TOWN OF CHESTERFIELD
NATURAL RESOURCES INVENTORY
and
CONSERVATION PRIORITIES

Prepared for:
Town of Chesterfield Conservation Commission

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Cover photograph – An eastern towhee resting in a red oak. Photo Credit: S. Lamonde

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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 (SPNHF 2005). 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 (SPNHF 2005). This rate of growth is followed by VT (10.4%), RI (7.7%), ME (7.3%), MA (6.7%), and CT (6.7%). In 2016, it was estimated that New Hampshire's population will increase 8.8% between 2010 and 2040 (RLS Demographics, Inc. 2016). However, a recent study found that New Hampshire is the fastest growing state in New England and has been for the past three years (Johnson 2020). This rate of growth is also supported by the aforementioned 2005 study when comparing population growth between 1990 and 2004. New Hampshire's development pressure will tax the state's natural resources if not thoughtfully managed.

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.

The town of Chesterfield has likewise seen significant population growth in the last 50 years. From a population of 1,817 in 1970 to 3,627 in 2019 (NH Employment Security 2021), the town has seen a 50% increase. It has changed in fundamental ways since its predominantly agricultural and more rural past. Many formerly active farms and working forests are now being converted to residential use as the attraction of the area has created unprecedented demand for housing. Route 9 has certainly had a profound effect on these changes as developments increase due to accessibility to goods and services within Chesterfield along this state road, especially in a tax-free state. Access to more populated areas, such as Keene and Brattleboro, has also made it very attractive to live in a more rural community.

Chesterfield today faces challenges that are familiar to many communities in southern New Hampshire. The rate of residential and commercial development and growth in general has continued to increase, especially over the past three decades. Larger challenges not widely foreseen a half century ago are now in plain sight, as global climate change and invasive species have become new causes for concern.

With the understanding that development will inevitably occur, Chesterfield is faced with choices about directing growth and open space conservation so that a suitable balance can be achieved. Planning for the protection of open space is a critical and positive step towards solutions to these challenges.

Fortunately, Chesterfield still has large areas of intact wildlife habitat of state-wide significance, extensive natural river frontage, unique natural communities, and relatively large areas of unfragmented forest. The acquisitions of significant conservation lands such as Friedsam Town Forest are cause for optimism, but the protection of other valuable open space lands will become increasingly important. Time, money, and human resources are limited in the accomplishment of conservation. Making the effort to document and keep track of the natural resources of a town is an effective and forward-thinking step in taking stock of assets and needs relative to which resources are most important to conservation.

Natural Resource Inventory

In order to provide a strong foundation for proactive planning and informed decision making, a Natural Resources Inventory, or NRI, is essential (Stone 2016). An NRI is a description of the natural elements that are tied to the geography of a town, a watershed, or larger region. These often include such elements as wetlands, aquifers, ponds, rivers, forests, plants, soils, and wildlife. This information can be created from existing data or from field-based assessments to better reflect the extent of natural resources within a community.

An NRI is not only an important starting point for informing conservation decisions, it is also a core responsibility written into the enabling State legislation allowing for the existence and authority of conservation commissions. This type of project helps to better understand what natural resources are within a town and where they are located. In conjunction with the conservation planning that it can inform, an NRI can also provide a basis for outreach to the public, which can result in further support for land conservation.

New Hampshire statute RSA 36-A authorizes Conservation Commissions to create an NRI. Conservation Commissions are established "for the proper utilization and protection of natural resources and for the protection of watershed resources" of the town. RSA 36-A:2 continues to state that "Such commission shall conduct researches into its local land and water areas [and] … 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 techniques that can be adopted to help protect various resources, such as water resources, 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. At its heart, the understanding of the dynamics of biodiversity can lead to the development of protection strategies, helping to ensure a healthy environment for humans, as well as all other life forms.

An NRI should not be a static record but one that stays current with changes in land use planning, new natural resources data, and climate change. It is a vision that should be based on the principles of conservation biology and that incorporates the current natural resources of a given area (such as a town, a watershed, or an entire region). Thus, conservation planning ideally strives to incorporate the socio-economic fabric of our world with that of the

[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 Spofford Lake.

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 considers both our natural environment and built infrastructure.

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; has assisted in building preserves and managing other lands for species of greatest conservation need, as well as our most common species; aided in the identification of biodiversity hot spots; and has 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.

The need for this type of informed land use planning is becoming more evident with the passing of time. Ecosystems have long been susceptible to long-term degradation from overexploitation and misuse of natural resources. This has led to the loss of critical habitats as a result of sprawling residential and commercial developments. While the past few decades have seen significant development and land conversion, there has been a concomitant rise in conservation planning efforts over the same time period, especially in New Hampshire.

The Town of Chesterfield published its latest Master Plan in 2016, providing a guide for the town's overall character and development. The Natural Resources chapter stated a very clear goal of the "protection of our natural resources for current enjoyment and preservation for future generations." From this goal, three objectives established:

- Encourage the preservation of the existing natural landscape through outreach and education.
- Seek to improve the existing conditions of our natural resources where damage, degradation or impairment has occurred.
- Continue to support the conservation efforts that have already been done and encourage landowners to consider putting land into conservation.

Statement of Purpose

The Chesterfield Natural Resources Inventory (NRI) was initiated in December 2020. The overall scope of this project was to revise its existing NRI (Littleton 2011) to support the Town's natural resource protection efforts and provide a basis for informed land use and conservation planning. Goals of the project were to 1) review and analyze existing natural resources data and reports, 2) develop a series of NRI maps designed for educational and planning purposes, 3) refine existing data such as grassland, active agricultural lands, conservation lands, and potential vernal pools, 4) conduct field investigations of wildlife habitats and significant natural communities, as well as biodiversity, including species of greatest conservation need, and 5) combine the natural resources data and maps into this NRI report and conduct a public presentation of our findings. The information found herein can be used in many ways by the Conservation Commission, Planning Board, and Select Board, as well as landowners, natural resource professionals, and the general public.

Land Use and Open Space – Aerial Photography View

The aerial base map provides a perspective of the landscape -- current areas of development and open space in Chesterfield (Figure 1). It displays roads, streams, rivers, ponds, and wetlands as a base layer to assist the viewer in navigating throughout the town with a bird's eye view.

Chesterfield Natural Resources Inventory
Aerial Base Map

Map Description:
This map uses an aerial photograph from May 2015 to show human infrastructure such as roads and residential, commercial, and industrial developments, as well as various natural features that occur in Chesterfield. Wetlands, streams, and ponds, as well as roads help to orient the map viewer within the town. Conservation lands have also been added to show where the many town-owned and private lands are located that have been protected over time.

Data Sources:
-Political Boundaries, downloaded from NH GRANIT
-Conservation Lands, downloaded from NH GRANIT, edited by Moosewood
-Surface Water (NHD), downloaded from NH GRANIT, edited by Moosewood
-Streams, downloaded from NH GRANIT
-Roads from NH DOT, downloaded from NH GRANIT
-Wetlands (NWI Plus), downloaded from NH GRANIT
-WMS Aerial Imagery (May 2015, 1-ft resolution), downloaded from NH GRANIT

Legend
- Town boundaries
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Conserved lands

N W E S

0 0.25 0.5 1 Miles

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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
Scale Factor: 1.0000
Latitude Of Origin: 42.5000
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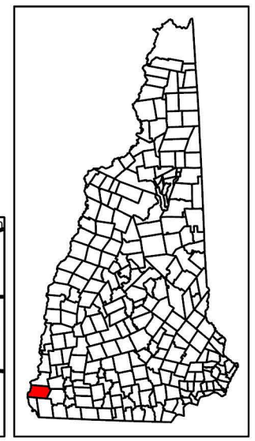
Date: 9/3/2022



WATER RESOURCES

Water resources, including surface water and groundwater resources are among Chesterfield's valuable assets. Drinking water sources depend on groundwater in bedrock or sand and gravel aquifers. Ponds, streams and the Connecticut River provide recreational opportunities and habitat for many wildlife species and contribute to downstream drinking water supplies. Wetlands provide varied habitats for wildlife, flood control by absorbing floodwaters and slowly releasing them, support maintenance of base flows in streams, protect and maintain water quality, and shoreline stabilization, among many important functions. This section provides detailed information about the type and extent of these resources in Chesterfield.

Wetlands

Wetlands include habitats such as marshes, wet meadows, beaver impoundments, swamps, fens, and bogs. As noted above, they perform a variety of functions and values, such as providing significant habitats for wildlife and plants, maintaining good water quality, storing floodwaters, and recreation opportunities.

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." Activities in wetland resources are regulated by the NH Dept. of Environmental Services Wetlands Bureau under RSA 482-A:2. These protected wetlands include forested, scrub-shrub, and emergent wetlands, marshes, wet meadows, bogs, shorelines of streams, rivers, lakes, and ponds, and in some communities 100-foot prime wetlands buffer.

The US Fish and Wildlife Service (FWS) has mapped wetlands in the United States through its National Wetlands Inventory (NWI) program. The NWI use the Classification of Wetlands and Deepwater Habitats of the United States to describe the different types of wetlands (Cowardin et al. 1979 and Federal Geographic Data Committee 2013).

This NWI mapping products are used by the state, municipalities, and natural resource managers to promote the understanding, conservation, and restoration of wetlands. The NWI provides useful information, including the type of wetland as well as its hydrology, associated plant communities, water chemistry, and other descriptors such as man-made dams and beaver influence. The NH Department of Environmental Services recently updated the NWI for parts of the state, including Chesterfield. This new dataset is referred as the NWI Plus, and includes additional functional assessment information.

Chesterfield has approximately 2,541 acres of mapped wetlands dispersed throughout the town (Table 1 & Figure 2 and 3). These include three main types of wetland systems - lacustrine, riverine, and palustrine. Lacustrine wetlands include deep water habitats in lakes and ponds (greater than 8.2 feet in depth) and the shallow littoral habitats that are considered wetlands. Examples of lacustrine wetlands in Chesterfield include Spofford Lake. Riverine wetlands are those associated with rivers, such as the Connecticut River.

All other wetlands in Chesterfield are palustrine wetlands, defined as shallow, freshwater habitats dominated by vegetation. These include aquatic bed communities dominated by water lilies and other floating or rooted aquatic plants, emergent marshes, shrub and forested swamps, and beaver ponds (unconsolidated bottom wetlands). The largest and most extensive wetlands can be found along the many streams and ponds, such as Catsbane Brook, Broad Brook, Wheelock Brook, and California Brook. In addition, the landscape supports many small isolated palustrine wetlands.

Table 1 Summary of wetlands in Chesterfield.

Wetland Classification	Area (acres)
Lacustrine	808
Riverine	551
Palustrine	
Unconsolidated Bottom	65
Aquatic Bed	129
Emergent Marsh	261
Scrub-shrub Swamp	275
Forested Swamp	452

SOURCE: National Wetlands Inventory Plus (2021)

Under RSA 482-A:15, the Wetlands Dredge and Fill Law provides the opportunity for municipalities to designate prime wetlands. These wetlands are considered to have high importance due to their size, unspoiled character, fragile condition, and substantial significance in a community. To identify potential prime wetlands, a town conducts an evaluation of all wetlands greater than two acres and considers a variety of ecological functions and societal values that these wetlands provide. Chesterfield began this wetlands evaluation process with their last NRI (Littleton 2011). Once potential prime wetlands have been identified, a municipal vote is needed to designate them as such, and a report and maps documenting their significance must be filed with the NH Department of Environmental Services. Prime wetlands are afforded more protection and greater scrutiny where impacts to them are proposed.

In 2010, Moosewood Ecological LLC conducted a wetlands comparative evaluation study for the Chesterfield Conservation Commission to inventory and evaluate 55 wetlands. This study was also intended to help the Conservation Commission assess potential impacts of dredge and fill activities, to improve the general knowledge of wetlands, and to educate landowners about wetlands. To understand Chesterfield's prime wetlands this study needs to be expanded to evaluate all wetlands 2 acres or larger. This would also provide a better understanding of the overall functions and values of wetlands throughout the town.

To adequately characterize and delineate wetlands, one must consider hydric soils, which includes wetland soils categorized as poorly drained and very poorly drained. These soil types have been mapped for general planning purposes by the USDA Natural Resources Conservation Service. Poorly drained soils are estimated to cover about 1,150 acres, while very poorly drained soils cover 1,621 acres, based on GIS calculations and totaling 2,771 acres. This differs from the estimated area of wetlands noted above. The difference in these two datasets is primarily due to the data used and the inherent errors associated with these data. Delineation of wetlands for site-specific purposes (i.e., developments) requires on-site examination by a wetland scientist, under RSA 310-A.

Chesterfield Natural Resources Inventory
Wetlands and Surface Water Resources

Map Description:
Wetlands and surface waters provide many ecological functions and human values. These include providing wildlife habitat, assisting with flood control, maintaining water quality, recharging groundwater supplies, offering education and scientific research opportunities, and recreation. This map does not reflect all of the wetlands located in Chesterfield, nor does it constitute jurisdictional wetland delineations. Wetlands mapped are for planning purposes only. On-site investigations are needed to confirm existing data and develop new data on wetlands. Conservation lands have also been added to show where many Town-owned and privately owned lands that have been protected over time, as well as the resources they protect.

Data Sources:
-Political Boundaries, downloaded from NH GRANIT
-Roads from NH DOT, downloaded from NH GRANIT
-Wetlands (NWI Plus), downloaded from NH GRANIT
-FEMA floodplains, downloaded from fema.gov
-Conservation Lands, downloaded from NH GRANIT, edited by Moosewood
-Surface Water (NHD), downloaded from NH GRANIT, edited by Moosewood
-Streams, downloaded from NH GRANIT
-Soils, downloaded from NH GRANIT
-Watersheds, downloaded from NH GRANIT

Legend
- Chesterfield boundary
- Town boundaries
- Local watershed boundaries
- Roads
- Streams

Floodplains
- 100-yr floodplain
- 500-yr floodplain

Waterbodies
- Lakes and ponds
- Wetlands
- Rivers

Soils
- Poorly drained
- Very poorly drained
- Conserved lands

N W E S

0 0.25 0.5 1 Miles

Partridge Brook

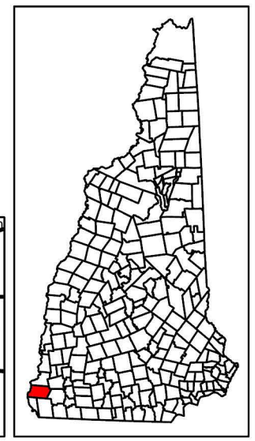
Ash Swamp Brook-Ashuelot River

Catsbane Brook-Connecticut River

Wheelock Brook-Ashuelot River

Ashuelot River

Vernon Dam-Connecticut River



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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
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False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
Scale Factor: 1.0000
Latitude Of Origin: 42.5000
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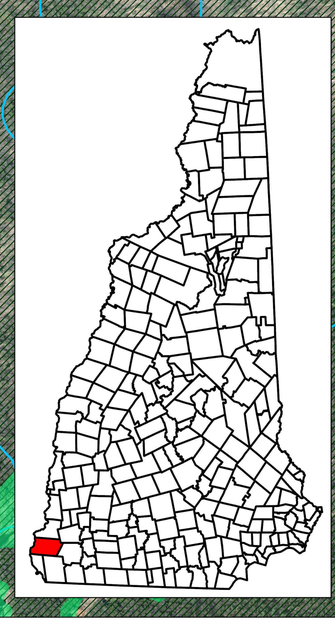
Date: 9/3/2022

Chesterfield Natural Resources Inventory
Spofford Lake Watershed

Map Description:
Spofford Lake, the largest lake for twenty miles in any direction, provides aesthetic, recreational, and cultural value to the Town of Chesterfield. While virtually no land within this lake's watershed is conserved, ordinances and guidelines help protect the critical wetlands and protected streams within this area.

