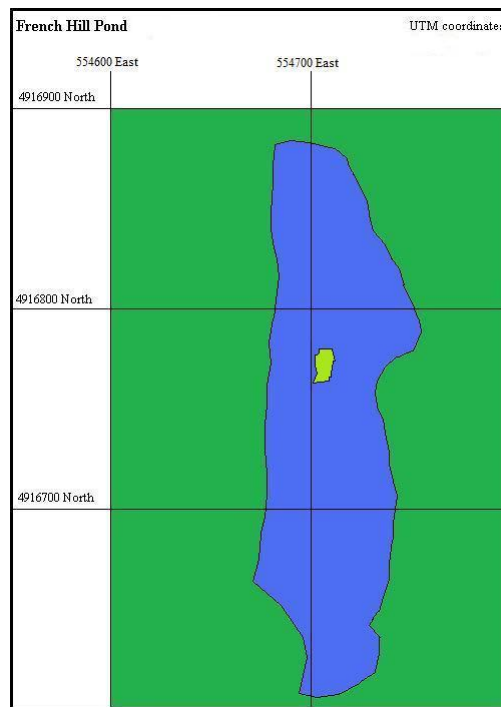


The Physical Characteristics of French Hill Pond

Size and Location

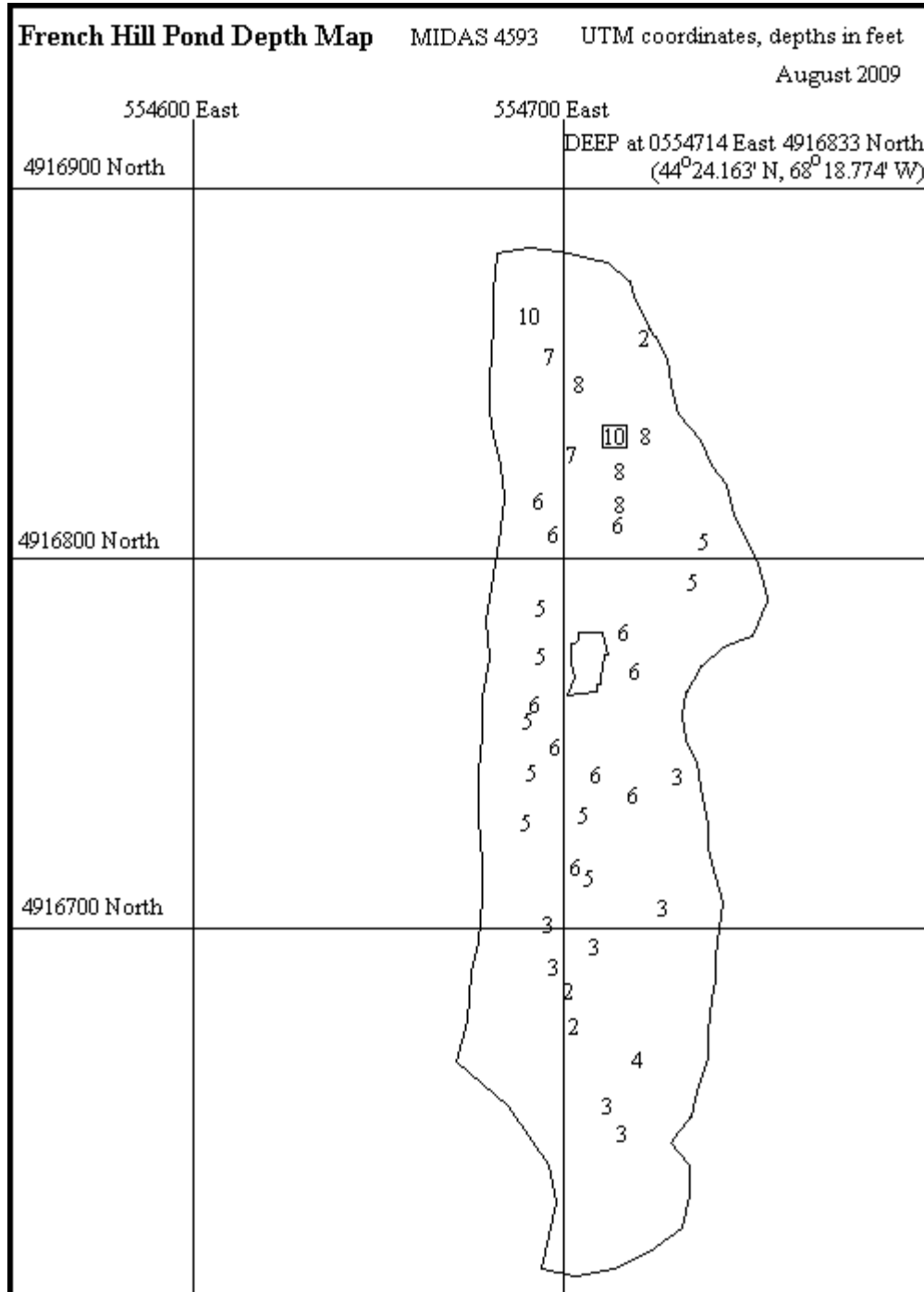
French Hill Pond is a body of water about 3.72 acres in area with an average depth of about five feet. The volume of the pond is about 20 acre-feet. The surface of the pond is about 63 feet (19 meters) above mean sea level. At its widest point, the pond is about 240 feet (73 meters) due east to west. There is a small island of less than 2,000 square feet (0.04 acres) in about the middle of the pond just south of this widest point. The longest distance due north to south is about 912 feet (278 meters). The island is just east of this longest line. Map 1 shows the pond on a Universal Transverse Mercator grid referenced to the WGS 84 datum. North is at the top. See the monograph describing the construction of the maps, *The Map*, for a description of this grid system and the geodetic reference.



