Source Protection Plan for Moultonborough, New Hampshire

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Cover Photo: Moultonborough and Lake Winnipesuakee from Mt. Whiteface in Sandwich, NH. Photo credit: Andrew Madison.

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1. Introduction

1.1 Background and Purpose

Groundwater is a critical natural and economic resource for New Hampshire. It is our most frequently used source of drinking water, in addition to being an integral part of the hydrologic system and vitally important for fish, wildlife, and recreation. The New Hampshire Department of Environmental Services (NHDES) estimates that 70 to 75 million gallons of groundwater are supplied for drinking water in New Hampshire per day. Approximately 60 percent of New Hampshire residents rely on groundwater for their drinking water and of the 2,416 public water supply systems in New Hampshire, 98 percent rely on groundwater. Groundwater also provides an estimated 40 percent of the total flow in New Hampshire's rivers, which in turn feed the state's lakes, reservoirs, and estuaries.

Groundwater can be contaminated when chemicals or other substances are spilled or discharged onto or into the ground. Liquids can flow through the ground into groundwater, and both solids and liquids can be flushed downward by rain and snowmelt. Once contaminants reach groundwater, they often move along with the groundwater flow. The most common causes of groundwater contamination in New Hampshire are leaking underground storage tanks, mishandling of industrial chemicals, and stormwater runoff. The presence in groundwater of some contaminants, such as MtBE (methyl*tertiary*butylether) strongly correlate with urban factors (population density, housing density, and the percentage of urban land use or roads) emphasizing the importance of controlling potential contaminants in developed or developing areas. Although MtBE has been removed from the gasoline supply, gasoline still contains many other toxic compounds. Land uses associated with gasoline releases to the ground are therefore still a concern. Some industrial solvents are especially potent contaminants; only 5 ounces of TCE (tetrachloroethylene), a common industrial solvent, can make up to 7.8 million gallons of water unacceptable for drinking based on federal standards. Although there are many state and federal programs that directly or indirectly serve to protect groundwater, it is generally acknowledged that local land use controls, inspection programs and public education are necessary to maximize the effectiveness of groundwater protection.

The primary goal of this Source Water Protection Plan is to protect groundwater that is used or may be used as a source for public drinking water systems in the Town of Moultonborough. This plan provides data, maps, guidance, priorities and actions to protect Moultonborough's groundwater aquifers and public drinking water sources from contamination. It serves as an informational tool and action plan for town officials, water system managers, developers, and residents. This plan is a working document that should be reviewed annually and updated every three years to remain current, active, and viable.

1.2 Definitions

Wellhead Protection Area (WHPA)- Sometimes also called a "source protection area" is the surface and subsurface areas from or through which contaminants are reasonably likely to reach a water system source, such as a well. The Wellhead Protection Area is divided into two zones: the Sanitary Protective Area and the Zone of Contribution. For Community Drinking Water Systems, the Sanitary Protective Area is typically a 400ft buffer surrounding the well where no potential contaminants should be present. The Zone of Contribution comprises the remainder of the wellhead protection area.

Public Water System- A "public water system" (PWS) is defined as "a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days out of the year" (Chapter Env-Ws 300, NH Drinking Water Rules). Public water systems are classified into three groups: community systems, non-community transient systems, and non-community non-transient systems.

- **Community systems** serve at least 25 individuals on a year-round basis. Examples include municipal water systems, mobile home park systems, condominium systems, and single family housing developments.
- **Non-community transient systems** serve at least 25 individuals, for at least 60 days per year. These water systems typically serve restaurants, hotels, service stations, campgrounds, or recreational areas.
- **Non-community non-transient systems** serve at least 25 individuals, for at least six months per year. These systems typically serve daycare facilities, schools, and commercial properties.

Aquifer- An aquifer is a layer of water-saturated, permeable rock, through which water can move and be extracted using a well.

Stratified Drift- A geologic formation comprised of fine and coarse material deposited by glacial melt water.

UST- Underground Storage Tank
AST- Aboveground Storage Tank
LUST- Leaking Underground Storage Tank
UIC- Underground Injection Control, any discharge of wastewater into the ground.
VOC- Volatile Organic Compound, an organic chemical with a low boiling point. These can include industrial solvents, fuels, and other petroleum products.
SOC- Synthetic Organic Compound, organic chemicals with a higher boiling point than VOC's. These are often found in chemical pesticides.

2. Methods

To determine what potential contaminants were present and to evaluate their risk, extensive research was performed examining land use practices and site histories. Information on above and underground storage tanks, hazardous waste and underground injection permits, and hazardous material spill reports was gleaned from New Hampshire Department of Environmental Services' One-Stop data portal (NHDES, 2016). This information was then verified and supplemented using a windshield survey, where sites were inspected visually from public throughways. At times, information garnered from NH DES's One-Stop was verified by communication with Lakes Region Water Company and the Moultonborough Planning Department. Land cover was determined using the 2010-2011 1-FT Color Aerial Photos. Soils and underlying geology was determined using the Natural Resource Conservation Service (NRCS) Web Soil Survey and the Soil Survey of Carroll County, New Hampshire (USDA Soil Conservation Service 1989).

Guidance on evaluating the risk presented potential sources of contamination was provided by The DES Guide to Ground Water Protection (NHDES 2008), The Trust for Public Land Source Protection Handbook (Hopper and Ernst 2005), and Nonpoint Source Pollution: A Handbook for Local Governments (Jeer et. al. 1997). Furthermore, all information, data, and conclusions stated in this plan were reviewed by the source protection committee for accuracy. All GIS data layers were accessed from the University of New Hampshire Extension's Geographically Referenced Analysis and Information Transfer System (NH GRANIT) and NH DES.

3. Town of Moultonborough

3.1 Town of Moultonborough, NH Demodraphics

The Town of Moultonborough is a rural-residential community covering 75 square miles in Carroll County, New Hampshire, along NH Routes 25, 171, and 119. Moultonborough is located along the northwest corner of Lake Winnipesaukee and is bordered by the towns of Meredith, Sandwich, Tuftonboro, Tamworth, Ossipee, and Center Harbor. Moultonborough has a population of approximately 4,500 with 1,884 households and a median household income of approximately $45,000 per year (US Census Bureau, 2010).

Historically, Moultonborough has been a town centered around timber harvesting, and agriculture, however currently, these industries are not as prevalent. Today, Moultonborough is largely a recreational community with tourist attractions, access points to Lake Winnipesaukee, Squam Lake and Lee's Pond, as well as large tracks of conservation land for hiking. Outdoor recreation remains an important part in Moultonborough's local economy, much of which is dependent on high-quality surface waters. Moultonborough also hosts a number of private communities, vacation homes, and campgrounds for summertime visitors. Many Moultonborough residents are seasonal, meaning they reside in Moultonborough for only part of the year, usually during the summer.

3.2 Zoning and Land Uses in Moultonborough

Land Use

As a rural-agricultural community, there is limited commercial or industrial development within the town. The few commercial property lots that exist are located in the center of town along NH Route 25, a few other lots are located on Moultonborough Neck and help serve the local recreation industry. Approximately 22% of Moultonborough is covered by surface waters such as Lake Winnipesuakee, Squam Lake, Lee's Pond, and other small water bodies. Additionally, 68% of Moultonborough is covered by forest, approximately 38% of which is currently conserved (Town of Moultonborough, 2008). Significant tracts of sensitive lands have been conserved on Red Hill in the northeast corner of Moultonborough, and on the steep slopes of Ossipee Mountain in the eastern part of the town. Additionally, smaller tracts of conserved land are located along the shorelines of Lake Winnipesuakee, and Garland Pond. Additionally, there are two golf courses and several small town parks in the town, as well as large tracts of land owned by schools, academies, and summer camps. The predominant land use in Moultonborough is single or two family residential, especially along the shorelines of Lake Winnipesuakee, Squam Lake, and Lake Kanasatka. Much of the privately owned land in

Moultonborough remains vacant or undeveloped, especially so along the slopes of Ossipee Mountain, and on Moultonborough Neck. Development remains low in Moultonborough, with only 10% of the total area in the town covered by residential or commercial development. A map depicting land use in Moultonborough is available in Appendix B.

Zoning

The Town of Moultonborough has enacted a zoning ordinance to regulate land use within the town limits (Town of Moultonborough, 2015). This ordinance was originally adopted in 1985, and has most recently been amended in 2015. Moultonborough's zoning ordinance provides for five zoning districts to cover commercial, residential, and groundwater uses. Additional ordinances dictate stormwater management requirements, shoreline regulations, and protections for sensitive wetlands. A map depicting the location of Moultonborough's zoning districts is available in Appendix B.

Commercial Zone A: Includes all land within 500ft of the edge of the right-of-way on either side of Route 25 from the town line of Center Harbor to the intersection with Blake Rd. This zoning district permits most forms of commercial land use with the exception of hazardous waste generators, junkyards or landfills, salt storage or snow dumps, waste lagoons, or bulk petroleum storage.

Commercial Zone B: Includes all land within 500 feet of the edge of the right-of way on either side of Route 25 at the intersection of Route 109 South to the Sandwich Town Line. This zoning district permits all commercial land uses with special exemptions required for some.

Commercial Zone C: Includes Moultonborough Village, also known as the "Corner", which covers all land within 500ft of Route 25 in both directions between Blake Rd. and Route 109. This zoning district was established to preserve the character of the village with regard to lot sizes, setbacks, and architecture. Specific regulations are established for building size, design, setback from roadway, and parking. Most forms of commercial activity are permitted in Commercial Zone C with the exception of the prohibited uses listed in Commercial Zone A as well as wind turbines, adult uses, cell phone towers, high-impact recreation, or excavation. Several other additional uses require a special exemption.

Residential-Agricultural: The area of the town not delineated as a Commercial Zone is defined as Residential-Agricultural where single or two family residences, or farms are allowed. Specific guidelines have been established for shorefront properties and properties located along steep slopes. Some commercial uses are allowed with special exemptions.

Groundwater Protection Overlay District: Includes delineated wellhead protection areas and stratified drift aquifers within the town's boundaries. The overlay district was adopted in 2007 to protect existing drinking water sources and to protect aquifers for potential, future use. The ordinance dictates prohibited and conditional uses including stormwater management, hazardous materials storage, spill prevention, control and countermeasures, and on-site waste disposal systems.

3.3 Topography, Geology, and Soils

Moultonborough has two prominent topographical features; Red Hill in the northwestern part of the town, and Ossipee Mountain in the eastern part of Moultonborough. Red Hill is a 1,960ft tall hill overlooking Squam Lake in Moultonborough, much of the hill is protected by conservation easements and some land is owned by the State. Red Hill is a popular hiking spot and hosts a fire tower at its summit. Ossipee Mountain is a 2,780ft tall mountain overlooking both Moultonborough Bay Inlet and Lake Ossipee. This mountain features steep slopes on its western face in Moultonborough and is protected as a conservation area. The center of Moultonborough, as well as Moultonborough Neck and much of the shoreline areas have an average elevation ranging between 600 and 700ft above mean sea level.

Bedrock geology in Moultonborough, and throughout much of the Lake Winnipesuakee region is dominated by igneous bedrock types including quartz diorite dating to the Devonian era 410-360 million years ago, and granite intrusions dating to the Jurassic era 205-145 million years ago. Moultonborough contains a wide variety of soils ranging from rocky outcroppings in the higher elevations to sandy loams near the lake, and peats in the wetlands. Fine sandy loams account for 47% of the Moultonborough area while gravely and stony soils account for 9%. Rocky outcroppings account for 18% of the soils in Moultonborough, primarily on Red Hill and Ossipee Mountain. Silt loams and mucky peat located in wetlands account for 4% of Moultonborough, surface waters account for 22%.

