

TOWN WHITEFIELD, NEW HAMPSHIRE

NATURAL RESOURCES INVENTORY
December 2022



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The Whitefield Conservation Commission would like to dedicate this report to the residents of the town of Whitefield. We also express our appreciation for the initial work on the previous Natural Resource Inventory performed by the late John Severance.

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This Study was funded by Eversource

Cover Photo of Whitefield, New Hampshire taken from Kimball Hill Road

Photo on current page of the Presidential Range of the White Mountains. Taken at John and Roxie Severance's home.

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SUMMARY AND HOW TO USE THIS REPORT

Land-use planning is instrumental in balancing future growth and development with protection of natural resources. We completed this report to give Whitefield data on these resources, so the Town can make informed and balanced decisions about future growth. By identifying and describing natural resources town-wide, this natural resource inventory (NRI) provides Whitefield with a foundation for proactive planning, rather than the all-too-common reactive approach.

The Town of Whitefield is committed to protecting and sustaining its quality of diverse natural resources. We completed a town-wide natural resource inventory using a combination of field work, mapping work, and assembling existing data. This project compiled natural resource data into a digital database in GIS format and produced a written report for use in the Town of Whitefield. The data from this project is compatible for integration with the existing Town GIS. Efforts from this project will aid in future work and inventories, as well as provide tools to guide future development decisions in Whitefield.

Based on results from this study, Elise Lawson and the Whitefield Conservation Commission offer the following additional recommendations:

1. **Surface Water Protection – 73.6 miles of streams/rivers – 1,031 acres of open water**
Many of Whitefield's residents obtain drinking water from Town treated water as well as personal drilled or dug wells. Maintaining good water quality is one of the highest priorities for the Whitefield Conservation Commission. Currently, water quality in these streams and rivers is in very good to excellent condition. Water quality should continue to be addressed not only in the Johns river, but also in the smaller headwater brooks that feed the Johns River and larger streams in town.
2. **Aquifer Protection – 3,460 acres – 15.6% of town** - Based on the locations of the underlying aquifers in Whitefield, it is important to protect the quality of groundwater, brooks, streams, and aquifers in Town. Future water supplies are a very valuable natural resource for Whitefield and the abutting municipalities - proven by the drinking water systems already in use.
3. **Forest lands – 79% forested in Whitefield**
 - a. **Dense Softwood Protection- 2,252 acres – 10% of Town**
Based on results from this project, there are a few areas that contain adequate acreage of dense softwood stands scattered throughout Town. These areas are beneficial to many wildlife species for cover as well as important wintering areas.
 - a. **Carbon Sequestration** – Explore the monetizing of existing forest resources in Whitefield from Carbon offset programs. Funds can be used to purchase forested

Natural Resource Inventory for Whitefield, NH

land for conservation, and sustainable forestry is an important part of this program. Funds can also be used to help private landowners put forested properties into conservation easements.

4. **Continued Wetland Conservation** – **2,212.4 acres wetlands – 10% of Town** - The Whitefield Conservation Commission recognizes the importance of wetland protection as an important means to maintain good water quality and wildlife habitat. It is hoped that the Town will continue to pursue ways to further conserve the functionality and diversity of these wetlands. An overall wetland study would help Whitefield to work with willing landowners to conserve some of these valuable wetland resources.
5. **Land Conservation** – Several areas in Whitefield have been identified as higher priority lands for conservation based on this NRI and previous studies.
6. **Hillside and Viewshed Protection** - Whitefield’s mountainous topography is directly related to the Town’s tourism industry, scenic beauty, and assortment of natural resources (wetlands, streams and rivers, wildlife, plants, etc.). Research and considerations should be made towards evaluating and possibly updating the zoning ordinance in Whitefield to conserve viewsheds as an important feature and tourist attraction to the area, while continuing to consider landowner rights.
7. **Cooperation** - It is recommended that Whitefield continue to work with neighboring towns, organizations, schools, and State and Federal agencies throughout the region to share future data as it becomes available. This will avoid an all-too-common problem of separate entities replicating work. Natural resource features do not end at Town boundaries. A watershed approach to conserving them is recommended. All the surrounding towns have completed Natural Resource Inventories, and all the data between the towns and Whitefield should be compatible in GIS format.

Long-term uses of this project could include, but are not limited to:

- Assist in determining “least-impact” sites for future development
- Locate ideal locations for telecommunication towers or wind farms
- Include in future Master Plan updates
- Promote protection plans for water quality, wetlands, and aquifers
- Continue to identify land for purchase or conservation easements for long term conservation of sensitive and diverse ecological areas

INTRODUCTION, HISTORY, AND OBJECTIVES

The Town of Whitefield, New Hampshire is rural and mostly forested containing nearly 35 square miles or 22,232 acres of land including over 1,030 acres of ponds and open water. Whitefields, as the town was originally named, was chartered by Governor John Wentworth on July 4, 1774. The last letter “s” was dropped upon the town’s incorporation in 1804 (Whitefield Master Plan, 2019). There were 51 residents in Whitefield when the first census was taken in 1810. The population was as high as 2,313 in the 2010 census and dropped to 2,213 in 2018. The Town’s geography is quite diverse, ranging from flat floodplain areas along the Johns River to rugged mountainous areas including steep slopes to the top of Bray Hill, Kimball Hill, Osburn Hill and Howland Hill. The highest point in Whitefield is in the southern part of town - 1,700 feet on the top of Kimball and Howland Hills. Out of 22,232 acres of land, 3,429.23 are conserved lands – approximately 15.4%. Three-quarters of Whitefield is forested.

The land within Whitefield has a long and rich history based on natural resources, dating back to use by Abenaki communities living in the region. Whitefield was a rural farming community in its early years of European settlers. Both hospitality and lumber industries grew in Whitefield during the 1800s. Tourists from larger cities in southern New England learned about the clean air in communities above “The Notch”. As the lumber industry continued to grow during the 1800s, more and more people came to Whitefield to take part in the economic boom (Whitefield Master Plan, 2019). Logging was the leading industry in Whitefield in the early 20th century. Since the 1940s, Whitefield’s tourism and small businesses have remained the focal point.

Whitefield contains a wide range of ecological habitats including part of the Pondicherry Refuge, Johns River headwaters, exemplary plant communities, and rare or endangered species. The latest Master Plan in Whitefield was completed in 2019. The last Natural Resource Inventory was completed in 2005: and data from this work was included in the current Master Plan. A list of goals for Natural Resources in town taken from the latest Master Plan include:

- Goal 1 – Protect conserved land for recreation, scenic views, and aesthetics
- Goal 2 – Protect steep slopes and hilltops
- Goal 3 – Address growth and development through zoning
- Goal 4 – Protect aquifers and open bodies of water
- Goal 5 – Maintain inventories of natural and scenic resources

Goals of the Natural Resource Inventory

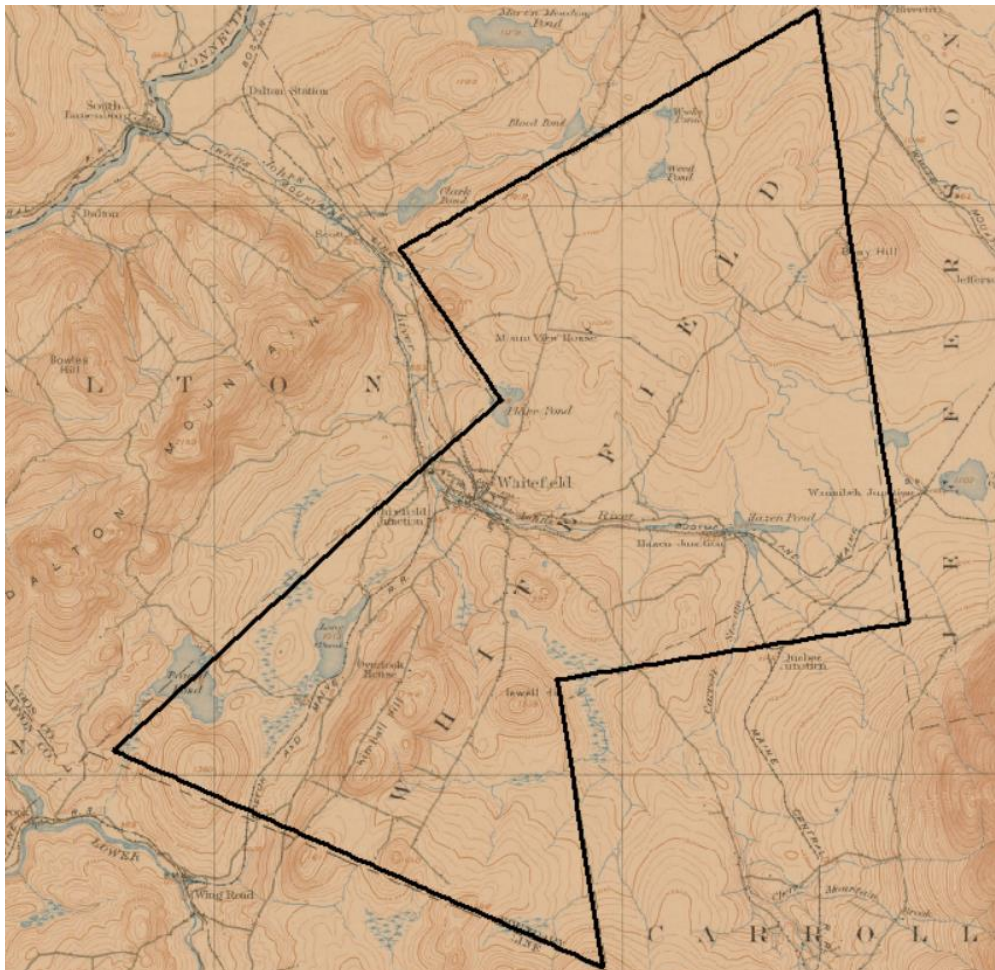
This project provides a Natural Resource Inventory (NRI) with the addition of data to the existing Whitefield GIS database that can integrate with past and future studies. One of the goals of this project is to provide an inventory, management recommendations, and further

Natural Resource Inventory for Whitefield, NH

planning tools for the Town of Whitefield. This report can be used as an educational and planning tool. It contains a written report with maps, as well as an extensive GIS database that can be overlaid existing maps in the Town's database. It promotes conservation of water, forested land, riparian habitat, wetlands, and unique co-existing natural resource features throughout the Town.

Measurable objectives of this project include the following:

1. Provide the Town of Whitefield with updated, standardized coverages that can be integrated into the existing GIS database.
2. Create a document that can be incorporated into future updates of Whitefield's Master Plan.
3. Increase awareness of the values of the characteristics of Whitefield including forest and water resources, scenic view areas, recreation areas, riparian buffer habitat, and wetlands with associated wildlife habitat.
4. Provide the Town with the ability to continue to build upon and update the natural resources digital database.



The Town of Whitefield with historic topographic map from 1900

METHODOLOGY

Frank Lombardi, chair of the Whitefield Conservation Commission was the main contact person for consultant, Elise Lawson of Watershed to Wildlife. Elise has worked as a natural resource consultant for over 20 years, many of them with business partner and Whitefield resident, John Severance (2000-2015). This town-wide Natural Resource Inventory uses a combination of existing mapping data, previous field work, and current field work to update an overall base NRI for Whitefield, NH.

Field Work

Elise completed six days of field work for this study (June 9, July 6, 13, 19, and 27, and September 17). The Whitefield Conservation Commission reached out to landowners for permission to walk on their properties for this NRI. We respect the rights of landowners, and we did not trespass on private property unless granted permission. Field work was conducted to get an overall view of Whitefield with a focus on previously identified targeted areas. This work included inventories and assessments on several wetland complexes, beaver ponds, and riparian habitats, and higher elevation uplands. In most cases Class VI roads and established trails were followed, while in other cases, compass-based orienteering and handheld GPS units were used. At points of interest, GPS locational data was taken, along with photographs and field notes. During field work sessions any rare or endangered species found was noted and located on a map. Observed invasive plant species were also documented. Members of the Whitefield Conservation Commission joined for at least part of each field day.

Gather Existing Digital Data

Existing maps and data for the Town of Whitefield were collected. Since many decisions are based on parcels as they relate to rivers, roads, trails, ponds, wetlands, and other features, it is important to point out the working accuracies of these data sources. Combining these sources in various overlays provides an excellent overview and planning tool but does not replace the value to perform site-specific investigations and analyses. For example, the 2009 aerial photographs are accurate to within 12.5 feet. On the other hand, the newer 2015 aerial photographs are advertised with 1-foot resolution. The handheld GPS unit used for this study is a Garmin GPSMAP 76CSx. It is advertised within 30 feet, but often much better depending on satellite availability, refraction, and topography.

Compile Existing Data into ArcGIS

Elise Lawson conducted GIS analyses. She gathered digital data from the Town of Whitefield, GRANIT, Natural Resource Conservation Service (NRCS), and the US Fish and Wildlife Service. These data include the following:

1. Aerial photography
2. Topographic maps

Natural Resource Inventory for Whitefield, NH

3. Hydrology (rivers, streams, lakes and ponds)
4. Roads and trails
5. Power lines and rail roads
6. Conservation lands
7. National Wetlands Inventory
8. Soil Information (NRCS – Natural Resource Conservation Service)
9. Aquifers and Subwatersheds
10. Bedrock Geology
11. Maps created during the Wildlife Action Plans completed by the NH Fish and Game Department

Existing available maps were then integrated using ArcMAP software. Using the USDA 2009 and 2015 aerial photography, topographic maps, and soils maps, Elise digitized features and overlaid them onto a base map. These include wetlands, farmland soils, steep slopes, permanent wildlife openings, and dense softwood stands. Potentially significant wildlife habitat areas were noted.

Wetlands were reviewed and analyzed using the 2009 and 2015 aerial photos, National Wetland Inventory (NWI), Natural Resource Conservation Service (NRCS) soils maps (displaying hydric soil map units), and field work to confirm wetland locations where visited. New Hampshire state laws require that three parameters be met for classification as a jurisdictional wetland: the presence of hydric soil (very poorly and poorly drained soils); sufficient hydrology; and hydrophytic¹ vegetation. When soil maps alone are used, they could potentially over-estimate the number of wetlands throughout the Town. This is particularly true given that up to 35% of a soil classification can be inclusions (for example, upland areas within NRCS hydric soil units or wetland areas within NRCS upland units). On the other hand, examining the NWI data alone under-represents the number of wetlands, due to the U.S. Fish and Wildlife Service's method of using aerial photography to identify wetlands. Open water, emergent, and scrub-shrub wetlands can readily be identified using aerial photography alone, but forested wetlands are often missed. Some types of wetland delineations require extensive fieldwork beyond the scope of this project. Despite differences and potential errors, data provided from these sources are important tools, and can be built-upon in future studies.

Farmland Soils – Prime farmland, farmland of statewide importance, and farmland of local importance throughout Whitefield were determined using the NRCS soils map data. Data

¹ Hydrophytic vegetation are plants that grow in water or on a substrate that is at least partially deficient in oxygen as a result of excess water; plants typically found in and adapted to wet habitats.

Natural Resource Inventory for Whitefield, NH

were displayed in ArcView and queried so only those soils classified as important farmland were displayed in the Town.

Land utilized for pasture, forestry, recreation, or land uses other than urban, built or disturbed areas can still qualify as prime farmland, farmland of statewide importance, or farmland of local importance. The rationale for this approach is that land not already committed to irreversible (urban) uses is still available for cropping. Three categories of important farmlands have been described by the NRCS and they are:

1. Prime Farmland Soils as defined by the U.S. Department of Agriculture is the land that is best suited for food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for a well-managed soil to produce a sustained yield of crops in an economic manner. These soils are generally flat and relatively free of stones.
2. Farmland soils of statewide importance are lands, in addition to prime farmland, that are of statewide importance to produce food, fiber, forage and oilseed crops. Criteria used to define this agricultural land were determined by State and local agencies in New Hampshire. The soils on the list are important to agriculture in New Hampshire, yet they exhibit some properties that exclude them from prime farmland. These soils can be farmed satisfactorily by greater inputs of fertilizer, soils amendments and erosion control practices than those necessary for prime agricultural farmland. They produce fair to good crop yields when managed properly.
3. Farmland of local importance is land, in addition to prime and statewide farmland, that is of local importance to produce food, fiber, forage and oilseed crops. The criteria used to define this farmland were determined by local agencies in Coos County.

Permanent openings (fields - areas dominated by grasses, forbs, brambles) were digitized from 2015 aerial photographs. The regions digitized include only those openings managed as permanent opening habitat. They do not include clear-cuts where the intent is for timber harvesting and regeneration for future logging. **Dense softwood** (or conifer) cover areas were also digitized from the aerial photographs. These areas are considered significant wildlife habitat and could be used by deer and moose for wintering areas.

Steep slopes were determined using the NRCS soils maps. Data was displayed in Arc Map and queried so only those soils map units with 20% slope and greater were displayed.

Maps are displayed at the end of this report with the features described above. All information gathered, compiled, and mapped for this report was delivered to the Whitefield Conservation Commission in digital format. It is the property of the Town of Whitefield

Public Presentation and Discussion

At the completion of this NRI, a public information meeting was held to explain results from this study. The goal of this meeting is to increase public awareness of the importance of the natural resource inventory including scenic and recreation areas, water resources, riparian habitat, forested land, and associated wildlife habitat. In addition, we will display work from this project for public access on Whitefield's town website.

RESULTS

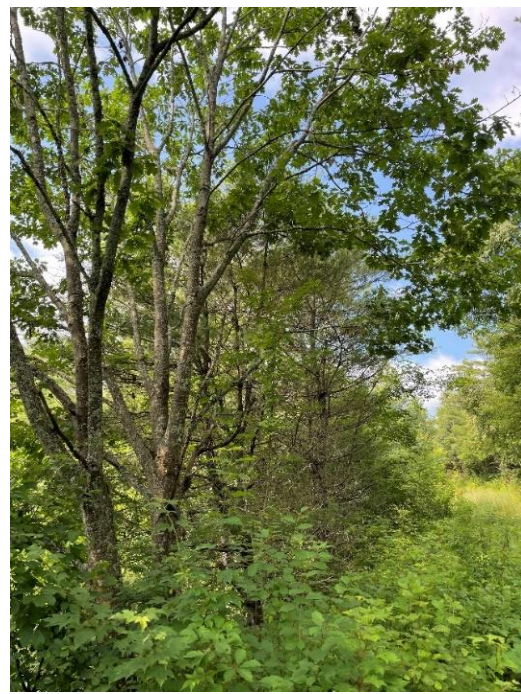
Forested Lands (Maps #1 and #2 at the end of report)

Whitefield is 79% forested. There are several different forest types, typical for this part of northern New Hampshire including:

- Hemlock-hardwood-pine – 2,425.86 ac = 10.9%
- Lowland spruce-fir – 9,879.95 ac = 44.4%
- Northern hardwood-conifer – 5,258.55 = 23.65%
- Floodplain Forest – 2.8 ac = .01%

The list of forest types, acreages and percentages above are taken directly from the NH Fish and Game's Wildlife Action Plan mapping of habitat types. The age of forests throughout Whitefield is diverse, ranging from newly regenerating forest to mature hardwood and softwood forests.

