TOWN OF RINDGE
NATURAL RESOURCES INVENTORY

Prepared for:
Rindge Conservation Commission

Jeffry N. Littleton
Moosewood Ecological LLC
Innovative Conservation Solutions for New England
PO Box 9—Chesterfield, NH 03443
jeff@moosewoodecological.com
(603) 831-1980

TOWN OF RINDGE
NATURAL RESOURCES INVENTORY

Prepared for:
Rindge Conservation Commission

JEFFRY N. LITTLETON
Principal Ecologist

Moosewood Ecological LLC
Innovative Conservation Solutions for New England

PO Box 9
Chesterfield, NH 03443
(603) 831-1980
Jeff@moosewoodecological.com
www.moosewoodecological.com

December 2018

Cover Photograph This osprey (*Pandion haliaetus*) was observed in 2011 atop a hemlock along the shore of Hubbard Pond during the ecological inventory for Annett State Forest by Moosewood Ecological LLC. Once a threatened species in New Hampshire, its population has rebounded due to the conservation efforts by many non-profit organizations, state and federal agencies, businesses, and individuals. Conservation is always a team effort.

TABLE OF CONTENTS

INTRODUCTION

Population Growth and Development

New Hampshire's population has been growing at a rate that is twofold that of the other New England states. The population has doubled in the forty years leading up to the turn of the century in 2000, and there was a rise in population of 17.2% between 1990 and 2004 alone. This rate of growth is followed by VT (10.4%), RI (7.7%), ME (7.3%), MA (6.7%), and CT (6.7%). Furthermore, it has been projected that the state will experience an increase of 23% from 1997 to 2020. New Hampshire's development pressure will tax the state's natural resources if not managed with diligence.

The Population and Housing chapter, adopted December 5, 2017, of the Master Plan offers some insights into population and growth in Rindge over time. The following excerpt provides a good perspective.

> "The population of Rindge has fluctuated since its incorporation in 1768. In the late 1700's and early 1800's the population was approximately 1,200 with a peak of 1,298 in 1820. In the late 1800's and early 1900's the population was approximately 700 with a lowest of 610 in 1930. There was a large increase in population of approximately 130% from 1960 (941) to 1970 (2,175). Since that time the percentage population increase between U.S. Census's, taken every 10 years, has steadily decreased with an approximately 10% increase in population from 2000 (5,451) to 2010 (6,014). Predicting what the population of Rindge will do over the next 5, 10, 20 or even 50 years is virtually impossible but Rindge needs to allow for a variety of housing options for its population."

The bulk of population growth is in the southern half of the state; however, 75% of conservation lands are located in the northern regions. This entrusts towns in the southern half of New Hampshire with the responsibility of managing their natural resources and biological diversity. It also establishes citizens as stewards of the land, requiring the use of informed decision making to promote a more sustainable approach to land use planning that protects our natural resources while providing space for homes and places to work. This blend of ecology and our socioeconomic structure is at the heart of conservation biology; a critical tool for conservation planning.

Natural Resources and Land Use Planning

One of the first steps in planning for growth and development is to conduct a natural resources inventory (NRI). This effort helps to better understand what natural resources are within a town and where they are located. As such, an NRI is a list and description of the natural elements found within and adjacent to a town (or even a watershed or larger region). These can include elements such as wetlands, aquifers, ponds, rivers, forests, plants, soils, and wildlife. These data can be created from existing sources or from field-based assessments to better reflect the extent of natural resources within a community.

New Hampshire statutes mandate that communities shall create an NRI. This is generally the responsibility of the local Conservation Commission, whose purpose is "for the proper utilization and protection of natural resources and for the protection of watershed resources" of the town. In particular, RSA 36-A:2 continues to state that "Such commission shall conduct researches into its local land and water areas [and] … shall keep an index of all open space and natural, aesthetic or ecological areas within the city or town … with the plan of obtaining information pertinent to the proper utilization of such areas, including lands owned by the state or lands owned by a town or city. It shall keep an index of all marshlands, swamps and all other wetlands in a like manner…"

An NRI can serve as the basis for developing innovative land use planning that can be adopted to help protect various resources, such as wetlands, wildlife habitats, and biological diversity. Biological diversity, or biodiversity, refers to the variety, variability, and complexity of life in all its forms and includes various ecological processes (for example, nutrient cycling, flooding, fires, wind events, and succession) that have helped to shape species over time.

Biodiversity includes various levels of ecological organization such as individual species and their genes that have evolved over time, as well as the many intricate plant and wildlife populations. It refers to even higher levels of organization including the assemblage of ecological communities[1] and even entire ecosystems, such as wetlands, forests, and rivers. Therefore, the concept of biodiversity engenders all levels of

[1] An ecological community is a group of two or more populations of different species found in the same place. For example, this would include the bird community of Converse Meadows or the peatland ecosystem of Contoocook Marsh.

biological organization and the interactions of living organisms within their physical environments. It is at the heart of this understanding of the dynamics of biodiversity that we seek to develop protection strategies, helping to ensure a healthy environment for humans, as well as all other life forms.

Planning for the conservation of natural resources and biodiversity is not a new concept. It has helped in such efforts as the recovery of the American bald eagle; assisted in building preserves and managing other lands for species of conservation concern, as well as our most common species; aided in the identification of biodiversity hot spots; and helped to identify and protect critical wildlife habitats within our landscape. It has been a center piece for natural resources protection, restoration, and adaptive management for the past six decades.

This form of land use planning is not a static directory but one that is ever-changing. It is a vision that should be based on the principles of conservation biology and incorporates the current ecological structure of a given area (such as a town, a watershed, or an entire region). Thus, conservation planning strives to incorporate the socio-economic fabric of our world with that of the ecological structure. This effort can help build more sustainable, more resilient New Hampshire communities far into the future as a result of implementing comprehensive land use planning that includes our natural environment and built infrastructure.

The need for this type of informed land use planning is becoming more evident. Ecosystems and their constituents have long been susceptible to long-term degradation from overexploitation and misuse of natural resources. This has led to a precipitous decline in several species, some even resulting in extinction altogether (such as the passenger pigeon and eastern elk). It has also led to the loss of critical habitats due to sprawling developments over time. While the past few decades certainly have seen a positive change in resource management and protection, there has been a distinct rise in conservation planning efforts within the 21st century, especially in New Hampshire.

To this end, the Town of Rindge, and more specifically the Conservation Commission, are no strangers to understanding its natural resources. For several decades they have been very active in supporting numerous investigations to assist with conservation and land use planning. These included projects for town-owned properties

such as Converse Meadow, Rindge Town Forest and Miriam Hunt Memorial Forest, Schoolhouse Park property, and the Contoocook Conservation Complex, as well as Annett State Forest, to help guide land management planning and activities.

Rindge has also been invested in assessing natural resources on a town-wide basis. This includes a wetlands assessment in 1993, a biodiversity conservation plan in 2007, and an assessment of impacts on wetlands and rare bats within the proposed 2015 Kinder Morgan NED gas pipeline. They have also engaged with graduate-level students from Antioch University.

Below is a list of relevant projects. These provide the community of Rindge with a sense of the efforts the Conservation Commission has put forth in the public interest. These reports are available on file with the Conservation Commission and are available for public review. See the Literature Resources section for full citations.

- Bluepoint Ecological LLC. 2006. Converse Meadow Conservation Area Land Management Plan. Rindge, NH.
- Bluepoint Ecological LLC. 2007. Rindge Biodiversity-Based Conservation Plan. Rindge, NH.
- Bluepoint Ecological LLC. 2009. Land Management Plan for the Rindge Town Forest and Tetreault Park. Rindge, NH.
- Comprehensive Environmental, Inc. 2014. Pearly Pond Watershed Restoration Plan.
- Corwin, S. 2010. Forest Management Plan for the Town of Rindge: Miriam Hunt Forest and Rindge Town Forest. Calhoun and Corwin Forestry, Peterborough, NH.
- Divan, M. 1998. Woody Vegetation Survey of the Miriam Hunt Memorial Forest in Rindge, NH. Master of Science Candidate at Antioch University, Keene, NH.
- Littleton, J. 2005. Ecological Inventory of the Converse Meadow Conservation Area. Moosewood Ecological LLC, Chesterfield, NH.
- Littleton, J. 2012. Ecological Inventory of the Annett State Forest and Hubbard Pond. Moosewood Ecological LLC, Chesterfield, NH.

- Littleton, J. 2014. Contoocook Conservation Complex: Ecological and Cultural Features Map. Moosewood Ecological LLC, Chesterfield, NH.

- Littleton, J. 2018. Schoolhouse Park Property Ecological Assessment and Management Plan. Moosewood Ecological LLC, Chesterfield, NH.

- Reynolds, D.S. 2017. Acoustic Bat Survey of Conservation Lands in Rindge (Cheshire County), NH. North East Ecological Services, Concord, NH.

- Robblee, M. 1998. Management Plan for the Hunt Property.

- Susca, P. 1992. Underground Storage Tanks in Rindge, NH. Masters of Science Candidate, Antioch University, Keene, NH.

- Town of Rindge. 2017. Master Plan.

- Van de Poll. 1993. Wetlands Assessment of the Town of Rindge, NH. Ecosystems Management Consultants.

- Van de Poll. 2016. Preliminary Assessment of Wetland Impacts of the Proposed Kinder Morgan NED Gas Pipeline in Rindge, NH. Ecosystems Management Consultants.

- Wolfe, D.G. 2004. A Comprehensive Biological Inventory of Aquatic Biodiversity at Four Ponds in Rindge, NH. Deep Conservation Consultants, Rindge, NH.

Pitcher plants in a peatland in Hubbard Pond at Annett State Forest.

The Town of Rindge further identifies the importance of natural resources and land use planning. Four sections of recently adopted Master Plan chapters are available on the town's website. Their Vision Statement, adopted February 11, 2016, states that:

> "The Town of Rindge and its residents are committed to protecting the Town's natural assets and preserving its small-town rural character. We should strive to achieve our vision for Rindge by balancing the rights of property owners, environmental concerns and residential and commercial needs through the active participation of members of our diverse community.
>
> The Town is served by private water and sewer systems. It is imperative that our existing water resources, such as wetlands, aquifers and watersheds, be protected to assure the continuous and adequate supply of clean water for present and future generations."

The Natural Resources chapter, adopted December 5, 2017, acknowledges that Rindge has "exceptional natural resources," and that these resources "support the community's health, economy, tax base, wildlife species, recreation activities, and quality of life." This chapter continues to describe the town's various resources, including topography and steep slopes, geology and soils, wetlands, water resources, agriculture, wildlife, and conserved lands, as well as recommendations that should be considered.

Finally, a chapter on Land Use, adopted February 11, 2016, was also included in the Master Plan. The residents of Rindge identified a variety of measures that should be considered for addressing land use planning. This chapter further states that:

> "Rindge's desired future land use should be driven by the Vision Statement which speaks of increased levels of natural resource protection, and retaining a sense of rural character rather than uniformly spreading residential, commercial, and industrial activity across the entire community. The Town's future land use should be driven by the need to protect open space, rights of property owner's and groundwater resources. Future land use needs to take into consideration the potential development that Rindge may experience, and respond to it by providing opportunities that are consistent with the vision statement."

Statement of Purpose

The Rindge Natural Resources Inventory (NRI) was initiated in December 2016. The overall scope of this project was to develop an NRI to support the Rindge's natural resource protection efforts and provide a basis for informed land use planning. Goals of the project were 1) to develop a series of NRI maps designed for educational and planning purposes, 2) to refine existing data for grasslands and to vernal pools from previous ecological investigations, and 3) to combine the various natural resources data and maps into a report.

Rindge's Physical Landscape

Rindge covers approximately 49 square miles, or 25,000 acres, of mostly forested and hilly terrain (Figures 1 and 2). Its topography is highly variable, ranging in elevation from approximately 900 feet around Contoocook Lake and Pool Pond to 1,505 feet on the lower slopes of Pratt Mountain along the eastern town boundary. The landscape is further characterized by the rolling hills of Todd Hill, Griswold Hill, Thrasher Hill, and Pratt Mountain.

Major water bodies include Lake Monomonac, Contoocook Lake, Pearly Pond, Hubbard Pond, Pool Pond, Grassy Pond, Emerson Pond, Crowcroft Pond, Robbins Pond, Bullet Pond, Pecker Pond, Stump Pond, and Divol Pond. Extensive wetland systems grace many sections along rivers and streams, including the town's most notably significant Converse Meadow. These varying landforms offer great diversity for wildlife and plant communities alike.

The most heavily developed areas in Rindge can be found along Main Street, Route 202, and Route 119. The majority of the town is dotted with residences, which are scattered throughout. As such, Rindge is characterized as a rural community. Conservation and town-owned lands can be found throughout Rindge. It is home to Annett State Forest, Rindge Town Forest, and Converse Meadow, as well as many others.

The Parcel Base Map (Figure 3) provides an opportunity to better understand how Rindge landscape has been parceled, or divided into separate properties. This map demonstrates the relative size and distribution of properties throughout the town. To better understand acreage and ownership, as well as tax parcel map and lot number, refer

to the paper maps located in the Town Office or visit the following website: http://www.rindgenh.org/towncloud/content/-97

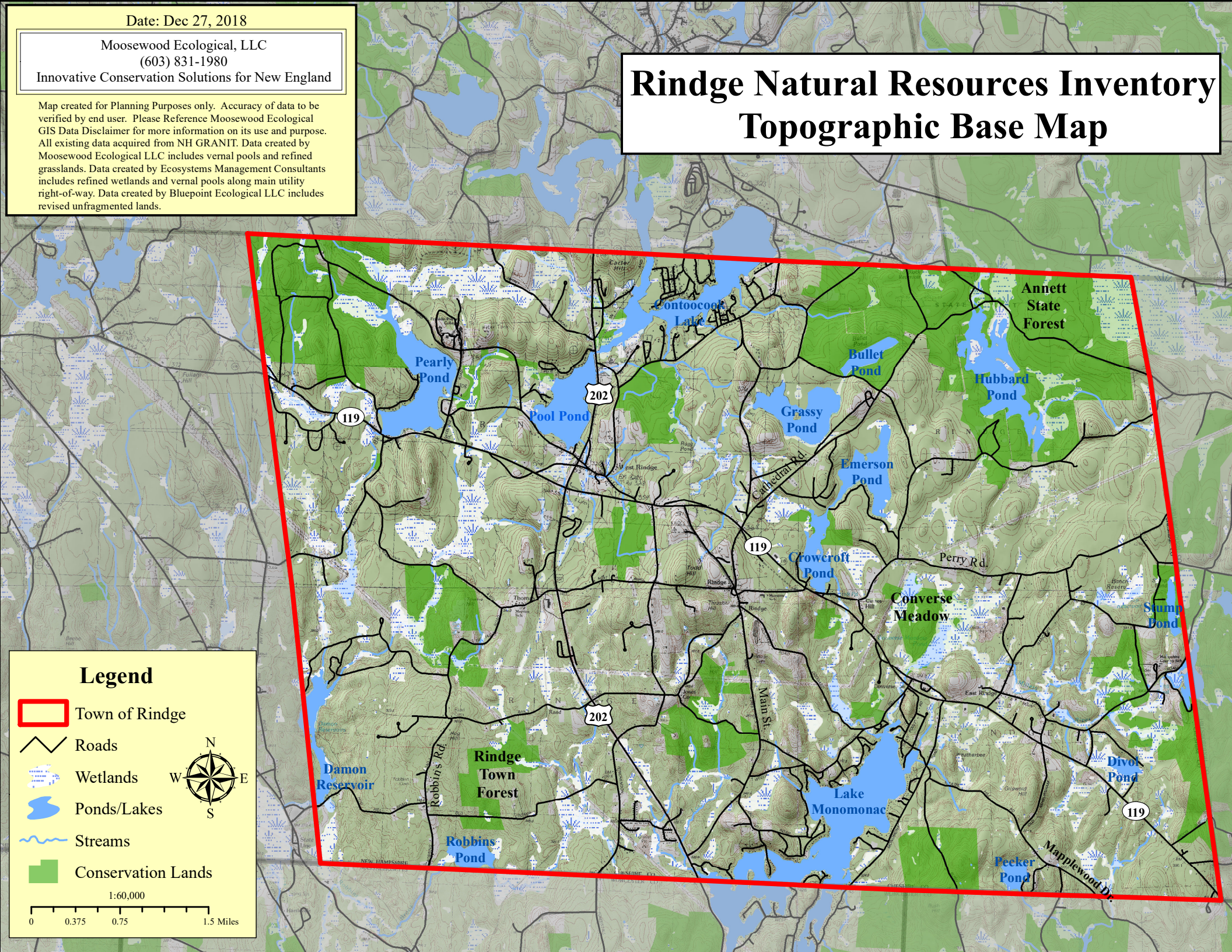
This double stonewall is filled with small stones as a result of annual cultivation by the early colonists at the Schoolhouse Park property.