3.4 Surface and Groundwater Resources

Surface Water Resources

Moultonborough's local economy and character is largely dependent on its high-quality surface waters, most prominent of which is Lake Winnipesuakee, New Hampshire's largest inland water body. Approximately 22% of Moultonborough's total area is covered by surface waters including Squam Lake, Lee's Pond, Garland Pond, Berry Pond, Lake Kanasatka, Wakondah Pond, and Shannon Pond in addition to Lake Winnipesuakee. Squam, Winnipesuakee, and Kanasatka Lakes are deep, oligotrophic lakes while Garland, Berry, and Lee's Ponds are shallow, eutrophic ponds surrounded by associated wetlands and connected by first, and second order streams.

One of the most prominent water features in Moultonborough is Moultonborough Bay, a feature of Lake Winnipesuakee surrounded by the Town of Moultonborough. Moultonborough Bay, and its inlet are relatively shallow bays with significant shorefront development including seasonal homes, camps, private communities, and golf courses. Water quality in the Moultonborough Bay Inlet basin has been an issue as the bay exhibits high total phosphorus and chlorophyll-*a*, low dissolved oxygen, and the presence of aquatic invasive plants.

Squam Lake is a large, deep oligotrophic lake which occupies the northwest corner of Moultonborough. A number of seasonal and vacation homes are located on the Moultonborough side of Squam Lake. Kanasatka Lake is another deep, oligotrophic lake that is located entirely within Moultonborough.

Although Moultonborough does not have any large rivers, numerous, small spring-fed brooks and streams are present. Most of these are first and second order streams draining Ossipee Mountain, Red Hill, or the wetlands and small ponds found throughout the town. Moultonborough also has significant tracts of wetlands on Moultonborough Neck, and in the northern reaches of the town along Barry, Garland, and Lee's Ponds.

Groundwater Resources

Moultonborough sits atop significant groundwater resources, much of which are the result of deposits leftover from glacial lakes 10,000-20,000 years ago. Two major aquifers travel under Moultonborough: the Halfway Brook aquifer under Berry, Garland and Lee's Ponds, and the Shannon Brook aquifer along the eastern shore of Moultonborough Bay (USGS, 1994). Both of the aquifers are stratified drift aquifers of high transmissivity (1,000-2,000ft^2/day). Both the Halfway Brook and Shannon Brook aquifers extend under Moultonborough Bay to Moultonborough Neck. These aquifers supply private wells, many of the public water systems in Moultonborough, and one water bottling plant.

3.5 Drinking Water Supplies in Moultonborough

As of 2016, the Town of Moultonborough does not provide municipal water by means of a community water system. Most Moultonborough residents rely on private wells, privately-owned community water systems. A small portion of Moultonborough has sewer access, however the majority of town residents are dependent on either residential septic systems or privately owned shared sewer/septic systems.

There are 55 active public drinking water systems in Moultonborough including 12 community drinking water systems, 38 transient systems, and five non-community non-transient systems. The 12 community public drinking water systems provide domestic drinking water for approximately 2880 individuals, including both full-time and seasonal residents, through 1155 service connections. An estimated 3,880 Moultonborough full-time and seasonal residents rely on private, residential wells for their daily water needs (USGS, 2005). This report will cover three community public water suppliers

Table 1. Public drinking water sources included in this report. Data from NHDES.

PWS ID	SYSTEM NAME	SYSTEM TYPE	SYSTEM CATEGORY	POPULATION SERVED	CONNECTIONS
1612010	PARADISE SHORES	COMMUNITY SYSTEM	MAJOR CWS (>1500 POP OR SURFACE SUPPLY)	1881	753
1612030	FAR ECHO HARBOR	COMMUNITY SYSTEM	SINGLE FAMILY RESIDENCES	200	80
1612040	WEST POINT	COMMUNITY SYSTEM	SINGLE FAMILY RESIDENCES	93	37

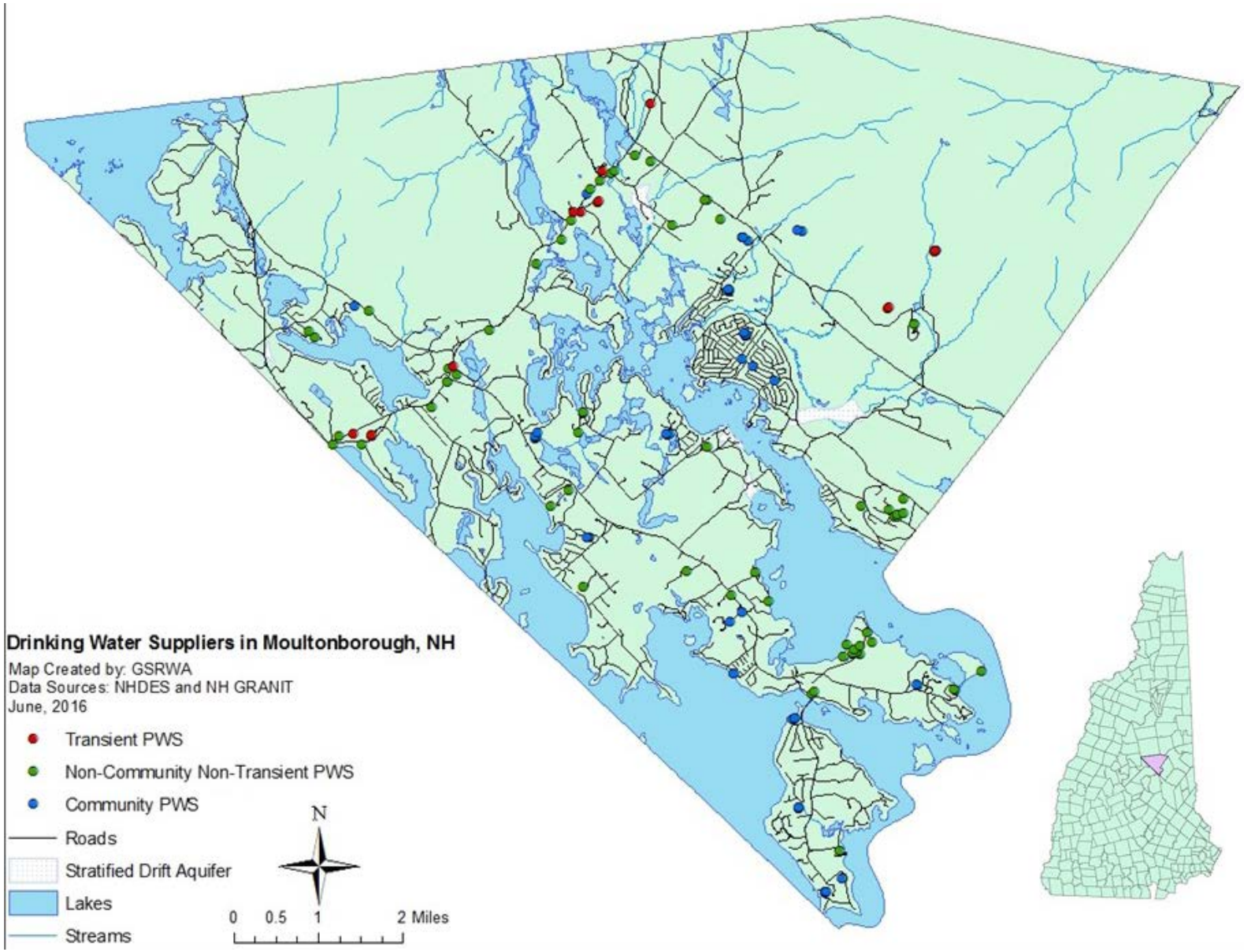

Figure 1. Drinking water suppliers in Moultonborough, NH. Data from NH DES and NH GRANIT.

4. Paradise Shores System

4.1 System Description

Paradise Shores (PWS ID:1612010) is a privately owned community drinking water supplier, owned and operated by Lakes Region Water Company, and serving 1,881 individuals through 753 service connections. The system serves the private community of Balmoreal in addition to a number of private residences. Paradise Shores obtains its water from four bedrock wells including two off of NH Route 109, two located on the slope of Mt. Rogers. The system also owns a wellfield near the shore of Lake Winnipesuakee, however the wellfield has been inactive since 2005.

Wells 005 and 006 are operated together as one source supplying an average of 58,000 gallons per day, and are located off of Paradise Dr. Wells 010 and 008 are located on the western slope of Mt. Roberts and supply an average of 7,000 gallons per day.

Table 2. Water sources for the Paradise Shores system. Data from NHDES One-Stop.

Source ID	Location	Well Type	Status	Depth (ft)	Yield (GPM)
004	Well Field	Bedrock Well	Inactive	662	0
002	Well Field	Bedrock Well	Inactive	556	0
003	Well Field	Bedrock Well	Inactive	100	0
005	Well Field	Bedrock Well	Inactive	661	35
007	Paradise Dr.	Bedrock Well	Active	650	37
006	Paradise Dr.	Bedrock Well	Active	552	75
009	Paradise Dr.	Bedrock Well	Inactive	0	0
010	Mt. Roberts	Bedrock Well	Active	740	40
008	Mt. Roberts	Bedrock Well	Active	940	40

4.2 Description of Wellhead Protection Area

The wellhead protection areas for each of the four active wells are defined as a fixed radius extending from the well. Sources 006, 008, and 010 have a fixed radius wellhead protection area of 4,000ft, source 007 has a fixed radius of 3,600ft and is contained entirely within the wellhead protection area for source 006. Since the wells are close to each other, the four wellhead protection areas largely overlap. Overall, the four wellhead protection areas have a combined area of 1827 acres, and are located on the northeast side of Moultonborough Bay Inlet between Lake Winnipesuakee, and Mt. Roberts along NH Route 109. Soils within the wellhead protection areas include rocky outcroppings and gravelly loams on the slopes of Mt. Roberts, as well as fine sandy loams on the west side of Route 109 and along the shore of Lake Winnipesuakee.

The wellhead protection areas for wells 008 and 010 overlap and cover an area of 1207 acres combined. Of this, 90 acres (7.5%) is occupied by residential or light agricultural uses, while the remaining 1117 acres (92.5%) is forested. These wells are located on the east side of Route 109 on the slopes of Mt. Roberts near Ossipee Mountain Rd. The wellhead protection areas include two unnamed intermittent streams.

The wellhead protection areas for wells 006 and 007 are located slightly west of those for wells 008 and 010 and cover an area of 1154 acres. Of this, 250 acres (22%) are occupied by

residential and light agricultural land uses, an additional 130 acres (11%) include a golf course, and the remaining 774 acres (67%) is forested. The wells are located west of Route 109 in a forested area. An intermittent stream flows through the wellhead protection areas of these two wells and into an unnamed wetland on the western edge of the area. Part of the private community of Balmoreal is located in the southern area of the wellhead protection area. Several businesses including a golf course, a gas station, and a restaurant are located within the wellhead protection area.

4.3 Potential Sources of Contamination

Transportation Corridors- Two major state routes travel through the wellhead protection areas for these four wells, these include NH Routes 109, and 171. Additionally, There are also several smaller collector and residential streets present within the wellhead protection area. Roadways increase the risk of accidental releases of petroleum and automotive products reaching the source through automotive accidents or leaking fluids from cars. Hazardous weather, particularly in winter, increases the risk of accidents. Roadways can also be a significant source of non-point pollution resulting from stormwater runoff. Chlorides from road salt application can also find their way into groundwater during snowmelt or runoff events. Since none of the roadways in the wellhead protection areas are heavily traveled or major thoroughfares, the risk to Paradise Shores' sources is low.

