

# **TOWN OF WHITEFIELD, NEW HAMPSHIRE**

**NATURAL RESOURCES INVENTORY**  
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## INTRODUCTION AND OBJECTIVES

The Town of Whitefield, New Hampshire contains approximately 34.3 square miles (21,952 acres) of land and 0.4 square miles (256 acres) of inland waters. There were 51 residents in Whitefield when the first census was taken in 1810. The population has grown to 2,006 residents according to the 2003 census. Whitefield has a fluctuating seasonal population due to the fact that there are numerous second homes. The Johns River roughly bisects the Town, flowing east to west, into areas north and south of the river.

Whitefield contains a wide range of ecological habitats including part of the Pondicherry Refuge, the newest wildlife refuge in the nation. Co-occurring in this area are the Johns River headwaters, an active regional airport, the Whitefield Industrial Park, exemplary plant communities, and some rare or endangered animal and plant species. The area was once a small village named Hazen Village which included a dam on the Johns River and an oval horse race track that is displayed on some of the older USGS topographic maps. Whitefield contains several open water bodies, perennial streams, large wetland complexes, and uplands with numerous peaks of 1,500 to 1,600 feet in elevation. Some of the hills in Whitefield include Bray Hill, Kimball Hill, Osburn Hill and Howland Hill. Many scenic vistas and roads exist throughout the Town.

The Town of Whitefield is a typical New Hampshire rural town that has progressed through the agricultural, industrial, and current eras. Presently, farming has declined dramatically while forestry, retail, and tourism have become the main economies.



A view of typical hill farmland in Whitefield

As is true of many communities of its size, Whitefield has a municipal Drinking Water System and Sewerage Disposal System for the downtown area which meets Environmental Protection Agency regulations within the Clean Water Act. With its large stratified drift aquifers found mainly along the John River and Burns Lake area the Town recognized a need to become more proactive in wanting to sustain natural resources, especially water quality. As with many communities, development and transportation corridors tend to follow along the rivers and valleys with flatter topography.

This project provides a base Natural Resource Inventory with digital data that can be integrated with other available and future data. For example, data from this project is compatible with existing GIS data from other projects such as: The Johns River Watershed Assessment; senior GIS project by Conservation Commission member, Rita Chadwick; the

## Natural Resource Inventory for Whitefield, NH

Town of Whitefield's existing GIS and digital tax maps; project data from the abutting towns of Dalton and Lancaster; the Ammonoosuc Watershed Region Conservation Plan.

One of the goals of this project is to provide inventory, management, and planning tools for the Town. Another goal of the project is to integrate all existing data for Whitefield, with data created and field verified from this project. This produces a seamless comprehensive town-wide composite, and provides an educational and planning tool, as well as promotes conservation of 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 the ability to integrate existing GIS coverages with those currently under development, and future GIS data, in a compatible format stored and retrievable in one comprehensive database.
2. Incorporate natural resources, scenic vistas, riparian buffers and other related elements for comprehensive planning.
3. Hold a public meeting to increase awareness of the values of the Town including scenic view areas, recreation areas, riparian buffer habitat, and wetlands with associated wildlife habitat.
4. Ability for the Town to provide hardcopy printouts of spatial data, on standard 8½" x 11" paper, as requested or needed.
5. Ability of the Town to continually build upon and update the digital database

### **METHODOLOGY**

Whitefield's Conservation Commission member and Water Superintendent, Bill Thompson, and Conservation Commission chair, Dick Mallion were the project officers. The Town partnered with Watershed to Wildlife, Inc. (WTW) in a contractual arrangement for technical assistance, and to integrate the data to create a comprehensive GIS project. Members of the Commission dedicated time to work with WTW. Rita Chadwick of the Whitefield Conservation Commission contributed former GIS work and fieldwork participation in this project. Commission members met with WTW to provide information and highlight areas for fieldwork. Throughout the project WTW communicated with the Commission periodically to give updates of the work as it progressed.

#### ***Field Work***

Fieldwork 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 floodplain habitat along the Johns River, and higher elevation uplands. In some cases Class VI roads and established trails were followed, while in other cases compass based orienteering and topographic maps were used. GPS data were collected at points of interest including monuments, brook crossings, vernal pool locations, dense softwood stands, and perennial stream confluences with rivers. In addition, photographs were taken with a digital camera along points of interest throughout the Town. During fieldwork sessions, any rare or endangered species found were noted and located on a map. Observed invasive plant species were also documented.

### ***Gather Existing Digital Data***

Existing maps and data for the Town of Whitefield were collected. The following table shows which maps were obtained, their scale, and the national mapping standard accuracy measure. 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 need to perform site-specific investigations for many developmental requests. Please refer to the table below to better understand some of these accuracy issues.

**Accuracies of Existing Maps**

<b>Data</b>	<b>Source</b>	<b>Ratio</b>	<b>Scale</b>	<b>National Mapping Standard Accuracy</b>
1992 and 1998 DOQ	GRANIT -.sid version	1:5,000	1" = 416.7'	Acceptable accuracy within 12.48 feet
Topographic	GRANIT	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
Roads and Trails, Power Lines, Railroads, Hydrology, Conservation lands, and NHB Data	GRANIT	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
Soils	NRCS	1:20,000	1" = 1,667'	Acceptable accuracy within 50 feet
Geology & Aquifers	USGS & NH-DES	1:24,000	1" = 1,667'	Acceptable accuracy within 60 feet
National Wetland Inventory	U.S. Fish and Wildlife Service	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
GPS Points	Garmin III plus	N/A	N/A	Generally within 30' but dependent upon satellite availability, PDOP, refraction, and topology.