Date: Dec 27, 2018

Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England

Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.

Rindge Natural Resources Inventory
Topographic Base Map



Legend

- Town of Rindge
- Roads
- Wetlands
- Ponds/Lakes
- Streams
- Conservation Lands

1:60,000

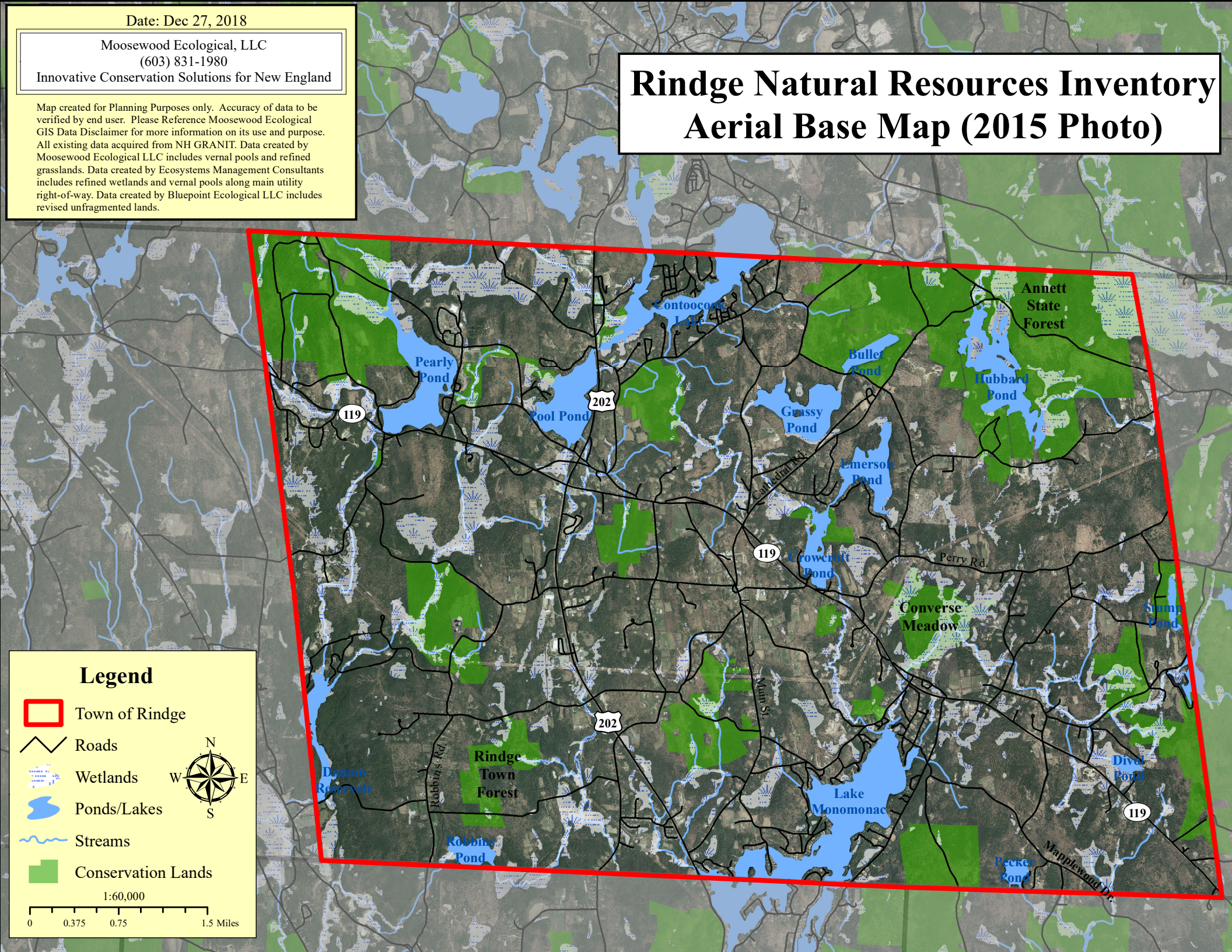
0 0.375 0.75 1.5 Miles

Date: Dec 27, 2018

Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England

Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.

Rindge Natural Resources Inventory
Aerial Base Map (2015 Photo)



Legend

- Town of Rindge
- Roads
- Wetlands
- Ponds/Lakes
- Streams
- Conservation Lands

N
W E
S

1:60,000

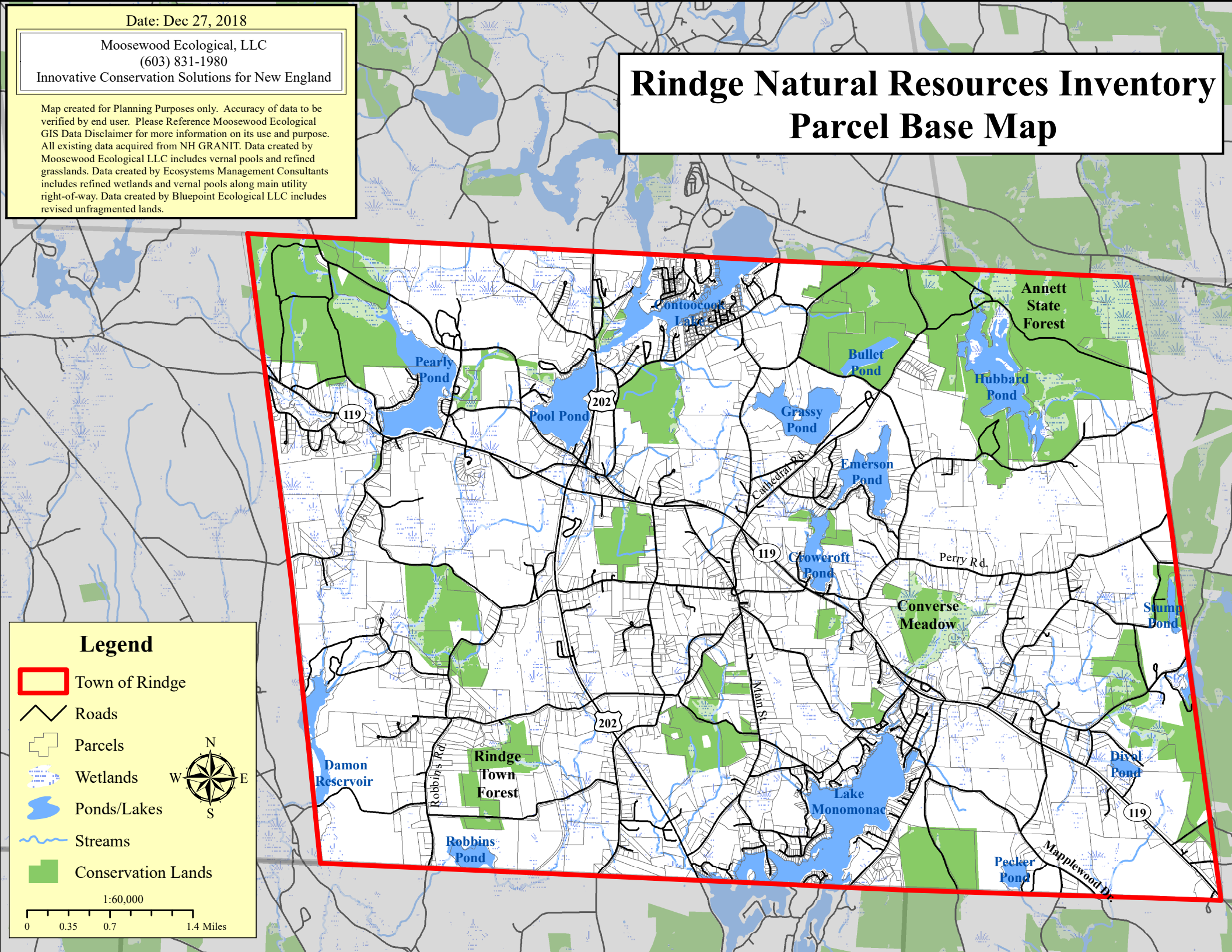
0 0.375 0.75 1.5 Miles

Date: Dec 27, 2018

Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England

Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.

Rindge Natural Resources Inventory
Parcel Base Map



Legend

- Town of Rindge
- Roads
- Parcels
- Wetlands
- Ponds/Lakes
- Streams
- Conservation Lands

N W E S

1:60,000

0 0.35 0.7 1.4 Miles

WATER RESOURCES

Water resources represent some of our most fragile ecosystems and are particularly sensitive to certain types of land use. Water resources comprise a variety of natural features, which include both surface water and groundwater resources. Such features include our streams, ponds, wetlands, and aquifers. In terms of their importance, these resources provide a variety of ecological functions and societal values, including:

- Water quality maintenance
- Flood control
- Wildlife and fisheries habitat
- Drinking water sources
- Recreation
- Visual quality and aesthetics
- Rare and endangered species habitat and natural communities
- Groundwater recharge and discharge
- Shoreline stabilization
- Educational and scientific value
- Overall biological diversity

Surface Water Bodies

Rindge contains a variety of surface water bodies, including rivers, streams, ponds, and lakes, that are distributed throughout the Town (Figure 4). Not only do water bodies provide a multitude of human benefits such as fishing, hunting, boating, swimming, and nature watching, they are also extremely significant for diverse wildlife and plants that depend upon these resources for part or all of their life cycle needs. Generally, major threats to water resources include potential water quality degradation and habitat loss due to surrounding land uses, including unsustainable forestry and agricultural practices and land conversion associated with various types of developments.

Lakes and ponds in Rindge cover approximately 1,585.8 acres, ranging in size from 16 acres to 405 acres (Table 1 and Figure 4). These have been recognized and labeled as such by the NH Dept. of Environmental Services and/or the US Geological

Survey. Twenty lakes and ponds are included on the NH Dept. of Environmental Services Consolidated List of Water Bodies subject to the Shoreland Water Quality Protection Act under RSA 483-B. These include Black Reservoir, Bullet Pond, Contoocook Lake, Crowcroft Pond, Divol Pond, Emerson Pond, Grassy Pond, Hubbard Pond, Island Pond, Lower and Upper Damon Reservoir, Monomonac Lake, Pearly Lake, Pecker Pond, Pool Pond, Robbins Pond, Stump Pond, Tarbell Brook Dam, and Van Dyke Dam. An additional 42 ponds, totaling 42.7 acres, have also been identified through refined mapping efforts. These are rather small waterbodies, ranging in size from 0.1 acres to 8.1 acres.

Table 1 Summary of lakes and ponds in Rindge, NH.

Lakes and Ponds	Size (acres)
Lake Monomonac^	594
Contoocook Lake*	348
Pearly Pond	187.3
Hubbard Pond	177.8
Pool Pond	140.1
Grassy Pond	126.2
Emerson Pond	97.7
Crowcroft Pond	65.9
Robbins Pond	42.4
Bullet Pond	34.4
Pecker Pond	22.9
Stump Pond	17.2
Divol Pond	16
Other Ponds	79.4

SOURCE: USGS topography, GRANIT hydrogrpahy datasets

*= 173.5 acres are located within Rindge

^= 405 acres are located within Rindge

Approximately 67.1 miles of rivers and streams have been mapped in Rindge (Table 2 and Figure 4). Five of these have been identified by the U.S. Geological Survey by name. Of the many rivers and streams, only one is included on the NH DES Consolidated List of Water Bodies subject to the Shoreland Water Quality Protection Act under RSA 483-B. NH DES considers the stream outlet of Poole Pond is where the Contoocook River begins, and the entire stretch has been designated.

Table 2 Summary of rivers and streams in Rindge, NH.

Streams	Length (miles)	Stream Order
Tarbell Brook	6	3rd
Lord Brook	2.7	3nd
Robbins Brook	1.6	2nd
Bear Meadow Brook	0.4	1st
North Branch Millers River	7.9	4th
Other Streams	48.5	1st-3rd

SOURCE: USGS topography, GRANIT hydrogrpahy datasets, NH DES

The Shoreland Water Quality Protection Act (RSA 483-B) is a state statute that was prepared to protect water quality for designated public waters. The Act establishes minimum standards for various setbacks from the reference line based on land use within the designated 250-foot buffer. For most new construction, as well as land excavating and filling, a state permit may be required (certain exemptions apply). As such, all great ponds (>10 acres), fourth order streams[2] or higher, and state-designated rivers have been identified by the NH Dept. of Environmental Services as water bodies that are subject to the Act.

For more details on the Act, as well as certified administrative rules, refer to the NH DES at http://des.nh.gov/organization/divisions/water/wetlands/cspa/index.htm

Tarbell Brook as it runs through the Schoolhouse Park property.

[2] Stream ordering is a hierarchy used to define the size of a stream. The smaller the stream order the smaller the stream. First order streams include the "starter" streams that can be found along the steep slopes of Groton. When two first order streams meet they form a second order stream, and so on.

Wetlands

Wetlands generally include familiar places such as marshes, wet meadows, beaver impoundments, swamps, fens, bogs, and other surface water bodies. As noted above, they perform a variety of ecological functions and values, such as providing significant habitats for wildlife and plants, maintaining good water quality, providing storage during a flood event, and sources for recreation. In New Hampshire, wetlands are defined by RSA 482-A:2 as "an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soils conditions." As such, wetlands are regulated by the NH Dept. of Environmental Services Wetlands Bureau as defined by RSA 482-A:2.

The US Fish and Wildlife Service's National Wetlands Inventory (NWI) and US Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) hydric soils were mapped to better understand the extent of wetlands within Rindge. These combined datasets provide for a more balanced approach at wetlands mapping. A portion of Rindge's wetlands were revised by Ecosystems Management Consultants (2015) using aerial photography interpretation and limited site visits for the Eversource electric transmission line right-of-way. However, a comprehensive mapping of Rindge's wetlands has yet to be completed.

The NWI is a hierarchal system of classification that was designed to map wetlands throughout the United States. The purpose was to determine wetlands loss over time. It also serves as a systematic method for comparing wetlands within a defined geographic location (i.e., town or watershed). The NWI provides some very useful information including the type of wetland as well as its hydrology, associated plant communities, water chemistry, and other modifiers such as human dams and beaver influence.

Rindge is estimated to have roughly 4,598.6 acres of wetlands dispersed throughout the Town (Table 3 & Figure 4). The largest and most extensive wetlands can be found along the various streams and rivers. However, the landscape provides small pockets of isolated wetlands as well.

Table 3 Summary of wetlands in Rindge, NH.

Wetland Classification	Area (acres)
Lacustrine (total)	1585.8
Palustrine (total)	3012.8
Emergent	337.5
Forested	1527.9
Scrub-shrub	467.9
Unconsolidated Bottom	196.2
Un-Classified	483.3

SOURCE:National Wetlands Inventory data layer and Ecosystems Management Consultants

To gain a better sense of the true extent of wetlands it is important to also consider hydric soils. Essentially, these are wetland soils, including poorly drained and very poorly drained soil types. These have been mapped by the USDA Natural Resources Conservation Service. Poorly drained soils are estimated to cover about 1,971.4 acres while very poorly drained soils cover 3,015.6 acres. These are estimates and field checking is needed when appropriate.