Residential Land Use- The area east of NH Route 109 and near wells 008 and 010 is almost completely forested and few houses exist, the area between Route 109 and the lake is more developed. Development in this area is largely rural, however there are some densely populated neighborhoods. Residences in this area rely on single or shared residential septic systems. Residential land use is associated with the presence of septic systems, oil heat, and lawn care products. On-site septic systems represent potential sources of nitrates, chlorides, bacteria, and viruses. If septic systems are improperly used for disposal of household hazardous wastes such as paints and solvents, septic systems can also be a source of synthetic organic compounds. Sewer service is not available in this area. Additionally, lawn chemicals such as pesticides, herbicides, and chemical fertilizers can leach into ground water if heavily used. Furthermore, if chemicals from home auto repair are improperly disposed of, they can also potentially contaminate near-by drinking water sources. The risk to sources 007 and 006 from residential land use is medium, while the risk to sources 008 and 010 is low.

Above and Belowground Storage Tanks- Bulk petroleum storage **c**an present a significant hazard for near-by drinking water sources. Leaks and spills can contaminate groundwater and render a source unviable for years. Methyl-tertiary-ButylEther (MtBE) is a gasoline additive with significant health effects that is often found in drinking water wells near where a spill has occurred. Three underground petroleum storage tanks are located within the wellhead protection areas for all four sources. These are located at a vehicle service station located along NH Route 109 and include:

- Two 6,000 gallon Gasoline tanks installed in 1990.
- One 8,000 gallon Gasoline tank installed in 2013.

A release from one of these tanks would likely travel to the four sources for the Paradise Shores system. In addition to the risk from a release from the tanks, there is also a risk of a spill during the filling process, or smaller spills during everyday vehicle fueling. In accordance with NH DES regulations, all of these tanks have been equipped with overfill prevent and release detection devices at the time of construction, however these are not fail-safe. The risk to the river well from this facility is considered high.

Golf Courses- Sources 007 and 006 are located near a golf course. Golf courses frequently use large quantities of pesticides to maintain grass-covered golf features. These fairways also require chemical fertilizers to support the growth of high-quality grasses. Frequent watering increases the likelihood of these chemicals leaching into groundwater. Contaminants of concern include nitrates and toxic pesticides. Golf courses rarely use animal waste as fertilizer, therefore fertilizer application in the context of a golf course, is not a likely source of bacteria and viruses. The risk to the Paradise Shores System from pesticide and fertilizer application is considered medium.

Hazardous Waste Producers- There are two potential hazardous waste producing facilities within the wellhead protection areas for all four sources. Neither of these facilities is a registered hazardous waste producer and it is believed that hazardous materials are used in very small quantities at these sites. The risk to the Paradise Shores system from these facilities is considered low.

- Boat Service station located near the intersection of Routes 109 and 171. This facility repairs boats and boat engines, which likely requires the use of solvents, paints, and oils. This facility is not a registered hazardous waste producer, possibly because these chemicals are not used in large enough quantities.
- A home-based taxidermy business is also located near the intersection of Routes 109 and 171. Taxidermy can involve the use of petroleum products, solvents, biological wastes, and VOC's. However since this is a small business, these chemicals are likely used in very small quantities. This business is not a registered hazardous waste producer.

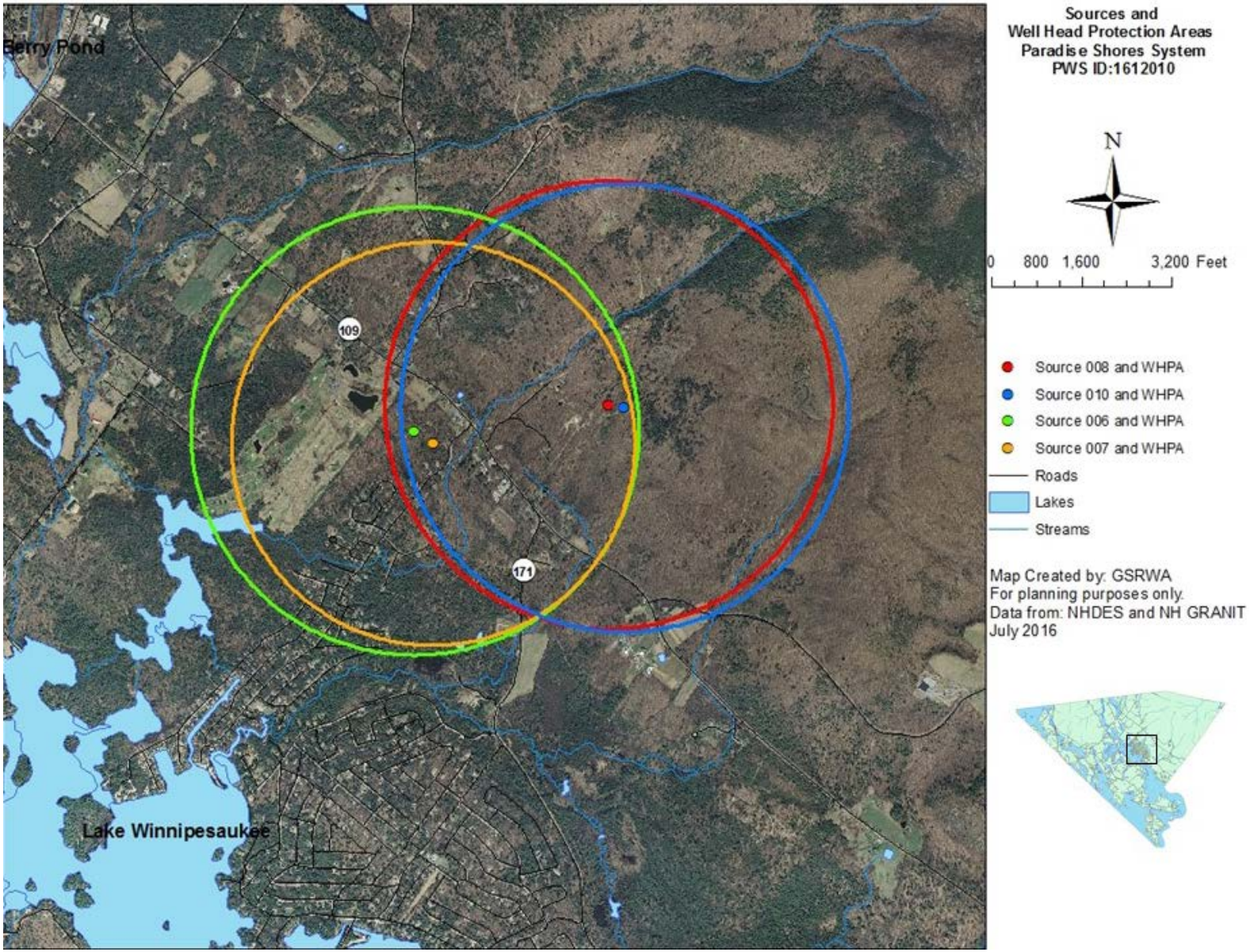

Figure 2. Wellhead protection areas for Paradise Shores system. Data from NHDES and NH GRANIT.

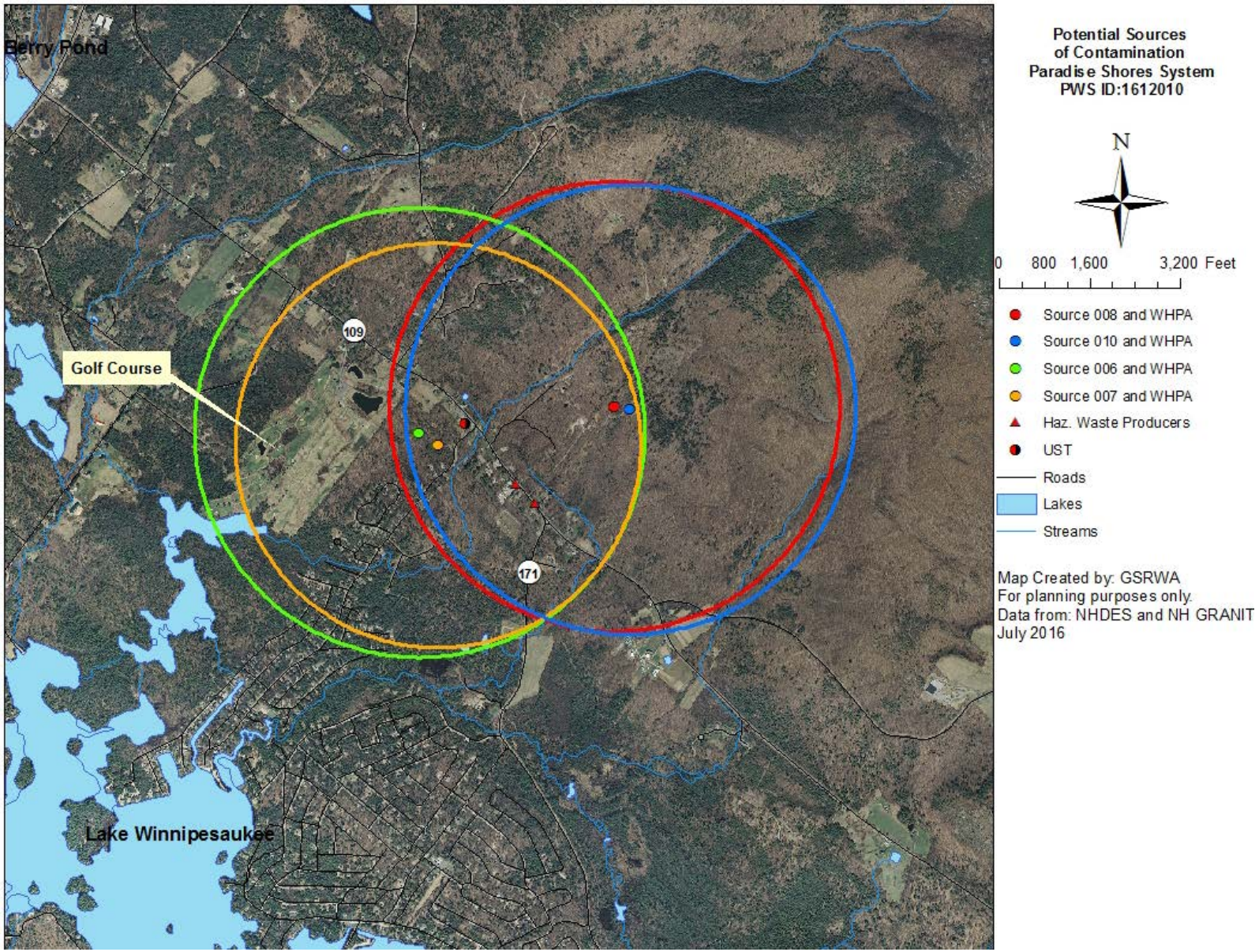

Figure 3. Potential sources of contamination for the Paradise Shores system. Data from NHDES and NH GRANIT.

5. Far Echo Harbor System

5.1 System Description

Far Echo Harbor (PWS ID:1612030) is a privately owned community drinking water supplier, owned and operated by Lakes Region Water Company, and serving 200 individuals through 80 service connections. The system serves the private community of Far Echo Harbor which is located on the southwestern tip of Moultonborough Neck. Far Echo Harbor obtains its water from two wells including one 41ft deep infiltration well, and one 505ft deep gravel packed well. Both wells are located on the shore of Lake Winnipesuakee.