Data Sources:
- Conservation lands, downloaded from NH GRANIT and additional conservation lands provided by the Town of Chesterfield
- Surface water (NHD), downloaded from NH GRANIT
- Streams, downloaded from NH GRANIT
- Roads from NH DOT, downloaded from NH GRANIT
- Wetlands (NWI), downloaded from NH GRANIT
- Spofford Lake watershed, Moosewood Ecological LLC

Partridge Brook



Legend

- Lakes and ponds
- Wetlands
- Roads
- Streams
- Conserved lands
- Spofford Lake watershed
- Protected stream
- Parcel boundary

N
W E
S

0 0.25 0.5 Miles

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Date: 8/17/2022

Wetlands such as this emergent marsh provide many ecological functions, including wildlife habitat, maintenance of water quality, flood control, groundwater recharge, and recreation.

Surface Waters and Watersheds

Chesterfield's surface waters range from small unnamed streams to the large Connecticut River and small unnamed ponds to the 736-acre Spofford Lake (Figures 2 and 3). These surface waters provide a multitude of human benefits such as fishing, hunting, boating, swimming, and nature observation, and are essential for wildlife and plants that depend upon these resources for their life cycle needs. Threats to water resources include potential water quality degradation by mobile, stationary, or area pollution sources, such as Mercury from coal-based emissions in the mid-west that has impacted surface waters in Chesterfield and the entire Northeast; habitat loss due to surrounding land use including unsustainable forestry and agricultural practices; and land conversion associated with roads and other development.

Spofford Lake and Ponds

Chesterfield has numerous ponds distributed throughout the town. The US Geological Survey and the NH Dept. of Environmental Services (NHDES) have identified seven distinct named ponds. These waterbodies cover approximately 815 acres, ranging in size from about 2.6 acres to 736 acres (Table 2 and Figure 2). Many other smaller ponds also exist in Chesterfield but were not specifically identified as part of this project.

Spofford Lake is a central feature in Chesterfield as it has served as a favored vacation destination, provides homes for summer and year-round residences, and is the largest lake in Cheshire County. It has been the subject of water quality monitoring by the Spofford Lake Association under the Volunteer Lake Assessment Program managed by the NH Dept. of Environmental Services. In the 2018 watershed management plan, it was noted that Spofford Lake is threatened by "low concentrations of dissolved oxygen in the hypolimnion (i.e., bottom waters), recent excessive plant growth in shallow littoral areas of the lake, and elevated levels of chloride" (FB Environmental Associates 2018).

Table 2 Summary of Lakes and Ponds in Chesterfield.

Ponds	Size (acres)
Baker Pond	16.2
Fullam Pond	21.3
Hubner Pond	2.6
Indian Pond	4.7
Lily Pond	18.3
Lily Pond (Pisgah)	15.9
Spofford Lake	736

SOURCE: USGS topography and NHDES.

Indian Pond is a small remote waterbody that sits in a small basin atop Wantastiquet Mountain.

Connecticut River and Streams

Approximately 123 miles of streams and rivers have been mapped in Chesterfield (Table 3 and Figure 2). Fifteen streams and rivers are named on U.S. Geological Survey maps. The Connecticut River is the largest flowing water course in Chesterfield followed by Broad Brook, Catsbane Brook, Hubbard Brook, Town Brook and Wheelock Brook. Under Article 3 in the 2009 Warrant certain sections of the following streams are protected in Chesterfield: Catsbane Brook, Gulf Brook, Partridge Brook, Very Brook, Hubbard Brook, and Town Brook. There are approximately 85 miles of unnamed perennial and intermittent streams. Most of these are tributaries of the largest rivers and streams in Chesterfield.

Not all intermittent streams, those that flow seasonally, have been mapped for Chesterfield. Also, ephemeral streams that flow in response to rain events have not been mapped. Most of these drainages are not shown on USGS topographic maps or in digital datasets used to map surface waters. Similar to perennial streams, intermittent streams have defined channels. However, they are typically fed by periods of high groundwater and supplemented by snowmelt and rain storms, and they typically do not have flowing water during dry periods. In contrast, perennial streams flow generally throughout the year. In contrast, ephemeral streams are drainages that do not have distinct channels and only flow

during snowmelt and rain storms. It is important to make these distinctions as each provides a different habitat, but all are important aspects of our landscape and their role in draining water from the uplands into perennial streams, wetlands, ponds, and Spofford Lake. Developments that do not include all of these drainages into the planning process can potentially cause unintended erosion and sedimentation of our water resources.

Table 3 Summary of rivers and streams in Chesterfield.

Streams	Length (miles)	Stream Order
Connecticut River	6.0	7th
Broad Brook	3.4	3rd
Catsbane Brook	3.8	3rd
Hubbard Brook	3.0	3rd
Town Brook	4.1	3rd
Wheelock Brook	3.9	3rd
California Brook	1.9	2nd
Governors Brook	1.6	2nd
Gulf Brook	2.4	2nd
Partridge Brook	3.3	2nd
Pond Brook	3.0	2nd
Lily Pond Brook	0.2	1st
Pisgah Brook	0.1	1st
Rixford Brook	1.3	1st
Snow Brook	0.6	1st
Unnamed Streams	84.4	1st - 3rd

SOURCE: USGS topography and hydrography datasets.

Partridge Brook roaring through the Chesterfield Gorge Natural Area.

Shoreland Water Quality Protection Act

The Shoreland Water Quality Protection Act (SWQPA), RSA 483-B, is a state statute enacted (initially as the Comprehensive Shoreland Protection Act) to protect the shorelands and water quality of public waters. These include all great ponds (>10 acres), fourth order streams or higher, and state-designated rivers have been identified by the NH Dept. of Environmental Services as water bodies that are subject to the SWQPA. The Act established minimum standards for the subdivision, use, and development of the shorelands along the state's larger waterbodies. For most new construction, as well as land excavating and filling, a state permit may be required (certain exemptions apply). Spofford Lake, Fullam Pond, Baker Pond, Lily Pond, and Connecticut River are public waters and therefore, included on the NH DES Consolidated List of Water Bodies subject to the SWQPA.

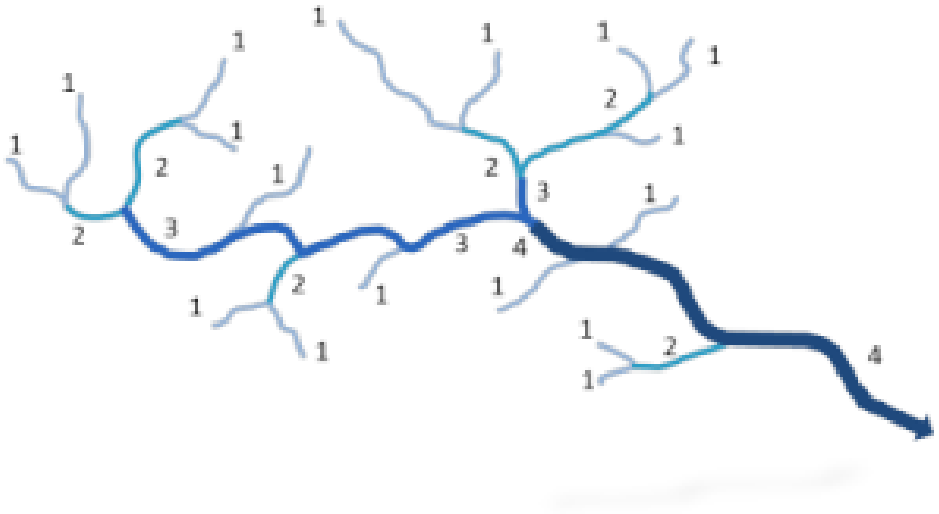

Diagram of how stream order is determined. Stream ordering is a method of classifying the hierarchy of tributaries within a watershed. The smaller the stream order value, the smaller the stream. First order streams include the headwater streams that can be found along the steeper slopes in Chesterfield. When two first order streams converge, they form a second order stream, and so on. The numbers in this figure represent the stream order.

Watersheds

A watershed is an area of land that drains to a common outlet. Watersheds exist at an almost infinite range of scales, from the tiniest tributary stream that is not mapped to major continent-draining rivers. Regardless of their scale, watersheds are a convenient way to parse the landscape into smaller ecological units. All precipitation within a watershed drains toward a common water resource, which may be a wetland, lake, pond, or ocean. The land use within a watershed affects the quality and quantity of surface waters and the underlying groundwater. Land use planning based on watershed protection can help protect a town's water resources, ensuring clean water for humans and ecosystem health.

Chesterfield is in the greater Connecticut River watershed. Chesterfield is further divided into four smaller but major waterheds (Figure 2). Streams in the Catsbane Brook and Partridge Brook watersheds drain directly into the Connecticut River. While the Wheelock Brook and Ashuelot River watersheds drain into the Ashuelot River and eventually into the Connecticut River. The smaller Spofford Lake watershed (Figure 3) is of great significance and is subsumed in the larger Partridge Brook watershed.

Groundwater Resources – Stratified Drift Aquifers

Groundwater resources that can serve as sources for drinking water are referred to as aquifers. Groundwater is located in two types of aquifers -- sand and gravel deposits and bedrock.

In the last post-glacial period as glaciers melted, these meltwaters left behind layers of sorted sediments including sand and gravel. The larger spaces between the particles in the sand and gravel provides groundwater storage and flow. Groundwater stored in *stratified drift aquifers* can serve as an excellent source of drinking water due to the larger quantities available. Locating these geologic features and protecting them as current and future water sources can help to ensure a supply of clean drinking water free of contamination. In contrast, bedrock aquifers typically produce lower quantities of water than stratified drift aquifers; however, bedrock aquifers provide drinking water for a majority of households in Chesterfield through private wells.

Chesterfield contains approximately 180.8 acres of stratified drift aquifers (Table 4 and Figure 4). Stratified drift aquifers are grouped into categories based on *transmissivity*, or the rate at which water moves through them. Transmissivity 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 stratified drift aquifers in Chesterfield have a transmissivity rate of 2,000 ft^2/day or less. Higher transmissivity rates occur in the Connecticut River Basin.

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 Favorable Gravel Well Analysis (FGWA) for the entire state. This project analyzed stratified drift aquifers for transmissivity rates in combination with water quality based on known and potential locations of surface and groundwater pollution, affording the opportunity for town planners and water suppliers to determine quantity and quality constraints on aquifers. The FGWA areas are illustrated in Figure 4.

Table 4 Extent of Chesterfield's stratified drift aquifers and favorable gravel well analysis.

Groundwater Attribute	Size (acres)
Stratified Drift Aquifer Transmissivity Rates	
<2,000 $feet^2$/day	13.1
2,000-4,000 $feet^2$/day	119.6
>4,000 $feet^2$/day	48.1
Favorable Gravel Well Analysis	
>75 Gallons/Minute	37.5
>150 Gallons/Minute	19.9

Source: USGS stratified drift aquifers and NH DES favorable gravel well analysis.

The FGWA created buffers to avoid all known and potential contamination sources and examined 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 Merrimack River have been identified by the FGWA. It was estimated that some of these areas could produce more than 150 gallons per minute.

Chesterfield Natural Resources Inventory
Groundwater Resources

Map Description:
Groundwater resources provide humans with sources of drinking water. It is important to protect these areas from contamination in order to supply clean water for consumption. This map shows where various groundwater aquifers are located in Chesterfield, as well as sites identified by the NH Department of Environmental Services as potential future public water supply sites. Conservation lands have also been added to show where many Town-owned and privately owned lands that have been protected over time, as well as the resources they protect.

Data Sources:
- Political boundaries, downloaded from NH GRANIT
- Conservation lands, downloaded from NH GRANIT
- Surface water (NHD), downloaded from NH GRANIT
- Wetlands (NWI), downloaded from NH GRANIT
- Roads from NH DOT, downloaded from NH GRANIT
- USGS Stratified Drift Aquifers, downloaded from NH GRANIT
- Favorable Gravel Well Analysis, NH DES
- Watersheds, downloaded from NH GRANIT
- Streams, downloaded from NH GRANIT

Legend
- Chesterfield boundary
- Town boundaries
- Local watershed boundaries
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Favorable gravel well anlysis - 75 gallons/min
- Favorable gravel well analysis - 150 gal/min
- Aquifers
- Conserved lands

N W E S

0 0.25 0.5 1 Miles

Partridge Brook

Ash Swamp Brook-Ashuelot River

Catsbane Brook-Connecticut River

Wheelock Brook-Ashuelot River

Vernon Dam-Connecticut River

Ashuelot River

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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
Scale Factor: 1.0000
Latitude Of Origin: 42.5000
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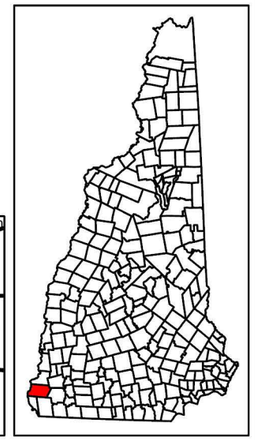


ECOLOGICAL RESOURCES

Ecological resources are natural resources that provide certain necessary but overlooked system maintenance functions within ecosystems (Scott et al. 1998). Ecological resources in Chesterfield include many features such as wildlife habitats, natural (plant) communities, and rare species. These natural resources encompass the realm of biodiversity, or the variety and variability of life, which supports healthy ecosystems for wildlife, plants, and humans.

This Natural Resources Inventory was enhanced by field surveys on select public and private properties to assess some of Chesterfield's biodiversity on the ground. These surveys focused on assessing Chesterfield's wildlife and plant diversity and habitats on 1) town-owned properties, 2) roadside surveys, 3) assessments on private properties where landowners provided permission, and 4) state-owned properties. These assessments, which are described below, provide a representative sample of Chesterfield's landscape to support proactive land use planning, community education, and land stewardship. The following sections provide a glimpse into the range of diverse species and habitats present in Chesterfield.