### ***Compile Existing Data into Autocad and Arcview***

Digital data was gathered from GRANIT, Natural Resource Conservation Service (NRCS), NH-DES, and the US Fish and Wildlife Service. GRANIT data includes the following:

1. DOQs – Aerial photography
2. Topographic map
3. Hydrology (rivers, streams, lakes and ponds)
4. Roads and trails
5. Power lines and rail roads

## Natural Resource Inventory for Whitefield, NH

Existing available maps were then integrated using AutoCAD and Arcview software. Using the 1998 and 1992 Digital Orthographic Quadrants (DOQ), USDA 2003 aerial photography, topographic maps, and soils maps, features were digitized and overlaid onto a base map. These include: Johns River riparian buffers, permanent openings, waterbodies, and dense softwood stands. Potentially significant wildlife habitat areas were noted.

Wetlands were reviewed and analyzed using the DOQ, National Wetland Inventory (NWI) and NRCS soils maps (displaying hydric soil map units). New Hampshire requires that three parameters be met for classification as a jurisdictional wetland: the presence of hydric soil; sufficient hydrology; and hydrophytic vegetation. When soils 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 DOQs alone would under-represent the number of wetlands, because only open water, emergent, and scrub-shrub wetlands are easily identified. Forested wetlands are often missed using aerial photography alone. 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.

Prime farmland, farmland of statewide importance, and farmland of local importance throughout Whitefield were determined using the NRCS soils map data. Data was displayed in Arc View and queried so only those soils classified as important farmland was displayed in the Town. Much of the prime farmland, additional farmland of statewide importance and some of the additional farmland of local importance are now used for crops (including hayland). Land used for pasture, woodland, recreation, or land uses other than urban, built-up or disturbed areas will still qualify as prime farmland, additional farmland of statewide importance, or additional 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 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 maybe 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 free of stones.
2. Farmland soils of statewide importance are lands, in addition to prime farmland, that are of statewide importance for the production of 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 for the production of food, fiber, forage and oilseed crops. The criteria used to define this farmland were determined by local agencies in Coos County. Relative values from 100 to 0 were assigned to each of the

county's soils based on each soil's potential to grow corn silage or grass-legume hay. The local agencies then determined that soils with relative value of 54 or greater would qualify as farmland of local importance.

Permanent openings (areas dominated by grasses, forbs, brambles, or shrubs) were digitized from the DOQs. 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 DOQs. These areas have been recognized as significant wildlife habitat and could be deer and moose wintering areas. Existing Riparian Zones were digitized from the DOQs. Riparian buffer habitat includes shrubs and trees along the Johns River. Areas which have been maintained as grassland or are paved are not considered to have adequate riparian buffer.

Steep slopes were determined using the NRCS soils maps. Data was displayed in Arc View and queried so only those soils map units with 15% slope and greater were displayed in Arc View.

All maps are displayed at the end of this report with the features described above. All information gathered, compiled, and mapped for this report is maintained by the Whitefield Conservation Commission in digital format.

### ***GIS Training Workshop and Installation of Project Data***

Installation of all project data, including a GIS ArcView Project was done on a computer in Whitefield. A two-hour 'hands on' training session in accessing and viewing the data, and plotting maps was conducted for Conservation Commission members that had an interest in providing GIS access for the Town of Whitefield. Future training was offered at a per diem rate.

### ***Public Information Workshop***

At the completion of the fieldwork, and GIS analyses, a public information meeting was held to explain results from the work. The goal of this meeting was to increase public awareness of the importance of the natural resource inventory including; recreation areas, riparian habitat buffers, wetlands, and associated wildlife habitat. In addition, work done from this project will be available for public viewing via 8½ X 11 paper handouts as requested through proper venues.

## RESULTS

### ***Rivers and Large Waterbodies***

The Johns River flows for approximately 31,500 feet or 6 miles through the Town. Being the only river in Whitefield, it is a valuable natural resource for the Town. The Johns River begins at the outlet of Little Cherry Pond and is a slow flowing low gradient fen with a mucky bottom until it reaches Bunton dam where the river transforms into a rocky-cobbly faster flowing river with a medium gradient into the town of Dalton. Though the Johns River is not large enough to be rated as a fourth order stream and therefore not currently subject to the Comprehensive Shoreland Protection Program, protecting the biological diversity and scenic values along this river have been a local priority for several years. There is a dam in the center of downtown Whitefield that is breached at the time of this report, with plans to replace the dam and construct rock ramps for fish passage. This will contribute to the success of coldwater trout, further enhanced by the NH Fish and Game department's annual stocking program. There are also ongoing efforts to improve riparian buffers to provide cooler water temperatures for better wild trout habitat.

The installation of the Boston & Maine Railroad track in the 1800s, which runs along 17,900 feet, or approximately 3.5 miles of the Johns River, mostly on the south side, probably caused degradation of the river at the time of construction, due to its close proximity to the banks of the river. On the other hand, it has served as an obstacle to building and development along many miles of the river. The vegetation, in many instances mature softwood trees, has provided a good riparian buffer and stabilized riverbanks, preventing erosion, while providing shade to maintain cool water temperatures for many fish and wildlife species, including brook trout. This is complement with steep rough terrain on the northern riverbank that has equally prevented development and provides a similar riparian buffer. With few exceptions, most of the 4.5 miles of the Johns River between Bunton Dam and upstream side of the Town of Whitefield has good-to-excellent riparian buffers with very little erosion.



