

CHAPTER 6: NATURAL RESOURCES



6.1 NATURAL RESOURCES INTRODUCTION

Center Harbor is well endowed with an abundance of natural resources. Nearly surrounded by large lakes, Center Harbor boasts more shoreline per acre of land than almost any other town in the state. Surface and groundwater resources abound in Center Harbor, and numerous wetlands protect drinking water supplies, prevent flood damage, and provide exceptional wildlife habitat. Productive soils grow healthy forests and maintain the scattered agricultural lands in town. Clean air, water, and land continue to attract visitors and year-round residents alike, as indicated by the 9% growth rate over the past ten years. This rate of increase comes with increasing pressure on natural resources, however, and planning for future land use requires that a careful inventory and assessment of natural resources be completed. Recent efforts by the Center Harbor Conservation Commission has resulted in a very detailed accounting of Center Harbor's natural resources, the very fabric of which sustains the quality of life that residents and visitors currently enjoy.

6.1.1 Highlights from the Recent Natural Resources Inventory

Center Harbor has:

- Over 25 miles of shoreline on three of New Hampshire's major lakes
- Over 28% of its land area covered by surface water and wetlands
- More than 70 active agricultural areas totaling over 400 acres
- Over 90 acres of prime farmland soils and 6,700 acres of farmland soils of statewide or local importance
- An elevation drop of 617 feet from the high point on Sunset Hill (1,121 feet) to the low point at Lake Winnepesaukee (504 feet).
- More than 500 acres of wintering deer yards at 33 locales
- Over 900 acres of prime wildlife habitat that supports rare species or natural communities

Other Natural Resources in Center Harbor include:

- Two types of bedrock –Kinsman granite (Dk2x) & Winnepesaukee tonalite (Dw3A)
- Soils that are 76% glacial till, 1% glacial outwash, less than 1% alluvium, 2.5% organic material, and 2% filled land, with the remainder in open water
- Over 28 miles of rivers and streams, 8.3 miles of which are perennial
- Part of two major watersheds—Squam (Pemigewasset) River, Winnepesaukee River
- Four major surface water bodies:
 - Squam Lake – 1,394.1 acres in Center Harbor with 18.0 miles of shoreline
 - Winnepesaukee Lake – 323.5 acres in Center Harbor with 3.7 miles of shoreline
 - Lake Waukewan – 15.7 acres in Center Harbor with 1.8 miles of shoreline
 - Winona Lake – 78.8 acres in Center Harbor with 2.1 miles of shoreline
- 1,070 acres of hydric soils and 217 acres of Prime Wetlands
- Over 7,450 acres of forest/shrub land or roughly 72% of Center Harbor's total land area.
- 2,989 acres (28.8%) in Tier 1 wildlife habitat (highest relative rank by ecological condition in NH), and 3,058 acres (29.4%) of Tier 2 wildlife habitat (highest in biological region)
- 862.4 acres of protected lands as of April 2010, with two parcels managed by the Center Harbor Conservation Commission and remainder in private land trusts stewardship.

6.2 PHYSICAL LANDSCAPE

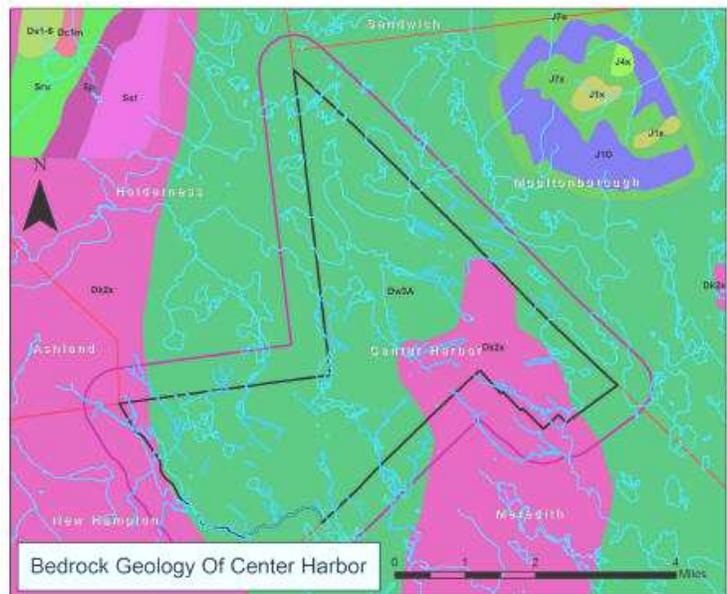
Center Harbor lies in the heart of the Lakes Region of New Hampshire near the northwest edge of the Northeastern Highlands (Level III) Ecoregion.¹ It falls within the Level IV Sub-region identified as the Ossipee-Sebago Hills and Plains. This region is known for an abundance of lakes and ponds amidst sandy glacial outwash and till. It is largely forested, with hemlock-hardwood-pine and northern hardwood-conifer forests predominant in the uplands. The region is also transitional from the more rugged, higher elevation White Mountains to the north and low-lying plains to the southeast. As a result, some of the isolated peaks and mountain ranges contain boreal elements, such as can be found in the Ossipee Mountains. In Center Harbor, the only montane forest of this type can be found on the highest elevation point (1,121 feet) on Sunset Hill. Additional higher elevation points can be found at “Observatory Hill” (910 ft.), McCrillis Hill (1,085 ft.), and Fogg Hill (985 ft.), although these hills are cloaked with northern hardwood-conifer forests in their upper part. [see Map 6-1: General Topography].

An average of four inches of precipitation falls each month, and supplies both surface water bodies and sub-surface aquifers with needed water. As noted above, nearly 20% of the town is permanently inundated, and at least nine named islands can be found within the four lakes in Center Harbor. Wetlands make up the balance of the surface water areas (10.3% of the town). These can be found adjacent to lakes, ponds, rivers and streams, as well as on flat terraces from low to high elevations. Groundwater infiltration is greatest in these flat or low slope areas, and five areas in town stand out as containing significant aquifers: 1) around the village and Center Harbor Bay, 2) along US Route 3/ NH Route 25 (Hawkins Brook), 3) at the Holderness town line along Swainey Brook, 4) along the Snake River, and 5) around the south edge of Hawkins Pond [see Map 6-2: Water Resources].

Figure 6-1: Bedrock Geology of Center Harbor

6.2.1 Bedrock Geology

The foundation of Center Harbor is comprised of Late Devonian magma domes associated with the Acadian Period of mountain-building.² Upwelling crustal material formed large crystalline granites of the Kinsman and Winnepesaukee formations during active periods of continental crust collision. The Kinsman Formation material can be easily identified by its large (i.e. 2 – 3 inch) crystals of potassium feldspar that are embedded in a fine granite or granodiorite matrix. It makes up less than 25% of the town and can be found in the



¹ For more information on Ecoregions, see www.fws.gov
² See *Bedrock Geology of New Hampshire* (1997) Lyon

Winnepesaukee trough. The slightly older Winnepesaukee Formation is comprised of even, medium-sized crystals of mica, quartz, and feldspar and has a more “classic granite” look to it. It can be found throughout the remainder of the town, including the Squam Lake trough, the western highlands section, and along the Winona Lake-Snake River drainage. Some of the higher hills in Center Harbor are comprised of erosion-resistant pegmatite formed during this period of uplift. Good examples can be seen on Sunset Hill, McCrillis Hill and Fogg Hill.

6.2.2 Surficial Geology

Three-quarters of Center Harbor is overlain with glacial till, a loose assortment of boulders, stones, cobbles, sand, silt and clay that was laid down by the Wisconsin ice sheet over 13,000 years ago. Most of this till comes with greater than 15% stones or boulders in the mix, and at least half of the till comes with a hardpan (densipan) at less than three feet from the surface. The erosional byproducts of granite tend to be coarse, and so many of the areas where glacial debris was deposited by water contain evenly sorted beds of soil particles between .05 and 2.0 mm in diameter. These “stratified drift” materials provide a good source of sand and gravel and in some cases, excellent recharge areas for groundwater. *Stratified drift* aquifers are shown on the Map 6-2: Water Resources along with other areas where sand and gravel have been deposited. The largest concentration of these deposits is at the five sites noted above.

6.3 AGRICULTURE and SOILS

6.3.1 Soils

The predominance of glacial tills noted above has been acted upon for more than 13 millennia by climate, vegetation, and topography. Chemical and physical alteration of the parent soil material has resulted in very good growing conditions for plants over most of the landscape. Only in areas where surface water, steep slopes, or abundant stones and boulders adorn the hillsides has agriculture – or silviculture in extreme cases – been interrupted. Till soils range from low, flat terraces to higher elevation, steep slopes. Many are in stony or bouldery phases, although several have been modified somewhat by the removal of surface stones to nearby walls. Depths exceed five feet in certain places, although most depths are less than three feet to either ledge, boulders, or water saturation.