This diverse wetland ecosystem at Converse Meadow Conservation Area provides significant habitats for wildlife and plants alike.

In 1993, the Rindge Conservation Commission engaged in a wetland evaluation project (Van de Poll 1993). This project sought to better understand the various functions and values of a subset of wetlands in town within 5 areas, including Taggert Meadow, Converse Meadow, Crowcroft Pond, Old Ashburnham Road vicinity, and the commercial and business district along Route 202. The Method for Inventorying and Evaluating Nontidal Wetlands in New Hampshire (NH Method) was used to evaluate the selected wetlands.

This evaluation determined that the wetlands associated with Converse Meadow and Crowcroft Pond had some of the highest functional values for ecological integrity, wetland wildlife, finfish habitat, recreation, historical potential, and noteworthiness (a functional value that examines a variety of features such as rare species habitat, biological and geological uniqueness, and potential for an archaeological site). The wetlands at Taggert Meadow also ranked fairly high, especially for educational potential. However, in general the wetlands along Route 202 had much lower rankings due to the degree of development in this area.

While this report provides a good base of knowledge on functional values of certain wetlands in Rindge, it is very limited in its study area in the town. Also, the NH Method was recently updated (Stone and Mitchell 2015), reflecting new knowledge in wetlands science and technological advancements in mapping over the past 26 years since the publication of the original manual. Therefore, it is highly recommended that Rindge revises the wetlands evaluation to include the entire town using the updated methodology. This would afford the opportunity to compare functional values of wetlands on a town-wide basis.

Watersheds

All of the previously discussed water resources reside in a particular watershed. A watershed is the area that drains to a common water resource. This may be a wetland, stream, or lake, and the land use within a particular watershed can have a direct effect on the quality and quantity of surface waters, wetlands, and the underlying aquifers. Land use planning that uses a watershed approach can have a great impact on a town's water

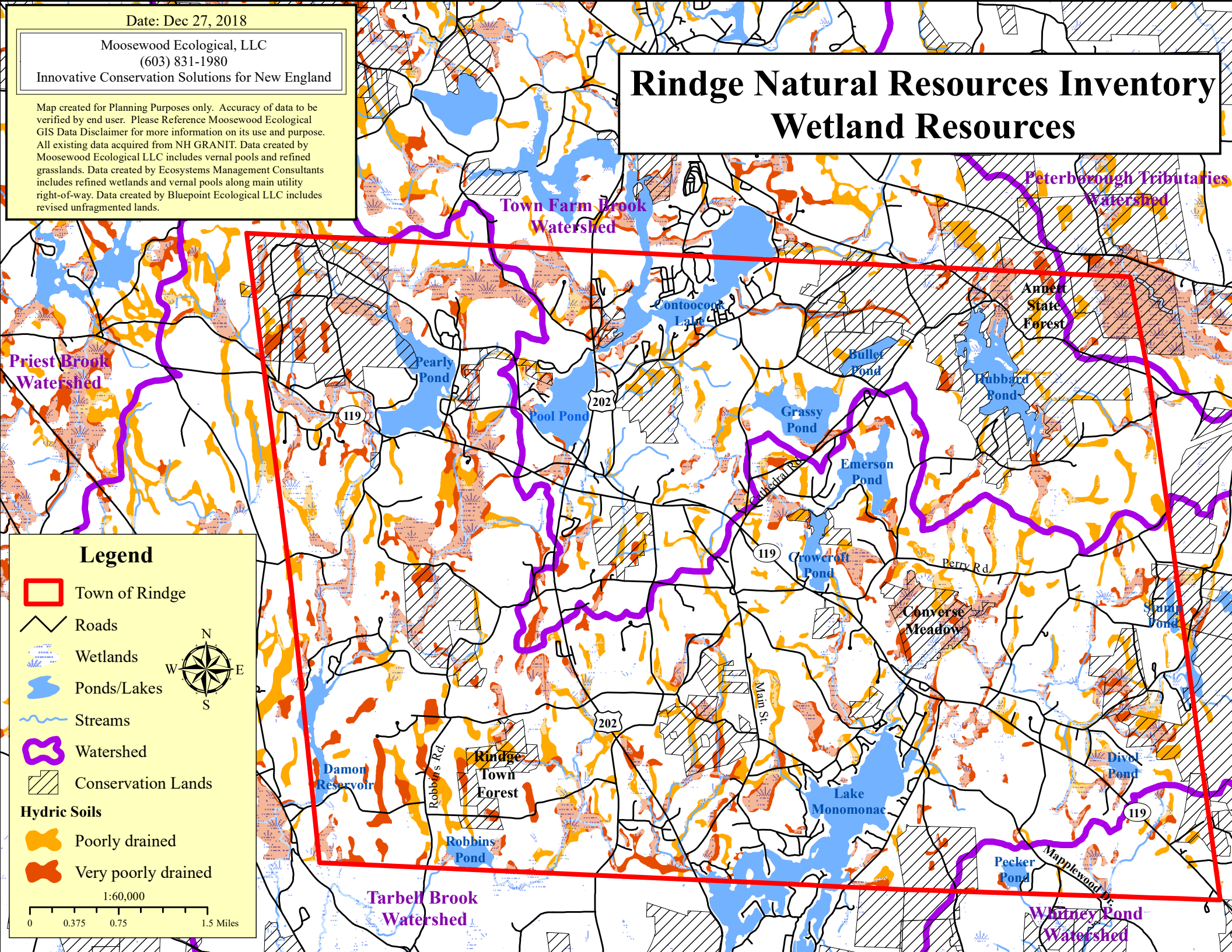
resources. This is important since we all depend upon clean water to help sustain life. Rindge is divided into 4 major watersheds (Table 4 and Figure 4).

Table 4. Summary of major watersheds in Rindge.

Watershed	Total Area (acres)	Area in Rindge (acres)
Peterborough Tributaries	28,113	272.9
Town Farm Brook	27,144	7106
Torbell Brook	38,605	17253.5
Whitney Pond	18,337	836.6

SOURCE: USGS HUC 12 watersheds from GRANIT

Pearly Pond is the third largest waterbody in Rindge.


Date: Dec 27, 2018
Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England
Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.
Rindge Natural Resources Inventory
Wetland Resources
Peterborough Tributaries Watershed
Town Farm Brook Watershed
Priest Brook Watershed
Tarbell Brook Watershed
Whitney Pond Watershed
Contoocook Lake
Annett State Forest
Pearly Pond
Pool Pond
Bullet Pond
Hubbard Pond
Grassy Pond
Emerson Pond
Crowcroft Pond
Converse Meadow
Stump Pond
Damon Reservoir
Rindge Town Forest
Robbins Pond
Lake Monomonac
Divol Pond
Pecker Pond
119
202
Cathedral Rd
Perry Rd
Main St
Robbins Rd.
Applewood Dr.
Legend
Town of Rindge
Roads
Wetlands
Ponds/Lakes
Streams
Watershed
Conservation Lands
Hydric Soils
Poorly drained
Very poorly drained
N
W
E
S
1:60,000
0
0.375
0.75
1.5 Miles

Groundwater Resources - Stratified Drift Aquifers

Groundwater resources are stored in two main types of aquifers and can serve as sources for drinking water. Aquifers can be located within saturated areas of sand and gravel deposits or in fractured bedrock. In the past as glaciers melted, they left behind layers of coarse sediments including sand and gravel. The space between these sediments provides opportunity for groundwater storage and flow. Groundwater stored in *stratified drift aquifers* of this kind can serve as an excellent source for drinking water. Locating and protecting these geologic features can help to ensure a supply of clean drinking water for the community as these areas are vulnerable to contamination.

Rindge contains approximately 2,800.6 acres of stratified drift aquifers (Table 5 and Figure 5). The largest and most significant aquifers are associated with Contoocook Lake, Hubbard Pond, and Poole Pond in the northern part of town, as well as with Monomonac Lake in the southern part. Smaller aquifers are associated with Divol Pond in the southeast and Damon Reservoir along the western town boundary.

Table 5 Summary of aquifers and favorable gravel well analysis in Rindge, NH.

Groundwater Attribute	**Size (acres)**
Stratified Drift Aquifer Transmissivity Rates	
<2,000 feet^2/day	2590.4
2,000-4,000 feet^2/day	210.1
>4,000 feet^2/day	0.0
Favorable Gravel Well Analysis	
>75 Gallons/Minute	91.6

Source: USGS stratified drift aquifers (GRANIT 2000) and NH DES favorable gravel well analysis (2011).

Aquifers are divided into categories based on *transmissivity*, or the rate at which water moves through an aquifer and is measured in square feet per day (ft^2/day). Therefore, higher rates of transmissivity correspond to a potentially higher yield of groundwater. Most of the aquifers in Rindge have a transmissivity rate of 2,000ft^2/day or less, which corresponds to a potential yield of less than 75 gallons per minute. However, a few smaller areas are predicted to have a much higher yield.

While transmissivity takes into account the quantity of water moving through an aquifer system it does not reflect the quality of the source. To assist in addressing this issue and to identify potential future public water supplies for communities, the NH Dept. of Environmental Services and the Society for the Protection of NH Forests prepared a Potential Favorable Gravel Well Analysis (PFGWA).

This technique analyzed the potential condition of stratified drift aquifers, affording the opportunity for town planners and water suppliers to determine quantity and quality constraints on aquifers. In doing so, the PFGWA creates buffers to eliminate all known and potential contamination sources and examines potential well yield to identify the most suitable areas for potential community wells. As such, the higher yielding aquifers associated with Contoocook Lake, Hubbard Pond, and Monomonac Lake have been identified by the PFGWA. It was estimated that these sites could produce more than 75 gallons per minute with a few sites potentially producing more than 150 gallons per minute.

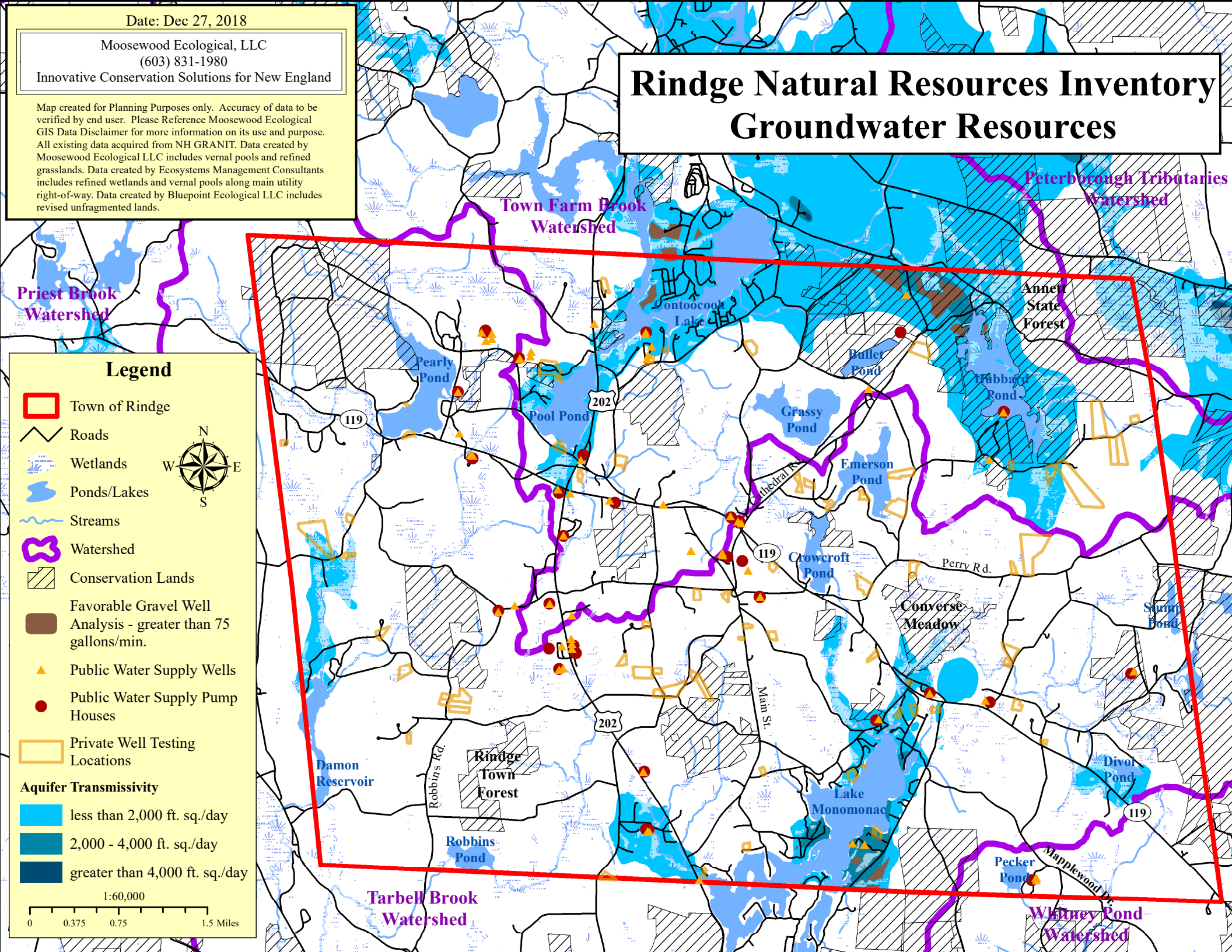
In effect, this effort is encouraging communities to take proactive measures at protecting their most significant groundwater resources; a resource we all depend upon. Susca (1992) highlighted the importance of groundwater protection in Rindge. His report assessed underground storage tanks (particularly tanks containing petroleum products) and the potential risk to human health from leaking tanks that can affect drinking water supplies and aquifers. He emphasized the need for early detection as a proactive measure for maintaining the quality of groundwater resources. His report also provided the town with various recommendations to help maintain the quality of groundwater drinking supplies in town.

At the time, his recommendations included regulatory measures to amend language for underground storage tanks in the site plan review regulations, zoning ordinances, and aquifer protection district. These amendments sought to enhance current town regulations that would bring underground storage tanks into compliance with state and local laws and other measures for ground water protection. As such, the Rindge Planning Board has since adopted these measures, helping to ensure residents that present and future drinking water sources will be safe. However, regulatory protection is only part of the solution.

Susca (1992) also suggested some basic non-regulatory measures. These included a program for environmental outreach and education for the community, town boards, and business owners. The emphasis of this program focused on the hazards posed by underground storage tanks, as well as methods that can be used to reduce hazards to drinking water supplies and aquifers. These recommendations cannot be over emphasized since voluntary actions are also needed to help protect this critical resource.

In addition, the NH Dept. of Environmental Services has mapped known and potential contamination sources throughout the state, including Rindge. These data were used as part of identifying potential future community water supplies. They also help assist with town planning and community education. It is highly recommended that these data be consulted when assessing future land use changes and development proposals to better understand how they relate to the proposed projects.

This wetland associated with the Contoocook Marsh Conservation Area helps to recharge one of Rindge's largest and most productive stratified drift aquifers.


Date: Dec 27, 2018
Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England
Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.
Rindge Natural Resources Inventory
Groundwater Resources
Legend
Town of Rindge
Roads
Wetlands
Ponds/Lakes
Streams
Watershed
Conservation Lands
Favorable Gravel Well Analysis - greater than 75 gallons/min.
Public Water Supply Wells
Public Water Supply Pump Houses
Private Well Testing Locations
Aquifer Transmissivity
less than 2,000 ft. sq./day
2,000 - 4,000 ft. sq./day
greater than 4,000 ft. sq./day
N
W
E
S
1:60,000
0
0.375
0.75
1.5 Miles
Priest Brook Watershed
Town Farm Brook Watershed
Peterborough Tributaries Watershed
Tarbell Brook Watershed
Whitney Pond Watershed
Pearly Pond
Pool Pond
Contoocook Lake
Annett State Forest
Bullet Pond
Hubbard Pond
Grassy Pond
Emerson Pond
Crowcroft Pond
Converse Meadow
Sump Pond
Damon Reservoir
Ridge Town Forest
Robbins Pond
Lake Monomonac
Divol Pond
Pecker Pond
119
202
Cathedral Rd.
Perry Rd.
Main St.
Robbins Rd.
Mapplewood Dr.