Good riparian buffers along the Johns River in Whitefield

Although there are several small tributaries entering the Johns River, the largest one in Whitefield is Carroll Stream located in the eastern end of Whitefield, which flows for approximately 9,320 feet, or 1.8 miles, and has headwaters in the WMNF on Cherry Mountain. The Carroll Stream confluence with the Johns River is located slightly below the

western end of the airstrip of the Mount Washington Regional Airport. Numerous smaller tributaries flow directly into the Johns River, such as Alyling Brook, Bear Brook, Leonard Brook, and several unnamed drainages.

Erosion is a minor issue along the Johns Rivers. This is mostly due to adequate vegetative buffers, and associated root systems. There are a few areas of concern where little to no buffers exists and in some cases, impervious surfaces are located along the riverbank. As future development occurs along the floodplain, careful planning, maintenance of riparian buffers, and stormwater runoff control will be essential.

Burns Pond, Hazens Pond, Airport Marsh, Weed Pond, Weeks Pond, Richardson Pond, the Cherry Pond Deadwater, and numerous smaller unnamed ponds are found in Whitefield. Portions of Mirror Lake, Forest Lake, and Little Cherry Pond lie in Whitefield. Due to the relative flatness of terrain and abundant hydric soils in the town, virtually all ponds have associated wetland complexes, some of them covering very large areas. These extensive networks of wetlands contain excellent wildlife habitat. Mirror, Burns, Forest, and the Airport Marsh have some degree of protection from future development as they are over 10 acres and classified as Public Waters subject to the Comprehensive Shoreland Protection Program.

All water bodies offer recreational and wildlife value for Whitefield, its immediate abutters, and the entire region. Swimming, kayaking, canoeing, bird-watching, hiking, fishing and hunting are all common occurrences in Whitefield. Tourism accounts for a large portion of income for northern New Hampshire and these waterbodies are significant components.



Richardson Pond

### ***Riparian Habitat***

The Johns River in Whitefield contains many acres of riparian habitat rich in plant and wildlife species. Within these periodically flooded areas are upland and wetland soil base habitats with a multitude of ‘edges’ creating unique opportunities for plant and animal species to thrive. The diverse riparian habitat in Whitefield includes scrub-shrub, emergent, grassland, meadow, and forest. These areas support numerous songbirds, including ground

nesters, raptors, ducks, herons, bank swallows, and many other avian species too numerous to list.

Along the Johns River in Whitefield, riparian buffer widths range from 0 feet to over 1,000 feet with several areas throughout the town having well over 1000 feet and only a few areas having 0 or less than 50 feet of shrub or tree riparian buffer. The riparian buffers are adequate for the majority of the floodplain areas, but could use improvements in some areas, particularly in regard to impervious surfaces. As stated earlier, the majority of the river is well buffered and does not experience erosion problems.

Riparian buffers provide travel corridors containing shelter, food, and birthing places for numerous terrestrial mammals such as beaver, muskrat, river otter, white-tailed deer, moose, black bear, raccoons, skunks, red and gray fox, coyote, weasel, mink and smaller mammals.



A river otter observed catching crayfish and fin fish at Bunton Dam in early-April.

The Town of Whitefield has plentiful wildlife, in part due to its riparian habitat areas. The importance of maintaining, and in many cases, increasing these areas cannot be overstated. As development pressures and natural resource management increase, the effect on these areas needs to be carefully weighed a balance found to prevent loss of the functionality of this habitat. It is intended that digital tools such as those produced from this project will assist Whitefield in assessing proposed future impacts before they occur. Retaining existing buffers, and promoting the growth of additional riparian buffers are critical to maintaining water quality, erosion prevention, fisheries habitat, wildlife travel corridors, and flood minimization.

## **Wetlands**

Wetlands are the core of life for the majority of plant and animal species and contain diverse habitats with numerous edge habitat needed by many species. It is estimated that riparian areas and wetlands are utilized by over 90% of the region's wildlife species and provide the preferred habitat for over 40% of local species. Future trails and observation points overlooking these wetlands provide excellent opportunity for wildlife viewing.

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Based on National Wetland Inventory (NWI) data there are approximately 2,402 acres of wetlands in Whitefield, (10.9% of the land mass). Based on NRCS data, there are approximately 11,271 acres of hydric soils in Whitefield, (51.3% of the land mass). New Hampshire requires three parameters in defining wetlands; hydrophytic vegetation, hydric soils, and hydrology. Although excellent tools, generally NWI data under represents the size and number of wetlands, and NRCS hydric soil data alone over represents the size and number. Field determinations will be necessary to accurately delineate all wetlands in the town. These can be incorporated over time with additional field verification.



Large persistent emergent, with a bordering scrub-shrub, connected to a forested wetland complex located below Burns Pond and near the Town's largest water supply well. There was abundant sign of several species of wildlife, including beaver at this site.

Wetland areas are dynamic and constantly changing. The general trend without severe weather is for wetlands to slowly fill-in over time. The process begins with open water. As time passes, submerged plants appear. Floating-leafed plants, such as water lilies, follow these. Then further emergent plants such as reeds, sedges, and wetland grasses follow. Shrubs such as high bush cranberry (*Viburnum trilobum*), sweet gale (*Myrica gale*), and bog rosemary (*Andromeda glaucophylla*) begin to appear. Heaths such as leatherleaf (*Chamaedaphne calyculata*) and labrador tea (*Ledum groenlandicum*) appear among the shrubs. Trees such as black spruce (*Picea mariana*) and tamarack (*Larix laricina*) then emerge. Balsam fir (*Abies balsamea*), red maple (*Acer rubrum*) and gray birch (*Betula populifolia*) swamps follow the spruce and tamarack. This natural successional process is often referred to as eutrophication.

