

Table 1. Problem Identification Table

Use this table to determine which issues are occurring in your lake. The “Category” column groups problems into overall issues and the “Problem” column are problems you might notice on your lake as a result of the issue. The “How to Identify” column provides a way to use data to determine the problem. Once you have your issues and problems identified, you can use the “option Table” column which refers to the series of option tables that provide management options available.

Category	Problem/Issue	How to identify	Option Table
Water Quality	<ul style="list-style-type: none"> • Internal Nutrient Loading • Sedimentation • Algae Blooms • Fish Kills • Anoxic Hypolimnion 	<ul style="list-style-type: none"> • Nutrients • Secchi • Chlorophyll • Temperature & Dissolved Oxygen Profiles 	<ul style="list-style-type: none"> • Oxygen • Nutrients & Algae
Watershed	<ul style="list-style-type: none"> • Agricultural Runoff • Urban Stormwater Runoff • Wetland Loss • Critical Habitat Loss 	<ul style="list-style-type: none"> • Nutrient and Sediment Loads • Land Use Assessment • Land Management Assessment 	<ul style="list-style-type: none"> • Watershed
Recreation	<ul style="list-style-type: none"> • User Conflicts 	<ul style="list-style-type: none"> • Accident Rates • User Surveys • Boat per Acre • Piers and access sites 	<ul style="list-style-type: none"> • User Conflict
Aquatic Plants	<ul style="list-style-type: none"> • Too many plants that impairs navigation or recreation • Too few plants that limit habitat • Presence of exotic/invasive plant species 	<ul style="list-style-type: none"> • Percent area coverage • Species composition • Density/Diversity • Floristic Quality Index 	<ul style="list-style-type: none"> • Plants • Invasive Species • Fish
Fisheries	<ul style="list-style-type: none"> • Unbalanced fisheries • Stunted Growth • Rough Fish Dominance • Poor Success 	<ul style="list-style-type: none"> • Species Composition • Age length ratio • Lbs or fish per acre • Catch per effort 	<ul style="list-style-type: none"> • Fish
Shoreline	<ul style="list-style-type: none"> • Limited habitat • Aesthetics • Erosion 	<ul style="list-style-type: none"> • Substrate • Woody cover • Structure of vegetation • Structures per mile • Variation in depth 	<ul style="list-style-type: none"> • Fish • Erosion Control
Wildlife	<ul style="list-style-type: none"> • Geese congregating • Eroding Shorelines • Flooding • Limited Plant Growth 	<ul style="list-style-type: none"> • Nutrients • E.Coli • Wildlife Observations 	<ul style="list-style-type: none"> • Wildlife

Lake Management Options:

Nuisance Algae & Excess Nutrients (Part 1 of 3)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No change in current strategy 	<ul style="list-style-type: none"> Negative impacts to fish and other aquatic life Reduced recreational use Possible decreased property values 	
Algaecides	<ul style="list-style-type: none"> Relatively inexpensive Reduce risk of health effects of toxic algae Rapid elimination of algae from water column 	<ul style="list-style-type: none"> May need repeated treatments May lead to chemical resistance and chemical accumulation in sediments Increased oxygen demand 	<ul style="list-style-type: none"> Costs depend on product, size of treatment area, and number of treatments needed Algae is killed by direct toxicity or metabolic interference Typically required application at least once/yr, often more frequently.
Alum Treatment/ Phosphorus Inactivation	<ul style="list-style-type: none"> Alum treatments can last as long as 5-20 years Reduction in algal biomass may increase dissolved oxygen Plant populations could expand or re-establish, which can also improve fish habitat Recreational activities such as swimming & boating would be improved. 	<ul style="list-style-type: none"> Expensive Companies who do the work are rare Short-term decline in plankton Increased water clarity could lead to an increase in plant population to nuisance conditions. 	<ul style="list-style-type: none"> External nutrient inputs must also be reduced or eliminated for alum to provide long-term effectiveness. Lakes that are shallow, non-stratified, and wind blown typically do not achieve long term control due to the disruption of the flocculent layer.