Sand and gravel deposits as noted above comprise less than one percent of Center Harbor’s landscape, including those areas where water is at or near the surface. Where surface water stands for more than one month during the growing season, organic soils have developed.³ During the wetland soils mapping project of the recent natural resources inventory (NRI) a total of 260 acres of organic soils were identified in Center Harbor. While these soils are poorly rated for growing crops or trees, some of them have been drained or filled for past land uses. In all, a total of 1.9% of the land in Center Harbor has been identified as containing fill materials.

6.3.2 Agriculture

³ By definition, organic soils have > 12.5% carbon by volume for a minimum depth of 16 inches.

Nearly 65% of the soils in Center Harbor are either *prime farmland soils*, soils of *statewide importance*, or soils of *local importance* according to the U.S. Department of Agriculture's Natural Resource Conservation Service.⁴ These three soils types are comprised of deep sandy loams or loamy sands, are not excessively droughty, and contain sufficient amounts of organic matter to provide excellent nutrients for plant roots. Prime farmland soils can be found in at least six different areas, and all are associated with active agricultural land. Over 90% of the prime farmland soil is under production for hay, Christmas trees or other crops. Greater than 97% of the remaining active agricultural areas lie within soil map units that are rated good to excellent for agriculture. These areas are mostly open fields that are kept mowed for open space, although some, such as along Center Harbor Neck Road, are under crop and hay production. [Map 6-3: Important Soils].

6.4 FOREST RESOURCES

One of the most important natural resources in Center Harbor is its forests. Center Harbor has over 7,110 acres of forest land or approximately 68% of Center Harbor's total land area as shown on Map 6-4: Forest Cover. Taking out the open water areas, Center Harbor is over 85% forested.

Center Harbor's forests are nearly all second growth forests that were cut over or burned at the time of settlement in the late 18th century. Over the course of just a few decades the initial primeval forests of hemlock, spruce, oak, pine, and chestnut were converted to farm fields, pastures, and fuelwood lots. Tens of miles of stonewalls attest the fact that one time, more than 75% of the town was farmed. Many of the islands in Squam Lake, extensive marshlands, and steep, bouldery slopes were the only places where trees remained. As a result, a small fraction of the original forests can be witnessed today. An old growth patch of hemlocks can be seen at Chamberlain-Reynolds Forest on Squam Lake, an ancient black gum swamp resides on Center Harbor Neck, and residual pasture trees that were left for shade can be seen atop Fogg Hill.

6.4.1 Forest Cover Types

Map 6-4: Forest Cover shows a predominance of mixed forest types in Center Harbor. The most common is what is called the Hemlock-Hardwood-Pine Type by the NH Fish & Game Department.⁵ Dominated by canopy species such as eastern hemlock, beech, red oak, and white pine, this type is estimated to cover over 7,000 acres of the town. This mixed forest can be found on all of the lower slopes and hillsides up to about 1,200 feet in elevation. It occurs on well-drained soils, with hemlock and beech occupying the wetter sites and red oak and white pine the drier sites. Near the tops of the major hills in Center Harbor, where south-facing slopes occur on thin, rocky soils, the entire forest can be made up of red oak and white pine. Occasionally, white oak and red pine can be found on these south-facing slopes as well.⁶

Only on the highest hills, especially those with a northerly aspect, can one find the Northern Hardwoods-Conifer Forest Type. It is uncommon in Center Harbor, although this type can be easily seen on the north side of McCrillis Hill along the roadside. There is also a small amount on Sunset Hill. The dominant canopy species are sugar maple, beech, yellow birch, and hemlock; although in most areas of the town where it occurs, hemlock and yellow birch tend to be the

⁴ The latest soils information can be viewed or downloaded at www.soildatamart.usda.gov

⁵ The statewide coverage of forest and other habitat types can be viewed at www.wildlife.state.nh.us/

⁶ Predominantly oak-pine forests on dry, thin soils correspond to the Appalachian Oak-Pine Type according to the NH Fish & Game Department (see Section 6.6.2).

most frequent. Occasionally, this forest type can be found along cool drainageways that benefit from the cold air descending from nearby hills. A walk up into the far reaches of Belknap Woods will provide a view of such a forest.

The NH Fish and Game Wildlife Action Plan habitat maps as cited below illustrate a small patch of the Lowland Spruce-Fir Forest Type in Center Harbor. Located on Sunset Hill, this roughly 19 acre patch occupies the uppermost, north-facing slopes of the hill. Although not verified on the ground, this type typically contains a high percentage of red spruce and balsam fir, along with an occasional paper birch and yellow birch. This habitat is considered a “lowland” type because it does not occur above 2,500 feet in elevation, whereas the Montane Spruce-Fir Forest of the White Mountains occurs above this elevation on the average. Some of the best local examples of this forest type can be seen atop Red Hill, at the Castle-in-the-Clouds (Mt. Shaw), and on Leavitt-Ladd Mountain in Meredith.

The remaining forest types in Center Harbor largely belong to forested wetlands, and are more fully described in the Water Resources section.

6.4.2 Unfragmented Lands

Unfragmented lands are land blocks—typically forested uplands—that are not bisected (fragmented) by roads or railroad corridors. They are also located away from residential and commercial development. Unfragmented lands are important as sources of forest products, as wildlife habitat, and as intact watersheds that supply clean drinking water. In Center Harbor there are approximately 7,117 acres of unfragmented lands. Excluded from this area is 1812 acres of lakes, 712 acres of roads and roadside buffers, 439 acres of non-forest wetlands, 314 acres of certain forested wetlands, and 402 acres of active agricultural lands. Roadside buffers varied according to the type of the roadway, and were based on the rationale that a less travelled or narrower roadway presents less of a barrier to accessing forest resources and provides an easier crossing for wildlife. The following buffer widths from roads in Center Harbor were used for this analysis:

<input type="checkbox"/> State roads, Class I & II	110 feet
<input type="checkbox"/> Class V, paved	75 feet
<input type="checkbox"/> Class V, gravel	50 feet
<input type="checkbox"/> Class VI	0 feet
<input type="checkbox"/> Private roads, paved or unpaved	50 feet

Forest blocks of 500 or more acres tend to have high value for ensuring healthy wildlife habitat as well as providing a significant opportunity for sustained forest management (see 6-5: Unfragmented Lands). Center Harbor has four significant forest blocks, each of which contains more than 500 acres within the town’s borders. The largest block, over 900 acres, exists north of Lake Waukegan on the slopes of Fogg Hill. The second largest forest block includes an area north and west of Waukegan Golf Course (more than 700 acres). The third largest block surrounding Belknap Woods has over 600 acres in town, and another 800 acres in Meredith. The fourth largest forest block surrounds Sunset Hill and has just over 500 acres in Center Harbor. Curiously, one of the smallest forest blocks in Center Harbor (180 acres) is connected to the largest unfragmented land area that is adjacent to the town - an area of over 3,000 acres in northeast Center Harbor and southeast Ashland.

6.5 WATER RESOURCES

6.5.1 Watersheds

Center Harbor contains a portion of two of the large watershed divisions in the state of New Hampshire,⁷ – the Squam Lake watershed of the Pemigewasset River and the Winnepesaukee Lake watershed of the Winnepesaukee River Basin. The Squam Lake watershed includes just one sub-watershed with 5,730 acres in Center Harbor (55%) and the Winnepesaukee River watershed includes three sub-watersheds – Lake Waukewan, Meredith Bay, and Center Harbor Bay – that contains 4,664 acres or 45% of the town. There are 11 hydrologic units known as “catchments” that comprise these four sub-watersheds, each of which is associated with a perennial stream. Five of these serve the five prime wetlands in Center Harbor; two more feed into Squam Lake; one flows into the lower portion of Center Harbor Bay; two drain into Lake Waukewan, and the remaining catchment lies above Winona Lake.

6.5.2 Large Water Bodies

Surface water covers over 28% of Center Harbor.⁸ Of this, four principal water bodies are recognized:

Table 6-1: Major Lakes in Center Harbor

Water Body Name	Total Acres	Acreage in Center Harbor	Percent of Total Acreage	Miles of Shoreline
Squam Lake	6,765	1,394.1	20.6	18.03
Lake Winnepesaukee	44,586	323.5	.73	3.68
Winona Lake	148	78.8	53.2	2.04
Lake Waukewan	912	15.4	1.69	1.76

Center Harbor includes most of the southeastern portion of Squam Lake, including Dog Cove and Sturtevant Bay. Center Harbor Neck divides the latter two coves, and High Haith forms the eastern boundary of Sturtevant bay and is the northernmost piece of contiguous land in the town. Center Harbor includes most of Great Island, all of Mouse Island and Kimball Island and most of Long Island in Squam Lake. In Lake Winnepesaukee there are three islands in Center Harbor Bay – two known as Half Mile Island and one known as Mile Island, both of which were named for the distance from the principal boat dock of the *Mount Washington*. There are no islands contained in the Center Harbor portion of either Lake Waukewan or Winona Lake.

