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### Kingswood Lake Management Plan

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# Kingswood Lake Management Plan

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Undergraduate Honors Thesis



## **Abstract:**

High water quality and natural buffers exist on Kingswood Lake located in Brookfield, New Hampshire. A comprehensive lakes inventory (CSI) was recorded and health of the land, wildlife, and waterways were observed. Educational outreach was taken to inform the local community and to instruct them on proper stewardship of the land. A completed watershed management plan was constructed including key recommendation of limiting nitrogen loading in the area, checking septic systems for leaching, stabilizing shoreline from erosion, and establishing man-made rain gardens to help preserve water quality. The Kingswood watershed management plan acts as a guide for the town of Brookfield, New Hampshire to help protect water quality for future generations and to provide residents with the necessary tools needed to begin this commitment to their natural environment.

## **Executive summary:**

Located in the town of Brookfield in Carroll County, New Hampshire, Kingswood Lake serves as summer getaway for many families that live on the lake. Threats to the water quality of Kingswood Lake come from increased development on the lake and lack of awareness about water quality. The overall goal for the Lake Kingswood management plan is to educate the general public about the lake and generate potential management strategies to encourage best management practices in and around the lake to protect water quality.

## **Project Overview**

Located in the town of Brookfield in Carroll County, New Hampshire Lake Kingswood is a private lake that serves primarily as a summer residency getaway. There is very little lake traffic however threats to water quality from increased removal of vegetation buffer, increased development in the area pose threats to greater levels of impervious surfaces, aging septic systems, and pollutions from runoff getting into the waterways.

## **Problems**

- Growing Development

- Maintaining Water quality
- Public Awareness
- Water Level
- Lake retention
- Potential for Invasive Species
- Septic Systems

## **Goals**

- Educate general public about water quality issues
- Monitor water quality
- Initiate efforts to reduce removal of vegetation along banks and erosion levels

## **Recommendations**

- Form a VLAP or LLMP monitoring program
- Establish more public involvement and awareness on what types of activities are harmful to water quality health.
- Build rain gardens
- Establish more buffers around shoreline and remove debris and dead trees from shoreline
- Better educate and regulate septic systems
- Regulate fertilizers
- Establish a weed watchers program
- Launch a water monitoring program
- Promote to maintain water level year round

## **Introduction:**

This project was developed and executed as an honors thesis project to develop and address problems and possible solutions in regards to Lakes management. This project in particular allowed a lakes management project to be developed for Kingswood Lake located in Brookfield, NH. A lakes management plan was drafted that outlines the perceived problems of the lake, the goals that they accomplished during the project, and recommendations for the future of the

health of the lake. Various data was collected that allowed for assessments of the lake to be made. A complete outline of what steps were made over the course of June 2013 to March 2014 which are included in this binder that demonstrate my opinions of possible next steps that could be taken at Kingswood Lake. The data included and the management plans are just recommendations and are not necessary steps that need to be taken. Therefore it is not the responsibility of Brookfield, NH of The University of New Hampshire to make these recommendations happen, it is just a suggestion.