Field Surveys

Field surveys were conducted on several properties spring 2021 through and winter 2022. Habitats with a high potential to harbor rare species and natural communities were identified using GIS mapping to guide field efforts. A subset of parcels identified for field surveys was chosen beginning with properties owned or protected by the Town or other conservation entities. A list identifying private lands as suitable for surveys was created, and this list formed the basis of a permissions-based outreach effort to individual landowners. Those who granted permission to conduct a survey were contacted in advance based on their preferences, and their properties were surveyed for a variety of ecological features. A total of one town-owned property and 22 private properties were visited in the field during the study, as well as observations from the roadsides. Highlights of the field work are included below in the wildlife habitat descriptions.

NH Wildlife Action Plan

Chesterfield's landscape supports a variety of wildlife habitats and natural communities, including rivers, streams, ponds, wetlands, and floodplains interspersed with a variety of upland forests, rocky ridges, grasslands, and shrublands distributed throughout the town. This diverse landscape supports a high degree of biodiversity.

The NH Fish and Game Department, in cooperation with other agencies, organizations, and individuals, produced the NH Wildlife Action Plan (WAP) in 2005. The latest revision was produced 2020 (NH Fish and Game 2020). Habitat data is revised every 5 years. The WAP 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 that an adequate representation of various wildlife habitats is maintained across New Hampshire's landscape, keeping common species common in New Hampshire and working to prevent the loss of our rare and endangered species.

The WAP project grouped habitats at three scales: broad-scale (matrix forests and sub-watershed groupings), patch-scale (priority habitats such as grasslands and peatlands), and site-scale (documented occurrences of rare and uncommon species and natural communities). Mapped data are available for viewing and use only at the broad- and patch-scale levels. Habitat mapping is intended to predict, not necessarily guarantee that the habitats shown are present. For this reason, field and remote sensing

verification is recommended by NH Fish and Game to increase the accuracy of the mapping at the parcel and municipal scale.

A total of 15 wildlife habitats described in the WAP were mapped for Chesterfield (Table 5 and Figure 5). Potential and confirmed vernal pools were mapped using 2015 aerial photography interpretation, data provided by the Chesterfield Conservation Commission, and data collected in the field by Moosewood Ecological LLC during the 2021 field season (Littleton et al. 2021). The WAP recognizes vernal pools as unique wetlands that provide critical breeding habitat for several amphibian species of greatest conservation need in New Hampshire; however, these isolated wetlands have not been mapped for New Hampshire. Vernal pool locations can be predicted through aerial photograph interpretation and LiDAR (Light Detection and Ranging) technology, providing the first step in identifying their potential distribution. However, pools are best mapped using on-site field assessments and verification of use by obligate species, those species that require vernal pools for part of their life cycles.

Table 5 Summary of habitats mapped by the Wildlife Action Plan in Chesterfield.

Wildlife Habitat	Extent (Area or Miles)	Percent of Town
Appalachian oak-pine	97 acres	0.3%
Barren or Developed	2431 acres	8.0%
Cliff and talus slopes	32 acres	0.1%
Floodplain forest	11 acres	0.0%
Grassland	1376 acres	4.5%
Hemloack-hardwood-pine forest	24283 acres	79.8%
Northern swamp	55 acres	0.2%
Open water	1334 acres	4.4%
Peatland	52 acres	0.2%
Rocky ridge	120 acres	0.4%
Sand/gravel	12 acres	0.0%
Temperate swamp	71 acres	0.2%
Marsh and shrub wetland	546 acres	1.8%
Vernal Pools	144 pools	N/A
Streams	123 miles	N/A

Source: Wildlife Action Plan (2015), USGS NH Hydrography, Vernal pools from Moosewood Ecological LLC

The WAP includes a risk assessment of 27 habitats and 157 species of greatest conservation need that was based on standards adopted by other northeastern states (NH Fish and Game 2020). The assessment assigned a number of risk factors to each of these species within each described habitat to determine which habitat types (and the species they support) appear to be most vulnerable to various effects including pollution, climate change, natural systems modification, invasive species, disease and development. Table 6 includes a list of WAP habitats occurring in Chesterfield that were determined to be the highest at risk from these factors.

Table 6 2020 NH Wildlife Action Plan - habitats critical for species at risk.

Forests	**Other Terrestrial Habitats**
Hemlock-Hardwood-Pine Forest	Rocky Ridges
Appalachian Oak-Pine Forest	Grasslands
Freshwater Wetlands	Shrublands
Floodplain Forests	**Freshwater Aquatic**
Vernal Pools	Large Warmwater Rivers
Temperate Swamps	Warmwater Rivers and Streams
Peatlands	Warmwater Lakes and Ponds
Shrub Wetlands	

SOURCE: NH Fish and Game (2020).

The Wildlife Action Plan Highest Ranked Habitats map (Figure 6) shows where habitats in the best ecological condition in the state are located; this was based on biodiversity, arrangement of habitat types on the landscape, and lack of human impacts.

With the goal of setting priorities for conservation of important wildlife habitat in New Hampshire, the WAP also identified areas of the state with unusually pristine, influential, diverse, or extensive examples of "exemplary" habitat. These areas were, in turn, ranked by condition on both sub-state regional and statewide levels, resulting in a tiered ranking of priority areas for conservation. Figure 6 illustrates the highest ranked habitat for conservation in Chesterfield.

Color-coded areas shown in Figure 6 indicate highest ranked habitats by condition, both within New Hampshire (hot pink) and within an ecoregion (green), and include Pisgah State Park, Madame Sherri, California Brook area, and the northwest section of Chesterfield. The extensive matrix of highest-ranked habitats is surrounded by large areas of "Supporting Landscape," indicating that Chesterfield has substantial highest-ranked WAP wildlife habitats. Supporting Landscapes (orange) provide important habitat of local importance. All three categories are considered unusually significant for wildlife, and especially important areas for land conservation.

Chesterfield Natural Resources Inventory
Significant Wildlife Habitats

Map Description:
The NH Fish and Game Department first produced the Wildlife Action Plan in 2005 and has most recently updated it in 2020. This map shows where various wildlife habitats are located in Chesterfield, including diverse wetlands, forests, grasslands, and shrublands. Many of these habitats support species of conservation concern. Conservation lands have also been added to show where the many Town-owned and privately owned lands and their resources have been protected over time.

Data Sources:
- Political boundaries, downloaded from NH GRANIT
- Conservation lands, downloaded from NH GRANIT
- Surface water (NHD), downloaded from NH GRANIT
- Roads from NH DOT, downloaded from NH GRANIT
- NH Fish and Game WAP Habitats, downloaded from NH GRANIT
- Revised Grasslands, Moosewood Ecological
- Wetlands (NWI), downloaded from NH GRANIT
- Streams, downloaded from NH GRANIT

Legend

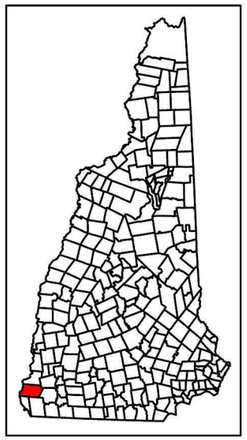
- Chesterfield boundary
- Town boundaries
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Conserved lands
- Active grasslands (>5 acres)

Habitat Type

- Appalachian oak-pine
- Cliff and Talus slope
- Developed Impervious
- Developed or Barren land
- Floodplain forest
- Grassland
- Hemlock-hardwood-pine
- Northern swamp
- Open water
- Peatland
- Rocky ridge
- Sand/Gravel
- Temperate swamp
- Marsh and shrub wetland

N W E S

0 0.25 0.5 1 Miles



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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
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False Northing: 0.0000
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Scale Factor: 1.0000
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Innovative Conservation Solutions for New England

Date: 9/4/2022

Chesterfield Natural Resources Inventory
Highest-Quality Habitat Tiers

Map Description:
The NH Fish and Game Department first produced the Wildlife Action Plan in 2005 and has most recently updated it in 2020. This map shows where highest-ranked habitats and supporting landscapes are located in Chesterfield and should be used as a planning tool to identify the most critical wildlife habitat locations relative to the State and ecoregion. Conservation lands have also been added to show where the many Town-owned and privately owned lands and their resources have been protected over time.

Data Sources:
-Political Boundaries, downloaded from NH GRANIT
-Roads from NH DOT, downloaded from NH GRANIT
-Wetlands (NWI Plus), downloaded from NH GRANIT
-NH Fish and Game WAP Habitats Tiers, downloaded from NH GRANIT
-Conservation Lands, downloaded from NH GRANIT, edited by Moosewood
-Surface Water (NHD), downloaded from NH GRANIT, edited by Moosewood
-Streams, downloaded from NH GRANIT

Legend
- Chesterfield boundary
- Town boundaries
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Conserved lands

Habitat Tiers
- 1) Highest Ranked Habitat in New Hampshire
- 2) Highest Ranked Habitat in Biological Region
- 3) Supporting Landscapes

N W E S

0 0.25 0.5 1 Miles

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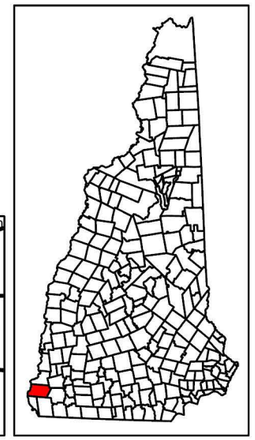


The following provides brief descriptions of the wildlife habitats observed on town-owned lands and private properties during the course of field work completed 2021. However, this does not represent a comprehensive list of wildlife, and many other species are expected to be using these habitats at various points of the year.

Appalachian Oak-Pine Forests

The Appalachian oak-pine matrix forest ecosystem is very limited in its distribution in Chesterfield; however, they offer habitat for a diverse suite of wildlife. These forests are limited in their distribution in New Hampshire and are typically found in lower elevations below 900 feet and are more widespread in southerly NH counties. They are associated with nutrient-poor, sandy soils or dry rocky ridges. In contrast, there are some rare forest communities within this ecosystem that occur in areas of nutrient-enriched soils. Fire is a common ecological process that helps to maintain many of the forest community types in this matrix forest complex. Plants found within this forest ecosystem are commonly found along the central and southern Appalachian Mountains, including white oak, black oak, scarlet oak, chestnut oak, pitch pine, and American chestnut, as well as mountain laurel and a variety of hickories.

According to the WAP, Appalachian oak-pine forests constitute a very minor portion forest community in Chesterfield, and it is predicted to cover approximately 7 acres, or about 0.2% of the town. These predictions are based on habitat models that suggest these areas would most likely support this forest ecosystem, prehistorically and in the absence of human disturbance (i.e., timber harvesting). Examples of this matrix forest type can be found mostly at Wantastiquet Mountain and Madame Sherri.

Appalachian oak-pine forests support 104 vertebrate wildlife species, including 8 amphibians, 67 birds, 14 mammals, and 12 reptiles (NH Fish and Game 2020). Four exemplary natural communities can be found in this type of forest. These include *Appalachian Oak-Pine Rocky Ridge, Appalachian Wooded Talus*, *Birch-Mountain Maple Wooded Talus*, and *Dry Appalachian Oak Forest*. Other natural communities known to exist in this area include *Appalachian Oak-Mountain Laurel Forest* and *Rich Appalachian Oak Rocky Woods*.

Hemlock-Hardwood-Pine Forests

This matrix forest is by far the most widespread type in Chesterfield, covering 24,283 acres, or 79.8% of the town. This forest type can be found in Friedsam Town Forest, Pisgah State Park, Chesterfield Gorge Natural Area, the base of Madame Sherri, and most any other upland It supports 140 vertebrate wildlife species, including 15 amphibians, 13 reptiles, 73 birds, and 39 mammals (NH Fish and Game 2020).

The hemlock-hardwood-pine forest ecosystem is a transitional forest type. It occurs at the overlap of the Appalachian oak-pine forest found at lower elevations and southward, and the northern hardwood-conifer forests found in higher elevations and farther north. Typically, this forest ecosystem is dominated by hemlock, beech, red oak, and white pine, with lower amounts of white ash, birches, maples, and occasionally hickories.

Rocky Ridges, Cliffs, and Talus Slopes

Rocky ridges are characterized by open bedrock and thin soils that support sparse vegetation. These areas are typically very dry, excessively well-drained, and acidic, supporting forest communities that are maintained by periodic fires due to exposure to lightning. Similarly, cliffs are relatively open with sparse vegetation. They are characterized as very steep rock faces over 10 feet tall. Talus slopes occur at the base of cliffs where boulders accumulate, forming crevices and caves that wildlife use to raise their young or hibernate during winter. These areas are uncommon and can contain rare natural communities. They may support rare wildlife species, such as timber rattlesnake (State-endangered species). Rocky outcrops and talus slopes that face south also provide wonderful sunning sites for bobcat in the winter

months. A very small area of this habitat type was mapped by the WAP on the Wantastiquet Mountain and Madame Sherri Forest.

Grasslands

Grasslands are non-forested areas maintained for a variety of uses, such as hay, pastures, and wildlife habitat. They are dominated by grasses and forbs (an herbaceous flowering plant that is not grass-like) with little to no presence of trees and shrubs. Grasslands were more abundant during the late 1700s through the 1800s before farms were abandoned and allowed to revert into forest. As such, there has been a steep decline in the diversity of wildlife associated with this habitat.

Locations of grasslands were revised from the WAP as part of this NRI. Grasslands were delineated and mapped using 2015 aerial photography, yielding a total of approximately 1,376 acres in Chesterfield. Grasslands include active pastures, hayfields and meadows. They support numerous species of greatest conservation need, and therefore, are some of Chesterfield's most significant habitats for wildlife. In fact, they can support rare species such as meadowlark, grasshopper sparrow, vesper sparrow, horned lark, wood turtle, and northern leopard frog.

Shrublands

Shrublands are contain thickets of young trees and shrubs mixed with occasional grasses and forbs. Shrubland habitat is declining in the state, and this decline has a profound effect on wildlife. Shrublands provide an important habitat for 139 species of reptiles, amphibians, mammals, and birds in New Hampshire (NH Fish and Game 2020). Several of these species have been identified as species of greatest conservation need. In fact, 22 of 28 species of shrubland birds are currently in decline.

Shrublands are difficult to quantify and map since they represent transitional habitat between forests and open areas, such as fields, sand and gravel pits, and developed sites. Most shrublands revert to forest if not maintained by natural disturbances (i.e., fire) or active management (i.e., mowing). Some upland sites, such as utility corridors, may provide relatively consistent shrublands as they are maintained periodically to prevent trees from growing into the powerlines. Shrub swamps, shorelines and other wetland sites also provide long-term shrub habitats where trees cannot grow due to flooding.