Carbon sequestration – Forests have always provided tremendous personal and public benefits, including clean water, wildlife habitat, recreational opportunities, and forest products. Additionally, forests are an essential natural solution for climate change. Carbon sequestration is the process where atmospheric carbon dioxide is taken up by trees, saplings, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide put into the atmosphere through deforestation, forest fires, and fossil fuel emissions. Sustainable forestry practices can increase the ability of forests to sequester atmospheric carbon while maintaining or enhancing soil stabilization and water quality.



Left photo – mature sugar maple and hardwoods along Gould Road in Whitefield.

Right Photo – maturing red oaks are not only excellent at sequestering carbon from the air, but also a great food source in the fall with their production of acorns.

Dense Softwood – 2,252 acres of forested land, just over 10% of Whitefield contains dense softwood stands, primarily eastern hemlock, balsam fir, and/or spruce. This figure is slightly lower than the amount of dense softwood inventoried in the 2005 NRI, which was at 11.4%. The recent aerial photos show that timber harvesting and development are the two primary reasons for this change. The softwood stands range in size from less than 1 acre to over 100 acres. Throughout Whitefield, softwood stands are found in a variety of soil types ranging from the flat, very poorly drained soils such as Peacham and Pondicherry Mucks, to well-drained soils on steep or very steep hillsides (Lyman-Tunbridge and Monadnock-Herman associations). Some of these dense softwood stands are found along rivers, streams, ponds, and wetland complexes offering proximity to good cover and a diversity of habitat types. The softwood stands in Whitefield are isolated, but a few are connected allowing for excellent winter cover and travel corridors for wildlife. For example, there are softwood corridors around Forest Lake, north of the airport, and along streams coming out of Weeks and Weed Ponds.

Deer yards cover only about 3% of the land base in New Hampshire so their identification and management are an important part of conserving the entire State's natural resources.

Dense softwood stands are an important habitat type to many wildlife species. They provide important cover and foraging habitat during harsh winter conditions by reducing snow accumulations and wind speeds. Therefore, animals such as red squirrels, snowshoe hare, ruffed grouse, white-tailed deer, and moose are often found utilizing them during the winter

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months. White-tailed deer are not well adapted for traveling in and dealing with deep snow conditions and require dense softwood stands to survive New Hampshire's harsher winters. When they congregate in these stands, they are referred to as deer yards or deer wintering areas. For the stand to be considered a deer yard two basic elements must be met: (1) A core area is identified by concentrations of dense softwoods, and (2) Mixed hardwood and softwoods adjacent to, or within the core area will provide accessible forage.



The spruce/fir forest adjacent to Weed Pond in Whitefield provides excellent cover. This stand is excellent wintering habitat and travel corridor for many wildlife species. It is in one of the few areas in Whitefield with a relatively larger area of dense softwood.



This small softwood stand between a transmission line ROW and Mirror lake is well used by wildlife.

Mast Trees - Whitefield has several species of trees that are considered important because of their mast production. These include red oak, beech, maple, hop horn beam, hemlock, black cherry, white ash, apple, and pine. Mast are the fruits produced by woody stemmed plants and can be either hard (seeds and nuts) or soft (fruits and berries). Wildlife species from nuthatches, chickadees, squirrels, and eastern chipmunks to white-tailed deer, black bears, turkeys, and wood ducks rely heavily on mast as a source of feed. Hard mast produced by red oak, and beech, and some shrubs such as beaked hazelnut, is considered extremely important because it can persist for a longer amount of time than soft mast and therefore is accessible to wildlife during times of the year when other food sources are limited.



Bear claw marks on this American beech indicate that it is a good mast tree (above photo). Mature red oaks (right photo) are found throughout Whitefield. This one is large enough to produce acorns, loaded with protein and fat. Both trees are important fall food sources for many wildlife species.



Early Successional Habitat – Early successional habitat includes an area with grasses, forbs, shrubs, and young trees (aspen, white birch, and white pine are common in northern NH). It provides excellent food and cover for wildlife but needs some sort of disturbance to be maintained. Early successional habitats have been declining throughout the Northeast for decades, as have the wildlife species associated with them. For example, American woodcock have declined by 40% over the past 30 years, and New England cottontails occur in only 20% of their historic range. In Whitefield, an excellent example of early successional habitat including pioneer species is located between the Whitefield Airport and the Johns River. This area was not only cleared but most of the topsoil removed. It is sandy and gravelly with pioneer species including aspen, white birch, white pine, grasses and forbs, reindeer lichen, and wildflowers.



Above photo: Early successional habitat with pioneer species: reindeer lichen, grasses, wildflowers, aspen, white pine, and white birch. This photo is adjacent to the railroad track which parallels the airport.

Right photo: Within the early successional habitat the soil is sandy with very little topsoil. As a result, there were several areas where birds had dusted themselves with the sand. Dust baths are part of a bird's preening and plumage maintenance. The dust is worked into the bird's feathers and absorbs excess oil to help keep the feathers from becoming greasy or matted. It also helps smother or minimized lice, feather mites and other parasites. Photos taken 9-17-22.



The area shown and described above is adjacent to the Johns River near Hazen Pond. The habitat along with the sand/gravel for construction of the railroad is excellent habitat for turtles, who require these sandy areas to lay eggs every spring. The proximity of the sandy area to open water, gives turtle hatchlings a better chance of making it to water. Other examples of early successional habitats in Whitefield include abandoned/reclaimed gravel pits, timber harvesting areas, transmission lines, and in rare cases in NH wildfires or prescribed burns.

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These indentations in the gravel are turtle nests. There are several along the edge of the railway tracks and wetlands such as this one. Many of the nests had been destroyed by predators, but hopefully some hatchlings made it to the open water at the base of the railway bed.



Early successional habitat under this transmission line will be maintained by the utility company. Although transmission lines are not aesthetic visually, the early successional habitat it maintains along with edge habitat is excellent for wildlife. Photo taken 9-17-22.

Permanent Wildlife Openings² (Map #2 at the end of report)

Permanent wildlife openings are dominated by grasses, forbs, wildflowers, brambles and fruiting shrubs. These include hay land, pastureland, cropland, brush-hogged fields, and mechanically maintained transmission lines. It is estimated that they provide required habitat for about 22% of New England's wildlife species and are seasonally important for nearly 70% of species. White-tailed deer, black bear, rodents, such as deer mice, meadow voles, shrews, and woodchucks, commonly feed on the vegetation present in these habitats, and carnivores from weasels and hawks to coyotes in turn feed on these species. Permanent wildlife openings are heavily used by bird species as feeding and nesting sites, specifically by the eastern bluebird, Bobolink, and northern harrier, which are species of concern in New Hampshire. They also create important edge habitat. Wherever an open area meets the forest, the area of transition will attract the largest diversity of species, both plant and animal. Generally, there will be species adapted to permanent wildlife openings, those adapted to forested habitat, and those who specialize in the transition zone area, who will frequent these edge habitats. For example, many bird species that feed in openings are known to nest within the edge habitat because there is typically more structural diversity and cover.

Currently, Whitefield has 1,731.1 acres maintained as permanent wildlife openings which make up 7.8% of the Town's area. This is very similar to the 2005 NRI where 1,713 acres were digitized. The New Hampshire's State average is 10% permanent wildlife openings. Elise digitized a total of 272 different openings from aerial photos during this project ranging in size from 0.2 acres to approximately over 56.5 acres. These opening are scattered throughout town and generally found along roads and often associated with a private residence or working farm. Diversity in sizes is a good feature to maintain in permanent wildlife openings because varying sizes are preferred by different species. For example, northern harriers – a predatory bird or raptor - prefer larger openings while feeding, yet snowshoe hare are more likely to feed in smaller openings where cover is more readily available. There are other permanent wildlife openings throughout Whitefield that are too small to be mapped into the Town's overall acreage of permanent wildlife openings, such as lawns near homes and seeded woods roads. These openings, especially those in more isolated parts of the Town, are still important habitat and help maintain Whitefield's plant and wildlife diversity.

As the percentage of permanent opening in New Hampshire has decreased significantly over the past 50+ years, the State is encouraging landowner to create or maintain permanent opening as important wildlife habitat.

² Permanent wildlife openings are those that are and will continue to be maintained as herbaceous openings (grass and legumes). They are valuable for many wildlife species in a landscape dominated by forested areas.

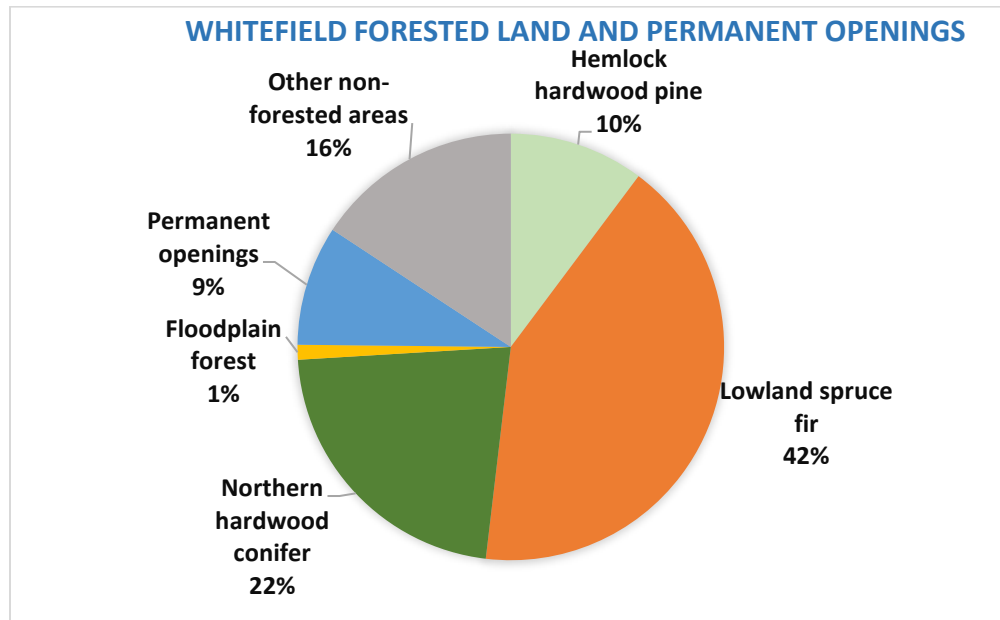


Open field part of a tree farm off Gould Road. The combination of field, forested areas along Gould Road, makes this area excellent wildlife habitat.

Retain, and possibly increase, permanent wildlife openings to increase the diversity of wildlife and plant community types throughout Whitefield. When possible, it is a good practice to remove non-functioning fencing, such as barb wire and woven sheep fence.



Permanent openings are not only are excellent for wildlife, but also offer scenic and expansive views. This photo was taken along Kimball Hill Road.

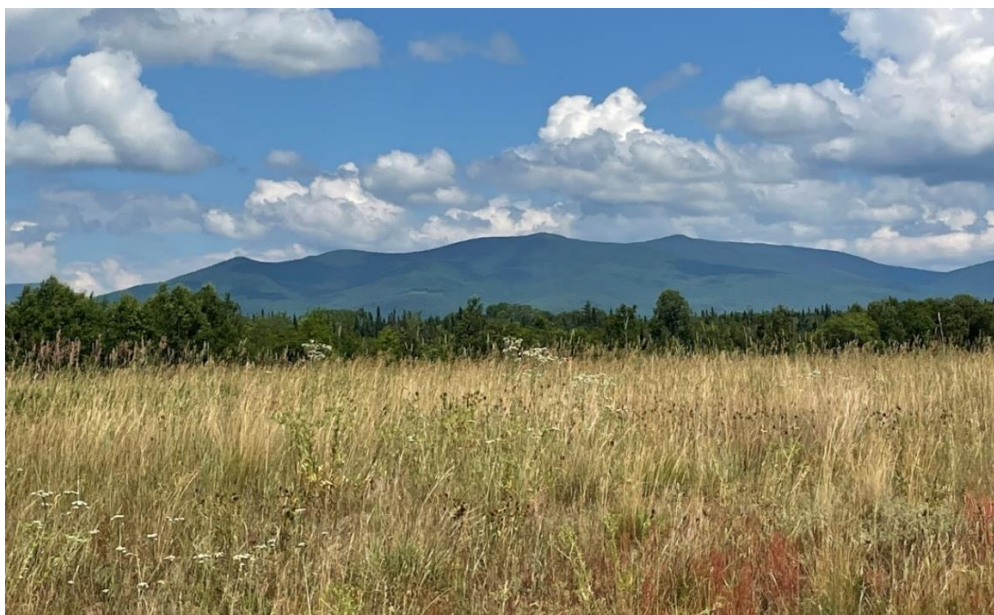


Conservation Land (Maps #1 and #3 at the end of report)

Over 3,429 acres equaling 15.4% of Whitefield is land conserved by governmental ownership or conservation easements and is protected as conserved land. This is over double the amount of conservation land from the 2005 NRI in Whitefield! Of these:

1. 2,579.8 acres (11.6%) is part of the Pondicherry National Wildlife Refuge
2. 549.24 acres (2.5%) of land is under Conservation Easements
3. 410.2 acres (1.8%) is owned by the Town of Whitefield
4. 266.8 acres (1.2%) of land is part of White Mountain Regional High School property within Whitefield

See Appendix A for a list of conserved land in Whitefield.



View across the Pondicherry Wildlife Refuge with Mount Waumbek beyond.



Town of Whitefield property looking towards the Pondicherry Wildlife Refuge boundary. This property is adjacent to the refuge and would make an ideal Town Forest. There are upland areas excellent for trail development and wetlands in the lower portion of the property. This parcel is also easy to access for educational opportunities.



The White Mountain Regional High School has conserved land around it including cross-country ski trails which are excellent for non-motorized recreation and open to the public.

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There are several ways to conserve land. Many lands are owned by federal, state, and local governments (national forests, state parks, and state/town forests, for example). A conservation easement on private land is another means to protect property. It creates a legally enforceable land preservation agreement between a landowner and a municipality or a qualified land protection organization or trust. It restricts real estate development, commercial and industrial uses, and certain other activities on a property to a mutually agreed upon level. The decision to place a conservation easement on a property is strictly a voluntary one where the easement is sold or donated. The restrictions, once set in place, are binding for all future landowners. The restrictions are spelled out in a legal document that is recorded in the local land records, and the easement becomes a part of the chain of title for the property. The landowner who gives up these development rights continues to privately own and manage the land and may receive significant state and federal tax advantages with their land for future generations. The easement holder has a responsibility to monitor future uses of the land to ensure compliance with the terms of the easement and to enforce the terms if a violation occurs.

Consider conserving at least part of the town-owned property south of the airport and adjacent to the Pondicherry National Wildlife Refuge. Wetlands on this property are connected to the refuge and important habitat and travel corridors for wildlife.

- ***Explore the possibility of the US Fish and Wildlife purchasing all or a portion of the property***
- ***Consider making the entire property a Town Forest for non-motorized recreation, education, and wetland/water quality protection***

The Town of Whitefield has a Conservation Fund with monies coming from land use change tax. This fund can facilitate land conservation projects.

Rivers, Streams, Lakes, and Ponds (Maps #3 to #4 at end of report)

There are over 73.5 miles of perennial streams and rivers that flow through Whitefield. The Johns River is the largest and flows for nearly 7.4 miles through town. It is also the only river found in Whitefield. It begins at the outlet of Little Cherry Pond in Jefferson. It is a slow flowing, low gradient fen with mucky bottom until it reaches Bunton dam where the river transforms into a rocky-cobbly faster flowing river with a medium gradient. It flows west through Whitefield roughly bisecting the town before entering Dalton, NH and eventually the Connecticut River. The Johns River was once dammed in Whitefield downtown area. In 2006 the dam was removed to allow for increased fish passage along its length. With few exceptions, most of the Johns River between Bunton Dam and the upstream side of Town of Whitefield has good to excellent riparian buffers with little erosion.

Natural Resource Inventory for Whitefield, NH



The Johns River looking west and east from the bridge in downtown. There is still a little evidence of a former dam on the left photo. The dammed area not only provided hydropower for local mills, but also created a ponded area, enjoyed by residents. The dam was removed to re-establish connectivity for aquatic species – including fish passage – throughout the length of the Johns River.

Several small tributaries enter the Johns River as it flows through Whitefield, with the one being Carroll Stream. Carroll Stream is 9,356.3 feet or 1.8 miles long in Whitefield, entering town at the Carroll Townline south of the airport. It flows through Airport Marsh and enters the Johns River in Hazen Pond just north of Airport Road and east of Hazen Road.



Airport Marsh Wildlife Management Area at the outlet. Carroll Stream, leaving Airport Marsh then joins the Johns River on the other side of Airport Road. Photo taken 6-9-22.

Natural Resource Inventory for Whitefield, NH

Bog Brook is another noteworthy stream in Whitefield. It flows for 25,630 feet or 4.85 miles through town. It begins right at the Bethlehem Townline flowing through southern Whitefield in the Richardson Pond areas for nearly 2 miles before entering Carroll, NH. It flows for approximately 2.5 miles through Carroll before re-entering Whitefield between Osborn Hill and Route 3. Bog Brook flows northwest through Whitefield eventually entering the Johns River just upstream from where Chase Brook enters, close to the Dalton Townline.



The Johns down stream of Hazen Pond. During field work, osprey and great blue heron were observed here. Photo taken on 7-13-22.



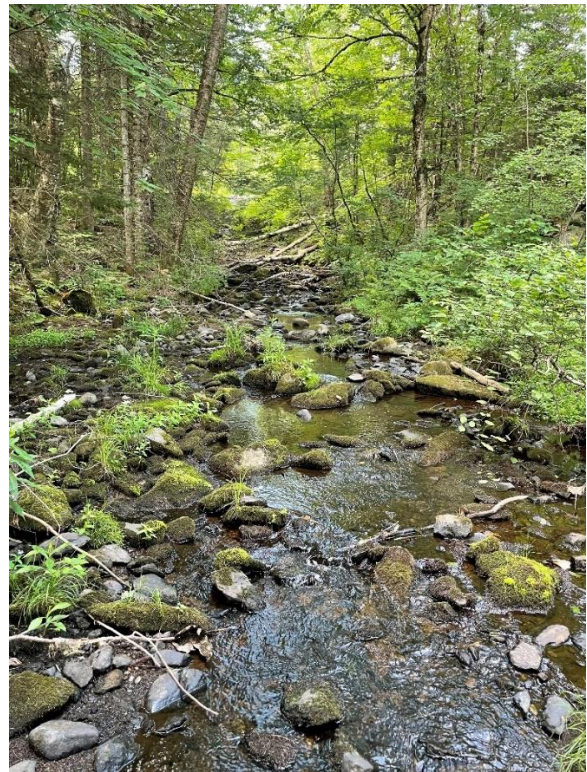
Johns River downstream from the former Browns Furniture entering the Town of Dalton. From here it flows parallel to Route 142 entering the Connecticut River in Dalton.

