TOWN OF SWANZEY
NATURAL RESOURCES INVENTORY
PHASE I

Prepared for:
Swanzey 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 SWANZEY
NATURAL RESOURCES INVENTORY
PHASE I

Prepared for:
Swanzey 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 The silver maple floodplain forests along the Ashuelot River are rare, providing critical habitat for a diverse array of plants and wildlife, some of which are species of conservation concern.

TABLE OF CONTENTS

Page

INTRODUCTION 1

WATER RESOURCES 10

ECOLOGICAL RESOURCES 19

AGRICUTURAL AND FOREST RESOURCES 27

CONSERVATION LANDS 34

RECOMMENDATIONS 36

LITERATURE RESOURCES 39

APPENDIX A – GIS DISCLAIMER 40

APPENDIX B – HABITAT SIZE REQUIREMENTS FOR WILDLIFE 42

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 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, and establishes citizens as stewards of the land, requiring the use of informed decision making to promote a more sustainable approach to land use 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 such elements 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, woodlands, and rivers. Therefore, the concept of biodiversity engenders all levels of biological organization and the interactions of living organisms within their physical environments. It is at the heart of understanding 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 four 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

[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 wetland bird community of Dillant-Hopkins Airport or the silver maple floodplain forest community along the Ashuelot River.

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 and 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.

Swanzey has recognized the need to incorporate its natural resources into the town planning process. The 2003 Master Plan addresses a variety of chapters concerning the environment and resource conservation, land use, and recreation. It includes some basic goals, such as:

> "It is our goal to protect ecological integrity and the purity of air, earth, and water of the 46 square miles for which we Swanzey residents are momentary stewards." Page 5

> "We encourage support of activities which 're-create' mind, body, and spirit of residents – whether physical exercise, cultural enrichment, historical and environmental awareness, solitude, and meaningful retreat." Page 5

The Master Plan continues to identify other goals, objectives, strategies, and recommendations relating to Land Use, Resource Conservation, and Recreation that address management and protection of natural resources.

In 2004, the Open Space Advisory Committee prepared and published A Plan for the Protection of Open Space, (aka, Swanzey Open Space Plan) with the purpose of helping to address many aspects of the 2003 Master Plan, particularly the aspect of land use planning. The Plan "sets forth criteria, goals, and recommendations for implementing an Open Space Protection Plan, and establishes a role for Town government in land conservation as a matter of public policy."

The Committee and other participants organized a list of numerous natural resources important for restoration and/or conservation. This included many elements that provide us many important ecological functions and societal values, such as:

- Recreation and public access
- Natural beauty
- Habitat diversity for native species
- Unfragmented habitat
- Historic and archeological areas
- Active agriculture and prime soils
- Community character
- Remoteness and sense of isolation
- Water supply and water quality
- Air quality

The Plan then provides a "preliminary list" of land conservation priorities, which include forested hills, river corridors, wetlands, open fields, and farmlands. It further addresses various recommendations and action steps to guide the conservation plan. The Swanzey Open Space Plan (2004) and Master Plan (2003) have contributed greatly to environmental awareness and community land use planning in Swanzey.

Statement of Purpose

The Swanzey Natural Resources Inventory (NRI) was initiated in March 2018. The overall scope of this project was to develop an enhanced Phase I NRI to support the

Town's natural resource protection efforts and provide a basis for informed land use planning. Goals of the project were 1) to engage the community in the NRI process through a community forum and public presentation, 2) to develop a series of NRI maps designed for educational and planning purposes, 3) to refine existing data for wetlands and grasslands, and to map potential vernal pools from aerial photography interpretation, and 4) to combine the various natural resources data and maps into a Phase I NRI report.

Community Outreach and Education

In cooperation with Moosewood Ecological, the Swanzey Conservation Commission held a community forum to engage residents in the public planning process. It was held on May 14, 2018 at Whitcomb Hall. This forum introduced the overall project background to the community, including the goals of each of the components. It also facilitated a discussion on growth and natural resources protection. This discussion focused on identifying the strengths and challenges of Swanzey's natural resources and its working landscape, as well as began to list some of its most significant natural areas.

As a final component of the NRI project, a public presentation was held on October 11, 2018, to discuss the findings of the NRI. Topics included wetlands, water bodies, groundwater, wildlife habitats, rare species, agriculture, and forest resources, as well as conservation lands in Swanzey. The many uses of an NRI were also illuminated during the presentation.

Swanzey's Physical Landscape

Swanzey covers approximately 46 square miles, or 29,440 acres, of mostly forested and hilly terrain (Figures 1 and 2). Its topography is highly variable, ranging in elevation from approximately 470 feet along the Ashuelot River and its floodplains to 1,417 feet on Franklin Mountain along the southwestern town boundary. Generally, the landscape becomes steep as one moves out of the Ashuelot River and South Branch Ashuelot River valleys in all directions.

The landscape is further characterized by the rolling hills of Forbush Hill, Marcy Hill, and Hewes Hill in the southeast; Gunn Mountain, Rattlesnake Mountain, and

Bullard Mountain in the southwest; West Hill in the northwest; and Mount Cresson and Mount Caesar rising abruptly from the Ashuelot River.

Major water bodies include Swanzey Lake and Wilson Pond. Extensive wetland systems grace many sections along rivers and streams, such as Ashuelot River, South Branch Ashuelot River, Martin Brook, Falls Brook, Forbush Brook, and Perry Brook. These varying landforms offer great diversity for wildlife and plant communities alike.

The most heavily developed parts of Swanzey include residential and commercial areas associated with the three main town centers, as well as the Dillant-Hopkins Airport located in the northern part of town. Moving away from these largely developed areas the town is mostly characterized by its rural setting that surrounds its economic centers.