Table 3. Water sources for the Far Echo Harbor system. Data from NHDES One-Stop.

Source ID	Well Type	Status	Depth (ft)	Yield (GPM)
001	Gravel Packed Well	Active	505	20
002	Infiltration Well	Active	41	15

5.2 Description of Wellhead Protection Area

The wellhead protection areas for each of the two wells are defined as a fixed radius extending from the well, 1,300ft for the infiltration well, and 2,000ft for the gravel packed well. The wellhead protection area for the infiltration well is contained entirely within the wellhead protection area for the gravel packed well.

The wellhead protection area for the gravel packed well totals 304 acres, 121 of which consists of the wellhead protection area for the infiltration well, which is entirely contained within the wellhead protection area for the gravel packed well (Figure 4). Approximately half of this area (152 acres) is covered by Lake Winnipesuakee, 40 acres is utilized by private residences, and the remaining 112 acres is forested. Soils in this area are very sandy with high transmissivity.

5.3 Potential Sources of Contamination

Transportation Corridors- There is only one major roadway, Moultonborough Neck Rd., and five residential streets present within the wellhead protection area. Roadways increase the risk of accidental releases of petroleum and automotive products reaching the source through automotive accidents or leaking fluids from cars. Hazardous weather, particularly in winter, increases the risk of accidents. Roadways can also be a significant source of non-point pollution resulting from stormwater runoff. Chlorides from road salt application can also find their way into groundwater during snowmelt or runoff events. Since none of the roadways in the wellhead protection areas are heavily traveled or major thoroughfares, the risk to Far Echo Harbor's sources is low.

Residential Land Use- The Far Echo Harbor Club is a private residential community. Many homes in this area are used seasonally or serve as vacation rentals. Residences in this area rely on single or shared residential septic systems. On-site septic systems represent potential sources of nitrates, chlorides, bacteria, and viruses. If septic systems are improperly used for disposal of household hazardous wastes such as paints and solvents, septic systems can also be a source of

synthetic organic compounds. Sewer service is not available in this area. Residential land use is also associated with the presence of oil-fueled furnaces, and lawn care products. Homes utilizing oil for heat can experience leaky tanks or lines, which can go unnoticed if the home is unoccupied part of the year. This happened to one home in the community in 1994, however no product was found in samples taken from the system wells. Additionally, lawn chemicals such as pesticides, herbicides, and chemical fertilizers can leach into ground water if heavily used. Furthermore, if chemicals from home auto repair are improperly disposed of, they can also potentially contaminate near-by drinking water sources. Given the density of the neighborhood, and how heavily septic systems might be used during summer months, the risk to the Far Echo Harbor System is high.

Recreation- The two wells for the system are located between a private beach and a small marina with only a small grove of trees as a buffer. Although the marina does not have fueling facilities, boats docked there could still potentially spill fuel or oil. Additionally, the public beach could also introduce pathogens or personal care products into the lake through bodily contact. Since the infiltration well is only 41ft deep and is largely reliant on hyporehic exchange with Lake Winnipesuakee, contaminants in the lake can find their way into the well. This means that spilled fuels, or bacteria from human contact can also migrate into the well through groundwater. Additionally, fuels spilled on land near the beach or near the marina can also migrate through groundwater to the well. Given the proximity of the wells to the beach and marina, the risk to these two wells is considered high.

In-Lake Pollutants- Although the surface waters of Lake Winnipesuakee itself do not serve as a public drinking water source, the lake can influence water quality in wells located on its shores. Contaminants in the lake including pathogens such as e-coli, giardia, and cryptosporidium are known to travel through groundwater and into drinking water wells from surface waters. Additionally, harmful cyanobacteria, resulting from in-lake blue-green algae blooms could also potentially reach the infiltration well through hyporehic exchange with the lake. E-coli and cyanobacteria are well known issues with Lake Winnipesuakee, and have become more prevalent as recreation, and residential development have increased along the shoreline of the lake. Since the gravel packed well is drilled to a depth of 505ft, it is largely protected from these issues, however the infiltration well should be considered at a high risk from these potential contaminants found in Lake Winnipesuakee.

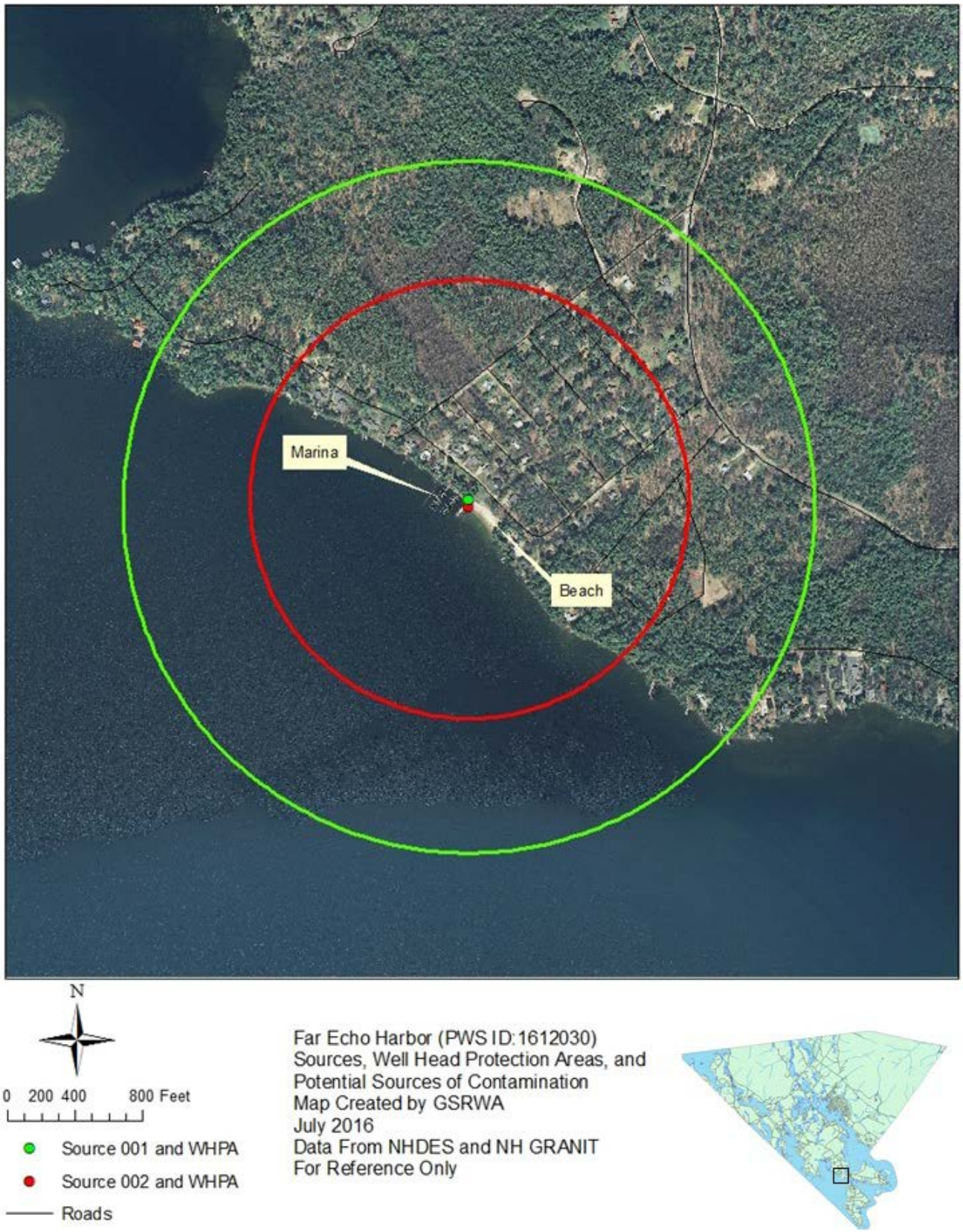

Figure 4. Far Echo Harbor system sources, wellhead protection area, and potential sources of contamination. Data from NHDES and NH GRANIT.

6. West Point System

6.1 System Description

West Point (PWS ID:1612040) is a privately owned community drinking water supplier, operated by Lakes Region Water Company, and serving 93 individuals through 37 service connections. The system serves the private community of West Point which is located on Long Island, off of the southern tip of Moultonborough Neck. West Point obtains its water from a wellfield comprised of three bedrock wells, and occasionally bulk transported water during times of high demand. The wellfield is located on the shore of Lake Winnipesuakee and provides an average of 3,500 gallons per day as of 2015.

Table 4. Water sources for the Far Echo Harbor system. Data from NHDES One-Stop.

Source ID	Well Type	Status	Depth (ft)	Yield (GPM)
001	Bedrock Well	Active	600	5.5
003	Bedrock Well	Active	525	7
004	Bedrock Well	Active	600	15
002	Infiltration Well	Inactive	108	N/A

6.2 Description of Wellhead protection area

The wellhead protection areas for each of the three wells that comprise the wellfield are defined as a fixed radius of 1,500ft extending from the well. The wellhead protection area for each well covers approximately 162 acres, however the three areas overlap with a combined area of 175 acres (Figure 5). Wellhead protection areas for this system were delineated by NHDES. The wellhead protection area for the infiltration well is contained entirely within the wellhead protection area for the gravel packed well.

Approximately three quarters of this area (105 acres) is covered by Lake Winnipesuakee, while the remaining 70 acres is largely covered by private residences and roadways. Soils in this area are very sandy with high transmissivity.

6.3 Potential Sources of Contamination

Transportation Corridors- There is only one major roadway, Long Island Rd., and several residential streets present within the wellhead protection area. Roadways increase the risk of accidental releases of petroleum and automotive products reaching the source through automotive accidents or leaking fluids from cars. Hazardous weather, particularly in winter, increases the risk of accidents. Roadways can also be a significant source of non-point pollution resulting from stormwater runoff. Chlorides from road salt application can also find their way into groundwater during snowmelt or runoff events. Since none of the roadways in the wellhead protection areas are heavily traveled or major thoroughfares, the risk to West Point's sources is low.

Residential Land Use- West Point Association is a private residential community. Many homes in this area are used seasonally or serve as vacation rentals. Residences in this area rely on single or shared residential septic systems. On-site septic systems represent potential sources of nitrates, chlorides, bacteria, and viruses. If septic systems are improperly used for disposal of household hazardous wastes such as paints and solvents, septic systems can also be a source of synthetic organic compounds. Sewer service is not available in this area. Residential land use is also associated with the presence of oil-fueled furnaces, and lawn care products. Homes utilizing oil for heat can experience leaky tanks or lines, which can go unnoticed if the home is unoccupied part of the year. Additionally, lawn chemicals such as pesticides, herbicides, and chemical fertilizers can leach into ground water if heavily used. Furthermore, if chemicals from home auto repair are improperly disposed of, they can also potentially contaminate near-by drinking water sources. Given the density of the neighborhood, and how heavily septic systems might be used during summer months, the risk to the Far Echo Harbor System is medium.