Natural Resource Inventory for Whitefield, NH

All perennial streams in Whitefield have several wetland types associated with them. Beaver activities along streams are dynamic and ongoing. Beaver enhance the diversity of wildlife habitat and make these rivers and streams some of the most diverse river/wetland complex systems throughout town. There are many unnamed streams located throughout Whitefield with high value habitat where good buffers have been retained. These areas provide high value plant and wildlife habitat and connectivity to forests, wetlands, and other habitat types.

The Johns River is the largest river in Whitefield, and the most vulnerable to runoff, erosion, and pollution because it flows right through downtown. Wherever possible:

- ***minimize impervious surfaces adjacent to the river***
- ***maintain and enhance native vegetative buffers***
- ***test the water quality throughout the year***



An unnamed perennial stream leaving Burns Lake in Whitefield. We are facing upstream towards Burns Lake (left photo), and downstream towards a wider wetland complex. The stream has moderate flow with a cobbly, rocky bottom. This stream eventually enters Bog Brook and then the Johns River. Photo taken on 7-13-22.

Table1: List of named Rivers and Streams in Whitefield

River/Stream Waterfalls	Length in Whitefield (miles)	Direction of flow	Watershed Area in Whitefield	River Confluences
Johns River	7.4	West	Johns River	Connecticut River in Dalton
Bog Brook	4.5	North and Northeast	Johns River Forest Lake/Bog Brook	Johns River then Connecticut River
Carroll Stream	1.8	North	Johns River	Johns River than Connecticut River
Black Brook	0.2	South	Lower Ammonoosuc River	Ammonoosuc River in Bethlehem and then Connecticut River in Littleton

The Whitefield Wastewater Treatment Facility effluent discharges into a perennial stream, which then enters the Johns River 300 feet downstream. The facility was originally built in the 1980s and serves approximately 600 residential and commercial users. Between July 2019 and July 2021 there was a comprehensive upgrade to bring the facility into compliance with new, stringent treatment process standards. Appendix B show improvements in water quality after the needed upgrades.

Lakes/Ponds – Whitefield contains 1,030.82 acres of lakes, ponds and open water making up 4.6% of the town area. Forest Lake is the largest lake at 196.22 acres. Of that 90.2 acres are in Whitefield and the remaining in Dalton. Forest Lake is mostly developed around it except for a section along the southern shoreline which contains a 12-acre forested wetland. Water quality of this lake is particularly important as it is not only habitat for wildlife, but also a popular recreation area.



Forest Lake facing the outlet and forested wetland. This is the most undeveloped portion of the lake. Photo taken 9-17-22.

Natural Resource Inventory for Whitefield, NH

Residents and several towns around Forest Lake are concerned with a proposed landfill adjacent to Forest Lake, Alder Brook and the Ammonoosuc River. The water quality of Forest Lake has been very good for many years and many residents are concerned with future water quality levels if a landfill is constructed.

An unnamed perennial stream leaves Forest Lake and enters Burns Lake which is 128 acres. A large wetland complex with several feeder streams enter Burns Lake. The diversity of wetland types adjacent to and including Burns Lake make it very diverse and a special area in Whitefield.



Burns Lake facing south. Photo taken on 7-13-22.

Appendix C at the end of this report contains an individual lake report for Forest and Burns Lakes in Whitefield, NH. Data was collected through the Volunteer Lake Assessment Program in 2021 on Forest Lake, and from 2008-2017 on Burns Lake (called Burns Pond in the report). It not only contains information on aquatic life and recreation, but also contains a watershed land use summary using the 2006 National Land Cover Database. It shows an excellent overall description of the area and includes Forest Lake.

The third largest lake or pond in Whitefield is Mirror Lake which is 54.4 acres total. Of that 45.3 acres are in Whitefield and the remaining area in Dalton. Like Forest and Burns Lakes, Mirror Lake is an important recreation area and partially developed around it. There are some diverse wetlands including a small series of beaver ponds on both the north and south shores of the lake making it excellent wildlife habitat especially in those areas.



The north end of Mirror Lake in Whitefield. It is shallow and contains an adjacent wetland which is rich in diversity.



A small series of beaver ponds at an outlet to Mirror Lake on the north end of the lake. Although there was no active beaver activity, it has been used regularly historically. There was also evidence of vernal pool species in these beaver ponds. Photo taken on 7-27-22. Marcia and Dave are examining the beaver pond from a snow machine bridge.

Table 2: Description of Named Ponds in Whitefield, New Hampshire

Lake/Pond Name	Acres in Whitefield (Total acres)	Location
Forest Lake	90.19 (196.22)	Southwest part of Whitefield, just south of Forest Lake Road. Over half of the lake is in Dalton, NH.
Burns Lake (Burns Pond)	127.92	West of Route 116 and north of Forest Lake Road. Southwestern part of Whitefield.
Mirror Lake	45.27 (54.36)	North of downtown Whitefield and west of Route 3. A portion is in Dalton, NH.
Airport Marsh Reservoir	12.37	Part of the Airport Marsh Wildlife Management Area just west of the airport strip and Airport Road.
Weed Pond	4.73	North part of Whitefield. Between Old East Road and Lancaster Road (Route 3).
Weeks Pond	3.03	Just north of Weed Pond and connected to it by a perennial stream and a beaver impacted wetland complex.
Richardson Pond	4.11	Southeastern Whitefield just east of Marjorie Lane, an extension of Spencer Road. The pond is impacted by beaver with an unnamed tributary to Bog Brook.

There are several smaller unnamed ponds found in Whitefield, most of which are dependent on beaver activities. These ponds can be any size from no open water to a ponded area several acres. The size can vary year to year.

All rivers and water bodies offer recreational and wildlife value for Whitefield, and the entire region. Swimming, kayaking, canoeing, birdwatching, hiking, skiing, fishing and hunting are all common activities in Whitefield. Tourism accounts for a large portion of income for northern New Hampshire and these waterbodies are significant components.

Maintaining good water quality of these areas is not only important ecologically, but also for valued tourism.

Sub-Watersheds (Map #4 at end of report)

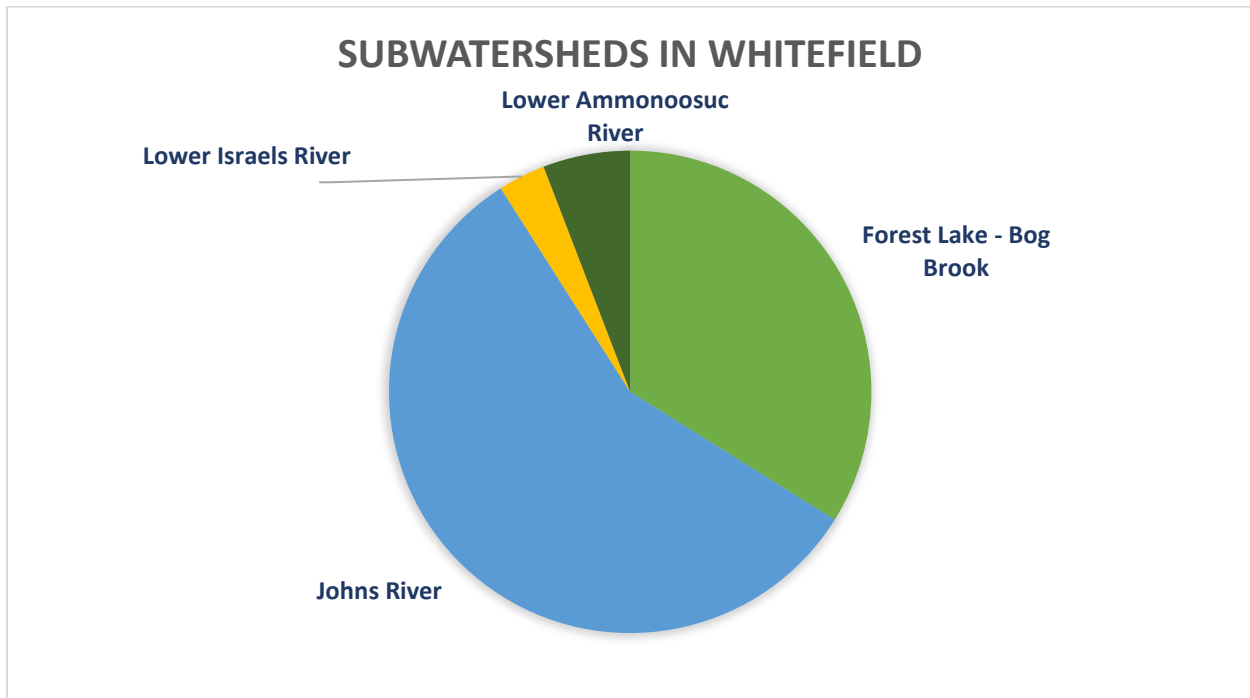
The ability to view the landscape from a watershed or sub-watershed perspective helps to understand drainages, flows, and associated habitat throughout the Town. Sub-watersheds do not stop at municipal boundaries; highlighting the fact that all things downstream are affected by land management upstream, particularly in the headwaters. The State of NH does not breakdown the watershed beyond the HUC 12 level, but most towns and cities contain more than one subwatershed determined by topography and ridgelines.

Whitefield contains portions of four sub-watersheds when broken down to the level 12 hydrologic unit code (HUC) listings. The largest subwatershed in Whitefield is Johns River subwatershed which covers central and northern portions of town at 12,691.9 acres. It includes Weeks and Weed Ponds, the Johns River, Carroll Stream, Hazen Pond and Airport Marsh, as well as many unnamed perennial streams. Most of these streams and brooks originate in Whitefield and some from Jefferson, NH. The Forest Lake-Bog Brook subwatershed is the next largest in Whitefield covering 7,536.7 acres and flows across the southern portion of Whitefield. This subwatershed includes Forest and Burns Lakes, Richardson Pond, and Bog Brook. It eventually drains into the Johns River. The Lower Israels River subwatershed is 1,299.3 acres. It is the northern-most subwatershed, containing two unnamed perennial streams which flow directly into the Israels River in Jefferson. These headwater streams are west of Bray Hill Road. Lastly, the Lower Ammonoosuc River Watershed is located in far southern Whitefield and is 704.1 acres. The headwaters of four perennial streams are located in Whitefield – one of them named Black Brook. These streams all flow south each directly entering the Ammonoosuc River in Bethlehem, NH.

All four of the subwatersheds in Whitefield are part of a larger watershed area called the Upper Connecticut River Watershed. A list of the subwatersheds in Whitefield are described in the following table.

Table 3: List of watersheds in Whitefield, NH

HUC 12 Name - subwatershed	Acres in Whitefield	HUC 6 Name – larger watershed Area	Acres in Whitefield
Johns River	12,691.9	Upper Connecticut River	22,232
Forest Lake-Bog Brook	7,536.7		
Lower Israels River	1,299.3		
Lower Ammonoosuc River	704.1		



Riparian Zones and Floodplains

A riparian zone or riparian area is the interface between land and a stream or river. Riparian zones are important habitat because of their role in soil conservation, their biodiversity, and the influence they have on aquatic ecosystems. Riparian habitats occur in many forms including grassland, woodland, wetland, floodplains, or a combination of features. A floodplain is flat or nearly level land adjacent to a stream or river that experiences occasional, seasonal, or periodic flooding. Floodplains are a category of riparian zones and can support rich, diverse ecosystems. Whitefield contains a diverse amount of riparian and floodplain areas.

Floodplains are very fertile agricultural areas, especially along larger rivers. Whitefield does not contain rivers as large as the Connecticut or Ammonoosuc Rivers but has fertile floodplain areas along smaller rivers and streams including the Johns River, Carroll Stream, and Bog Brook. Floods carry nutrient-rich sediment and distribute it across a wide area. Floodplains are flat and often have relatively few boulders or other large obstacles that may prevent farming. Although some portions of Whitefield's riparian areas and floodplains have been impacted by development, most areas have not, and there are a few opportunities for maintenance of adjacent riparian habitat and creation of additional buffers.



Forested flood plain along the Bog Brook about 1,300 feet upstream from its confluence with the Johns River. This lush floodplain forest contains black cherry, balsam fir, white pine, sensitive fern, wetland grasses, wood nettle, among many other plants. Photo taken 7-19-22.



Riparian habitat on both sides of Hazen Pond area offers excellent travel corridor for wildlife. Fortunately, this area is conserved in Whitefield and Jefferson as part of the Pondicherry NWR.

Floodplains and riparian areas are home to a diversity of wildlife. The rich soils create excellent insect and amphibian breeding habitats, and these species in turn become prey for birds such as woodcock and barred owl, for mammals such as mink and raccoon, and for reptiles such as smooth green snake and wood turtle. These corridors allow wildlife to move

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from one habitat to another. Intact riparian areas are essential for creating and maintaining a healthy aquatic system. Overhanging vegetation such as shrubs and trees provide important shade to aquatic habitats allowing them to maintain cooler water temperatures and adequate amounts of dissolved oxygen. This is particularly important for trout and other salmonid species. The root systems of the riparian vegetation are also important for reducing the amount of erosion and subsequent sediment accumulation that the constant moving water and flooding situations can cause. Riparian habitats also slow and hold floodwaters reducing shoreline damage and can work as a filtration system removing nutrients and toxins from the water and assisting in maintenance of water quality. Riparian vegetation can also provide habitat structure to aquatic systems through dead or broken limbs and whole trees that fall into the water.

Logging these forested riparian areas is generally not recommended due to proximity to the rivers and wetlands. Because some areas contain mature tree species, it will also offer excellent recreational opportunities. Hiking trails will be relatively easy to construct and maintain. If timber is harvested in these areas, it should occur during the winter months when the ground is completely frozen.



Photo on the left would benefit from more vegetation along the Johns River, particularly more trees and shrubs. This will help maintain good water quality of the Johns River as it flows through downtown area.

The photo on the right illustrates excellent riparian buffer on both sides of the Johns River.

For all these reasons and more, conserving or expanding riparian areas and shoreland buffers is a vital part of conserving Whitefield natural resources. Adherence to New Hampshire's Shoreland Protect Program will help maintain existing riparian habitat, providing wildlife travel corridors and maintaining good water quality.

Wetlands and Hydric Soils (Maps #3 at end of report)

Wetlands are an essential habitat type for most plant and animal species in New Hampshire. Wetlands are extremely diverse depending on the hydrology, soils, topography, and climate of an area. In addition to the rivers, lakes, and ponds, there are four general types of Palustrine³ wetlands: forested, scrub shrub, emergent (wet meadow), and open water, with additional sub-types within each of these categories. This diversity extends into each individual wetland where a variety of plant/wildlife species and water regimes co-exist. In addition, the edge habitats within and around wetlands are frequently used by a great deal of wildlife species. It is estimated that riparian areas and wetlands are used by over 90% of the region's wildlife species and provide preferred habitat for 50% of local species. For these reasons wetlands provide plentiful wildlife habitat, viewing and hunting opportunities.



Series of wetlands and beaver ponds between Forest and Burns Lakes. Photo taken on 6-9-22 facing upstream and south towards Forest Lake. All four types of wetlands can be seen here including open water, emergent, scrub shrub and forested wetlands.

³ Palustrine wetlands are a group of vegetated wetlands traditionally called marshes, swamps, bogs, fens. They also include the small, shallow, permanent or intermittent water bodies often called ponds.



Approximately 700 feet downstream from the outlet of Burns Lake, the unnamed perennial stream enters a flatter, fen area which is flooded by beaver. The natural flat area has a diversity of wetland types and wildlife habitats. Photo taken on 7-13-22 facing downstream and north.



This photo was taken by Frank Lombardi on 7-13-22 using a drone. It is the same wetland complex shown in the photo above. Work with the drone offered a great perspective of wetlands in town.



Weed Pond (shown here), Weeks Pond, and the associated series of beaver ponds is one of the most diverse and sensitive areas in Whitefield. This entire area is also highlighted by NH Fish and Game Department as highest ranked habitat in NH and highest ranked habitat in biological region.



Drone overview of Weed Pond and the wetlands surrounding it. This entire area has been identified as a high priority for land conservation, because of its incredible diversity, and it is one of the largest undeveloped blocks of land in Whitefield. Photo taken by Frank Lombardi on 7-19-22.

Along with providing important plant, wildlife, and fish habitat, wetlands are also an important protector of water sources. Because they often contain hydrophytic vegetation (plants adapted to living in water and/or wet conditions) and poorly drained soils, wetlands store significant amounts flood and/or run-off water, minimizing serious damage in times of high water. They are important contributors to groundwater recharge. This ability to retain water allows wetlands to act as a filtration source. As moving water is slowed and stored in wetlands, suspended sediments and particles settle to the mucky substrate and plant roots are given a chance to absorb excess nutrients, toxins, pollutants, and contaminants. These functions make wetlands an important source for maintaining the health of aquatic systems.

Wetland areas are dynamic and constantly changing. The general trend (without severe weather or other outside influences) is for wetlands to slowly fill in over time. The process begins with open water, and over time, submerged plants appear. Floating-leafed plants, such as water lilies, eventually follow. Then emergent plants such as reeds, sedges, and wetland grasses begin to flourish. Shrubs such as high bush cranberry (*Viburnum trilobum*), sweet gale (*Myrica gale*), mountain holly (*Ilex mucronate*), and bog rosemary (*Andromeda glaucophylla*) begin to appear and heaths such as leatherleaf (*Chamaedaphne calyculata*) and labrador tea (*Ledum groenlandicum*) surface among the shrubs. Trees including red maple (*Acer rubrum*), gray birch (*Betula populifolia*), and larch (*Larix laricina*) subsequently emerge. This natural successional process is often referred to as lakefill.