Map 1 – French Hill Pond

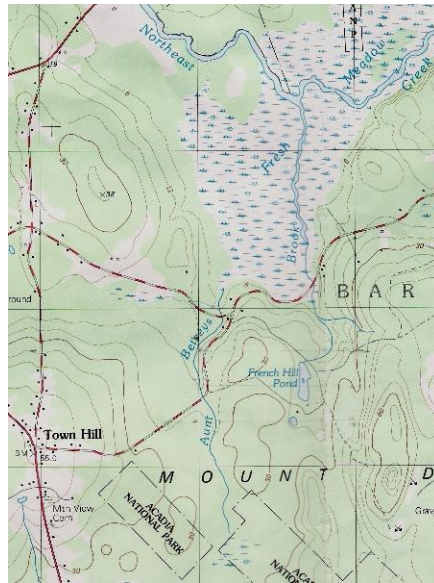
The deepest point of the pond is about ten feet (three meters). This deep point is located at $44^{\circ} 24.163'$ North and $68^{\circ} 18.774'$ West on the WGS 84 datum and is in the northern middle area of the pond. Another deep point of about the same depth is located nearer the shore in the northwest quadrant of the pond at $44^{\circ} 24.181'$ North and $68^{\circ} 18.791'$ West on the WGS 84 datum. This latter deep point is very near a small brook that drains a wet area of the adjacent forest to the west of the pond. It was not used for Secchi disk and other studies because the water in this area is contaminated by the brook. Map 2 shows the depths in feet for various points on the pond. The depth of the deepest point is enclosed in a box.

The immediate depths at the shore are from two to four feet and the bottom rapidly drops-off, except at the southern quadrant of the pond. In this southerly quadrant, the depths tend to be shallow, ranging from about a foot to four feet at most but averaging between two to three feet. This area also has a collection of tree stumps and branches and large communities of plants.