The Topographic Base Map in Figure 1 provides a sense of some of Swanzey's hiking and rail trails. Six trailheads show the locations of various open spaces including Mt. Caesar, Carroll's Hill, Mt. Cresson, Dickinson Forest, Honey Hill, Tippin Rock/Hewes Hill. These six areas offer a total of 9 miles of trails available for all ages as they are family-friendly, and many are organized as loop hikes. Trail maps are located at some trailheads while the town's website provides maps for Carroll's Hill, Mt. Cresson, and Tippin Rock/Hewes Hill, as well as bike trails to explore covered bridges, the Ashuelot River Rail Trail, and the Cheshire Rail Trail. These rail trails are also shown on the topographic map.

The Parcel Base Map (Figure 3) provides an opportunity to better understand how Swanzey's landscape has become 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 and lot numbers, refer to the paper maps located at the Town Office or visit Swanzey's website at https://www.town.swanzey.nh.us

Swanzey Natural Resources Inventory
Topographic Base Map

Mt. Cresson Trailhead

Dickinson Forest Trailhead

Mt. Caesar Trailhead

Honey Hill Trailhead

Tippin Rock/Hewes Hill Trailhead

Carroll's Hill Trailhead

Yale-Toumey Forest

Swanzey Lake

Wilson Pond

Ashuelot River

Cheshire Rail Trail

Ashuelot Rail Trail

Swanzey Town Boundary

Roads

Wetlands

Lakes and Ponds

Streams

Conservation Lands

Trailheads

N

Miles

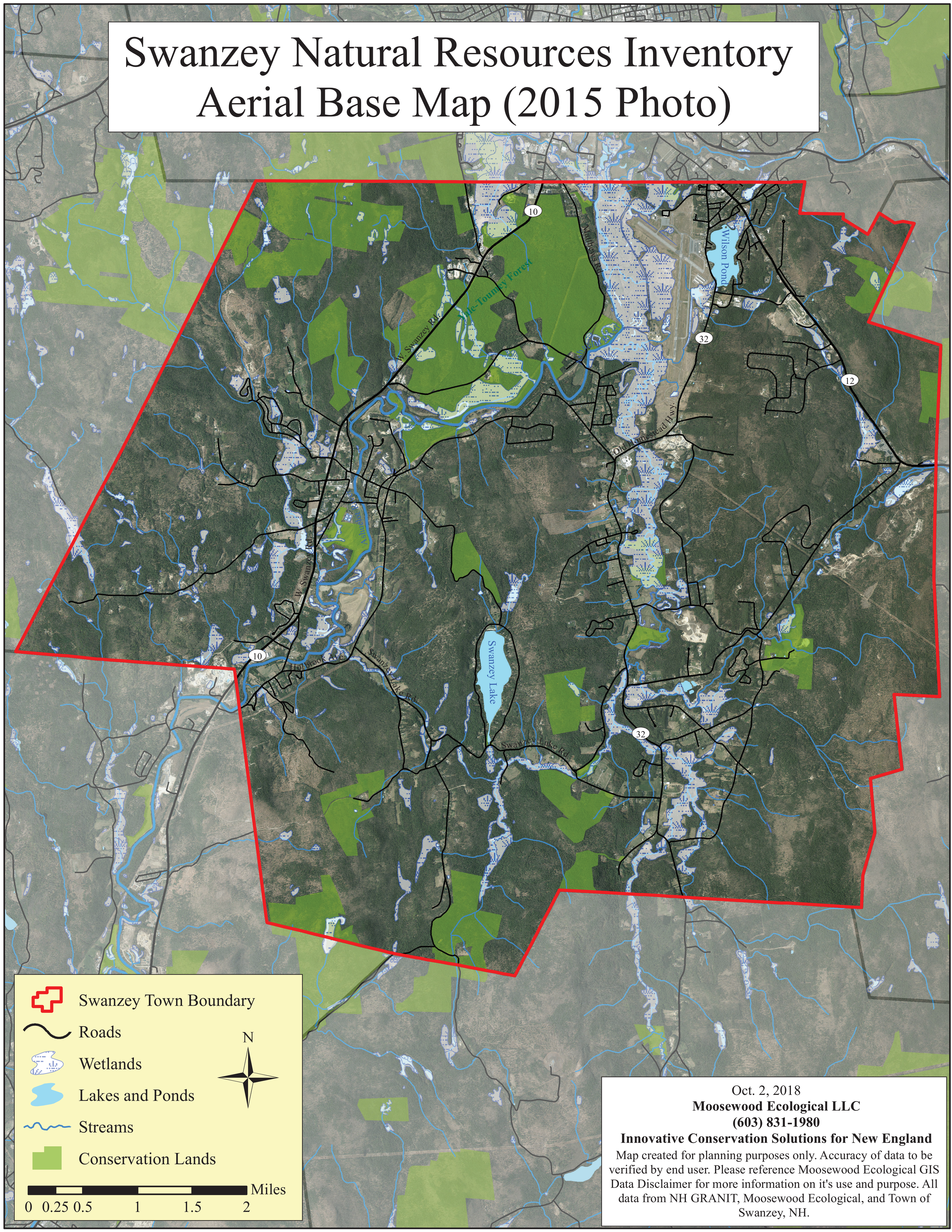
0 0.25 0.5 1 1.5 2

Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

Swanzey Natural Resources Inventory
Aerial Base Map (2015 Photo)