## Natural Resource Inventory for Whitefield, NH

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

- Human development including damming or excavation could increase wetland sizes, or 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, large waterbodies, and streams
- Human activities such as logging and landscape alteration can dredge out wetland areas or increase the amount of runoff into wetlands



This lush swamp contains many cedar trees and numerous blow downs

Vernal pools are unique and often isolated wetlands. A vernal pool is a temporary body of water which provides essential breeding habitat for certain reptiles, amphibians, and crustaceans – such as wood turtles, wood frogs, spotted salamanders, and fairy shrimp. They fill annually from precipitation, runoff, and rising groundwater. Vernal pools are usually dry by the middle of summer, making them uninhabitable for fish, and therefore a safer environment for amphibians. Vernal pools vary in size, shape, and location. With the abundance of hydric soils and wetlands, Whitefield contains a large number of vernal pools. Several were found during field work for this NRI, and future studies could easily document additional ones throughout Town.



A vernal pool located near the railroad bed paralleling Rte. 116 near the Whitefield/Bethlehem town line. No obligate species were documented at this time of year (November), but this site should be revisited next spring.

### ***Forested Flood Plains***

Floodplain forests are unique natural communities that occur on periodically flooded land along river corridors. Their uniqueness and location adjacent to riparian habitat and rivers provide valuable wildlife habitat for breeding birds, spring migratory birds, insect populations, and amphibians. Generally, larger patches of forested floodplains exhibit greater species richness and support greater diversity of wildlife. Migratory and breeding bird populations associated with floodplain forests include downy and hairy woodpeckers, American robins, gray catbirds, warbling vireos, and song sparrows. Hemlock, White Pine, Box Elder, Spruce and Balsam Fir are abundant along the Whitefield reaches of the John River, and are dominant tree species in much of the floodplain. The strong root system of these species is important in controlling bank erosion.

Throughout Whitefield and New Hampshire red maple swamps are also common examples of forested flood plains. In New Hampshire, red maple swamps are home to such rare species as the marbled salamander. They are the principal forest type used by breeding wood ducks in the northeast. Songbirds (e.g., Canada warbler, veery) and birds of prey (e.g., red-shouldered hawk, barred owl) also have an affinity for red maple swamps. Nearly 50 species of mammals utilize red maple swamps, including black bears, white-tailed deer, moose, and bats.

### ***Permanent Openings***

As is the situation in most all of New Hampshire, the Town of Whitefield has experienced a loss of working farms. As the percentage of non-developed, permanent openings in New Hampshire has decreased significantly over the past 50 years, the state is encouraging landowners to create or maintain permanent openings as important wildlife habitat. These permanent openings, dominated by grasses, forbs, brambles, or fruiting shrubs,

provide necessary habitat for about 22% of New England's wildlife species, and seasonally important habitat to nearly 70% of species. The eastern bluebird and northern harrier are two examples of species of concern in New Hampshire, which rely on permanent openings.

Permanent openings in general also have the advantage of creating 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 openings, those adapted to forested habitat, and those who specialize in the transition zone area who will frequent these edge habitats.

Approximately 1,713 acres of land is managed for permanent openings, including agriculture, in Whitefield. This is nearly 7.8% of the total town's land area, and is below the average of 10% openings throughout the State of NH. Some of the larger permanent openings border the Johns River near the airport area. Often overlooked areas of permanent opening are below the miles of electricity transmission lines within the Town. These areas used to be sprayed with herbicides to kill vegetation. They are now mechanically mulched with excavators known as Brontosaurus: a much better technique for wildlife. Retaining permanent openings will be beneficial to the diversity of wildlife and vegetation throughout the town.

### **Forested Lands**

As with surrounding New Hampshire towns, the Town of Whitefield contains large acreages of forest. Since 1900, much of Whitefield's land mass has been devoted to forestry, and harvesting has occurred as growth cycles have warranted. Typical tree species that grow in this location are white pine (*Pinus strobus*), white birch (*Betula papyrifera*), yellow birch (*Betula lutea*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), poplar (*Populus* spp.), white ash (*Fraxinus americana*), eastern hemlock (*Tsuga Canadensis*), red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and tamarack (*Larix laricina*). Northern white cedar (*Thuja occidentalis*) is also prevalent, especially in the southwestern part of Whitefield in the drainage flowing into Burns Pond. Northern white cedar provides particularly dense cover for wildlife, including winter deer yards.

Over 85% of Whitefield contains forested habitat. Forested areas include hardwood stands, mixed hardwood and softwood stands, and softwood stands. Most of these forested habitats are softwood stands of varying age classes. Over, 2,492 acres or 11.4% of Whitefield's land area is dense softwood cover. Some of these stands are important deer wintering areas, which cover only about 3% of land base in New Hampshire. For the area to be considered a deer yard two basic elements must be met: (1) Core area identified by concentrations of dense softwoods, and; (2) Mixed hardwood and softwoods adjacent to, or within the core area will provide accessible forage.

Many of the dense softwood stands scattered throughout Whitefield are fairly small in size (10 to 20 acres), however there are a few larger ones ranging from 50 to 125 acres in size. Many are lowland softwood stands, associated with watercourses and riparian habitat. Some of the larger softwood stands are found along the Deadwaters of the upper Johns River and the flowage area upstream of Burns Pond. Even though deer or moose may not use the smaller softwood stands in the winter, many other smaller mammals and birds rely on them. They provide shelter from harsh winter weather by reducing snow accumulation and wind speeds, access to food supplies, and escape from predators.