Lake Management Options:

Nuisance Algae & Excess Nutrients (Part 2 of 3)

Option	Pros	Cons	Notes
Revegetation with Native Aquatic Plants	<ul style="list-style-type: none"> Control growth of nuisance algae by shading and competition for resources/nutrients Sediment stabilization Increased water clarity Reduce wave action that can lead to reduced shoreline erosion Provides habitat for fish and wildlife 	<ul style="list-style-type: none"> Vegetation expanding to nuisance levels and needing control Newly planted plants need protection for the first few years until they are self propagating. 	<ul style="list-style-type: none"> Submerged plants are difficult to propagate. Plants growths of sufficient density may limit algal access to nutrients.
Carp Removal	<ul style="list-style-type: none"> In shallow lakes with a high density of carp, carp removal can be beneficial and it will reduce stirred up bottom sediments and phosphorus concentrations 	<ul style="list-style-type: none"> Will require routine removal especially if there is an inlet for carp to continue reaching the lake. 	<ul style="list-style-type: none"> Consulting firms will conduct carp removal for a cost and depends on lake acreage.
Watershed BMPs	<ul style="list-style-type: none"> Refer to WATERSHED LAKE MANAGEMENT ISSUE TABLE 	<ul style="list-style-type: none"> Refer to WATERSHED LAKE MANAGEMENT ISSUE TABLE 	<ul style="list-style-type: none"> Addressing the amount of nutrients entering the lake is crucial to reducing nutrient loading.
Ordinances	<ul style="list-style-type: none"> Is a good way to educate the public Enforceable 	<ul style="list-style-type: none"> Most commercial applicators and individuals already use phosphorus free fertilizer, so some bans may not make huge difference in practices. 	<ul style="list-style-type: none"> Examples include: Municipal Phosphorus Bans for fertilizer and other products.

Lake Management Options:

Nuisance Algae & Excess Nutrients (Part 3 of 3)

Option	Pros	Cons	Notes
Dyes/Surface Cover	<ul style="list-style-type: none"> • Appealing color • Creates light limit on algal growth without high turbidity or increasing depth. • May achieve some control of rooted aquatic plants. 	<ul style="list-style-type: none"> • May cause thermal stratification in shallow ponds • May not control surface bloom-forming algal species. • May enter the aquifer. 	<ul style="list-style-type: none"> • Use of dye to change the lake color for management or aesthetic purposes.
Enhanced Grazing	<ul style="list-style-type: none"> • May increase water clarity by changes in algal biomass or cell size distribution without changes in nutrient levels. • No chemicals 	<ul style="list-style-type: none"> • Effects may not be controllable or long lasting and may foster shifts in algal composition to even less desirable forms. 	<ul style="list-style-type: none"> • Manipulation of biological components of lake system to achieve grazing control over algae. Typically involves alteration of fish community to promote growth of large herbivorous zooplankton, or stocking with phytophagous fish.
Dredging	<ul style="list-style-type: none"> • Nutrient reserves are removed and algal growth can be limited by nutrient availability if main nutrient source is internal cycling. 	<ul style="list-style-type: none"> • May create turbidity and affect fish community. • Interference with recreation or other uses during dredging • Expensive 	<ul style="list-style-type: none"> • Sediment is physically removed by wet or dry evacuation. Dredging is most often a major restructuring of a severely impacted system.
Mechanical Removal	<ul style="list-style-type: none"> • Algae and associated nutrients are removed from the system. • Surface collection can be applied as needed. 	<ul style="list-style-type: none"> • Labor intensive. • Variable collection efficiency. 	<ul style="list-style-type: none"> • Collection of floating scums or mats with rakes, nets, or other devices.

Lake Management Options:

Shoreline (Part 1 of 2)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No change in current strategy 	<ul style="list-style-type: none"> Erosion will continue and subsequently may cause poor water quality due to high levels of sediment or nutrients entering a lake. Limits plant growth. Aesthetically unpleasing and may potentially reduce property values 	
Install a Seawall	<ul style="list-style-type: none"> Effective erosion control Long life and relatively low maintenance 	<ul style="list-style-type: none"> Expense of installation and associated permits Permits and surveys are needed whether replacing an old seawall or installing a new one. Wave deflection causing sediment disturbance and resuspension. 	<ul style="list-style-type: none"> Depending on factors such as slope and shoreline access, cost of seawall installation ranges from \$100-200 per linear foot.
Install Rip-Rap or Gabions	<ul style="list-style-type: none"> Rocks can absorb some of the wave energy while providing a more aesthetically pleasing appearance than seawalls. Long life and relatively low maintenance. Fish and wildlife habitat can be provided if large boulders are used. 	<ul style="list-style-type: none"> Expense of installation and associated permits. Rip-rap may be a concern in areas of high public usage since it is difficult and possibly dangerous to walk on due to the jagged and uneven rock edges. This may be a liability concern to property owners. 	
Ordinances	<ul style="list-style-type: none"> Create a township/city/ HOA ordinance that limits development near shorelines 	<ul style="list-style-type: none"> Can be difficult to pass. 	