On the other hand, there are several environmental and human-induced reasons for wetlands to increase in size. Some examples of these include:

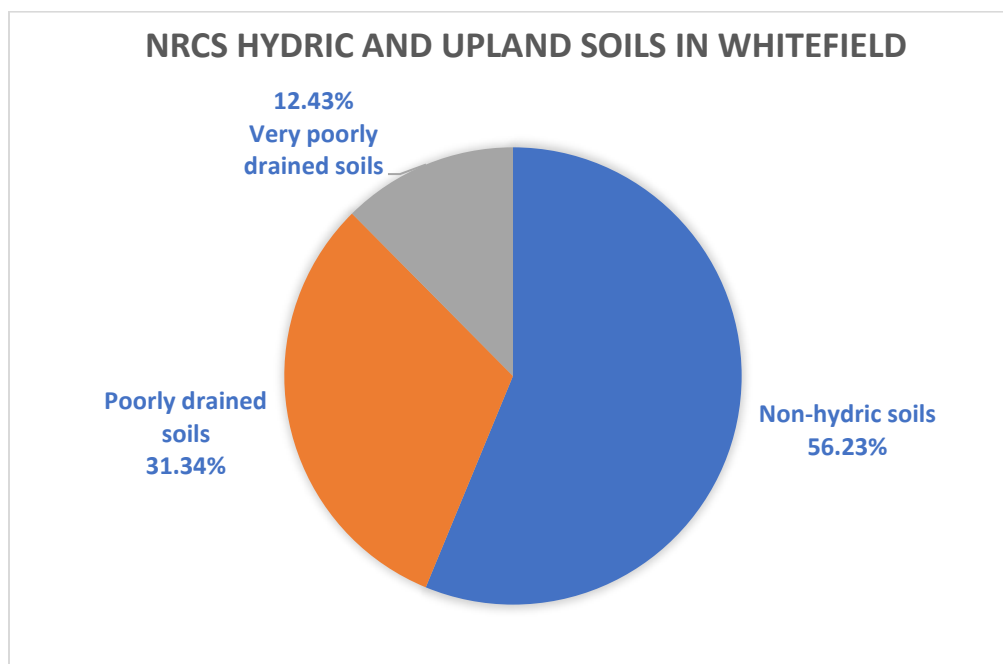
- Human development, including damming or excavation such as the mining of gravel and sand could increase wetland sizes and often create new wetlands
- Severe weather changes – an increase in rain will increase the wetland area, whereas a drought may diminish the area
- The cyclic movements of beaver as hardwood saplings regenerate in early succession. In Whitefield there is abundant sign of beaver activities in most of the wetland complexes throughout Town
- Human activities such as logging and landscape alteration can dredge out wetland areas or increase the amount of runoff into wetlands

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Photos of the same ponded area in Whitefield. The left photo was taken for the original NRI on 9-13-04, and the right photo taken on 7-13-22. The water level is considerably lower presently, but given the dynamic nature of beaver, it will undoubtedly be full of water again at some point in the future. The lower water level allowed for great tracking in the wetland including bear, deer, great blue herons, turtles (large and small), ducks and geese, raccoon, many small mammals.

Whitefield contains over 2,252 acres of wetlands (10.13% of town). They range in size from less than an acre to over 300 acres and contain a variety of wetland habitats including forested, scrub shrub, emergent, riverine, and open water wetlands. Most wetlands mapped in Whitefield have been obtained from the U.S. Fish and Wildlife Service's National Wetland Inventory. By examining the 2015 aerial photographs, Elise digitized several additional wetland areas for this study.



Of the hydric soils mapped throughout Whitefield, 6,968.56 acres are classified as poorly drained and 2,762.92 acres are very poorly drained – with a total of 9,731.48 (43.77%) hydric soils throughout Whitefield! Poorly drained soils are defined as soils where water is

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removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. In very poorly drained soils, water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Hydric soils are scattered throughout the Town with some of the larger areas listed below. There are generally fewer wetlands in the hilly or mountainous parts of Town (near Kimball, Howland, and Osburn Hills). On the other hand, in flatter sections in the western, eastern and northern parts of town, there are larger areas of very poorly drained soil. The largest wetlands are found near the Connecticut River, and contain a combination of forested, scrub shrub, and emergent wetlands.



A colony of sun dews (*Drosera rotundifolia*) in wetlands adjacent to the Johns River in the Pondicherry Wildlife Refuge. The leaves are covered with gland-tipped hairs whose secretion of sticky fluid traps insects, which are then digested by enzymes. This plant's ability to extract nutrition from insects helps it survive in nutrient-poor emergent wetlands.

Whitefield contains relatively more wetlands compared to surrounding towns and should continue to prioritize maintaining and enhancing water quality, working to conserve and maintain all types of wetlands throughout the Town.

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A forested wetland with perennial stream is on Bray Hill Road. Although not a large wetland complex, it is connected directly to the Johns River. The headwaters stream leaving this wetland flows west, into Jefferson, and then curves back into Whitefield, entering the Johns River just downstream from Little Cherry Pond in Whitefield. Photo taken on 7-13-22.



This wetland is directly connected to Mirror Lake on the north shore. It is approximately 25 acres and contains forested, scrub shrub and emergent wetlands. The emergent wetlands in the foreground are sometimes flooded increasing the amount of open water in Mirror Lake.

Vernal Pools – Nine (9) vernal pools were documented in Whitefield over several years. Undoubtedly there are many more throughout town. ***We recommend conducting a town-wide vernal pool study to continue building upon the database.*** Vernal pools are unique often isolated and important wetland types. Vernal pools provide essential breeding habitat for certain amphibians and invertebrates such as wood frogs (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*), yellow spotted salamanders (*Ambystoma maculatum*), and fairy shrimp (*Branchinecta lynchi*). These creatures depend on vernal pools as breeding sites because they are only temporary water bodies preventing fish and other aquatic predators from taking up residency. Reptiles such as painted turtles (*Chrysemys picta*) also rely on vernal pools as important feeding areas in early spring. Vernal pools fill annually from precipitation, runoff, and rising groundwater in the fall and spring. By mid-summer, however, these wetlands are typically dry, making them a dynamic system inhabitable to many species except for specifically adapted plant and wildlife species. For this reason, many unique, rare, threatened, and endangered species are linked to this wetland type. The State of New Hampshire (Fish and Game Department and Wetlands Bureau) recognizes their value as important habitat and give them special attention. Refer to Map #3 - *Wetlands, Water Resources and Conservation Land* - at the end of the report for locations of known vernal pools throughout Whitefield.



A vernal pool in Whitefield along Gould Road. When this photo was taken (6-9-22), the vernal pool was teeming with wood frog tadpoles. This vernal pool is 8 to 10 feet wide by approximately 100 feet long. It is part of a larger forested and scrub shrub wetland with larch, balsam fir, red maple, speckled alder, sensitive fern, sedges and grasses, horse tail and willow. A winter wren was also heard singing.



This vernal pool is to the left of the public access area on Burns Lake. It contained wood frog tadpoles and green frogs with cattails, meadow sweet, speckled alder, sedges and rushes, and a variety of songbirds. Photo taken on 6-9-22.

Geology ([Map #5 at the end of this report](#))

Geologic events that occurred thousands and millions of years ago still influence the management of forests today. Parent bedrock material provides the nutrients for vegetation today and to some extent determine which species will grow where on the forest. The last glacier broke apart, transported and dumped or deposited the material in a way that has an even stronger influence in what species will grow where on the forest. The glacier also has an influence on the soil and forest types that are seen today.

Most of the geologic types in Whitefield are plutonic and associated volcanic rocks. When magma never reaches the Earth's surface and cools to form intrusions, the resulting rocks are called plutonic. These include granite and diorite rocks which are found in NH. When the magma does reach the surface during a volcanic eruption, the rocks that form there are called volcanic rocks (examples in NH are rhyolite rocks). There are large areas of plutonic rocks throughout town.

There are three areas in Whitefield containing a combination of metasedimentary and metavolcanic rocks (Ammonoosuc Volcanics, Littleton Formation, and Dead River Formation). The Ammonoosuc Volcanics is largest area. It runs southwest to northeast right up the middle

of town and is over 4,800 acres. Two much smaller areas are in the northwest corner of Whitefield. All three areas are a type of metamorphic rock, which is formed by a combination of two methods. The first (metasedimentary rock) is formed through the deposition and solidification of sediment. The rock is then buried under the earth surface and subjected to high pressures and temperatures, causing the rock to recrystallize. The second (metavolcanic rock) is a rock originally produced by a volcano, which is then subjected to high pressure, high temperature, or both, causing the original volcanic rock to recrystallize.

The bedrock and resultant soil formed during past geologic periods together with the transport and deposition of this material by the glacier is a strong influence on the trees, shrubs and herbaceous vegetation that grows on the forest. The most influential is the type of till or outwash that was deposited, and whether the till lies on top of a hard pan layer. Sugar maple, beech and yellow birch grow on the fine till and dry compact till soil; beech, paper birch and red maple grow on the washed till; spruce-fir grows on the outwash and wet compact till sites. These are the species best suited to these respective habitats and whose regeneration and growth will be promoted.

The bedrock geology map attached at the end of this report, was done at a coarse scale without much, if any, field delineation and verification. It is a good starting place, and more detailed studies, such as the one described above, can be completed to refine and give a more detailed view of geology throughout Whitefield.

Soils

Just as the bedrock geology is part of what determines soil type, the nature of soil has a profound effect on plant growth. Whether it is rich with organic material, very poorly drained, or sandy, these characteristics will affect the type of vegetation adapted to grow in those conditions, and thus affecting the type of wildlife in the area. Scientists can learn much about the soil type by examining the vegetation. At the same time, examining the soil will predict the type of vegetation that can grow in the area. Because soils affect the vegetation that will grow in an area, they also influence the habitat types and therefore the wildlife species dwelling there. As a result, understanding soil conditions and characteristics can be indicators of critical areas such as wetlands, agricultural lands, forestlands, and wildlife habitat. In descriptions of soil types, the NRCS evaluates soils according to their capacity for agriculture, sand and gravel production, woodland, community development, recreation, and wildlife habitat. Certain soils are better suited for certain land uses such as agriculture or residential development. For example, residential development should be located away from areas with unstable soil conditions such as high-water tables, and slow percolation rates, due to constraints for building foundations and septic system placement.

Farmland Soils (Map #6 at the end of report)

As true with many New England towns and cities, Whitefield had some family farms in the 1800's and early 1900s. Despite harsher conditions, farmers hard work and

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dedication made Whitefield a farming community. During the late 1800's, small family farms were caught in the struggle of adjusting to a transition to commercial dairy activities within larger regional markets.

As is the situation for New Hampshire overall, the Whitefield has experienced a loss of working farms. Many of the former, larger-scale farms have been replaced with smaller farms offering a wide range of products throughout Town. The farms in Whitefield include:

- Granite State Farm on Melanie Drive – growing and selling microgreens locally
- Maple Mountain Farmstead
- North Country Apple Orchard
- Uphill Farm on Bray Hill Road – offers organic produce and has CSAs (Community Supported Agriculture)
- Scenic View Farm on Twin Mountain Road -
- Wagon Shed on Twin Mountain Road
- White Mountain Apiary and Bee Farm

In the survey for the latest Master Plan for Whitefield, residents were asked what businesses or services they would like to see more of in Whitefield, results showed that farms and agricultural businesses are considered one of the most desirable businesses (Whitefield Master Plan, 2019).

As stated in the methodology section, prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It is land that still has the potential to serve agricultural uses and can be cultivated land, pasture, or woodland. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well-managed soil to produce the highest sustainable yields with minimal inputs of resources while at the same time generating the least possible damage to the environment. Farmlands that hold state and local importance may not be as ideal for producing the highest possible sustainable yield as prime farmlands, but these soil types have been determined to be of agricultural importance on a more localized scale.

Out of the 22,232 acres of land within Whitefield the NRCS has mapped 410.51 acres (1.85%) of land classified as USDA prime farmland soils, 516.68 acres (2.32%) are classified as farmland soils of statewide importance, and 3,616.67 acres (16.27%) is classified as farmland soils of local importance. Although farmland soils are found throughout town, the majority of prime farmland is scattered through the middle of Whitefield and associated with the Johns River area. Generally, where there are steeper slopes (hills and mountains in town), there are fewer agricultural soils.



This field on route 116 is classified as Prime Farmland. It is a productive hayfield. Photo taken on 7-13-22 facing the Pondicherry Wildlife Refuge and Cherry Mountain beyond.



This stonewall is on Town of Whitefield property just south of the airport. It indicates farming occurred here. The upland sections of this parcel are classified as locally important farmland. Although this area has not been a field for many years, the lush regeneration after a recent logging job, indicates good soil quality for vegetation growth. Photo taken 6-9-22 facing uphill towards the Pondicherry Refuge.

As mentioned in the “Permanent wildlife openings” section, areas which had been used for agriculture, but are now abandoned, could be maintained as permanent opening habitat to benefit many wildlife species.

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Stratified-Drift Aquifers ([Maps #3 and #4 at the end of report](#))

An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be pumped for drinking. Groundwater is a critical natural resource for the State of New Hampshire. Approximately 98% of public water systems rely on groundwater. There are three types of groundwater aquifers: stratified-drift, till, and bedrock. Stratified drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are fractured rock. In stratified drift aquifers, the materials are sorted sand and gravel. In till aquifers, the material is a gravel, sand, silt, and clay mixture. In bedrock aquifers, the material is rock with fractures.

Stratified-drift aquifers are an important source of groundwater for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. They typically are the most productive sources of groundwater and therefore the highest yielding public water supply wells tap these aquifers. Stratified-drift or overburden aquifers are most directly influenced by surface waters and land-use activities. They are, therefore, perhaps most susceptible to contamination. Approximately 14% of land surface in the State is underlain with stratified-drift aquifers. In Whitefield 3,459.66 acres (15.6%) of the land area contains an aquifer. The two largest are under the Connecticut and Israels Rivers and adjacent areas. They both extend beyond town boundaries into larger aquifer regions.

There are two large aquifer areas in Whitefield. One is directly associated with the Connecticut and Johns Rivers on the western side of town. It extends beyond Whitefield into Dalton and Lancaster. The other is directly associated with the Ammonoosuc and Johns Rivers on the eastern side of town. It also extends outside of Whitefield, but in this case into Bethlehem.



Left photo: Wetland upstream and facing Burns Lake. It is over part of the second largest aquifer in town, which connects along the Johns River to the Connecticut River in Dalton and Lancaster.

Right photo: Hazens pond area is over the largest aquifer in Whitefield, which follows the Johns River and Carroll Stream connecting with the aquifer along the Ammonoosuc River in Bethlehem.

Stratified drift aquifers consisting of sand materials, such as those in Whitefield tend to be more porous and have a higher potential for quicker transmissivity and recharge. This also raises the risk of contamination and requires a region-wide approach, working with neighboring towns. ***Although most people in Whitefield get water from surface water, drilled or dug wells, these aquifers are important water sources for use in the future. Whenever possible, these aquifers should be protected from contamination (impervious surfaces, point and non-point source pollution sources, development) to ensure their future water quality and availability for the Town.***

Slope (Map #6 at the end of this report)

Slope is an important component of an area's landform and influences the plants and animals living there. Soils tend to be shallower on steeper slopes, the volume and amount of surface water runoff is higher, and the erosion potential is greater compared to flatter areas. These conditions create a unique habitat where in some cases plants and wildlife have special adaptations for dealing with the limitations associated with steep slopes.

Steep slopes provide opportunities for panoramic views and for this reason tend to be sought for residential development. Slope has several limitations for building such as structural problems and a greater chance of erosion. The consequences of erosion are loss of soil resulting in sedimentation of surface waters, loss of the productive capability of the land, and in severe cases, visual scars that can be seen from far away. Slope is traditionally expressed as a percent and represents the amount of rise or fall in feet for a given horizontal distance. For example, a 15% slope means that for a 100-foot horizontal distance, the rise or fall in height is 15 feet. As slope becomes steeper the expenses associated with building increase. In general, slopes between 15% and 25% are considered areas where development would be restrictive and slopes greater than 25% are considered too steep to provide adequate sites for structures such as roads, homes, and septic systems.

NRCS soil data was used to determine areas in Whitefield with slopes equal to and greater than 20%. Using NRCS data, 2,400.26 acres or 10.8% of the land in Whitefield contains slopes that are over 20%. Of that just over 795 acres or about 3.6% of Whitefield's land mass contains slopes over 30%. Most of the steep slopes in Whitefield are in the southern half of town and include Kimball, Howland, and Osburn Hills and the slopes leading up these hills.



Steep slopes and hillsides allow for excellent views. This photo is taken on Kimball Hill Road along the side slope of Kimball Hill in Whitefield.

Rare Species and Exemplary Natural Communities

The Town of Whitefield has documented occurrences of rare species and communities. They are listed by the NH Natural Heritage Bureau (NHB), the State agency that houses all reported occurrences.

New Hampshire is home to more than 500 species of vertebrate animals. Many of these animals live in Whitefield and the surrounding towns. The number would be considerably larger if a complete list of invertebrates (insects, crustaceans, clams and snails) were included. About 75% are nongame wildlife species – not hunted, fished or trapped. Thirty species are endangered and 21 are threatened in the state. The New Hampshire Fish and Game Department maintains lists of Endangered or Threatened animal species in New Hampshire (<https://www.wildlife.state.nh.us/nongame/endangered-list.html>). Minimal information is available relative to their occurrence in Whitefield, but their habitats, when identified should be protected.

Whitefield has large tracts of land that are unfragmented, with some being conserved. These contain a diversity of habitat types and thus, Whitefield has potential for containing many rare and endangered plant and wildlife species, beyond those currently recorded in Town.



This spruce grouse was documented in the White Mountain National Forest very close to Whitefield. Spruce grouse live in boreal and higher elevation spruce-fir forests in NH including Coos County and the White Mountain National Forest. Although NH populations and range appear stable, potential habitat shifts resulting from climate change are an important threat, and the Spruce Grouse should remain Special Concern considering this risk. Additional risks include loss of stands retaining spruce grouse structure requirements and the potential habitat impacts (structure and distribution) of forest pests.



Although not rare in New Hampshire, maidenhair fern (*Adiantum pedatum*) require rich, moist forests. Native Americans used this plant to treat a variety of conditions including rheumatism, fever, heart disease, and asthma. The thin, round black stems were used to make baskets.

NH Natural Heritage Bureau Listing for Whitefield

NH Natural Heritage Bureau 

Town	Flag	Species or Community Name	Listed? US	NH	- reports last 20 yrs Town	State
<u>Whitefield</u>						
Natural Communities - Palustrine						
~		Northern white cedar - balsam fir swamp	--	--	Historical	24
~		Northern white cedar seepage forest	--	--	Historical	6
**		Poor level fen/bog system	--	--	1	29
Plants						
~		Allegheny-vine - <i>Adlumia fungosa</i>	--	E	Historical	21
~		clustered sedge - <i>Carex cumulata</i>	--	T	Historical	20
~		Lindley's american-aster - <i>Symphotrichum ciliolatum</i>	--	T	Historical	12
~		Loesel's wide-lipped orchid - <i>Liparis loeselii</i>	--	T	Historical	27
~		northern arrowhead - <i>Sagittaria cuneata</i>	--	E	Historical	12
~		parasol sedge - <i>Carex umbellata</i>	--	E	Historical	12
~		peat moss - <i>Sphagnum contortum</i>	--	T	Historical	10
~		reddish pondweed - <i>Potamogeton alpinus</i>	--	E	Historical	7
~		satiny willow - <i>Salix pellita</i>	--	E	Historical	17
Vertebrates - Mammals						
**		American Marten - <i>Martes americana</i>	--	SC	1	143
Vertebrates - Birds						
**		Cliff Swallow - <i>Petrochelidon pyrrhonota</i>	--	T	1	29
**		Common Loon - <i>Gavia immer</i>	--	T	3	339
**		Marsh Wren - <i>Cistothorus palustris</i>	--	--	1	37
**		Northern Harrier - <i>Circus hudsonius</i>	--	E	1	13
**		Pied-billed Grebe - <i>Podilymbus podiceps</i>	--	T	1	35
~		Rusty Blackbird - <i>Euphagus carolinus</i>	--	SC	Historical	16
Invertebrates - Dragonflies & Damselflies						
~		Kennedy's Emerald - <i>Somatochlora kennedyi</i>	--	SC	Historical	5

Listed? E = Endangered T = Threatened SC = Special concern

Flags **** = Highest importance
 *** = Extremely high importance
 ** = Very high importance
 * = High importance
 ~ = Historical Record

These flags are based on a combination of (1) how rare the species or community is and (2) how large or healthy its examples are in that town. Please contact the Natural Heritage Bureau at (603) 271-2215 to learn more about approaches to setting priorities.