There is a large diversity of forest types in Whitefield; the majority being softwood species with some dense softwood stands. This stand is a potential deer wintering area with a network of sunken trails throughout the deep moss herbaceous layer.

## **Soils**

The nature of soil has a profound effect on plant growth. Whether it is rich with organic material, very poorly drained, or sandy, will affect the type of vegetation adapted to grow in those conditions. 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.

Soil information is critical in making sound land use decisions. By examining soil types and morphology, many predictions are made regarding forest management, erosion potential, and development possibilities. For example, residential development should be located away from areas with unstable soil conditions, high water tables, and slow percolation rates due to constraints for building foundations and septic system placement.

Soil information is also an excellent indicator of critical resource areas such as wetlands, agricultural lands, forestlands, and wildlife habitat. In descriptions of soil types, the NRCS evaluates soil types according to their capacity for agriculture, woodland, community development, recreation, and wildlife habitat.



This Typical Peru Fine Sandy Loam soil is exposed due to erosion from logging and beaver activities.

Several factors exert a major influence on soil development. These include climate, time, topography, parent material, biota, and human activities. Studying soil can also lead to an understanding of how that soil was formed. For example, along the upper Johns River, floodplain fen soils exist. These soils have been formed by sediment being deposited from past floodwaters and accreting acidic bog-like conditions. These types of soil are classified as Alluvium (deposited by running water) and Histosols (containing over 50% organics in the upper 32 inches). As another example, soils with a deep, rich top layer (or A horizon) indicate that the area has been used for agriculture for many years. Throughout the forested areas of Whitefield, spodosol soils continue to develop under the acidic organic litter. These soils take many years to develop identifiable horizons and typically have an albic or “E” horizon just under the organic or “O” horizon. The “E” horizon is generally 1 to 3 inches thick and is described as looking similar to wood ash. The phenomenon is caused by the actions of water and acidic decomposition or fallen needles and leaves stripping off the normal coatings of clay and or iron oxides. The spodosols are relatively young soils.

A parameter sometimes overlooked in soils is that of pH. New Hampshire soils are commonly slightly acidic due to the influence of granite, referencing the term ‘The Granite State’. There are a few areas in Whitefield where there are calcareous soils with ‘sweeter’ higher pH due to small pockets of calcium within the granite bedrock. In Whitefield these areas tend to be near Forest Lake and Burns Pond. Such areas often offer opportunities for unique habitat and rare (at least to northern NH) plant life. The abundance of white cedar in the in the Burns Pond flowage area suggests higher pH soils.

Arc View compatible shape files of the NRCS soils map and the USGS geologic bedrock of the Town of Whitefield have been included with the digital data. It is important to

recognize that these delineations are limited in detail as they are Category II and III Levels derived from large grid fieldwork done in 1983 and USGS Quadrant maps at 1:24,000 scale. These soil delineations are also limited for site-specific use in that minimum area polygons are three acres in size and can contain up to 35% inclusions of various soils and slopes.

### ***Prime, State and Local Farmland***

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 can be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. 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 a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment. Another factor that influences farmland along the Johns River is the presence of an abundant volume of moving water. The fact that water reacts much more slowly than air to temperature changes provides a microclimate within the floodplain area, offering cooler temperatures in the extreme heat of summer and warmer temperatures (including the formation of fog) in the cooler fall temperatures extending the growing season.

Throughout the town of Whitefield there are 5,556 acres (8.7 mi<sup>2</sup>) of land classified as important farmland. This represents 25% of land base in Whitefield. There are approximately 390 acres of USDA classified prime farmland found throughout the town of Whitefield. Most of these soil types lie in a band across the middle of Whitefield following the John River flood plains. Additionally, Whitefield has 812 acres of farmland of statewide importance, determined by State and local agencies. Lastly, 4,354 additional acres of farmland has been classified as local importance. These last soils are scattered throughout the town. The farmland on Kimball Hill in Whitefield has long been given the distinction as the highest elevation (1700'+) cultivated working farmland in New England.

Decision makers must be aware of the long term implications of various land use options for the production of food, fiber, forage and oilseed crop, and the trade-offs involved. Actions that put high quality farmland in irreversible uses should be initiated only if those actions are clearly in the public interest.

### ***Stratified-Drift Aquifers***

There are three types of groundwater aquifers: Stratified-drift; till; and bedrock. The basic difference is that stratified drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are solid 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 rock is fractured.

Stratified-drift aquifers are an important source of ground water for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. Approximately 14% of land surface in the State is underlain with Stratified-drift aquifers. In and around Whitefield they consist of stratified, sorted, principally coarse-grained sediments (sands and gravels) deposited by glacial melt-water during the time of deglaciation.

Approximately 5.9 mi<sup>2</sup> (3,766 acres) or just over 17% of the area of Whitefield is

underlain with Stratified-drift and Till Aquifers. These are located mostly along the Johns River floodplain and Burns Pond flowage, but also found in other areas of the Town.

Whitefield also contains 1.26 acres of documented fractured bedrock aquifers; two areas located in the southern end of town at the town line with Bethlehem along Route 116, one on either side of the highway.

Wells used by communities and private landowners draw groundwater from aquifers. The stratified-drift aquifers represent the greatest potential groundwater source for the Town of Whitefield. These aquifers represent potential usable water sources for municipal purposes and should be protected to insure their future quality and availability.