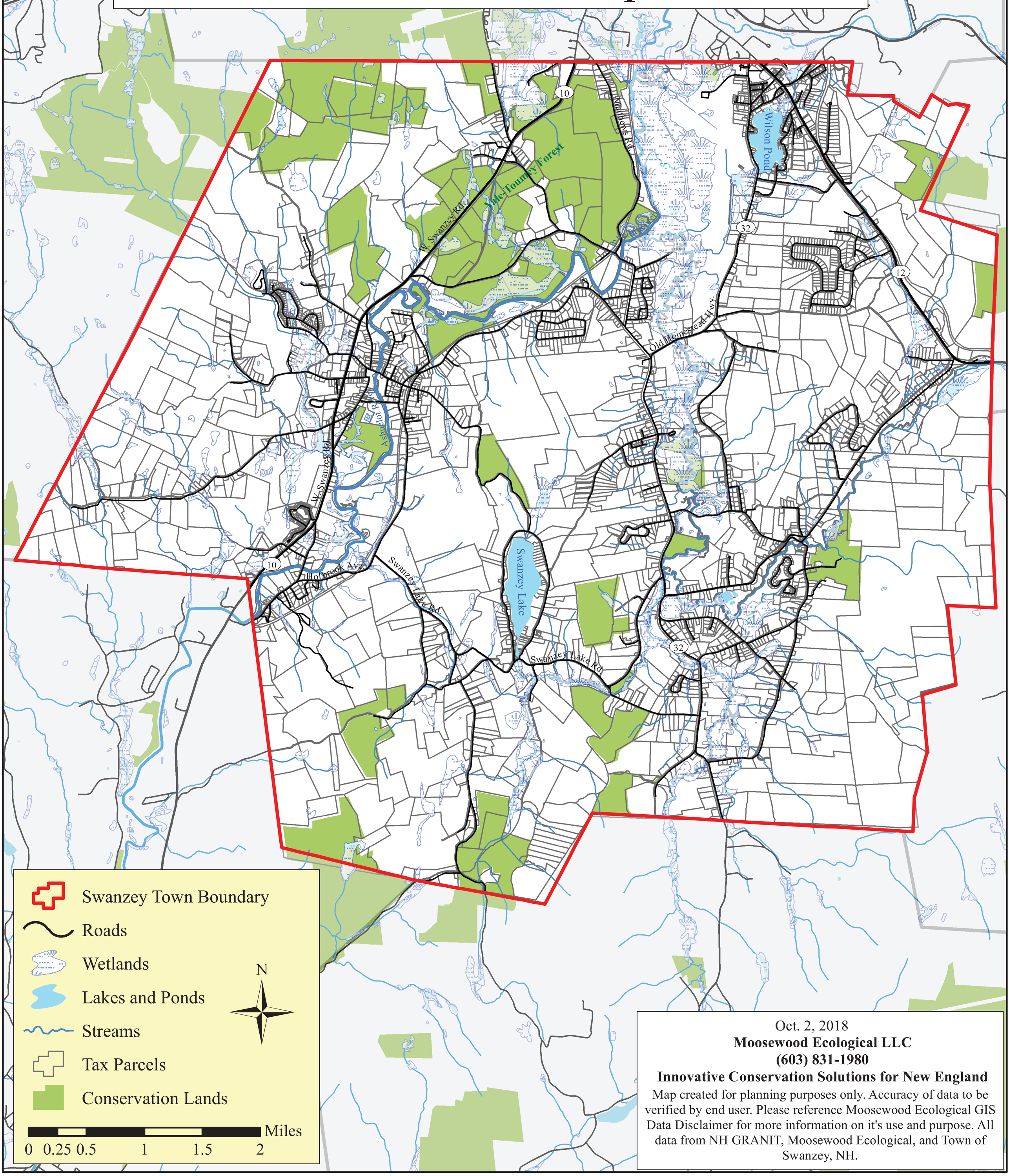


Oct. 2, 2018

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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

Swanzey Natural Resources Inventory
Parcel Base Map



Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

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

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.

As part of this project, wetlands were revised to better reflect their representation in Swanzey. The US Fish and Wildlife Service's National Wetlands Inventory (NWI) and aerial photography interpretation were used for this revision. US Department of Agriculture's (USDA) Natural Resources Conservation Service hydric soils were also mapped to better understand the extent of wetlands within Swanzey. These combined datasets provide for a more balanced approach at wetlands mapping.

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.

Swanzey is estimated to have roughly 2,524.9 acres of wetlands dispersed throughout the Town (Table 1 & Figure 4). Lacustrine wetlands include lakes and ponds, whereas palustrine wetlands include familiar places such as marshes, swamps, and beaver ponds. 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 1. Summary of wetlands in Swanzey.

Wetland Classification	**Area (acres)**
Lacustrine (total)	180.4
Palustrine (total)	2,344.50
Emergent	
Forested	
Scrub-shrub	
Unconsolidated Bottom	

SOURCE: Data developed by Moosewood Ecological LLC (2018).

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 2,119 acres while

very poorly drained soils cover 1,125 acres. These are estimates and field checking is needed when appropriate.

Watersheds

All 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 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. Swanzey is divided into 5 major watersheds (Table 2 and Figure 4).

Table 2. Summary of major watersheds in Swanzey.

Watershed	Total Area (acres)	Area in Swanzey (acres)
Keene Tributaries	21,637	2,033
Perry Brook	14,442	5,658
South Branch Ashuelot River	33,737	9,422
The Branch	33,935	33
Winchester-Swanzey Tributaries	28,590	11,866

SOURCE: USGS HUC 12 watersheds from GRANIT

Surface Water Bodies

Swanzey 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 Swanzey cover approximately 180.4 acres, ranging in size from 72.4 acres to 108 acres (Table 3 and Figure 4). These have been recognized and

labeled as such by the NH Dept. of Environmental Services and the US Geological Survey. Swanzey Lake and Wilson Pond 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. In addition, approximately 45 acres of ponded water behind the Ashuelot River dam impoundment is included in this list.

Table 3. Summary of lakes and ponds in Swanzey.

Lakes and Ponds	Size (acres)
Swanzey Lake	108
Wilson Pond	72.4

SOURCE: USGS topography and GRANIT hydrogrpahy datasets.