Map 2 – French Hill Pond Depths

French Hill Pond is in the Town Hill area of Bar Harbor and located on Frenchman's Hill Road about one-half mile east of the Crooked Road in the Frenchman's Hill Subdivision, Bar Harbor, Maine. The pond is in the French Hill Brook Watershed. French Hill Brook flows north from the pond into Fresh Meadow part of which is in Acadia National Park. There are several brooks flowing into French Hill Pond, but the only outlet is French Hill Brook. The following section of the United States Geological Survey (USGS) topographic map titled *Salsbury Cove, Maine (15' Quadrangle 1981)* shows the location of the pond and brook.



Map 3 – Topographic Map of French Hill Pond Area

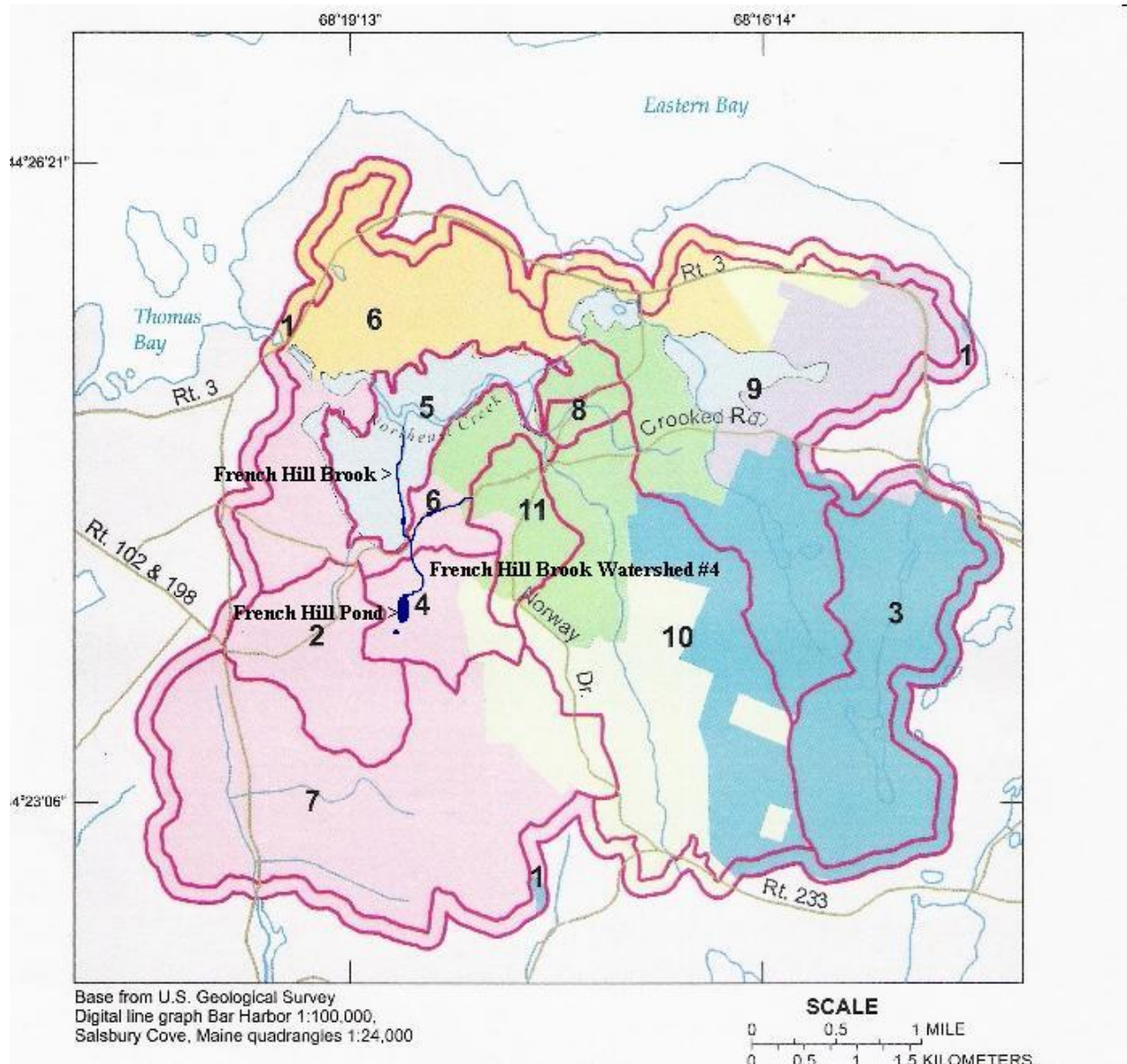
The most northerly point on the shore of the pond is at 44° 24.191' North and 68° 18.791' West. The most southerly point of the pond is at 44° 24.040' North and 68° 18.783' West. The point on the shore of the pond farthest east is at 44° 24.139' and 68° 18.743' West. The point farthest west is 44° 24.072 North and 68° 18.807' West. The center of the island is about 44° 24.13' North and 68° 18.78' West. These coordinates are referenced to the WGS 84 datum. The map shown above is referenced to the NAD 27 datum.