May 2022

To learn more about threatened or endangered species or unique communities, contact the New Hampshire Natural Heritage Bureau office of NH Division of Forest and Lands for plant species 603-271-2214 website – <https://www.nh.gov/nhdfl/about-us/natural-heritage-bureau.htm>.

Wildlife Action Plan (Maps #2 and #7)

The New Hampshire Fish and Game Department worked together with select partners in the conservation community to create the state's first Wildlife Action Plan (WAP). The plan, which was mandated and funded by the federal government through the State Wildlife Grants Program, provides a base tool for restoring and maintaining critical habitats and populations of the state's species of concern and their habitat. New Hampshire Fish and Game states that WAP is a first step on a statewide scale to work towards helping keep species off the rare species lists. The NH Wildlife Action Plan was submitted to the U.S. Fish and Wildlife Service on October 1, 2005 and was approved in the spring of 2006. It was then revised in 2015.

Natural Resource Inventory for Whitefield, NH

In the GIS phase of the Wildlife Action Plan, biologists and GIS technicians conducted co-occurrence analyses using a variety of digitized natural resource features such as wetlands, riparian habitat, unique rock outcrops, dense softwood stands, alpine areas, etc. This analysis identified and ranked areas of conservation priorities throughout the state and at a statewide level.

Whitefield contains several areas classified as “Highest Rank Habitat in NH” as well as “Highest Ranked Habitat in the Biological Region”. Areas classified as with these two categories include the following:

- Weed and Weeks Ponds and associated perennial stream, wetlands and unfragmented habitat
- Large area west-central part of Whitefield – Johns River, Carroll Stream, Hazen Pond, Airport Marsh and airport region.
- Southeastern corner of Whitefield off Marjorie Lane – Richardson Pond and associated unnamed perennial streams
- A small area between Bray Hill Road and Old East Road – northeastern tip of Whitefield
- Small area south of Forest Lake in the southwest corner of Whitefield

Future work, including this NRI, can be shared with Fish and Game, and incorporated into the Wildlife Action Plan to build upon and improve data and habitat analyses.

For more details on the Wildlife Action Plan visit the NH Fish and Game’s website at: <https://wildlife.state.nh.us/wildlife/wap.html>. The plan and associated maps can be downloaded and viewed. Fish and Game keeps record of updates and on how the Plan is being used and updated. There is also an opportunity to sign up for regular WAP e-mails.

Scenic Resources

With a hilly topography, ponds, rivers, and wetlands, Whitefield has many scenic views and viewsheds throughout the entire Town. Most areas offer scenic views overlooking rivers, streams, hillsides, and the White Mountains. Many of these views extend into abutting towns. Almost every road in Whitefield has exceptional views including:

- Several locations on Kimball Hill Road – designated scenic town road
- Bray Hill Road
- Airport Marsh and Mount Washington Regional Airport area
- Several locations along Route 116
- Several locations on Route 3
- The Mountain View Road
- Crane Road
- Gould Road - designated scenic town road
- Spencer Road – designated scenic town road

Natural Resource Inventory for Whitefield, NH

- Hall Road – designated scenic town road
- Pondicherry Refuge trailhead and kiosk



View across White Mountain Regional Airport towards Cherry Mountain. Photo taken 7-13-22.



View across this permanent opening is stunning. Looking at Cannon, Lafayette and Garfield Mountains and the Twin Range. Photo taken on 7-13-22.

Natural Resource Inventory for Whitefield, NH

As shown in the photograph above, many of the fields and permanent wildlife openings in Whitefield offer views to the landscape beyond. People experience scenic views in all directions while driving, biking or walking along the roads in the Town, particularly where fields and permanent wildlife openings are maintained. ***Continuing to maintain permanent wildlife openings will retain these outstanding views throughout Whitefield.***



Scenic areas can also include standing on a beaver dam or the edge of a pond (this is Weed Pond), looking out across the area. If patient, this area is excellent for viewing wildlife. Photo taken 7-19-22.

Development and population growth throughout the State and region have caused people to increase their appreciation of the natural scenery New Hampshire has to offer. As with many other towns and cities in NH, there are potential threats to viewsheds. Several communities are struggling with the concern of future development on the ridgelines and top of hills. In many communities there have been extensive debates over wind towers, cell towers, and houses built on ridgelines because of their detrimental effect on viewsheds.

Cultural Resources

The Town of Whitefield has an exceptionally rich history of land use changes and cultural features from its original settlement to current times. Many of these historic and cultural features can be seen at:

1. The Whitefield Common
2. The Mountain View Grand
3. Johns River in the downtown area
4. Heritage trail
5. Snowmachine trails
6. Seasonal camps around Mirror, Forest and Burns Lakes

Natural Resource Inventory for Whitefield, NH

European settlers and later entrepreneurs were drawn to Whitefield due to its forested landscape topography, the Johns River, and farming and timber opportunities. Construction of the railroad made Whitefield a hub for new residents and visitors to the area. Whitefield was, and still is, a land of abundant opportunity thanks to its natural resources.

Along Main Street and the side roads off Main there are several historical buildings and homes. They offer a window into Whitefield's history and are very attractive along Main Street.



This bridge over a perennial stream in Whitefield was built in 1892 for a railroad. The construction is still in fantastic condition.

Old wells, such as this one to the right, can be found throughout Whitefield. This along with old cellar holes and stone walls are signs of Whitefield's past. Photo taken 7-6-22.





In the past, water was piped from Mirror Lake to a tannery (now Browns Street Furniture). The remanent site of underground piping system can be seen in this mixedwood forest. Photo taken on 7-6-22 facing north towards Mirror Lake.

Invasive Plant Species

There is an increase in public awareness and concern about the rapid growth of invasive species in NH and throughout New England. Invasive species are plant and wildlife species that are not native to an area but take up residency and can out-compete native species. These species tend to be more common in wet areas such as lakes, wetlands, riparian habitats, and areas of recent disturbance including roadsides. They can also be found at old farm sites where people have planted various fruiting and ornamental plants for agricultural purposes.

During four days of field work the invasive species noted were:

- Japanese knotweed (*Polygonum cuspidatum*) was observed in a number of locations in town.
- Purple loosestrife (*Lythrum salicaria*) was noted in a few locations along the Johns River, particularly in the wetlands adjacent to the airport and railroad tracks.
- Japanese barberry (*Berberis thunbergii*) was seen in mixed forested areas throughout town, although mostly isolated plants were observed



Japanese barberry in a mixedwood forest in Whitefield. This isolated shrub does not appear to be taking over currently. There were several of these isolated shrubs noted throughout town.

This NRI is not an all-inclusive search and documentation of invasive species in Whitefield. Undoubtedly, other species and locations where invasive species occur in Whitefield have been or will be documented. The Town of Whitefield should continue their efforts to help identify and eradicate these invasive species and may want to seek assistance from the Invasive Plant Atlas of New England (IPANE), New England Wildflower Society, and other organizations that have begun programs to control or eradicate invasive species. For further information on invasive species, and an update of the list of these species, review the IPANE website <https://www.eddmaps.org/ipane/>. The Invasive Plant Atlas of New England's (IPANE) mission is to create a comprehensive web-accessible database of invasive and potentially invasive plants in New England that will be continually updated by a network of professionals and trained volunteers.

Natural Resource Inventory for Whitefield, NH

Habitat Area Summary Table

The table displayed below is a summary of different habitat areas in acres and square miles.

Habitat Type	Number of Acres	Number of Square Miles	Percentage of Town Land Mass
Whitefield Town Boundary	22,232	34.74	100%
Conservation Land	3,429.23	5.36	15.42%
Ponds and Open Water	1,030.82	1.61	4.63%
Wetland Complexes (from National Wetland Inventory data & field work)	2,252.12	3.52	10.13%
Hydric Soils – poorly and very poorly drained	9,731.48	15.21	43.77%
Aquifers	3,459.66	3.84	15.56%
Dense Softwood Cover	2,252	3.52	10.13%
Permanent Wildlife Openings	1,731.07	2.70	7.79%
Farmland Soils – prime, statewide and local importance	5,43.86	7.10	20.44%
Steep slopes – 20% and greater	2,400.26	3.75	10.80%
Steep slopes – 30% and greater	795.01	1.24	3.58%

DISCUSSION – FUTURE APPLICATIONS AND BENEFITS

This project is an inventory of natural resources, including a written report, maps, and a digital database in GIS format. It is the property of the Town of Whitefield and was funded by Eversource. The data from this project is compatible for integration with the existing Town GIS. Efforts from this project will aid in future work and inventories, as well as provide tools to guide future development and conservation decisions in Whitefield.

It is anticipated that results from this study will help the Town of Whitefield in many ways. Town-wide zones based on habitat and vegetation can be assessed and modified. Data gathered from this work will also assist the Conservation Commission, Planning and Zoning Boards in foreseeing possible conflicts with future development. Perhaps the most powerful advantage of this project is that future studies and work can be easily integrated to build upon this database indefinitely.

Based on results from this study, Elise Lawson and the Whitefield Conservation Commission offer the following additional recommendations:

1. **Surface Water Protection** - Many of Whitefield's residents obtain drinking water from Town treated water as well as personal drilled or dug wells. Maintaining good water quality is one of the highest priorities for the Whitefield Conservation Commission. Currently, water quality in these streams and rivers is in very good to excellent condition. Water quality should continue to be addressed not only in large rivers like the Johns River, but also in the headwater streams and brooks that feed into the Johns River and other rivers outside of Whitefield boundaries (Ammonoosuc, Israels, and Connecticut Rivers for example).
 - a. Where possible work to maintain or enhance riparian habitat adjacent to headwater streams and brooks. Any wetland setback should also apply to all Riverine wetlands including perennial streams.
 - b. Consider monitoring water quality in the Johns River as well as some of the smaller feeder streams in town. Particularly in areas where there are little buffers and down stream from the Wastewater Treatment Facility.
 - c. The Town should update potential contamination source location inventory at least on an annual basis and ensure that compliance (secondary contain structures, and spill kits) are in place.
2. **Aquifer Protection** - Based on the locations of the underlying aquifers in Whitefield, it is important to protect the quality of groundwater, brooks, streams, and aquifers in Town. Future water supplies are a very valuable natural resource for Whitefield and the abutting municipalities - proven by the drinking water systems already in use.

Natural Resource Inventory for Whitefield, NH

- a. Implement Best Management Practices (BMPs) within aquifer areas.
 - b. Monitor septic system plumes with a focus on parcels adjacent to rivers, wetlands, and aquifers.
 - c. Monitor the placement of future septic systems keeping in mind the typically high permeability of many of Whitefield's soils.
 - d. Develop Town-wide ordinances to help protect aquifers, including restriction of impervious surface development and dumping of waste on top of aquifers, particularly those with high productivity and flow.
3. **Dense Softwood Stand Protection** – Based on results from this project, there are a few areas that contain adequate acreage of dense softwood stands scattered throughout Town. These areas are beneficial to many wildlife species for cover as well as important wintering areas.
 - a. Maintain existing stands for the benefit of the deer, moose and other wildlife populations is very important.
 - b. Where possible, extend the existing softwood areas and connect patches of softwood in a continuum should be further investigated and willing landowners should be encouraged to do so, particularly those with abutting wetlands and riparian buffers.
4. **Continued Wetland Conservation**– The Whitefield Conservation Commission recognizes the importance of wetland protection as an important means to maintain good water quality. It is hoped that the Town will continue to pursue ways to further conserve the functionality and diversity of these wetlands. An overall wetland study could help Whitefield to work with willing landowners to conserve some of these valuable wetland resources. This NRI recommends the following:
 - a. Conduct an overall wetland study throughout Whitefield to identify, assess and functionally rank wetlands in town.
 - b. Continue to inventory vernal pools throughout Whitefield to enable the Conservation Commission, Planning Board, and Select Board to critique and adjust future subdivision proposals if vernal pools are likely to be impacted.
 - c. Continue to monitor stormwater runoff and associated drainage immediately after storm events whenever possible. Treatment devices for stormwater structures should be installed and maintained; particularly within 150 feet of rivers and wetlands.
5. **Land Conservation** – Several areas in Whitefield have been identified as higher priority areas for conservation based on this NRI and previous studies. They are described below.

Natural Resource Inventory for Whitefield, NH

- a. **Johns River and Pondicherry Wildlife Refuge** in eastern part of town – over 2,200 acres within Whitefield and mostly protected by US Fish and Wildlife. The Refuge extends into Jefferson and is considerably larger. This study recommends conserving all or part of the Town-owned property directly adjacent to the NWR, particularly the wetlands to the north. This town-owned parcel would make an excellent Town Forest directly connecting to the NWR.
 - b. **Weed and Weeks Ponds** with associated wetlands and streams in northern part of Whitefield – over 1,600-acre undeveloped block. This area has high biodiversity, wildlife use, and travel corridors. The diversity of forested areas and wetland types make it high value for conservation. Consider working with property owner(s) in this area conserve the property. One option is to explore carbon offset incentives through participating organizations. The Northeast Carbon Program is an excellent resource. ([Link here](#)). The contact person for New Hampshire is Matt Kelly, Forestry Field Specialist, UNH Cooperative Extension (Matt.Kelly@unh.edu).
 - c. **Richardson Pond area** with associated wetlands and streams in southeastern part of Whitefield – over 1,600-acre undeveloped block. This area was not visited during field work as we were not granted permission, and we respect landowner rights. The most recent aerial photo shows series of beaver ponds, streams and wetlands which could contain excellent biodiversity. Recommend offering options to the landowner(s) similar to “b” above.
6. **Hillside and Viewshed Protection** - Whitefield’s hilly topography and surrounding mountains are directly related to the Town’s tourism industry, scenic beauty, and diversity of natural resources (wetlands, streams and rivers, wildlife, plants, soils, etc.). We recommend evaluating and possibly updating the zoning ordinance in Whitefield to conserve viewsheds as an important feature and tourist attraction to the area, while continuing to consider landowner rights.
- a. **Scenic View Conservation** - The potential for continued population increase throughout the Town makes it wise for landowners to sustainably conserve their land. By taking a proactive approach to deal with future development pressures, the scenic vistas and beauty will remain as impressive tomorrow as they are today. Scenic easements are types of conservation easements that make protection of scenic resources possible.
 - b. **Ridge-line Development Criteria** - Several municipalities throughout the State have developed ridge-line ordinances to protect ridgeline views. Whitefield may want to review some of these and explore the possibility of implementation.

Natural Resource Inventory for Whitefield, NH

- c. **Steep Slope Development Criteria** – Develop Town-wide ordinances to restrict future development and road construction at sites with over 25% slopes and limit development on slopes between 20% and 25%.
7. **Cooperation** – Natural resources do not end at the town boundary. It is recommended that Whitefield continue to work with neighboring towns, schools, organizations, and State and Federal agencies throughout the region to share future data as it becomes available. This will avoid an all-too-common problem of separate entities replicating work. A watershed approach to conserving natural resources including water quality is recommended. All the surrounding towns have completed or are in the process of completing a Natural Resource Inventories and all the data between the towns and Whitefield should be compatible in GIS format.
 - a. Work with regional planning commissions, who have developed several templates for town-wide and Town-wide ordinances in areas from wetland and shoreline setbacks to restrictions on steep slopes, to ridgeline development.
 - b. Partner with neighboring municipalities to start a local advisory committee for the Johns Rivers.
 - c. Partner with local high schools and colleges to encourage young people to be involved.
8. **Carbon Sequestration** – Explore the possibility of bringing funds into Whitefield from Carbon offset programs. See above recommendation a link to the Northeast Forest Carbon Program. Funds from this program can be used to incentivize landowners to protect their land from development for a period of time. Sustainable forestry is an important part of this process.

Long-term uses of this project could include, but are not limited to:

- Include NRI data in future Master Plan updates
- Assist the Town and others in determining “least-impact” sites for future development
- Locate ideal locations for telecommunication towers or wind farms
- Promote the protection of water quality, wetlands, and aquifers under portions of the Town
- Continue to identify land for purchase or easements for protection into the future

Furthermore, Whitefield officials should consider requesting that all future development plans be delivered in digital format, which would build upon the existing database (including assist in updating tax maps for assessment) at little cost to the Town.



A well-placed sign by residents near Burns Lake. Photo credit: Joe Hoffman.