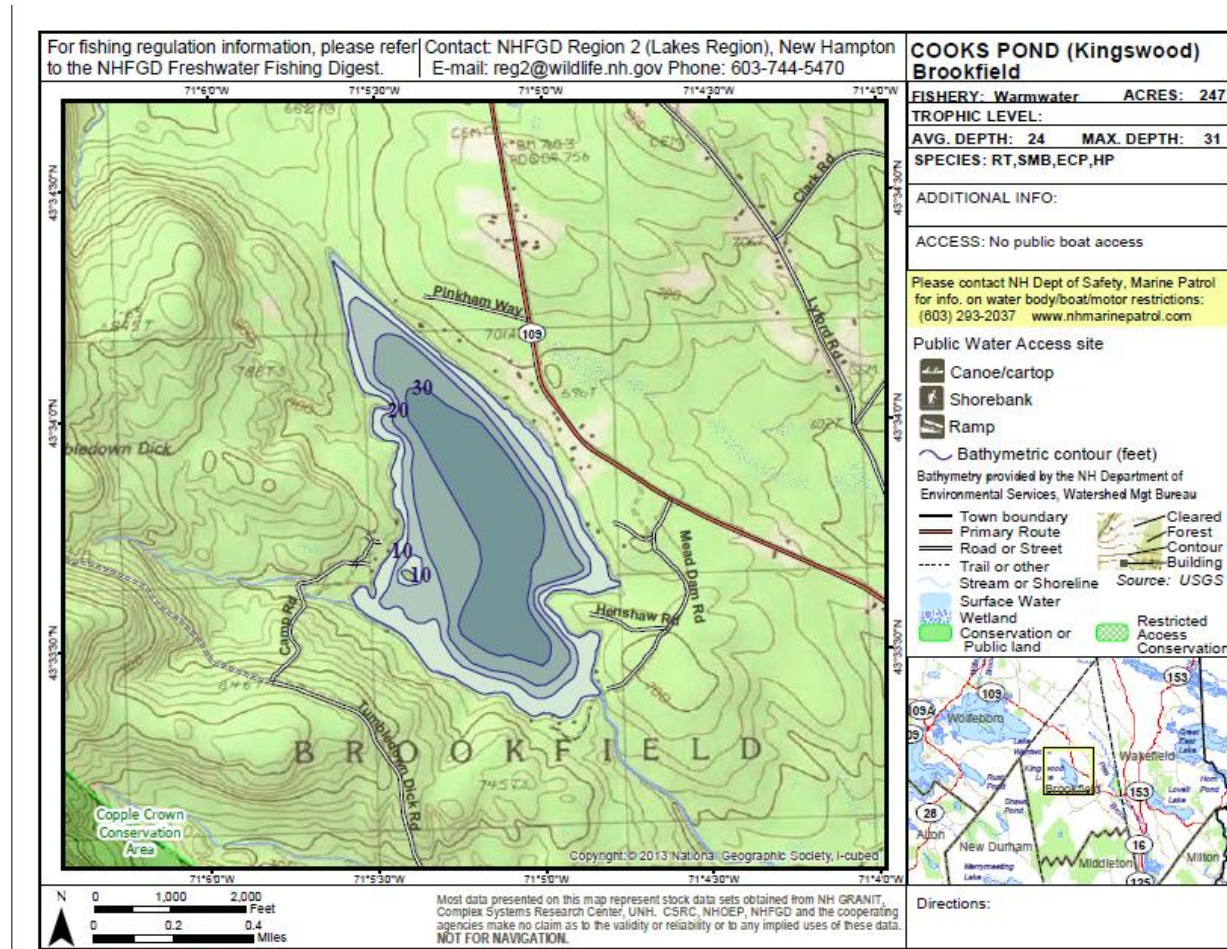


Figure 1: Map of Kingswood Lake

Source: [http://www.wildnh.com/Fishing/bathy\\_maps/kingswood\\_brookfield.pdf](http://www.wildnh.com/Fishing/bathy_maps/kingswood_brookfield.pdf)

**“This is my summer home”**

## **Methodology:**

Kingswood Lake has a dam at the south/east end of the lake. It currently keeps the water levels full during the summer which is at lake level. This means that the lake is equal to zero on the local gauge at the dam or top of the logs at the dam site. After the summer the lake goes through seasonal fall drawback which takes place each year around Columbus Day. The stop logs are removed from the dam gradually over a period of time to achieve a four foot drawdown in elevation. In most years though the four foot drawdown is not met and it more likely to be about three to three and a half feet drawdown. The spring refill occurs at the beginning of the New Year where most of the stop logs are replaced and put back in the dam. The lake then is allowed to slowly refill to reach the full lake level come summer. It is important to recognize that the water levels fluctuate in response to precipitation, snowmelt, and drought. The target water levels are adjusted and tend to be variable depending on these conditions. Overall though the purpose of the dam and the seasonal drawdown and refill is to allow for people to be able to have their permanent docks and decks not be ice damaged ([www.des.state.nh.us](http://www.des.state.nh.us)). There is no other particular reason that the drawdown occurs as it is not, from an environmental standpoint, beneficial.



Figure 2: Kingswood Lake, looking across the lake from route 109 in late summer of 2013.

Overall the lake has no historical problems of water quality and has low pressure in general due to the amount of people per acre of land. In the past the lake has increased though in population and historical summer homes have grown in size to accommodate the growing number of more permanent homes.

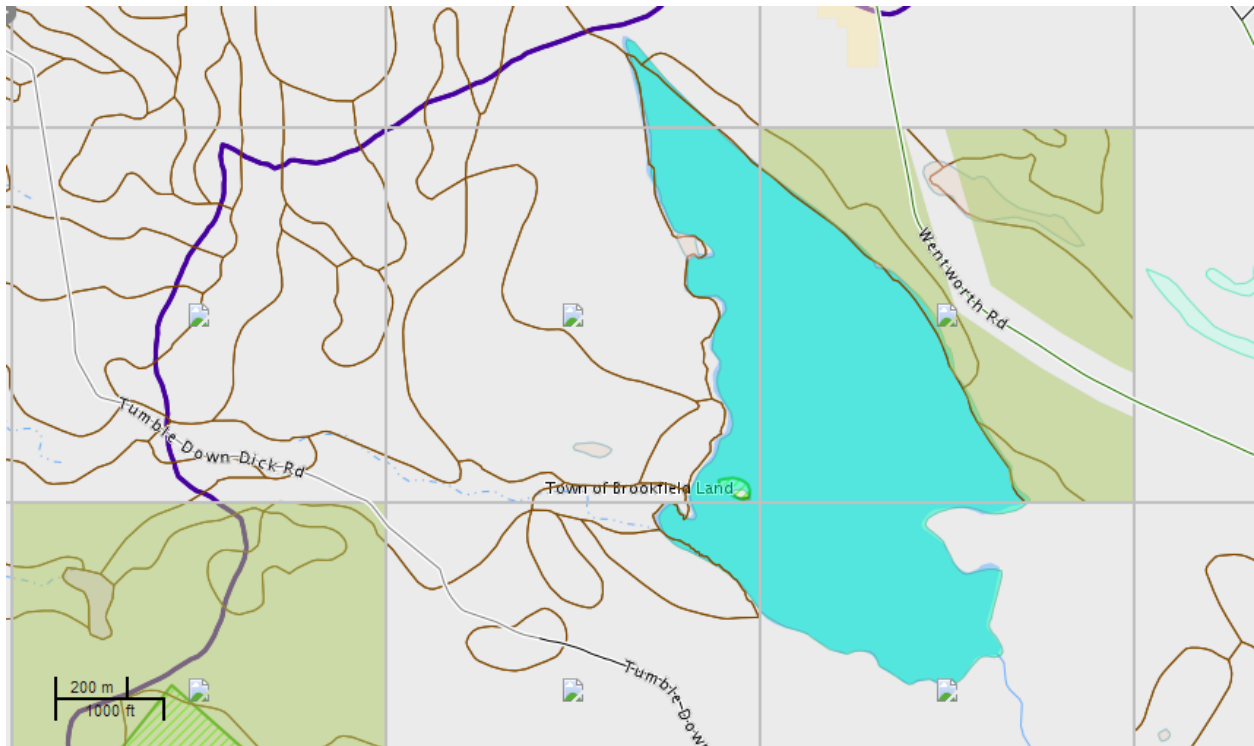
In the past water was used from the lake as drinking water and house water for showering and doing dishes. There are many older homes on the lake that have lawns running right up to the water's edge. The lake in general is much more developed on the true north side as Governors Wentworth Highway runs parallel to the road. The Southern side of the lake is very rural but becoming more developed as the dirt road that runs parallel to the lake, Tumbledown Dick Road, is becoming accessible in the winter. In addition the lake has a large amount of conservation land that is on the western part of the lake and has natural edges.

