

Condition Report Diamond Lake Wake Ordinance

To Accompany Ordinance xxx-yyy of the Municipal Code of Grand View Township, Wisconsin

Geographic Setting: Diamond Lake is a 322 acre drainage lake in Grand View Township, Bayfield County WI. It has a maximum depth of 83 feet with half of the lake area shallower than 20 feet (the littoral zone).

Water clarity at present is good to excellent (Secchi values ~ 12 feet), and the most recent macrophyte survey (Berg, 2022) shows that species diversity is excellent with over 60 species identified, some of them rare. These results are from the point-intercept macrophyte survey conducted on August 17-18, 2021 by Endangered Resource Services, LLC, Matthew S. Berg, Research Biologist. The survey concluded in part:

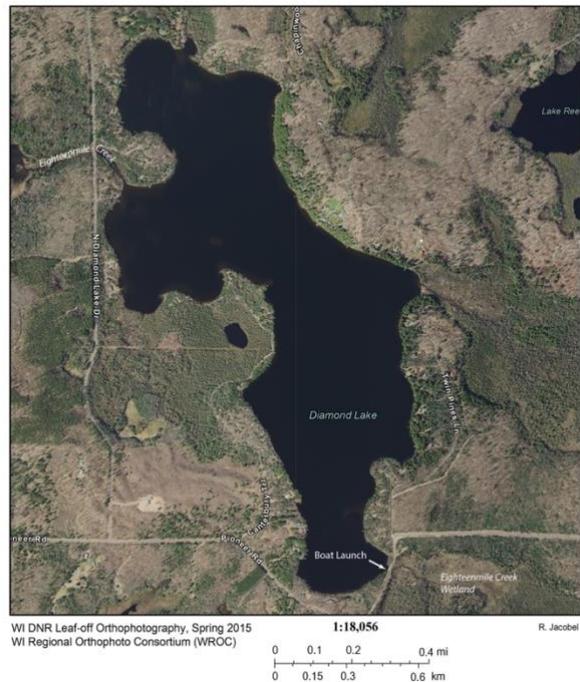
Overall diversity was exceptionally high with a Simpson Index value of 0.94. Richness was also moderately high with 43 species found in the rake. This total increased to 60 species when including visuals and plants found during the boat survey. Several of these additional species were uncommon to rare; highly localized along undeveloped shorelines; and known to be sensitive to habitat modification making them potentially vulnerable to lakewide extinction. Localized richness was also moderately high as we calculated a mean native species at sites with native vegetation of 3.27 species/site. (Berg, 2022).

Background: Beginning in the summer of 2020, the DL Board has received an increasing number of complaints from residents about wave damage from wake surfing boats. Complaints range from observations of shoreline erosion to docks and boats being swamped, significant property damage to a dock in one case, and danger to the health and safety of swimmers and non-motorized craft impacted by the large wakes.

Invasive Species: An additional concern is the potential for aquatic invasive species to be spread into Diamond Lake from the ballast used to create enhance wakes by these craft. Water is held in a bladder, that is impossible to drain completely, leading to transport of potentially contaminated water from one lake to another.

An article published by Campbell et al., in the journal *Management of Biological Invasions* in 2016 documents this problem, stating in part:

Diamond Lake Leaf-off Image Map



*Transient boaters are a known vector of aquatic invasive species. This has led to the establishment of prevention guidance to reduce the risk of most boating activities. However, this guidance may not adequately reduce the risk of invasive species **transport in wakeboard boats** due to the presence of ballast systems, which may be difficult or impossible for a boater to drain. We documented that these watercraft transport relatively large volumes of residual water (mean water volume 31.7 L) even after drain pumps run dry and that live organisms can be found in residual water for at least a week after use. The amount of residual water found in ballast tanks was variable (range of 1.0 L to 86.8 L), indicating that there may be factors that would allow for more complete drainage of ballast tanks.*

Campbell et al. went on to note:

Given the results of this study, the simple actions that drain water on other types of watercraft (e.g. fishing boats, cruisers), such as pulling the drain plug and emptying the bilge, will not achieve the same risk reduction in wakeboard boats with ballast water systems. (Campbell et al., 2016).

Large Wakes Studies: Our concerns have led us to scientific studies documenting the impacts of large wakes, and to see what redress has been taken by nearby lake associations and townships. We have been guided in particular by a recent study done by the University of Minnesota Hydrodynamics Laboratory (Marr et al., 2022) that compared boats with wake-enhancing adaptations (mechanical or ballast) with traditional ski boats.

One of the principal findings of this study is that while all wakes dissipate over distance, the energy delivered to the shoreline from the wake-enhancing boats required more than 600 feet to decrease to the same level as traditional ski boats at 200 feet. At distances of 100 feet, the wave height from wake-enhancing craft was two to three times higher than for traditional ski boats (which was less than 10 inches, as shown in the accompanying figure).