REFERENCES

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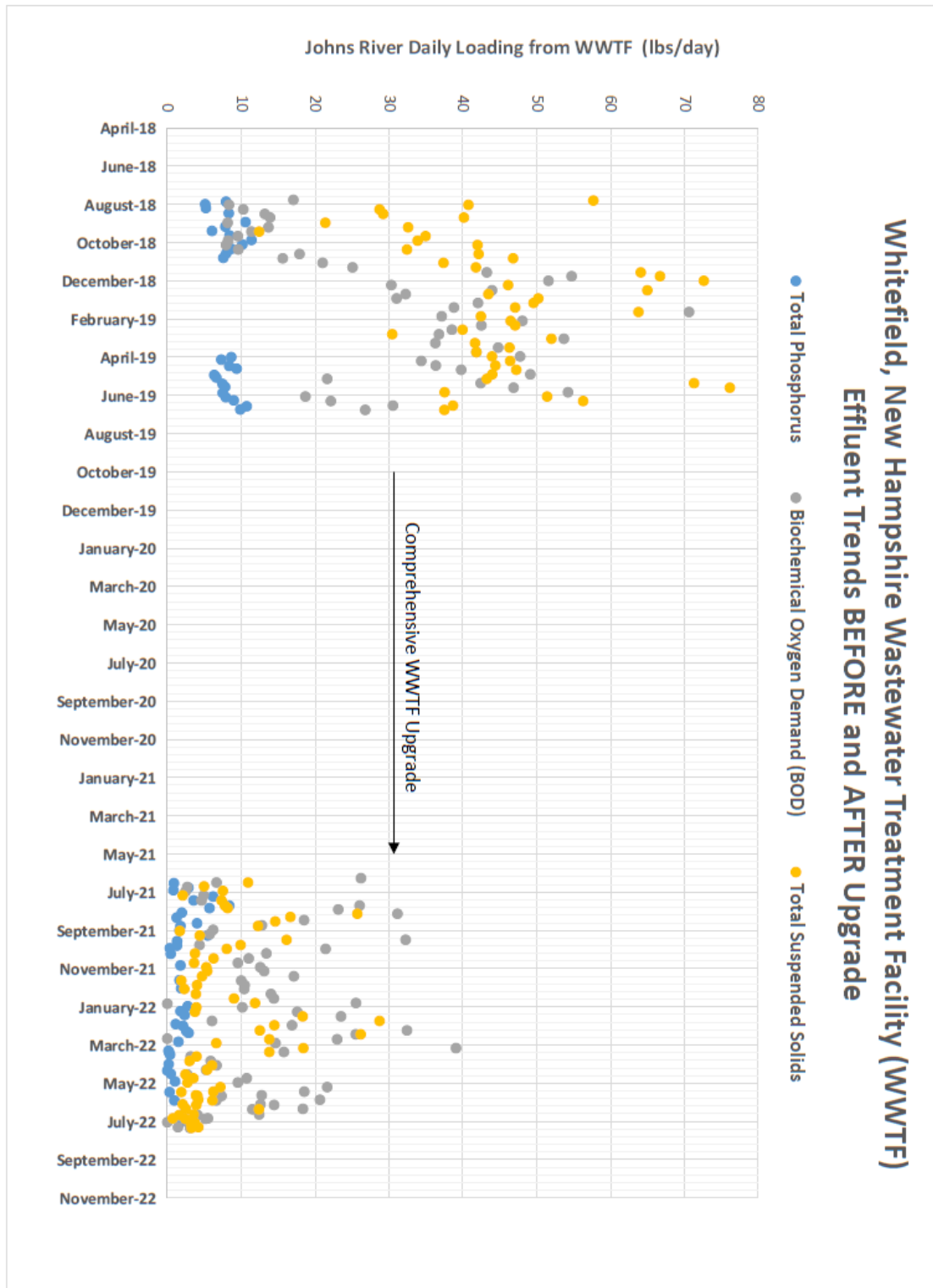
[https://www.whitefieldnh.org/sites/g/files/vyhlif1446/f/news/whit mp final nov12 19.pdf](https://www.whitefieldnh.org/sites/g/files/vyhlif1446/f/news/whit_mp_final_nov12_19.pdf)

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Appendix A – List of Conserved Land in Whitefield, NH as of September 2022

Tax ID	NAME	Type	Acres
045-001 -001	Bean	CE	36.71
045-001 -002	Bean	CE	189.07
044-001 -002	Forest Lake State Park	FO	0.23
044-021 -001	Maple Lane Farm	CE	166.4
036-008 -004	Pondicherry Unit of Silvio O Conte NFWR	FO	3.43
036-008 -012	Pondicherry Unit of Silvio O Conte NFWR	FO	115.89
036-008 -002	Pondicherry Unit of Silvio O Conte NFWR	FO	4.92
036-008 -010	Pondicherry Unit of Silvio O Conte NFWR	FO	146.94
036-008 -007	Pondicherry Unit of Silvio O Conte NFWR	FO	8.21
036-008 -008	Pondicherry Unit of Silvio O Conte NFWR	FO	0.25
036-008 -009	Pondicherry Unit of Silvio O Conte NFWR	FO	0.31
036-008 -015	Pondicherry Unit of Silvio O Conte NFWR	FO	0
036-008 -006	Pondicherry Unit of Silvio O Conte NFWR	FO	0.41
036-008 -014	Pondicherry Unit of Silvio O Conte NFWR	FO	0
036-008 -011	Pondicherry Unit of Silvio O Conte NFWR	FO	40.14
036-008 -013	Pondicherry Unit of Silvio O Conte NFWR	FO	160.06
036-008 -032	Pondicherry Unit of Silvio O Conte NFWR	FO	1325.34
036-008 -005	Pondicherry Unit of Silvio O Conte NFWR	FO	14.37
036-008 -033	Pondicherry Unit of Silvio O Conte NFWR	FO	0
036-008 -038	Pondicherry Unit of Silvio O Conte NFWR	FO	134.51
036-008 -001	Pondicherry Unit of Silvio O Conte NFWR	FO	247.74
036-004 -003	Pondicherry Wildlife Refuge	CE	3.35
036-004 -001	Pondicherry Wildlife Refuge	CE	11.45
045-017 -002	Rexford Conservation Area	CE	43.62
045-017 -001	Rexford Conservation Area	CE	95.52
045-017 -003	Rexford Conservation Area	CE	2.97
044-023 -001	Shooting Range/Mitigation Site	FO	0.42
036-006 -001	Whitefield Water Department Land	FO	32.8
045-008 -003	Whitefield Water Department Land	FO	0.31
045-008 -001	Whitefield Water Department Land	FO	289.13
045-008 -002	Whitefield Water Department Land	FO	77.05
044-013 -001	Whitefield Water Department Land	FO	10.87
036-017 -002	WMRHS School	FO	33.62
036-017 -001	WMRHS School	FO	233.19

Appendix B: Effluent Trends Before and After Upgrade



Appendix C: Volunteer Lake Assessment Program – Forest and Burns Lakes

LM-042

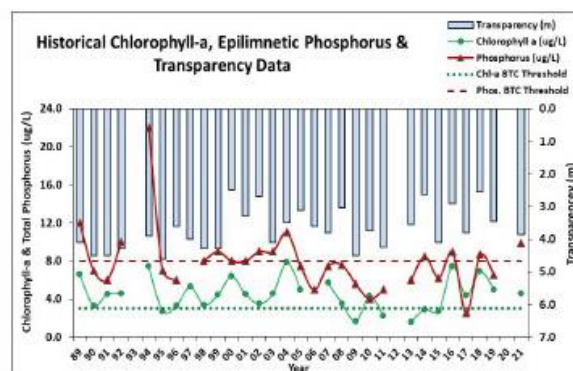
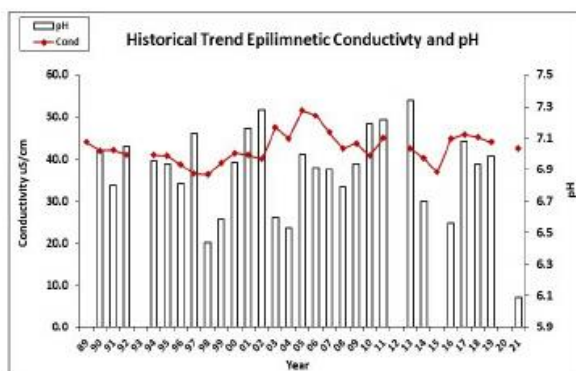


VOLUNTEER LAKE ASSESSMENT PROGRAM INDIVIDUAL LAKE REPORTS FOREST LAKE, DALTON/WHITEFIELD 2021 DATA SUMMARY

RECOMMENDED ACTIONS: Great job sampling in 2021! Lake phosphorus levels are generally representative of borderline oligotrophic/mesotrophic, or high quality, conditions while chlorophyll levels (algal growth) are generally representative of mesotrophic, or average, conditions. The lake experienced short term cyanobacteria bloom conditions in August of 2021 highlighting the delicate balance of the system. Increase monitoring frequency to once per month, typically June, July and August, to better understand seasonal and annual variations in water quality, particularly phosphorus levels as it relates to cyanobacteria growth. The declining lake clarity (transparency) may be related to high volume storm events flushing wetland systems rich in organic acids that cause water to become highly colored and therefore less clear, as well as transporting sediments due to erosion. Continue to conduct color analyses on deep spot samples to evaluate changes in water color and transparency over time. Consider converting the state beach to a perched beach to prevent erosion of beach sand into the lake. NHDES fact sheet WB-18 Permitting Non-Tidal Beaches is a good resource. Educate boaters on best practices while recreating on the lake. NHDES fact sheet WMB-25 Impacts of Motorized Craft on New Hampshire's Waterbodies is a good resource. Keep up the great work!

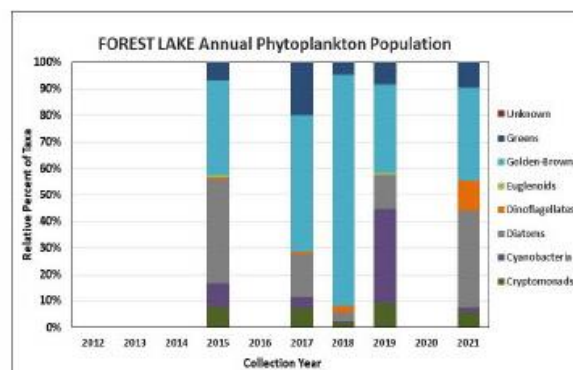
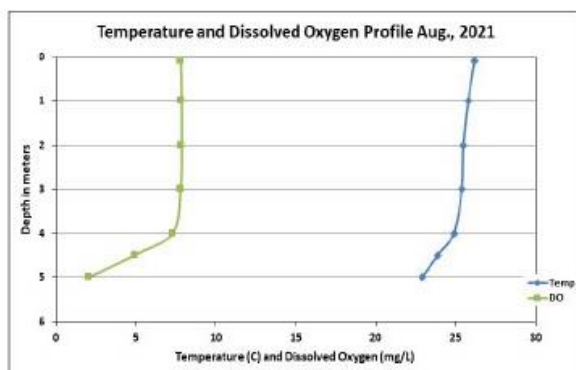
HISTORICAL WATER QUALITY TREND ANALYSIS

Parameter	Trend	Parameter	Trend
Conductivity	Stable	Chlorophyll-a	Stable
pH (epilimnion)	Stable	Transparency	Worsening
		Phosphorus (epilimnion)	Stable



DISSOLVED OXYGEN AND PHYTOPLANKTON

(Note: Information may not be collected annually)



NHDES Volunteer Lake Assessment Program (VLAP) | sara.e.steiner@des.nh.gov



VOLUNTEER LAKE ASSESSMENT PROGRAM INDIVIDUAL LAKE REPORTS FOREST LAKE, DALTON/WHITEFIELD 2021 DATA SUMMARY

OBSERVATIONS (Refer to Table 1 and Historical Deep Spot Data Graphics)

- **CHLOROPHYLL-A:** Chlorophyll level was slightly elevated in August, and was slightly greater than the state median and the threshold for oligotrophic lakes. Historical trend analysis indicates relatively stable chlorophyll levels since monitoring began.
- **CONDUCTIVITY/CHLORIDE:** Epilimnetic (deep spot), Newt Cottage, North Inlet, and Northwest Inlet conductivity and chloride levels were within a low range and approximately equal to the state medians. Historical trend analysis indicates stable epilimnetic conductivity levels since monitoring began.
- **COLOR:** Apparent color measured in the epilimnion indicates the water was lightly tea colored, or light brown.
- **E. COLI:** State Beach Brook, West Side Cove and Winslow Cottage E. coli levels were very low and much less than the state standard for surface waters.
- **TOTAL PHOSPHORUS:** Epilimnetic phosphorus level was slightly elevated, was slightly less than the state median, and was slightly greater than the threshold for oligotrophic lakes. Historical trend analysis indicates stable, yet variable, epilimnetic phosphorus levels since monitoring began. Newt Cottage phosphorus level was low. North Inlet and Northwest Inlet phosphorus levels were moderate and slightly above average for those stations. Finkel phosphorus level was elevated during cyanobacteria surface accumulations.
- **TRANSPARENCY:** Transparency measured without the viewscope (NVS) was above average (good) for the lake and was higher (better) than the state median. However, historical trend analysis indicates significantly decreasing (worsening) NVS transparency since monitoring began. Viewscope (VS) transparency was higher (better) than NVS transparency and likely a better measure of actual conditions.
- **TURBIDITY:** Epilimnetic, Newt Cottage, North Inlet, and Northwest Inlet turbidity levels were within a low range.
- **pH:** Epilimnetic pH level was slightly acidic and less than the desirable range 6.5-8.0 units. Historical trend analysis indicates stable, yet variable, epilimnetic pH levels since monitoring began. Newt Cottage, North Inlet and Northwest Inlet pH levels were within the desirable range.

Station Name	Table 1. 2021 Average Water Quality Data for FOREST LAKE - DALTON/WHITEFIELD										
	Alk. (mg/L)	Chlor-a (ug/L)	Chloride (mg/L)	Color (pcu)	Cond. (us/cm)	E. coli (mpn/100mL)	Total P (ug/L)	Trans. (m)		Turb. (ntu)	pH
								NVS	VS		
Epilimnion	9.4	4.60	7	35	42.6		10	3.87	4.20	0.36	6.09
Finkel							24				
Newt Cottage			7		43.4		6			0.26	6.59
North Inlet					43.6		10			0.51	6.86
Northwest Inlet			8		43.4		10			0.37	6.85
State Beach Brook						6					
West Side Cove						< 1					
Winslow Cottage						3					

NH Median Values

Median values generated from historic lake monitoring data.

Alkalinity: 4.5 mg/L **Chlorophyll-a:** 4.39 ug/L
Conductivity: 42.3 uS/cm **Chloride:** 5 mg/L
Total Phosphorus: 11 ug/L **Transparency:** 3.3 m
pH: 6.6

NH Water Quality Standards

Numeric criteria for specific parameters. Water quality violation if thresholds exceeded.

Chloride: > 230 mg/L (chronic) **Turbidity:** > 10 NTU above natural
E. coli: > 88 cts/100 mL (beach)
E. coli: > 406 cts/100 mL (surface waters)
pH: between 6.5-8.0 (unless naturally occurring)

Natural Resource Inventory for Whitefield, NH



Volunteer Lake Assessment Program Individual Lake Reports BURNS POND, WHITEFIELD, NH

MORPHOMETRIC DATA					TROPIC CLASSIFICATION		KNOWN EXOTIC SPECIES	
Watershed Area (Ac.):	3,072	Max. Depth (m):	6.1	Flushing Rate (yr ¹)	4.1	Year	Trophic class	
Surface Area (Ac.):	117	Mean Depth (m):	2.9	P Retention Coef:	0.53	1984	MESOTROPHIC	
Shore Length (m):	3,700	Volume (m ³):	1,390,500	Elevation (ft):	1016	1993	MESOTROPHIC	

The Waterbody Report Card tables are generated from the DRAFT 2018 305(b) report on the status of N.H. waters, and are based on data collected from 2008-2017. Detailed waterbody assessment and report card information can be found at www.des.nh.gov/organization/divisions/water/wmb/swqa/index.htm

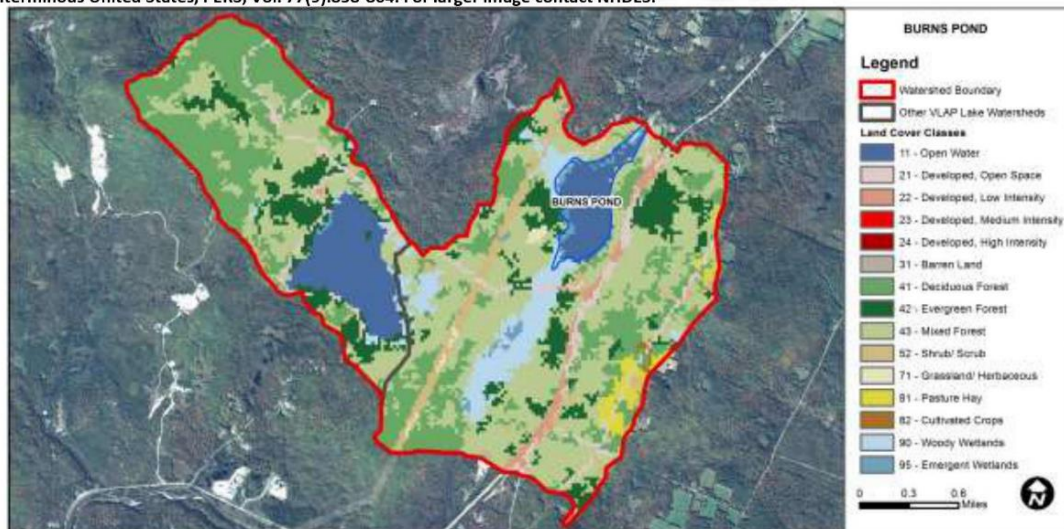
Designated Use	Parameter	Category	Comments
Aquatic Life	Phosphorus (Total)	Cautionary	Limited data for this parameter predicts exceedance of water quality standards or thresholds; however more data are necessary to fully assess the parameter.
	pH	Slightly Bad	Data periodically exceed water quality standards or thresholds for a given parameter by a small margin.
	Oxygen, Dissolved	Cautionary	Limited data for this parameter predicts exceedance of water quality standards or thresholds; however more data are necessary to fully assess the parameter.
	Dissolved oxygen satura	Cautionary	Limited data for this parameter predicts exceedance of water quality standards or thresholds; however more data are necessary to fully assess the parameter.
	Chlorophyll-a	Good	Sampling data is better than the water quality standards or thresholds for this parameter.
Primary Contact Recreation	Escherichia coli	No Data	No data for this parameter.
	Chlorophyll-a	Very Good	All sampling data meet water quality standards or thresholds for this parameter.

BEACH PRIMARY CONTACT ASSESSMENT STATUS

BURNS POND - PUBLIC BEACH	Escherichia coli	Good	Sampling data commonly meet water quality standards or thresholds for this parameter.
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WATERSHED LAND USE SUMMARY

Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PERS, Vol. 77(9):858-864. For larger image contact NHDES.



Land Cover Category	% Cover	Land Cover Category	% Cover	Land Cover Category	% Cover
Open Water	9.42	Barren Land	0.08	Grassland/Herbaceous	0.36
Developed-Open Space	4.11	Deciduous Forest	23.85	Pasture Hay	1.47
Developed-Low Intensity	1.45	Evergreen Forest	11.25	Cultivated Crops	0.12
Developed-Medium Intensity	0	Mixed Forest	36.88	Woody Wetlands	6.25
Developed-High Intensity	0	Shrub-Scrub	3.77	Emergent Wetlands	0.95

Natural Resource Inventory for Whitefield, NH



VOLUNTEER LAKE ASSESSMENT PROGRAM INDIVIDUAL LAKE REPORTS BURNS POND, WHITEFIELD 2019 DATA SUMMARY

RECOMMENDED ACTIONS: Continue current annual monitoring to build a baseline data set and increase monitoring frequency to once per month, typically June, July and August, to better assess seasonal and historical variations in water quality. Pond quality is generally representative of mesotrophic, or average, conditions and we hope to see this continue. The higher conductivity levels at the Inlet likely reflect the use of winter de-icing materials. Encourage local winter maintenance companies to obtain NH Voluntary Salt Applicator license through UNH Technology Transfer Center's Green SnowPro Certification program. Continue to educate lake and watershed residents on best practices to reduce nutrient loading to the pond. Encourage the use of phosphate free fertilizers, regularly maintain and pump septic systems, prevent stormwater erosion and runoff from shorefront properties, maintain vegetative buffers along the shoreline, and stabilize steep slopes. UNH Cooperative Extension's "Landscaping at the Water's Edge" and DES' "NH Homeowner's Guide to Stormwater Management" are great resources. Keep up the great work!