6.5.3 Streams and Rivers

Map 6-2: Water Resources in Center Harbor indicates that there are 11 perennial streams and 32 additional intermittent stream systems. Perennial streams total 9.16 miles and include the 1.3 mile long Snake River, the 1.3 mile Hawkins Pond tributary, the 1.3 mile unnamed brook feeding into Center Harbor Bay, and the 1.25 mile section of Hawkins Brook above the Meredith town line.

⁷ Known as “HUC 8” watersheds, the “Hydrologic Unit Codes” at this level contain eight digits in their numerical identifier. Pemigewasset River is known as 0107001 and Winnepesaukee is known as 0107002.

⁸ For a complete list of surface water bodies in Center Harbor, see Appendix A.

All of the latter do not include the flatwater (wetland) portions of the tributaries nor the ponds associated with these wetlands. There are 19.5 miles of intermittent streams, many of which feed into the perennial streams. Several short sections can also be found leading directly into the four major water bodies noted above. Although these contain very small catchments without perennial characteristics, they form critical basins that directly affect the water quality of the surface waters downstream.

There are no large (i.e. 4th order) streams or rivers in Center Harbor. This is significant because of the strict regulations associated with such streams and rivers in the state. The N.H. Comprehensive Shoreland Protection Act (RSA 483-B) outlines restrictions to development and other activities within the 250-foot buffer zone of all great ponds (i.e. natural lakes and ponds > 10 acres in size) all fourth order (and some named third order) streams and rivers.⁹ In Center Harbor, the largest riverine system is the Snake River, which is considered a third order stream.¹⁰ All four water bodies described above, along with Hawkins Pond, Bear Pond, and Otter Pond are considered great ponds, however, and are protected in part under the CSPA.

6.5.4 Groundwater

Map 6-2: Water Resources shows the presence of nine stratified drift aquifers in Center Harbor (352 acres). Mapped by the N.H. Department of Environmental Services Water Resources Division in 1987, these areas include porous, sands and gravels associated with glacial outwash where precipitation and infiltration rates are high. In four cases, the plurality of the mapped aquifer lies within Center Harbor, however in the fifth case (along Swainey Brook), most of the aquifer lies outside of the town. All of the Winnepesaukee watershed aquifers are low yield – i.e. less than 1,000 square feet per day transmissivity.¹¹ The single aquifer in the Pemigewasset watershed along Swainey Brook is rated as a medium yield aquifer at more than 2,000 square feet per day. Since these groundwater resources supply many private wells – at least 8 in Center Harbor – as well as virtually all of the large surface waters of the town, they are extremely important to protect.

Map 6-3: Important Soils also shows where at least one fairly large deposit of sand and gravel exists outside of a known aquifer area. The flat terrace along Beaverside Drive off of US Route 3/ NH Route 25 contains a 33-acre area with Colton loamy fine sand where groundwater infiltration and drinking water supply potential is also very high. Whereas this is likely not the only area where sand and gravel deposits support rapid infiltration by precipitation, snowmelt, and run-off, it would be of benefit to consider mapping all known past and present gravel pit areas to better understand where groundwater resources lie within the town.

6.5.5 Water Quality

Squam Lake Watershed

⁹ The Comprehensive Shoreland and Protection Act (CSPA) can be found at <http://www.gencourt.state.nh.us/rsa/html/NHTOC/NHTOC-L-483-B.htm>.

¹⁰ A full explanation of the Strahler stream order classification system can be found in C.A. Frissell, W.J. Liss, C.E. Warren, and M.D. Hurley. 1986. A hierarchical framework for stream habitat classification: viewing streams in a watershed context. *Environmental Management* Vol. 10(2) 199-214.

¹¹ Transmissivity is a measure of the aquifer's ability to transmit precipitation into the subsurface outwash materials.

Squam Lake has been regularly monitored by the Lay Lakes Program at UNH for the past 32 years. Among the 20 monitoring locations, one is located in Center Harbor Bay near the bridge that leads onto High Haith. Both open water and tributary data have been tested for transparency, chlorophyll α , total nitrogen, total phosphorus, dissolved oxygen, biologic oxygen demand (BOD), and conductivity (specific conductance). In general, the overall water quality of the Center Harbor Bay is excellent, although there are seasonal variations that have affected this condition, especially during periods of high precipitation leading to sediment and nutrient run-off and loss of transparency.

Winnepesaukee Watershed

On the Winnepesaukee side of Center Harbor's major watershed divide, the N.H. Department of the Environmental Services Volunteer Lake Assessment Program (VLAP) has been sampling Lake Waukegan and for almost 20 years. This sampling effort has included one deepwater site in Center Harbor, Mayo Station off Mayo Shores, and several shallow water sites in Center Harbor, such as the inlet to Lake Waukegan, along the Snake River, and at Winona Lake. The same abiotic and biotic parameters have been tested, with an additional emphasis on chlorides from road salt. In general, the findings of the VLAP effort have been positive, with relatively stable and predictable levels of physical and chemical parameters among sampling stations. Some concern has been expressed about summer levels of dissolved oxygen at the lake bottom, although nutrient inputs such as nitrogen and phosphorus have been within or well below statewide averages.

Considering the high value that Waukegan Lake has for Center Harbor, New Hampton, and Meredith residents, a multi-town advisory committee was formed in 2004 to develop and implement a watershed wide management plan. The Waukegan Watershed Advisory Committee (WWAC) completed the plan in late 2005 and has been since charged with the task of its implementation. As a result, the entire watershed above Lake Waukegan has received greater scrutiny than any other watershed, sub-watershed or catchment in the town. This was demonstrated by a recent suite of abiotic and biotic samplings performed by Plymouth State University in 2006-2007. During this sampling effort, chlorides were collected monthly at 14 sampling points around Waukegan, many of which were in Center Harbor. Three of these sampling sites were also the subject of long-term biomonitoring samples. The latter are summarized by the following table:

Table 6-2: Biomonitoring Stations above Lake Waukegan 2006-2007

Site Number	General Location	Tributary Name	Latitude	Longitude	Site Type	Sampling Approach
5	Just above West Lake Road	5 - Winona Inflow	43.68690178	-71.57804324	low riffle 2nd order stream near dirt road	rock basket; series of 3 tied together
6	Below Hawkins Pond outflow dam	6 - Hawkins Pond Inflow	43.68525876	-71.56446783	2nd order stream, fast-running	rock basket; series of 3 tied together
7	150 m above inflow into lake; 1250 m below GC	7 - Golf Course Drainage	43.67175769	-71.52132550	2nd order stream below rock shelf	rock basket; series of 3 tied together

The findings from the chlorides study showed a general trend of increased levels during late winter and early spring samples followed by a rapid decline by early summer. Both the maximum spring levels and the mean summer levels have been well below the statewide average and well below the critical threshold set by the state and federal government. The biotic (macro-invertebrate) samples also showed a positive trend in pollution levels, as evidenced by a preponderance of pollution-intolerant organisms. Although some indicators of water pollution are present at isolated locales in the town, Center harbor appears to have very good water quality on the whole among all of its surface water areas.

6.5.6 Wetlands

Map 6-6: Wetlands illustrates the location of all areas in Center Harbor where water is at or near the surface of the land. Deepwater areas have been described above, yet those that involve shallow water as well as those areas that are at the edge of deepwater are described below. Wetlands are defined as follows:

“Wetlands include those areas that are inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions.” RSA 482-A:2 X.

In general, wetlands exist where surface and/or groundwater can be found at the soil surface for a long enough period of time for both hydric soil conditions to develop and wetland plants to grow. The latter, known as “hydrophytes,” include such plants as cat-tails, sedges, and rushes in wet meadows and marshes, alder, blueberry and leatherleaf in scrub-shrub wetlands, and red maple, yellow birch, and black ash in forested wetlands. Although streams and rivers are “surface waters” in the eyes of the state, they often develop wetland conditions by having bordering vegetated areas with hydric soils and prevalence of hydrophytes. Intermittent streams are also considered part of the jurisdictional wetland system by the state of New Hampshire, and therefore the Center Harbor wetlands mapping effort included these valuable surface water areas.

Wetlands provide valuable functions to society. The ability to store floodwaters reduces downstream flood damage. The recharge of groundwater into the underlying aquifer provides clean drinking water supplies. Occurring in low lying areas, wetlands also receive, trap, and process sediments and nutrients that arrive from adjacent roadways and development. Thus they improve water quality by filtering out unwanted chemicals and suspended solids in our flowing streams and ponds. Perhaps most importantly, they serve as a refuge for wildlife, and offer countless habitats, shelter areas, and food sources for mammals, birds, fish, amphibians, and reptiles.

A total of 1,102 acres of wetlands were identified during the Center Harbor NRI. This represents 10.6% of the town. With the exception of the prime wetlands, most of these were identified using 2006 aerial photography. Eight principal wetland cover types were recognized among 112 wetland complexes in town.¹² The smallest wetland was .013 acres and the largest was 123 acres, with a mean size of 2.5 acres. The attached Map 6-6: Wetlands indicates where an additional 1,004 acres of non-lake wetlands were mapped in the half-mile “ring” that surrounds Center

¹² For a list of wetland types found in Center Harbor, see Appendix B.