ECOLOGICAL RESOURCES

Wildlife Habitats

The NH Fish and Game Department, in cooperation with other agencies, organizations, and individuals, produced the NH Wildlife Action Plan (WAP) in 2005 and revised it in 2015. This document was designed as a planning and educational tool for federal, state, and municipal governing bodies, conservation commissions, land trusts and other conservation organizations, natural resource professionals, and private landowners, as well as the general public.

The WAP was developed to promote the conservation and management of New Hampshire's biological diversity. It provides a resource for developing informed land use decisions and land management planning. The intent was to ensure an adequate representation of various wildlife habitats are maintained across our landscape, keeping common species common in New Hampshire and working to prevent the loss of our rare and endangered species.

A total of eleven wildlife habitats were mapped by the WAP in Rindge (Table 6 and Figure 6). These habitats should be field verified to the extent possible to confirm the location, extent, and habitat type. For this project, grasslands were refined based on 2015 aerial photography interpretation. Confirmed vernal pools were mapped during various field assessments (Littleton 2005 and 2012, Bluepoint Ecological 2007, and Van de Poll 2016a and 2016b; Figure 7).

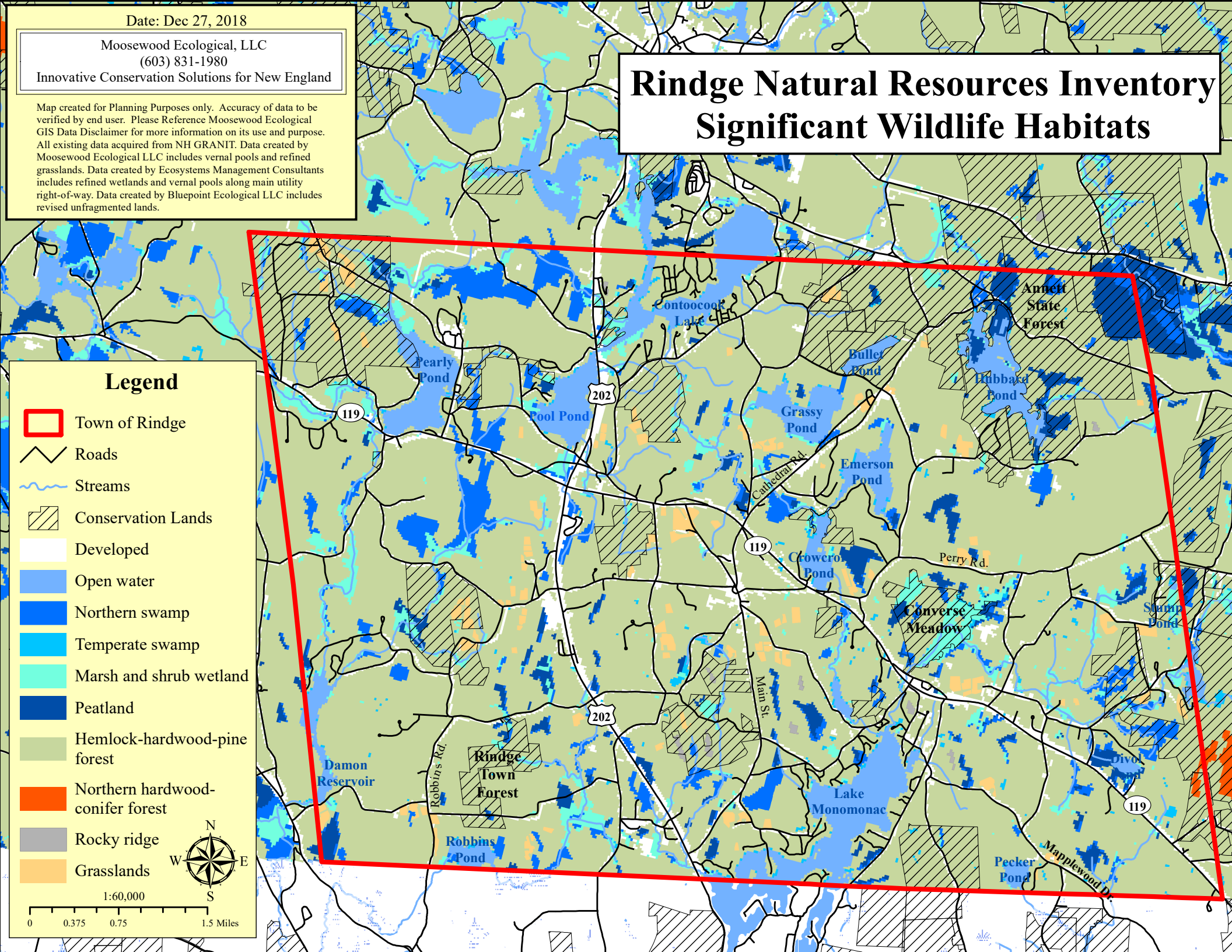
The WAP does recognize vernal pools as a significant wildlife habitat, but they have not been mapped for New Hampshire. Mapping vernal pools on a state-wide level would entail a major effort and expense. However, the need is apparent and this significant resource will eventually be part of the WAP habitat maps. The NH Natural Heritage Bureau, as well as many other organizations, have been working on mapping vernal pools across the state. Therefore, cohesion among these organizations is a necessary next step. As such, potential vernal pools can be mapped from aerial photography interpretation but site assessments are needed to confirm the location and extent of verified vernal pools and to identify obligate species (i.e., wood frogs, spotted salamanders, and fairy shrimp) within them.

Vernal pools provided critical breeding habitat for many obligate species, such as spotted salamanders, wood frogs, Jefferson salamanders, and fairy shrimp. There are at least 136 confirmed vernal pools in Rindge and many more are expected to be present throughout the town.

Table 6 Summary of wildlife habitats in Rindge, NH.

Wildlife Habitat	Size/Count	% of Town
Grassland	419.8 acres	1.65
Hemlock-hardwood-pine	17818.8 acres	69.96
Barren or Developed	1720.3 acres	6.75
Northern hardwood-conifer	11.6 acres	0.05
Northern swamp	1140.6 acres	4.48
Open water	1581.1 acres	6.21
Peatland	786.2 acres	3.09
Rocky ridge	32.3 acres	0.13
Temperate swamp	168.4 acres	0.66
Marsh and shrub wetland	985.6 acres	3.87
Streams	67 miles	n/a
Confirmed Vernal Pools	136 pools	n/a

Source: Grasslands and potential vernal pools mapped by Moosewood Ecological (2017) using aerial photography and National Wetlands Inventory (2001); confirmed vernal pools mapped using field assessments by Moosewood Ecological (2004 and 2011), Bluepoint Ecological (2007), and Ecosystems Management Consulting (2015); NH Hydrography (2006) and Wildlife Action Plan (2015) from GRANIT


Date: Dec 27, 2018
Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England
Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.
Rindge Natural Resources Inventory
Significant Wildlife Habitats
Legend
Town of Rindge
Roads
Streams
Conservation Lands
Developed
Open water
Northern swamp
Temperate swamp
Marsh and shrub wetland
Peatland
Hemlock-hardwood-pine forest
Northern hardwood-conifer forest
Rocky ridge
Grasslands
N
W
E
S
1:60,000
0
0.375
0.75
1.5 Miles
Contoocook Lake
Annett State Forest
Pearly Pond
Pool Pond
Bullet Pond
Hubbard Pond
Grassy Pond
Emerson Pond
Cathedral Rd.
Crowcrop Pond
Perry Rd.
Converse Meadow
Stump Pond
Damon Reservoir
Robbins Rd.
Rindge Town Forest
Main St.
Lake Monomonac
Robbins Pond
Pecker Pond
Mapplewood Dr.
119
202

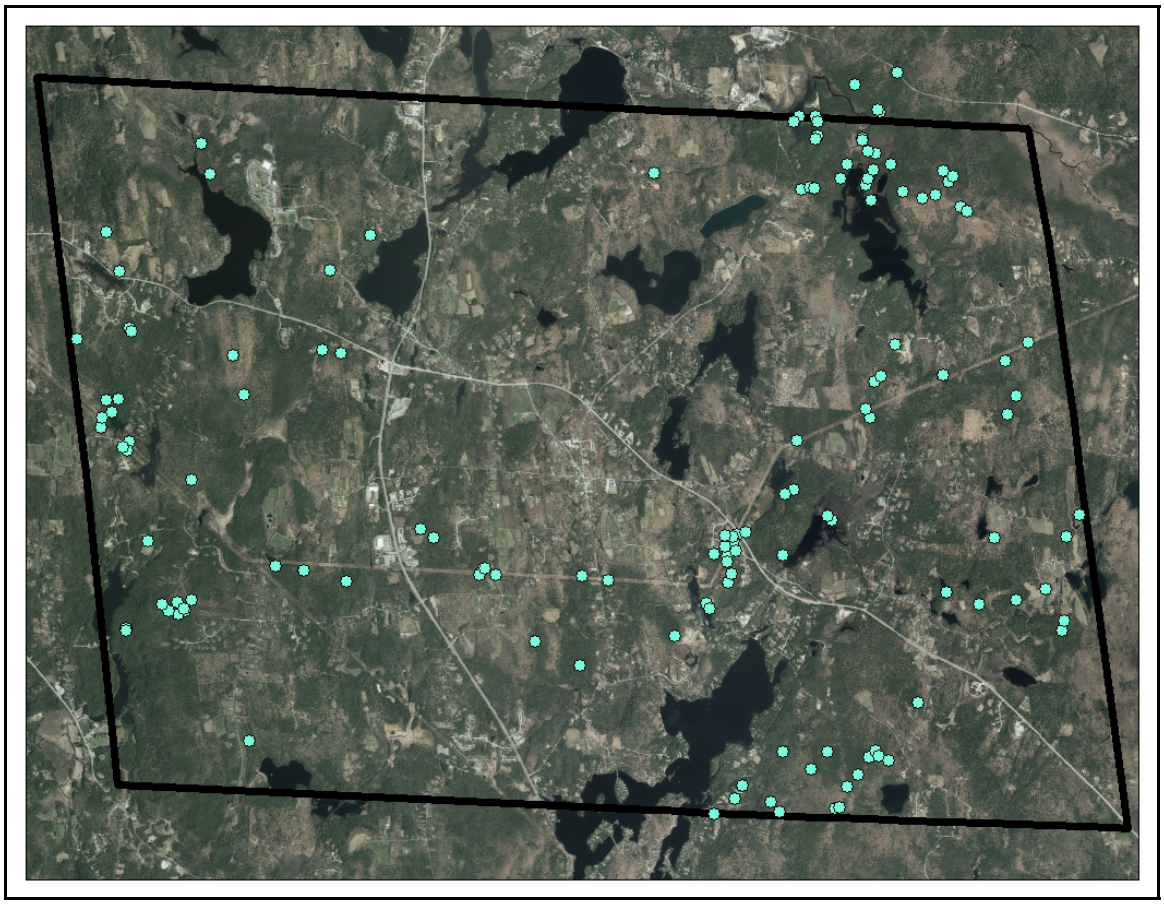


Figure 7 Distribution of confirmed vernal pools throughout Rindge, NH.

The WAP provides a great overall view and critical first step at understanding the complexity and distribution of the various habitats on a property, within a watershed, or throughout Rindge. This "bird's eye" view provides one piece in predicting wildlife diversity and identifying conservation focus areas. However, on-the-ground site assessments provide more in-depth knowledge of the broad habitats in the WAP, as well as fine-scale habitats such as vernal pools, heron rookeries, turtle nesting sites, dens, deer wintering areas, and forest seeps.

Numerous studies have identified and verified many wildlife habitats in Rindge. For instance, ecological inventories conducted by Moosewood Ecological LLC have identified diverse habitats on the Converse Meadow Conservation Area (2005), Annett State Forest (2012), Contoocook Marsh Conservation Area (2014), and the Schoolhouse Park property (2018).

These projects have provided significant ecological data to inform land management planning and stewardship of various habitats such as marsh and shrub wetlands, vernal pools, peatlands, streams, temperate forest swamps, and upland forests. Other studies in Rindge have also been geared towards better understanding of on-site wildlife habitats, including the biodiversity plan (Bluepoint 2007), NED pipeline wetlands assessment (Van de poll 2016a), inventories of various ponds (Wolf 2004, Littleton 2005, and Littleton 2012), and the various land management plans prepared for town-owned properties.

This blooming mountain laurel is associated with an exemplary red spruce swamp in Annett State Forest. It is part of the northern swamp habitat, and is very uncommon in this part of the state.

Biological Diversity – Wildlife, Rare Species, and Exemplary Natural Communities

Rindge has a wealth of plants and wildlife. This diversity has been documented in numerous studies mentioned throughout this document and listed in the Literature Resources section. Ecological investigations have been conducted at Poole Pond, Grassy Pond, Hubbard Pond, Emerson Pond, Pearly Pond, Converse Meadows, Annett State Forest, Contoocook Marsh, Schoolhouse Park property, and the major powerline corridor through Rindge (wetlands and bat investigations), as well as many town-owned properties, private lands by permission, and roadside surveys.

These site investigations have yielded a great abundance of wildlife observations. A total of 186 vertebrate species of wildlife have been recorded in Rindge (Appendix B). Species diversity includes 105 birds, 35 mammals, 14 amphibians, 10 reptiles, 12 fish, and 20 dragonflies and damselflies. Rindge also has some very basic knowledge on some of its aquatic macroinvertebrates (large water bugs seen by the eye without the aid of a microscope) based on a study of Poole Pond, Grassy Pond, Hubbard Pond, and Emerson Pond (Wolf 2004). This study identified various species including 32 dragonflies, 11 damselflies, 15 caddisflies, 8 mayflies, 3 true bugs, 6 aquatic beetles, 6 snails, 4 leeches, 3 crayfish, and 11 other species of aquatic macroinvertebrates (i.e., mussels, mites, and other flies).

While the various ecological investigations have provided a robust knowledge of diversity, these lists should be viewed as a continual work in progress as there are many other known and potential species that exist in Rindge. For instance, few projects have focused on agricultural lands and other open areas that would have a different suite of species, especially birds. Also, there is a lack of information on insects such as bees, butterflies, moths, beetles, flies, dragonflies, and damselflies. Local knowledge and future ecological studies can enhance the town's database of wildlife diversity, helping to educate the community and town officials, as well as assist with future land use planning.

Of the 186 species officially recorded, there are a total of 30 species of greatest conservation need identified in the New Hampshire Wildlife Action Plan, including 15 birds, 9 mammals, 2 amphibians, and 4 reptiles (Appendix B and Table 7). These include federally-threatened species and state-threatened and endangered species, as well as those considered as a special concern due to declining populations, localized populations, or

lack of complete knowledge about the species. In addition, there are many birds identified in regional conservation plans as species of concern, such as various waterfowl, warblers, thrushes, and others.

Table 7 Rare species and exemplary natural communities in Rindge, NH.

Rare Elemental Occurrence	Rarity Rank
Natural Communities - Palustrine Wetlands	
Medium Level Fen System**	
Red Spruce Swamp**	
Plants	
arctic bur-reed (*Sparganium natans*)#	T
pale duckweed (*Lemna valdiviana*)#	E
wild lupine (*Lupinus perennis ssp. perennis*)#	T
Fish	
Banded Sunfish (*Enneacanthus obesus*)**	SC
Birds	
Common Loon *(Gavia immer)* **	T
Reptiles	
Wood Turtle *(Glyptemys insculpta)* ***	SC
Smooth Green Snake (*Opheodrys vernalis*)**	SC
Blanding's Turtle (*Emydoidea blandingii*)**	E
Amphibians	
Slimy Salamander (*Plethodon glutinosus*)# **	
Insects - Dragonflies and Damselflies	
Martha's Pennant (*Celithemis martha*)**	

Source: NH Natural Heritage Bureau database (2018).