Sources and Disposition of Water

The principle source of water appears to be a brook flowing into the southern part of the pond. This brook is fed by a smaller private pond on the Harper property south of French Hill Pond. The source of that water appears to be the forest and wetlands in the southern part of the French Hill Brook Watershed. There is another smaller brook draining the property to the southeast. Another small brook drains the wet area of the property to the east of the pond. There also appears to be springs on the eastside property near the most eastern point of the shore because this area often remains unfrozen in winter. Another brook on the northwestern shore of the pond drains the woods and wetlands west of the pond. Some of these sources may be dry for part of the year.

The only outlet from the pond is French Hill Brook flowing north to Fresh Meadow. This disposition of the water in French Hill Pond has greater importance than usual because Fresh Meadow is part of the greater Northeast Creek Watershed, considered one of the most pristine watersheds on the east coast of the United States.

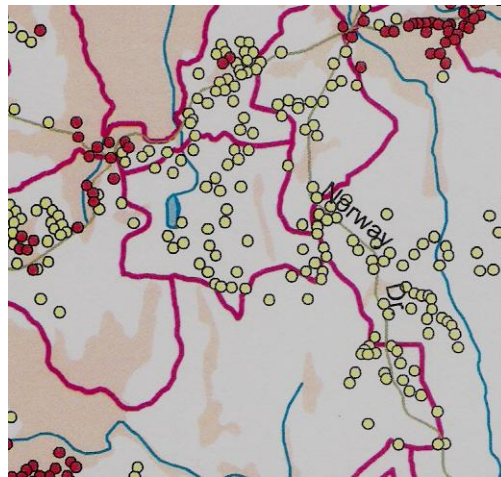
The following map is from the USGS Open-file Report 02-435, *Estimated quantity of water in fractured bedrock units on Mt. Desert Island, and estimated groundwater use, recharge, and dilution of nitrogen in septic waste in the Bar Harbor area, Maine*. It shows the watersheds in the Northeast Creek area of Mount Desert Island. The watersheds are numbered from 1 to 11 with watershed 4, the French Hill Brook Watershed, containing French Hill Pond. The watersheds are outlined in red. Watershed 1 is a 500-foot buffer area. The colored, shaded areas



Map 4 – Watersheds in the Northeast Creek Area

are specific districts in Bar Harbor. The pink area is the Village of Town Hill in which most of the French Hill Brook Watershed lies. Part of the French Hill Brook watershed is in the McFarland Hill District and a small portion is in the Emery District.

Some water in the French Hill Brook Watershed will come from the homes of people living in the watershed. The following map from the USGS Open-file Report 02-435 shows the distribution of homes in the watershed as of 2002.