Harbor. In all, there are 2,106 acres of wetland and 4,164 acres of deepwater habitat in Center Harbor and the half-mile area that surrounds it.

6.5.7 Prime Wetlands

In Center Harbor, five wetlands were approved by town vote in 2006 as “prime.” In 2009, revised mapping of these wetlands allowed for the official designation of these five areas as prime wetlands by the state of New Hampshire.¹³ According to RSA 482: A-15, prime wetlands are those that by virtue of their “unspoiled and fragile nature” can be voted on by the town to be registered with the state, and thereby receive extra protection under state law. The latter includes a 100-foot development buffer or setback and a mandatory public hearing for any non-exempt activities within that buffer. Center Harbor’s five prime wetlands are detailed in Table 6-3.

Table 6-3: Prime Wetland Summary – Center Harbor

Code	Name	Acres	Acres in C.H.	Tax Map	Nearest Road(s)	Zoning
52	Paquette Wetland Complex	18.48	18.48	Sheet 4	US Route 3	RR,C
54-55	Hale Swamp	123.17	96.68	Sheet 3	US Route 3, Waukewan Road	RR
58a-d	Leroux Wetland Complex	17.52	17.52	Sheet 1, 3	McCrillis Hill Road	RR
79-80	Hawkins Pond	31.40	31.40	Sheet 1	Hawkins Pond Road, Piper Hill Road	RR
88	Johnson-Perkins Wetland Complex	26.30	26.30	Sheet 1	Piper Hill Road	RR

TOTAL 216.87 190.38

Zoning Key C = Commercial
 RR = Rural Residential

The Paquette Wetland Complex is mostly a scrub-shrub and open water marsh with significant floodwater storage and exceptional groundwater recharge capability. It is also adjacent to the Hawkins Brook Prime Wetland in Meredith. Hale Swamp is the largest and most diverse wetland complex in Center Harbor and contains excellent wildlife habitat across a low, wet divide at the headwaters of both major watersheds in the town. It also contains one of the two quaking bogs in Center Harbor. The Leroux Wetland Complex is west of Hale Swamp and includes a series of pristine beaver marshes below Pine Hill in Holderness. The Hawkins Pond Prime Wetland is located along the southern third of Center Harbor’s largest pond, and is comprised of extensive leatherleaf fern mats surrounded by open water. The Johnson-Perkins Wetlands Complex lies to the east of Hawkins Pond, and includes the headwaters of the largest wetland complex in Holderness above White Oak Pond. All five prime wetlands provide invaluable flood water storage and water quality enhancement function, as well as exceptional wildlife habitat.

6.6 WILDLIFE

One of the most highly valued features of Center Harbor’s natural resources is its wildlife. For the purposes of this chapter, the term “wildlife” includes all vertebrate and invertebrate animals, both native and non-native, that regularly occupy one or more habitats within the town. Wildlife species are an integral part of the natural aquatic and terrestrial habitats of Center Harbor, they

¹³ A summary of the prime wetlands report submitted to the state of New Hampshire is on file at the Town Hall.

provide opportunities for hunting and fishing, are excellent subjects for study, and add to the general economic health of town for visitors who come here to see and enjoy wildlife.

6.6.1 Wildlife Diversity

In general, wildlife species fall into five vertebrate classes and one large invertebrate group. The vertebrate classes include mammals, birds, fish, reptiles, and amphibians. The invertebrate group is typically split up into convenient sub-groups for the purposes of determining ecosystem health and for tallying and tracking rare species. These sub-groups include aquatic invertebrates (used for indicating water quality as demonstrated above), dragonflies and damselflies (*Odonata*), butterflies and moths (*Lepidoptera*), and “Other” (including spiders, terrestrial insects, worms, land snails, snow fleas, and hundreds of other orders and families). Based on two “bio-blitzes” and several field inventories in the Center Harbor area, the following table provides an estimate of the number of wildlife species that can be expected to occur within the municipality:

Table 6-4: Approximate Number of Wildlife Species in Center Harbor

Mammals	45
Birds	191
Fish	27
Reptiles	14
Amphibians	15
Aquatic Invertebrates	415
Odonata	85
Lepidoptera	775
Other [^]	550
GRAND TOTAL	2,117

[^] Note that this estimate is only based on what has been found to date in the region

As indicated in Table 6-4, there are over 290 vertebrate species of wildlife known for the Lakes Region that could occur in Center Harbor. This does not include accidental or casually introduced species such as the orange-crowned warbler that was found during the latest Christmas Bird Count, or the black crappie that was caught in Lake Winnepesaukee from an accidental introduction. Among vertebrates it includes all of the regularly occurring species that breed, temporarily reside or migrate through the area. Among invertebrates it includes the estimated number of year-round residents in the air, water and soil of Center Harbor. Invertebrate numbers are the most poorly known, and within the “Other” group, it is likely a very low estimate.

The diversity of forested habitats of Center Harbor include ample populations deer, moose, bear, raccoon, otter, fisher, mink, ermine, bobcat, coyote, fox, beaver, and porcupine. Higher concentrations of these species have been generally observed in isolated areas away from development and roadways. The unfragmented land areas described in the Forest Resources section define those areas where terrestrial wildlife populations can be expected to be the highest. The aquatic habitats of Center Harbor are far less subject to pervasive disturbance and typically retain wildlife species that indicate good quality habitat. This has been reflected by the N.H. Fish and Game Department’s mapping of high quality habitat within the state.

6.6.2 Wildlife Action Plan

In 2005, the New Hampshire Fish and Game Department completed its first state-wide Wildlife Action Plan (WAP). The intent of the WAP was to identify and map the commonly recognized wildlife habitats in the state, and to identify where the most critical wildlife habitat locations remain. The WAP conveys habitat information through an explicit narrative, a comprehensive species database, and a series of maps. In 2010, the habitat condition maps were updated in order to help the public focus on future conservation, restoration and management of critical habitat areas. The information contained in the WAP will continue to be revised in years to come.

The WAP identifies seventeen (17) habitat types throughout the state, six (6) of which were identified in the Town of Center Harbor. These areas are illustrated in Map 6-4: Forest Cover. Based on the findings of the Center Harbor 2010 Natural Resources Inventory, several other WAP-recognized habitat types were found to occur in Center Harbor. The following table compares the findings of the WAP versus those identified from field and aerial photo interpretation:

Table 6-5: Summary of Wildlife Habitat Types in Center Harbor

Habitat Type	Acreage (WAP)	Percent of Town	Field & Photo Interpretation	Percent of Town
Appalachian oak-pine	0	0	73.4	.70
Hemlock-hardwood-pine	7,857.2	76.6		
Northern hardwood-conifer	0	0	210.3	2.02
Lowland spruce-fir	19	.16	15.1	.14
Rocky Ridge & Talus Slope	0	0	4.0	.04
Grassland > 10 acres	590.9	5.69	401.9	3.87
Peatland	29.0	.28	255.5	2.46
Marshes	307.8	2.96	261.0	2.51
Open Water	1767.6	17.0	1997.1	19.2

The 2010 Center Harbor NRI revealed that at least three other WAP habitat types were present in Center Harbor. The south-facing oak dominated woodlands and forests described in 6.4.1 Forest Resources represents a fourth forested wildlife habitat known as the Appalachian Oak-Pine Forest. Characterized by red and white oak and white or red pine, forests of this type can be found on Fogg Hill and along Winona Lake Road. Northern Hardwood-Conifer Forests were also not mapped for Center Harbor but occur in at least five locales in town. The north-facing summits of McCrillis and Sunset Hills support forests of this type, as well as the cool-air lowlands at Belknap Woods. Lastly, several areas of Rocky Ridge & Talus habitat were found at higher elevation and/or steep slope areas. Fogg Hill contains four of these sites and McCrillis Hill one site. Because each of these sites are small (i.e. < 1.5 acres), it is likely that other rocky ridge and talus sites occur in Center Harbor.