Lake Management Options:

Shoreline (Part 2 of 2)

Option	Pros	Cons	Notes
Create a Buffer Strip	<ul style="list-style-type: none"> • Less expensive than rock or sea-wall. • Native plants have deeper roots than turf grass. • Minimal maintenance after first two years • Helps filter run-off from lawns and agricultural fields by trapping nutrients, pollutants, and sediment that would otherwise drain to the lake. • Potential flood control protection. • Many fish and wildlife species prefer the native shoreline vegetation. 	<ul style="list-style-type: none"> • Certain species can be aggressive and may need to be controlled occasionally. • Not suitable for all sites due to slope or wave energy. 	<ul style="list-style-type: none"> • Costs are variable depending on how much preparation work is needed and species planted.
Establish a “No Wake Zone” or “No Motor Area”	<ul style="list-style-type: none"> • May reduce wave activity along shorelines susceptible to erosion. • May improve water quality since less sediment may be disturbed and suspended in the water column. • Less motorboat disturbance will benefit wildlife and may encourage many species to use the lake both during spring and fall migration and for summer residence. 	<ul style="list-style-type: none"> • Enforcement and public education are the primary obstacles. • May be some loss of recreational use for some users, particularly boating. 	<ul style="list-style-type: none"> • Legal ordinances may be needed.
Aquatic Plants	<ul style="list-style-type: none"> • Aquatic plants can stabilize bottom sediment to reduce suspended solids in the water column. • Also provides fish habitat. 	<ul style="list-style-type: none"> • If excessive plant growth, plants may need to be managed. • Education to lake-users on the benefits of aquatic plants needed 	SEE AQUATIC PLANT ISSUES TABLE

Lake Management Options:

Aquatic Plants (Part 1 of 2)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No change in current strategy 	<ul style="list-style-type: none"> Plants may continue to expand which may cause water quality issues, fish kills, or recreational issues. 	<ul style="list-style-type: none">
Aquatic Herbicides	<ul style="list-style-type: none"> Relatively inexpensive Selectivity is possible. Seasonal control can be accomplished. Improved recreation. 	<ul style="list-style-type: none"> Possibility of overtreatment. Plants can gain a chemical resistance over time. Decreasing plant community may increase algae. Depending on the chemical, use restrictions may be needed for a short time. Increased oxygen demand from decaying vegetation 	<ul style="list-style-type: none"> There are many aquatic herbicides available. It is important to understand how herbicides work to choose the most appropriate option for your lake needs.
Mechanical Harvesting	<ul style="list-style-type: none"> No recreation restrictions No chemicals. 	<ul style="list-style-type: none"> Disposal of plants. Costs for maintaining equipment. Off season storage. Labor costs. Non-selective. 	New harvesters can cost >\$100,000
Hand Removal	<ul style="list-style-type: none"> Inexpensive Selectivity is possible 	<ul style="list-style-type: none"> Limited areas can be harvested Labor intensive Disposal of plants 	
Biological Introductions (Example: Milfoil Weevil)	<ul style="list-style-type: none"> Harnesses biological interactions to produce desired conditions rather than chemicals. Provides potentially continuing control with one treatment. 	<ul style="list-style-type: none"> Expensive Results are sporadic and often cyclical. Weevil population can be affected by panfish predation. 	<ul style="list-style-type: none"> Weevils need over-wintering habitat. May be negatively impacted by boating activities. Found naturally in Lake County lakes.