Map 5 – Distribution of Homes in and Around the French Hill Brook Watershed

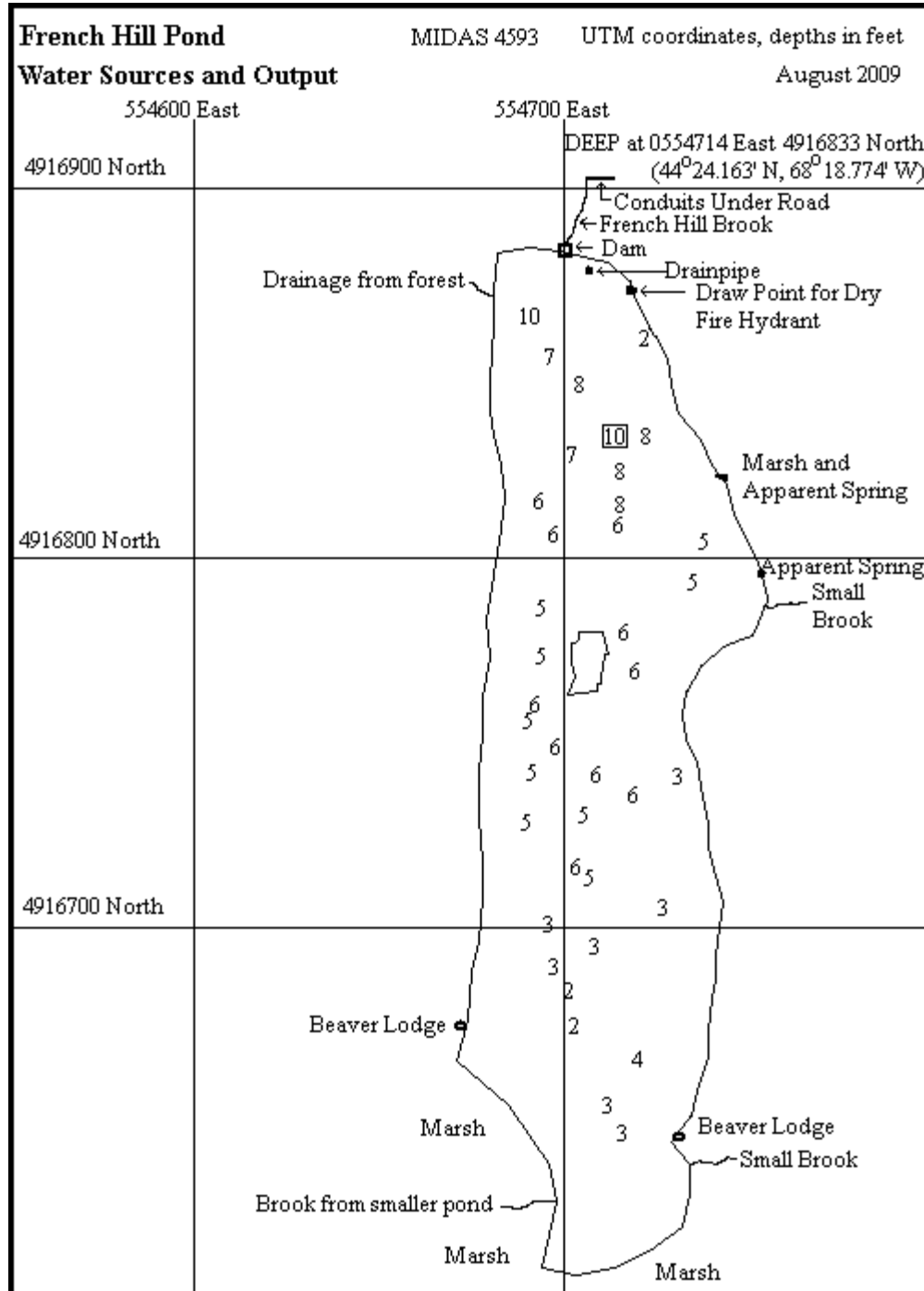
The covenants in the deeds to the Frenchman’s Hill Development restrict home construction to one primary residence and one guest house per lot. The lots are about four acres in size. There are three lots on the shore of the pond. Only one of these lots has a house and garage both of which are more than 150 feet from the shore of the pond. The largest lot on the pond is a common area on which a structure is not likely to be built. The third lot straddles the southern part of the pond. A house could be built on this lot but current regulations and the topography of the lot would restrict this house to a part of the lot quite distant from the pond. Further construction in this development is not likely to affect the pond but could impact French Hill Brook. Therefore, the sources and distribution of French Hill Pond water are not likely to change because of human activity.