WAP Information about the *condition* of the above habitats was further analyzed to develop a statewide and regional ranking and identify the highest condition habitat relative to all areas of a given habitat type in the state. The plan established a ranking system in four (4) tiers as follows:

- Tier 1: Habitats of Highest Relative Rank by Ecological Condition in NH
- Tier 2: Habitats of Highest Relative Rank by Ecological Condition in Biological Region
- Tier 3: Supporting Landscapes
- Tier 4: Local Significance

Table 6-6: Wildlife Action Plan Ranked Habitats in Center Harbor

Rank	Number of Units	Acreage	Percent of Town	Principal Areas
Tier 1	36	3,663.18	35.24	Squam Lake, Lake Winnepesaukee, Hawkins Pond
Tier 2	20	265.40	2.55	Proctor Sanctuary, Hale Swamp, Johnson-Perkins
Tier 3	40	3,057.84	29.42	North & central highlands; Winona Lake highlands
Tier 4	29	2,988.76	28.75	Remaining undeveloped lowlands
Totals	125	9,975.18	95.96	

Over 35% of Center Harbor contains Tier 1 habitat. These lands include Squam Lake and its 500-foot buffer, Lake Winnepesaukee and its 500-foot buffer, the Bear Pond – Hawkins Pond waterway, and the Snake River above Lake Waukegan. These areas have statewide significance for promoting biodiversity, maintaining landscape-level ecological integrity, and having limited amounts of human impacts. 2.5% of Center Harbor’s landscape contains Tier 2 habitat. The principal areas of Tier 2 habitat are the drainageway leading into Squam Lake through Proctor Sanctuary, Hale Swamp, Johnson-Perkins Wetland, and Otter Pond. While not as pristine or valuable in supporting biodiversity and exceptional species as Tier 1 habitat, this area nonetheless has regional significance according to the Wildlife Action Plan and is deserving of conservation priority. Nearly 30% of the remaining habitat in Center Harbor is ranked as Tier 3 habitat known as “Supporting Landscape.” Not unlike the Tier 4 areas of local significance, Tier 3 lands have moderate importance for promoting wildlife diversity yet are somewhat compromised by human impact factors such as roads, development, and pollution.

The Wildlife Action Plan is a valuable tool for setting regional priorities but because of its scope it cannot identify local areas that have ecological value. The following section fills this gap and provides site-specific information about those areas that rank very high *within Center Harbor* and therefore provide a clearer “road map” for conservation.

6.7 SIGNIFICANT ECOLOGICAL AREAS

Significant ecological areas (SEA’s) are lands that by virtue of their unspoiled condition, unique physical or biological features, rarity, and/or exemplary nature have special value in a particular locale. SEA’s are often qualitatively defined by ecologists or wildlife biologists through fieldwork and/or high resolution aerial photograph interpretation. In Center Harbor, 36 of the 42 SEA’s were identified during the field portion of the NRI (see Map 6-8: Significant Ecological Areas). The remaining SEA’s were identified using aerial photographs and local knowledge. A complete list of the SEA’s can be found in Appendix C.

Each significant ecological area was generally identified on the basis of the above definition and further described according to their outstanding physical and/or biological attributes. The SEA list in Appendix C notes the top three attributes associated with each SEA. Common examples include “pristine wetland,” or “wildlife habitat,” or “vernal pool.” In each case the attributes involved outstanding examples for the town. In particular, these included pristine forest or wetland areas, late successional forests that have been undisturbed for over 150 years, and areas of exceptional wildlife habitat.

6.7.1 Exemplary Natural Communities

The New Hampshire Natural Heritage Bureau (NHB), a bureau of the Division of Forest and Lands, identifies, tracks, and promotes the protection of state-listed rare plants, animals, and exemplary natural communities.¹⁴ The list of rare plants is published periodically according to state law (RSA 217-A), the rare animal list is published in cooperation with the Nongame and Endangered Wildlife Program of the NH Fish and Game Department and the NH Audubon Society. Exemplary natural communities are tracked by the NH Natural Heritage Bureau in conjunction with The Nature Conservancy and a number of consulting biologists, and are published in the “Town Lists” report that can be found at: <http://nhdfl.org.aurora.silverttech.net/library/pdf/Natural%20Heritage/TownList.pdf>.

In Center Harbor there is just one listing for an exemplary natural community, the Black Gum-Red Maple Basin Swamp. Although this is defined as “historical” in the January 2011 town list, the site for the initial listing has not changed and still contains a high quality example of this natural community. In fact, according to the findings of the 2010 NRI there are five (5) Black Gum-Red Maple Basin Swamps in Center Harbor. All five examples can be found on Squam Lake on Center Harbor Neck or High Haith and can easily be viewed by boat as they occur along the shoreline.

The absence of other exemplary natural communities on the NH Natural Bureau’s town lists is a function of limited staff resources or a lack of NHB field surveys and not actual absence of other exemplary natural communities. The SEA list in Appendix D refers to as many as nine (9) high quality natural communities that will likely prove to be of regional significance once they are properly documented. These include the Winona Lakeshore dry rich site, the dry oak-pine community on the southwest sides of Fogg Hill, the Snake River marsh, many of the above-cited black gum-red maple swamps, and four of the five designated prime wetland systems.

6.7.2 Rare & Endangered Species

A search of the NH Natural Heritage Bureau’s records of state-listed plants and animals yielded a result of seven (7) historical records (five (5) plants, and two (2) animals), and three (3) extant records (one (1) plant and two (2) animals). Although the Center Harbor NRI did not include a field-based survey of the town, previous observations by the principal investigator in the project yielded records of an additional five (5) extant species, plus several state “watch” species.

Animals

Bald eagles have become regular visitants to Center Harbor. Squam Lake, where a resident pair has been nesting since 2003, and Lake Winnepesaukee have supported winter-time eagle records during the mid-winter Eagle Count sponsored by the NH Audubon Society. Given the amount of available habitat, it is possible that a pair will breed in Center Harbor again in the future. Meanwhile, the common loon continues to breed in Center Harbor waters, particularly at Squam Lake where 3 nesting pairs have been found during the past several years. Unfortunately, none of them have produced successful fledglings due to nest failure, boating accidents, and/or predation which eliminated the eggs or chicks. Squam Lake has been home to another rare species, the lake

¹⁴ According to *Natural Communities of New Hampshire* by Spurduto and Nichols (2004), “exemplary natural communities represent the best remaining examples of New Hampshire’s flora, fauna, and underlying ecological processes.” They “include nearly all examples of rare types (such as alpine communities) and high-quality examples of common types.” More information can be found on-line at <http://www.nhdfl.org/bureaus/naturalheritage/index.htm>

whitefish, which is listed by the NH Fish & Game Department as a “species of special concern.”¹⁵ Sometimes observed during the annual fishing derby, this medium-sized sport fish can be found in both Squam Lake and Lake Winnepesaukee. Lastly, although listed as a historic species, the pied-billed grebe can still be seen migrating through Center Harbor waters in the spring and (rarely) fall, especially along the Snake River where it was last recorded as a nesting species in the 1980’s.

Plants

The only extant plant record in the NHB database is for water marigold (*Bidens beckii*), which was found by a Center Harbor resident in 2002 on Center Harbor Neck. Three of the listed historical species have been looked for by the NRI principal investigator with the result that one was relocated. Three-birds orchid (*Triphora trianthophora*) has been found on one of the islands in Squam Lake not very far from where it was originally described. Both ginseng (*Panax quinquefolia*) and Loesel’s twayblade (*Liparis loeselii*) were not relocated in the Winona Lake area after several attempts by several field botanists. Habitat conditions for the remaining two historical plants, erect knotweed (*Polygonum erectum*) and wild senna (*Cassia hebecarpa*), no longer exist at the sites where they recorded nearly 100 years ago.

Five (5) species of rare plants were found by the principal investigator during the Center Harbor Prime Wetlands Completion Project in 2009. The first, the state-endangered lake quillwort (*Isoetes lacustris*), was found in a shallow sandy bay of Squam Lake. The second and third species, both members of the figwort family, were found along Winona Road in one of the SEA’s. Both *Aureolaria pedicularia var. intercedens* and *Aureolaria flava* occur in dry, semi-rich soils with ample sunlight in the oak-pine woodland near the lake. The fourth species, squawroot (*Conopholis americana*), was also found in a dry, semi-rich oak woodland on Fogg Hill above Winona Lake. The fifth, white-fringed orchid (*Platanthera blephariglottos*), was found in Hale Swamp in its favored bog mat habitat. All of the last four species are currently listed as “State Watch” species and although they are rare, they have ample populations to keep them off the threatened and endangered list.

6.8 OPEN SPACE AND CONSERVATION LANDS

As of the end of 2010, Center Harbor had 23 parcels totaling 963.7 acres in conservation (see list in Appendix D). This represents 9.3% of the town, or 11.4% of the land area. Other than the state boat ramp on Hawkins Pond, all of the conservation lands are held by private organizations. Six (6) of these lands are held in fee, one (1) contains a reverter interest to a non-profit agency, and the remainder (15) are conservation easements that are held by non-profit land conservation organizations. The latter include the following organizations, along with the acreage that they have a direct interest in:

- Lakes Region Conservation Trust (286 acres)
- New Hampshire Audubon Society (49 acres)
- New England Forestry Foundation (195 acres)
- Society for the Protection of New Hampshire Forests (23 acres)
- Squam Lake Conservation Society (381 acres)

¹⁵ The list of rare wildlife in the state that is considered to be of “special concern” can be found at http://www.wildnh.com/Wildlife/Nongame/Nongame_PDFs/Species_of_special_concern_0309.pdf

The Town of Center Harbor through its Conservation Commission (CHCC) holds a direct interest in the 24.7 acre Kimball Island on Squam Lake. The CHCC also hold a joint conservation interest on the 271-acre Center Harbor Woods with the Squam Lakes Conservation Trust. Owned by the Lakes Region Conservation Trust who received this property in 2010 from the Dane Family after a successful fund-raising effort, this latest conservation property is the largest in town. The CHCC also holds an executory interest in two properties, the Twombly easement and the Sturtevant Bay easements on Squam Lake.