Floodplains

Floodplains are found along river valleys directly adjacent to rivers, streams, and larger wetland complexes, including the Connecticut River. They can vary in their species composition and overall structure from forests to open herbaceous floodplains with shrub swamps, oxbows, and vernal pools. They are strongly influenced by the size of the watershed and the gradient of the river. Historically, many of our floodplains were cleared for agricultural fields in the 1700s-1800s. Many have now been converted into residential, commercial, and industrial developments, while others remain as farmlands. As a result, floodplains are more limited due to these types of land conversion, as well as construction of dams that control water levels.

Floodplains and riparian forests play critical roles in helping to protect water quality by slowing floodwaters and supporting diverse plant communities. They also provide significant habitat for a wide variety of wildlife including several species of greatest conservation need, such as wood turtle, Blanding's turtle, spotted turtle, smooth green snake, northern leopard frog, Jefferson salamander, American woodcock, cerulean warbler, and veery.

It is estimated that Chesterfield has a total of 11 acres of floodplain forests found along the Connecticut River. The most natural area supports a small example of the *Silver Maple-False Nettle-Sensitive Fern Floodplain Forest* community found along River Road. This is a rare natural community.

Marsh and Shrub Wetlands

There are about 546 acres of marsh and shrub wetlands in Chesterfield. They are widely dispersed throughout the town. The largest occurrences are along Catsbane Brook, California Brook area, and Pisgah State Park where the exemplary *Drainage Marsh-Shrub Swamp System* resides. However, many smaller examples can be also found along streams, associated with beaver ponds, and small isolated pockets scattered throughout Chesterfield in low-lying depressions or perched basins.

Marshes are often dominated by a combination of grasses, sedges, rushes, and to a lesser degree, forbs, and may contain areas of open water. Edges of beaver ponds tend to support marshes and abandoned beaver ponds usually revert to marsh habitat with less open water. Shrub swamps, in contrast, are dominated by wetland shrubs such as highbush blueberry, arrowwood, northern wild raisin, winterberry, and speckled alder. Marsh and shrub wetlands are distinctly different in their habitat structure and therefore, will support different wildlife communities. However, they are often found existing together, supporting relatively high biodiversity. Marsh and shrub wetlands support 18 wildlife species of greatest conservation need in New Hampshire, as well as rare plants and plant communities (NH Fish and Game 2020).

Peatlands

Peatlands are open wetland habitats dominated by shrubs, sedges, and *Sphagnum* mosses. They are characterized by peat soil - organic soil of partially decomposed plants. Peatlands form in sites of limited or no surface water input and range from being highly acidic and poor nutrient levels to moderately nutrient-enriched. "Quaking" bogs are one uncommon type of peatland. Peatlands are often isolated in basin settings, or occupy the shallow end of larger wetlands or shallow ponds. The low pH (indicator of acidic conditions) is a strong factor influencing the composition of plant species.

Typical plants associated with poor to medium nutrient peatlands include insectivorous pitcher plants and sundews, diverse sedge communities, mosses, highbush blueberry, mountain holly, speckled alder, sheep laurel, bog rosemary, and forbs such as bog aster and bog goldenrod. Fifty-four rare plants are supported by peatlands state-wide, including dwarf huckleberry, several rare sedges, and rare orchids. Associated uncommon wildlife species of note include ringed boghaunter dragonfly, palm warbler, mink frog, and ribbon snake.

It is estimated that there are about 52 acres of peatlands distributed across Chesterfield's landscape. Most are small, isolated wetland habitats at the beginning of small headwater streams and other areas of slow, sluggish waters. Peatlands are present within several wetlands in Chesterfield.

Temperate Forested Swamps

There are about 71 acres of forested swamps in Chesterfield. Forested swamps are typically isolated wetlands found in low-lying basins. They are sparsely distributed throughout the town. Similar to marsh and shrub wetlands, forested swamps help maintain water quality, store floodwaters, recharge groundwater supplies, and may support vernal pools as well. The most common examples include *Red Maple–Sphagnum Basin Swamps, Seasonally Flooded Red Maple Swamp,* and *Hemlock-Cinnamon Fern Forest.*

Vernal Pools

Vernal pools provide unique and critical habitats for a variety of species. These pools typically fill during the spring, dry out completely or partially later in the summer, and contain no viable fish populations. These attributes are critical for the long-term survival of vernal pool obligate organisms. They also have no permanent inlet or outlet streams. For vernal pools to continue to function as critical wildlife habitats, they require a forested canopy around the vernal pool and significant intact, natural

forest surrounding them, as many obligate species spend most of their life cycles up to 1,000 feet from the vernal pool in these forested uplands. It is for this reason that larger forested buffers surrounding vernal pools are encouraged.

Amphibians such as wood frog, spotted salamander, and Jefferson's salamander (a species of special concern) use vernal pools. Vernal pools are also significant for other species of conservation concern including Blanding's turtle, spotted turtle, and ribbon snake. Many aquatic macroinvertebrates such as fairy shrimp and fingernail clam depend upon this habitat. Documented local examples are present on conservation lands at Madame Sherri and Pisgah State Park.

One-hundred forty-four confirmed or potential vernal pools have been identified thus far throughout Chesterfield. These can be found in many settings in the landscape, such as at the beginning of headwater streams on hilltops and ridges, along benches on side slopes of hills and peaks, riparian forests, floodplain forests, and level areas between hilltops, as well as where the topography forms small depressions in flat areas.

Lakes and Ponds

There are approximately 1,334 acres of open waterbodies in Chesterfield. At 736 acres, Spofford Lake is by far the largest, followed by Fullam, Bake, and Lily Ponds. They can provide significant recreational resources, as well as wildlife habitat not available elsewhere. Ponds are an important habitat for many species of reptiles and amphibians such as snapping turtles, painted turtles, red-spotted newts, green frogs, bullfrogs, and pickerel frogs. Many species of waterfowl use these habitats for resting during migration, as well as for feeding and breeding, including great blue herons, mallards, and geese. They even provide a food source for bald eagles and osprey. Otters are often observed along with racoons hunting for fish and crayfish. In addition, there are numerous aquatic macroinvertebrates in ponds and lakes, providing a rich source of food for other wildlife species.

Rivers and Streams

There are approximately 123 miles of rivers and streams in Chesterfield. They are quite diverse as they provide important resources for a variety of species that thrive in both cold water and warm water habitats. Most of Chesterfield's cold-water streams can be found cascading down its hills and ridgelines where they provide cold, clear, highly oxygenated waters. These streams are important for brook trout and stream salamanders such as the spring salamander, as well as many aquatic macroinvertebrates that are a source of food.

The dominant flowing water in the region, the Connecticut River, forms the western boundary of Chesterfield, and is the most significant water course in the Town. The river had been impacted by sewage, industrial wastes, and soil runoff that degraded the water quality to where it was unsafe to swim. With the passage and subsequent implementation of the federal Clean Water Act in 1972, these trends started to reverse, and the river started to be appreciated again for its scenic and ecological values, as well as for recreation.

The Connecticut River and its tributaries provide habitat for a diverse wildlife community of aquatic and terrestrial mammals, fish, birds, reptiles, amphibians, and insects. Rivers and streams are threatened by climate change due to increasing water temperatures and erosion from more frequent and intense rainstorms. In addition, development adjacent to rivers and streams can degrade wildlife habitats by increasing the level of invasive plants, reducing water quality, and fragmenting landscapes.

Documented Rare Species and Natural Community Systems in Chesterfield

Numerous rare and uncommon plant and animal species have been documented in the town of Chesterfield, and these data are maintained by the New Hampshire Natural Heritage Bureau of the NH Division of Forests and Lands, in cooperation with the New Hampshire Fish and Game Department's Nongame and Endangered Wildlife Program. Generalized information on the presence of these species and communities is available from the Natural Heritage Bureau by municipality. According to the Bureau's *Rare Plants, Rare Animals and Exemplary Natural Communities in New Hampshire Towns*, most of the wildlife species listed in Table 7 have been documented in the town of Chesterfield in the last 20 years (NH Natural Heritage Bureau 2020). However, most rare plants and exemplary natural communities/systems have not been observed within the past 20 years. This does not mean that they do not still exist however. The four upland natural communities have been observed within the past 10 years (Littleton, pers. ob.). All natural communities and systems follow the classification system developed by the New Hampshire Natural Heritage Bureau (Sperduto 2011, Sperduto and Nichols 2011).

Table 7 Rare species and natural community systems documented in Chesterfield.

Rare Elemental Occurrence	Rarity Rank
Natural Communities	
Appalachian oak - pine rocky ridge ~	N/A
Appalachian wooded talus ~	N/A
Birch - mountain maple wooded talus ~	N/A
Dry Appalachian oak forest ~	N/A
Drainage marsh-shrub swamp system***	N/A
Plants	
American climbing fern ~	E
Appalachian bristle fern ~	E
Butterfly milkweed ~	E
Common star-grass ~	T
Crested sedge ~	E
Downy false foxglove ~	E
Incurved umbrella sedge ~	T
Large-fruited sanicle ~	T
Long-leaved pondweed ~	T
Narrow-leaved glade fern ~	E
Northeastern bulrush***	E
Northern horsebalm ~	E
Northern wild senna ~	E
Small-headed rush ~	E
Smooth rockcress ~	E
Upright false bindweed ~	E
Birds	
American Black Duck (n)	SGCN
Bald Eagle**	SC
Cerulean Warbler**	T
Common Loon**	T
American Kestrel	SGCN
American Woodcock	SGCN

Bank Swallow	SGCN
Bay-breasted Warbler (n)	SGCN
Black-billed Cuckoo	SGCN
Blue-winged Warbler	SGCN
Bobolink	SGCN
Brown Thrasher	SGCN
Canada Warbler	SGCN
Cape May Warbler (n)	SGCN
Chimney Swift	SGCN
Common Nighthawk (n)	SGCN
Common Tern (n)	SGCN
Eastern Meadowlark	SGCN
Eastern Towhee	SGCN
Eastern Whip-poor-will	SGCN
Field Sparrow	SGCN
Northern Goshawk	SGCN
Northern Harrier (n)	SGCN
Peregrine Falcon (n)	SGCN
Pied-billed Grebe	SGCN
Prairie Warbler	SGCN
Purple Finch	SGCN
Ruffed Grouse	SGCN
Scarlet Tanager	SGCN
Veery	SGCN
Wood Thrush	SGCN
Mammals	
Moose	SGCN
Reptiles	
Spotted Turtle**	E
Wood Turtle***	SC
Amphibians	
Jefferson Salamander ~	SC
Dragonflies	
Rapids clubtail***	SC
Skillet Clubtail ~	SC

Source: NH Natural Heritage Bureau database (2020).
E - Endangered
T - Threatened
SC - Special Concern
SGCN - Species of Greatest Conservation Need
*** - Extremely High Importance
** - Very High Importance
* - High Importance
~ - Historical record
(n) - nonbreeding season

Five exemplary natural communities and one system have been documented in Chesterfield; :four upland communities and one wetland system (Table 7; NH Natural Heritage Bureau 2020). The four upland communities are located on Watantastiquet Mountain and the wetland system is located in Pisgah State Park. Each mapped record of a species or community is based on actual observation points, degree of confidence regarding actual location and extent, knowledge of the biology or ecology of a particular species or natural community, and the extent of suitable habitat. The location and extent of these elements are one basis for the delineation of conservation focus areas.

Chesterfield is rich in records of animals of conservation concern. There are 31 records of bird species of greatest conservation need. According the NH Natural Heritage Bureau, there are three species listed as of very high importance, including bald eagle, common loon, and cerulean warbler. The latter two birds are listed as state-threatened. Moose is the only mammal listed as a species of greatest conservation need. Jefferson salamander is also a species of greatest conservation need, but this record is an historical record, meaning it was last observed over 20 years ago. Spotted turtle (state-threatened) and wood turtle (special species of concern) have been documented and are considered to be of very high importance and extremely high importance, respectively. Finally, the rapids clubtail (extremely high importance) and skillet clubtail (historical record) represent two dragonfly species of greatest conservation concern.

A total of 16 endangered and threatened plants have been documented in Chesterfield. Fifteen species are considered historical records since they have not been documented within the past 20 years. This does not mean that they do not exist, but rather they have not been surveyed again. The endangered northeastern bulrush has been observed in the past 20 years. This species if listed as a very high importance for conservation.

Wildlife of Chesterfield

Chesterfield's wetland and upland habitats support an incredible diversity of wildlife. From 2021 to 2022, a total of 455 species were noted as data from NH Natural Heritage or observed in Chesterfield either during the 15 days of field surveys by Moosewood Ecological or during the community Bioblitz event that was held in July 2021 (Littleton et al. 2019-2020 and NH Natural Heritage 2020 [Table 7]). These 455 species included 196 birds, 28 mammals, 10 amphibians, 7 reptiles, 1 crustacean, 10 arachnids (spiders and mites), 5 mollusks and 198 insects (Appendix B). Of these, there are 56 *species of greatest conservation need* as noted by the NH Wildlife Action Plan (NH Fish and Game 2020), including one NH endangered species (common nighthawk), five NH threatened species (bald eagle, common loon, peregrine falcon, pied-billed grebe, and spotted turtle), and 12 species of special concern (American kestrel, bank swallow, blue-winged warbler, cerulean warbler, cliff swallow, eastern meadowlark, horned lark, sora, Jefferson's salamander, wood turtle, rapids clubtail, and skillet clubtail). This list of wildlife is not a comprehensive list of all the wildlife known in Chesterfield, but it does provide a source to build upon.

Unfragmented Lands and Habitat Connectivity

Unfragmented lands are relatively large blocks of contiguous habitat that include a mix of forests, wetlands, riparian areas, or other habitat that supports wide-ranging mammals and forest interior birds. Unfragmented lands are defined by the lack of human infrastructure, such as roads and developed areas. Fragmentation of landscapes can negatively affect wildlife populations, from reducing habitat quality and availability, to causing direct mortality due to wildlife migration across roads. Increased predation and nest parasitism occurs along edges of smaller blocks of habitat, resulting in diminished breeding success; fewer offspring may lead to species elimination. The severity of fragmentation can be affected by the size and shape of unfragmented blocks, the species or natural community in question, the extent of natural habitats lost, intensity of human use, and colonization by invasive species.

The NH Wildlife Action Plan developed an unfragmented lands analysis. However, this data layer has inherent errors due to incorrect classification of Class VI roads as being a fragmenting feature. As such, the unfragmented lands were refined to more accurately reflect Chesterfield's landscape (Figure 7). Fragmenting features were defined as 500 feet from existing roadways, including all state and town roads, but excluding Class VI roads and trails, as well as private driveways. This analysis assumes that most development occurs within 500 feet of roadways.