The following map shows the location of water sources and French Hill Brook in more detail. Note that most of the water comes from natural forest and wetlands to the south and west of the pond. Most of this area cannot be developed. The flow of water in the marshy area south of the pond is complex. Some of the water from the two brooks in this area mixes in the marsh before entering the pond. There is also water runoff from the road south of the pond.

French Hill Brook does not normally start at the dam built on the northern shore of the pond. A drainpipe near the dam keeps the pond level at the depths shown on the map. Water flows into this drainpipe, through a buried conduit under the shore and road and into French Hill Brook northeast of Frenchman’s Hill Road. In very dry times, usually in August, flow into this drainpipe may cease and the level of the pond may drop about a foot. After a heavy rain, the

level of the pond may rise as much as a foot and the water will flow over the dam, under the road and into French Hill Brook. A “beaver deceiver” is located round the drainpipe.

The northeast corner of the pond is also the site of a dry fire hydrant. The access port is at the



Map 6 – French Hill Pond Water Sources and Output

edge of the road that runs from northwest to southeast past the pond. Bangor Hydro-electric Company power lines cross the northern tip of the pond almost west to east.

The dry fire hydrant was used at least once to provide water to fire trucks fighting a grass fire on a ridge to the east. The fire trucks made a number of trips to replenish their water but there was no noticeable drop in the level of the pond. The pond level will noticeably drop in very dry periods mostly from evapotranspiration, that is, evaporation of the water directly from the pond and release of water to the atmosphere by vegetation. Evapotranspiration occurs in wet periods as well but does not seem to have a significant effect on pond water level.

The following aerial photograph taken for the USGS and obtained from Microsoft Bing[®] shows the location of the small pond south of French Hill Pond. The brook flowing into French Hill Pond from the southwest on the map above drains the small pond.



Aerial View of French Hill Pond and Small Pond South of French Hill Pond

The following photograph shows French Hill Pond from the south. Note the dam and spillway to the left. The drainage pipe is to the left of the dam and cannot be seen in this photograph. The spillway becomes active during and after a heavy rain and during the spring snowmelt. The picnic table is one of three located on the grassy mown area on the pond shore. Local residents use this area as a picnic area. Kayaks, inflatable boats and canoes are used on the pond.



View of French Hill Pond

The small pond south of French Hill Pond is shown in the next photograph. This small pond is about an acre in surface area. It drains forested areas to the south and southwest.



View of Small Pond

The following photograph shows the brook that drains the small pond into French Hill Pond. French Hill Pond is behind the trees to the left.



Brook Supplying French Hill Pond from the Small Pond

Geology of French Hill Pond

French Hill Pond is located on a geological formation of undifferentiated intrusive igneous rocks. This formation holds groundwater fairly well. The well on the property east of the pond located about 300 feet from the shore of the pond has a recovery rate of 50 gallons per minute. The water in the formation to the east of the pond appears to be under pressure and moving as evidenced by water seeping up from the ground in this area even in dry periods. This source of water may account for the apparent springs on the east side of the pond.

There are a number of pink granite ledges in the area, some of which can be seen at the edge of the pond particularly on the east side. The bottom of the pond appears to be covered by rocks according to depth-finder readings. Some of the large rocks at water's edge appear to be cut square indicating that, at some time in the past, this area may have been quarried. The following photograph taken on the east shore of the pond illustrates this possibility.



Rocks and Weeds in French Hill Pond

Part of the French Hill Brook Watershed is on the Presumpscot Formation. This formation is the area in pink on Map 5 above. The Presumpscot Formation in the French Hill Brook Watershed is high on a ridge nearer to Norway Drive than the pond. This formation is notorious for not holding groundwater well. Note that no homes in the French Hill Brook Watershed are built on this formation.