Over 86% of the conservation land in Center Harbor falls within Tier 1, Tier 2, or Tier 3 wildlife habitat types according to the NH Fish & Game Department's Wildlife Action Plan (WAP). Over half of this land is within Tier 1 habitat, and most of the rest is in Tier 3 habitat. Only 13.8% of the conservation land includes one or more Significant Ecological Areas (SEA's), however. Chamberlain-Reynolds Forest (owned by the New England Forestry Foundation) includes four SEA's entirely, and the Center Harbor Neck easements and the Center Harbor Woods property include over 95% of another two SEA's. Prime wetlands form the core of another four SEA's, yet the remaining 32 SEA's are completely unprotected. As described below, these areas should be considered top conservation priorities for the town.

In terms of future conservation, the Town of Center Harbor has a dedicated Conservation Fund that is used to support its protection of natural resources as defined by RSA 36-A.¹⁶ Much of the money for this fund comes from the Land Use Change Tax (LUCT) that is imposed on land owners who develop property that is in Current Use. At present, 25% of this tax goes toward the Conservation Fund with 75% going to the General Fund. At present there is no limit to the amount of LUCT monies that goes into the Conservation Fund.

6.9 SCENIC RESOURCES

Scenic vistas are a part of the fabric and quality of life in Center Harbor. In fact, it is the view of Center Harbor Bay as one drives into Center Harbor that gives the village so much of its charm. Although the Natural Resources Inventory was not charged with a detailed assessment of scenic resources in the town, several sites were noted during the roadside surveys that were conducted. The following list is not exhaustive, but does provide a preliminary list of exceptional scenic vistas that one can view from the roadsides of Center Harbor:¹⁷

- View from anywhere in the village of Center Harbor Bay
- View of Half-Mile Islands and Center Harbor Bay from NH Route 25 south of the village
- View of village and Center Harbor Bay from Dane Road (NH Route 25B)
- View west towards Pine Hill in Holderness from Hillcrest Farm on Dane Road
- View of Dog Cove from Dane Road
- View of Hale Swamp bog from US Route 3

¹⁶ RSA 36-A enables towns in the state to create conservation commissions through an appointment process overseen by the Board of Selectmen, City Council or other local governing body. The principal charge of a conservation commission under RSA 36-A is to "protect the Town's natural resources, to develop and maintain an inventory of those natural resources, to preserve open space and scenic views, to monitor conservation easements held by the Town, to protect water quality and to develop and distribute information to the public on conservation issues."

¹⁷ Note that many of these vistas are equally spectacular in winter or summer, but that some offer fuller views in winter

- View of lower Hale Swamp & Swainey Brook from US Route 3
- Views from the top of “Observatory Hill” along College Road
- View northwest from top of hill on Center Harbor Neck Road
- View of Squam Lake from the end of Mouse Lane
- View of the old airstrip fields along Mead Farm Road
- View of Sturtevant Bay and Moultonborough Bay from High Haith Road
- View of open fields along Coe Hill Road
- View of hayfield along Dane Road from Follett Road
- View west across field from Keyser & Tuttle Roads
- View from top of hill at Waukewan Golf Course
- View south across the cat-tail marsh off of Waukewan Road
- View west-southwest from Perkins Farm on Waukewan Road
- View of Snake River and Lake Waukewan from Waukewan Road bridge
- View of Snake River and Winona Lake from Winona Road bridge
- View of Hawkins Pond from dam on Hawkins Pond Road
- View of Hawkins Pond Prime Wetlands from Hawkins Pond Road
- View south across fields on Hawkins Pond Road near the town line
- View of Bear Pond and Hawkins Pond inflow from Piper Hill Road
- View north from near the top of Piper Hill Road
- View from the high point on McCrillis Hill Road (at bend)
- View of the Johnson-Perkins Prime Wetland from McCrillis Hill Road

The scenic resources list does not include all of the scenic views that can be had in Center Harbor, and notably omits those that can be seen away from town roads. Arguably, the views from anywhere on Squam Lake or Lake Winnepesaukee rival the best roadside views in town. Similarly, the views from the front or back porch of many residences in Center Harbor offered unexcelled vistas of neighboring towns, lakes, and distant mountain ranges. Aside from the tax burden and property value benefits of such views, the scenic quality of Center Harbor has been a long-standing tradition that has brought about carefully designed commercial architecture, subdivision plans, and roadway lay-outs in town. Enhancing and protecting the scenic views of Center Harbor should factor into all ordinances that guide development and protect property. This should include, to the extent possible, views towards Center Harbor lands from adjoining municipalities.

6.10 RECOMMENDATIONS

Center Harbor has an abundance of natural resources that offer agricultural products, wood products, clean drinking water, flood protection, wildlife habitat, water-based recreation, and hunting opportunities for residents and visitors. Whereas existing zoning ordinances and overlay districts protect some of these valuable services, there are other action steps that could be taken to ensure that Center Harbor residents continue to prosper by virtue of their natural resources in the future. The following offers specific resource protection recommendations in six key areas (A-F).

A. Bedrock and Surficial Geology

Center Harbor is almost entirely granite with bedrock aquifers that account for more than 85% of the public and private drinking water supplies. Very little is known about these bedrock water

sources and virtually no local protection is afforded these critical elements of Center Harbor's natural resources. The following action steps should be considered for long-term protection of invaluable drinking water supplies:

- 6.10.1 Conduct a bedrock aquifer study of the town.
- 6.10.2 Identify probable deep well catchment areas for each section of town.
- 6.10.3 Consider an overlay district for "headwater protection areas".

The surficial geology picture of Center Harbor is slightly more complex yet no less important in terms of providing safe drinking water supplies to town residents. As noted in Section 6.5.4, there are just six surface aquifer areas in Center Harbor that are as yet unprotected by local ordinances. In addition, as noted on Map 6-3: Important Soils, there is at least one sand and gravel resource that recharges groundwater that lies outside of the mapped aquifer areas. Regulating water use, extraction, and discharges above these groundwater supply areas would help protect drinking water supplies over the long-term.

- 6.10.4 Consider drafting and approving an Aquifer Protection Ordinance.
- 6.10.5 Inventory known and historic gravel extraction sites and consider conserving these lands as potential future wellhead areas.

B. Agricultural Resources

Section 6.3 and the Map 6-3: Important Soils describe the general soil types in Center Harbor and identify six areas (56 acres) as prime farmland, and four areas (52 acres) that contain soils of statewide importance. Together this represents only one percent of Center Harbor. Moreover, less than half of this area is in active agricultural production. Most of the 401.9 acres of active agricultural areas occur on soils of local importance. Less than 10% of these lands are currently protected from development.

- 6.10.6 Conduct an assessment of active agricultural areas and determine those with the most productive soils.
- 6.10.7 Prioritize the protection of the most productive soils areas for conservation/agricultural uses.
- 6.10.8 Consider local tax relief for productive agricultural areas parcels that are less than 10 acres in size.

C. Forest Resources

Center Harbor's forest resources are of especial value for the following reasons:

- They provide a renewable resource with economic importance and value to the region for lumber, fuelwood, and other wood products.
- They provide critical habitat for the town's flora and fauna.

- They form the backdrop for a scenic and aesthetically pleasing environment for residents and visitors alike.
- They provide ample opportunities for recreation.

Although the forests of Center Harbor mostly belong to private individuals and non-profit conservation organizations, they nonetheless hold great value in the public interest. While individual owners of small forested tracts can join together to perform timber management activities, most tracts less than 10 acres in size tend to put forestland out of production. Either large-lot (i.e. forest) zoning or direct conservation of large, unfragmented tracts of forest land will help protect this renewable resource.

- 6.10.9 Utilize the Co-Occurrence Analysis of the natural resources in Center Harbor to guide conservation of large, unfragmented blocks of forest land.
- 6.10.10 Target forest blocks with more productive soils for timber production.

D. Surface and Groundwater Resources

Center Harbor contains more than 1,800 acres across four lakes with over 25 miles of shoreline, plus an additional 224 acres of ponds and open water marshes. There are over nine miles of perennial streams, plus an additional 19.5 miles of intermittent streams that drain two major watersheds in town. Wetlands add another 1,000+ acres to lands with water at or near the surface of the soil. Sub-surface water (groundwater) is identified from nine sites (352 acres), plus an additional 33 acres of sand and gravel soils near Hale Swamp. All of these water resources provide both environmental and economic value to the community and contribute significantly to the quality of life in town.