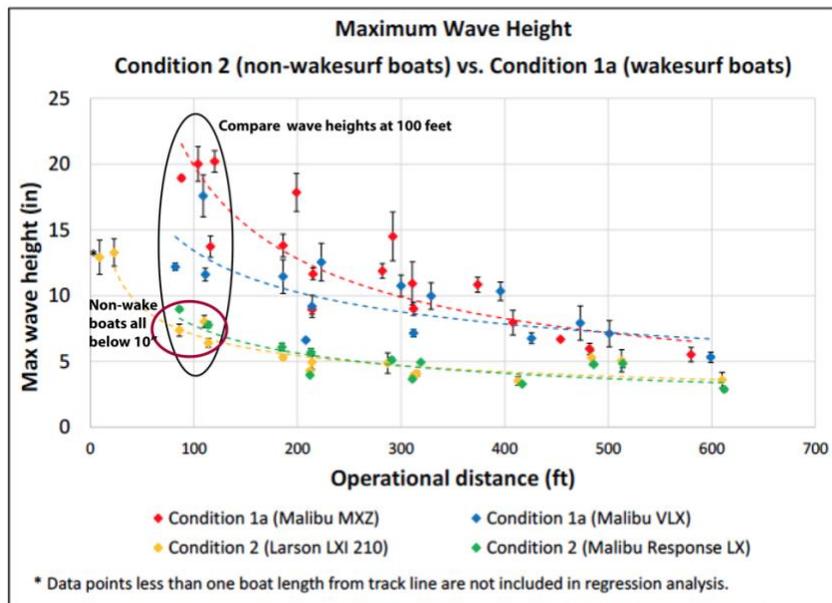


Figure 42. Comparison of maximum wave height of the test boats under their typical operational conditions.

Other studies have begun to document the impact that large wakes have beneath the surface where energy is dissipated as waves reach the shoreline (eg. Trye and Luebke, 2022). Sediment is readily mobilized as seen in the marked decrease in water clarity, eg. nearby Lake Tahkodah showed markedly decreased Secchi values after just a one-season exposue to large wakes. Minerals like phosphor can also be released from the sediment, leading to increased eutrophication.

As sediment is disturbed, aquatic plants are also impacted. With over 50% of our lake area at less than 20 feet depth, we are concerned that the outstanding species diversity currently present in Diamond Lake will be permanently reduced.

Existing Statutes and Responses: Discussions with the parties involved in cases where that has been possible have been unproductive. A typical response is that the boats are operating in compliance with all WI state boating statutes.

Because of the lack of legislation yet at the State level in Wisconsin, a number of lake associations, districts, and townships have adopted statutes limiting large wakes. Nearby the Lake Tahkodah district this year enacted ordinances limiting wake height with both Cable and Drummond Townships. In 2021, Hayward township, with several larger lakes, passed a restriction on wake height within 700 feet of the shoreline. It is our understanding that Cable Township is currently developing an ordinance for all lakes within its jurisdiction.

Diamond Lakers Association: The DL Association is a voluntary Qualified Lake Association under WI Statute 281 currently with 58 members drawn from property owners and residents from around the lake and within a mile of its shoreline. The membership comprises over 80% of all those residing on the lake and over 90% of those who visit more than a few times a year, one of the highest percentages in Wisconsin.

The issue of large wakes was discussed at length at the July 2022 annual meeting with particular focus on the issue of water safety, shoreline and property damage and the problem of increased chance for the introduction of invasive species. Those present voted nearly unanimously to charge the Board with developing a large wakes ordinance with Grand View Township. A subsequent survey of the full membership found 90% of those responding in favor of pursuing an ordinance. We are in the process of surveying the membership now that the text of the proposed ordinance has been drafted.

Specifics of This Ordinance: In framing our ordinance, we have been guided by the specifics of the ordinances that have been enacted nearby and also the particular characteristics of Diamond Lake. Because of the small size of DL, we believe a distance limitation from the shore is not a practical way to reduce impacts to people, property, aquatic plants and the shoreline. Guided by the recent research and our goals of (1) preventing invasive species, (2) eliminating damage from high wakes, and (3) a simple means for identifying when infractions occur, we propose an ordinance with three complementary elements.

In (*Section 8*) we propose a wake height limitation (see elevated wakes definition, *Section 6*) that allows traditional towing activities but excludes wake-enhancing technology.

In **(Section 7)** we also distinguish explicitly between towing activities like water skiing and wake surfing (non-towing) because the latter are possible only with the enhancements that produce large breaking wakes. The two are easily distinguished by an observer at any distance.

Because of the great concern over introducing exotic species into DL, we explicitly seek to eliminate the possibility of transfer in ballast tanks by prohibiting their use **(Section 10)**. We clearly distinguish this from ‘live wells’ for fishing.

We believe the ordinance we have proposed will enhance the recreational opportunities for all users of Diamond Lake and will preserve and enhance the economic conditions and property values of all residents.

References:

Berg, Matthew S., 2022. *Warm-water Point-intercept Macrophyte Survey Diamond Lake - WBIC: 2897100 Bayfield County, Wisconsin*. Survey Conducted by and Report Prepared by Endangered Resource Services, LLC, St. Croix Falls, Wisconsin, August 17-18, 2021.

Campbell, Tim, Todd Verboomen, Gary Montz and Titus Seilheimer, 2016. *Volume and Contents of Residual Water in Recreational Watercraft Ballast Systems*, Management of Biological Invasions 7(3): pp. 281-286 (2016).

Marr, Jeffrey, Andrew Riesgraf, William Herb, Matthew Lueker, Jessica Kozarek, and Kimberly Hill, 2021. *A Field Study of Maximum Wave Height, Total Wave Energy, and Maximum Wave Power Produced by Four Recreational Boats on a Freshwater Lake*. St. Anthony Falls Laboratory, University of Minnesota Engineering, Environmental and Geophysical Fluid Dynamics, SAFL Project Report No. 600 (2021).

Tyre, Tim and Charles Luebke, Terra Vigilis Environmental Services, June 2022. *Wave Propagation and Water Quality Impacts on Fresh Water Lakes – Phase 2*, presentation to the NW Wisconsin Lakes Conference, June 2022. <https://nwwislakesconference.org/nw-wi-lakes-conference-sessions/>