Underground Petroleum Storage- There are two 4,000 gallon underground gasoline tanks located at a marina approximately 1,800ft north of the West Point Well Sites. These two tanks were installed during May, 1991 to replace two 4,000 gallon gasoline tanks installed in 1971. During a site visit associated with the installation of the new tanks, petroleum was detected in groundwater samples taken near the former UST's and an odor of petroleum was noticed in excavated soils, indicating a leak in one of the tanks. No petroleum products were detected in near-by drinking water wells. Additionally, a 1,000 gallon underground gasoline tank was removed in 1992, no product was detected during removal. Although this site is technically located 300ft outside of the wellhead protection areas, a major spill or leak could potentially impact the system. If the 108ft deep infiltration well were to be re-activated it would be especially vulnerable to a release from one of these tanks, or from a smaller release from a boat docked at the marina. The 500-600ft depths of the wells, as well as the lake located between the marina and the wells, give them a degree of protection from these tanks. The risk to the active West Point wells from near-by UST's is medium.

Recreation- The wells for this system are located near a private beach and a small marina. The bedrock wells are not likely to be impacted by bodily contact with the water, nor are they likely to be impacted by small petroleum leaks from boats berthed at the marina. However, if boats are fueled at the marina, a large spill could impact the near-by wells. The risk to the West Point Wells from recreation is considered low.

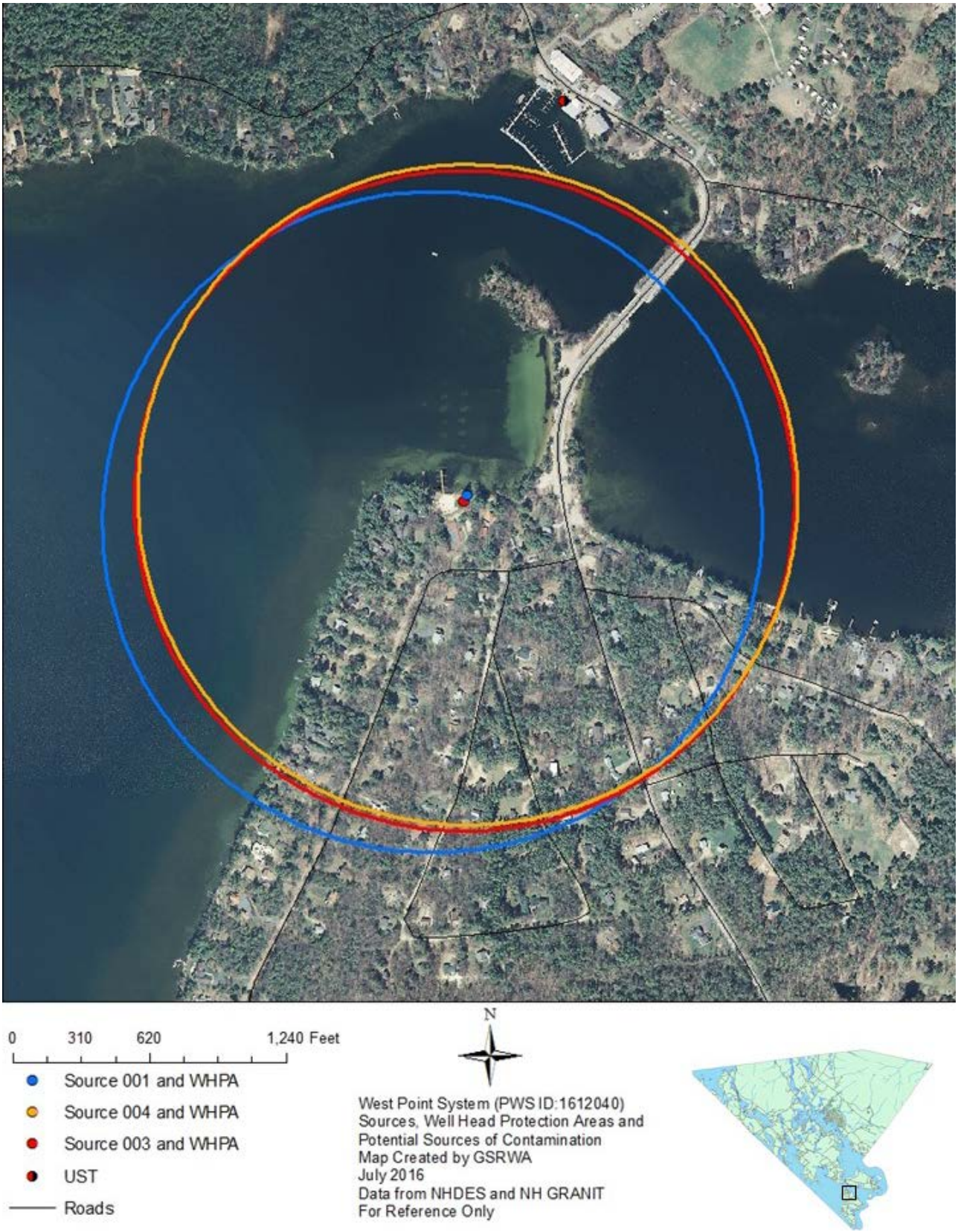

Figure 5. West Point sources, wellhead protection area, and potential sources of contamination. Data from NHDES and NH GRANIT.

7. Management of Risk

In order to reduce the risks of contamination to drinking water wells in Moultonborough, and to continue to properly steward drinking water resources, the following activities should be implemented:

- Conduct an Education and Outreach Campaign
- Maintain a Drinking Water Committee
- Create a List of Property Owners within the Wellhead Protection Area

Although these activities are designed to help protect groundwater resources for potable water uses. They also serve a role in protecting surface water resources, specifically, Lake Winnipesuakee. By informing home and business owners of how they can help keep groundwater resources pure, they can be encouraged to participate in activities that also protect sensitive surface water resources.

7.1 Conduct and Education and Outreach Campaign

Public education and outreach is central to this plan because increased awareness by property owners, consumers, and local businesses leads to better management of contamination risks within the wellhead protection areas. The Town of Moultonborough and the Lakes Region Water Company should conduct the following activities:

- Distribute Example Letter #1 to property owners located within the wellhead protection areas. The purpose of this letter is to notify owners that their property is located within a wellhead protection area for a public water supply. A factsheet on topics such as septic system maintenance, and heating oil storage, and a copy of the source protection map (with well locations omitted) should be included with the notification letter.
- Distribute information regarding the proper maintenance of septic systems, appropriate fertilizer use, and other general groundwater protection information, at Town Hall, and local businesses such as hardware stores, and community or common buildings located in private communities. These should be distributed along with example letter #1. Additionally, they could also be provided by a local septic service provider.
- Distribute Example letter #2 along with appropriate maps to the following entities: Private Communities, Moultonborough Police Department, Moultonborough Fire Department, New Hampshire Department of Transportation District 3, and the Moultonborough Highway Department. This is to increase institutional awareness of the wellhead protection areas and to encourage these entities to consider the sensitivity of the wellhead protection areas to contamination while executing their respective duties.
- Distribute example letter #3 to businesses located within or near wellhead protection areas, along with the associated fact sheets.
- Distribute a notice highlighting the schedule for Moultonborough's Household Hazardous Waste Collection Day, to foster increased use of this service.
- Maintain signs at the well houses which read "Tampering with this Facility is a Federal Offense". This is especially important for wells located near publically accessible areas such as the sources serving the West Point and Far Echo Harbor

Systems. Additionally, signs should be placed along roadways passing through well head protection areas alerting motorists

These materials will help inform residents on what actions they can take to help keep groundwater resources used for drinking water clean and pure. By highlighting the tangible benefits homeowners receive from being stewards of communal drinking water supplies, an outreach campaign is more likely to encourage and obtain support and action. In addition to benefits for groundwater resources, education and outreach can also help protect surface water resources such as near-by Lake Winnipesuakee. These outreach materials can also be used to help increase awareness of the impact of septic systems and lawn care chemicals on the waters of the lake. By drawing on the relationship between in-lake water quality, drinking water quality, and property values, an education and outreach campaign can effective communicate to homeowners how they can best protect water resources as well as the investment they have in their homes.

7.2 Maintain a Source Water Protection Committee

The Town of Moultonborough should maintain a source protection committee either as a sub-committee of an existing town commission, or as a stand-along committee. This committee should be tasked with reviewing and updating any source protection plans on an annual basis, and to provide comment and guidance to other town departments and commissions with regard to drinking water related issues. At a minimum, the source protection committee should consist of:

- Water System Operators
- A Selectboard Member
- Conservation Commission Member
- Planning Board member
- Zoning Board of Appeals
- Local Resident
- Local Farmers and Land Owners
- Local Business Owners
- Private Community Board of Directors

In addition to discussing drinking water quality issues, this committee can also help address the mutual concerns of both drinking water quality and surface water resources. The committee should also consider including local scientists, as well as environmentally based non-profits who may be able to lend expertise in communicating the relationship between surface and groundwater quality.

7.3 Maintain a List of Property Owners within the Wellhead Protection Area

The creation of a list of wellhead protection area property owners was goal of this source water protection plan. This database of property owners, lot numbers and contact information is available in Appendix X. This list will be used as the contact list for any education and outreach campaign and materials will be sent to individuals included on the list. It is important to note that this list includes both year-round, and seasonal home owners. Therefore some property owners may live out of town or even out of state. Furthermore this list includes shorefront property

owners so that they may be engaged and informed of the impact of lawn care chemicals on surface water quality, and how they can help prevent excess nutrients from being released into the waters of Lake Winnipesuakee.

7.4 Conduct a Septic System Survey and Failure Analysis

A septic survey could be performed to evaluate the state of septic systems located within wellhead protection areas or along shorelines. This, however, would require a great investment in resources to accomplish this task including several personnel to distribute, collect, and analyze paper or even electronic surveys. Such an effort should only be mounted with the full support, and involvement of the Town of Moultonborough, and any effort to evaluate the status of septic systems should also include follow-up actions.

A septic survey was performed for Lake Waukewan in Meredith, NH during 2009, which could be considered a model for any similar survey. This survey was performed as a result of recommendation made in the 2005 *Management Plan for the Waukewan Watershed.* It is important to note however that Lake Waukewan serves the Town of Meredith as a source of drinking water, whereas Lake Winnipesuakee does not. The Lake Waukewan survey included properties within 250ft of the shoreline, which effectively limited the survey to shorefront properties, this resulted in approximately 112 properties being included in the survey (Palmiotto, 2005). The 2009 survey involved an extensive review of records on installed septic systems kept at the NH Department of Environmental Services in Concord, NH. This took considerable effort. The survey identified 31 properties considered to be high risk, as a follow-up the town of Meredith sought funding to assist homeowners with the replacement of these systems. Additionally, data collected from the survey was used to help create a health regulation to address the risks presented by faulty septic systems.

Another survey was performed around Lake Wentworth in Wolfeboro, NH during August and September 2011 (Jespersen et. al. 2011). This survey sampled 625 properties within 250ft of the shoreline of Lake Wentworth. The survey questioned property owners on the size of their septic systems, how frequently they were maintained, the size of their households, and the distance of their system from the shoreline. Given the size of the Lake Wentworth survey, it could serve as an example for a potential Moultonborough Bay Inlet survey. It is important to note that the Lake Wentworth survey involved the efforts of 34 individuals including 21 volunteers performing door-to-door surveys.

