

May 23, 2019

John Dietz, Mayor
Elk River City Council
City of Elk River
13065 Orono Parkway
Elk River, MN 55330

Re: DNR Advisory Report on the Formation of the Lake Orono Improvement District in Sherburne County

Dear Mayor Dietz and City Council Members:

I am writing to inform you that the Minnesota Department of Natural Resources (DNR) has reviewed the petition submitted to create the Lake Orono Improvement District (LID) and prepared this Advisory Report in accordance with Minnesota Rules, part 6115.0970, subp. 5. We conclude that:

- we approve of the proposed boundary for the Lake Orono LID for the purposes of dredging, lake drawdowns, aquatic plant management, in-lake water quality projects, and shoreline projects; and
- we recommend that the LID proposers work with the DNR, along with the MPCA, Elk River Watershed Association, Sherburne County Soil and Water Conservation District (SWCD), and other local and regional partners on larger watershed projects as is feasible.

Goals of the Proposed Lake Improvement District

The goals of the Lake Orono LID, as stated in the LID proposal, are to manage water quality, sedimentation, existing aquatic invasive species (AIS), nuisance vegetation, algae, and to be positioned to cope with future AIS threats. To attain these goals, the LID proposes to engage in the following projects:

- Investigate the feasibility for dredging and a partial lake drawdown and carry out those actions.
- Dredge approximately 130,000 cubic yards of sediment from Lake Orono to return it to its historic baseline depth.
- Manage the invasive aquatic plant curlyleaf pondweed (CLP, *Potamogeton crispus*), as well as other detected AIS.
- Manage native plants and algae if they increase to nuisance levels.
- Improve water quality by reducing excessive nutrients in the lake.
- Undertake lake research projects and other lake management projects as future needs arise.

Background Information on Lake Orono

1. Lake Orono (Lake ID Number 71001300) is classified as General Development (GD). Per the Elk River's Shoreland Overlay District, GD lakes have structure setbacks of 50 and 75 feet above the Ordinary High Water Level (OWHL) for sewered and unsewered properties, respectively.
2. Lake Orono has an area of approximately 300 acres, almost all (94%) of which is considered to be littoral (15 feet deep or less per Minnesota Rules, part 6280.0100, sub 9). Generally, the littoral

zone is the part of a lake where rooted aquatic plants can grow, though the maximum depth at which plants can grow depends on water clarity and so varies from lake to lake and even from year to year within the same lake. Lake Orono's maximum depth is 18 feet, and its current mean depth is 3.1 feet, although the historic mean depth is approximately 5 feet.¹

3. The lake is a reservoir of the Elk River, created when a dam was constructed on the river in 1916. Water outlet level is maintained by the City of Elk River at 871 feet MSL.
4. Lake Orono is at the downstream end of the Elk River watershed. The immediate catchment has an area of approximately 5,943 acres, and the total upstream watershed has an area of approximately 388,456 acres, or 611 square miles. These yield land:lake ratios of approximately 9.8:1 for the direct catchment and 1,295:1 for the total watershed.
5. Agriculture covers almost half the area in the upstream watershed. Pasture and grazing land cover about 18% and row crops 27% of the watershed area. Forest, almost entirely deciduous, covers approximately 20%².
6. Both basins of Lake Orono are considered to be impaired for mercury, water clarity, and nutrients.
7. The Elk River Watershed has multiple impairments in various lakes and along various stretches of the river. The water quality impairments on the Elk River all have a target Total Maximum Daily Load (TMDL) completion year of 2023, and consist of three bacteria (*E. coli*), two fish, and one aquatic macroinvertebrate bio-assessments.
8. In 2015, a TMDL was completed for Upper and Lower Lake Orono as part of the Mississippi River St. Cloud (MRSC) Watershed Restoration and Protection Strategy (WRAPS) and TMDL project (<https://www.pca.state.mn.us/sites/default/files/wq-iw8-46e.pdf>). The second cycle of the WRAPS process for the MRSC watershed began in May 2019. Through the WRAPS process, partners throughout the watershed will be working together to further evaluate the MRSC watershed and continue the ongoing efforts to restore and protect its surface water resources. This effort will include the review of existing and development of new restoration strategies within the Elk River Watershed (e.g., TMDL development and evaluation of implementation efforts for existing TMDLs).
9. Lake Orono is in the North Central Hardwoods Forest Ecoregion. The lake's water quality parameters are outside the means for this ecoregion, with water clarity lower and chlorophyll-*a* and total phosphorus higher than the means.
10. Lake Orono is considered to be eutrophic. The mean Trophic State Index (TSI) for Lake Orono is 61; values from 50 to 60 are considered to be mildly eutrophic and higher values are eutrophic.
11. Lake Orono is infested with curlyleaf pondweed (CLP), an aquatic invasive plant. In addition, the invasive emergent plants purple loosestrife (*Lythrum salicaria*) and yellow iris (*Iris pseudacorus*) grow along the lake's shoreline.
12. The City of Elk River maintains a concrete boat ramp in Lake Orono Park, on the western shore just south of US Hwy 10. A public fishing pier and public beach are located south of the boat ramp.
13. The proposed LID will include all properties with direct or deeded lake access.
14. The proposed method of the LID formation is by city resolution in response to citizen petition.