Approximately 125 miles of rivers and streams have been mapped in Swanzey (Table 4 and Figure 4). Fourteen of these have been identified by the U.S. Geological Survey by name. Of the many rivers and streams, four are listed on the NH DES Consolidated List of Water Bodies subject to the Shoreland Water Quality Protection Act under RSA 483-B. These include the Ashuelot River, South Branch Ashuelot River, Ash Swamp Brook, and Martin Brook (beginning at the junction of Falls Brook).

Table 4. Summary of rivers and streams in Swanzey.

Streams	Length (miles)	Stream Order
Ashuelot River	9.7	6th
South Branch Ashuelot River	12.1	5th
Ash Swamp Brook	0.3	4th
Martin Brook	3.6	4th
Wheelock Brook	1.2	3rd
Perry Brook	4.2	3rd
Falls Brook	1.4	3rd
California Brook	3.3	3rd
New Run Brook	2.0	2nd
Indian Brook	3.0	2nd
Hill Brook	2.1	2nd
Forbush Brook	2.6	2nd
Bridge Brook	2.2	2nd
Bailey Brook	2.7	2nd
Other Streams	74.1	1st - 3rd

SOURCE: USGS topography and GRANIT hydrogrpahy datasets.

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 Shoreland Water Quality Protection Act, as well as certified administrative rules, refer to the NH DES at http://des.nh.gov/organization/divisions/water/wetlands/cspa/index.htm

[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 Swanzey. When two first order streams converge, they form a second order stream, and so on.

Swanzey Natural Resources Inventory
Wetland Resources

Keene Tributaries Watershed

The Branch Watershed

Winchester-Swanzey Tributaries Watershed

South Branch Ashuelot River Watershed

Perry Brook Watershed

Vale-Tourney Forest

Matthews Rd.

Wilson Pond

W. Swanzey Rd.

Ashuelot River

Old Homestead Hwy.

Holbrook Ave.

Swanzey Lake Rd.

Swanzey Lake

10

32

12

Swanzey Town Boundary

Roads

Wetlands

Lakes and Ponds

Streams

Conservation Lands

Watershed (HUC 12)

Keene Tributaries

Perry Brook

South Branch Ashuelot River

The Branch

Winchester-Swanzey Tributaries

Hydric Soils

Poorly drained

Very poorly drained

N

0 0.25 0.5 1 1.5 2 Miles

Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

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.

Swanzey contains approximately 7,791.9 acres of stratified drift aquifers (Table 5 and Figure 5). The largest and most significant aquifers are associated with the Ashuelot River on the west side of town, as well as with the South Branch of the Ashuelot River, Martin Brook, and Wilson Pond to the east. Smaller aquifers are associated with Perry Brook in the south-central section.

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 Swanzey 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 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. In effect, this effort is encouraging communities to take proactive measures at protecting

their most significant groundwater resources. As such, the higher yielding aquifers associated with the Ashuelot River, the South Branch of the Ashuelot River, and Martin Brook 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 300 gallons per minute.

Table 5. Summary of aquifers and favorable gravel well analysis in Swanzey.

Groundwater Attribute	**Size (acres)**
Stratified Drift Aquifer Transmissivity Rates	
<2,000 feet^2/day	4,514.2
2,000-4,000 feet^2/day	3,151.3
>4,000 feet^2/day	126.4
Favorable Gravel Well Analysis	
>75 Gallons/Minute	1,344.4

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

Swanzey Natural Resources Inventory
Groundwater Resources

Keene Tributaries Watershed

Winchester-Swanzey Tributaries Watershed

South Branch Ashuelot River Watershed

Perry Brook Watershed

Yale-Toumey Forest

Matthews Rd.

Wilson Pond

W. Swanzey Rd.

Ashuelot River

Old Homestead Hwy.

Holbrook Ave.

Swanzey Lake Rd.

Swanzey Lake

10

32

12

Swanzey Town Boundary

Roads

Wetlands

Lakes and Ponds

Streams

Conservation Lands

Watershed

Favorable Gravel Well Analysis

Aquifer Transmissivity

less than 2,000 ft. sq./day

2,000 - 4,000 ft. sq./day

greater than 4,000 ft. sq./day

N

0 0.25 0.5 1 1.5 2 Miles

Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

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, to promote the conservation and management of NH's biological diversity. The WAP 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 fourteen wildlife habitats as recognized by the WAP were mapped for Swanzey (Table 6 and Figure 6). These habitats should be field verified to the extent possible to confirm the location, extent, and habitat type. Grasslands were refined based on 2015 aerial photography interpretation. Potential vernal pools were mapped using 2015 aerial photography interpretation (Figure 7). The WAP does recognize vernal pools an important wildlife habitat but has not mapped them for New Hampshire. Locations of this critical habitat can be predicted through aerial photography interpretation, providing the first step in learning about their distribution. However, they are best mapped using on-site field assessments and verification.

Table 6. Summary of wildlife habitats in Swanzey.

Wildlife Habitat	Size/Count	% of Town
Appalachian oak-pine	5,846 acres	20.15
Cliff and Talus	47 acres	0.16
Floodplain Forest	552 acres	1.90
Grassland	949 acres	3.27
Hemlock-hardwood-pine	16,609 acres	57.25
Barren or Developed	2,300 acres	7.93
Northern swamp	5 acres	0.02
Open water	228 acres	0.79
Peatland	75 acres	0.26
Rocky ridge	112 acres	0.39
Temperate swamp	554 acres	1.91
Marsh and shrub wetland	950 acres	3.27
Streams	125 acres	n/a
Vernal Pools	42 pools	n/a

Source: Refined wildlife habitats by Moosewood Ecological (2018) using Wildlife Action Plan data (2015), aerial photography (2015) interpretation, National Wetlands Inventory (2001), NH hydrography data (2006), from GRANIT