E - Endangered

T - Threatened

SC - Special Concern

- Historical observation greater than 20 years ago

** - Very High Importance

*** - Extremely High Importance

As with wildlife, many of the studies above have also begun to catalogue the array of plants in Rindge. Of the many species documented, there are 3 known occurrences of rare plants (Table 7). Two species are state-threatened, while one is state-

endangered. All 3 species were documented more than 20 years ago so their current presence is unknown. There is a high likelihood that other rare plants exist in Rindge.

Another element used to understand diversity in Rindge includes the concept of natural communities. The NH Natural Heritage Bureau (NHNHB), a bureau within the Division of Forest and Lands, is responsible for locating, tracking, and facilitating the protection of rare species and exemplary natural communities. They have developed an extensive classification system for natural communities in New Hampshire and have ranked each according to rarity in the state, as well as globally.

The NHNHB maintains a list of known rare elemental occurrences (i.e., rare species and rare and exemplary natural communities) for each town in the state and can provide reports of occurrences that are documented for public conservation lands. However, data on rare elemental occurrences on private properties are not available to the public unless permission has been granted by the landowner to release such data.

Natural communities are assemblages of organisms, their physical environments, and ecological processes that affect them. Essentially, they are ecological units that are repeated on the landscape. Natural communities include both uplands and wetlands such as forests and woodlands, shorelines, vernal pools, forested swamps, peatlands, floodplains, and deep aquatic systems. Each natural community is distinguished by its species composition and physical structure and condition.

These communities provide scientists and resource managers with an ecological understanding of the land and its inhabitants to make intelligent, informed decisions regarding land use. Therefore, natural community classifications provide conservationists with a powerful tool to guide strategic planning. Equally as important, they provide a basis from which inventory and monitoring programs can be developed, and a means to document and track rare species and exemplary natural communities.

This classification system places a heavy emphasis on vegetation. It is the particular composition of the vegetation that helps to define each community. While wildlife is an important aspect of these natural communities they are not considered when classifying them. Mainly because of their high mobility, animals are often associated with a variety of communities and most are not diagnostic in their classification. For example,

a bear's home range can be well over 20 square miles. As such, they are found using a mosaic of natural communities, from wetlands to uplands.

Rindge has two known exemplary natural communities (Table 7). Exemplary communities include rare types or excellent, in tact examples of more common types of natural communities. The medium level fen system and red spruce swamp can be found at Annett State Forest. Other natural communities deserving of further investigations include the water lobelia aquatic sandy pond shore observed at Grassy Pond (Wolf 2004), which is rare, and the black gum swamps at the Rindge Town Forest (Corwin 2010) and other properties. Other exemplary natural communities most likely exist in Rindge.

This is part of the exemplary medium level fen system located at Hubbard Pond. It comprises a series of floating peat mats surrounded by open water.

Unfragmented Lands and Habitat Connectivity

Unfragmented lands are defined by the surrounding human infrastructure (roads and developed areas). Fragmentation of land can negatively affect species survival rates by increasing mortality, lowering breeding success, or causing species loss altogether. The degree of severity of fragmentation depends upon many aspects, such as the size and shape of unfragmented blocks, the species or community in question, the extent of loss of natural habitats, intensity of human use, and colonization of invasive species.

The NH Wildlife Action Plan (WAP) developed an unfragmented lands analysis. However, this data layer has inherent errors. As such, the unfragmented lands were

revised to more accurately reflect Rindge's landscape (Figure 8). For the purposes of this project, fragmenting features were defined as 500 feet on either side of existing roadways, including all state and town roads but excluding Class VI roads and trails, as well as private driveways. This assumes that most development occurs within 500 feet of roadways. Unfragmented blocks of land include a variety of natural habitats such as forests, wetlands, streams, and ponds but also can include human-modified areas such as agricultural lands and shrublands.

Large blocks of unfragmented areas are widely known to support greater biodiversity than smaller blocks. As forest blocks become smaller due to the construction of roadways and developments their biodiversity generally decreases. This fragmentation affect has less immediate impact on generalist species or those with small home ranges (such as gray squirrel, raccoon, many amphibians, and small rodents) while affecting and potentially eliminating area-sensitive specialists that need large forested blocks in order to maintain their home ranges and for long-term survival (such as bear, bobcat, moose, various reptiles, wood thrush, and goshawk). Appendix C provides a general list of habitat block size requirements for wildlife to help illustrate this point.

Incisor scrapes on this red maple was recently created by a moose as it feeds on the inner bark during the winter. Moose, as well as many other mammals, need large landscapes with habitat connectivity in order to fulfill all of its life cycle needs.

Large landscapes also provide for wildlife movement and habitat connectivity. By maintaining connectivity between critical habitats, it is be possible to provide permanent wildlife corridors within the built environment. Wildlife travel corridors function as areas that one or many species may use to move from one habitat to another. This movement can be based on traveling to various areas for feeding, breeding, nesting, or shelter.

Wildlife must be able to travel safely throughout the landscape in order to meet their biological needs. Many depend upon a variety of habitats for their survival and may utilize many natural features for travel. These include features such as riparian zones of wetlands, ponds and streams, ridgelines, utility right-of-ways, and forest patches acting as a safe route between two or more habitats. A variety of wildlife can be associated with these corridors, including otter, muskrat, fox, coyote, bobcat, deer, moose, fisher, mink, and bear.

Wildlife corridors are not only significant for mammals but equally as important for amphibians, reptiles and migratory birds. Both amphibians and reptiles begin to move from their wintering habitats to their respective breeding and nesting grounds in the spring. This is the time of year that most mortality can be noticed as these species travel across roadways in search of suitable habitats. This affect can often be exacerbated as the same individuals must return back to their wintering habitats.

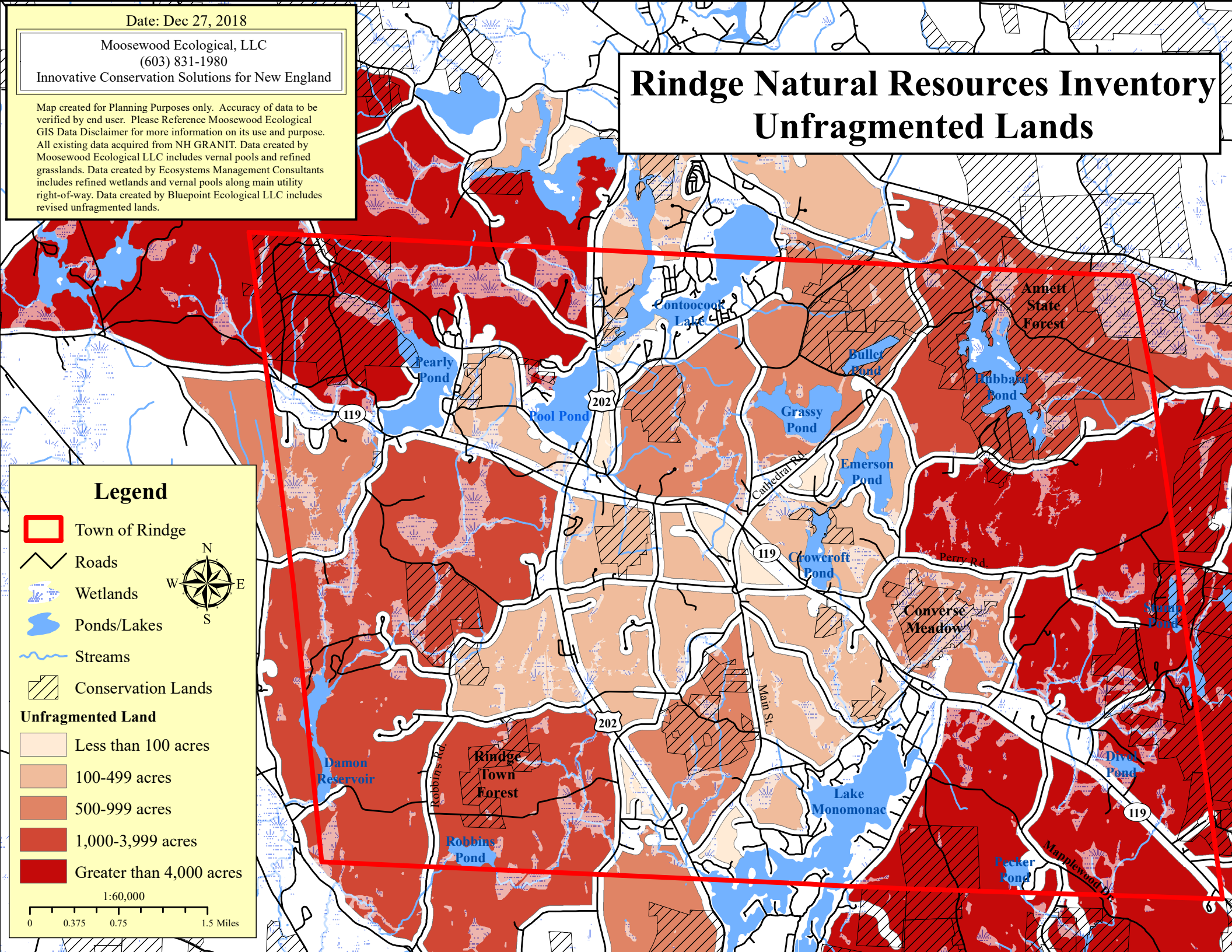
Thus, there is a great significance in maintaining habitat connectivity, as well as understanding where these patterns of movement are taking place. This latter point can be a very important educational tool for community education and awareness about corridors across roadways. It can provide a means to adjust transportation patterns to help eliminate potential road mortality, or identify sites for road modifications to allow wildlife to safely cross.

Date: Dec 27, 2018

Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England

Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.

Rindge Natural Resources Inventory
Unfragmented Lands



Legend

- Town of Rindge
- Roads
- Wetlands
- Ponds/Lakes
- Streams
- Conservation Lands

Unfragmented Land

- Less than 100 acres
- 100-499 acres
- 500-999 acres
- 1,000-3,999 acres
- Greater than 4,000 acres

N W E S

1:60,000

0 0.375 0.75 1.5 Miles

AGRICULTURAL AND FOREST RESOURCES

Rindge is rich with important soils for both forest management and agriculture. These areas represent some of the best soils for the production of forest products and food, feed, and fiber from farming. These natural resources can help provide us with insight into the potential production within the working landscape.

Important Agricultural Soils

In response to the Farmland Protection Policy Act of 1981[3], agricultural soils were mapped by the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Based on a variety of physical and chemical properties (i.e., drainage, texture, hydric regime, pH, erodibility factor), these soils have been identified as being among the most productive lands for many types of farming practices. These include prime farmland soils, farmland soils of statewide significance, and farmland soils of local significance. Each is defined below by the USDA NRCS:

Prime Farmland

- Soils that have an aquic or udic moisture regime and sufficient available water capacity within a depth of 40 inches to produce the commonly grown cultivated crops adapted to New Hampshire in 7 or more years out of 10.
- Soils that are in the frigid or mesic temperature regime.
- Soils that have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches.
- Soils that have either no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow cultivated crops common to New Hampshire to be grown.
- Soils that have a saturation extract less than 4 mmhoc/cm and the exchangeable sodium percentage is less than 15 in all horizons within a depth of 40 inches.
- Soils that are not frequently flooded during the growing season (less than a 50% chance in any year or the soil floods less than 50 years out of 100.)

[3] As defined by the USDA NRCS: "The Farmland Protection Policy Act of 1981 was established to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses.

- The product of the erodibility factor times the percent slope is less than 2.0 and the product of soil erodibility and the climate factor does not exceed 60.
- Soils that have a permeability rate of at least 0.06 inches per hour in the upper 20 inches.
- Soils that have less than 10 percent of the upper 6 inches consisting of rock fragments larger than 3 inches in diameter.

Farmland of Statewide Importance

These soils refer to land that is not prime or unique but is considered farmland of statewide importance for the production of food, feed, fiber, forage and oilseed crops. Criteria for defining and delineating farmland of statewide importance are determined by a state committee chaired by the Commissioner, New Hampshire Department of Agriculture, Markets and Food, with members representing the University of New Hampshire Cooperative Extension, New Hampshire Association of Conservation Districts and the New Hampshire Office of State Planning. The NRCS State Soil Scientist serves on this committee in an advisory capacity. The original criteria were established on June 20, 1983. It was updated on December 7, 2000.

Soils of statewide importance are soils that are not prime or unique and:

- Have slopes of less than 15 percent
- Are not stony, very stony or bouldery
- Are not somewhat poorly, poorly or very poorly drained
- Includes soil complexes comprised of less than 30 percent shallow soils and rock outcrop and slopes do not exceed 8 percent.
- Are not excessively drained soils developed in stratified glacial drift, generally having low available water holding capacity.

Farmland of Local Importance

Farmland of local importance is farmland that is not prime, unique or of statewide importance, but has local significance for the production of food, feed, fiber and forage. Criteria for the identification and delineation of local farmland are determined on a

county-wide basis by the individual County Conservation District Boards. The original criteria were established on June 20, 1983. Updates are noted according to the county initiating the update. The criteria for soils of local importance in Rindge are as follows:

- Soils that are poorly drained, have artificial drainage established and are being farmed.
- Specific soil map units identified from the NRCS county soil survey legend, as determined by the Conservation District Board.

Important agricultural soils cover approximately 9,543.5 acres, or roughly 37% of Rindge (Table 8 and Figure 9). These soils are widely distributed throughout the town. Prime farmland soils make up about 9% of the total acreage of agricultural soils while farmlands of local and statewide significance represent 91% of these soils.

Table 8 Summary of important soils for farm production in Rindge, NH.

Important Soil Type	Size (acres)	% of Town
Prime Farmland Soils	876.7	3.4
Farmland Soils of Statewide Significance	999.5	3.9
Farmland Soils of Local Significance	7667.3	30.1

SOURCE: GIS Analysis (Moosewood Ecological 2017) of USDA Natural Resources Conservation Service soils.

Sun Moon Farm is just one of Rindge's many active farms.