^{1,2} Lake Orono Lake Management Plan 2017-2020

Issue Analysis

Sedimentation

Lake Orono is a reservoir at the downstream end of the Elk River, and receives approximately 3 to 7 million pounds of sediment¹ from the Elk River watershed each year, resulting in a net deposition of approximately 8000 cubic yards of sediment annually³. This reduces the overall depth of the lake and reduces navigation, aquatic recreational opportunities, and user safety in the lake, and covers vegetation, rocks and gravel, and other underwater structures important for vegetation and wildlife. In 1998, approximately 120,000 cubic yards of sediment was removed from Lake Orono. However, given the lake's position at the bottom of a large, heavily agricultural watershed, sedimentation will continue to be a problem for the lake and dredging to remove excess sediment and restore lake depth will need to be conducted periodically. The study that formed the basis for the sedimentation removal project in 1998 predicted that sediment removal would need to be undertaken again in approximately 20 years, and that prediction has proven accurate. Over the past two decades, mean lake depth has been reduced from 5 feet to approximately 3.1 feet. To restore lake depth to its state after the last dredging activity, the LID proposes to remove approximately 130,000 cubic yards of material. The proposal also states that the dredged sediments will be reused, and it proposes to create a deeper water (up to 10 feet in depth) area near the lake inlet to trap and store sediment. Water levels in the lake may be temporarily lowered by opening the dam to facilitate sediment removal.

Sedimentation studies by Wenck Associates suggest that the rate of sedimentation has increased slightly over the past twenty years. In 2011, sedimentation rates were calculated to be approximately 6400 to 6900 cubic yards of sediment, while accumulation rates since 2011 seem to be approximately 8000 cubic yards. This may be the consequence of more accurate and more comprehensive data collection since 2011, or it could reflect an actual increase in sediment accumulation in Lake Orono. Water quality and water flow modeling by the Sherburne County Soil and Water Conservation District suggests that total suspended solids (TSS) in the watershed increased dramatically between 2009 and 2016, due to increased precipitation; this could have been the source of the apparent increase in sedimentation. MPCA is planning to conduct an intensive water quality monitoring program in the Mississippi River St. Cloud watershed, and the information gathered in this program may better address this question.

Sedimentation is a known, expected, and predictable ongoing problem for reservoirs such as Lake Orono. The only choices are: 1) let the lake fill in, 2) modify the dam to reduce head and allow more sediment to be transported downstream, 3) stop the sediment upstream of Lake Orono, or 4) periodically remove accumulated sediment. The LID has determined that the periodic removal of sediment is the most practical solution for Lake Orono at this time. The lake management plan states that the removed sediment will be reused. The removed sediment will likely contain curly pond leaf (CLP) turions, and therefore should be used only in upland areas so the turions cannot be introduced into a new water body.

The activities proposed to address this lake problem are heavily regulated and require several permits:

- Any sediment removal below the OHWL requires a DNR Public Waters (PW) permit, Minnesota Pollution Control Agency (MPCA) sediment disposal permits, and other applicable permits.
- Lake drawdowns require consent of at least 75% of affected landowners, a permit amendment, and are regulated under Minnesota Statutes § 103G.408.