The lake as a whole has very limited amount of water quality data sampled and has low state involvement in terms of management plans due to the fact that the lake has no public access. Educating the land owners around the lake to promote best water quality techniques would be beneficial to establish a better understanding from the community about the valuable resource

they live on. Getting the current lakes association to fund water testing would be a beneficial step in the future.

Various sources of information were utilized to devise this management plan. One tool used was the Comprehensive Lakes Inventory which helped to identify issues of concern. There was a lot of research performed by the group in attempt to learn the history of the pond and about programs we could recommend be used for future management. Other sources of information were personal interviews with residents on the pond, people who recreate on the pond. In class presentations from members of Lake Associations, DES, and UNH have also provided valuable information. Site visits were performed to make observations and gather information on several occasions. Our last source of information was contact via phone and e-mail with anyone we could find associated with the Pond to obtain insight, opinions, and information.

## Results:



- **Figure 3:**
- **SOURCE: Granit: NH Wetland Mapper. Environmental Protection Agency. 2012.**



### *Description of the Lake*

Kingswood Lake is located in Brookfield, NH which is in Carroll County. It is located within the Salmon Falls River Watershed. The lake itself is located along Wentworth Road, also called Governors Wentworth Highway, which is less than a mile west of Brookfield town center. The entire shoreline of this 235 acre lake is developed with sprawling homes that are mostly summer homes. Many of the homes on the lake have mowed lawns, stonewalls along the edge of the water, and docks that get placed seasonal. The New Hampshire Department of Environmental Services maintains a dam which is located at the southern end of the lake. The dam releases water every fall typically around Columbus Day. The dam release water that flows southeast about a half a mile through forested terrain until it reaches Churchill Brook. Churchill brook begins east of Tumble Down Dick Road and continues to flow east through forested land until it runs under Govers Road and continues on for about another half a mile until it joins up with Pike Brook. The overall water quality for Churchill brook and Pike Brook are limited as they are not regularly tested; however, due to the fact that they have natural forested habitat landscape to flow through the water quality is assumed to be relatively good. (SOURCE:

[http://swim.wellsreserve.org/town.php?town\\_id=3](http://swim.wellsreserve.org/town.php?town_id=3))

### *The demographics and Gography of Brookfield*

Historically speaking Brookfield was settled in 1726 by Scotch-Irish immigrants and first called Coleraine which was later changed and included as part of Middleton, the town adjacent Brookfield. Brookfield became an independent town in 1794 and was known for its fertile grounds and good water. The most likely reason the Brookfield became its own town was because of the mountainous terrain and travel was hard for people to get to town meetings.

Today, the town of Brookfield is relatively small and located in a rural area of the lakes region. The most recent census, 2010, estimated the town's population at 650 people. There are currently 236 households and out of that number there are 180 families. Making the population density to be 26.4 people per square mile (10.2/km<sup>2</sup>).

The town itself is mostly forested with some small farms that are primarily horse farms. Brookfield has few roads in it and no major developments. The highest point in elevation in

Brookfield is the top of Copple Crown Mountain which is as 1,868 feet above sea level. The town has one recreational ski mountain located at the end of Moose Mountain road. The development of the town is primarily concentrated along Stoneham Road and Route 109. The growth of the town is increasing dramatically though and it's estimated that by 2030 the population size could increase by over 40%.

The town itself is 8,773 acres of forest and 409 acres of farmland. Although there is primarily forested land there is no permanent protection for the future. There is a master plan for the town, but development is touched upon rarely and there is no clear goal for more conservation of the land. The town has a total area of 23.3 square miles. Out of that 23.3 sq mi, 0.4 sq mi of it is water (1.68%).

In regards to water, Brookfield is drained by the Branch River and Pike River within the Piscataqua watershed. The western edge of the town is in the Merrimack River watershed and the northernmost tip of the town is in the Saco River watershed. However majority of the town relies in the Piscataqua watershed.