Physical Chemistry of French Hill Pond

The water in French Hill Pond is tea-colored. This coloring is common in Maine lakes and ponds. It is produced by dissolved organic acids like tannins and lignin. Tannins come from organic matter like oak tree bark often in the form of tannic acid, an organic acid, $C_{14}H_{10}O_9$. Lignin is an organic material similar to cellulose that binds the fibers in plants. One would expect a considerable quantity of these chemicals in French Hill Pond because most of the pond water comes from forests and wetlands and is not well-filtered before entering the pond. These chemicals pose no threat to the health of the pond or people using the pond.

The transparency of the water is measured using a Secchi disk. A Secchi disk is a metal or plastic disk about eight inches in diameter painted with alternating black and white quadrants. A measuring tape is attached to the disk. This tape is marked in units of meters allowing accurate measurements to within a centimeter. The Secchi disk is lowered into the water and observed through a water scope. The depth at which the Secchi disk can no longer be seen is recorded. That value is a measure of the water transparency. Secchi disk readings in Maine lakes and ponds are usually between 0.2 meters and 21.27 meters. The average Secchi disk reading in Maine is 4.83 meters. Secchi disk readings are taken on the shady side of the boat at the deepest point in the lake or pond while the boat is securely anchored. A standard, metal Secchi disk and slant glass and mask water scope were used to measure the transparency of French Hill Pond.

The degree to which a lake or pond is acidic or basic is determined by measuring the pH of the water. This parameter helps identify the type of plants and animals that are likely to thrive in the lake or pond. The pH of Maine lakes varies from 4.37 to 9.70. The average pH is 6.82. Any pH less than seven indicates acidic water. A pH greater than seven indicates a basic condition. A pH of exactly seven is neutral.

The pH of French Hill Pond was measured on the surface at the deepest point using a Hanna Instruments pH Checker[®] 1. This instrument was manually calibrated using 7.01 and 4.01 buffer solutions at 20° C (68° F). The accuracy of this instrument is ± 0.2 pH at 20° C (68° F) with a resolution of 0.01. Within an hour of recording the first pH reading in French Hill Pond, this instrument was used to measure the pH of tap water a sample of which was sent to a water testing laboratory immediately. The Hanna instrument measured the pH of the tap water as 6.76. The laboratory subsequently determined that the tap water sample had a pH of 6.8. These pH readings indicate a high confidence in the accuracy of the instrument and procedure used to measure the pH. The surface temperature of the water was taken at the same time as a pH reading.

Total phosphorus dissolved in lake or pond water is an indicator of how well the lake or pond will support plant growth. The unit of measure of total phosphorous is normally expressed in

parts per billion, because there is normally much less than one part per million (ppm) of dissolved phosphorous in lake/pond water, but is often expressed in parts per million. Laboratory analysis results are often reported as milligrams (thousandths of grams) of phosphorous per liter of lake/pond water. This number is equivalent to parts per million because there are 1000 grams in a liter of water. The epilimnetic (surface layer of water) total phosphorous in Maine lakes varies from 0.001ppm to 0.426ppm with an average of 0.012ppm. The sample taken from French Hill Pond was analyzed by the University of Maine. The total phosphorous in French Hill Pond was 36 parts per billion on 08/25/2009. This value is three times the average of total phosphorous in Maine lakes but more than an order of magnitude less than the maximum total phosphorous found in Maine lakes. Therefore, French Hill Pond will support plant life but probably not to excess.

Dissolved oxygen is important to maintain life in a lake or pond. Fish require at least 5ppm of dissolved oxygen to thrive. Dissolved oxygen can be measured through chemical analysis or with a dissolved oxygen meter. Another important parameter related to dissolved oxygen is water temperature. Warm water contains less dissolved oxygen than cold water. Lakes and ponds tend to develop layers of water with the warmer water in the top layer. Fish, for example, will generally prefer the colder layer if it has enough oxygen. Dissolved oxygen and temperature readings are taken at one meter intervals at the deepest point of the lake or pond until the bottom is reached or the readings stabilize. These readings will determine if the lake or pond has stratified layers and is capable of supporting animal life.