3. 2010 Wenck Associates Report on Lake Orono Sedimentation Study.

The LID will need to work closely with:

- DNR Area Fisheries Supervisor Joe Stewig (joe.stewig@state.mn.us, 320-223-7867) for guidance on minimizing impacts to flora and fauna from the drawdown, dredging, water level restoration, and related activities.
- DNR Area Hydrologist James Bedell (james.bedell@state.mn.us, 320-223-7850) for overall guidance on the activities and PW permits.
- DNR Dam Safety Program Supervisor Jason Boyle (jason.boyle@state.mn.us, 651-259-5715) for guidance on any activities requiring operation of the dam.
- US Army Corps of Engineers (USACE) and Board of Water and Soil Resources (BWSR) for guidance and to clarify applicable standards.
- The MPCA on permits to ensure the safe and appropriate disposal of dredged sediment.
- The City of Elk River on the drawdown, sediment removal, and sediment disposal work. Both the City of Elk River and various individuals associated with Lake Orono Improvement Association and the Lake Orono Water Quality Committee have experience with these activities from the lake's first sediment removal in 1998, and the DNR is encouraged by this experience and previous success. MN DNR also notes that Upper Orono, the area with the greatest amount of sediment deposition, also has the most abundant CLP. The DNR expects the LID and the City of Elk River to require their dredging contractors to take every sensible precaution to avoid spread of the CLP plants or turions during these operations. The proposers should consult with the DNR Aquatic Invasive Species Program staff for further guidance on avoiding CLP spread from dredging and sediment.
- The Lake Orono Water Quality Committee proposes to extend the time span between sediment removal projects from the current expected 20 years to at least 30 years. This will be challenging because most of the sediment comes from the upstream watershed. Since this area is outside of the LID boundary, there is very little that the LID can do directly. However, the Lake Orono Water Quality Committee is working closely with several other groups that have more direct opportunities to promote Best Management Practices (BMPs) in the upstream watershed and reduce sediment loading. MN DNR encourages the LID to continue with these partnerships.

The LID also proposes projects besides dredging to reduce sediment input to the lake. Available data suggest that total suspended solids (TSS) contribution from the area immediately surrounding Lake Orono is minor; however, it is easy for the LID to directly pursue sediment reduction projects in this area. Such projects would consist of encouraging property owners to plant native vegetation and vegetative buffers along the shoreline to reduce runoff into the lake. The DNR encourages the LID to promote these projects among the LID's members. The City of Elk River can also engage in actions to reduce the sediment load in city runoff carried by drainage ditches into the lake. These actions may include continuing its practice of dredging material accumulated in front of drainage areas and sweeping the streets near the lake regularly, especially before forecast storm events. The LID will also educate citizens on the importance of keeping lawn waste out of streets, ditches, and areas prone to runoff.

The DNR would like to remind the LID proposers that increased precipitation, and particularly an increase in more intense rainfalls and storms, is predicted for Minnesota due to climate change. The observed increase in precipitation (and accompanying increase in TSS) could be part of this predicted trend. The DNR encourages the LID proposers to continue to monitor TSS and water flow into and out of Lake Orono so this question can be explored further. The DNR also encourages the LID proposers to take into account

the predicted more intense rainfalls when planning sedimentation removal projects, because such rainfall patterns will increase TSS, and therefore sediment accumulation, in Lake Orono.

Invasive Plants Management

Lake Orono has three invasive plant species: the submersed plant curly-leaf pondweed (CLP) and two emergent plants, purple loosestrife and yellow iris. CLP has been present in the lake since 2003 and currently covers approximately 33% of the lake. The LID proposes to reduce abundance of CLP with herbicide applications and possibly mechanical removal. The two emergent aquatic invasive species, purple loosestrife and yellow iris, can be managed by manual removal and replacement with native wetland plantings and shoreline vegetation restoration.

Herbicide treatment of CLP started in 2017 and was repeated in 2018. In 2017, 4.27 acres were treated, and in 2018, 22 acres were treated. CLP was found at a far lower frequency in 2018 than in 2017 (35% of the littoral zone vs. 71% of the littoral zone). With so few data points, no conclusions can be drawn. Pesticide treatments also may not be as effective if flow rates are high and the pesticides move downstream. Therefore, timing and concentration exposure time is essential when considering a pesticide treatment.