Center Harbor has a number of water resource protection measures in place, such as the Wetlands Conservation Overlay District and five designated Prime Wetlands. State regulations, especially the Comprehensive Shoreland Protection Act, also help in the protection of surface water resources; however, they do not offer as strict an oversight as could be affected by local regulation. The following recommendations are offered for the purposes of enhancing existing land use restrictions related to water quality and quantity:

- 6.10.11 Review the existing language of the Wetlands Conservation District and consider stronger buffer restrictions, such as a 100-foot natural vegetation buffer around prime wetlands and along significant shorelines.¹⁸
- 6.10.12 Follow the recommendations of the 2009 Center Harbor Prime Wetlands Completion Project to nominate and approve additional prime wetlands in town.
- 6.10.13 Consider the designation of certain perennial streams in Center Harbor for the establishment of greater land use restrictions to protect water quality.

¹⁸ Prime wetlands are currently under review at the state level, which, as in 2010, will likely result in the relaxation of the restrictions in the 100-foot buffer zone.

- 6.10.14 Conduct periodic water quality assessments of water bodies such as Hawkins Pond that do not currently receive any statewide review.
- 6.10.15 Identify the catchment area(s) above the most likely future community well system in center Harbor and seek to protect and/or carefully manage the land within it.
- 6.10.16 Encourage best management practices for timber and erosion control, agricultural practices, and stormwater management by ensuring adequate outreach and education for all municipal officials, private residents, and landowners.

E. Wildlife and Wildlife Habitat

The information presented in Sections 6.6 and 6.7 provides a synopsis of the best wildlife habitat areas in Center Harbor. Both the Co-Occurrence Analysis contained in the 2010 NRI and the identification of significant ecological areas (SEA's) provides a road map for conservation protection of these important wildlife habitat areas. Well over half of the town contains habitat of significance according to the NH Fish & Game Department's Wildlife Action Plan or WAP. The 2010 update identified over 6,000 acres of high quality habitat around Squam Lake and Lake Winnepesaukee that has statewide or regional significance. The SEA assessment identified 42 areas totaling 902 acres, much of which includes uplands away from the WAP-identified high quality habitat areas. The aggregation of these two land assessment efforts provides the rationale to move ahead with a priority conservation plan for the town.

- 6.10.17 Target the SEA lands that also fall within the WAP-identified high quality wildlife habitat areas as priority protection sites.
- 6.10.18 Work with local non-profit land conservation organizations such as the Lakes Region Conservation Trust and the Squam Lakes Conservation Society to invite private landowners to help fulfill this goal of *apriori* protection.
- 6.10.19 Offer conservation education programs that highlights the attributes of the SEA's.
- 6.10.20 Consider publishing a guide to recreational trail opportunities in Center Harbor that utilize existing conservation properties; include canoe and kayak trails in the guide.

F. Scenic Resources

As noted in Chapter 2 and Section 6.9 above, scenic resources are an integral part of the quality of life in Center Harbor. The list of 27 vistas (Section 6.9) is a beginning step in the identification and protection of scenic value in Center Harbor. The principal recommendation found in 2.5.2: Conduct a town-wide evaluation of scenic vistas, viewsheds, and other points of interest with town volunteers familiar with the scenic resources in Center Harbor.

- 6.10.21 Work with adjoining towns in a scenic assessment project, and coordinate activities that protect the viewsheds at the major roadway entrances to the town.

APPENDIX A
List of Surface Waters

Water Body Name	Total Acreage	Acreage in C.H.	% of Total	Length of Shoreline (mi.)
Squam Lake	6,765	1394.1	20.6	18.03
Lake Winnepesaukee	44,586	323.5	0.73	3.68
Winona Lake	148	78.8	53.2	2.04
Lake Waukewan	912	15.4	1.69	1.76
Total Lakes	52,411	1,812		26
Hawkins Pond	124.36	123	100	3.1
Bear Pond	15.7	15.7	100	0.72
Otter Pond	15.0	15.0	100	0.66
Fogg Hill Bog Pond	9.6	9.6	100	0.73
Lower Golf Course Pond	8.33	8.33	100	0.57
Dane Road Pond	7.75	7.75	100	0.49
Total Ponds[^]	180.76	179.4		6.27

[^] Includes all adjacent shallow water areas with emergent vegetation

	Length of Thread in C.H.	Stream Order
Unnamed - Winnepesaukee North	1.36	1
Unnamed - Dane Rd Pd outflow	1.25	1
Snake River	58.2	25.1
Otter Pond Outflow	1.05	43.1
Unnamed - W of Hawkins Pond	0.90	1
Lands Brook	0.77	1
Hawkins Brook	0.70	1
Golf Course drainage	0.65	1
Hawkins Pond Outflow	0.61	1
Unnamed - Laurel Cove, Squam	0.52	2
Unnamed - Dog Cove	0.48	1
Belknap Woods Brook	0.43	1
Swainey Brook - upper seg.s	0.36	1
Bear Pond Outflow	0.27	1
Winona Lake Inflow	0.22	1
	0.06	1

APPENDIX B				
List of Wetland Types^				
^ Cover class types follow dominant classes only - e.g. for a PFO1/SS1E the total acreage reflects the PFO portion only				
NWI SYSTEM	Subsystem	Class	Water Regime	Acres in Center Harbor
LACUSTRINE				1812.2
	L2 - Littoral			100.8
		AB - Aquatic Bed	H - Permanently Flooded	3.2
		RB - Rock Bottom	G - Intermittently Exposed	0.1
			H - Permanently Flooded	0.2
		RS - Rocky Shore	G - Intermittently Exposed	9.4
		UB - Unconsolidated Bottom	H - Permanently Flooded	83.9
		US - Unconsolidated Shore	G - Intermittently Exposed	4.0
RIVERINE				24.7
	R3 - Upper Perennial			10.8
		RB - Rock Bottom	F - Semi-permanently Flooded	0.2
		UB - Unconsolidated Bottom	F - Semi-permanently Flooded	7.6
			G - Intermittently Exposed	1.1
			H - Permanently Flooded	1.9
	R4 - Intermittent	SB - Streambed		13.9
			E - Seasonally Flooded / Saturated	13.4
			F - Semi-permanently Flooded	0.5
PALUSTRINE				851.7
		AB - Aquatic Bed		6.5
			F - Semi-permanently Flooded	1.6
			H - Permanently Flooded	4.9
		EM - Emergent		95.5
			B - Saturated	2.4
			D - Seasonally Flooded/Well Drained	2.0

APPENDIX B				
List of Wetland Types^				
^ Cover class types follow dominant classes only - e.g. for a PFO1/SS1E the total acreage reflects the PFO portion only				
NWI SYSTEM	Subsystem	Class	Water Regime	Acres in Center Harbor
			E - Seasonally Flooded / Saturated	57.8
			F - Semi-permanently Flooded	25.5
			G - Intermittently Exposed	0.1
			H - Permanently Flooded	7.7
		FO - Forested		446.6
			D - Seasonally Flooded/Well Drained	6.6
			E - Seasonally Flooded / Saturated	411.3
			F - Semi-permanently Flooded	19.7
			H - Permanently Flooded	9.0
		ML - Moss-Lichen	B - Saturated	0.2
		RB - Rock Bottom	G - Intermittently Exposed	0.1
		SS - Scrub-Shrub		126.8
			B - Saturated	32.8
			D - Seasonally Flooded/Well Drained	0.2
			E - Seasonally Flooded / Saturated	78.7
			F - Semi-permanently Flooded	8.8
			H - Permanently Flooded	6.3
		UB - Unconsolidated Bottom		176.2
			F - Semi-permanently Flooded	7.4
			H - Permanently Flooded	168.8
UPLAND ISLANDS				207.2