Lake Management Options:

Aquatic Plants (Part 2 of 2)

Option	Pros	Cons	Notes
Biological Introduction (Grass Carp)	<ul style="list-style-type: none"> • May greatly reduce plant biomass in a single season and can provide multiple years of control in single stocking. Sterile juveniles are stocked intended to prevent population growth. 	<ul style="list-style-type: none"> • Non-selective • Grass Carp may eat all plants in lake and make it difficult for any plants to be established. Due to this, there could be an increase in algae blooms. 	<ul style="list-style-type: none"> • Grass carp can only be stocked in man-made bodies of water with controlled outlets and inlets. They cannot be stocked in glacial lakes, slough potholes, bottomlands, backwaters, streams, rivers if state threatened or endangered plant or animal species are present, or in any state inventory natural area or nature preserve. • They can live for 15-20 years.
Re-establishing Native Aquatic Vegetation	<ul style="list-style-type: none"> • Control growth of nuisance algae by shading and competition for resources • Sediment stabilization • Increase water clarity • Provides habitat for fish and wildlife. 	<ul style="list-style-type: none"> • Vegetation can potentially expand to nuisance levels and need control. • Newly planted plants need protection for the first few years. 	<ul style="list-style-type: none"> • Submerged plants can be difficult to propagate.
Dyes/Surface Cover	<ul style="list-style-type: none"> • Appealing in color. • Creates light limit on algal growth without high turbidity or great depth. • May achieve some control of rooted aquatic plants 	<ul style="list-style-type: none"> • May cause thermal stratification in shallow ponds • May not control surface bloom-forming algal species. 	
Water Level Control	<ul style="list-style-type: none"> • Provides widespread control in increments of water depth. • Complements certain other techniques (i.e. dredging) 	<ul style="list-style-type: none"> • Potential issues with water supply. • Potential impacts to non-target flora and fauna. • Potential issues with flooding. 	<ul style="list-style-type: none"> • Lowering or raising the water level to create an inhospitable environment for some or all aquatic plants.

Lake Management Options:

Fish (Part 1 of 2)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No change in current strategy 		
Aquatic Plants	<ul style="list-style-type: none"> Increase fish habitat & cover. Increase dissolved oxygen. Increase food for fish foraging. Increase spawning habitat. 	<ul style="list-style-type: none"> >40% aquatic plant coverage could create boat user conflict. High density of plants can also affect fish population and size structure of fish (stunted fish). 	<ul style="list-style-type: none"> IDNR recommends 20-40% plant coverage for fish habitat.
Increase DO	<ul style="list-style-type: none"> SEE DISSOLVED OXYGEN ISSUE TABLE 	<ul style="list-style-type: none"> SEE DISSOLVED OXYGEN ISSUE TABLE 	<ul style="list-style-type: none"> SEE DISSOLVED OXYGEN ISSUE TABLE
Better timed herbicide treatments	<ul style="list-style-type: none"> Early season herbicide treatments target invasive species over native species. Early season treatments are better for T/E species. 		<ul style="list-style-type: none"> Some fish kills can be a result of chemical treatments.
Updated Fish Survey	<ul style="list-style-type: none"> Understanding current fisheries status in your lake to guide future decisions. Can be used for stocking guidelines. 	<ul style="list-style-type: none"> May be biased depending on season of fish survey and game fish. Only observing fish in the littoral zone/upper water column. 	<ul style="list-style-type: none"> IDNR conducts fish surveys on lakes and has reports online. Consulting firms will contract for fish surveys.
Stocking	<ul style="list-style-type: none"> Creating a balanced fishery when following IDNR recommendations. Increase recreational fishing opportunities. 	<ul style="list-style-type: none"> Cost. 	

Lake Management Options:

Fish (Part 2 of 2)

Option	Pros	Cons	Notes
Carp Removal	<ul style="list-style-type: none">• Reduce nutrients and total suspended solids.• Increased water clarity.• Increased aquatic plant coverage.• Relatively low cost.	<ul style="list-style-type: none">• Disposal.• Needs to be continued every so often and even multiple times in a year.	<ul style="list-style-type: none">• Spring and fall best time of year for removal.• Need to maintain healthy game fish population.
Fish Habitat	<ul style="list-style-type: none">• Many options available to increase fish habitat from coarse woody debris.• Provides fish over/ protection from predators.• Food/area for organisms to grow and live.• Provides cooler water and shade.• Spawning habitat.	<ul style="list-style-type: none">• Need bottom owner permission.• Sediment buildup is possible.• Need appropriate depth/ location to provide functional habitat.• Potential navigation hazard if not maintained.• Concentrated fish populations are vulnerable to harvest.	<ul style="list-style-type: none">• Many options for fish habitat including coarse woody debris, fish cribs, Christmas trees, etc.