Full lake point intercept surveys of aquatic vegetation in Lake Orono have been conducted in May 2012, by MN DNR staff, and in 2017 and 2018 (early June to evaluate CLP, and July to evaluate the native plant community) by a private consultant. The 2012 DNR survey was conducted to learn the extent of CLP, while the two later surveys were conducted to assess the native aquatic plant community in addition to CLP. The 2012 DNR survey found CLP at 14% of sampling points, and the 2017 and 2018 surveys found higher occurrences of CLP. The July surveys found aquatic plant growth at 46% and 72% of points sampled, with 18 to 22 native species. The surveys found plants to a maximum depth of 8 feet in 2017 and 5.5 feet in 2018, with the vast majority between 3 and 5 feet. The dominant native plant species are coontail (*Ceratophyllum demersum*), 'common waterweed' (*Elodea canadensis*) and duckweeds.

The DNR notes that the dredging and partial lake drawdown, which are expected to be implemented as soon as 2019-2020, may have a profound effect on the distribution and abundance of CLP. Additional CLP plants and turions would be removed during sediment dredging. The DNR notes that the heaviest CLP growth occurs in Upper Orono, where most sediment deposition occurs and which will be most heavily dredged. If done properly, the dredging could help to alleviate the CLP abundance. The proposed lake drawdown could also help to reduce CLP. A winter drawdown would expose sediments to freezing and kill many of the exposed plants and turions, likely reducing the "seed bank" for CLP. Areas that do not maintain a hard freeze may be more suitable for pesticide treatments. It is important to note that, while a winter drawdown would freeze out CLP, it can also have an undesirable effect on other plants as well as hibernating animals. Drawdowns should be timed to avoid or minimize these effects, especially any possibility of taking endangered or threatened species, or impacting Species of Special Concern.

The DNR suggests that the LID re-evaluate the lake's vegetation community after any drawdown and dredging, then base its vegetation management activities on the new community structure. The drawdown and dredging may significantly reduce the need for herbicide application. In addition, CLP has unique life history patterns (emergence and growth early in the spring, followed by midsummer senescence) that must be taken into account when treatments and monitoring surveys are conducted.

Any AIS management should be accompanied by regular lake vegetation surveys, and with the guidance of the DNR's Aquatic Invasive Species Program.

It is important to recognize that although CLP is invasive, this plant is still beneficial to fish and wildlife, especially in the early spring when it may be the only plant that can provide cover, habitat, and foraging areas. A balance of managing plant communities and nuisance vegetation should be carefully considered. Overall, lakes need aquatic vegetation for a variety of ecological purposes and it would not be favorable to remove the majority of vegetation without implementing restoration efforts, especially if the stated goals are to improve wildlife habitat, improve algal growth, promote fishing, reduce erosion, and improve water quality. Some vegetation is preferable to no vegetation, even if that vegetation is CLP.

The petition also states that the LID will engage in additional actions to monitor, manage, and prevent additional AIS infestations. These actions include contracting for AIS inspections at the public boat landing, educating property owners and lake users about AIS detection and prevention. The DNR strongly supports these practices. The most efficient way to manage AIS is to address it early, before it rises to nuisance levels. Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) is present in four basins in Lake Orono's upstream watershed (Big, Eagle, Little Elk, and Mitchell Lakes; all in Sherburne County), so EWM could get into Lake Orono as well. The DNR encourages the LID to work with the City of Elk River, Sherburne County, and local DNR Watercraft Inspection Program staff to promote these additional activities.

The DNR cautions the proposers that AIS growth is lower than it could be. Most of the lake is less than 15 feet deep, and therefore theoretically capable of having vegetation growth. Current vegetation distribution is limited by the lake's low water clarity, but if water quality improves and clarity increases, it may spark increased vegetation growth, including CLP. If this occurs, the LID should remember that this may be a consequence of improved water quality and not necessarily negative. The LID should therefore continue to work very closely with the DNR Aquatic Invasive Species Program to ensure that any AIS management remains in balance with overall water quality improvement goals.