OBSERVATIONS (Refer to Table 1 and Historical Deep Spot Data Graphics)

- ◆ **CHLOROPHYLL-A:** Chlorophyll level was moderate in August, increased slightly from 2018, was slightly greater than the state median, and was approximately equal to the threshold for mesotrophic lakes. Historical trend analysis indicates relatively stable chlorophyll levels since monitoring began.
- ◆ **CONDUCTIVITY/CHLORIDE:** Epilimnetic (upper water layer), Metalimnetic (middle water layer) and Outlet conductivity and/or chloride levels remained slightly greater than the state median, yet were less than a level of concern. Historical trend analysis indicates stable epilimnetic conductivity levels since monitoring began. Inlet conductivity levels were slightly elevated and the highest measured since 2011.
- ◆ **COLOR:** Apparent color measured in the epilimnion indicates the water was moderately tea colored or brown.
- ◆ **TOTAL PHOSPHORUS:** Epilimnetic, Hypolimnetic, Inlet, and Outlet phosphorus levels fluctuated within a low to moderate range. Epilimnetic phosphorus level increased slightly from 2018 and was slightly less than the state median and the threshold for mesotrophic lakes. Historical trend analysis indicates stable epilimnetic phosphorus levels since monitoring began.
- ◆ **TRANSPARENCY:** Transparency measured with (VS) and without (NVS) the viewscope was within an average range for the pond and increased (improved) slightly from 2018. Historical trend analysis indicates stable transparency since monitoring began.
- ◆ **TURBIDITY:** Epilimnetic, Hypolimnetic, Inlet, and Outlet turbidity levels were within a low range.
- ◆ **pH:** Epilimnetic and Outlet pH levels were within the desirable range 6.5-8.0 units and historical trend analysis indicates relatively stable epilimnetic pH levels since monitoring began. Hypolimnetic and Inlet pH levels were slightly less than desirable.

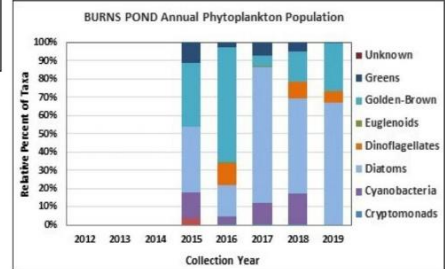
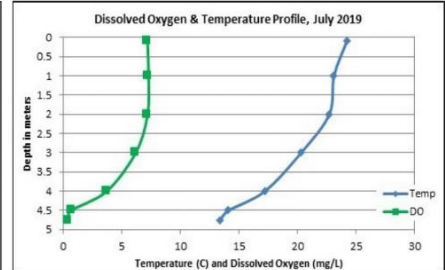
Station Name	Alk. mg/l	Chlor-a ug/l	Chloride mg/l	Color pcu	Cond. us/cm	Total P mg/l	Trans. m	Turb. ntu	pH
							NVS VS		
Epilimnion	7.7	5.38	13	80	73.5	10	2.12 2.25	0.52	6.84
Hypolimnion					76.8	11		0.50	6.32
Inlet					146.0	15		0.57	6.22
Outlet					73.7	10		0.48	6.90

NH Median Values: Median values for specific parameters generated from historic lake monitoring data.

Alkalinity: 4.5 mg/L
Chlorophyll-a: 4.39 ug/L
Conductivity: 42.3 uS/cm
Chloride: 5 mg/L
Total Phosphorus: 11 ug/L
Transparency: 3.3 m
pH: 6.6

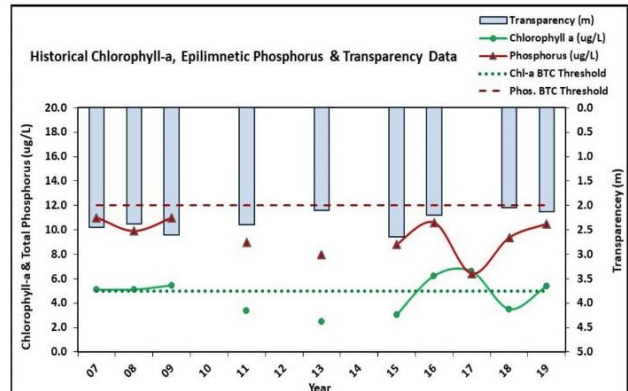
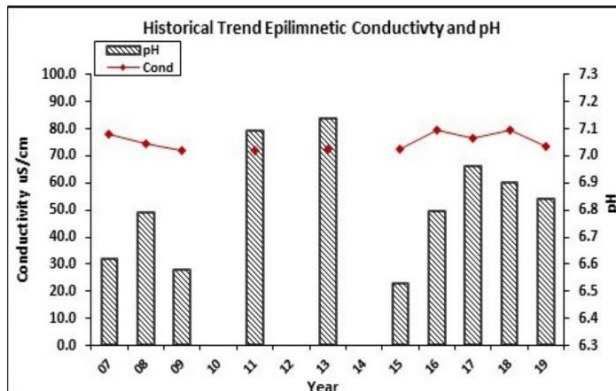
NH Water Quality Standards: Numeric criteria for specific parameters. Results exceeding criteria are considered a water quality violation.

Chloride: > 230 mg/L (chronic)
E. coli: > 88 cts/100 mL – public beach
E. coli: > 406 cts/100 mL – surface waters
Turbidity: > 10 NTU above natural level
pH: between 6.5-8.0 (unless naturally occurring)



HISTORICAL WATER QUALITY TREND ANALYSIS

Parameter	Trend	Explanation	Parameter	Trend	Explanation
Conductivity	Stable	Trend not significant; data show low variability.	Chlorophyll-a	Stable	Trend not significant; data moderately variable.
pH (epilimnion)	Stable	Trend not significant; data moderately variable.	Transparency	Stable	Trend not significant; data show low variability.
			Phosphorus (epilimnion)	Stable	Trend not significant; data show low variability.



This report was generated by the NHDES Volunteer Lake Assessment Program (VLAP). For more information contact VLAP at (603) 271-2658 or sara.steiner@des.nh.gov

MAPS

Map #1: Dense Softwoods, Permanent wildlife openings, Conservation Land

Map Data Sources:

- Town Boundary, Roads, Open Water, and Streams obtained from GRANIT
- Dense Softwood Stands and Permanent wildlife openings digitized by Elise Lawson 2020 using the 2015 aerial photographs
- Conservation Lands obtained from GRANIT and the Town of Whitefield

Map #2: Wildlife Action Plan – Habitat Map

Map Data Source:

- New Hampshire Fish and Game Department – downloaded from GRANIT and queried so habitat types displayed

Map #3: Water Resources and Conservation Lands

Map Data Sources:

- Town Boundary, Roads, Aquifers, Open Water, Streams, obtained from GRANIT
- Vernal Pool locations taken using a handheld GPS unit (Garmin GPSmap 76CSx) during field work by Elise Lawson and/or John Severance over several years of field work
- National Wetlands Inventory wetlands obtained from U.S. Fish and Wildlife Service and GRANIT
- Additional Wetlands were field verified by Elise Lawson, John Severance, and/or digitized using 2015 aerial photographs (obtained from GRANIT)
- Poorly and Very Poorly Drained Soils obtained from the Natural Resource Conservation Service
- Conservation Lands obtained from GRANIT and the Town of Whitefield

Map #4: Subwatersheds and Aquifers

Map Data Sources:

- Town Boundary, Roads, Open Water, Streams obtained from GRANIT
- Subwatershed Units (NH DES HUC 12 Names) obtained from GRANIT

Map #5: Steep Slopes and Farmland Soil

Map Data Sources:

- Town Boundary, Roads, Open Water, Streams obtained from GRANIT
- Soil data obtained from Natural Resource Conservation Service and queried to display farmland soils and soils with steep slopes

Map #6: Bedrock Geology

Map Data Source:

- Town Boundary, Roads, Bedrock Geology downloaded from GRANIT

Map #7: Wildlife Action Plan – Tiers Map

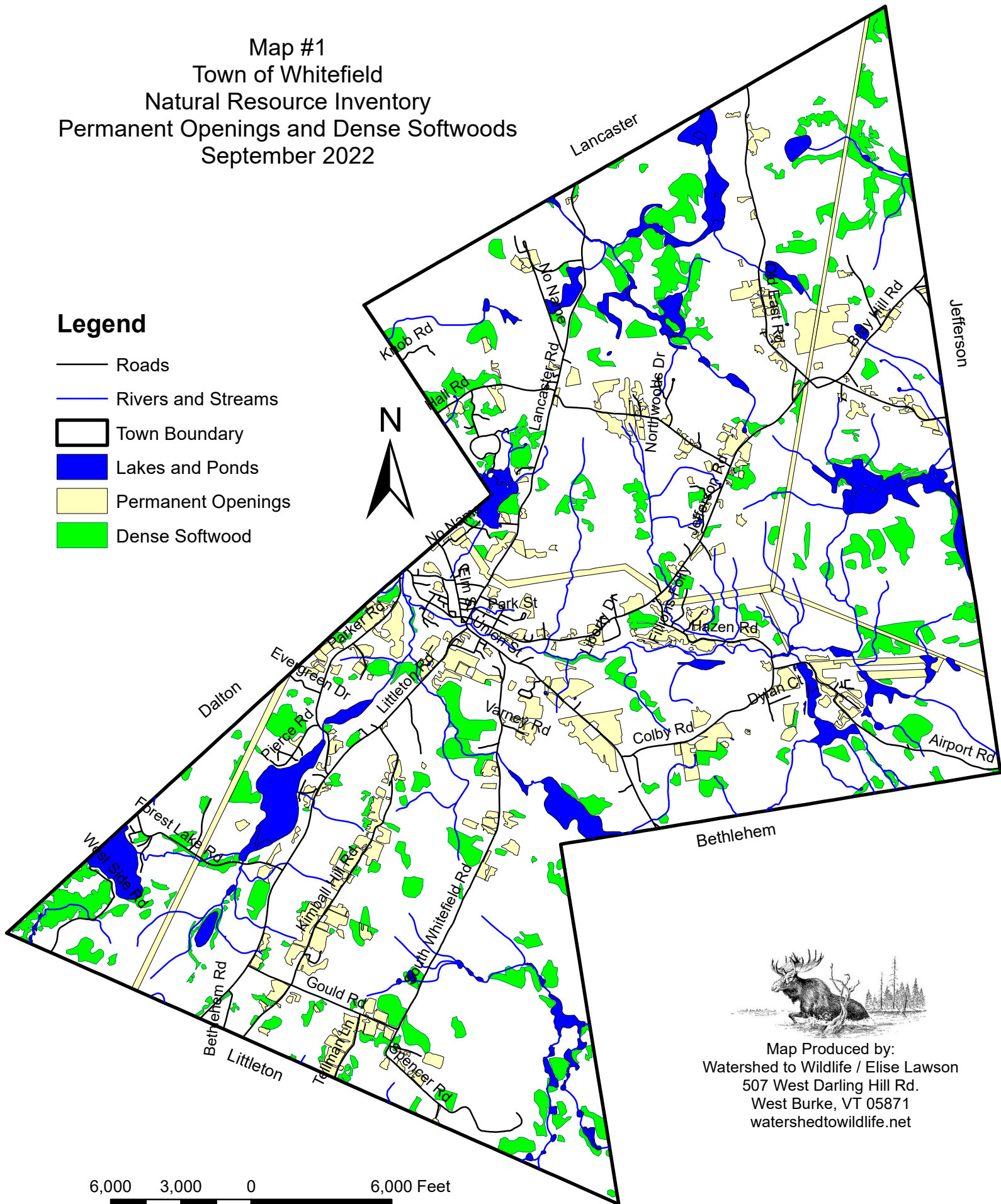
Map Data Source:

- New Hampshire Fish and Game Department – downloaded from GRANIT and queried so the highest rank and supporting areas displayed.

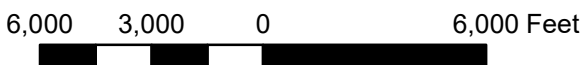
Map #1
 Town of Whitefield
 Natural Resource Inventory
 Permanent Openings and Dense Softwoods
 September 2022

Legend

- Roads
- Rivers and Streams
- Town Boundary
- Lakes and Ponds
- Permanent Openings
- Dense Softwood






Map Produced by:
 Watershed to Wildlife / Elise Lawson
 507 West Darling Hill Rd.
 West Burke, VT 05871
watershedtowildlife.net



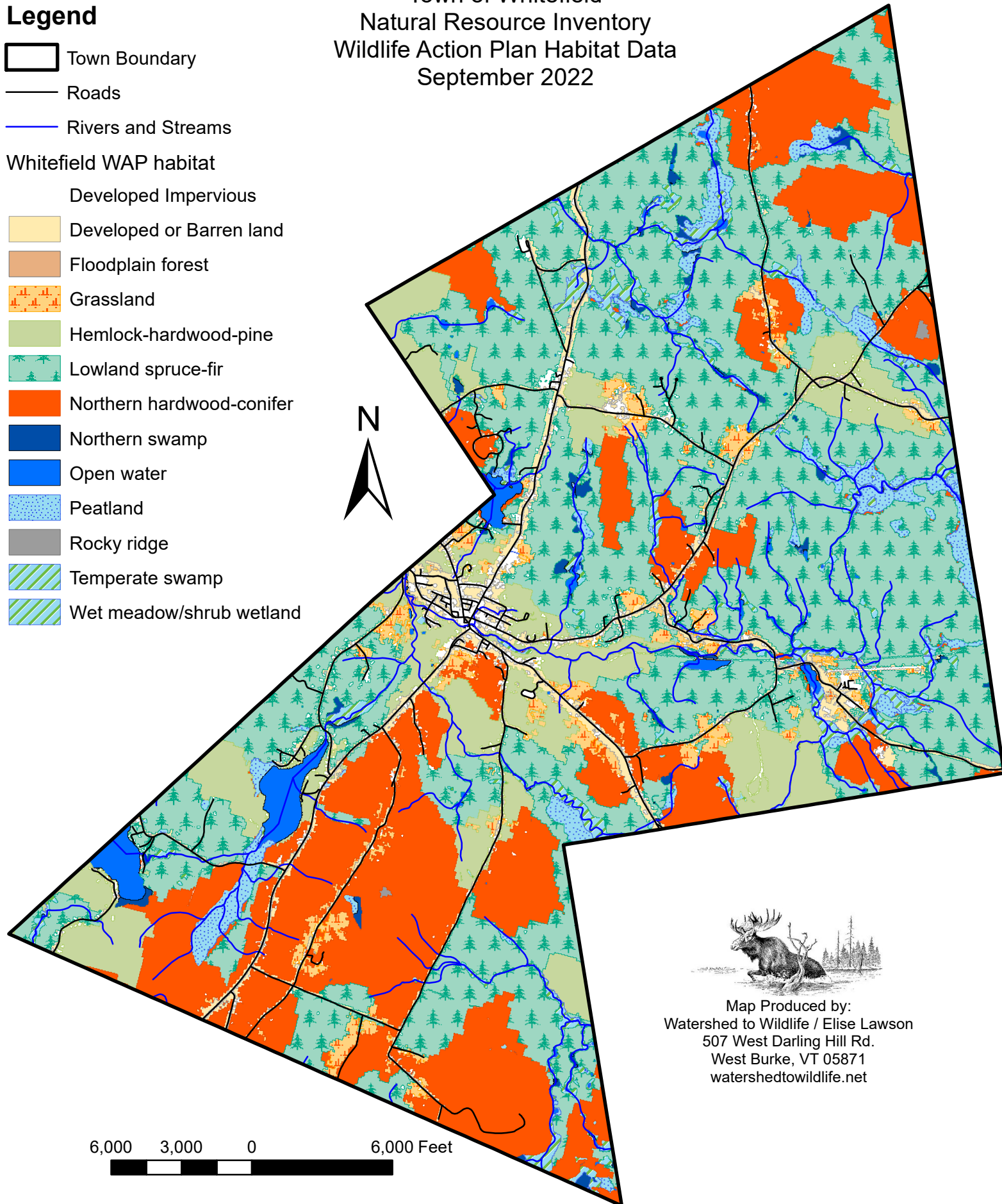
Map #2
Town of Whitefield
Natural Resource Inventory
Wildlife Action Plan Habitat Data
September 2022

Legend

-  Town Boundary
-  Roads
-  Rivers and Streams

Whitefield WAP habitat







-  Developed Impervious
-  Developed or Barren land
-  Floodplain forest
-  Grassland
-  Hemlock-hardwood-pine
-  Lowland spruce-fir
-  Northern hardwood-conifer
-  Northern swamp
-  Open water
-  Peatland
-  Rocky ridge
-  Temperate swamp
-  Wet meadow/shrub wetland

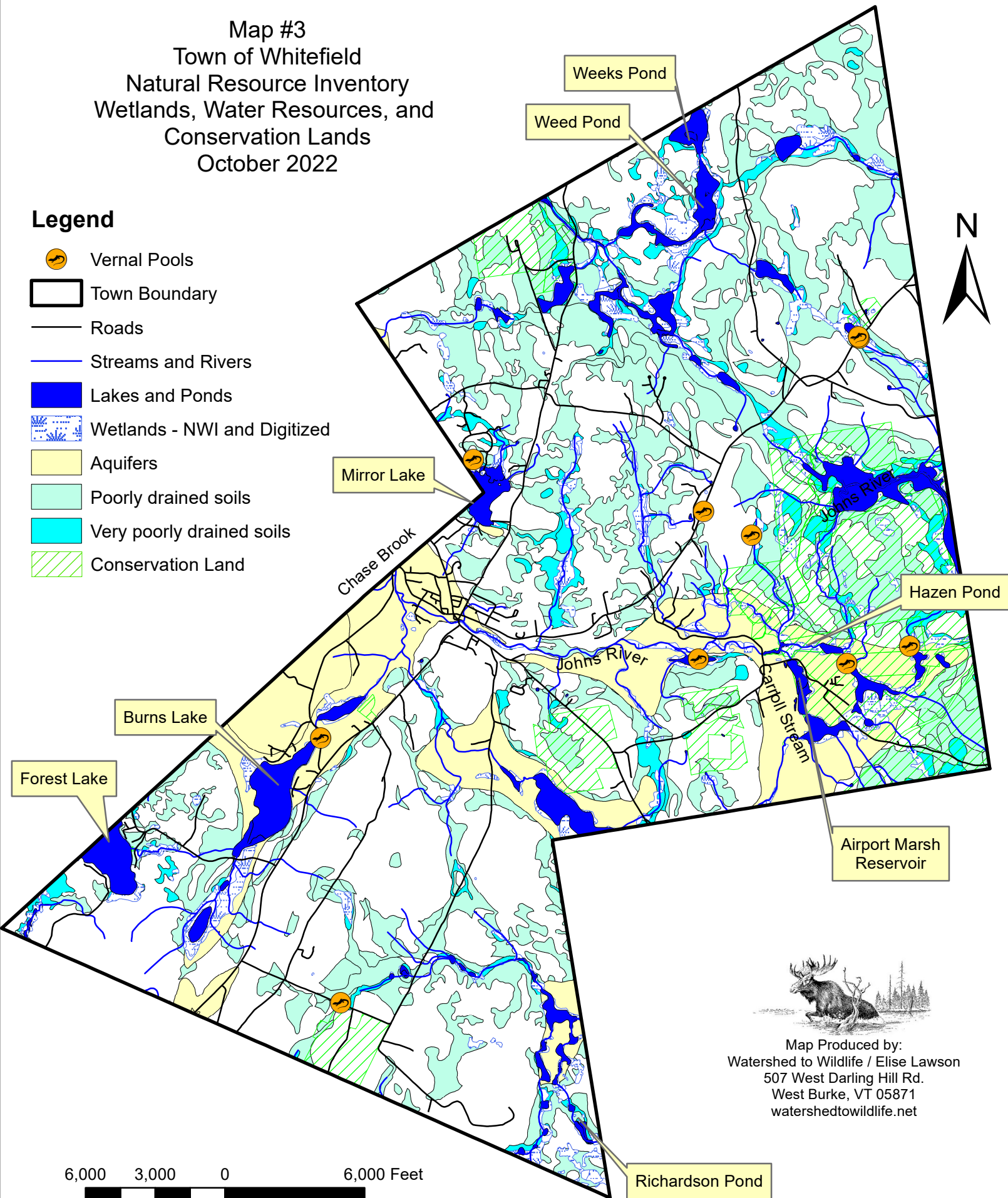


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Map #3
Town of Whitefield
Natural Resource Inventory
Wetlands, Water Resources, and
Conservation Lands
October 2022