Currently, the town has many recreational opportunities through hiking, walking, mountain biking, horseback riding, and snowmobiling; however, there is little protection for the future of these recreational endeavors.



Figure 4: Two residents kayaking out on Kingswood Lake in summer of 2013

**Conservation Land**

It is fortunate that Brookfield has two large pieces of conservation land in the town that make up 2,232 acres. Both conservation properties are open to the public and have trails through them that are maintained.

The Copple Crown Conservation Area is a 732 parcel that surrounds Copple Crown Mountain. The conservation land is managed by the Lakes Region Conservation Trust. The other piece of conservation land, called Jones Brook Wildlife Management Area, is 1,500 acres that spans across the town border into Middleton. The conservation land includes the Perkins and Rand Mountains as well as Moose Mountain. The land is managed by the New Hampshire Fish and Game Department and is owned by the state of New Hampshire.

Overall, having conservation land that is within the watershed that remains low impact land helps to improve water quality in Kingswood Lake. It reduces erosion and input of human activities that help to sustain natural habitat in Brookfield and around the lake.

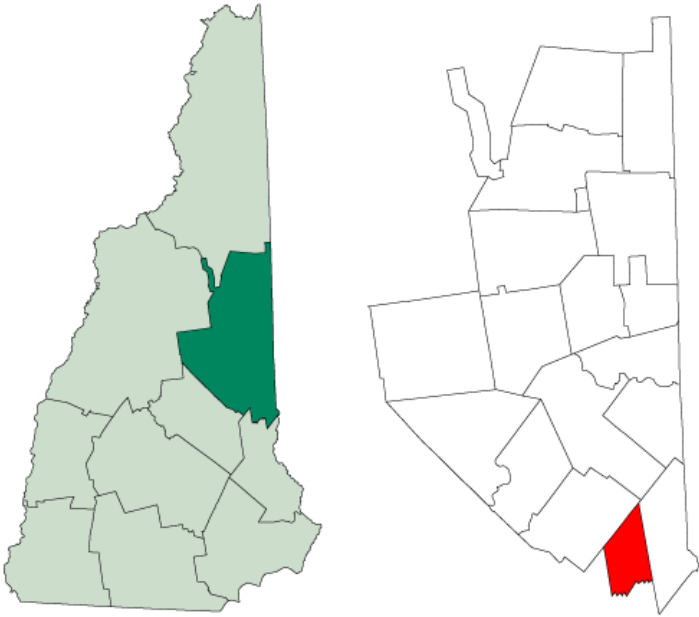


Figure 5: New Hampshire displayed and counties outlined. The town of Brookfield is shown in red.

### *Water and Sewer Districts*

Due to the fact that Brookfield, NH has a relative low population level it means that the main water source is private wells through groundwater and that everyone uses septic systems. There are a number of houses that have been grandfathered in meaning that some seasonal summer homes may not even have septic systems and many septic systems are old and not up to date. After doing a survey around the lake it was found that over 50% of the homes did not know when the last time their septic system had been pumped and in general how they could tell when it needed to be. The septic systems on the lake are most likely leaking into the lake and increasing the levels of phosphorus and nitrogen into the system.