The LID should contact the local Aquatic Invasive Species specialist Christine Jurek (christine.jurek@state.mn.us, 320-223-7847) for further guidance on AIS management.

Native Vegetation Management

The LID proposes to manage native aquatic vegetation and algae, should these rise to nuisance levels. The DNR recognizes that management of nuisance levels of native vegetation is sometimes necessary for navigation or recreational purposes, but in Lake Orono, reduction of native plant overgrowth may not be necessary or beneficial. The majority of the areas where plant growth is common are areas that are less than five feet in depth and are not ideal for recreation due to these shallow depths. These areas should be maintained for habitat instead. In addition, the removal of native aquatic plants may result in more algal growth and an increase in turbidity in the water and is thus inconsistent with plans to reduce algae proliferation and improve water quality.

The dredging plans may also have adverse impacts on the lake's native plant community. Many of the areas targeted for dredging may include floating-leaf or emergent vegetation that provides high quality

wildlife habitat. The LID should work with the DNR's Aquatic Plant Management Program to survey aquatic and wetland plants in the areas under consideration for dredging and come up with a strategy to avoid or minimize destruction of desirable native vegetation due to dredging activity, and to design restoration projects in dredged areas where harm to native vegetation cannot be avoided.

Lake Orono has several complex and interrelated problems, and measures taken to address these problems will have impacts on the lake's native vegetation. These include impacts from dredging, drawdowns, and herbicide treatment or mechanical removal of CLP. Balancing all of these measures while protecting the integrity of the aquatic vegetation community will be very challenging, but necessary. The DNR strongly encourages the LID to include consideration of the impacts of all of these problems and their proposed solutions on the vegetation, and propose a viable strategy to protect or restore the native vegetation community from the consequences of these solutions, in any Lake Vegetation Management Plan that it adopts.

Water Quality

Lake Orono is eutrophic, with elevated total phosphorus concentrations and low water transparency. Mean summertime TP is around 100-111 µg/L, and mean Secchi depth is about 3.1 feet. Threshold values for lakes similar to Lake Orono in the same ecoregion (North Central Hardwood Forest Shallow Lakes) are considerably less: <60 µg/L TP, <20 µg/L chl-*a*, and >3.3 feet Secchi depth. According to the MPCA, internal nutrient recycling and nutrients from stormwater runoff are a small part of the lake's water quality problems. Four sediment cores collected and analyzed for phosphorus in 2018 showed one sample slightly above the median for Minnesota lakes ; one within the lower 25% of values expected for Minnesota lakes; and two with no phosphorus release. These results support the hypothesis that most of the excess phosphorus comes from the watershed.

Lake Orono has a very large watershed:lake ratio, most of which is agricultural or otherwise developed in some fashion. The watershed is itself considered impaired for water quality characteristics in numerous stretches. These characteristics increase the lake's vulnerability to pollution from the watershed. Because these phosphorus sources are largely outside the boundaries of the proposed LID, it will be challenging for the LID to remediate them; nevertheless, reducing phosphorus inputs from the watershed is the most effective way to help Lake Orono with its eutrophication problems. To achieve this goal, the DNR strongly encourages the LID to pursue any erosion control, landscaping and ecosystem restoration projects within the boundary of the LID, and to pursue partnerships and collaborations with private property owners, Sherburne County, the Sherburne County SWCD, BWSR, the Elk River Watershed Association, and the MPCA to indirectly influence those sources of phosphorus outside the LID's boundaries. According to the Orono Lake Management Plan, the Lake Orono Water Quality Committee (LOWQC) already has a long history of working with many of these groups to pursue water quality enhancement projects in the Elk River Watershed.

The DNR also suggests that the LID undertake a survey to determine whether any septic systems on the lake are noncompliant and, if so, bring them into compliance. Noncompliant septic systems can be a significant contributor of nutrients to the lake.

The high mercury concentration in fish tissue is being addressed with the Statewide Mercury TMDL.

Other

The proposal includes a statement that the LID may restore, establish, or maintain upland vegetation buffers to enhance wildlife habitat and deter Canada geese. This is a suitable goal for the LID and the DNR supports it. In addition to wildlife benefits, buffers along the shoreline will also improve water quality as they trap runoff into the lake, reducing sediment, nutrients, chlorides, and other pollutants.