Performing a similar survey along the shoreline of Moultonborough Bay Inlet, as well as the connected waterbodies of Berry, Garland, and Lees Ponds, in addition to well head protection areas, would potentially include over 700 properties. To mail surveys to property owners would likely cost in excess of $1,500 including postage, return postage, and printing fees, in addition to the personnel costs to collect and analyze these surveys. An online survey could be a low cost alternative to traditional paper surveys, however extensive outreach would be required to inform homeowners of this effort, how to access and complete the survey, and encourage participation. A data review similar to Meredith's would require extensive time and several staff members, as a result this may be the most expensive option for a similar survey. Any survey should be performed anonymously, with identifying property information provided by landowners only on a voluntary basis. An effort of this magnitude should only be undertaken if there is a great need and desire to obtain usable data from this effort. If the primary purpose of undertaking a septic system and survey analysis is public education and outreach, a campaign similar to the one described in section 7.1 of this report would accomplish that goal. Example surveys, and maps highlighting potential areas to be surveyed are available in Appendix D.

8. Contingency Planning

The New Hampshire Department of Environmental Services requires community public drinking water systems to have emergency plans outlining what to do in the event of a long or short term emergency. These plans are required to outline emergency notification procedures, interconnections with neighboring systems, plans for distributing bulk water, and plans to resume normal operations once the emergency has passed. Additionally, these plans contain contact information for system operators, local emergency responders, contractors and vendors, local elected officials, and local media outlets. These emergency plans are required to be updated every three years. Paradise Shores, West Point, and Far Echo Harbor have developed extensive emergency response procedures and both systems updated their emergency operating plans in 2015.

Emergency operating plans are a strong tool for planning for, and responding to an emergency such as a chemical spill. However these plans work best when shared with partnering agencies and are practiced regularly. Community drinking water systems should share their emergency operating plans not only with their local fire department, but with upstream departments as well. Additionally, water suppliers should rehearse these plans through drills and table-top exercises with other involved agencies. These types of exercises can help reinforce roles held by different agencies, identify deficiencies, and improve communication between agencies and between neighboring communities. Water systems should also consider sharing these plans neighboring communities as well.

9. Conclusions

Moultonborough is unique among New Hampshire communities in that it has no single municipal drinking water system, but 55 separate public drinking water suppliers to serve 4,500 permanent residents and many more seasonal visitors. However the responsibility to protect these resources still requires the support and involvement of the town government, residents, system operators, and seasonal visitors. Education and outreach is the key to involving these entities to encourage action on their part to protect drinking water resources. With the intelligent cooperation of land-owners, system owners and operators, and public officials these water supplies should be viable for many years. Although the primary purpose of this plan is to protect public drinking water supplies, the action items contained within, especially the education and outreach components, have tangible benefits for surface water resources that are not used as drinking water supplies.

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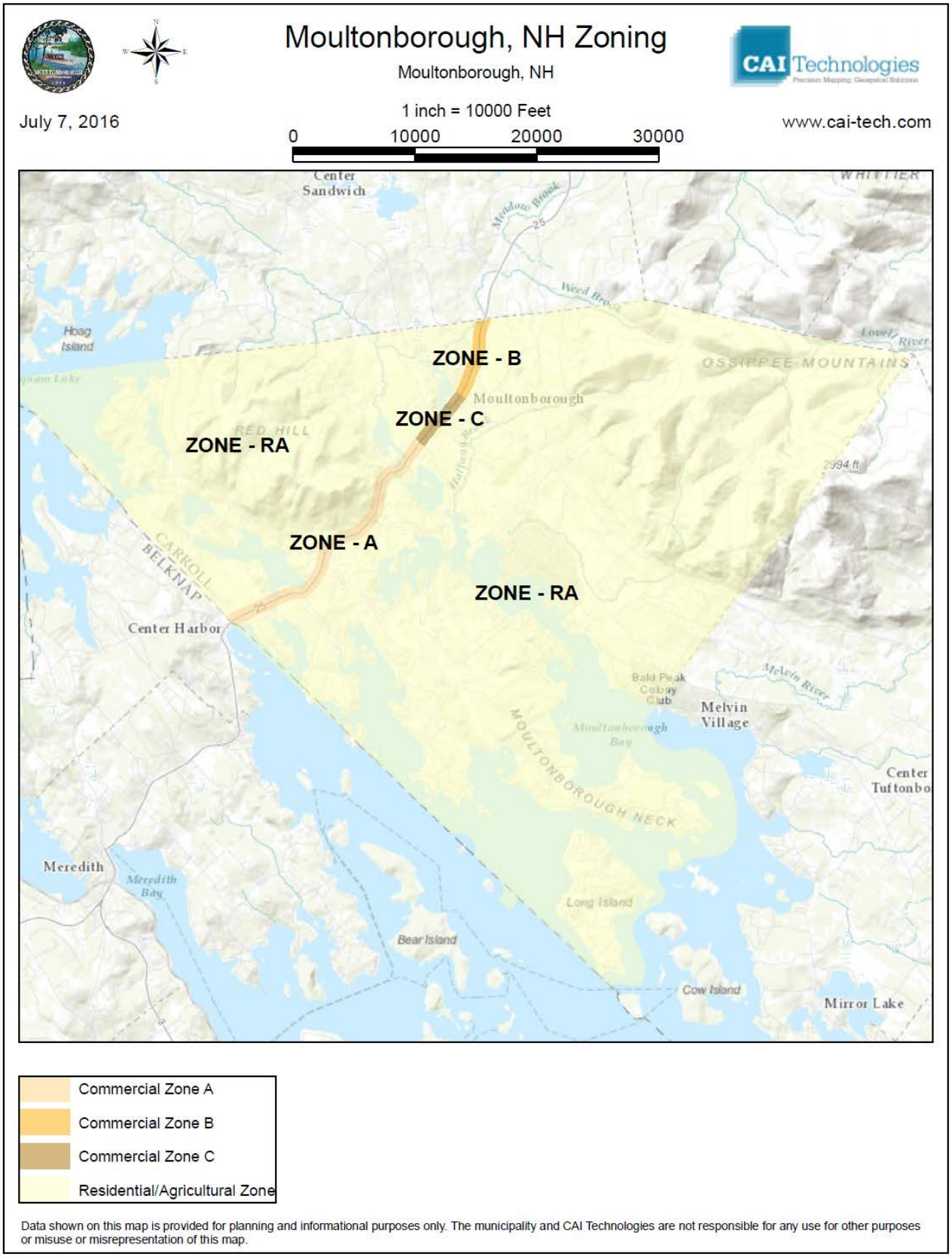
Paradise Shores System, Moultonborough, NH. PWS ID 1612010, Potential Sources of Contamination and Action Items						
Contaminant Source	Location	Site Tax-Lot Number	Distance from Sources (ft)	Contaminants of Concern	Risk Level	Action Item
Roadways (NH Routes 109 & 171)	Throughout	N/A	Source 007- 320ft Source 006- 860ft Source 008- 2200ft Source 010- 2400ft	Impervious Surfaces, non-point runoff, automotive chemicals, road salts	Low	Signage along roadways, Letters to Highway Dept. and NHDOT
Residential Land Use	Throughout	Multiple Lots	Source 007- 320ft Source 006- 860ft Source 008- 2200ft Source 010- 2400ft	Septics, lawn chemicals, heating oil, automotive chemicals	Medium	Education and Outreach letters to Homeowners
Vehicle Service Station	-71.35968, 43.74542	69-2	Source 007- 750ft Source 006- 900ft Source 008- 2600ft Source 010- 2900ft	Petroleum Products, MtBE, VOC's	High	Education and Outreach letter to Business
Golf Course	-72.36802, 43.74790	69-31	Source 007- 1000ft Source 006- 600ft Source 008- 3800ft Source 010- 4100ft	Nitrates, pathogens, pesticides, fertilizers, SOC's	Medium	Education and Outreach letter to Business
Agriculture	Throughout	Multiple Lots	Source 007- 1800ft Source 006- 2300ft Source 008- 2700ft Source 010- 2900ft	Nitrates, pathogens, pesticides, SOC's	Low	Education and Outreach letters to Property Owners

Far Echo Harbor System, Moultonborough, NH. PWS ID 1612030, Potential Sources of Contamination and Action Items						
Contaminant Source	Location	Site Tax-Lot Number	Distance from Sources (ft)	Contaminants of Concern	Risk Level	Action Item
Roadways (Far Echo Harbor Rd.)	Throughout	N/A	Source 001- 75ft Source 002- 75ft	Non-point runoff, automotive chemicals, road salts	Low	Maintaining Culverts, Limiting Salt Use, Signs along roadway near wells
Residential Land Use	Throughout	Multiple Lots	Source 001- 100ft Source 002- 100ft	Septics, lawn chemicals, heating oil, automotive chemicals	High	Edu. And Outreach Mailings
Recreation (Beach and Docks)	43.67028, -71.36512 43.67059, -71.36570	245-24	Source 001- 50ft Source 002- 50ft	Pathogens, petroleum products	High	Signs at well houses

West Point System, Moultonborough, NH. PWS ID 1612040, Potential Sources of Contamination and Action Items						
Contaminant Source	Location	Site Tax-Lot Number	Distance from Sources (ft)	Contaminants of Concern	Risk Level	Action Item
Roadways (Long Island Rd.)	Throughout	N/A	Source 001- 450ft Source 003- 450ft Source 004- 450ft	Impervious Surfaces, non-point runoff, automotive chemicals, road salts	Low	Signs along roadway, reduced salt use
Residential Land Use	Throughout	Multiple Lots	Source 001- 140ft Source 003- 140ft Source 004- 140ft	Septics, lawn chemicals, heating oil, automotive chemicals	Medium	Education and Outreach letters to Homeowners
Underground Petroleum Storage	-71.34920, 43.66747	255-1	Source 001- 1850ft Source 003- 1850ft Source 004- 1850ft	Petroleum Products, MtBE, VOC's	Medium	Education and Outreach letter to Business
Recreation	-72.35128, 43.66268	263-89	Source 001- 75ft Source 003- 75ft Source 004- 75ft	Pathogens, petroleum products	Low	Signs at well houses