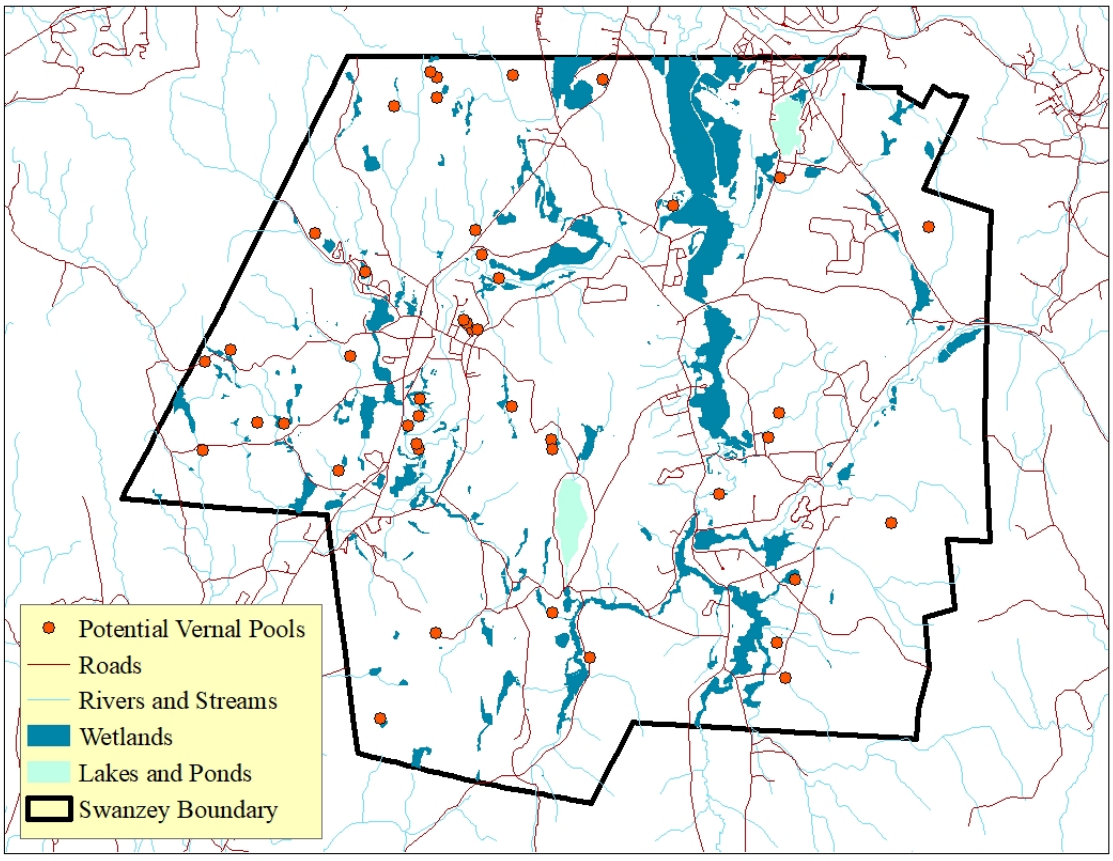
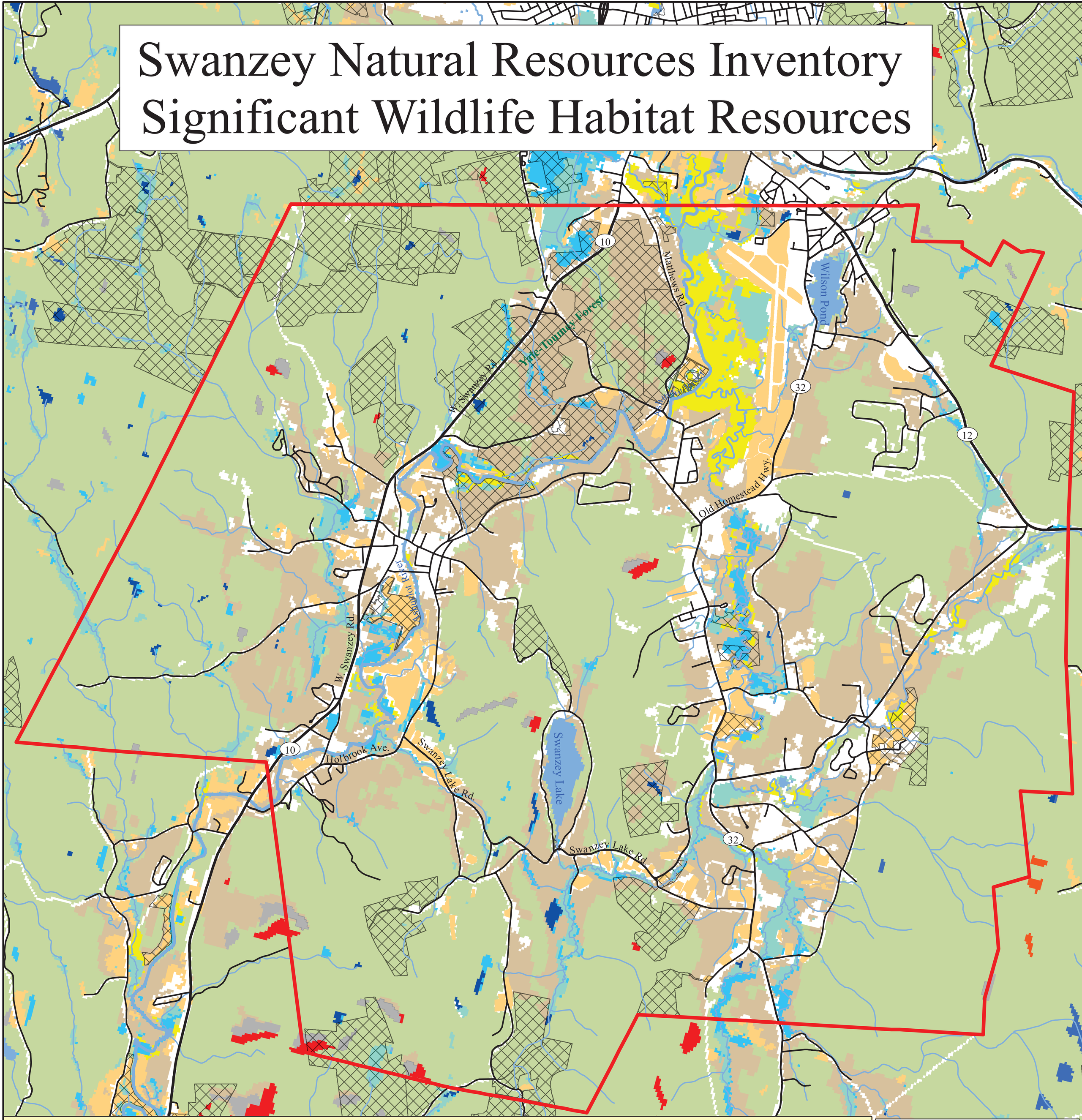