Legend

-  Vernal Pools
-  Town Boundary
-  Roads
-  Streams and Rivers
-  Lakes and Ponds
-  Wetlands - NWI and Digitized
-  Aquifers
-  Poorly drained soils
-  Very poorly drained soils
-  Conservation Land

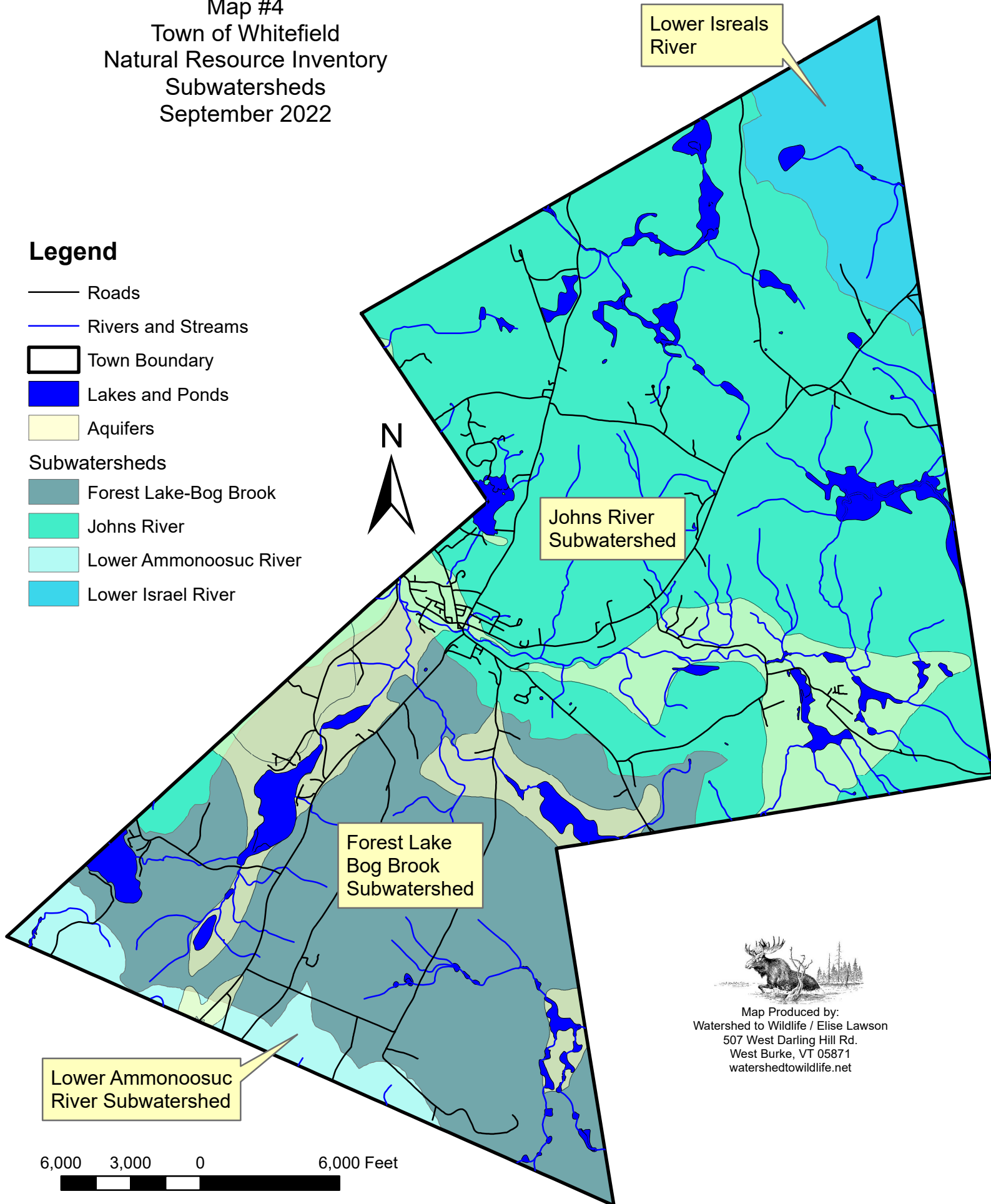


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Map #4
Town of Whitefield
Natural Resource Inventory
Subwatersheds
September 2022

Legend

- Roads
- Rivers and Streams
- ▭ Town Boundary
- ▭ Lakes and Ponds
- ▭ Aquifers
- Subwatersheds**
 - ▭ Forest Lake-Bog Brook
 - ▭ Johns River
 - ▭ Lower Ammonoosuc River
 - ▭ Lower Israel River

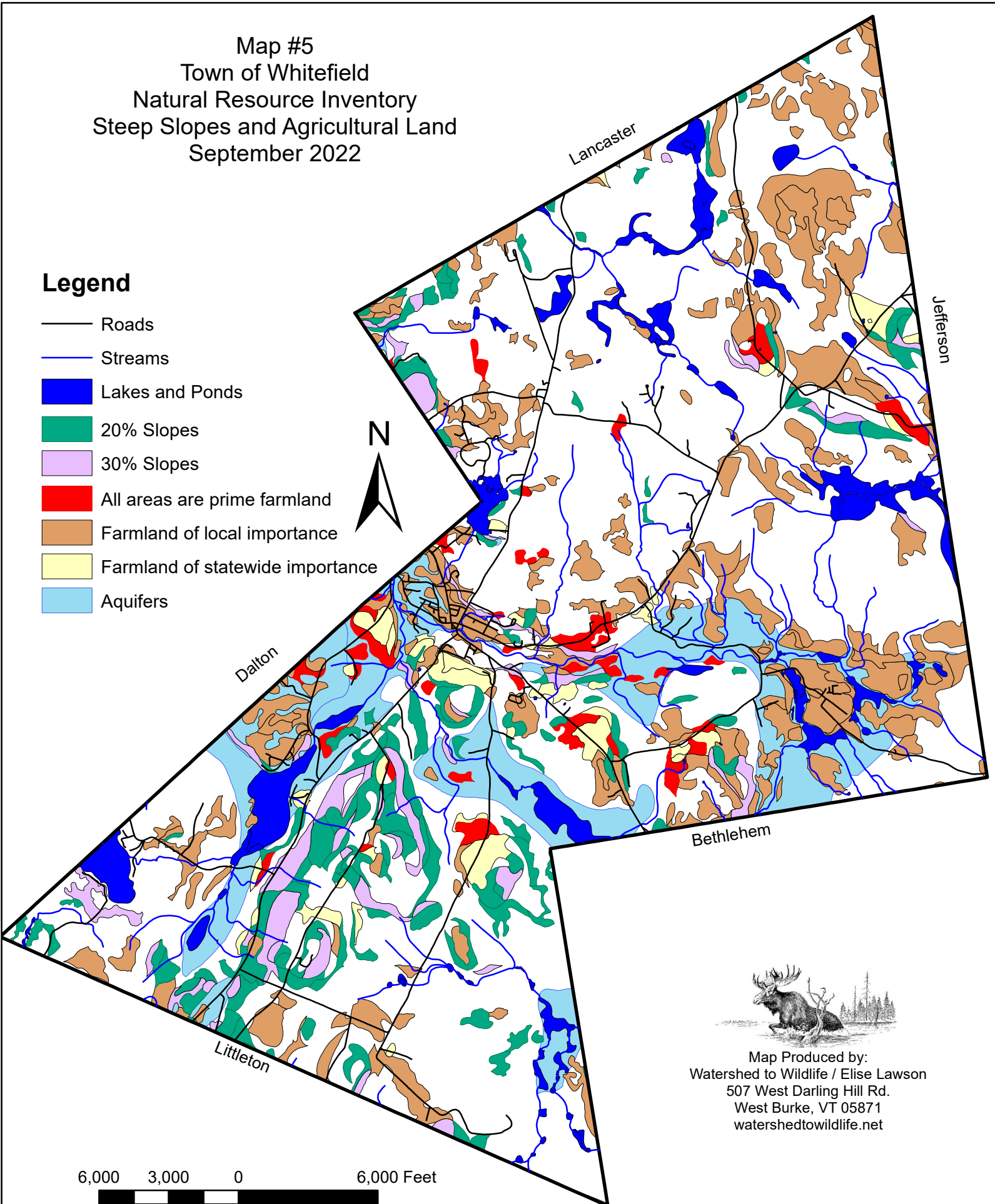


Map Produced by:
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Map #5
Town of Whitefield
Natural Resource Inventory
Steep Slopes and Agricultural Land
September 2022

Legend














- Roads
- Streams
- Lakes and Ponds
- 20% Slopes
- 30% Slopes
- All areas are prime farmland
- Farmland of local importance
- Farmland of statewide importance
- Aquifers

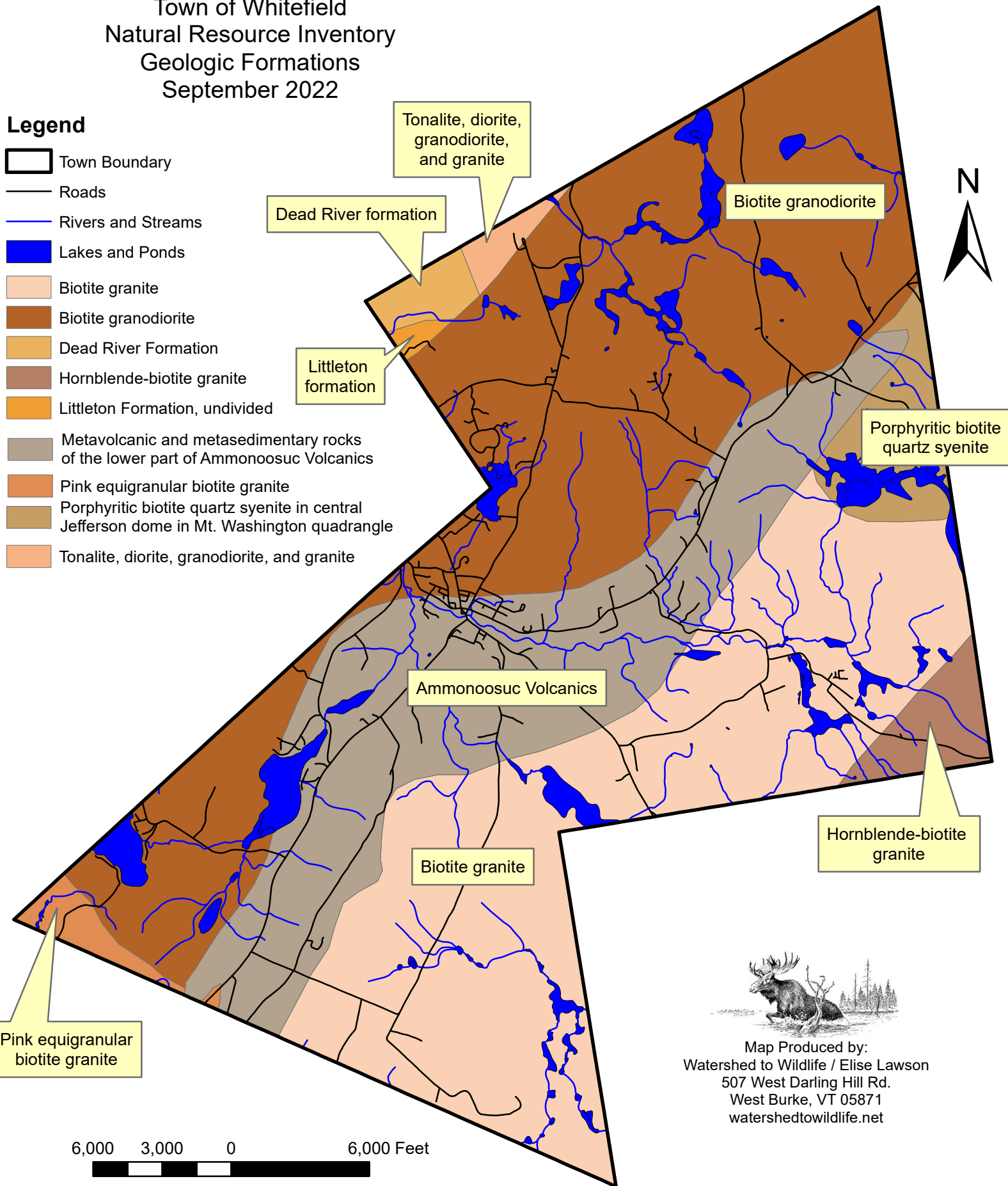


Map Produced by:
Watershed to Wildlife / Elise Lawson
507 West Darling Hill Rd.
West Burke, VT 05871
watershedtowildlife.net

Map #6
Town of Whitefield
Natural Resource Inventory
Geologic Formations
September 2022

Legend

-  Town Boundary
-  Roads
-  Rivers and Streams
-  Lakes and Ponds
-  Biotite granite
-  Biotite granodiorite
-  Dead River Formation
-  Hornblende-biotite granite
-  Littleton Formation, undivided
-  Metavolcanic and metasedimentary rocks of the lower part of Ammonoosuc Volcanics
-  Pink equigranular biotite granite
-  Porphyritic biotite quartz syenite in central Jefferson dome in Mt. Washington quadrangle
-  Tonalite, diorite, granodiorite, and granite

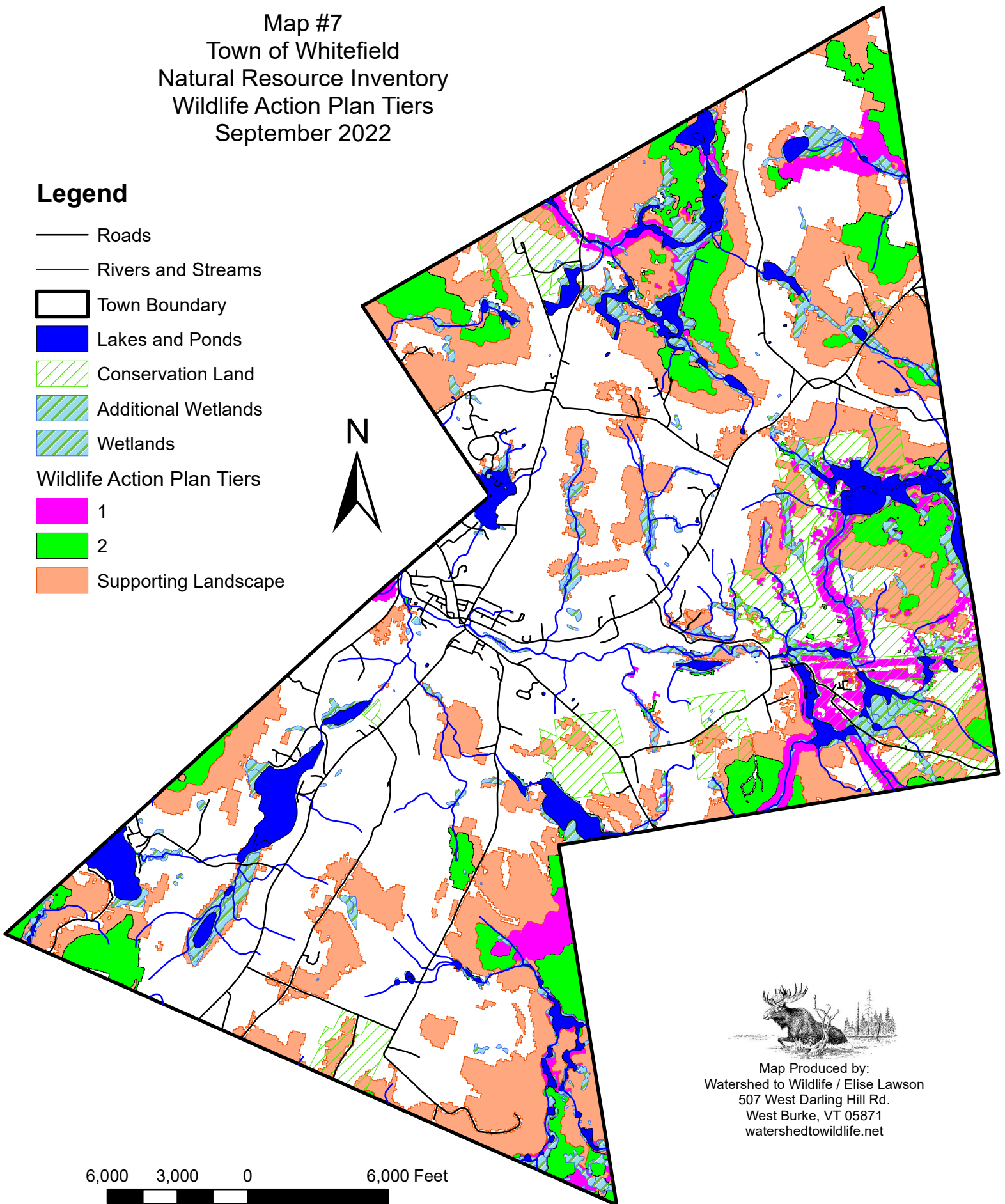


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Map #7
Town of Whitefield
Natural Resource Inventory
Wildlife Action Plan Tiers
September 2022

Legend

- Roads
- Rivers and Streams
- ▭ Town Boundary
- ▭ Lakes and Ponds
- ▨ Conservation Land
- ▨ Additional Wetlands
- ▨ Wetlands
- Wildlife Action Plan Tiers
 - ▭ 1
 - ▭ 2
 - ▭ Supporting Landscape



Map Produced by:
Watershed to Wildlife / Elise Lawson
507 West Darling Hill Rd.
West Burke, VT 05871
watershedtowildlife.net

6,000 3,000 0 6,000 Feet