Lake Management Options:

Wildlife: Beaver Management (Part 1 of 2)

Option	Pros	Cons	Notes
Exclusion: fencing or wrapping trees	<ul style="list-style-type: none"> • Protection of mature plants. • May encourage beaver to move. 	<ul style="list-style-type: none"> • Beavers may start to select less preferred plants, leading to the need to protect more plants. 	
Removal	<ul style="list-style-type: none"> • Animals are removed, plants are protected and water levels are not altered. 	<ul style="list-style-type: none"> • Can be time consuming and expensive. • New beavers may fill void. 	<ul style="list-style-type: none"> • A professional trapper is needed. • State and local laws regulate trapping activities, contact IDNR.
Habitat Alteration:	<ul style="list-style-type: none"> • May encourage beavers to move away from site. 	<ul style="list-style-type: none"> • Dams may be rebuilt. • Less desirable plants may still be damaged. 	<ul style="list-style-type: none"> • Examples include: removing dams, replacing preferred trees with less desirable ones
Beaver friendly outlets	<ul style="list-style-type: none"> • Dam can remain, but water can flow out. 	<ul style="list-style-type: none"> • Expensive. • Need to be maintained. 	<ul style="list-style-type: none"> • Need to be professionally installed.

Wildlife: Muskrat Management

Option	Pros	Cons	Notes
Exclusion	<ul style="list-style-type: none"> • Minimize plant and shoreline damage. 	<ul style="list-style-type: none"> • Can be time consuming and expensive. 	
Removal	<ul style="list-style-type: none"> • May encourage muskrats to move. • Animals are removed, plants are protected, and water levels are not altered. 	<ul style="list-style-type: none"> • Can be time consuming and expensive. • New muskrats may fill void. 	<ul style="list-style-type: none"> • A professional trapper is needed. • State and local laws regulate trapping activities, contact IDNR.
: Habitat Alteration	<ul style="list-style-type: none"> • May encourage muskrats to move. • Shoreline slope < 3:1 are less preferred by muskrats. 	<ul style="list-style-type: none"> • May not be effective. 	<ul style="list-style-type: none"> • Rip-rap over filter fabric may discourage burrowing.

Lake Management Options:

Wildlife: Goose Management (Part 2 of 2)

Option	Pros	Cons	Notes
Exclusion	<ul style="list-style-type: none"> Selected areas can be targeted for protection. 	<ul style="list-style-type: none"> Limited effectiveness. 	
Removal	<ul style="list-style-type: none"> Reduction of fecal matter. 	<ul style="list-style-type: none"> New geese may fill void. 	<ul style="list-style-type: none"> Hunting, egg addling/nest destruction are options Need appropriate licenses and permits.
Habitat Alteration:	<ul style="list-style-type: none"> May encourage geese to move. 	<ul style="list-style-type: none"> May not be effective if only established in small area and not lake wide. 	<ul style="list-style-type: none"> A good example are buffer strips and native vegetation.
Dispersal/ Repellent Techniques	<ul style="list-style-type: none"> May encourage geese to move. 	<ul style="list-style-type: none"> Geese eventually become tolerant of technique May not be effective long-term. Need to be persistent or use with other techniques. Local noise ordinances may apply. 	<ul style="list-style-type: none"> Products include sprays and noise makers. String/wire along shoreline. Dog chasing geese.
Education: “Do Not Feed Waterfowl”	<ul style="list-style-type: none"> May encourage geese to move. 	<ul style="list-style-type: none"> Enforcement. 	<ul style="list-style-type: none"> Local ordinance can be developed . Does require public education.

Lake Management Options:

User Conflict (Part 1 of 2)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No change in current strategy. 	<ul style="list-style-type: none"> Taking no action when user conflicts are present will result in the possible escalation of the conflicts both on and off the water. 	
Time Zoning	<ul style="list-style-type: none"> Allows various activities on the lake that may otherwise conflict. Helps people recognize that the lake is for everyone's enjoyment and that some compromise is necessary. 	<ul style="list-style-type: none"> Perception of unfairness; there may not be enough time allocated for their particular activity. These feelings may be exacerbated if fees have been required as part of the activities (i.e. boating stickers, launch fees). Enforcement. Possible costs with enforcement and education. 	<ul style="list-style-type: none"> Dedicated specific times that various activities can be done on the lake.
Space Zoning	<ul style="list-style-type: none"> May alleviate human safety concerns on the lake. Environmentally sensitive areas of the lake could be protected from shoreline erosion or habitat degradation. Protecting shoreline around a lake is beneficial to lake users as it helps protect property values, water quality and fish and wildlife habitat. 	<ul style="list-style-type: none"> Perception of unfairness; there may not be enough time allocated for their particular activity. These feelings may be exacerbated if fees have been required as part of the activities (i.e. boating stickers, launch fees.) Enforcement. Possible costs with enforcement and education. 	<ul style="list-style-type: none"> Allowing certain activities on certain areas of the lake.