Larger blocks of unfragmented areas support greater biodiversity than smaller blocks. They 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. As unfragmented areas become fragmented due to the construction of roadways and development, their biodiversity generally decreases. This fragmentation effect has less immediate impact on generalist species (those with small home ranges, such as gray squirrel, raccoon, many amphibians, and small rodents). Area-sensitive specialists can be eliminated because they need large forested blocks in order to maintain their home ranges and for long-term survival; examples include bear, bobcat, moose, wood thrush, goshawk, and various reptiles such as Blanding's turtles. To illustrate this point, Appendix C provides a general list of habitat block size requirements for wildlife.

Large unfragmented landscapes allow wildlife to migrate to new territories and to move among critical feeding, breeding, nesting, and overwintering habitats. Maintaining connectivity between critical habitats can provide permanent wildlife corridors within the built environment, enabling wildlife populations to survive.

Wildlife must be able to travel safely throughout the landscape to meet their biological needs. Many animals depend upon a variety of habitats for their survival and may utilize several natural features for travel. These include features such as riparian zones of wetlands, ponds and streams, ridgelines, utility rights-of-way, 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 important for amphibians, reptiles, and migratory birds. 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 negative effect is repeated when the same individuals return 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 an important focus for both community education and awareness about wildlife corridors that cross roadways. This knowledge can provide a means to adjust transportation patterns to decrease potential road mortality and identify sites for road modifications, including bridges and culverts designed to allow wildlife to safely cross within them.

Chesterfield Natural Resources Inventory
Unfragmented Land Blocks

Map Description:
The NH Fish and Game Wildlife Action Plan mapped unfragmented lands throughout the state. This assumes that most developments occur within 500 feet on either side of roads, excluding private driveways and Class VI roads. Unfragmented lands include areas that are typically not affected by roads, including those found in urban, suburban, and rural residential areas. Many species of wildlife need large, unfragmented areas for survival. Protecting these areas is important for maintaining biodiversity. Conservation lands have also been added to show where the many Town-owned and privately owned lands and their resources have been protected over time.

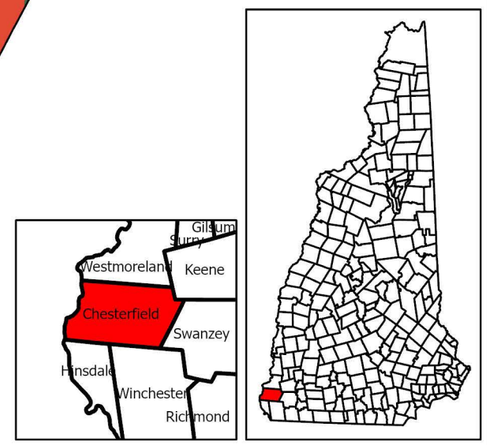
Data Sources:
-Political Boundaries, downloaded from NH GRANIT
-Roads from NH DOT, downloaded from NH GRANIT
-Wetlands (NWI Plus), downloaded from NH GRANIT
-WMS Aerial Imagery (May 2015, 1-ft resolution), downloaded from NH GRANIT
-Conservation Lands, downloaded from NH GRANIT, edited by Moosewood
-Surface Water (NHD), downloaded from NH GRANIT, edited by Moosewood
-Streams, downloaded from NH GRANIT

Legend
- Chesterfield boundary
- Town boundaries
- Conserved lands
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams

Unfragmented land blocks
- Less than 100 acres
- 100 - 499 acres
- 500 - 999 acres
- 1000 acres or more

N W E S

0 0.25 0.5 1 Miles



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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
Scale Factor: 1.0000
Latitude Of Origin: 42.5000
Units: Foot US

Moosewood Ecological LLC
Innovative Conservation and Land Management Solutions

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Innovative Conservation Solutions for New England

Date: 9/5/2022

Invasive Species

Invasive species are defined as any species, plant or animal, that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. These invasive species aggressively compete with and displace the associated flora and fauna communities (Mehrhoff et al. 2003). In other words, they possess traits that provide them with a competitive edge, including the production of numerous offspring, adaptation to a variety of site and soil conditions, thrive in areas of disturbance, and early, rapid development in the spring.

Many invasive plant species were imported for ornamental components of landscaping, erosion control, and/or food for native wildlife. Other invasive plant species, macroinvertebrates, and fungi were brought to North America inadvertently through shipments of products from other continents. Historically, these invasive organisms have caused the demise of American chestnuts and elms. Currently, Chesterfield is faced with several invasive species pathogens affecting our forests, including emerald ash borer, beech bark scale disease, hemlock wooly adelgid, Asian long-horned beetle, and red pine scale.

As with most communities in New Hampshire, Chesterfield has some areas that have a strong presence of invasive plants while other areas may have relatively low to no presence. Edges of natural habitat including shorelines and road frontage, powerlines, recently logged areas, old farm fields, and abandoned buildings and properties are especially likely to have invasive plant species, as we found in Chesterfield. Invasive plants were also observed at several public hiking properties in Chesterfield, including Madame Sherri Forest, Friedsam Town Forest, and Pisgah State Park. Invasive plant species observed throughout Chesterfield include Japanese knotweed, Asiatic bittersweet, glossy and common buckthorn, Japanese barberry, multi-flora rose, burning bush, bush honeysuckles, and garlic mustard.

AGRICULTURAL AND FOREST RESOURCES

Chesterfield has a variety of soils that have supported forestry and agriculture over the years. These farm 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[2], 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), soils considered "Important Agricultural Soils" are among the most productive lands for many types of farming practices. Important Agricultural Soils that are mapped consist of prime farmland, and farmland of statewide or local importance

Important agricultural soils are estimated to cover approximately 5,853 acres, or roughly 19% of Chesterfield (Table 8 and Figure 8). However, the area covered by important agricultural soils are estimated to be less due to developments. Important agricultural soils are widely distributed throughout the town with notable assemblages in the northern and western part of the town. Prime farmland soils make up about 3.5% of the total acreage of Chesterfield's agricultural soils, while farmland soils of local and statewide significance represent roughly 82% of these soils. Other important agricultural resources include active farmlands.

[2] 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.

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

Important Soil Type	Size (acres)	% of Town
Prime Farmland Soils	1,055	3.5%
Farmland Soils of Statewide Significance	1,297	4.3%
Farmland Soils of Local Significance	3,501	11.5%

SOURCE: USDA Natural Resources Conservation Service soils (2009).

Prime Farmland

Prime Farmland Soils are those soils best suited to food, feed, forage, fiber, and oilseed crops. The soils are of the highest quality and can economically produce sustained high yields of crops when treated and managed according to acceptable farming methods (UNH Cooperative Extension 2018). The specific criteria for prime farmland soils are:

- 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).
- 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 inch 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/or oilseed crops. 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 boulder
- 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/or forage. The criteria for soils of local importance in Chesterfield and Cheshire County are as follows:

Soils that are not prime or unique farmland or soils of statewide importance and meet the following criteria:

- Have slopes less than 25%
- Are not extremely stony or bouldery
- Are not poorly or very poorly drained
- Complexes consisting of less than 40 percent shallow soils and rock outcrop and slopes do not exceed 25 percent.
- Maybe excessively drained soils developed in stratified glacial drift.

Aerial photography interpretation in 2021 revealed 56 areas as active agriculture in Chesterfield, totaling 1,376 acres. Land use included a combination of cropland, livestock pastures, and hayfields. These sites should be field checked for accuracy, and other active farmland acreage should be added when noted.

Chesterfield Natural Resources Inventory
Agricultural Resources

Map Description:
The US Department of Agriculture's Natural Resources Conservation Service has been responsible for mapping the various soil resources in New Hampshire. This map shows were some of the best farmland soils exists in Chesterfield. Prime farmland soils are considered the best for the production of food feed and fiber. Farmland soils of local and statewide significance are very important for agricultural production. Moosewood Ecological LLC has digitized active agricultural lands to demonstrate where these are located in conjunction with these important agricultural resources. Conservation lands have also been added to show where the many Town-owned and privately owned lands and their resources have been protected over time.

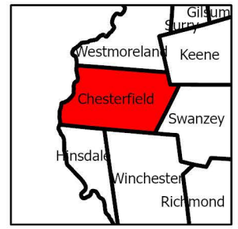
Data Sources:
- Political boundaries, downloaded from NH GRANIT
- Conservation lands, downloaded from NH GRANIT
- Surface water (NHD), downloaded from NH GRANIT
- Streams, downloaded from NH GRANIT
- Roads from NH DOT, downloaded from NH GRANIT
- NRCS Soils, downloaded from NH GRANIT
- Active grasslands, Moosewood Ecological LLC
- Active farms, Moosewood Ecological LLC
- Wetlands (NWI), downloaded from NH GRANIT

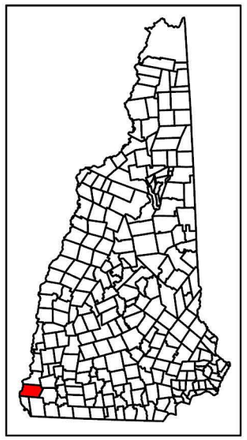
Legend
- Chesterfield boundary
- Town boundaries
- Conserved lands
- Active farms
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Active grasslands (>5 acres)

Soils
- All areas are prime farmland
- Farmland of local importance
- Farmland of statewide importance

N W E S

0 0.25 0.5 1 Miles





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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
Scale Factor: 1.0000
Latitude Of Origin: 42.5000
Units: Foot US

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Date: 9/5/2022

Important Forest Soils

Forest resources within New Hampshire are significant for many reasons. Forests provide sources of employment, forest products, clean air, and-substantial habitats for wildlife and plants. Forest resources also promote local economies, recreation and tourism, mitigate the effects of climate change, and accommodate 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 and undeveloped forest soils exist in Chesterfield.

New Hampshire soils are complex and highly variable due primarily to their glacial origins. The Natural Resource Conservation Service (NRCS) soil mapping recognizes and inventories these complex patterns and has organized them into a useful and understandable planning tool named Important Forest Soil Groups. All soils have been grouped into one of six categories. These groupings allow managers to evaluate the relative productivity of soils and to better understand patterns of plant succession and how soil and site interactions influence management decisions.

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 has 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, such as 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 drained 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 tend to transition into late successional forests tolerant of hardwoods, predominantly beech. Forest growing on this soil group that 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 comprise nearly 6,920 acres, or approximately 23% of Chesterfield (Table 9). 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. In Chesterfield, these areas of forest soil group IC are mostly along Catsbane Brook. Group IC soils types are suited for softwood production, mainly white pine.

Table 9 Summary of important forest soils for timber production in Chesterfield.

Important Soil Type	Size (acres)	% of Town
Hardwood Production (Groups IA and IB)	6,681	22.0%
Softwood Production (Group IC)	239	0.8%

SOURCE: USDA Natural Resources Conservation Service soils (2009).

There are numerous resources to help landowners manage their forests responsibly. UNH Cooperative Extension has many publications on this topic. It is highly recommended that landowners work with a qualified, reputable licensed forester to develop a forest management plan, as well as use the recommended management practices found in Good Forestry in the Granite State (Bennett 2010). This guide can be found at the following website: www.extension.unh.edu/goodforestry

Pisgah State Park is over 13,300 acres and was acquired by the state in the late 1960s. There are 4,716 acres of the park that resides in Chesterfield. Timber harvests have been actively pursued from 2013-2021 (Figure 9). These harvests cover approximately 543 acres in Chesterfield.

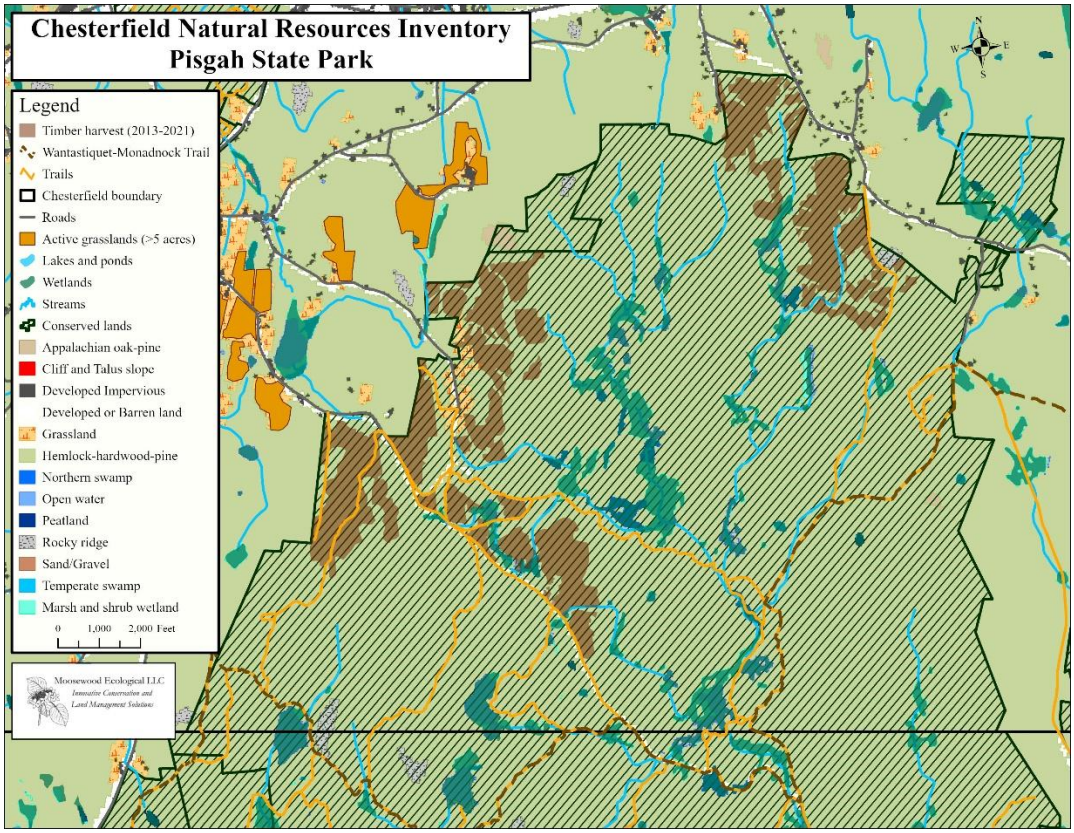


Figure 9 Map of Pisgah State Park's timber harvests located in Chesterfield.

CONSERVATION AND PUBLIC LANDS

The permanent protection offered by conservation easements and deed restrictions, and lands held by public entities for conservation, protect open space, natural resources, traditional uses, natural processes (i.e., protection of drinking water), and provide access to recreational resources that are essential to sustaining Chesterfield's rural character and quality of life. These lands will remain undeveloped and in their natural state, often in perpetuity, to support important environmental or aesthetic functions. Some may also be used for agriculture, forestry, and/or outdoor recreation.