The following table shows the data collected on French Hill Pond in 2009. No dissolved oxygen tests were performed in 2009. The time is 24-hour time. Times greater than 12:00 are post meridian times (pm). Convert to pm by subtracting 12:00. The Secchi disk readings are to the nearest hundredth of a meter or centimeter. Total phosphorous is in parts per million. The pH is defined to be minus the decimal logarithm of the hydrogen ion activity in water based solutions. The surface temperature is in degrees Fahrenheit.

Date	Time	Secchi Disk Reading	Total Phosphorous	Surface Temperature	pH
08/16/2009	14:00	1.07 meters	N/A	N/A	N/A
08/25/2009	11:01	1.02 meters	0.036ppm	72° F	5.75
09/10/2009	13:32	1.05 meters	N/A	70° F	5.55
09/24/2009	12:09	1.01 meters	N/A	66° F	6.15

Table 1 – 2009 Pond Physical Characteristics Readings

The readings on 08/25/2009 were taken after two days of rain. The decrease in pond transparency can be attributed to silt runoff from the rain storms. The pH of pure rain is about 5.8, which correlates nicely with the pond reading.

The 09/24/2009 readings were taken after over a week of clear days and a decrease in the water level by about six inches. Note that the turbidity of the water increased as did the pH.

The USGS study, *Hydrologic Data Collection in Small Watersheds on Mount Desert Island, Maine, 1999-2000*, found that the pH of French Hill Brook in August of 2000 was 6.3 and the dissolved oxygen was 69 percent saturated at 15.9° C, which equates to about 7ppm. The collection point for the USGS study data in French Hill Brook was near the crooked road and close to the point where French Hill Brook enters Fresh Meadow. Therefore, this data does not necessarily represent the condition of French Hill Pond at that time but does represent the condition of the water that the French Hill Brook Watershed contributes to the Northeast Creek watersheds. No dissolved oxygen readings were taken from French Hill Pond in 2009.

The Secchi disk readings and simple observation of the French Hill Pond water indicate that the water in French Hill Pond is turbid. However, most of this turbidity seems to be due to the high concentration of tannins in the water. Algae also contribute to this turbidity.

Water samples were also taken on 08/25/09 to test for human pathogens in the pond water. These samples were taken as surface grab samples at the deepest point of the pond. The sample bottles were not rinsed because they contained a chemical and were carefully filled to avoid losing this chemical and avoid contamination. The presence of E. coli was determined by Colilert MPN Enumeration and found to be 530 MPN/100ml. Fecal streptococcus was measured by membrane filtration and found to be 300 CFU/100ml. The acronym CFU is Colony Forming Units, ml is milliliters and MPN is Most Probable Number (of colony forming units). Generally, the State of Maine discourages swimming in water in which the CFU/ml of these pathogens exceeds 250. However, the safety of a lake or pond depends upon a number of factors and cannot be decided based upon these results alone. The source of these pathogens is generally animal waste. Given the month in which the samples were taken, relatively small size of French Hill Pond and the relatively large number of animals in the vicinity of the pond; these readings are not surprising.

Summary

French Hill Pond is a turbid body of water about 3.72 acres in surface area and about 20 acre-feet in volume. An island of about 2,000 square feet is in the middle of the pond. The deepest point of the pond is just over ten feet. French Hill Pond is in the French Hill Brook watershed that drains wetlands and forests east, south and west of the pond. The water from French Hill Pond flow into French Hill Brook and into Northeast Creek.

The bottom of the pond appears to be littered with rocks. It is located on a geological formation of undifferentiated igneous rocks. The surrounding area has pink granite ledges.

The water transparency measured by a Secchi disk is just over a meter (about 40 inches). The pH of the water varies from 5.55 to 6.15. The total dissolved phosphorous was found to be 36 parts per billion. The water was found to contain a significant quantity of human pathogens, specifically E. coli and fecal streptococcus.