Lake Management Options:

User Conflict (Part 2 of 2)

Option	Pros	Cons	Notes
Speed/Power Limits	<ul style="list-style-type: none">• Safety would likely be enhanced due to slower moving boat traffic.• Limited boat traffic may lead to less wave action. Overall this could reduce shoreline erosion and re-suspended bottom sediments & nutrients.• Less wave activity would mean recreation activities such as canoeing, paddle boarding, and wildlife viewing may be enhanced.• Less noise pollution.• Less pollution from gas motors (particularly liquid gas and oil)	<ul style="list-style-type: none">• Perception of unfairness; there may not be enough time allocated for their particular activity. These feelings may be exacerbated if fees have been required as part of the activities (i.e. boating stickers, launch fees.)• Enforcement• Possible costs with enforcement and education	

Lake Management Options:

Dredging (Part 1 of 2)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No Change in current strategy. 	<ul style="list-style-type: none"> Negative impacts to navigation and recreational access. Poor water quality will continue. 	
Mechanical Dredging	<ul style="list-style-type: none"> Navigation can be improved if channels have become too shallow for boat traffic. Recreational access can be restored or improved if launch locations have become too shallow for boats to safely use. Nutrient rich sediment can be removed possibly reducing nuisance plant growth and algal blooms. Nuisance aquatic weed growth can be reduced by direct removal of the plants and their roots. If the area is dredged below the limit of light penetration, future plant growth may be inhibited. If the lake experiences frequent fish kills due to its shallow nature, fish survival can be improved by increasing the lake volume as a result of creating deeper water areas. A deeper lake will have less sediment resuspension from wind and wave action and boating activity. 	<ul style="list-style-type: none"> Expensive. The planning process leading up to the actual work is time consuming and can take a year or more before work begins. Lake drawdown has to occur, possibly causing severe damage to fish and other aquatic organisms. Dredging too deep or not deep enough may expose contaminated sediment. Use of lake may be temporarily restricted. Disposal of sediment can be an issue– a dump site must be identified and sediment must be analyzed for contaminated materials. 	<ul style="list-style-type: none"> \$15-30/cubic yard. Permits needed by multiple agencies.

Lake Management Options:

Dredging (Part 2 of 2)

Option	Pros	Cons	Notes
Hydraulic Dredging	<ul style="list-style-type: none">• More effective than mechanical dredging at removing soft, watery sediments.• Can remove more sediment faster than mechanical dredging.• Less turbidity than wet mechanical dredging.• Typically more cost-effective method and faster than mechanical dredging.• Cutting depth can be closely controlled.• Lake drawdown is unnecessary since the equipment floats in water.	<ul style="list-style-type: none">• Expensive.• The planning process leading up to the actual work is time consuming, and can take a year or more before the work begins.• Lake use may be temporarily restricted.• Disposal of sediment can be an issue. A dump site must be identified.• Hydraulic dredging requires the sediment slurry to be pumped to a dewatering basin, or cell.	<ul style="list-style-type: none">• \$15-30/cubic yard.• Permits needed by multiple agencies.

Lake Management Options:

Dissolved Oxygen (Part 1 of 1)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No Change in Current Strategy. 	<ul style="list-style-type: none"> Increased fish stress or fish kills. Nutrient release from lake sediment, including phosphorus and nitrogen. Slower decomposition of organic matter. 	
Aeration	<ul style="list-style-type: none"> Improved dissolved oxygen concentrations in the water column may help prevent fish kills and increase habitat for aquatic life (zooplankton and warm water fish such as bass and bluegill). Potential reduction of algae blooms. Reduction of internal nutrient loading if aeration is strong enough to prevent stratification. 	<ul style="list-style-type: none"> If improperly sized, aerators could mix anoxic water to surface. If installed on lake bottom, increased suspended sediments could occur. Installation (electrical source, tubing, etc.) and ongoing maintenance and costs associated with the equipment. Costs. 	<ul style="list-style-type: none"> Aeration systems must be properly sized. Costs will depend on size and type of system, electrical costs and duration of time.
Snow Removal from Ice-Covered Lakes	<ul style="list-style-type: none"> May help during years of heavy snow cover over a long period of time. 	<ul style="list-style-type: none"> Safety issues. Impacts are difficult to quantify. 	<ul style="list-style-type: none"> Must clear approximately 30% of the surface area of the lake.
Increasing Lake Depth (Dredging)	See Dredging Lake Management Issue Table.	See Dredging Lake Management Issue Table.	
Aquatic Plant Management	See Aquatic Plants Lake Management Issue Table.	See Aquatic Plants Lake Management Issue Table.	
Reduce Lake Phosphorus Concentrations	<ul style="list-style-type: none"> See Nutrient Management Issue Table. See Watershed Management Issue Table. 	<ul style="list-style-type: none"> See Nutrient Management Issue table. See Watershed Management Issue Table. 	

Lake Management Options:

Invasive Species: Emergent Plants(Part 1 of 3)

(Ex: purple Loosestrife)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none">• No Cost• No time commitment	<ul style="list-style-type: none">• Invasives are likely to continue to spread and outcompete with native species.	
Manual Removal	<ul style="list-style-type: none">• Targets specific species• Low cost.	<ul style="list-style-type: none">• Time consuming• If not done properly, can spread seeds more.• May take yearly removal.• Disposal can be difficult.	<ul style="list-style-type: none">• For Purple Loosestrife—the best time for control is in late June, July or early August when it is in flower and before it goes to seed. Once the flower petals start to drop from the bottom of the spike, the plant begins to produce seed. For sites where plants have already gone to seed, you can remove all of the flowering pikes first by bending them over a plastic garbage bag and cutting them off into the bag. It's easiest to hand pull when the plants are young so the root structure isn't as strong. Removing flowering spikes will prevent this year's seeds from producing more plants in the future.
Homeowner Education	<ul style="list-style-type: none">• Cheap• Effective	<ul style="list-style-type: none">• Can be difficult to reach all homeowners.• People can have different values/aesthetic preferences.	<ul style="list-style-type: none">• Educating homeowners on what invasive species look like is one of the best tools for invasive species prevention and action. Consider using pamphlets, newsletters, and posters that educate on the appearance of the invasive species, alternatives, and solutions.

Lake Management Options:

Invasive Species: Submerged Plants (Part 2 of 3)

(Ex: Eurasian Watermilfoil, Curlyleaf Pondweed)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No Cost. No Time Commitment. 	<ul style="list-style-type: none"> Invasive are likely to continue to spread and outcompete with natives. 	
Prevention & Education	<ul style="list-style-type: none"> Cheap. Target a large audience. Prevents spread of AIS to other waterbodies. 	<ul style="list-style-type: none"> No enforcement. 	<ul style="list-style-type: none"> The best way to tackle AIS are to prevent them from getting in your lake in the first place. This takes an effort to educate lake users on the best way to prevent the spread of AIS like rinse, drain, and drying your boat and checking for aquatic hitchhikers.
Aquatic Herbicides	<ul style="list-style-type: none"> Can manage invasive for the season. 	<ul style="list-style-type: none"> Not a long-term solution. Can be costly. Chemicals added to waterbody. 	<ul style="list-style-type: none"> .It is recommended to always do an aquatic plant survey before treatment and to conduct treatments early in the season to avoid interaction with beneficial native plants.
Biological Introductions (EX: Milfoil weevil)	<ul style="list-style-type: none"> Harnesses biological interactions to produce desired conditions rather than the use of chemicals. Provides potentially continuing control with one treatment. 	<ul style="list-style-type: none"> Expensive Results are sporadic and often cyclical. Weevil population can be affected by panfish predation. 	<ul style="list-style-type: none"> Weevils need overwintering habitat. May be negatively impacted by boating activities.
Manual or Mechanical Removal	<ul style="list-style-type: none"> See Aquatic Plant Issues Table. 	<ul style="list-style-type: none"> See Aquatic Plant Issues Table. 	<ul style="list-style-type: none"> See Aquatic Plant Issues Table.