## **Slope**

Slope is the amount of rise or fall in feet for a given horizontal distance. It is expressed in percent. A 15% slope means that for a 100-foot horizontal distance, the rise or fall in height is 15 feet. Slope is one significant aspect of landform, which presents limitations for development. As slopes become steeper, the expense of building increases. Furthermore, increased slope means there is a greater chance of erosion, structural problems, and water pollution problems. In general, slopes greater than 25% are considered too steep to provide adequate sites for structures such as roads, homes, and septic systems. On steep slopes, soils are usually shallower, the volume and velocity of surface water runoff is higher, and the erosion potential is greater than on flatter areas. The consequences of erosion are loss of soil resulting in sedimentation of surface waters and loss of the productive capacity of the land.

The NRCS soils maps were used to determine areas with slopes equal to and greater than 15%: areas where development would be restrictive. Approximately 2,491 acres or 11.4% of land throughout Whitefield contains slopes that are over 15%. Of that, approximately 894 acres or 4.1% contain slopes over 25%. The flat land throughout Whitefield is located mostly along and around the Johns River floodplains. These flatlands, though, are often associated with flood hazard areas, especially if the water table is high.

A positive aspect of Whitefield's steep slopes is the opportunity for panoramic views in numerous locations throughout the Town. Identification and proper planning are important to Whitefield to maintain these viewsheds. (Please refer to the section on 'Scenic Resources' in this report).

## **Rare Species and Exemplary Natural Communities**

The Town of Whitefield has potential for numerous occurrences of these species and communities due to the unique diverse habitats throughout. Based on the NH bedrock geology data, some of these occurrences are due to calcareous soils which are rare, as aforementioned in the 'soils' section of this report. There are some documented plants, birds, and one insect species occurrences in this area with ongoing studies.

New Hampshire Natural Heritage Bureau documented Natural Communities occurring in Whitefield are; Palustrine northern white cedar-balsam fire swamp, and Palustrine northern white cedar seepage forest.

The northern harrier (*Circus cyaneus*) is slowly making a comeback in NH and has been documented in Whitefield. With 7.8% permanent openings and mowed fields, Whitefield provides habitat for these raptors as well as others. The Graceful Clearwing (*Hemaris gracilis*) is the rare insect species documented in Whitefield.

Natural Resource Inventory for Whitefield, NH



A rare photo opportunity of an osprey landed on the ground, taken at Forest Lake State Park. It is believed that this bird flew into the chain-link fence camouflaged by shrubs and trees. Fortunately it flew off unharmed after a few minutes.-

The abundance of steep slopes, forestland, and wetland complexes in Whitefield suggest that other plant and animal species exist, but need further investigation and documentation.

Below is a list of rare, threatened, or endangered species documented throughout the Town of Whitefield. Most of these species have historical species occurrences, which mean that they have not been seen for over 20 years. Data was extracted from the New Hampshire Natural Heritage Inventory Bureau.

**New Hampshire Natural Heritage Inventory  
Rare Species and Exemplary Natural Communities throughout Whitefield<sup>1</sup>**

Species Name	Listed?		# Locations reported in last 20 years	
	Federal	State	Town	State
<b>NATURAL COMMUNITIES - Palustrine</b>				
*Northern white cedar – balsam fir swamp	-	-	1	21
Northern white cedar seepage forest	-	-	Historical	8
<b>PLANTS</b>				
Ciliated Aster ( <i>Aster ciliolatus</i> )	-	T	Historical	9
Ciliated Willow-herb ( <i>Epilobium ciliatum</i> )	-	T	Historical	24
Climbing Fumitory ( <i>Adlumia fungosa</i> )	-	T	Historical	16
Green Adder’s-mouth ( <i>Malaxis unifolia</i> )	-	T	Historical	53
Hidden Sedge ( <i>Carex umbellata</i> )	-	E	Historical	12

<sup>1</sup>

Natural Resource Inventory for Whitefield, NH

Species Name	Listed?		# Locations reported in last 20 years	
	Federal	State	Town	State
Loesel's Twayblade ( <i>Listera loeselii</i> )	-	T	Historical	25
Slender Sedge ( <i>Carex gracilescens</i> )	-	-	Historical	1
Small Yellow Lady's-slipper ( <i>Cypripedium parviflorum</i> )	-	E	Historical	10
Thin-leaved Alpine Pondweed ( <i>Potamogeton alpinus</i> )	-	T	Historical	7
Wapato ( <i>Sagittaria cuneata</i> )	-	T	Historical	10
<b>VERTEBRATES - Birds</b>				
** Northern Harrier ( <i>Circus cyaneus</i> )	-	E	1	32
** Rusty Blackbird ( <i>Euphagus carolinus</i> )	-	W	1	8
<b>INVERTEBRATES - Insects</b>				
Graceful Clearwing ( <i>Hemaris gracilis</i> )	-	-	Historical	8

**Listed?** E = Endangered T = Threatened  
**Flags** \*\*\*\* = Highest importance  
 \*\*\* = Extremely high importance  
 \*\* = Very high importance  
 \* = High importance

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 Natural Heritage Inventory at (603) 271-3623 to learn more about this or other ways of setting priorities.

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 percent are nongame wildlife species - not hunted, fished or trapped. Twenty-one species are endangered and thirteen are threatened in the state. The New Hampshire Fish and Game Department maintains a list of Endangered or Threatened animal species in New Hampshire, which is shown below. Little information is available relative to their occurrence in Whitefield, but their habitats, when identified should be protected.



A black-backed Woodpecker observed in a dense softwood stand in Whitefield.