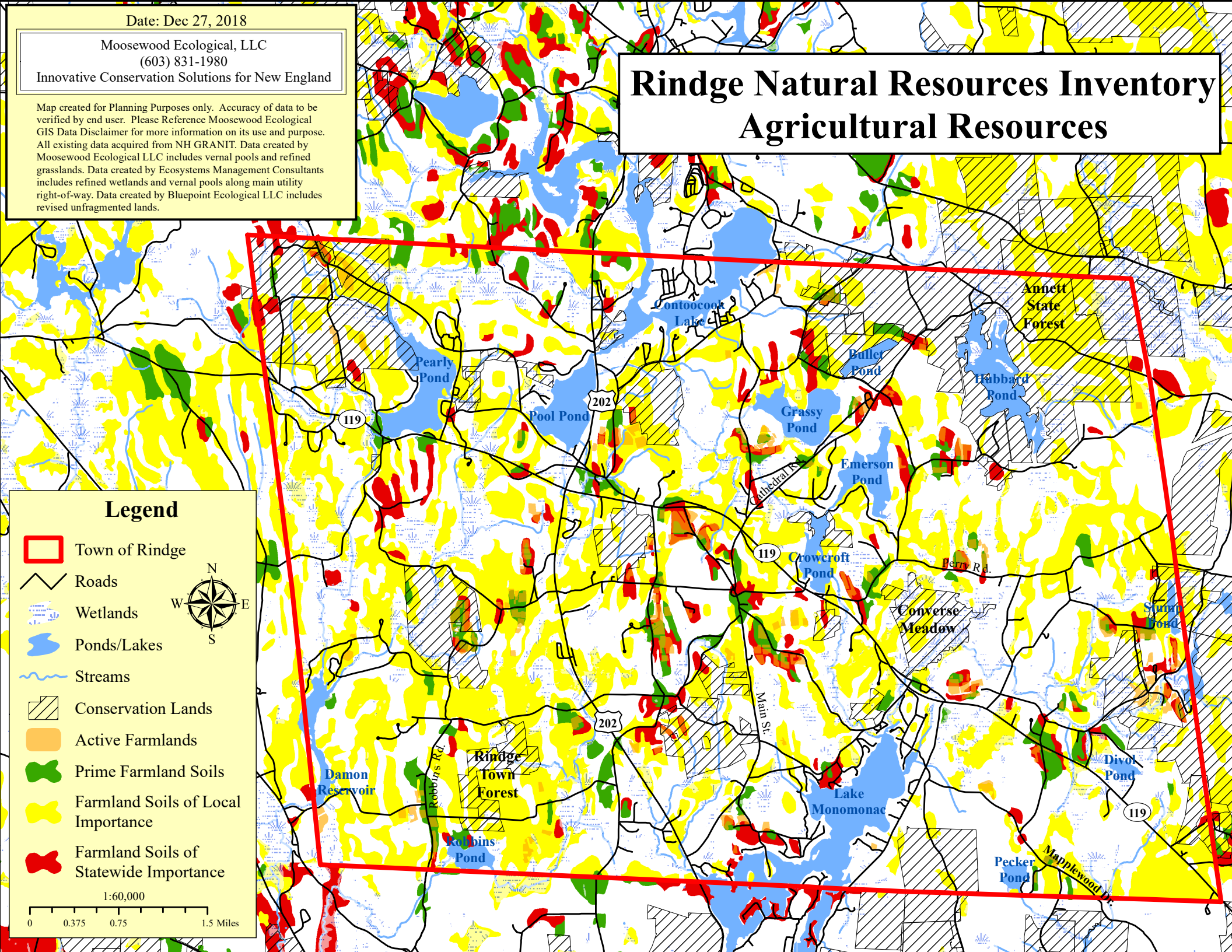
The Board of Selectmen established the Rindge Agriculture Committee as a means to better understand farms and agricultural resources, as well as to engage and lead the community. The goals of this committee include:

- To document and maintain a survey of lands suitable for agriculture and silviculture purposes, and complete an initial census of related local producers, merchants and education resources within Rindge;
- Recognize, publicize, support and otherwise promote on-going agriculture and silviculture activities and enterprises within Rindge, including the cultivation and use of related local product in local homes, properties, schools and businesses;
- Ensure that agriculture and silviculture interests and lands be explicitly incorporated into the Rindge Master Plan;
- Identify significant agriculture and silviculture lands to be preserved in perpetuity within Rindge;
- Establish the groundwork and legitimize the formation of a Rindge Agriculture Commission with the required expertise and authority to apply for and secure grants and other funding to be used to provide incentives for the support and development of agriculture and silviculture activities, protect farm and forest lands, and otherwise procure easements on these lands, dedicated for agriculture and silviculture within Rindge.

To this end, the Rindge Agricultural Commission has begun to develop a list of current farms. While the list below may not be a comprehensive it does provide a good starting point to catalogue farming in Rindge.

- Sun Moon Farm
- Sunny Slope Farm
- Peggy Critter
- Jones Farm
- Sunflower Field Farm
- Ray & Penny Rodriguez

- Fieldstone Farm
- Whites Farm
- Wolterbeek Farm
- Topside Farm
- Asa and Tiffany Unger Clark's Farm
- Mary L. Ware Farm
- Goodwill Farm
- Checkerberry Farm
- Starrett Farm


Date: Dec 27, 2018
Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England
Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.
Rindge Natural Resources Inventory
Agricultural Resources
Legend
Town of Rindge
Roads
Wetlands
Ponds/Lakes
Streams
Conservation Lands
Active Farmlands
Prime Farmland Soils
Farmland Soils of Local Importance
Farmland Soils of Statewide Importance
N
W
E
S
1:60,000
0
0.375
0.75
1.5 Miles
Contoocook Lake
Annett State Forest
Pearly Pond
Pool Pond
Bullet Pond
Hubbard Pond
Grassy Pond
Emerson Pond
Cathedral Rd
Crowcroft Pond
Perry Rd.
Converse Meadow
Sunny Pond
Main St.
Damon Reservoir
Robbins Rd.
Rindge Town Forest
Robbins Pond
Lake Monomonac
Divol Pond
Pecker Pond
Mapplewood Dr.
119
202

Important Forest Soils

Forest resources within New Hampshire are significant for many reasons. They provide sources of employment, a multitude of forest products, promote local economies, recreation and tourism, provide clean air, mitigate the effects of climate change, and provide substantial habitats for wildlife and plants, as well as diverse ecological functions (such as nutrient cycling, carbon sequestration, and water quality maintenance through sediment trapping). For these reasons, it is important to maintain large tracts of forests and to better understand where important forest soils exist in Rindge.

The USDA Natural Resources Conservation Service has mapped the distribution of important forest soils and has classified them according to their capacity to grow trees. These soils signify areas as providing the most productive lands for timber production. The NRCS has identified three soils groups within this category and have described each as follows:

This hemlock-beech-oak-pine forest is common throughout Rindge, as well as southwestern New Hampshire.

Forest Soil Class IA

This group consists of the deeper, loamy textured, moderately well, and well-drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships. The successional trends on these soils are toward stands of shade tolerant hardwoods, i.e., beech and sugar maple. Successional stands frequently contain a variety of hardwoods such as red oak, beech, sugar maple, red maple, white birch, yellow birch, aspen, and white ash in varying combinations with red spruce, hemlock, and white pine. Hardwood competition is severe on these soils. Softwood regeneration is usually dependent upon persistent hardwood control efforts.

Forest Soil Class IB

The soils in this group are generally sandy or loamy over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Successional stands, especially those which are heavily cutover, are commonly composed of a variety of hardwood species such as red oak, red maple, aspen, paper birch, yellow birch, sugar maple, and beech, in combinations with white pine, red spruce, balsam fir, and hemlock. Hardwood competition is moderate to severe on these soils. Successful softwood regeneration is dependent upon hardwood control.

Forest Soil Class IC

The soils in this group are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. White pine, red maple, aspen, and paper birch are common in early and mid-successional stands. Successional trends on these coarse textured, somewhat droughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., hemlock and red spruce. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production. With modest levels of management, white pine

can be maintained and reproduced on these soils. Because these soils are highly responsive to softwood production, especially white pine, they are ideally suited for forest management.

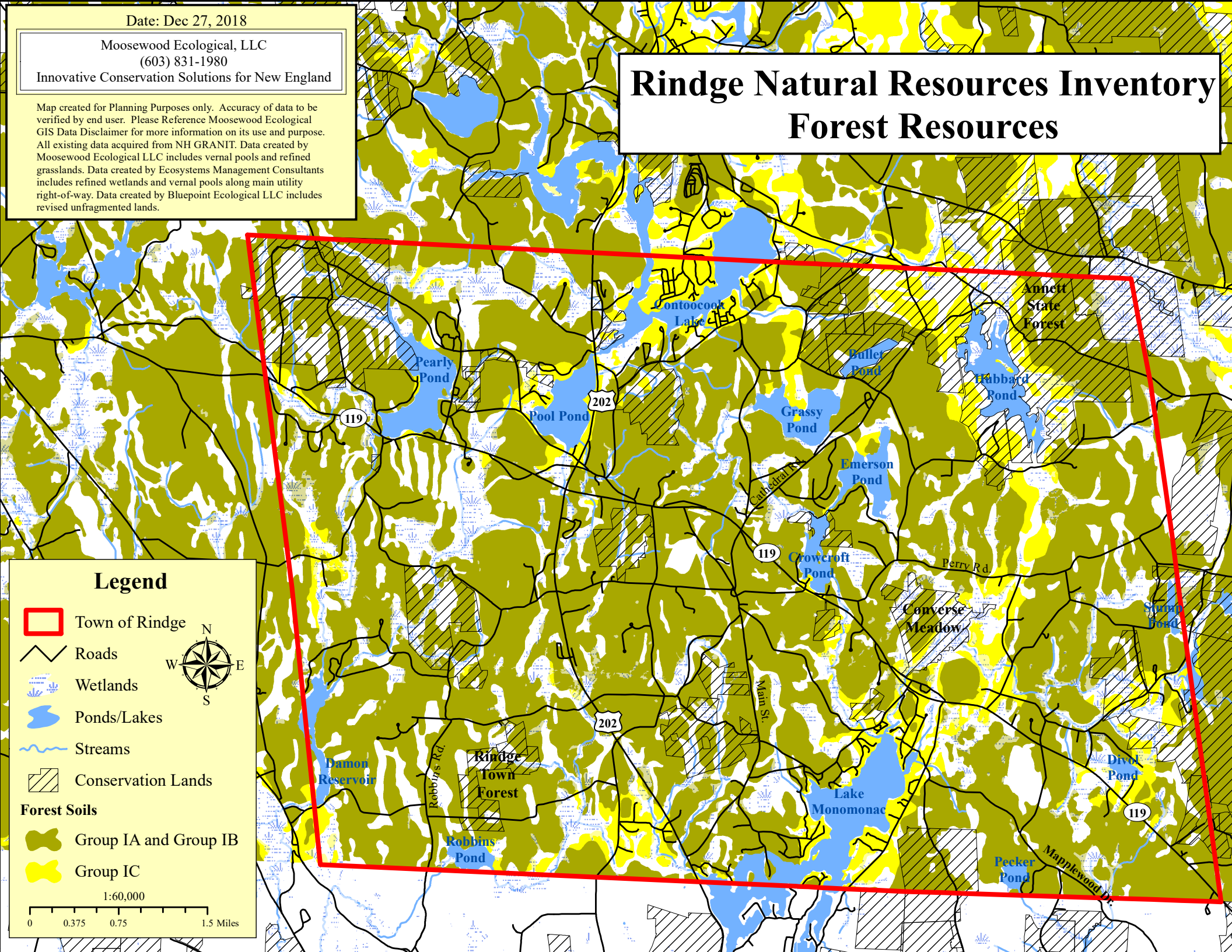
Important forest soils represent nearly 17,500 acres, or approximately 69% of Rindge (Table 9 and Figure 10). Forest soil groups IA and IB make up the majority of this resource and are most ideally suited for hardwood production. Soil group IC appears to be more restricted to stream drainages where outwash sands and gravels were deposited by glacial activity about 11,000 years ago. Group IC soils types are suited for softwood production, mainly white pine.

Table 9 Summary of important forest soils for timber production in Rindge, NH.

Important Soil Type	Size (acres)	% of Town
Hardwood Production (Groups IA and IB)	15,229.8	60
Softwood Production (Group IC)	2267.88	9

SOURCE: GIS Analysis (Moosewood Ecological 2017) of USDA Natural Resources Conservation Service soils.

Large woody debris like this large, old rotting hemlock are an essential aspect to helping maintain healthy forests while providing habitat for many small animals.


Date: Dec 27, 2018
Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England
Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.
Rindge Natural Resources Inventory
Forest Resources
Legend
Town of Rindge
Roads
Wetlands
Ponds/Lakes
Streams
Conservation Lands
Forest Soils
Group IA and Group IB
Group IC
N
W
E
S
1:60,000
0
0.375
0.75
1.5 Miles
Contoocook Lake
Annett State Forest
Pearly Pond
Pool Pond
Bullet Pond
Hubbard Pond
Grassy Pond
Emerson Pond
Cathedral Rd
Crowcroft Pond
Perry Rd
Converse Meadow
Stump Pond
Damon Reservoir
Robbins Rd.
Rindge Town Forest
Robbins Pond
Main St.
Lake Monomonac
Divot Pond
Pecker Pond
Mapplewood Dr.
119
202

STEEP SLOPES

Steep slopes are a critical resource of Rindge's landscape (Figure 11). These areas can present some challenges for various types of land use, such as roads, housing and commercial developments, agriculture, and forest management. Main concerns centered around the alteration of steep slopes include soil erosion and reduced flood resiliency.

Natural vegetation (trees, shrubs, ferns, and wildflowers) and leaf litter, limbs, and downed trees covering the soil on steep slopes helps to absorb rain water during storms and to slow down the flow of surface water. This helps to provide flood resiliency for the community, whereby our forests naturally reduce the amount of water that enters our streams, wetlands, ponds, and lakes. Compounding the steepness of slopes and the effects of potentially excessive flooding is the erosion of soils.

Soil erosion, particularly on steep slopes, creates several concerns. These include soil loss and degradation, loss of nutrients and soil biota, loss of natural vegetation, introduction of invasive plants, excess sedimentation and compromised water quality of wetlands, streams, and lakes, negative effects on aquatic biodiversity, and changes in water flow (both surficial and groundwater).

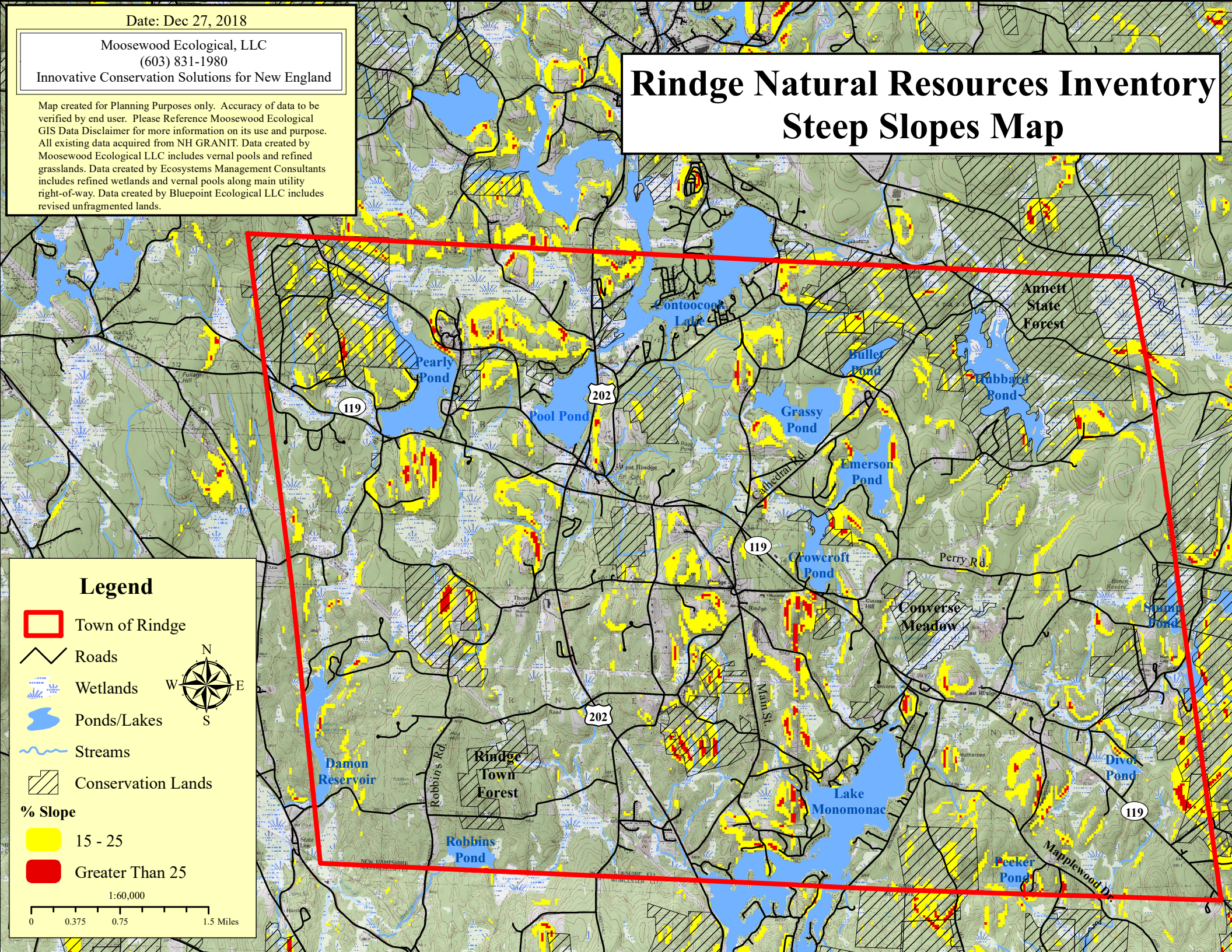
Steep slopes were generated using digital elevation models provide by NH GRANIT database at the Earth Systems Research Center at the University of New Hampshire. This data set provides a more accurate account of slopes than what's available using the slope ranges found in the USDA Natural Resources Conservation Service's soils. Moderately steep slopes (15-25%) account for roughly 2,071 acres, while very steep slopes greater than 25% cover about 205 acres in Rindge.