### *Salmon Falls River Watershed*

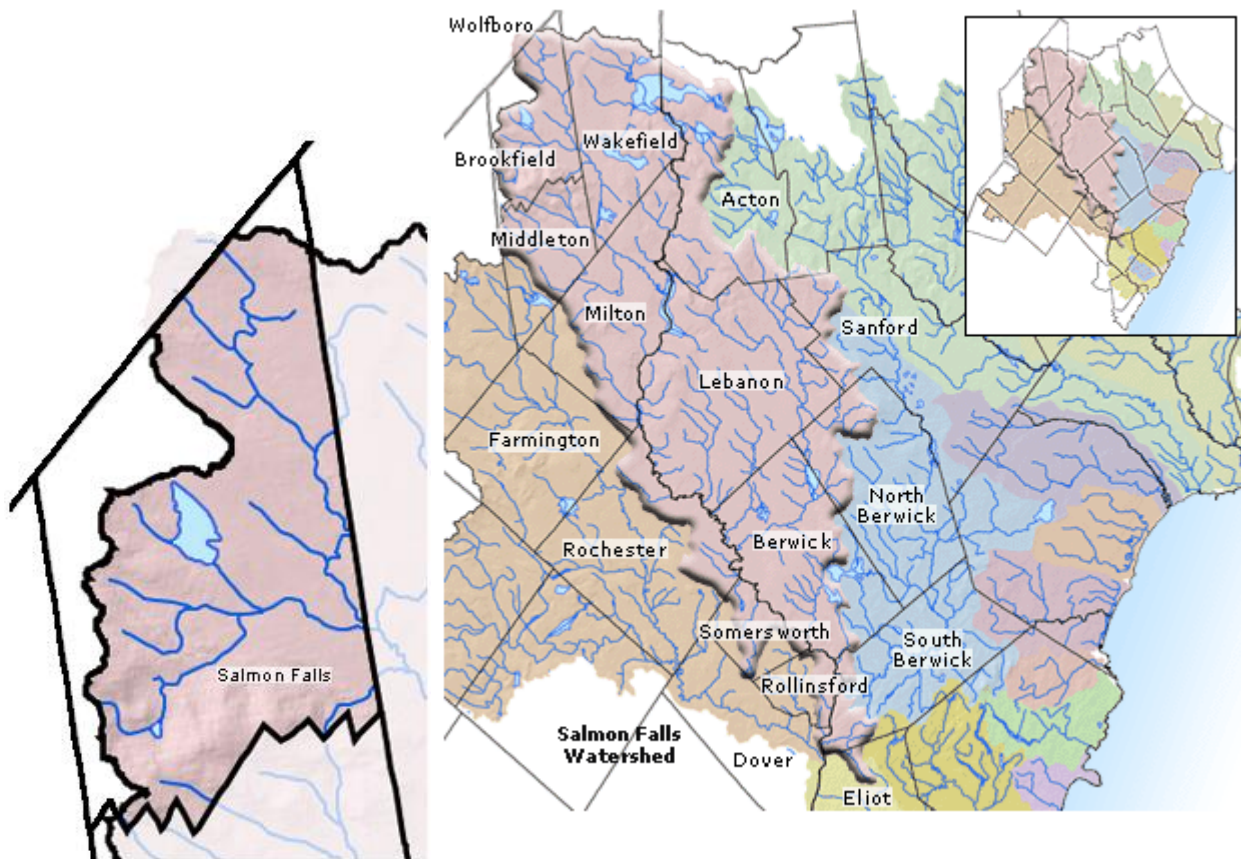


Figure 6: Salmon Falls Watershed displayed and the towns residing within the watershed.

Kingswood Lake is part of the greater Salmon Falls River Watershed that drains 238 square miles from 18 towns, ten in New Hampshire and eight in Maine. There are a number of significant water features which include Great East Lake, Lovell Lake, Lake Murdock, Little River, Branch River, and the main stem of the Salmon Falls River. The watershed itself has many wetlands, small rivers, and ponds that are in the area. The overall landscape area is divided into three main sections: upper, middle, and lower section. The types of landscape communities vary drastically due to human urbanization. Some of the landscape includes forested floodplains, peat lands, grasslands, and mixed pine, oak and hemlock forests.

The upper part of the watershed consists primarily of forested and agricultural land with many lakes and ponds. Parcels of conservation land are located in Brookfield, Milton, and Middleton, NH. The middle section has more development, major roads, and town centers; however, there are still large forested areas. The forested sections include agricultural land, wetlands, and scattered forested areas. There is habitat for many species of wildlife and plants. One of the most significant habitats in the area includes the endangered Northern Black Racer and Small Whorled Pogonia. There is conservation land in the area, smaller parcels, which are located in Lebanon and Berwick, ME, and Rochester, NH. The lower section of the watershed is highly developed and has higher amounts of impervious surfaces running through Somersworth, Southern Berwick, and Berwick.

The entire length of the Salmon Falls River runs 37.5 miles starting at its headwaters at Great East Lake to where it meets the Cocheco River. The Salmon Falls River forms the border between Maine and New Hampshire towns and crosses has 15 dams in total.

### ***Kingswood Lake Association***

The Kingswood Lake Association is comprised of seasonal home owners who normally meet annually in early July. These meetings are held to discuss concerns regarding the lake and to present recommendations for the upcoming year. Financial resources are essential in order to carry out tasks such as monitoring and policy enforcement; however, funding is not currently being properly accessed. The necessary resources to establish monitoring or enforcing policies to stop or discourage residents on the lake from cutting excessively on their property or destroying

buffers are not in place. This brings into question a big problem as more development occurs on the lake and little to know knowledge of proper water quality techniques to promote the best health of the lake are put into place.

### ***Loon Island***

Located on Kingswood Lake is one island, Loon Island. This island does not allow public access and it is currently under conservation. There is normally a nesting pair of loons that occupy the lake and nest on Loon islands South side. The loon preservation committee that protects and enforces keep humans off the island to allow for optimal loon nesting conditions.

**(SOURCE: <http://www.loon.org/supporting-associations-list.php>)**



Figure 7: Loon Island

The island is under New Hampshire revised statues annotated (RSA) index that demonstrated that it is under the jurisdiction of the department as public reservations (227-H:11 islands).

**(SOURCE: <http://nhrsa.org/law/227-h-11-islands/>)** “Nothing contained in this section shall confer authority on the department to dispose of the islands by sale, and nothing contained in this section shall be construed to affect the title to any such islands.”

### *Species*

There are a number of species present on the lake that make Kingswood Lake a valuable resource. In general the mating pair of Common Loons (*Gavia*) on the lake that have had one to two chicks for the past nine years has generated an awareness to protect them and provide them with good water quality. Loons in general have very specific habitat and the birds are very particular about what they eat, where they live, and how often they breed. Loons prefer nest sites that have low slope (1-5%), that are within 3 to 5 feet of the edge of the water, in remote areas away from human contact, and large habitat areas for breeding and fishing as they are tutorial birds. Loon habitat areas are unclear and not protected in most areas. The lakes region and Kingswood Lake in particular provides ideal habitat as Loon Island is designated specifically for loons breeding. Lakes region is one of the most populated areas with Loons in New Hampshire; however, with increased development loons are flying further away to locate better nesting sites.