Appendix B- Moultonborough, NH Zoning and Land Use Maps



Moultonborough, NH Land Use

Moultonborough, NH

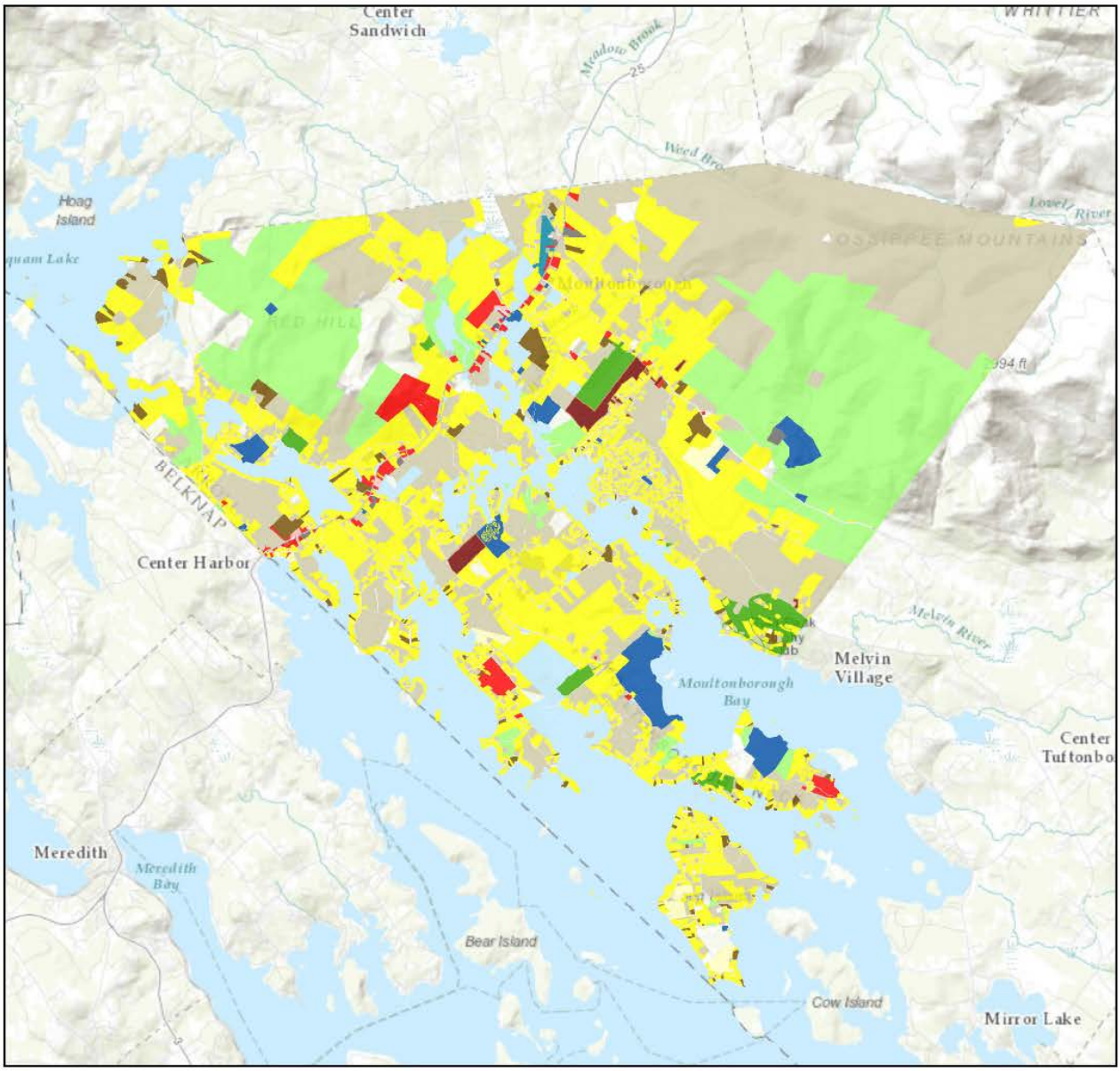
July 7, 2016

1 inch = 10000 Feet

0 10000 20000 30000

CAI Technologies

www.cai-tech.com



One and Two Family Residential	Commercial	Institutional	Conservation Land
Multi-Family Residential	Office	Government	Vacant Land
Condominiums	Industrial	Utilities	
Manufactured/Mobile Homes	Airport	Recreation	

Appendix C- Example Outreach Materials

Sample Letter #1

DATE

Official Town of Moultonborough Letterhead

Dear _____: (Homeowner)

The Purpose of this letter is to ask for your cooperation in ensuring safe drinking water. If we are all careful, we can protect our source of drinking water from contamination.

Your property has been identified as being located within the area from which water flows to one of the wells serving the _____ system (see map attached). As such it is important that you are aware that what you do on your property could affect the quality of the groundwater that serves the _____ system wells. If you are not served by this water system, you should be aware that the activities that occur on your property may affect the water quality of your private well.

No one wants to drink polluted water. Who would pour gasoline, motor oil, paint, garden chemicals, or household chemicals into their drinking water? Yet, the equivalent is done when someone pours any of these products down their toilet, sink drain, or onto the ground. By following the "Do's and Don'ts" on the attached flyer, your household can avoid activities that could threaten water quality.

Please take the time to review and follow the flyer's instructions. We need your help to protect this valuable source of drinking water!

We appreciate your cooperation.

Sincerely,

Contact Person's name

Sample Letter #2

DATE

Official Town of Moultonborough Letterhead

Dear (State, Local, Federal Entity Chief),

Enclosed is a map showing the Source Protection Area for some of the water sources which serve the Town of Moultonborough, New Hampshire. A Source Protection Area consists of the surface and subsurface area from or through which contaminants are likely to reach a water supply source. Land use activities in the source protection areas have the potential to adversely impact water quality of these wells. If the ground water that supplies our wells becomes contaminated, it may be impossible to eliminate the contamination so that the source can continue to be used for drinking water. We are proactively trying to protect are water sources by implementing a source protection plan of which this letter of notification is a part.

We are contacting you to request your assistance in protecting this supply. There are a number of ways in which your agency may be able to help with protection that can help reduce the possibility of contamination of the water supply. For example, please keep us informed of any related land use decisions or permitting issues and involve us in the planning and decision process where it is deemed appropriate.

On behalf of the Business/Village/Town, I would like to thank you for your attention to this matter. If you have any questions or if I can be of some assistance please feel free to call me at (603) XXX-XXX.

Sincerely,

Contact Person

Encl. Maps of Source Protection Areas

Sample Letter #3

DATE

Official Town of Moultonborough Letterhead

Dear _____: (Business Name)

The Purpose of this letter is to ask for your cooperation in ensuring safe drinking water. If we are all careful, we can protect our source of drinking water from contamination.

Your facility has been identified as being located within the area from which water flows to one of the _____ system wells (see map attached). As such it is important that you are aware that what you do on your property could affect the quality of the groundwater that supplies these wells. If you are not on _____ system water, you should be aware that the activities that occur on your property may affect the water quality of your facility's well.

No one wants to drink polluted water. Who would pour gasoline, motor oil, paint, garden chemicals, or household chemicals into their drinking water? Yet, the equivalent is done when someone pours any of these products down their toilet, sink drain, or onto the ground. By following the guidelines on the attached flyers, your facility can avoid activities that could threaten water quality. Every business wants to be a positive force in their community, being a good neighbor to the community water system is a perfect start.

Please take the time to review the attached information. We need your help to protect this valuable source of drinking water!

We appreciate your cooperation.

Sincerely,

Contact Person's name

Is Gasoline Contaminating Your Drinking Water?

Gasoline is one of the most dangerous products commonly found around the home, yet people often store and use it with little care. Some of the chemicals in gasoline have been found in drinking water with increasing frequency, including benzene, toluene and MtBE (Methyl t-Butyl Ether), which is *easily dissolved in water* and is a possible carcinogen. Even a gasoline spills as small as a gallon can contaminate your drinking water wells or a public water supply.

To Protect Your Drinking Water From Gasoline

Avoid Spilling Gasoline on the Ground, Especially Near Wells

- Don't drain gasoline from lawn mowers, snow blowers, etc. onto the ground.
- Don't burn brush with gasoline.
- Don't top off your fuel tank.
- Keep refueling and engine work away from water supply wells, and if possible, over a concrete floor or similar barrier. Immediately clean up any gas or oil spills.

Avoid Spilling Gasoline in Lakes, Ponds, and Rivers

- Keep special gasoline-absorbing pads on your gas-powered boat and know how to use them.
- If you own a larger boat, make sure it has no-spill tank vents.
- Fill portable tanks from outboard boat engines on shore.
- Refuel snowmobiles and ice augers on shore; do not take gasoline storage tanks onto ice-covered ponds.

Store Gasoline Properly

- Use a clearly labeled container made for gasoline and with a spout to avoid spills.
- Keep gasoline containers in a dry, well ventilated shed or detached garage away from water supply wells. Don't keep metal gasoline cans on a dirt floor for extended periods.

Dispose of Waste Gasoline Properly

- Handle old or dirty gasoline as hazardous waste. Bring it to a household hazardous waste collection center in a proper gasoline container.

If a spill occurs: For *any size* spill that is not immediately cleaned up, first contact your local 911 responder or fire department, then call the DES emergency spill number at (603) 271-3899 (Mon-Fri, 8-4), or weekends and evenings at (603) 223-4381 (NH State Police).

Revised August 2011

Got Clean Drinking Water?

It's up to you!

The DOs and DON'Ts for maintaining clean Drinking Water

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

For more information please contact the Drinking Water Source Protection Program at (603) 271-7061 or visit our website: http://des.nh.gov/organization/divisions/water/dwgb/dwspp/index.htm.

Where does your drinking water come from?

Your drinking water comes from either groundwater or surface water. Groundwater is the water that flows through the spaces between soil particles and through fractures in rock. It comes from rain and snowmelt percolating through the ground. Surface water comes from rainfall and snowmelt running over land and from *groundwater* seepage into lakes, rivers and reservoirs.

Why should you be concerned?

While some pollutants, such as bacteria, viruses and phosphorus, can be reduced by passing through soil under certain conditions, groundwater can be easily contaminated by chemicals and oils. Surface water is also affected by soil and pollutants picked up as water flows over land.

Keep Household Hazardous Wastes Out of your Drinking Water! Such as …
Automotive Fluids • Auto Batteries • Used Motor Oil
Oil-Based Paint • Paint Thinner • Antifreeze
Pesticides • Cleaning products • Gasoline

DO –

- Use non-toxic and less-toxic alternatives to pesticides and household chemicals.
- Take leftover household chemicals to your town's household hazardous waste collection day.
- Follow package directions on pesticides, fertilizers and other household chemicals.
- Check your underground fuel storage tank (UST) frequently for leaks. If a UST is more than 20 years old, replace it with an aboveground storage tank that has a concrete slab underneath it, a cover and secondary containment.
- Take care of your septic system. Inspect it every year and get it pumped out every 3-5 years.
- Avoid damage to your leach field and distribution lines by keeping vehicles, livestock and other heavy objects off of them.
- Test soil every two years to determine existing nutrient levels and pH before applying fertilizers.
- Use slow or controlled release nitrogen sources of fertilizer.
- Measure the area of your lawn to be fertilized to determine how much to use and calibrate or adjust spreader settings to match the recommended rate for fertilizers.
- Use drip pans large enough to contain motor vehicle or power equipment fluids being replaced or drained.
- Fully drain oil over a drip pan or pail before disposal. Most solid waste transfer stations accept used oil filters for recycling. Store and transport used oil filters in a covered leak-proof container until disposal.
- Keep absorbent materials such as rags, pads, "Speedi-Dry" or kitty litter near the work area and clean up all spills as soon as they occur.
- Dispose of all used absorbents immediately in a leak-proof container.
- Refuel or repair engines over an impervious surface, such as a concrete floor or tarp.
- Drain all fluids from motor vehicle parts before removing them from the vehicle.
- Follow medicine disposal guidelines described at www.nh.gov/medsafety.

DON'T –

- Buy more pesticides or hazardous chemicals than you need.
- Dispose of hazardous chemicals by pouring them down the drain or onto the ground.
- Over-use pesticides or household chemicals. More is not necessarily better.
- Have your UST removed by a contractor who is not familiar with state guidelines for UST removal.
- Overload your septic system with solids by using a garbage disposal, unless the system is specifically designed for one.
- Pour chemicals down the sink or toilet.
- Use septic system cleaners or additives containing acids or chemical solvents such as trichloroethylene (TCE).
- Use fertilizers if heavy rains are anticipated as the nutrients will be flushed from the lawn into drains and low areas.
- Apply fertilizers within 25 feet of most lakes and streams.

ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

WD-SSB-13 2011

You and Your Septic System

A Homeowner's Guide to Septic System Maintenance

Your septic system is a highly efficient biological system that can effectively digest and disperse your household sewage and other organic wastes. Properly designed, installed and maintained, it should give you many years of trouble-free service, **but only if it is properly maintained.** The key to the life and service of any septic system is proper maintenance.

How Does Your Septic System Work?

A septic system is designed to condition untreated liquid household waste (sewage) so that it can be readily dispersed and percolated into the subsoil. Percolation through the soil accomplishes much of the final purification of the effluent, including the destruction of disease-producing bacteria.