Date: Dec 27, 2018

Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England

Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.

Rindge Natural Resources Inventory
Steep Slopes Map



Legend

- Town of Rindge
- Roads
- Wetlands
- Ponds/Lakes
- Streams
- Conservation Lands

% Slope

- 15 - 25
- Greater Than 25

N W E S

1:60,000

0 0.375 0.75 1.5 Miles

CONSERVATION LANDS

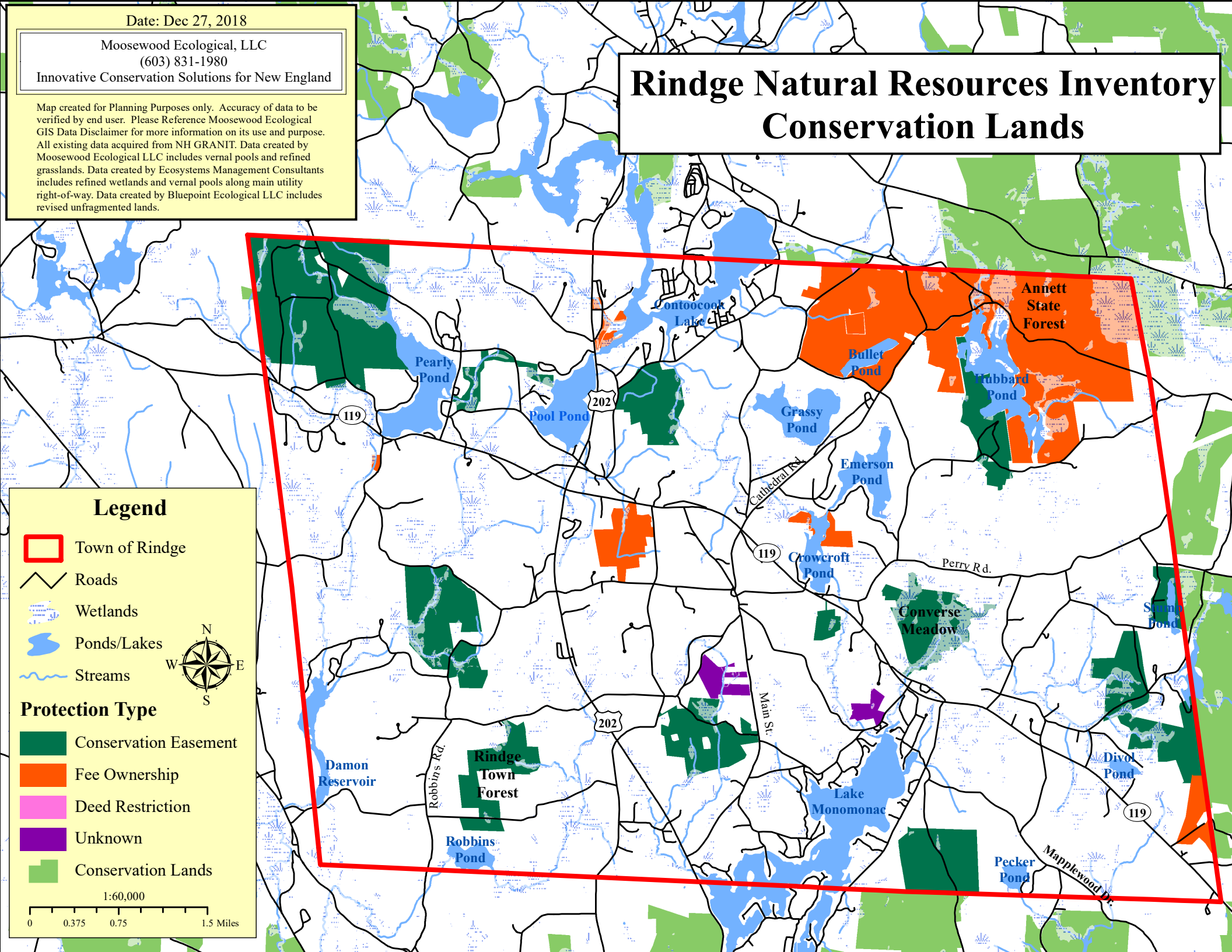
There are approximately 4,766 acres of conservation and town-owned lands in Rindge (Table 10 and Figure 12). The majority of these lands (59%) are privately-owned and protected by conservation easements, whereas 40% of conservation lands and town-owned lands are held under fee ownership and deed restriction. as well. In 2007, Bluepoint Ecological identified about 84 acres of additional conservation lands; however, the type of protection was not documented and therefore, is currently unknown. Therefore, a comprehensive study and listing of Rindge's conservation lands is warranted.

Table 10 Conservation lands by protection type in Rindge, NH.

Protection Type	Acres
Conservation Easement	2,784.6
Fee Ownership	1,895.7
Deed Restriction	1.8
Unknown	83.8

SOURCE: GRANIT Conservation Lands database (2018) and Rindge Conservation Commission (2017).

The wood turtle is a species of conservation concern in New Hampshire. This individual was documented on one of Rindge's conservation lands.


Date: Dec 27, 2018
Moosewood Ecological, LLC
(603) 831-1980
Innovative Conservation Solutions for New England
Map created for Planning Purposes only. Accuracy of data to be verified by end user. Please Reference Moosewood Ecological GIS Data Disclaimer for more information on its use and purpose. All existing data acquired from NH GRANIT. Data created by Moosewood Ecological LLC includes vernal pools and refined grasslands. Data created by Ecosystems Management Consultants includes refined wetlands and vernal pools along main utility right-of-way. Data created by Bluepoint Ecological LLC includes revised unfragmented lands.
Rindge Natural Resources Inventory
Conservation Lands
Legend
Town of Rindge
Roads
Wetlands
Ponds/Lakes
Streams
N
W
E
S
Protection Type
Conservation Easement
Fee Ownership
Deed Restriction
Unknown
Conservation Lands
1:60,000
0
0.375
0.75
1.5 Miles
Contoocook Lake
Annett State Forest
Bullet Pond
Hubbard Pond
Pearly Pond
Pool Pond
Grassy Pond
Emerson Pond
Cathedral Rd.
Crowcroft Pond
Perry Rd.
Converse Meadow
Shimo Pond
Damon Reservoir
Robbins Rd.
Rindge Town Forest
Main St.
Lake Monomonac
Divol Pond
Robbins Pond
Pecker Pond
Mapplewood Dr.
119
202

NATURAL RESOURCES INVENTORY AND CONSERVATION PLANNING

Rindge has been actively pursuing knowledge about its natural resources to help inform its conservation planning, on both small and large scales. Site assessments have helped to greatly inform localized conservation efforts. For example, site assessments at Converse Meadow and Annett State Forest have yielded great information that would support the conservation of surrounding lands. This is especially true if the adjacent or surrounding property helps to protect a critical habitat, rare species, or could support a nature trail system while linking conserved lands. Small scale efforts help to inform large scale planning.

The Biodiversity Conservation Plan (Bluepoint 2007) provides good guidance for prioritizing conservation efforts on a large scale. This project combined data on a town-wide scale with that of site-specific information on wildlife, habitats, and natural communities. This is one critical element of a comprehensive conservation plan. However, it only focuses on biological diversity and lacks attention on agriculture, forestry, wetlands, groundwater resources, and climate change. These are equally important factors to consider in a conservation plan.

How will the forests and other habitats change over time under a different climate and with increasing pressure from invasive species? Where are Rindge's most climate resilient landscapes? Where will future agricultural lands be created if local farming becomes more abundant or becomes a necessity? What areas are needed to protect clean drinking water supplies? A comprehensive conservation plan seeks to incorporate these questions.

There has been so much more information gathered and developed about the natural resources in Rindge over the past decade since the development of the Biodiversity Plan. There also has been great developments in technology to help analyze Rindge's landscape and natural resources. This affords the opportunity to incorporate new data with existing information to identify conservation focus areas so Rindge can continue to pursue its proactive planning efforts with updated information.

Another aspect that could be incorporated into a conservation plan is the cultural and historical resources in the community. Rindge offers a multitude of outdoor recreational opportunities from hiking, boating, and cross-country skiing to hunting and

fishing. How do these aspects help to connect people with nature and engage residents into the planning process? Also, historical features deserve protection, as they tell a rich story of Rindge's past. For instance, the cellar hole and dug well at the Schoolhouse Park property was used as a schoolhouse by early colonists. The stewardship of this property by the Rindge Conservation Commission protects critical natural resources as well as cultural and historical resources for residents to enjoy.

Conservation planning also includes developing stewardship plans to help manage lands. This can occur on any property; conserved or not. However, just because a property may have been protected by a conservation easement[4] or other means it doesn't necessarily mean that the significant features have been adequately protected. This is where stewardship planning is effective. To effectively manage a property, it is imperative to conduct site investigations to better understand its significant habitats, natural communities, rare species, forest resources, and historical features.

After reviewing the existing information on Rindge's natural resources, it became clear that a detailed conservation plan should be prepared. This would coalesce all the natural resources data into a written plan that includes input from the community. A variety of maps would demonstrate key natural resource features and conservation focus areas.

This Natural Resources Inventory provides one of the first steps in crafting a comprehensive conservation plan. The next step should include community input and participation, as well as developing goals. These elements provide a road map to recommend focus areas and other measures for small- and large-scale conservation practices. The results of such a plan would provide the Rindge Conservation Commission with knowledge for future conservation efforts with willing landowners.

RECOMMENDATIONS

The information provided herein, including the various maps, can be used when considering the adoption of various land use planning techniques or when working with willing landowners on resource protection efforts. The data used to develop this

[4] A conservation easement is a tool to conserve land whereas landowners relinquish their rights to further develop the property. However, the landowner typically retains the right for forestry and agricultural practices.

information represents the most current, readily available data to better understand Rindge's natural resources. As such, there are some basic guidelines that the town can continue to use to promote innovative and informed land use planning.

- Protect large unfragmented blocks, especially those with high quality habitats located within close proximity of one another and with limited barriers for wildlife movement;
- Protect known rare species populations;
- Protect representative examples of critical habitats for known rare species;
- Protect rare and representative examples of natural communities;
- Protect intact wetland and stream riparian buffers and promote the restoration of degraded areas;
- Support voluntary and regulatory approaches at natural resources protection;
- Build upon existing contiguous protected lands;
- Connect protected lands and other critical habitats with upland, aquatic, and/or riparian corridors;
- Better understand wildlife movement patterns to identify and design the most effective conservation corridors; and
- Promote community education and outreach regarding Rindge's biodiversity and the importance of long-term protection strategies.

The following general recommendations were based on the findings of the project. These are considered as the next Actions Steps that Rindge could consider while proceeding with community land use planning and education.

1. Conduct a Parcel-based Ecological Assessment. This is a computer-based model that ranks parcels based on their natural resource values. The assessment will assist with conservation planning and working with willing landowners interested in land protection.

2. Revise the wetlands evaluation conducted in 1993 to include the entire town using the updated NH Method. Map all wetlands in town using aerial photography interpretation. A good portion of the town has been mapped, and this would aid in the revision of the wetlands evaluation.

3. Conduct an audit of current zoning regulations to better understand if and how they protect critical natural resources. This effort can illuminate certain land use planning techniques that Rindge might want to consider adopting in an effort to develop informed land use decisions for a more sustainable future. This could identify ways to use land more efficiently, encourage more compact development, and allocate specific areas for conservation and development.

4. Document rare species known to occur in Rindge with the NH Natural Heritage database. Many species exist in town that have not been reported to the bureau.

5. Update the wildlife species list in Appendix B as new studies have been conducted and as community members provide accurate data.

6. Revise the conservation lands mapping through research to more truly reflect areas protected, as well as the type of protection. It appears that there are some areas in question as to the type of protection and if the current list is accurate.

7. Prepare a comprehensive Conservation Plan that incorporates the breadth of natural resources in Rindge. This Plan should consider a holistic view of the concerns and priorities identified by the community. This effort should build upon the biodiversity plan developed in 2007. This will help to revise Rindge's conservation planning efforts and defining conservation focus areas while reviewing how the current plan has been helpful, how it can serve Rindge better, and what projects have been accomplished. Furthermore, this recommendation is supported by various pieces of the Rindge Master Plan that identifies the need to protect open space. In doing so, the town would greatly benefit from a

comprehensive Conservation Plan that reflects the most updated natural resources data.

8. Incorporate the NRI as part of the Natural Resources section of the Rindge Master Plan adopted in 2018. This provides a vision for the town from which adaptive land use planning can be adopted. Build public support for the NRI through informational sessions, published materials, and other means of community education and outreach. This will help to inform the community about its natural resources and future planning.

9. Continue to work with adjacent communities on similar conservation initiatives of common interest. It would be helpful to meet annually with the Conservation Commissions within each of the adjacent communities to build strong relationships and create open lines of communication, as well as to inform these communities about Rindge's conservation planning efforts.

10. Continue with community outreach and landowner education regarding Rindge's natural resources and conservation planning. This can be accomplished in many ways, including workshops, hikes, and printed materials such as brochures and maps to help landowners with resource protection and management. A subcommittee of the Conservation Commission could be developed to focus on outreach and education efforts.

Rindge has a wide range of natural resources that host a diversity of species. These include ecologically significant areas such as high quality and unique examples of wildlife habitats, exemplary natural communities, rare species habitats, and Rindge's large unfragmented forests. Rindge also boasts significant natural resources that are vital for the working landscape. These include active farmlands and important soils, which signify specific areas as providing the most productive lands for agriculture and timber production. As such, this document was created to better understand where these

significant natural resources are located and to devise a list of significant areas to help guide conservation planning efforts.

Planning for the protection of biological diversity is an ongoing process as more is learned from scientific research and the effects of land use. Fortunately, land use planners are better equipped with various tools to assist with informed decision making. One such tool is the Rindge Natural Resources Inventory. This report should be viewed as a work in progress. It should be reviewed and updated every 5-10 years to reflect new data, including on-site assessments, additional conservation lands, new regulatory policies, and regional conservation priorities as the natural and developed landscape evolves over time.

LITERATURE RESOURCES

Stone, A.L., F. Mitchell, R. Van de Poll, and N. Rendall. 2015. Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire. University of NH Cooperative Extension, Durham, NH.

Bluepoint Ecological LLC. 2006. Converse Meadow Conservation Area Land Management Plan. Rindge, NH.

Bluepoint Ecological LLC. 2007. Rindge Biodiversity-Based Conservation Plan. Rindge, NH.

Bluepoint Ecological LLC. 2009. Land Management Plan for the Rindge Town Forest and Tetreault Park. Rindge, NH.

Brown, R. 2007. A Layperson's Guide to New Hampshire Current Use. Statewide Program of Action to Conserve Our Environment (SPACE), Concord, NH.

Comprehensive Environmental, Inc. 2014. Pearly Pond Watershed Restoration Plan.

Corwin, S. 2010. Forest Management Plan for the Town of Rindge: Mirium Hunt Forest and Rindge Town Forest. Calhoun and Corwin Forestry, Peterborough, NH.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Dept. of Interior, Fish and Wildlife Service, Washington D.C. 131 pp.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. 21 p.