The authors reviewed existing sources of mapped conservation lands from NH GRANIT and the resources of the Chesterfield Conservation Commission. Other local conservation sources were contacted to verify the accuracy of the data and to provide missing parcel information. Additional conservation parcels were added to those provided by NH GRANIT. The parcel geography was rectified to match the digital tax parcel lines. Following the guidance provided by NH GRANIT, each parcel was assigned to one of five protection codes/types based on the nature of the ownership and conservation protection of the parcel. These include:

- Conservation Easement - Legal conservation restrictions enforced by an agency or land trust
- Deed Restriction - Property protected by restrictions in a fee deed
- Fee Ownership - Property held in fee by a town, land trust or agency as conservation land (may also have an easement)
- Set Aside Lands - Property set aside as conservation land through the development planning process. "Full" set aside lands are delineated where conserved lot boundaries are known and "partial" set aside lands indicate areas where an unknown subset of land is conserved

Based on this new dataset, Chesterfield has a total of 7,462 acres of conservation and public lands (Figure 10). This represents 25% of the total area of the town. By way of comparison, the combined five boroughs of New York City have 21.2% of area within the municipal corporate boundary devoted to open space uses (Harnik et al. 2017). Table 10 shows total acreages of conservation lands in Chesterfield by protection type.

Table 10 Conservation lands in Chesterfield by type and acreage.

Protection Type	Acres
Conservation Easement	1,526
Deed Restriction	49
Fee Ownership	5,887
Set Aside Lands	165

SOURCE: GRANIT Conservation Lands database (2021), Chesterfield Conservation Commission (2021-2022), and Monadnock Conservancy (2021).

In addition, Chesterfield has 16,620 acres enrolled in the current use, the NH-based tax break and wildlife incentive program for maintaining undeveloped land. While these lands are not permanently protected, they were included since they offer at least temporary land conservation, thereby supporting local wildlife and ecosystems. For more information on NH's current use program see the following website: https://www.wildlife.state.nh.us/landshare/current-use.html

Chesterfield Natural Resources Inventory
Conservation and Town Land

Map Description:
Chesterfield is fortunate to have a variety of Town-owned lands and private properties that are conserved. This is vital to protecting the Town's natural and cultural history, as wall as providing spaces for recreation such as hiking, biking, hunting, fishing, winter sports, and wildlife viewing. Land is protected in a variety of ways, including the most commonly used conservation easement. However, there are still areas vulnerable to land uses that can negatively impact rare species and significant habitats. Therefore, this natural resources inventory (NRI) seeks to identify additional areas that may deserve formal protection.

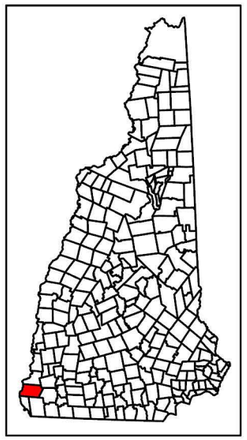
Data Sources:
- Political boundaries, downloaded from NH GRANIT
- Surface water (NHD), downloaded from NH GRANIT
- Roads from NH DOT, downloaded from NH GRANIT
- Conservation lands, downloaded from NH GRANIT and additional conservation lands provided by the Town of Chesterfield
- Wetlands (NWI), downloaded from NH GRANIT
- Streams, downloaded from NH GRANIT

Legend
- Chesterfield boundary
- Town boundaries
- Roads
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Current Use

Conserved lands
- Conservation easement
- Deed restrcition
- Fee owned
- Set aside (full)
- Set aside (partial)

N W E S

0 0.25 0.5 1 Miles



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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
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CLIMATE CHANGE and RESILIENT LANDSCAPES

In light of evidence of a changing climate, many communities are now incorporating the concept of resiliency into their proactive planning efforts. The concept of ecological resiliency refers to the capacity of wildlife and plants and the natural processes and physical conditions they depend on, to sustain change over time. Resiliency studies attempt to predict how the landscape may respond to a changing climate. These climate changes include extreme temperature and precipitation patterns, a higher annual base temperature, increasing intensity and frequency of storms, flooding, and rising sea levels.

When crafting a conservation and open space plan it is necessary to understand the distribution of the various natural resources and conserved lands within and adjacent to Chesterfield. As part of this planning process, it is imperative to identify and capture climate-resilient landscapes. This process provides a more inclusive approach, integrating significant natural resources with areas that are capable of recovering from major disturbance events (such as stronger storms, increased droughts, and floods) for long-term conservation success.

There are three major measures of resiliency at the landscape level that we can use to plan for this future change. The first characteristic is the *geophysical diversity* of a landscape. This aspect refers to the diversity of geology, soils, elevations, and landforms, including water features such as lakes and streams. Physical diversity promotes both habitat and species diversity due to a wide range of conditions, including elevations, sun exposure (temperature and moisture), soils, hydrology, and ecological processes that help define distinct ecosystems. In general, the more physical diversity there is in a landscape, the more likely that landscape is to recover from extreme disturbances – thus it is more resilient.

The second major characteristic is *connectedness*. This refers to the ability of species to freely move throughout the landscape unimpeded by major barriers such as human developments or human-altered ecosystems. Connectedness can be viewed at the local and regional levels. The goal is to connect conservation open space to promote free movement of wildlife and plant species.

Biological condition is the third and final consideration in planning for climate resilience. This characteristic takes into consideration the impact of stressors on the environment, including past land use, human development, invasive species, air and water pollution, and climate change. Biological condition also considers the presence of species of greatest conservation need.

While climate change is a global threat to forests, we must remember that they impact New Hampshire, and specifically Chesterfield. Recent predictive models have shown that northeastern United States forests are likely to experience a greater loss in tree species diversity (due to climate change) than other parts of the country. Invasive species and introduced pathogens have also been recognized as a significant threat, ever since the decimation of virtually all American chestnut trees in North America (by the introduced chestnut blight fungus that entered the United States on Japanese chestnut trees imported before 1900). The absence of this tree species, once a keystone forest species, has fundamentally altered forest composition in certain forested areas of Chesterfield. In more recent years, invasive plants as well as introduced insects and diseases have become widespread in NH. Major river valleys such as the Merrimack are especially susceptible to the introduction and spreading of such exotic plant species as Asian bittersweet, Japanese knotweed, and glossy buckthorn. The seeds of these invasive plants are a popular food source for both resident and migrating birds; as a result, these seeds have been spread along river valley migration routes.

According to the US Environmental Protection Agency (2021), the Northeast is experiencing the largest increase in the amount of rainfall measured during heavy precipitation events than any other region in the US. More frequent heat waves in the Northeast are also expected to increasingly threaten human health through more heat stress and air pollution. Sea level rise and more frequent heavy rains are expected to increase flooding and storm surge, threatening infrastructure. And as temperatures rise, agriculture will likely face reduced yields, potentially damaging livelihoods and the regional economy.

A progressively warmer climate has been seen as one cause of the spread of many of these species. In the last 5 years alone, the emerald ash borer (EAB) and red pine scale have quickly spread to their respective host trees much in the way the American elm was once so drastically affected. As road maintenance, forestry, and recreational improvements are planned on open space, roads, and Town-owned lands, extra precautions need to be taken to minimize the introduction and spread of invasive plants.

TNC Resilient and Connected Landscapes Study

In 2016, The Nature Conservancy released the Resilient and Connected Landscapes study, which mapped climate-resilient sites, confirmed biodiversity locations of rare species and unique communities, and species movement areas (zones and corridors) across Eastern North America. The study used the information to prioritize a conservation portfolio that naturally aligns these features into a network of resilient sites integrated with the species movement zones, and thus a blueprint for conservation that represents all habitats while allowing nature to adapt and change. The following brief concept descriptions come from The Nature Conservancy's online portal:

- Resilient Area: places buffered from climate change because they contain many connected micro-climates that create climate options for species.
- Flow: the movement of species populations over time in response to climate. Flow tends to concentrate in the zones and corridors described below.
- Climate Corridor: narrow zone of highly concentrated flow, often riparian corridors or ridgelines.
- Climate Flow Zone: broad areas of high flow that is less concentrated than in the corridors - typically intact forested regions.
- Confirmed Diversity: known locations of rare species or unique communities based on ground inventory. Unconfirmed areas may contain the same species.

Resilient sites are projected to retain high quality habitat and continue to support a diverse array of plants and animals. Sites that have both complex topography and connected land cover are places where conservation action is most likely to succeed in the long term. Permanent conservation of the resilient areas should be prioritized to ensure they can continue to provide habitat for species. Securing resilient sites safeguards natural benefits such as fresh drinking water and clean air for local communities now and into the future.

To learn more about resilient and connected landscapes and to view the full maps developed by The Nature Conservancy and the process behind them, see: www.conservationgateway.org

RECREATIONAL RESOURCES

Recreational resources abound in Chesterfield (Figure 11). One of the major quality of life assets in Chesterfield is its significant and extensive recreational trails network. Access to trails across the town promotes healthy lifestyles, a connection to nature, and the relief of stress through exercise.

Under the influence of the Corona virus over the past couple of years, the ability to be outside has been one of the few public activities considered safe, making these amenities all the more important. Trails in the town are largely on conservation lands, Town-owned lands, and State-owned lands, although a number of trails and connectors cross private lands. Many of the trails are maintained by the Chesterfield Conservation Commission and Friends of Pisgah, as well as their volunteers.

While trails are developed for use by people, this use can negatively impact wildlife, especially if the trails are not designed appropriately. In 2019, Stevens and Oehler (NH Fish and Game) authored *Trails for People and Wildlife* in which they reviewed some 63 scholarly studies on people using trails and trail impact to wildlife. They reported that NH Fish and Game developed a methodology that uses GIS mapping to analyze how and where trail use impacted wildlife. Thresholds of effect were identified by the human use of a linear trail referred to as the "corridor of influence". Different species and classes of wildlife were found to react to trail use differently. For amphibians and reptiles, the awareness and potential disturbance distance is an average of 60 feet from a trail. For birds, the average distance is 150 feet, and for mammals the average distance is 400 feet. In instances where trails are sited in close proximity to each other, there can be areas between trails where the corridor of influence overlaps, continuously discouraging the presence of wildlife. Stevens and Oehler's study also produced data that displays significant natural resource areas and ranks them on the landscape. These data inputs included wet areas, steep slopes, rare species locations, habitat edges, and special habitats. When trail buffer corridors are superimposed on these sensitive natural resources, areas of potential conflict, as well as overlapping buffers, are revealed. Areas where conflicts may exist between trail use and protection of wildlife resources appeared. This method can be a useful tool in planning new trail locations, evaluating potential shortcomings of the location of existing trails, and considering the removal of trails with potential negative impacts to wildlife. It is important to maintain habitat connectivity.

Boating, whether motorized or non-motorized, certainly has its place in Chesterfield. There are many ponds, Spofford Lake, and the Connecticut River on which we can enjoy experiences. Fullam Pond, Lily Pond, and Baker Pond in Pisgah State Park have non-motorized boat access. Boat landings for both motorized and non-motorized boats can be found on the Connecticut River and Spofford Lake.

Other significant recreational areas include beaches, picnic areas, sports fields, and playgrounds. There are two beaches located on Spofford Lake. North Shore Road beach is provided free for residents only, while Ware's Grove beach is open to the public for a fee. Picnic areas are available at the Chesterfield Gorge Natural Area and two picnic areas can be found at Friedsam Town Forest: one at the lower lot on Twin Brook Road and the other at the parking area on Route 63. In addition, a playground with a basketball court, tennis court (with both tennis and pickle ball lines), open lawn space, and a ball field are afforded at the Chesterfield School.

Chesterfield Natural Resources Inventory
Recreational Resources

Point	Description (features)
1	River Road boat acces
	car-top watercraft only
2	North Shore Town Beach
	Town residents only
3	Pierce Island
	accessible by boat
4	Spofford lake boat access
	motorized and nonmotorized watercraft
5	Wares Grove Beach
	public swimming beach
6	Pine Grove Springs Country Club
	golf
7	Chesterfield Central School
	Field sports, tennis, pickleball, playground
8	Baker Pond
	nonmotorized watercraft only
9	Lily Pond
	nonmotorized watercraft only
10	Fullam Pond
	nonmotorized watercraft only

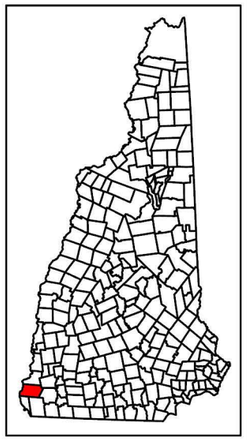
Map Description:
The Town of Chesterfield hosts a variety of recreational resources, including dozens of miles of trails, parks, natural preserves, and public boating. These opportunities for outdoor physical activity and exploration help foster a healthy community, inspire a deeper connection to nature, and attract visitors from out of town. Conservation lands have also been added to show where the many Town-owned and privately owned lands and their resources have been protected over time.

Data Sources:
-Political Boundaries, downloaded from NH GRANIT
-NH Recreational Trails, downloaded from NH GRANIT
-Roads from NH DOT, downloaded from NH GRANIT
-Wetlands (NWI Plus), downloaded from NH GRANIT
-Conservation Lands, downloaded from NH GRANIT, edited by Moosewood
-Scenic Roads, created with information from Chesterfield Highway Department
-Surface Water (NHD), downloaded from NH GRANIT, edited by Moosewood
-Wantastiquet-Monadnock Trail, accessed from Monadnock Conservancy, edited by Moosewood
-Snowmobile trails, recreated from NHSA
-Streams, downloaded from NH GRANIT

Legend
- Chesterfield boundary
- Town boundaries
- Parking
- Picnic area
- Recreation points
- Scenic roads
- Roads
- Trails
- Wantastiquet-Monadnock Trail
- Bike routes
- Snowmobile trails
- Lakes and ponds
- Wetlands
- Rivers
- Streams
- Conserved lands

N W E S

0 0.25 0.5 1 Miles



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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 984,250.0000
False Northing: 0.0000
Central Meridian: -71.6667
Scale Factor: 1.0000
Latitude Of Origin: 42.5000
Units: Foot US

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Date: 9/5/2022

CONSERVATION FOCUS AREAS

Areas of largely undeveloped and unprotected open space were identified and delineated to display geographic areas of Chesterfield that contain high natural resource values (Figure 12). These Conservation Focus Areas (CFA's) were identified based on the evaluation of the Water Resources, Ecological Resources, and Agricultural and Forest Resources using parcel-based co-occurrence models.