Figure 8: Common Loon

In addition to loons on the lake there is a number of important fish species present such as Largemouth bass (*Micropterus salmoides*), Smallmouth bass, (*Micropterus dolomieu*), Crappie (*Pomoxis*), Walleye (*Sander vitreus*), Catfish (*Siluriformes*), Spotted bass (*Micropterus punctulatus*), White bass (*Morone chrysops*), Striped Bass (*Morone saxatilis*), and Trout (*Oncorhynchus mykiss*). All these different types of fish create ideal fishing conditions and act as a food resource for the loons.

Another key species that is present on Kingswood Lake is the Spotted salamander (*Ambystoma maculatum*). The Spotted salamander relies heavily on the number of vernal pools located around Kingswood Lake and the two wetlands located at the east and west end of the lake.



Figure 9: Spotted Salamander

Source: [www.wildlife.state.nh.us](http://www.wildlife.state.nh.us)

### ***Summary of CLI***

In order to address the current status of Kingswood Lake a Comprehensive Lake Inventory (CLI) was completed. This form uses ten attributes to score the lake based on a point system in the three areas of recreational value, unique or outstanding value, and susceptibility to impairment. Information was collected from maps, GIS, residents, site visits, NH DES and other various sources. Attributes in question ranged from geography, waterbody/watershed characteristics, water quality, recreation, biological characteristics, and restrictions and regulations. The CLI identifies issues that should be addressed and monitored. A high score is interpreted differently for each of the three categories; for recreational value it means that a water body has high recreational value, for unique or outstanding value it indicates that a water body has many unique or outstanding features, for susceptibility to impairment it means a water body has a high susceptibility. In Kingswood Lake's case it was rather challenging finding information that was both up to date and available seeing as the lake has no public access and has not been accessed in detail. Kingswood's scores were very good. Kingswood Lake has relatively low levels susceptibility to impairment and it has relatively high levels of recreational value. However if there was public access the level of recreational potential would increase. The unique or outstanding features are primarily Loon Island as it is a public reservation as well as the wetlands



and riparian buffers. The lake as a whole is in good health, but could if future development occurred, drastically alter the water quality, clarity, and overall composition of the lake.

Recreational Value	78
Unique or Outstanding Value	73
Susceptibility to Impairment	16

Figure: Scores for the three areas of the CLI.

## **Problems:**

### ***Public Awareness and Education***

There is a significant lack of education due to the fact that most residents are only seasonal and have summer homes. Public awareness deficiency primarily because there is no monitoring system in place so people are unaware of how they should be acting to be good stewards of the land. The lack of awareness and education is the major problem around the lake and in the Brookfield community. There is a lack of needed support and education around the area. The lake supports and provides for many people's entertainment. There is a problem with the lack of knowledge that should be given to the general public to better support and protect this unique and great resource.

### ***Water Level***

The dam withdrawals water each Columbus Day and drops the level of the lake by about 4 feet each year. Kingswood Lake primarily drops the level of the water to accommodate homeowner's docks so that there is not ice damages. However drawing down the level of the lake hinders many of the shoreline plants and causes soil exposure that negatively affects the overall lakes health.



Figure 10: A Residents dock on Kingswood Lake in early Fall, 2013.

### ***Lake Retention***

Currently it is unknown what the flushing of the lake is at and the water quality could be decreasing.

### ***Maintaining Water Quality***

Water quality could have a potential decrease because of the increased urbanization. The current water quality is relatively unknown. Therefore, best management practices should be put in place to maintain water quality and prevent from decreasing the overall health of the waterways.

**“The Clean Water Act (CWA) requires states to establish water quality standards and conduct assessments to ensure that surface waters are clean enough to support human and ecological needs”**

### ***Potential for Invasive species***

Kingswood Lake has currently no known invasive species; however, because there is no known invasive species does not mean that they are not present. The most common invasive species in New Hampshire is Milfoil. Milfoil is an aquatic plant not native to New England. This aquatic invasive plant is hard to control once introduced into a water body and therefore taking preventative methods is the best step.

This is a problematic aquatic plant forms thick mats on the surface which reduces the sunlight and interferes with recreational activities. These thick mats make it hard to swim, fish, and boat, usually reducing the lakes recreational value to those who partake in these activities. Along with these problems milfoil can also take oxygen away from the water by decreasing the mixing rate; this will lead to the water becoming anoxic in the hypolimnion.

These thick mats will start to grow in the lake quicker and sooner in the year than the other native aquatic plants. If it is a high growth year for this species this can lead to competition and shading out of native species which are beneficial to the ecosystem. Milfoil reproduces extremely rapidly and can infest an entire lake within two years of introduction to the system. In the late summer and fall the plants become brittle and naturally break apart. These fragments will float to other areas, sink, and start new plants. Milfoil will also grow from fragments created by boaters or other disturbances during any time of year. A new plant can start from a tiny piece of a milfoil plant. This is why milfoil can so easily be transported from lake to lake on boat trailers or fishing gear.