Recommendations & Conclusions

Proposed LID Boundaries

The boundaries of the proposed LID include only properties with direct or deeded access to Lake Orono. Minnesota Rules, part 6115.0920, subp. 5 requires that the boundaries include all lands and waters within the direct drainage basin of the lake (shown on the attached map). However, the rules also allow the County Board or City Council to create a boundary less than the entire drainage basin with written Commissioner approval if the boundary selected includes a sufficient amount of the lake's watershed to develop and implement feasible solutions to the problems the LID intends to address. Restriction of the district's boundary to these properties is sufficient to address the in-lake and shoreline water quality and vegetation management activities for which the LID is being proposed. Therefore, in accordance with these rules, the DNR approves the proposed boundaries identified in the resolution.

Advisory Comments & Recommendations

As a reservoir at the bottom of a large and heavily developed watershed, Lake Orono has a chronic water quality and sedimentation problem, yet the causes of these problems largely lie outside the proposed LID boundary. The proponents of the LID appear to be aware of the complexity and magnitude of this problem, and are including in the proposal both projects that the LID can carry out directly within its boundaries, and projects outside the LID's boundaries that will require coordination and cooperation with other parties, including the Sherburne County SWCD, Elk River Watershed Association, DNR, other area lake associations, and the MPCA. The DNR is pleased that the LID proposers recognize and acknowledge the importance of working with these other groups, because it is unlikely that problems of the nature and magnitude of Lake Orono's sedimentation and eutrophication problems can be alleviated solely through in-lake and shoreline projects.

The LID proponents have also worked very closely with a large number of city, DNR, and MPCA staff people to elicit feedback, comments, and suggestions on the LID's proposed projects and goals before proceeding with the LID formation process. This proactive work has resulted in a very well-thought out product. The DNR commends the proposers for their efforts in this regard, and encourages the LID to continue with these collaborations should the LID be approved. These partnerships are the most effective means of improving water quality and reducing sediment loading in Lake Orono.

Finally, many of the proposed projects to address one problem may have adverse effects on other desirable aspects of the lake (e.g., drawdown and dredging will affect the native vegetation and wildlife).

Balancing and mitigating these effects will require ongoing collaboration with natural resource professionals.

Thank you for consideration of these comments. Please contact Kathy Metzker, DNR Land Use Hydrologist, at kathleen.Metzker@state.mn.us or 651-259-5694 if you have any questions. If approved, please provide the name and address of the primary contact of the Board of Directors for the LID and remind the LID of its obligation to provide DNR notice of annual meetings and copies of annual reports per Minnesota Statutes, § 103B.571.