Natural Resource Inventory for Whitefield, NH

**Endangered and Threatened Wildlife in New Hampshire - Effective 04-06-03**

**ENDANGERED**

Common Name	Scientific Name
<b>MAMMALS</b>	
Canada lynx	<i>Lynx canadensis</i>
Small-footed bat	<i>Myotis leibii</i>
<b>BIRDS</b>	
Pied-billed grebe	<i>Podilymbus podiceps</i>
Bald eagle*	<i>Haliaeetus leucocephalus</i>
Northern harrier	<i>Circus cyaneus</i>
Golden eagle	<i>Aquila chrysaetos</i>
Peregrin falcon	<i>Falco peregrinus</i>
Piping plover*	<i>Charadrius melodus</i>
Upland sandpiper	<i>Bartramia longicauda</i>
Roseate tern*	<i>Sterna dougallii</i>
Common tern	<i>Sterna hirundo</i>
least tern	<i>Sterna antillarum</i>
purple martin	<i>Progne subis</i>
sedge wren	<i>Cistothorus platensis</i>
<b>FISH</b>	
Sunapee trout	<i>Salvelinus alpinus</i>
Shortnose sturgeon*	<i>Acipenser brevirostrum</i>
<b>REPTILES</b>	
Timber rattlesnake	<i>Crotalus horridus</i>
<b>AMPHIBIANS</b>	
Marbled salamander	<i>Ambystoma opacum</i>
<b>INVERTEBRATES</b>	
Dwarf wedge mussel	<i>Alasmidonta heterodon</i>
Brook floater	<i>Alasmidonta varicose</i>
Frosted elfin butterfly	<i>Incisalia irus</i>
Karner blue butterfly*	<i>Lycaeides Melissa samuelis</i>
Persius dusky wing skipper	<i>Erynnis persius persius</i>
Ringed bog haunter dragonfly	<i>Williamsonia lintneri</i>

**THREATENED**

Common Name	Scientific Name
<b>MAMMALS</b>	
Pine marten	<i>Martes Americana</i>
<b>BIRDS</b>	
Common loon	<i>Gavia immer</i>
Osprey	<i>Pandion haliaetus</i>
Cooper's hawk	<i>Accipiter cooperii</i>

## Natural Resource Inventory for Whitefield, NH

Common Name	Scientific Name
Arctic tern	<i>Sterna paradisaea</i>
Common nighthawk	<i>Chordeiles minor</i>
Three-toed woodpecker	<i>Picoides tridactylus</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
<b>REPTILES</b>	
Eastern hognose snake	<i>Heterodon platyhinus</i>
<b>INVERTEBRATES</b>	
Pine pinion moth	<i>Lithophane lepida lepida</i>
Pine barrens Zanclognatha moth	<i>Zanclognatha Martha</i>
Cobblestone tiger beetle	<i>Cicindela marginipennis</i>

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 (271-3623), or the Nongame and Endangered Species Program of the NH Fish and Game Department (271-2461).



With the abundance of mature forest and wetlands, future studies for rare, endangered, or threatened species seem warranted in Whitefield.

## **Scenic Resources**

Whitefield's location on the Johns River, along with its general hilly topography, provides residents and tourists with many scenic resources. In recent years, development and population growth throughout the state and region have caused people to appreciate the natural scenery northern New Hampshire has to offer. Along the roads throughout Whitefield, visitors and residents have panoramic views of mountains, rolling hills, and the Johns River. From many vantage points the views include landscape scenery dominated by wetlands or waterbodies surrounded by forest. The combination of abundant steep slopes along with trails and class VI roads provide for numerous panoramic views throughout the Town.

Another means to obtain a view of the landscape is from the air. Whitefield is home to the Mount Washington Regional Airport with a 3,500' asphalt airstrip located near Airport Marsh and the confluence of Carroll Stream with the Johns River in the eastern part of town. This offers a unique opportunity for Whitefield residents to fly over their town for a birds-eye-view. This is a particularly popular view during the fall foliage season.



The left photo shows the Mount Washington Regional Airport and a portion of the Johns River. To the right is an example of one of the many scenic views of the White Mountains found throughout Whitefield.

The following are some of Whitefield's many scenic vista points.

- Several locations on Kimball Hill Road
- Bray Hill Road
- Airport Marsh and Mount Washington Regional Airport area
- Several locations on Route 116

## Natural Resource Inventory for Whitefield, NH

- Several locations on Route 3
- The Mountain View Road
- The Crane Road
- The Spencer Road
- Pondicherry Refuge trailhead and kiosk

The Town of Whitefield has designated four Scenic Town Roads:

Kimball Hill Road    Hall Road    Gould Road    Spencer Road



An excellent view of the White Mountains from Route 116; much of the area in Whitefield overlooking this view is part of the Pondicherry Refuge.

### ***Conservation Land***

At the time of this study, there are approximately 1,627 acres of conservation land in Whitefield. This is equivalent to 7.4% of the land area. There are other areas more recently placed into conservation easements, but their exact size and location have not been entered into the GRANIT database at this time. Much of this newly conserved land is part of expansions of the Pondicherry Refuge.

A conservation easement on private land is a property right that can be bought or sold. It allows property owners to put limitations on their property when an easement is sold, or for another person to set limitation upon the property owner when an easement is purchased. There are efforts by landowners in the town to conserve and connect smaller parcels into one larger, contiguous area of land for conservation.



## Natural Resource Inventory for Whitefield, NH

Diverse natural resource features were found in this wetland complex at the end of the Johns River Deadwater entering Little Cherry Pond at the Whitefield/Jefferson town line.

One of the largest contiguous areas in conservation is the Pondicherry Refuge currently containing approximately 5,000 acres (and continuing to expand) in Jefferson and Whitefield. The Pondicherry Refuge contains unique habitat and connectivity with an impressive diversity of plant and animal species.