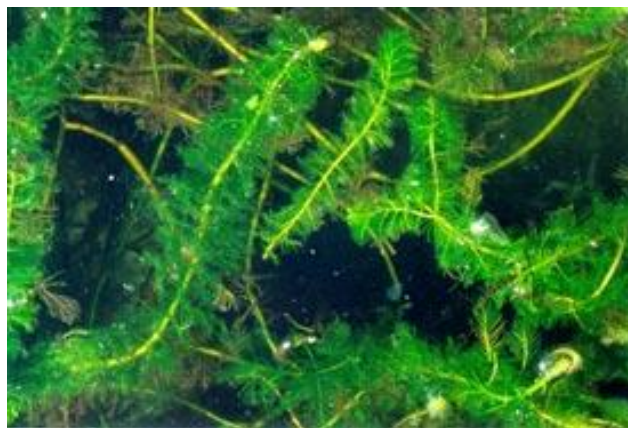


Figure 11: Milfoil

Source: sites.duke.edu

### *Septic Systems*

Unknown septic systems conditions are most likely an issue around Kingswood Lake. After conducting a survey it showed that over 65% of the homeowners around the lake were unaware when their septic system was put in place and how often they were getting it pumped out. Therefore it is assumed that many homes are adding increased levels of Phosphorus and Nitrogen into the lake and surrounding wetlands and streams which could cause algae blooms.

### *Growing Development*

Growing development around the lake and within the watershed potentially puts added pressure on the water resources. As stated previously population size could increase by over 40% by 2030 in the town of Brookfield and in particular much of that population growth would most likely occur around the lake. Increased development around the lake would mean a deduction of natural buffers, an increase in impervious surfaces, and an increase of Phosphorus and Nitrogen loading. Overall putting added pressures around the lake which could decline the water quality.



Figure 12: A house on the eastern shore of Kingswood Lake with lawn right up to the water's edge.

## **Recommendations:**

There are a number of recommendations that can be put in place to help maintain water quality. The recommendations are listed below which include establishing better buffers around the edge of the lake, incorporating rain gardens in low buffer areas, maintaining the water level and reducing the drawdown of the lake, increase water quality monitoring through volunteerism, and establish a weed watchers program to help keep out invasive species.

### ***Rain Gardens***

Implementing rain gardens on various sections along Kingswood Lake would be beneficial to help slow the excess runoff of storm water into the watershed. Having rain gardens would allow for more time for the water to be filtered through the soil and plants to rid excess pollutants from oil from cars or salt from the roads before draining into the pond. Some benefits to rain gardens throughout the area could be: filter runoff pollution, recharge local groundwater, improve water quality, reduce potential of home flooding, remove standing water in your yard, and reduce potential of home flooding.

### ***Fertilizers***

As more homes are developed along the water's edge it is important in considering alternatives to having lawns right up to the water. In general having a lawn means that if one does chose to use fertilizers there should be a set limit and a buffer of where one can apply, how often, and at what times of the year. It is important to not apply fertilizers during chance of high rains. In addition using if someone choses to fertilize using 0-phosphorus would be beneficial to reduce runoff. Also using Phosphorus free household products such as soaps, shampoos, cleansers, and detergents would help to decrease the amount of potential nutrient inputs into the lake so algae blooms do not occur.



Figure 13: Rain garden

### ***Septic Systems***

There are many homes around the lake that have been transitioned from summer homes to year round homes. This saying most if any have not updated their septic system. Checking ones septic system is an important step to limit any leachate that could be running off into the lake and causing increased levels of Phosphorus. Septic tanks should be pumped every few years based on size of the tank, number of household members, and number of months used. It is important that septic systems be checked because some homes on the lake have been “grandfathered” and may not even have septic systems. An evaluation that could be funded by the Kingswood Lakes Association, of individual septic systems should be performed and a plan devised accordingly. Depending on the amount of homes in need of a new septic system, one possibility is a community system. The town of Brookfield should apply for state grants or use property tax revenues to identify and update any malfunctioning grandfathered septic systems. Then the community should be educated about regular septic system maintenance.

### ***Monitoring***

Monitoring of phosphorus levels and transparency in the spring, summer, and fall should be conducted. Kingswood Lake should limit the amount of phosphorus entering the lake by not

using fertilizer in shoreline areas. Shoreline residents should also consider using low phosphate soaps and detergents. Shoreline protection should be emphasized to promote protection and enhancement of lake water quality. Residents should be mindful of trash, paints, and other hazardous materials that could leach through the soil and contaminate nearby water bodies.

### ***Riparian Buffers and Soil Erosion Control***

Buffers strips are an effective and economical means of minimizing erosion and control inputs of phosphorus. Some recommendations include trying to improve areas where buffers are low or nonexistent. There are three basic types of buffer strips: natural, enhanced, and landscaped. Natural buffers are composed of natural vegetation that was left alone and was initially present. Furthermore, natural buffers have never been mowed. This type of buffer typically may take some time to grow back or recovery if removed or damaged but it requires the least maintenance and is often the most economical. In addition trying to avoid removing large areas where natural buffers are already present. Minimize the amount of cutting and removal of natural ground debris. As well as encouraging land owners to have sloped areas that are currently 25degrees or higher should be replanted. Shrubs and plants that require less maintenance and pesticides should be replanted and ideally native plants. Sloped areas that do not have buffers between them and the water's edge should receive as little fertilizer use as possible and avoid being over watered. The amount of impervious surfaces within a lawn and around the house should be minimized as much as possible to maximize the amount of water absorption area. Impervious surfaces such as footpaths should be as narrow as possible and winding, or run parallel to the water as well as be effectively stabilized

### ***Invasive Species***

Currently, Kingswood Lake is lucky enough to not have any invasive species, plant or animal that I am aware of. However due to the lack of quantitate water quality assessment it is hard to tell for sure if there are invasive as there has not been a complete survey done. Kingswood Lake being a private access lake means that there is low traffic and possibility of outside boats and people bringing in invasive species, but the possibility is still there. Currently in over 50 water bodies in New Hampshire are infested with milfoil (*myriophyllum heterophyllum*) which is the biggest invasive species problem in the area. Milfoil reproduces quickly and outcompetes native

species. Milfoil negatively affects water quality and ecosystem biodiversity and could be a big threat to Kingswood Lake if it entered the waterway. Taking preventative measures instead of being confronted with a problem than trying to find a solution afterwards is the best variable answer.