APPENDIX C Center Harbor Significant Ecological Areas								
Code	Name	Locale	Attributes			ACRES	AREA (s.f.)	PERIMETER (ft)
0	Winona Lakeshore Dry Rich	East side Winona Lake along Winona Rd	Rare plants	semi-rich oak woodland	circumneutral soils	0.4	16748.3	1077.8
0	Winona Lakeshore Mesic Rich	East side Winona Lake Rd & lower talus	Rare plants	semi-rich SM-RO forest	circumneutral soils	3.4	149966.3	2965.6
0	Fogg Hill South	South and west sides of Fogg Hill	Dry Oak-Pine Forest	talus & rocky ridge	circumneutral soils	52.7	2296973.0	7328.4
0	Fogg Hill Main Summit	Main summit of Fogg Hill	Old Growth Oak	talus & rocky ridge	poss. bobcat den site	2.1	91496.2	1679.3
0	Fogg Hill East Summit	East summit of Fogg Hill	Old Growth Oak-Pine	talus & rocky ridge		0.9	38460.2	791.3
0	Fogg Hill Bog & Swamp	NW of Fogg Hill at end Fogg Hill Rd	Acidic Level Bog System	pristine beaver swamp	rare plants?	22.2	968376.0	4831.7
0	Fogg Hill Talus Area	WNW slope of upper Fogg Hill	Talus Boulder Woodland	wildlife habitat		0.6	27264.9	649.6
0	Snake River Wetland Complex	Along Town Line E side Snake River	Pristine wetland system	beaver marsh	rare animals	33.3	1451053.2	11588.1
0	Otter Pond Area	Otter Pond and associated wetlands	Remote open water body	wildlife habitat	deer wintering area	63.2	2753124.4	8160.2
0	Otter Pond North	Drainage N of Otter Pd above Bear Pd	Wildlife habitat	vernal pool	waterfall & cascades	2.7	116227.8	1563.4
0	Bear Pond East	Forested/scrub-shrub swamp E of Bear Pd	Wildlife habitat	unique wetland		12.3	534068.2	3500.5
0	Hawkins Pond Prime Wetland	Hawkins Pd and +/- 100-foot buffer	Wildlife habitat	uncommon nat. comm.	nesting waterfowl	62.0	2699357.7	8630.4
0	Johnson-Perkins Prime Wetland	Johnson-Perkins wetland & +/- 100-ft buffer	Wildlife habitat	nesting waterfowl		40.2	1752079.4	6967.6
0	Center Harbor NW	NW part of town above Winona Lk	Remote beaver wetland	wildlife habitat	potential heron rookery	7.6	329110.7	2475.8
0	Lower Piper Hill Road	N of Piper Hill Rd below Bear Pond	Lowland conifer swamp	deer wintering area	vernal pools	6.3	272682.5	2218.9
0	McCrillis Hill Talus Slope	SE side of McCrillis Hill	Talus-boulder steep slope	late succ. forest	wildlife habitat	5.7	250413.7	2060.7
0	Leroux Prime Wetland	Leroux wetland & +/- 100-ft buffer	Wildlife habitat	deer wintering area	waterfowl nesting	41.0	1786456.6	7984.0
0	Hale Swamp Prime Wetland	Hale Swamp wetland & +/- 100-ft buffer	Wildlife habitat	rare nat.comm.s	rare plants	143.0	6230694.9	21197.7
0	Chamberlain-Reynolds Old Grow	Old growth hemlock E side scrub-shrub swamp	Old growth forest	wildlife habitat	fungi diversity	5.4	236397.5	4571.4
99	Chamberlain-Reynolds Wetlands	Scrub-shrub swamp central	Pristine wetland	wildlife habitat	rare species	13.2	574485.1	6495.7
99	Heron Cove Marsh & Aquatic Bed	Squam Lake south & adjacent marsh	Pristine wetland	rare species	wildlife habitat	3.0	132086.7	2438.5
0	Chamberlain-Reynolds Beach	Squam Lake shoreline south	Remote sandy shoreline	rare species		4.0	174847.0	3058.1
99	CH Neck Black Gum SW	Squam Lake - Dog Cove upper	Pristine wetland	rare natural community		1.3	56344.8	1404.6
0	CH Neck Black Gum NW	West side of Center Harbor Neck	Pristine wetland	rare natural community	wildlife habitat	2.3	98414.1	3412.1
0	Owl's Head Neck Black Gum	Squam Lake - Neck of Owl's Head	Pristine wetland	rare natural community	vernal pool	0.6	27367.5	907.9
99	High Haith Black Gum Swamp	Squam Lake - High Haith west	Pristine wetland	rare natural community	deer wintering area	1.4	59274.5	1160.5
99	Kimball Island Shoreline North	Squam Lake - Kimball Island North	Productive shoreline	rare species	wildlife habitat	9.1	396046.5	5458.3
99	Long Island	Squam Lake - Long Island	Pristine island forest	rare species	wildlife habitat	56.1	2442775.9	16904.5
99	High Haith Black Gum South	Squam Lake - High Haith south	Pristine wetland	rare species	vernal pool	0.7	31959.0	1657.2
99	Center Harbor Neck Cove West	Squam Lake - CH Neck SW	Pristine lakeshore	rare species	wildlife habitat	15.6	679662.3	4003.4
99	Sturtevant Bay South	Squam Lake - Sturtevant Bay south	Pristine cove lakeshore	rare species	wildlife habitat	5.7	249043.3	2224.5
0	Newman Wetland	North of Newman Road at end	Extensive wetland	wildlife habitat		36.1	1571911.1	6856.0
0	Lower Proctor Sanctuary	West of CH Neck Road - NHA property	Wildlife habitat	vernal pools	rare nat. comm.	54.3	2363366.6	7502.2
0	Center Harbor Woods	E side CH Neck Rd - former Dane property	Vernal pools	wildlife habitat		30.6	1334341.9	5964.2
0	Belknap Woods	Beaver ponds south of Dog Cove	Wildlife habitat	migratory waterfowl	vernal pools	64.1	2793822.2	7443.0
0	Upper Hawkins Deer Yard	Upper Hawkins Brook	Wildlife habitat	remote wetland		6.1	267469.1	2257.5
0	Golf Course Drainage	Below Waukegan Golf Course	Wildlife habitat	deer wintering area	pristine stream	33.1	1441252.7	8736.4
0	Sunset Hill	South side & summit of Sunset Hill	Wildlife habitat	dry oak-pine forest		13.8	603249.6	2942.7
0	Hemlock Seepage	West of Route 25 near town line	Wildlife habitat	deer wintering area	vernal pool	9.3	406437.1	2913.1
0	Winnepesaukee Forest	East of Route on Winni shoreline	Late successional forest	wildlife habitat		4.9	212016.9	1907.3
0	Route 25 East	Just E of Rte 25 - big pines	Late successional forest	deer wintering area	vernal pools	10.3	448938.9	2868.2
0	Center Harbor Bay Islands	West side Center Harbor Bay	Lakeshore habitat	Shallow embayment	rocky shoals	21.4	931179.5	4927.6
	Site visited in field							
99	= potential exemplary natural community					TOTAL	902.1	

APPENDIX D
List of Conservation Lands

Tax ID Number	Parcel Name	Protection Type	Listed Acreage of Parcel	Accuracy of Parcel Information	Date of Recording	Access Allowed	Status	Key:
098-005 -000	Halfmile Islands	CE	9.8	1	19811223	3	3	PRIMARY PROTECTION TYPE
097-037 -001	G + C Mead Memorial Point	CE	6.5	2	20010111	1	2	CE = Conservation Easement
085-007 -000	Duck Island	CE	1.5	2	19881227	5	3	FO = Fee Ownership
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	SECONDARY PROTECTION TYPE
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	EI = Executory Interest
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	RV = Reverter
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	ACCURACY = Map accuracy, i.e. 1 = very good to 5 = unknown
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	ACCESS = 1 = allowed; 3 = not allowed; 5 = no response to inquiry
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	STATUS
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	1 = permanent, legal, no motorized, to be maintained in natural state
097-020 -000	Kimball Island	CE	24.0	3	19771006	3	3	2 = permanent, legal, limited snowmobiling allowed, no extractive uses
098-030 -001	Kelsey Easement	CE	1.8	2	20030612	3	1	3 = permanent, legal, extractive uses, motorized recreation allowed
097-053 -001	Owl's Head Preserve I	CE	-999.0	3	20041217	1	2	4 = no legal protection, allows conversion of > 50% to unnatural cover
097-054 -001	Owl's Head Preserve II	CE	-999.0	3	20060105	1	2	
097-019 -000	Great Island	CE	105.4	1	19900817	3	3	
097-019 -000	Great Island	CE	105.4	1	19900817	3	3	
098-012 -001	Proctor Wildlife Sanctuary	FO	45.0	2	19750117	1	1	
097-036 -001	G & C Memorial Forest	FO	-999.0	3	19970926	1	2	
097-018 -001	Belknap Woods	CE	90.2	3	20010702	1	2	
097-003 -001	Twombly	CE	23.0	1	1986	3	3	
097-024 -001	Chamberlain-Reynolds Memorial Forest	FO	150.0	3		1	3	
097-025 -001	McCleary	RV	17.0	3	19900831	1	2	
098-005 -000	Halfmile Islands	CE	9.8	1	19811223	3	3	
098-006 -001	Mile Island	CE	4.3	1	19811221	3	3	
097-029 -001	Hawkins Pond Boat Launch Facility	FO	4.6	0	19930617	1	4	
097-055 -001	Damon Conservation Area	CE	-999.0	2	20071226	1	2	
098-013 -001	Sturtevant Bay	CE	1.2	4	19851220	1	2	
098-020 -001	Sturtevant Bay II	FO	5.0	2	20001229	1	2	
097-041 -001	Leaman Woods	CE	6.1	3	19991217	1	2	
097-040 -001	Quiet Bay	CE	9.0	3	19981109	1	2	
097-017 -002	Eastman Brown (Alt Name: Beij)	CE	-999.0	2	19910305	1	2	
006-060-000	Center Harbor Woods (Alt Name: Dane)	FO	0.0	3	2010	1	2	
Note: Database contains more information than displayed in this table.								