The selection criteria listed below capture a diversity and range of importance values that taken together clearly differentiated high quality areas or the landscape from developed and lower quality areas. This process was used to sort and prioritize the importance of unprotected open space lands in Chesterfield for protection by acquisition or other means of land protection (e.g., conservation easement) while working with willing landowners interested in conserving natural resources.

Selection Criteria

Conservation priority criteria were developed to guide the location and delineation of proposed CFA's. The criteria were organized under four headings to capture the multiple considerations that support selection of a particular area: Natural Resources, Landscape Context, Human/Cultural Importance, and Concurrence. The criteria are as follows:

Natural Resources

- Resources Present: The specific type of important resources present including drinking water (stratified drift aquifers), low degree of fragmentation, productive soils, rare biological elements, and active agriculture.
- Rarity: How uncommon or widespread a resource is locally and regionally.
- Rare Biological Elements: Presence, number and significance of rare plant, animal or natural community elements.
- Threats: How vulnerable an area is to degradation, conversion, or development.
- Quality: Ranking of general quality and natural condition.
- Adjacent Conservation: How protection would connect to, enhance, and/or augment existing conservation areas to strengthen protection of natural resources.

Landscape Context

- Size: Relative size of entire CFA area (the larger the better).
- Contribution to Existing Conservation Base: Proximity to protected land.
- Physical Diversity: Variety of geology and landform types and hydrological features.
- Ecological Integrity: Biological condition including rarity, stress, and degradation.
- Strategic Location on Landscape: How well this area benefits the ecological integrity of surrounding areas.
- Connectedness: How well this area provides connectivity with adjacent habitats.
- Resiliency Value: Overall resiliency based on physical diversity, ecological integrity, and connectedness.

Human / Cultural Importance

- Essential Needs: Provides or has potential to provide essential resources such as drinking water, flood control and storage, food crops, livestock grazing, timber products, etc.

- Quality of Life: Provides or supports recreational opportunities.
- Connection: Strategic location provides walkable / bikeable connections to and between open space areas.

Concurrence

- Identified by other Study or Informed Input: Studies corroborate the selection of an area (e.g., NH Wildlife Action Plan).
- Meets Established Criteria: How well conservation of an area achieves Chesterfield's conservation goals.

Criteria for Land Conservation Projects Outside of the Conservation Focus Areas

This project attempted to identify and delineate areas of Chesterfield that represent the most significant natural resources in the town. These delineations were based on a GIS analysis, but also involved judgement calls and reasonable thresholds for consideration that by definition excluded other areas. However, numerous resources important to Chesterfield do actually occur outside the selected Conservation Focus Areas. Some of these occur in the absence of other important resources, or are unique for Chesterfield, or are in areas of limited size. One example is the Spofford Lake watershed.

This plan cannot predict what undocumented resources may be identified in the future. In addition, resources currently not considered critical for protection may in the future take on more significance than they do today. Finally, important lands that are now unavailable for acquisition and protection by Chesterfield due to current ownership may become available in the future, and opportunities may present themselves in the future that would deserve serious conservation consideration.

For these reasons, it is recommended that such parcels and areas be considered on a case-by-case basis for protection using the same selection criteria that resulted in the proposed Conservation Focus Areas. These criteria recognize that a number of important resources are already known to occur outside the mapped focus areas, and that these other natural resource areas may someday be recognized as also worthy of protection.

Chesterfield Natural Resources Inventory

Ecological Assessment Model: Conservation Focus Areas

Map Description:
This map displays the final output of all three ecological assessment models combined within a non-parcel-based framework: ecological resources, water resources, and agriculture and forestry resources. This model considers, at a Town-wide scale, the highest priority areas for conservation of these resources. Each priority tier encompasses one-third of Chesterfield not currently conserved. Conservation lands have also been added to show where the many town-owned and private lands have been protected over time.

Data Sources:
-Conservation focus area model, created by Moosewood
-Political Boundaries, downloaded from NH GRANIT
-Conservation Lands, downloaded from NH GRANIT, edited by Moosewood
-WMS Aerial Imagery (May 2015, 1-ft resolution), downloaded from NH GRANIT

Legend
- Town Boundary
- Conserved Lands
- Streams
- Lakes and ponds
- Wetlands
- Rivers

Conservation Focus Areas
- Low priority
- Moderate priority
- High Priority
- Spofford Lake watershed
- Protected stream

N W E S

0 0.25 0.5 1 Miles

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.

Prepared for the Town of Chesterfield, NH

Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
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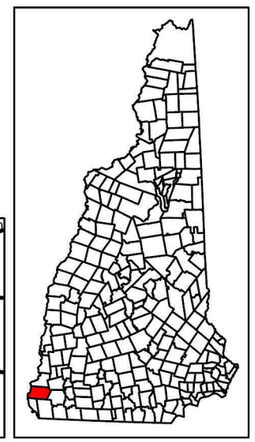
Date: 9/2/2022



RECOMMENDATIONS

The information provided herein, including the 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 Chesterfield'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;
- Protect drinking water resources for future community water supply;
- 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 Chesterfield'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 for future work to be considered in Chesterfield while proceeding with community land use planning and education.

1. Incorporate the NRI, especially the Conservation Focus Areas map, into the Chesterfield Master Plan adopted in 2016. This provides a vision for the town from which land use planning can be adopted. Also, continue working on the objectives in the Natural Resources section of the Master Plan.

2. Build public support for the NRI through informational sessions, published materials, social media, and other means of community education and outreach. This will help to inform the community about its natural resources and future planning.

3. Use the Conservation Focus Areas (CFAs) as a tool for future land protection efforts through multiple approaches, including landowners willing to engage in land conservation, resource mitigation projects as part of proposed developments or habitat alteration, and land use regulations and zoning ordinances. However, as noted above there are areas outside of these CFAs that could be significant for land protection currently or into the future. Therefore, it is recommended that areas not identified herein should be considered on a case-by-case basis.

4. Pursue a more rigorous inventory and evaluation of Chesterfield's wetlands to include all wetland 2 acres and larger. This will provide the town with a better sense of which wetlands perform best for certain functional values. This expanded evaluation can provide the town with important information needed if the town would like to pursue prime wetlands designation for

Chesterfield's most significant wetlands. This would be a great opportunity for the Spofford Lake Association to contribute resources to better understand the wetlands within the Spofford Lake watershed.

5. Use the *Trails for People and Wildlife* (Stevens and Oehler 2019) to help guide planning for future trails and assess existing trails and their potential impacts on wildlife.

6. Develop stewardship plans for town-owned lands, incorporating data from this NRI with other existing information on these properties such as forest management plans. Typical elements addressed in stewardship plans include wildlife and habitats, rare species, soils, natural communities, invasive plants and forest pathogens, recreation, forestry, and cultural features. However, since each property is different there may be other aspects to consider. Stewardship recommendations should clearly address management goals and specifically outline short and long-term resource protection measures, including appropriate buffers around sensitive habitats and natural communities, rare plant populations, and cultural features, as well as management activities to foster the proper utilization and enhancement of natural resources.

7. Future habitat ground-truthing efforts should focus on verifying agricultural lands and their types of land use (i.e., crops, pasture, hayfield, orchard, etc.); verification of potential vernal pools; documentation of mammal corridors through roadside winter tracking and wildlife cameras; and documentation of amphibian and reptile corridors through roadside surveys as these species travel from their wintering grounds to feeding and mating habitats.

8. 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 Chesterfield might want to consider adopting in an effort to support 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. The Town may want to review *Innovative Land Use Planning Techniques* developed by the NH Dept. of Environmental Services (2008) when revising or adopting new land use regulations.

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 Chesterfield's conservation planning efforts.

10. Continue with community outreach and landowner education regarding Chesterfield's natural resources and conservation planning. This can be accomplished in many ways, including workshops, hikes, and informational resources such as maps, that can be posted on the Conservation Commission website or shared through social media to help landowners with resource protection and management. A subcommittee of the Conservation Commission could be established to focus on outreach and education efforts. Chesterfield could also consider supporting a citizen science (community science) program to support community engagement by its residents to learn more about the town's biodiversity. A series of trainings for the iNaturalist program could be developed to teach residents how to use this technology to gather

information on Chesterfield's biodiversity, as well as host special workshops such as seasonal Bioblitz events for public lands.

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APPENDIX A

GIS DATA AND USE 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, aerial photography, or LiDAR (Light Detection and Ranging) technology. 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. The identification of wetlands requires a field delineation by a certified natural resource professional. 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 LIST