### ***Weed Watchers Program***

The Lake Association should establish membership with the Weed Watchers program. Weed Watchers is a program very similar to the NH Lakes Host program with the exception that it is entirely voluntary. A good way to meet folks and help out the lake at the same time. Signs should be posted in the town hall to inform lake residents of the laws and regulations to help prevent the introduction of invasive species. Inform local residents of the invasive species problem and encourage cleaning of all boating and fishing equipment of all plant material before using any boat launches. Encourage cleaning of all boating and fishing equipment of all plant material when traveling between lakes to avoid the introduction of invasive species that threaten lake water quality. Be sure to properly dispose of all plant material in upland areas.

A weed watchers program overall would be run by the lake association; in which the members will be educated on what to look for and early detection methods of these very invasive species. The state's Department of Environmental Services can conduct a seminar on what to look for, where to look, and how to document what is found; this will enable people with no experience to be able to help their community and keep their resources clean. By doing this, Brookfield, will be granted money from the state if any issues arise. However, if there is no program then Brookfield will have to deal with the outbreak solely out of their budget. This group of weed watchers would ideally have to check the lake from March, or when the ice melts, until about October. If the population of invasive species is kept to a minimum and no larger outbreaks are recorded both the esthetic and recreational values of the lake will increase. Implementing a weed watchers program using the community around Kingswood Lake will be beneficial in many ways.

First, the community will be helping N.H. State, better their local environment. Second, Kingswood Lake will become more appealing to fisherman and recreational owners on the lake.



Lastly, Kingswood Lake can have overall better water quality and overall health by keeping out harmful water quality problems that invasive species can cause. Keeping this watershed clean will provide a great service to this currently healthy ecosystem.



Figure 14: Resident on the Kingswood Lake enjoying recreational activities

***Encourage more regular meetings and more involvement in regards to the Lake Association***

Currently there is a Lakes Association on Kingswood Lake, but they only meet annually and it is a rather small group that does not have regularly involvement. The Lake Association group should directly involve residents on the lake more and add more support to the lake's overall health and decision making process. A pamphlet was created to try to get more people aware and involved of the current health of Kingswood Lake as well as multiple presentations and discussions were held at the town hall over the last six months. The ideal long term goal is to inform the general public about Kingswood Lake and involve more people to participate in the maintaining Kingswood Lake's overall health for the greater good of the community.

***Water Level***

Currently Kingswood Lake's water level fluctuates due to the withdrawal that happens around Columbus Day by the dam. A decision should be made to reduce the levels of withdrawal and have a new assessment of what the new level of withdrawal should be to find a better balance between to maintain water quality and people's needs to protect their docks. A decision should

be made either voted on by the town of Brookfield that includes members of the Lake Association to decide what the desired water level that Kingswood Lake should be kept at. This decision should involve all residents in the area to best determine what is acceptable for both the health of the pond and the people's properties surrounding the water.

### ***Water Quality***

There are no major roads that threaten the water quality around Kingswood Lake; however, there are increased development and increased removal of natural buffers that are threatening the overall health of the water quality. In addition the properties that have their lawn right up to the edge of the property pose a threat decreasing water quality health. Educating the community about best management techniques is crucial to maintaining water quality health.

## **Conclusion:**

Because Kingswood Lake has no current public access there is very little known about the lake and therefore there is very little data on the area as a whole. This was the major reason why this study was conducted to determine the state of Kingswood Lake. Overall establishing community support and education to promote good water quality practices to sustain Kingswood Lake as a natural resource. Developing more community support to protect the lake from shoreline erosion and increase pollutants or invasive species that could get into the lake is essential for keeping Kingswood Lake clean.

The Brookfield community has the unique situation of having a resource that is in good health and needs more community support and education on the potential threats and problems that could occur in the future. Having a good support system to help solve the current problems by not dropping the water level as much, increase water quality by building rain gardens and not destroying natural buffers, educating new land owners that come into the area, and monitoring for invasive will overall help the lake as a whole maintain its beauty and its water quality. In addition establishing monitoring programs, getting septic systems tested, continuing to educate the community, and reducing excess Phosphorus and Nitrogen inputs into the lake will benefit not only the lake itself, but the community of delicate ecosystems in the area.

Without proper management Kingswood Lake will experience decline and could be lost to the surrounding development. Those who use this lake, love it, but steps need to be taken so that it will still be there for them to use and be improved in the future. If this management plan is implemented it will contribute to a much brighter future for Kingswood Lake by improving water quality, recreational value, ensuring esthetics value on the lake, and most importantly preserving it for everyone to enjoy for years to come.



Figure 15: Kingswood Lake, June 2013

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