Sincerely,
DIVISION OF ECOLOGICAL AND WATER RESOURCES

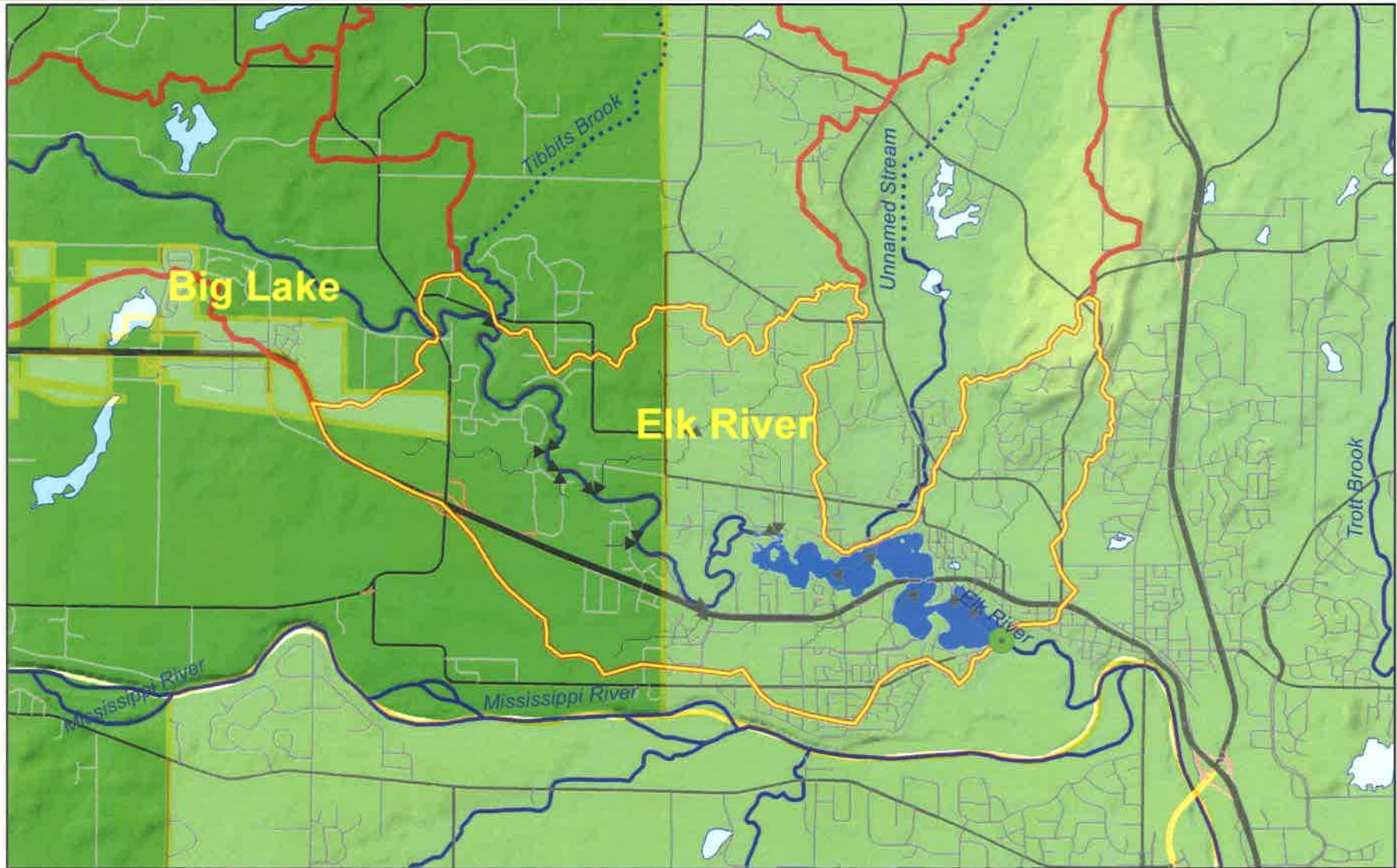


Steve Colvin
Director, Division of Ecological and Water Resources

Attachment

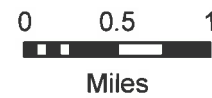
- c: Jennifer Shillcox, DNR Land Use Programs Supervisor
- James Bedell, DNR Area Hydrologist (Sherburne County)
- Christine Jurek, DNR Aquatic Invasive Species Specialist
- Daniel Petrik, DNR Land Use Specialist
- Jason Boyle, DNR Dam Safety Program
- Seth Goreham, MPCA North Central Watershed Unit Supervisor
- Phil Votruba, MPCA Project Manager-Mississippi-St. Cloud Watershed
- Audrey Kuchinski, DNR Aquatic Plant Specialist
- Joe Stewig, DNR Area Fisheries Supervisor
- Patrick Plant, Chair, Lake Orono Water Quality Committee
- Christy Cox, President, Lake Orono Improvement Association
- Calvin Portner, City Administrator
- Amanda Bednar, Environmental Coordinator, City of Elk River

Lake Orono Catchment



The watershed data presented here are part of the National Watershed Boundary Dataset (WBD). A Hydrologic Unit (HU) is the smallest division in the nested, hierarchical watershed classification system of the WBD. Electronic data for use in a GIS (Geographic Information System) can be downloaded from the DNR Data Deli: <http://deli.dnr.state.mn.us/>

- Dams
- Flow Path
- Catchment
- Upstream Watershed
- Orono



Watershed	Area	
	Acres	Square Miles
Lake Orono DOW Lake No. 71001300	300	0.47
Direct Catchment Watershed Elk River	5943	9.3
Total Upstream Contributing Watershed	388456	607