Amphibians	
American Toad	*Anaxyrus americanus*
Spring Peeper	*Pseudacris crucifer*
American Bullfrog	*Lithobates catesbeianus*
Green Frog	*Lithobates clamitans*
Pickerel Frog	*Lithobates palustris*
Wood Frog	*Lithobates sylvaticus*
Jefferson's Salamander*	*Ambystoma jeffersonianum*
Spotted Salamander	*Ambystoma maculatum*
Eastern Red-backed Salamander	*Plethodon cinereus*
Eastern Newt	*Notophthalmus viridescens*
Crustaceans	
Brickwork Woodlouse^	*Porcellio spinicornis*
Arachnids	
[no common name]^	*Acalitus ferrugineum*
[no common name]^	*Aceria triplacis*
Maple Spindle Gall Mite^	*Vasates aceriscrumena*
Maple Bladdergall Mite^	*Vasates quadripedes*
American Dog Tick	*Dermacentor variabilis*
Eastern Black-legged Tick	*Ixodes scapularis*
Marbled Orbweaver^	*Araneus marmoreus*
[no common name]^	*Tetragnatha viridis*
Striped Fishing Spider^	*Dolomedes scriptus*
American Nursery Web Spider^	*Pisaurina mira*
Birds	
Brant	*Branta bernicla*
Canada Goose	*Branta canadensis*
Tundra Swan*	*Cygnus columbianus*
Wood Duck	*Aix sponsa*
Northern Shoveler	*Spatula clypeata*
Gadwall	*Mareca strepera*
American Wigeon	*Mareca americana*
Mallard	*Anas platyrhynchos*
American Black Duck	*Anas rubripes*
Green-winged Teal	*Anas crecca*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Birds	
Lesser Scaup	*Aythya affinis*
Common Eider	*Somateria mollissima*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta deglandi*
Black Scoter	*Melanitta americana*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Wild Turkey	*Meleagris gallopavo*
Ruffed Grouse	*Bonasa umbellus*
Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Mourning Dove	*Zenaida macroura*
Yellow-billed Cuckoo	*Coccyzus americanus*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Common Nighthawk	*Chordeiles minor*
Eastern Whip-poor-will	*Antrostomus vociferus*
Chimney Swift	*Chaetura pelagica*
Ruby-throated Hummingbird	*Archilochus colubris*
Sora*	*Porzana carolina*
Killdeer	*Charadrius vociferus*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Dunlin*	*Calidris alpina*
Least Sandpiper	*Calidris minutilla*
American Woodcock	*Scolopax minor*
Spotted Sandpiper	*Actitis macularius*
Greater Yellowlegs	*Tringa melanoleuca*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Laughing Gull	*Leucophaeus atricilla*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Great Black-backed Gull	*Larus marinus*
Caspian Tern	*Hydroprogne caspia*
Black Tern	*Chlidonias niger*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Birds	
Common Tern	*Sterna hirundo*
Red-throated Loon	*Gavia stellata*
Common Loon	*Gavia immer*
Great Cormorant	*Phalacrocorax carbo*
Double-crested Cormorant	*Nannopterum auritum*
American Bittern*	*Botaurus lentiginosus*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Black Vulture	*Coragyps atratus*
Turkey Vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Northern Harrier	*Circus hudsonius*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Northern Goshawk	*Accipiter gentilis*
Bald Eagle	*Haliaeetus leucocephalus*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Red-tailed Hawk	*Buteo jamaicensis*
Rough-legged Hawk	*Buteo lagopus*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
Northern Saw-whet Owl	*Aegolius acadicus*
Belted Kingfisher	*Megaceryle alcyon*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Dryobates pubescens*
Hairy Woodpecker	*Dryobates villosus*
Pileated Woodpecker	*Dryocopus pileatus*
Northern Flicker	*Colaptes auratus*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Eastern Wood-Pewee	*Contopus virens*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Alder Flycatcher	*Empidonax alnorum*
Willow Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Birds	
Eastern Phoebe	*Sayornis phoebe*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
Yellow-throated Vireo	*Vireo flavifrons*
Blue-headed Vireo	*Vireo solitarius*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*
Northern Shrike	*Lanius borealis*
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Fish Crow	*Corvus ossifragus*
Common Raven	*Corvus corax*
Black-capped Chickadee	*Poecile atricapillus*
Tufted Titmouse	*Baeolophus bicolor*
Horned Lark	*Eremophila alpestris*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Tree Swallow	*Tachycineta bicolor*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Ruby-crowned Kinglet	*Corthylio calendula*
Golden-crowned Kinglet	*Regulus satrapa*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Brown Creeper	*Certhia americana*
Blue-gray Gnatcatcher	*Polioptila caerulea*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes hiemalis*
Carolina Wren	*Thryothorus ludovicianus*
European Starling	*Sturnus vulgaris*
Gray Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
Northern Mockingbird	*Mimus polyglottos*
Eastern Bluebird	*Sialia sialis*
Veery	*Catharus fuscescens*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Wood Thrush	*Hylocichla mustelina*
American Robin	*Turdus migratorius*
Bohemian Waxwing	*Bombycilla garrulus*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Birds	
Cedar Waxwing	*Bombycilla cedrorum*
House Sparrow	*Passer domesticus*
Evening Grosbeak	*Coccothraustes vespertinus*
Pine Grosbeak	*Pinicola enucleator*
House Finch	*Haemorhous mexicanus*
Purple Finch	*Haemorhous purpureus*
Common Redpoll	*Acanthis flammea*
Red Crossbill	*Loxia curvirostra*
White-winged Crossbill	*Loxia leucoptera*
Pine Siskin	*Spinus pinus*
American Goldfinch	*Spinus tristis*
Snow Bunting	*Plectrophenax nivalis*
Chipping Sparrow	*Spizella passerina*
Field Sparrow	*Spizella pusilla*
American Tree Sparrow	*Spizelloides arborea*
Fox Sparrow	*Passerella iliaca*
Dark-eyed Junco	*Junco hyemalis*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-throated Sparrow	*Zonotrichia albicollis*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
Swamp Sparrow	*Melospiza georgiana*
Eastern Towhee	*Pipilo erythrophthalmus*
Bobolink	*Dolichonyx oryzivorus*
Eastern Meadowlark	*Sturnella magna*
Orchard Oriole	*Icterus spurius*
Baltimore Oriole	*Icterus galbula*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
Common Grackle	*Quiscalus quiscula*
Ovenbird	*Seiurus aurocapilla*
Louisiana Waterthrush	*Parkesia motacilla*
Northern Waterthrush	*Parkesia noveboracensis*
Golden-winged Warbler*	*Vermivora chrysoptera*
Blue-winged Warbler	*Vermivora cyanoptera*
Black-and-white Warbler	*Mniotilta varia*
Tennessee Warbler	*Leiothlypis peregrina*
Nashville Warbler	*Leiothlypis ruficapilla*
Mourning Warbler	*Geothlypis philadelphia*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Birds	
Common Yellowthroat	*Geothlypis trichas*
American Redstart	*Setophaga ruticilla*
Cape May Warbler	*Setophaga tigrina*
Cerulean Warbler	*Setophaga cerulea*
Northern Parula	*Setophaga americana*
Magnolia Warbler	*Setophaga magnolia*
Bay-breasted Warbler	*Setophaga castanea*
Blackburnian Warbler	*Setophaga fusca*
Yellow Warbler	*Setophaga petechia*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Blackpoll Warbler	*Setophaga striata*
Black-throated Blue Warbler	*Setophaga caerulescens*
Palm Warbler	*Setophaga palmarum*
Pine Warbler	*Setophaga pinus*
Yellow-rumped Warbler	*Setophaga coronata*
Prairie Warbler	*Setophaga discolor*
Black-throated Green Warbler	*Setophaga virens*
Canada Warbler	*Cardellina canadensis*
Wilson's Warbler	*Cardellina pusilla*
Scarlet Tanager	*Piranga olivacea*
Northern Cardinal	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Indigo Bunting	*Passerina cyanea*
Insects	
Six-spotted Tiger Beetle	*Cicindela sexguttata*
Red-necked Cane Borer Beetle^	*Agrilus ruficollis*
White-spotted Sawyer Beetle^	*Monochamus scutellatus*
[no common name]^	*Judolia cordifera*
Dogbane Leaf Beetle^	*Chrysochus auratus*
[no common name]^	*Enoclerus nigripes*
Twice-stabbed Lady Beetle	*Chilocorus stigma*
Asian Lady Beetle	*Harmonia axyridis*
Oak Leafrolling Weevil^	*Synolabus bipustulatus*
Goldenrod Soldier Beetle^	*Chauliognathus pensylvanicus*
Golden Net-winged Beetle^	*Dictyoptera aurora*
Reddish-brown Stag Beetle^	*Lucanus capreolus*
Japanese Beetle	*Popillia japonica*
Oriental Beetle	*Exomala orientalis*
Tomentose Burying Beetle^	*Nicrophorus tomentosus*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Insects	
American Carrion Beetle^	*Necrophila americana*
gold-and-brown rove beetle^	*Ontholestes cingulatus*
Bumble Bee Mimic Robber Fly^	*Laphria thoracica*
[no common name]^	*Condylostylus patibulatus*
Jewelweed Leaf-miner Fly^	*Phytoliriomyza melampyga*
Goldenrod Gall Fly^	*Eurosta solidaginis*
Common Drone Fly^	*Eristalis tenax*
Transverse-banded Flower Fly^	*Eristalis transversa*
Oblique-banded Pond Fly^	*Sericomyia chrysotoxoides*
Bald-faced Hornet Fly^	*Spilomyia fusca*
Tufted Globetail^	*Sphaerophoria contigua*
Margined Calligrapher	*Toxomerus marginatus*
Cattail Mosquito^	*Coquillettidia perturbans*
grape filbert gall^	*Ampelomyia vitiscoryloides*
[no common name]^	*Polystepha globosa*
Oak Leaf Gall Midge^	*Polystepha pilulae*
Linden Wart Gall Midge^	*Contarinia verrucicola*
Carbonifera goldenrod gall midge	*Asteromyia carbonifera*
Willow Pinecone Gall Midge^	*Rabdophaga strobiloides*
Ocellate Gall Midge	*Acericecis ocellaris*
Eastern Phantom Crane Fly	*Bittacomorpha clavipes*
Western Conifer Seed Bug	*Leptoglossus occidentalis*
[no common name]^	*Limnoporus dissortis*
Small Milkweed Bug^	*Lygaeus kalmii*
Meadow Plant Bug^	*Leptopterna dolabrata*
American Giant Water Bug^	*Lethocerus americanus*
[no common name]^	*Elasmucha lateralis*
[no common name]^	*Mormidea lugens*
Green Stink Bug^	*Chinavia hilaris*
Witch-hazel Cone Gall Aphid	*Hormaphis hamamelidis*
Beech Scale	*Cryptococcus fagisuga*
Western Honey Bee	*Apis mellifera*
Two-spotted Bumble Bee^	*Bombus bimaculatus*
Brown-belted Bumble Bee^	*Bombus griseocollis*
Common Eastern Bumble Bee	*Bombus impatiens*
Bicolored Striped Sweat Bee^	*Agapostemon virescens*
Blueberry Stem Gall Wasp^	*Hemadas nubilipennis*
Oak Apple Gall Wasp^	*Amphibolips cookii*
Larger Empty Oak Apple Wasp^	*Amphibolips quercusinanis*
Acorn Plum Gall Wasp^	*Amphibolips quercusjuglans*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Insects	
white oak club gall wasp^	*Callirhytis clavula*
[no common name]^	*Callirhytis glomerosa*
Woolly Oak Gall^	*Callirhytis lanata*
Woolly Catkin Gall Wasp^	*Callirhytis quercusoperator*
Wool Sower Gall Wasp^	*Callirhytis seminator*
oak wheat gall^	*Kokkocynips decidua*
Banded Bullet Gall Wasp^	*Kokkocynips imbricariae*
[no common name]^	*Zapatella quercusphellos*
Odorous House Ant^	*Tapinoma sessile*
Dark Paper Wasp	*Polistes fuscatus*
Bald-faced Hornet^	*Dolichovespula maculata*
European Hornet^	*Vespa crabro*
Widow Yellowjacket^	*Vespula vidua*
Rosy Maple Moth	*Dryocampa rubicunda*
Cecropia Moth^	*Hyalophora cecropia*
Luna Moth	*Actias luna*
Polyphemus Moth^	*Antheraea polyphemus*
Bedstraw Hawkmoth^	*Hyles gallii*
Virginia Creeper Sphinx^	*Darapsa myron*
Waved Sphinx^	*Ceratomia undulosa*
Common Spring Moth^	*Heliomata cycladata*
Bruce Spanworm Moth^	*Operophtera bruceata*
Yellow-collared Scape Moth^	*Cisseps fulvicollis*
Banded Tussock Moth^	*Halysidota tessellaris*
Hickory Tussock Moth	*Lophocampa caryae*
Isabella Tiger Moth	*Pyrrharctia isabella*
Toothed Somberwing^	*Euclidia cuspidea*
Morbid Owlet^	*Chytolita morbidalis*
Slant-lined Owlet^	*Macrochilo absorptalis*
Dark Phalaenostola Moth^	*Phalaenostola eumelusalis*
Variable Fan-foot^	*Zanclognatha laevigata*
Gypsy Moth	*Lymantria dispar*
Laugher Moth^	*Charadra deridens*
Orange-humped Mapleworm^	*Symmerista leucitys*
White-dotted Prominent^	*Nadata gibbosa*
Silver-spotted Skipper^	*Epargyreus clarus*
Dun Skipper^	*Euphyes vestris*
Hobomok Skipper^	*Lon hobomok*
Long Dash^	*Polites mystic*
Little Glassywing^	*Pompeius verna*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Insects	
Northern Broken-Dash^	*Wallengrenia egeremet*
Arctic Skipper^	*Carterocephalus mandan*
Monarch	*Danaus plexippus*
Silver-bordered Fritillary^	*Boloria selene*
Great Spangled Fritillary	*Speyeria cybele*
White Admiral	*Limenitis arthemis arthemis*
Red-spotted Admiral	*Limenitis arthemis*
Red Admiral^	*Vanessa atalanta*
Painted Lady^	*Vanessa cardui*
Common Ringlet	*Coenonympha california*
Little Wood Satyr^	*Megisto cymela*
Appalachian Brown^	*Lethe appalachia*
Eyed Brown^	*Lethe eurydice*
Black Swallowtail	*Papilio polyxenes*
Clouded Sulphur	*Colias philodice*
Small White Grass-veneer^	*Crambus albellus*
Eastern Grass-veneer^	*Crambus laqueatellus*
White-spotted Sable^	*Anania funebris*
Pine Tube Moth^	*Argyrotaenia pinatubana*
Spring Fishfly^	*Chauliodes rastricornis*
Serrate Dark Fishfly^	*Nigronia serricornis*
Ebony Jewelwing	*Calopteryx maculata*
Spotted Spreadwing	*Lestes congener*
Amber-winged Spreadwing	*Lestes eurinus*
Sweetflag Spreadwing	*Lestes forcipatus*
Slender Spreadwing	*Lestes rectangularis*
Swamp Spreadwing	*Lestes vigilax*
Variable Dancer	*Argia fumipennis*
Powdered Dancer	*Argia moesta*
Aurora Damsel	*Chromagrion conditum*
Familiar Bluet	*Enallagma civile*
Marsh Bluet	*Enallagma ebrium*
Stream Bluet	*Enallagma exsulans*
Skimming Bluet	*Enallagma geminatum*
Hagen's Bluet	*Enallagma hageni*
Vernal Bluet	*Enallagma vernale*
Fragile Forktail	*Ischnura posita*
Eastern Forktail	*Ischnura verticalis*
Sphagnum Sprite	*Nehalennia gracilis*
Sedge Sprite	*Nehalennia irene*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Insects	
Lance-tipped Darner	*Aeshna constricta*
Variable Darner	*Aeshna interrupta*
Shadow Darner	*Aeshna umbrosa*
Common Green Darner	*Anax junius*
Springtime Darner	*Basiaeschna janata*
Fawn Darner	*Boyeria vinosa*
Harlequin Darner	*Gomphaeschna furcillata*
Spatterdock Darner	*Rhioaeschna mutata*
Lilypad Clubtail	*Arigomphus furcifer*
Black-shouldered Spinylegs	*Dromogomphus spinosus*
Spine-crowned Clubtail	*Gomphus abbreviatus*
Beaverpond Clubtail	*Gomphus borealis*
Lancet Clubtail	*Phanogomphus exilis*
Ashy Clubtail	*Phanogomphus lividus*
Rapids Clubtail	*Gomphus quadricolor*
Dusky Clubtail	*Gomphus spicatus*
Cobra Clubtail	*Gomphus vastus*
Skillet Clubtail*	*Gomphus ventricosus*
Dragonhunter	*Hagenius brevistylus*
Rusty Snaketail	*Ophiogomphus rupinsulensis*
Eastern Least Clubtail	*Stylogomphus albistylus*
Riverine Clubtail	*Stylurus amnicola*
Arrow Clubtail	*Stylurus spiniceps*
Delta-spotted Spiketail	*Cordulegaster diastatops*
Twin-spotted Spiketail	*Cordulegaster maculata*
Arrowhead Spiketail	*Cordulegaster obliqua*
Stream Cruiser	*Didymops transversa*
Swift River Cruiser	*Macromia illinoiensis*
American Emerald	*Cordulia shurtleffi*
Beaverpond Baskettail	*Epitheca canis*
Common Baskettail	*Epitheca cynosura*
Prince Baskettail	*Epitheca princeps*
Stygian Shadowdragon	*Neurocordulia yamaskanensis*
Calico Pennant	*Celithemis elisa*
Eastern Pondhawk	*Erythemis simplicicollis*
Chalk-fronted Corporal	*Ladona julia*
Frosted Whiteface	*Leucorrhinia frigida*
Dot-tailed Whiteface	*Leucorrhinia intacta*
Belted Whiteface	*Leucorrhinia proxima*
Spangled Skimmer	*Libellula cyanea*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Insects	
Slaty Skimmer	*Libellula incesta*
Widow Skimmer	*Libellula luctuosa*
Twelve-spotted Skimmer	*Libellula pulchella*
Four-spotted Skimmer	*Libellula quadrimaculata*
Painted Skimmer	*Libellula semifasciata*
Elfin Skimmer	*Nannothemis bella*
Blue Dasher	*Pachydiplax longipennis*
Common Whitetail	*Plathemis lydia*
Cherry-faced Meadowhawk	*Sympetrum internum*
Band-winged Meadowhawk	*Sympetrum semicinctum*
Autumn Meadowhawk	*Sympetrum vicinum*
Red-legged Grasshopper^	*Melanoplus femurrubrum*
Short-winged Meadow Katydid^	*Conocephalus brevipennis*
Fork-tailed Bush Katydid^	*Scudderia furcata*
Northern Bush Katydid^	*Scudderia septentrionalis*
Tree Cattle^	*Cerastipsocus venosus*
Mammals	
American Black Bear	*Ursus americanus*
Moose	*Alces alces*
White-tailed Deer	*Odocoileus virginianus*
Virginia Opossum	*Didelphis virginiana*
Snowshoe Hare	*Lepus americanus*
Eastern Cottontail	*Sylvilagus floridanus*
North American Porcupine	*Erethizon dorsatum*
American Beaver	*Castor canadensis*
Muskrat	*Ondatra zibethicus*
Deer mice	Genus: *Peromyscus*
Jumping mice	Family: *Zapodidae*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Chipmunk	*Tamias striatus*
American Red Squirrel	*Tamiasciurus hudsonicus*
Groundhog	*Marmota monax*
Coyote	*Canis latrans*
Gray Fox	*Urocyon cinereoargenteus*
Red Fox	*Vulpes vulpes*
Bobcat	*Lynx rufus*
North American River Otter	*Lontra canadensis*
Short-tailed Weasel	*Mustela richardsonii*
Long-tailed Weasel	*Neogale frenata*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

Mammals	
American Mink	*Neogale vison*
Fisher	*Pekania pennanti*
Common Raccoon	*Procyon lotor*
New World moles	Subfamily: *Scalopinae*
Meadow Vole	*Microtus pennsylvanicus*
Northern Short-tailed Shrew^	*Blarina brevicauda*
Mollusks	
Banded Mysterysnail^	*Viviparus georgianus*
Changeable Mantleslug^	*Megapallifera mutabilis*
Winding Mantleslug^	*Philomycus flexuolaris*
Eastern Whitelip	*Neohelix albolabris*
Bellmouth Ramshorn	*Planorbella campanulata*
Reptiles	
Eastern Milksnake^	*Lampropeltis triangulum*
Red-bellied Snake^	*Storeria occipitomaculata*
Common Garter Snake	*Thamnophis sirtalis*
Common Snapping Turtle	*Chelydra serpentina*
Spotted Turtle	*Clemmys guttata*
Painted Turtle	*Chrysemys picta*
Wood Turtle	*Glyptemys insculpta*
* historical record (>20 years ago)	
^ supplemental observation from iNaturalist (Research Grade)	

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