Figure 7. Potential vernal pools in Swanzey, NH.

Swanzey Natural Resources Inventory
Significant Wildlife Habitat Resources



Swanzey Town Boundary
Roads
Streams
Conservation Lands

Open water
Northern swamp
Peatland
Temperate swamp
Marsh and shrub wetland
Cliff and Talus slope
Rocky ridge

Grassland
Floodplain forest
Appalachian oak-pine
Hemlock-hardwood-pine
Northern hardwood-conifer
Barren or Developed

0 0.25 0.5 1 1.5 2 Miles

N

Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

Known Rare Species and Exemplary 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. As such, 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.

The NHNHB has documented one exemplary natural community in Swanzey (Table 7). The rare silver maple floodplain forest can be found along the Ashuelot River. Currently, there is a restoration project that seeks to transform present-day hayfields into historic floodplains along the Ashuelot River. The Nature Conservancy is managing the project and working in cooperation with the Swanzey Conservation Commission and other partners. Floodplain forest natural communities are rare due to habitat conversion for agricultural fields, as well as residential and commercial development.

The NHNHB has documented two rare plants in Swanzey (Table 7). Both are considered as state-endangered; however, the northeastern bulrush is also included on the federally-endangered species list. The state of New Hampshire identifies this plant as an extremely high importance for conservation.

At least eight species of wildlife have been reported in Swanzey (Table 7). These include four species of grassland birds, wood turtle, northern leopard frog, American eel, and the state and federally-endangered dwarf wedge mussel. All of these wildlife species represent high importance for conservation.

While Table 7 provides a list of known rare species and exemplary natural communities in Swanzey it does not, however, represent a comprehensive survey of the town. It only represents data reported to the NHNHB. Therefore, additional investigations

are recommended as the Swanzey Conservation Commission moves forward with field assessments as part of refining the Natural Resources Inventory.

Table 7. Known rare species and exemplary natural communities in Swanzey, NH.

Rare Elemental Occurrence	Rarity Rank
Natural Communities	
Silver Maple-False Nettle-Sensitive Fern Floodplain Forest	S2
Plants	
Long-headed Windflower (*Anemone cylindrica*)	E
Northeastern Bulrush (*Scirpus ancistrochaetus*)***	E
Birds	
Eastern Meadowlark (*Sturnella magna*)**	T
Grasshopper Sparrow (*Ammodramus savannarum*)**	T
Horned Lark (*Eremophila alpestris*)**	SC
Vesper Sparrow (*Pooecetes gramineus*)**	SC
Reptiles	
Wood Turtle *(Glyptemys insculpta)****	SC
Amphibians	
Northern Leopard Frog (*Lithobates pipiens*)**	SC
Fish	
American Eel (*Anguilla rostrata*)**	SC
Mollusks	
Dwarf Wedge Mussel (*Alasmidonta heterodon*)**	E

Source: NH Natural Heritage Bureau database (2018) and Moosewood Ecological LLC (2018).

S2 - Imperiled due to a few occurrences

E - Endangered

T - Threatened

SC - Special Concern

* - High Importance

** - Very High Importance

*** - Extremely High Importance

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 Swanzey'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 B provides a general list of habitat block size requirements for wildlife to help illustrate this point.