### ***Invasive Plant Species***

There is an increase in public awareness and concerns about the increase in the number of species and the rapid growth of various invasive species in NH and throughout New England, particularly around water bodies and wetlands. Two species were observed and documented during fieldwork for this project; Japanese Knotweed (*Polygonum cuspidatum*) and Purple loosestrife (*Lythrum salicaria*).



Japanese knotweed was observed in a number of locations.



Purple loosestrife was observed in a few locations, particularly near the airport along the Johns River.



Though not usually thought of as an invasive species, this lupine was observed in full bloom in November on Bray Hill.

## Natural Resource Inventory for Whitefield, NH

The Town of Whitefield may want to consider seeking assistance from the Conservation Commission, Connecticut River Joint Commission, IPANE, NEWFS, Friends of Pondicherry Refuge, and other organizations that have begun programs to control or eradicate invasive species.

### ***Habitat Area Summary Table***

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

<b>Habitat Type</b>	<b>Number of Acres</b>	<b>Number of Square Miles</b>	<b>Percentage of Town Land Mass</b>
Whitefield Town Boundary	21,952	34.3	100%
Dense Softwood Cover	2,492	3.9	11.4%
Wetland Complexes (from NWI data)	2,402	3.8	10.9%
Hydric Soils	11,271	17.6	51.3%
Aquifers Total:	3,766	5.9	17.2%
Stratified Drift	3160	4.9	14.4%
Till	605	0.94	2.8%
Bedrock	1.26	<0.1	<0.1%
Permanent Opening	1,713	2.7	7.8%
Prime Farmland	390	0.6	1.8%
Farmland of Statewide Importance	812	1.3	3.7%
Farmland of Local Importance	4,354	6.8	19.8%
Steep slopes – 15% and greater	2,491	3.9	11.3%
Steep slopes – 25% and greater	895	1.4	4.1%
Conservation Lands	1,627	2.5	7.4%

### **DISCUSSION – FUTURE APPLICATIONS AND BENEFITS**

This project has compiled natural resource data into a digital database and GIS format. It contains a database with a comprehensive, updateable, digital inventory of the entire Town. It is also anticipated that efforts from this project will aid in future work and inventories, as well as provide data for future development in the Town of Whitefield.

## Natural Resource Inventory for Whitefield, NH

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 identified and classified. Data gathered from this work will also assist the Planning and Select Boards and the Conservation Commission in determining possible conflicts for future development. Perhaps the most powerful advantage of this project is that future studies and events can be integrated to build upon this database and the Town's existing GIS indefinitely.

Based on results from this study Watershed to Wildlife, Inc. and the Whitefield Conservation Commission have identified areas for additional work. They include the following:

1. By identifying existing riparian buffers, the Town can examine areas where new buffers should be established or where existing ones should be extended and protected. Riparian landowners should be encouraged to retain, enhance, or improve buffers along the riverfront. Depending on the goals of the landowners, they should be encouraged to grow shrub and tree buffers as wide as possible. Further discussions on this topic can be found in the *Johns River Watershed Assessment Study* done by the Johns River Conservation Group
2. There are numerous wetland complexes adjacent to the Johns River and its tributaries, including several large ponds and lakes. The importance of wetlands in floodplains cannot be over emphasized. It is hoped that the Town will pursue ways to study the functionality and vulnerability of these wetlands, with a long-term goal of prime wetland designations.
3. Based on results from this project, there are numerous, though mostly fragmented, softwood stands in Whitefield. This suggests that maintaining the existing stands for the benefit of the deer, moose and other wildlife populations is very important.
4. The potential for a population increase throughout the Town makes it wise for landowners to sustainably conserve their land, particularly along the Johns River. By taking a proactive approach to deal with future development pressures, the scenic vistas and beauty will remain as impressive (or even better) tomorrow as they are today. Scenic easements are types of conservation easements that make protection of scenic resources possible.
5. It is hoped that Whitefield will continue to work with other organizations and agencies throughout the region to share future data as it becomes available. This will avoid an all-to-common problem of separate entities replicating work. Below are some examples:
  - a. In 2003, the Johns River Conservation Group completed an assessment for the Johns River Watershed and that data was incorporated into this project. Information from this study should be offered to the communities within the watershed.

## Natural Resource Inventory for Whitefield, NH

- b. WCC member, Rita Chadwick conducted a GIS ArcView analysis for Whitefield as part of her senior project through NH Community Technical College.
- c. The abutting Town of Dalton has done a Phase I and Phase II NRI and a detailed study of the Chase Bog Wetland Complex, which is partially located in the Town of Whitefield. A collaboration of data and planning with the Dalton CC would be beneficial to both towns. (This is also true with the towns of Jefferson and Lancaster.)
- d. By further collaborating and sharing data with local elementary schools, high schools, academies, and colleges, Whitefield can continue to update its natural resource inventory. The NRCS soils office, NH Fish and Game Department, UNH Cooperative Extension, NH Audubon, The Nature Conservancy, and the US Fish and Wildlife offer services to Whitefield. These agencies are examples of partners for future work.
- e. Examples of future work include habitat transects, further wetland identification and delineation (possibly with Designated Prime Wetland options), water quality testing, monitor well sampling, and species counts.

Long-term usages of this project could include, but are not limited to: assisting the Town and others in determining “least-impact” sites for telecommunication towers; guiding refinement of the Master Plan based on impacts of the Johns River corridor; and empowering the Town to digitally produce “what-if” scenarios with visual plots for proposed development in the Town of Whitefield. Furthermore, the Town is in a position to request that all future development plans be delivered in digital format, which would build upon the initial database as well as update the tax maps for assessment at little cost to the Town.

**MAPS**