Lake Management Options:

Invasive Species: Invertebrates (Part 3 of 3)

(Ex: Zebra Mussels, Rusty Crayfish)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none">• No Cost.• No Time Commitment.	<ul style="list-style-type: none">• Invasive are likely to continue to spread and outcompete with natives.	
Prevention & Education	<ul style="list-style-type: none">• Cheap• Target a large audience.• Prevents spread of AIS to other waterbodies.	<ul style="list-style-type: none">• No enforcement.• Most useful before invasive enters your lake, but can be useful to help minimize spread to other lakes.	<ul style="list-style-type: none">• The best way to tackle AIS are to prevent them from getting in your lake in the first place. This takes an education effort to educate lake users on the best way to prevent the spread of AIS.

Lake Management Options: Watershed (Part 1 of 2)

Option	Pros	Cons	Notes
No Action	<ul style="list-style-type: none"> No Cost. No Time Commitment. 	<ul style="list-style-type: none"> Pollutants from watershed continue to enter the lake. 	
Rain Gardens	<ul style="list-style-type: none"> Reduce runoff volumes. Recharges groundwater and stream baseflows. Filters runoff pollutants. Can increase aesthetic value of properties. Provides wildlife habitat. Low maintenance. 	<ul style="list-style-type: none"> Need to have yard space. Cost of purchasing native plants. 	
Native Plant Buffers	<ul style="list-style-type: none"> Protects water quality. Reduces erosion. Enhance wildlife habitat. 	<ul style="list-style-type: none"> May not be homeowners aesthetic. 	<ul style="list-style-type: none"> Recommended to have a 25 foot buffer along shore-lines.
Permeable Pavement (driveways/patios)	<ul style="list-style-type: none"> Slows water down allowing infiltration. Uses less de-icing material since runoff is infiltrated. 	<ul style="list-style-type: none"> High costs. 	
Residential Bioswales	<ul style="list-style-type: none"> Reduce runoff volumes and rates by slowing water down through the vegetation and allowing groundwater to recharge. Native plants in bio-swale increase infiltration and filter nutrients. 	<ul style="list-style-type: none"> Need engineering guidance. 	
Urban Tree Canopy	<ul style="list-style-type: none"> Trees reduce and slow stormwater by intercepting precipitation. Increase shade cover. Enhance wildlife habitat. 	<ul style="list-style-type: none"> Cost. Space. 	The larger the tree, the greater the cooling effect.

Lake Management Options: Watershed (Part 2 of 2)

Option	Pros	Cons	Notes
Rain Barrels	<ul style="list-style-type: none"> • Captures runoff before it has a chance to pick up pollutants that end up in nearby waterways. • Easy to install. • Encourages water conservation 	<ul style="list-style-type: none"> • Need to have gutters. • Appearance. 	Rain barrels are fairly cheap. You must calculate how much runoff is coming off your roof in order to have the appropriate size (or amount) of barrels.
P-Free Fertilizer	<ul style="list-style-type: none"> • Reduces phosphorus runoff from properties to waterways. • Easily available. 	<ul style="list-style-type: none"> • Some soil types require certain amounts of phosphorus. Get your soil tested to determine what fertilizer is needed. 	<ul style="list-style-type: none"> • Recommended that fertilizer is only applied once a year, early fall is the best time to do this. • A phosphorous-free fertilizer will have a zero as the middle number on the bag.
Dog Waste Management	<ul style="list-style-type: none"> • Results in less organic debris and bacteria in waterways. • Preventing serious health issues to humans and other animals. 	<ul style="list-style-type: none"> • Disposal site can have a negative odor. 	<ul style="list-style-type: none"> • Dog waste is a pollutant and contaminant of water supply. Proper clean up of pets limits the amount of pathogens that can be washed into waterways. Appropriate disposal includes bringing a bag, pickup the waste and then disposing it in a trash can.
Septic System Maintenance	Prevents malfunctioning and leaking pollutants into local waterways and increases the life of the septic field.	<ul style="list-style-type: none"> • Takes time and money to inspect. 	Recommended proactive measures to maintain your septic include: pumping or inspecting the system once every three years, diverting surface water way from the drain field, avoiding driving or parking on the drain field to prevent soil compaction, keeping the roots of trees and shrubs away from the drain field to avoid obstructed drain lines.