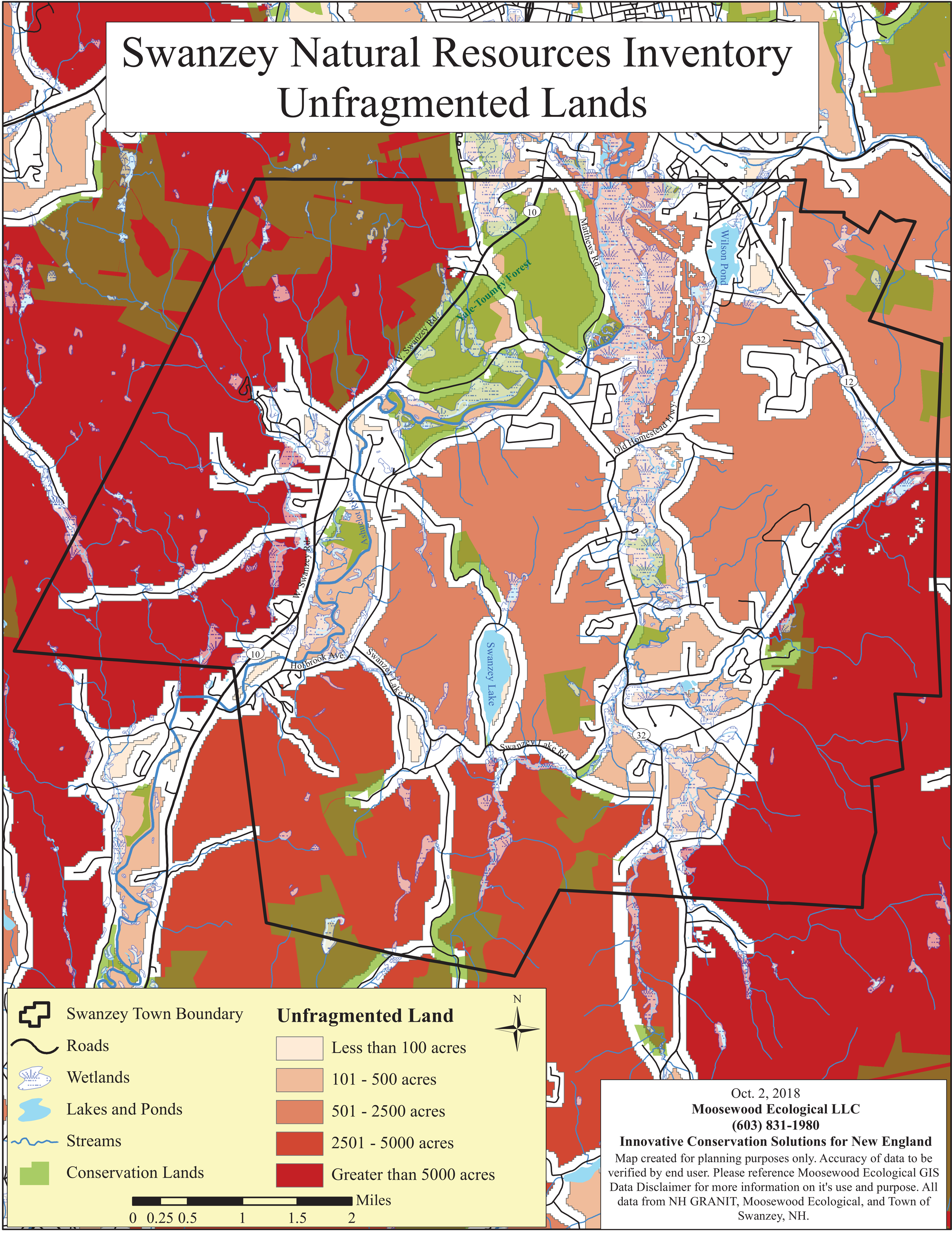
Large landscapes also provide for wildlife movement and habitat connectivity. By maintaining connectivity between critical habitats, it is be possible to provide permanent wildlife corridors within the built environment. Wildlife travel corridors function as areas that one or many species may use to 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.

Swanzey Natural Resources Inventory
Unfragmented Lands



Swanzey Town Boundary

Roads

Wetlands

Lakes and Ponds

Streams

Conservation Lands

Unfragmented Land

- Less than 100 acres
- 101 - 500 acres
- 501 - 2500 acres
- 2501 - 5000 acres
- Greater than 5000 acres

N

0 0.25 0.5 1 1.5 2 Miles

Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

AGRICULTURAL AND FOREST RESOURCES

Swanzey 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 Swanzey 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 9,798 acres, or roughly 34% of Swanzey (Table 8 and Figure 9). These soils are widely distributed throughout the town. Prime farmland soils make up about 16% of the total acreage of agricultural soils while farmlands of local and statewide significance represent 84% of these soils.

Table 8. Summary of important soils for farm production in Swanzey.

Important Soil Type	Size (acres)	% of Town
Prime Farmland Soils	1,600	5.5
Farmland Soils of Statewide Significance	740	2.6
Farmland Soils of Local Significance	7,458	25.7

SOURCE: GIS Analysis (Moosewood Ecological 2018) of USDA Natural Resources Conservation Service soils.

Swanzey Natural Resources Inventory
Agricultural Resources

10
32
12
Matthews Rd
Wilson Pond
W. Swanzey Rd.
Yale-Tolles Forest
Ashuelot River
Hobbrook Ave.
Swanzey Lake Rd.
Swanzey Lake
Old Homestead Hwy.

- Swanzey Town Boundary
- Roads
- Wetlands
- Lakes and Ponds
- Streams
- Conservation Lands
- Grasslands and Active Farmlands
- Prime Farmland Soils
- Farmland Soils of Local Importance
- Farmland Soils of Statewide Importance

N

0 0.25 0.5 1 1.5 2 Miles

Oct. 20, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

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 Swanzey.

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:

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 17,024 acres, or approximately 65% of Swanzey (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 Swanzey.

Important Soil Type	Size (acres)	% of Town
Hardwood Production (Groups IA and IB)	12,385	47
Softwood Production (Group IC)	4,639	17.8

SOURCE: GIS Analysis (Moosewood Ecological 2018) of USDA Natural Resources Conservation Service soils.

