FACTORS Kw	Kf	T
Saco	0-3	SPM	---	3.6 - 5.5	2-6	25-100	---	---	3
	3-15	SIL	4-15	5.1 - 7.3	0.6-2	3.0-10	.49	.49	
	15-40	SIL	2-15	5.6 - 7.3	0.6-2	0.5-3.0	.64	.64	
	40-65	VFSL	2-15	5.6 - 7.3	0.6-2	0.5-3.0	.64	.64	

WATER FEATURES **SOIL FEATURES**

Soil Name	Hydrologic Group	Depth to Seasonal High Water Table (Feet)	Flooding Frequency	Flooding Duration	Hydric Soil?	Depth to Bedrock (range in inches)	Land Capability Class and Subclass
Saco	D	0.0-0.5	Frequent	Brief	Yes	---	6 w

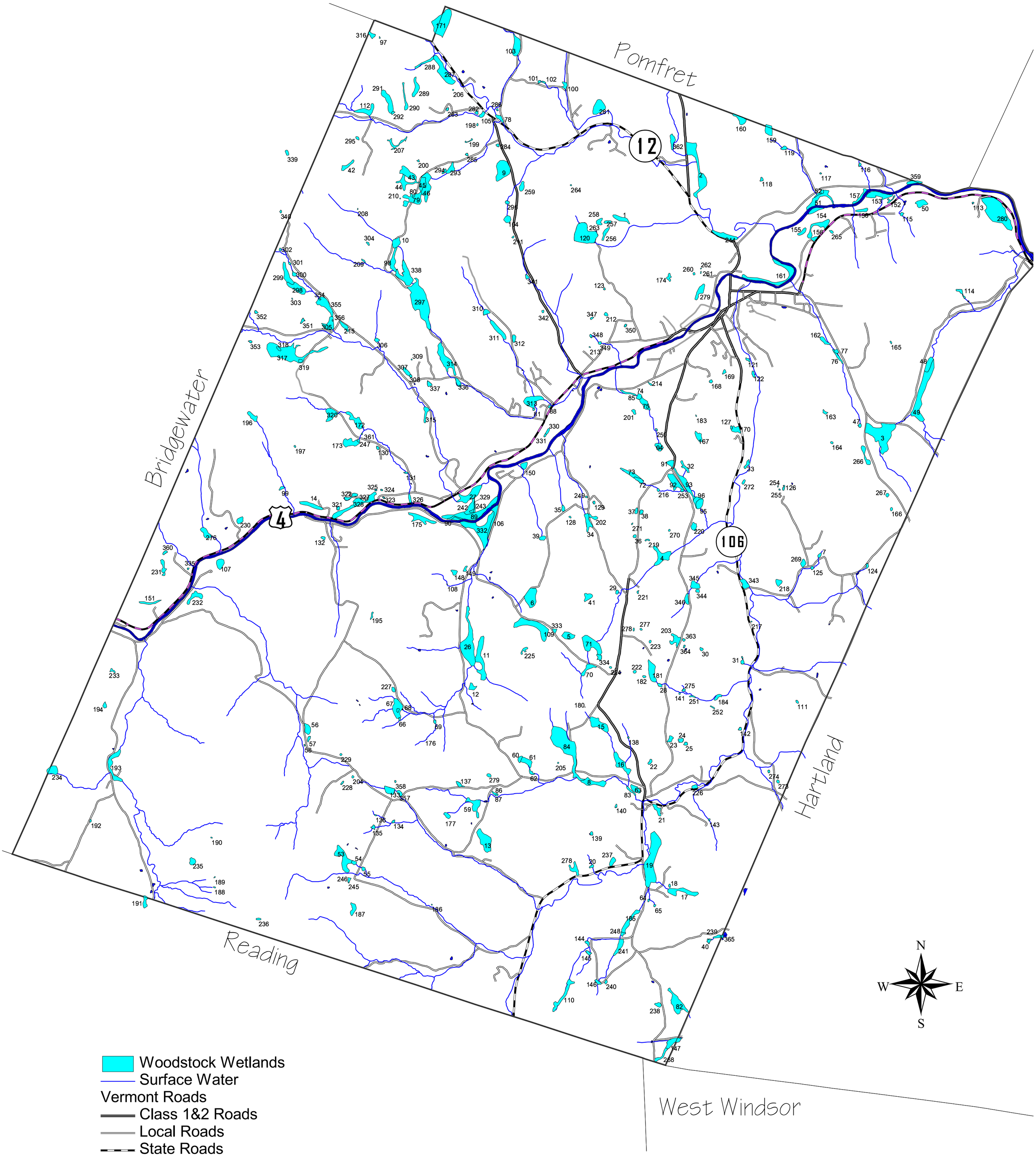
LAND USE LIMITATIONS **AGRICULTURAL YIELD DATA**

Soil Name	Land Use	Rating	Reason **	Crop Name	Yield / acre
SACO	Pond reservoir area	Moderate:	seepage		
	Dwellings with basements	Severe:	flooding		

WOODLAND MANAGEMENT

Soil Name	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Soil Name	Common Trees	Site Index
SACO	Severe	Slight	Severe	SACO	Red maple Speckled alder Black willow	50

Wetland Inventory, Town of Woodstock, VT



Woodstock Wetlands
Surface Water
Vermont Roads
Class 1&2 Roads
Local Roads
State Roads
US Roads
Other Roads

Notes:
Wetlands by Arrowwood Environmental, 2004.
Other data from Vt. Center for Geographic Information

0.5 0 0.5 1 Miles

ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON,VT 05462
(802) 434-7276 FAX: (802) 434-2102