Your septic tank is the first step in the process of sewage conditioning. Without it, the untreated sewage would quickly clog the receiving soil and prevent the purification process of leaching and soil percolation. Septic tanks serve three functions:

- Removal of solids.
- Bacterial action.
- Sludge and scum storage.

In the first step, as sewage enters the septic tank, its rate of flow is reduced so that the larger solids sink to the bottom or rise to the surface. These solids are retained in the tank, and the clarified effluent with suspended and dissolved solids is discharged.

Bacterial action is the second function. The solids and the liquids in the tank are partially decomposed by bacteria and other natural processes. These bacteria are called anaerobic because they thrive in the absence of free oxygen. This decomposition of sewage under anaerobic conditions is termed "septic," hence the name of the system (and the cause of the odor).

Storage is the third function of your system. Sludge is the accumulation of solids at the bottom of the tank, while scum is a partially submerged mat of floating solids that may form at or near the surface. Space must be provided in the tank to store the residues during the intervals between cleaning. Otherwise, the sludge and scum will eventually be scoured from the tank and will clog the leach field and receiving soil. PERIODIC CLEANING OF YOUR TANK IS ESSENTIAL TO ITS PROPER FUNCTION.

Finally, the treated effluent from the septic tank is discharged to the leach field where it percolates through suitable gravel and finally into the subsoil for further purification.

Remember: A properly maintained septic system will adequately treat your sewage. A septic system failure is unhealthy, illegal if not corrected and a nuisance. Also, replacing an existing system can be costly! The life of the system can be prolonged by proper maintenance and frequent tank pumping.

What You Can Do to Properly Maintain Your Septic System

First and foremost, inspect your septic tank every year. If the sludge and surface scum combined are as thick as 1/3 the liquid depth of your tank, have the tank pumped out by a licensed pumper. Your tank should be pumped out **at least every two to three years**.

Do not flush bulky waste or grease into the system. It can plug the sewer and/or distribution lines.

Do not flush toxic materials into the system. Paint thinner, gasoline, pesticides, chlorine, drain cleaners and other caustic or toxic substances can kill the naturally-occurring bacteria in the tank and impair its function. If in doubt, don't flush it.

Conserve water. Too much water can overload your system and adversely affect its function.

Don't allow vehicles or livestock on your leach field. The weight can compact the soil and/or break pipes.

Any soggy areas around the system, or disagreeable odors, could indicate system failure. Have it checked.

Additional Suggestions

Minimize or eliminate use of kitchen "disposal" units, which grind up food wastes and place a burden on the septic tank, especially if the original septic design did not accommodate one.

If water treatment system backwash has been directed into the home septic system, check to make sure that the additional volume from the discharge can be accommodated by your septic system. Unfortunately the majority of treatment systems are installed after the home and septic system are built. The additional water to the septic tank and leaching field may cause problems with septic system operation or may overload the existing leaching area and result in premature failure. Additionally, some experts believe that the brine from backwashing may have detrimental effects on bacteria growth and may influence the soil's ability to infiltrate water.

Maintaining a Record

On the next page, is a template for creating a permanent maintenance record of your septic system for your files.

For More Information

For more information, please contact the DES Subsurface Systems Bureau at (603) 271-3501 or go on-line at http://des.nh.gov/organization/divisions/water/ssb/index.htm for detailed information.

Septic System Maintenance Record for: _____

First, in the space below, make a sketch of the location of your septic tank in relation to your house. Measure and record on your sketch the distances from the house foundation to the septic tank or cesspool cover, to the distribution box, leaching system and to other permanent features such as nearby trees or rocks.

Date System Installed: _____ Installer: _____

Record of Pumping Service/Maintenance	
Date	**Septic Service Provider**

For More Information
For more information, please contact the DES Subsurface Systems Bureau at (603) 271-3501 or go on-line at http://des.nh.gov/organization/divisions/water/ssb/index.htm for detailed information. Subsurface Systems Bureau; 29 Hazen Drive, PO Box 95; Concord, NH 03302-0095.

Appendix E- Septic Survey and Failure Analysis Materials

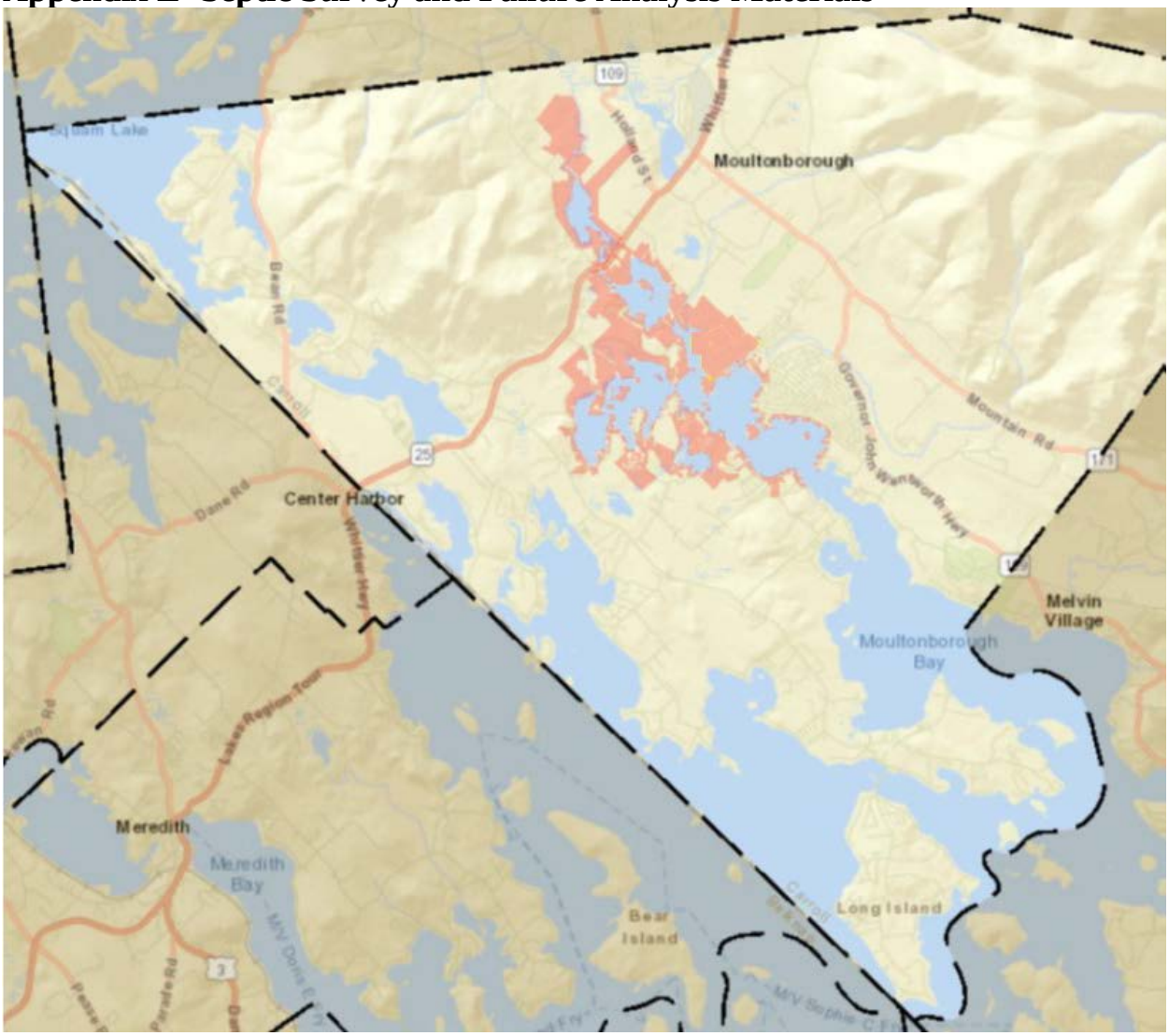


Figure D-1. Moultonborough Bay Inlet septic survey areas. Pink-colored areas denote shoreline properties which should be surveyed. Total: 712 properties. Source: Town of Moultonborough.

Sample Survey Letter
Date

Dear Property Owner,

The Town of Moultonborough, and Lake Winnipesaukee Association are working together to address water quality issues in Moultonborough Bay Inlet through the creation of a watershed management plan. Moultonborough Bay Inlet has historically shown higher level of in-lake nutrients including phosphorus and nitrogen, and is currently on the state's list of impaired waterways for cyanobacteria. Nutrients can come from a variety of sources including agriculture, roadways, lawn care chemicals and residential septic systems to name a few. Identifying the sources of nutrient inputs is the first step in addressing water quality issues in Moultonborough Bay Inlet. The purpose of this survey is to gain a better understanding of the state of septic systems located in the Moultonborough Bay Inlet area and the impact they could be having on our waters.

Data from this survey will be compiled as a part of a Source Water Protection Plan being prepared for the Town of Moultonborough in conjunction with this project and will be used to evaluate the state of septic systems located on properties located within 250ft of the shoreline. Participation in this survey is voluntary and anonymous, no identifying information is needed as the goal of this survey is not to single out home owners but to gain a better understanding of the lake as a whole. All you need to do is complete the 11 question, multiple choice survey on the back, and mail back in the provided envelope.

Although a properly functioning, maintained septic system can help protect water bodies from pollution, over-use or lack of maintenance can allow nutrients or household chemicals to leach into surface water bodies or groundwater wells. Understanding the risk presented by septic systems is essential to any watershed management plan, especially in developed areas.

Thank you for your participation in this survey, your responses, as well as the responses of your neighbors will help us better understand the factors affecting the waters of Moultonborough Bay Inlet and will help us plan for Moultonborough's future. Again, no identifying such as name, address, or lot number information is needed, this survey is completely anonymous.

Sample Septic Survey

Moultonborough Bay Inlet- Anonymous Septic System Survey

Please complete this survey honestly and to the best of your knowledge. No personal or property information is needed as all responses are anonymous. Information collected from this survey will help evaluate water quality in Moultonborough Bay Inlet and help the Town of Moultonborough and Lake Winnipesaukee Association protect the waters of Moultonborough Bay Inlet. Your participation is appreciated! Please circle the most appropriate answer.

Approximate year the home was built:_____ Number of years owned by current owner:_____

How old is your Septic System (years)?
<10 10-15 15-20 25+ Don't Know

Approximately how large is your septic tank (gallons)?
<500 500-750 750-1,000 1,000-1,500 1,500+ Don't Know

How many bathrooms?
1 2 3 4+

How many months out of the year is your home used?
<4 4-6 6-8 8-10 10-12

Which of the following amenities/appliances do you use on your property (circle all that apply)?
Dishwasher Washing Machine Garbage Disposal Other:_____

What size is your property?
¼ Acre ½ Acre ¾ Acre 1 Acre 1+ Acre

How far away from the nearest water body (lake or stream) is your septic system located?
20ft or Less 20-50ft 50-75ft 75-100ft 100ft + Don't Know

How often is your septic tank pumped?
Every 1-3 Years Every 3-5 Years Every 5-10 Years Every 10+ Years Never

What types of problems are you experiencing with your system (Circle all that apply)?
None Odors Surface Discharge Clogging Backups Sluggish Plumbing

What is your drinking water source?
Public Water Private Well Bottled Water

Thank you for completing this survey! Please place the completed survey in the self-addressed, stamped envelope provided and drop it in the mailbox. Rest assured this survey is anonymous and the data gained from this survey will be used to learn more about our piece of the lake and to help keep it clean.