Swanzey Natural Resources Inventory
Forest Resources

Swanzey Town Boundary

Roads

Wetlands

Lakes and Ponds

Streams

Conservation Lands

Forest Soils

Group IA and Group IB

Group IC

N

0 0.25 0.5 1 1.5 2 Miles

Oct. 2, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

CONSERVATION LANDS

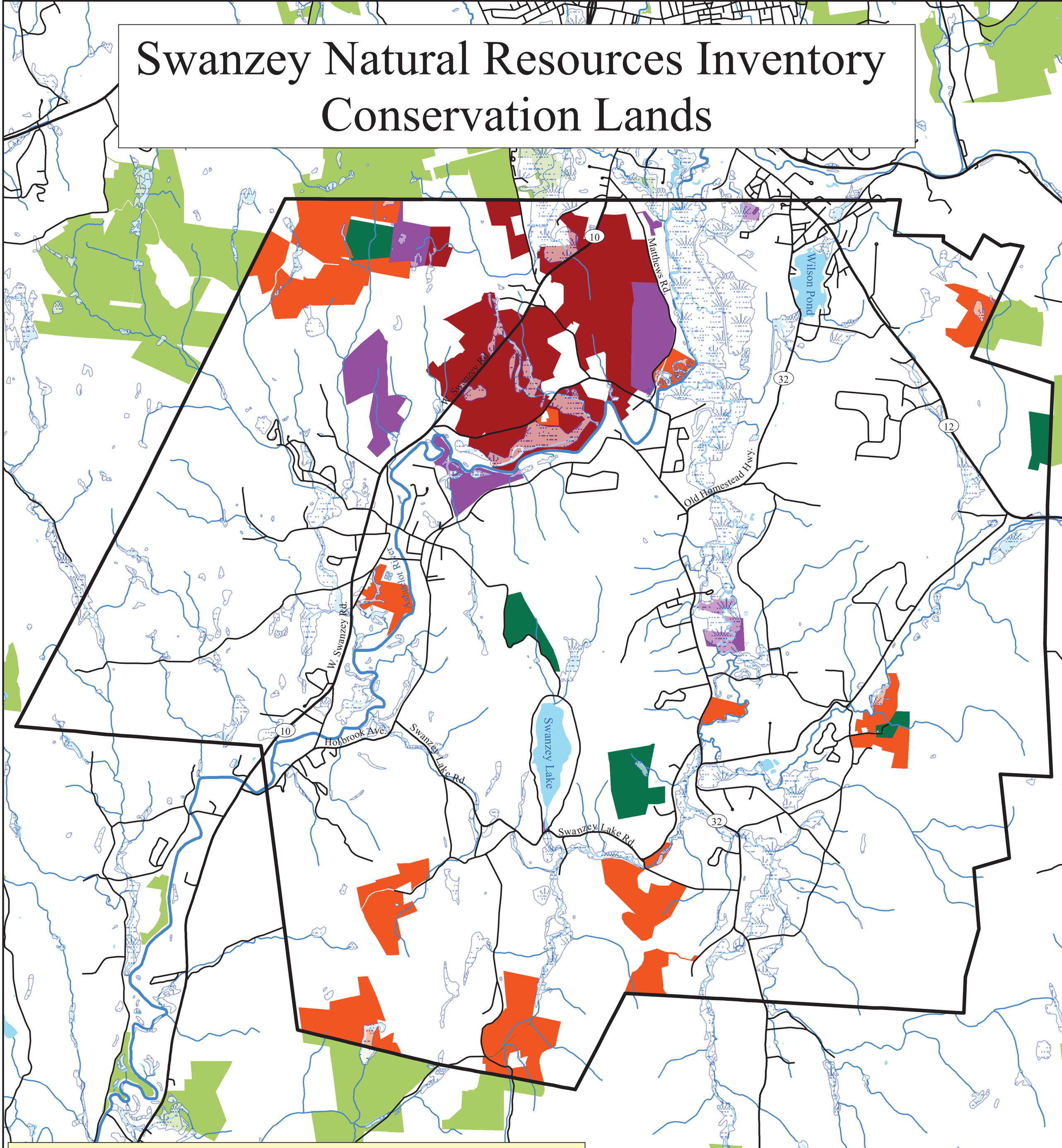
There are approximately 3,372 acres of conservation and town-owned lands in Swanzey (Table 10 and Figure 11). The Yale-Toumey Forest represents 43% of these lands; however, there is no explicit form of permanent conservation yet the Yale-Toumey Forest is generally recognized by the public as being conserved. Nearly 37% of conservation lands are privately-owned and protected by conservation easements. The remaining 20% of conservation lands are held under fee ownership and deed restrictions.

Table 10. Conservation lands by protection type in Swanzey.

Protection Type	Acres
Conservation Easement	1,234
Deed Restriction	155
Fee Ownership	533
Yale-Toumey Forest	1,450

SOURCE: GRANIT Conservation Lands database (2018) and Monadnock Conservancy (2018)

Swanzey Natural Resources Inventory
Conservation Lands



Swanzey Town Boundary

Roads

Wetlands

Lakes and Ponds

Streams

0 0.25 0.5 1 1.5 2 Miles

Protection Type

Conservation Easement

Deed Restriction

Fee Ownership

Yale-Toumey Forest

Conservation Lands

N

September 14, 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 it's use and purpose. All data from NH GRANIT, Moosewood Ecological, and Town of Swanzey, NH.

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 information represents the most current, readily available data to better understand Swanzey's natural resources. As such, there are some basic guidelines that the town can 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 Swanzey'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 Swanzey could consider while proceeding with community land use planning and education.

1. Continue with Swanzey's NRI efforts by engaging in the Phase II project that seeks to conduct various site assessments. The purpose of these assessments should focus on collecting ecological information such as biodiversity, natural communities, invasive plants, and small-scale habitats (such as vernal pools, dens, talus slopes, heron rookeries, and turtle nesting areas), as well as verify the extent of the Wildlife Action Plan habitats. Other elements could include mammal tracking to understand corridors and connectivity and wetlands evaluations. Community outreach and education should also be a component of the Phase II NRI.

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

3. Update the Swanzey Open Space Plan developed in 2004 to include newly acquired natural resources data. This will help to revise Swanzey's conservation planning efforts and enhancing conservation focus areas while reviewing how the current plan has been helpful, how can it serve Swanzey better, and what projects have been accomplished.

4. Incorporate the NRI into the Swanzey Master Plan adopted in 2003. 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.

5. 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 Swanzey 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.

6. 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 Swanzey's conservation planning efforts.

7. Continue with community outreach and landowner education regarding Swanzey'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.

LITERATURE RESOURCES

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

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.

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.

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

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