Divan, M. 1998. Woody Vegetation Survey of the Miriam Hunt Memorial Forest in Rindge, NH. Master of Science Candidate at Antioch University, Keene, NH.

Littleton, J. 2005. Ecological Inventory of the Converse Meadow Conservation Area. Moosewood Ecological LLC, Chesterfield, NH.

Littleton, J. 2012. Ecological Inventory of the Annett State Forest and Hubbard Pond. Moosewood Ecological LLC, Chesterfield, NH.

Littleton, J. 2014. Contoocook Conservation Complex: Ecological and Cultural Features Map. Moosewood Ecological LLC, Chesterfield, NH.

Littleton, J. 2018. Schoolhouse Road Property Ecological Assessment and Management Plan. Moosewood Ecological LLC, Chesterfield, NH.

New Hampshire Department of Environmental Services. 2008. Innovative Land Use Planning Techniques: A Handbook for Sustainable Development. New Hampshire Department of Environmental Services, Concord, New Hampshire.

New Hampshire Fish and Game Department. 2015. New Hampshire Wildlife Action Plan. New Hampshire Fish and Game Department, Concord, New Hampshire.

New Hampshire Natural Heritage Bureau. 2018. Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns. Concord, NH.

New Hampshire Office of Energy and Planning. 1998. Population Estimates and Projections database. Concord, NH.

Reynolds, D.S. 2017. Acoustic Bat Survey of Conservation Lands Rindge (Cheshire County), NH. North East Ecological Services, Concord, NH.

Robblee, M. 1998. Management Plan for the Hunt Property.

Society for the Protection of New Hampshire Forests. 2005. New Hampshire's Changing Landscape - Population Growth and Land Use Changes: What They Mean for the Granite State. SPNHF, Concord, NH.

Sperduto, D.D. 2011. Natural Community Systems of New Hampshire. New Hampshire Natural Heritage Bureau, Concord, New Hampshire.

Sperduto, D.D. and William F. Nichols. 2011. Natural Communities of New Hampshire. UNH Cooperative Extension, Durham, New Hampshire.

Stone, A.J.L. 2001. Natural Resources Inventory – A Guide for New Hampshire Communities and Conservation Groups. UNH Cooperative Extension, Durham, New Hampshire.

Stone, A.J.L. and F. Mitchell (eds.). 2015. Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire. UNH Cooperative Extension, Durham, New Hampshire.

Susca, P. 1992. Underground Storage Tanks in Rindge, NH. Masters of Science Candidate, Antioch University, Keene, NH.

Town of Rindge. 2017. Master Plan.

Van de Poll. 1993. Wetlands Assessment of the Town of Rindge, NH. Ecosystems Management Consultants.

Van de Poll. 2016a. Preliminary Assessment of Wetland Impacts of the Proposed Kinder Morgan NED Gas Pipeline in Rindge, NH. Ecosystems Management Consultants.

Wolfe, D.G. 2004. A Comprehensive Biological Inventory of Aquatic Biodiversity at Four Ponds in Rindge, NH. Deep Conservation Consultants, Rindge, NH.

APPENDIX A

MOOSEWOOD ECOLOGICAL
GIS DATA DISCLAIMER

Moosewood Ecological LLC GIS Data Disclaimer

A variety of existing and newly created data layers were used to prepare the Natural Resources Inventory (NRI) maps. These existing data have been developed by numerous government agencies and other sources. They have been produced specifically for the town, the state of New Hampshire, or the entire United States using *remote data*. These sources of remote data were developed from the interpretation of satellite imagery and aerial photography. The data were produced at various scales and therefore, represent different degrees of errors, omissions, and inaccuracies.

The NRI maps are for education and planning purposes only. They are suitable for general land use planning. However, they are not suitable for detailed site planning and design, including wetlands delineations and other jurisdictional determinations. As such, boundaries of all habitats, including wetlands, and parcels are approximate locations and should be field verified. The accuracy of the data is the end user's responsibility, and Moosewood Ecological LLC cannot be responsible for the accuracy and completeness of the data. Moosewood Ecological LLC makes no warranty, expressed or implied, as to the accuracy or completeness of the data. Furthermore, Moosewood Ecological LLC shall assume no responsibility for any errors, omissions, or inaccuracies in the information provided.

APPENDIX B

WILDLIFE SPECIES LISTS

Birds of Rindge, NH

SCIENTIFIC	**COMMON**
Gavia immer	**Common loon**
Podilymbus podiceps	**Pied-billed grebe**
Phalacrocorax auritus	Double-crested cormorant
Branta canadensis	Canada goose
Aix sponsa	Wood duck
Anas crecca	Green-winged Teal
Aythya collaris	Ring-necked duck
Aythya marilla	Greater scaup
Anas rubripes	**American black duck**
Anas platyrhynchos	Mallard
Bucephala albeola	Bufflehead
Lophodytes cucullatus	Hooded merganser
Mergus merganser	Common merganser
Larus marinus	Greater-blackbacked gull
Botaurus lentiginosus	American bittern
Ardea herodias	Great blue heron
Ardea alba	Great egret
Butorides striatus	Green heron
Rallus limicola	Virginia rail
Charadrius vociferus	Killdeer
Gallinago delicata	Common snipe
Scolopax minor	**American woodcock**
Tringa flavipes	Lesser yellowlegs
Tringa solitaria	Solitary sandpiper
Actitis macularia	Spotted sandpiper
Bonasa umbellus	**Ruffed grouse**
Meleagris gallopavo	Wild turkey
Cathartes aura	Turkey vulture
Circus cyaneus	Northern harrier
Buteo jamaicensis	Red-tailed hawk
Buteo lineatus	Red-shouldered hawk
Buteo platypterus	Broad-winged hawk
Accipiter gentilis	**Northern goshawk**
Accipiter cooperii	Cooper's hawk
Accipiter striatus	Sharp-shinned hawk
Pandion haliaetus	Osprey
Strix varia	Barred owl
Zenaida macroura	Mourning dove
Archilochus colubris	Ruby-throated hummingbird
Ceryle alcyon	Belted kingfisher
Sphyrapicus varius	Yellow-bellied sapsucker

SCIENTIFIC	**COMMON**
Picoides pubescens	Downy woodpecker
Picoides villosus	Hairy woodpecker
Colaptes auratus	Northern flicker
Dryocopus pileatus	Pileated woodpecker
Myiarchus crinitus	Great-crested flycatcher
Tyrannus tyrannus	Eastern kingbird
Contopus virens	Eastern wood-pewee
Sayornis phoebe	Eastern phoebe
Empidonax alnorum	Alder flycatcher
Chaetura pelagica	**Chimney swift**
Tachycineta bicolor	Tree swallow
Riparia riparia	**Bank swallow**
Stelgidopteryx serripennis	N. Rough-winged swallow
Hirundo rustica	Barn swallow
Cyanocitta cristata	Blue jay
Corvus corax	Common raven
Corvus brachyrhynchos	American crow
Poecile atricapilla	Black-capped chickadee
Baeolophus bicolor	Tufted titmouse
Sitta canadensis	Red-breasted nuthatch
Sitta carolinensis	White-breasted nuthatch
Certhia americana	Brown creeper
Troglodytes troglodytes	Winter wren
Troglodytes aedon	House wren
Regulus satrapa	Golden-crowned kinglet
Regulus calendula	Ruby-crowned kinglet
Dumetella carolinensis	Gray catbird
Sialia sialis	Eastern bluebird
Catharus fuscescens	**Veery**
Catharus guttatus	Hermit thrush
Hylocichla mustelina	**Wood thrush**
Turdus migratorius	American robin
Toxostoma rufum	**Brown thrasher**
Bombycilla cedrorum	Cedar waxwing
Vireo olivaceus	Red-eyed vireo
Vireo solitarius	Blue-headed vireo
Setophaga virens	Black-throated green warbler
Mniotilta varia	Black-and-white warbler
Setophaga caerulescens	Black-throated blue warbler
Setophaga magnolia	Magnolia warbler
Setophaga coronata	Yellow-rumped warbler

SCIENTIFIC	**COMMON**
Cardellina canadensis	**Canada warbler**
Setophaga pensylvanica	Chestnut-sided warbler
Setophaga fusca	Blackburnian warbler
Setophaga pinus	Pine warbler
Setophaga petechia	Yellow warbler
Oreothlypis ruficapilla	Nashville warbler
Geothlypis trichas	Common yellowthroat
Seiurus aurocapilla	Ovenbird
Agelaius phoeniceus	Red-winged blackbird
Molothrus ater	Brown-headed cowbird
Quiscalus quiscula	Common grackle
Icterus galbula	Baltimore oriole
Piranga olivacea	**Scarlet tanager**
Junco hyemalis	Dark-eyed junco
Cardinalis cardinalis	Northern cardinal
Carpodacus purpureus	**Purple finch**
Carduelis tristis	American goldfinch
Pheucticus ludovicianus	Rose-breasted grosbeak
Pipilo erythrophthalmus	**Eastern towhee**
Melospiza melodia	Song sparrow
Melospiza georgiana	Swamp sparrow
Zonotrichia albicollis	White-throated sparrow
Spizella passerina	Chipping sparrow

Bold type indicates a species of greatest conservation concern.

Mammals of Rindge, NH

SCIENTIFIC	COMMON
Canis latrans var.	Eastern coyote
Vulpes vulpes	Red fox
Urocyon cinereoargenteus	Gray fox
Castor canadiensis	American beaver
Alces alces	**Moose**
Odocoileus virginianus	White-tailed deer
Felis rufus	Bobcat
Lepus americanus	Snowshoe hare
Sylvilagus floridanus	Eastern cottontail
Lutra canadensis	River otter
Martes pennanti	Fisher
Mustela erminea	Ermine (short-tailed weasel)
Mustela frenata	Long-tailed weasel
Mustela vison	Mink
Mephitis mephitis	Striped skunk
Didelphis virginiana	Virginia opossum
Procyon lotor	Raccoon
Marmota monax	Woodchcuck
Erethizon dorsatum	North American porcupine
Ondatra zibethicus	Muskrat
Peromyscus spp.	Deer or White-footed mouse
Sciurus carolinensis	Gray squirrel
Tamias striatus	Eastern chipmunk
Tamiasciurus hudsonicus	Red squirrel
Parascalops breweri	Hairy-tailed mole
Sorex palustris	**Northern water shrew**
Synaptomys cooperi	**Southern bog leming**
Ursus americanus	Black bear
Myotis lucifugus	**Little brown myotis**
Myotis septentrionalis	**Northern myotis**
Myotis species	*Mytotis* (species unidentified)
Eptesicus fuscus	**Big brown bat**
Lasionycteris noctivagans	**Silver-haired bat**
Lasiurus borealis	**Eastern red bat**
Lasiurus cinereus	**Hoary bat**

Bold type indicates a species of greatest conservation concern.

Amphibians and Reptiles of Rindge, NH

SCIENTIFIC	**COMMON**
Ambystoma maculatum	Spotted salamander
Ambystoma laterale x jeffersonianum	**Blue-spotted salamander complex**
Desmognathus f. fuscus	Northern dusky salamander
Eurycea bislineata	Northern two-lined salamander
Plethodon cinereus	Redback salamander
Plethodon glutinosus	**Slimy salamander**
Notophthalmus v. viridescens	Red-spotted newt
Bufo americanus	American toad
Hyla versicolor	Gray treefrog
Pseduacris crucifer	Spring peeper
Rana catesbeiana	Bullfrog
Rana clamitans	Green frog
Rana palustris	Pickerel frog
Rana sylvatica	Wood frog

SCIENTIFIC	**COMMON**
Chelydra serpentina	Common snapping turtle
Chrysemys p. picta	Eastern painted turtle
Stenotherus odoratus	Musk turtle
Glyptemys insculpta	**Wood Turtle**
Embydoidea blandingii	**Blanding's turtle**
Nerodia s. sipedon	Northern water snake
Opheodrys v. vernalis	**Eastern smooth green snake**
Storeria o. occipitomaculata	Northern red-bellied snake
Thamnophis s. sauritus	**Eastern ribbon snake**
Thamnophis s. sirtalis	Eastern garter snake

Bold type indicates a species of greatest conservation concern.

Fish of Rindge, NH

SCIENTIFIC	**COMMON**
Enneacanthus obesus	Banded sunfish
Lepomis gibbosus	Pumpkinseed sunfish
Micropterus salmoides	Largemouth bass
Erimyzon oblongus	Creek chubsucker
Semotilus corporalis	Fallfish
Notemigonus crysoleucas	Golden shiner
Esox niger	Chain pickerel
Amerius natalis	Yellow bulhead
Ameiurus nebulosus	Brown bullhead
Perca flavescens	Yellow perch
Lepomis auritus	Redbreast sunfish
Lepomis macrochirus	Bluegill

DRAGONFLIES

SCIENTIFIC	**COMMON**
Aeshna canadensis	Canada darner
Anax junius	Common green darner
Gomphus spicatus	Dusky clubtail
Hagenius brevistylus	Dragonhunter
Williamsonia flecheri	Ebony boghaunter
Libellula semifaciata	Painted skimmer
Libellula (Ladona) julia	Chalk-fronted corporal
Libellula (Ladona) exusta	White corporal
Libellula (Plathemis) lydia	Common whitetail
Leucorrhinia frigida	Frosted whiteface
Leucorrhinia proxima	Red-waisted whiteface
Leucorrhinia hudsonica	Hudsonianian whiteface
Libellula pulchella	Twelve-spotted skimmer
Libellula incesta	Slaty skimmer
Perithemis tenera	Eastern amberwing
Pachydiplax longipennis	Blue dasher
Somatochlora elongata	Ski-tailed emerald
Sympetrum vicinum	Yellow-legged meadowhawk
Sympetrum obtrusum	White-faced meadowhawk
Celithemis martha	Martha's pennant

DAMSELFLIES

SCIENTIFIC	**COMMON**
Calopteryx maculata	Ebony jewelwing
Argia fumipennis	Variable dancer
Nehalennia gracilis	Sphagnum sprite
Lestes eurinus	Amber spreadwing
Lestes vigilax	Swamp spreadwing

APPENDIX C

HABITAT BLOCK SIZE REQUIREMENTS FOR WILDLIFE

1-19 Acres	20-99 Acres	100-499 Acres	500-2,500 Acres	>2,500 Acres
raccoon	raccoon	raccoon	raccoon	raccoon
	hare	hare	hare	hare
				coyote
small rodent	small rodent	small rodent	small rodent	small rodent
	porcupine	porcupine	porcupine	porcupine
				bobcat
cottontail	cottontail	cottontail	cottontail	cottontail
	beaver	beaver	beaver	beaver
				black bear
squirrel	squirrel	squirrel	squirrel	squirrel
	weasel	weasel	weasel	weasel
		mink	mink	mink
				fisher
	woodchuck	woodchuck	woodchuck	woodchuck
		deer	deer	deer
muskrat	muskrat	muskrat	muskrat	muskrat
			moose	moose
red fox	red fox	red fox	red fox	red fox
songbirds	songbirds	songbirds	songbirds	songbirds
		sharp-shinned hawk	sharp-shinned hawk	sharp-shinned hawk
			bald eagle	bald eagle
skunk	skunk	skunk	skunk	skunk
		Cooper's hawk	Cooper's hawk	Cooper's hawk
		harrier	harrier	harrier
		broad-winged hawk	broad-winged hawk	broad-winged hawk
			goshawk	goshawk
		kestrel	kestrel	kestrel
			red-tailed hawk	red-tailed hawk
		great-horned owl	great-horned owl	great-horned owl
			raven	raven
		barred owl	barred owl	barred owl
		osprey	osprey	osprey
		turkey vulture	turkey vulture	turkey vulture
		turkey	turkey	turkey
most reptiles	most reptiles	reptiles	reptiles	reptiles
	garter snake	garter snake	garter snake	garter snake
	ring-necked snake	ring-necked snake	ring-necked snake	ring-necked snake
most amphibians	most amphibians	most amphibians	amphibians	amphibians
		wood frog	wood frog	wood frog