CONDITION REPORT TO SUPPORT AN ORDINANCE RESTRICTING ARTIFICIALLY ENHANCED WAKES IN THE WATERS OF THE TOWN OF LAFOLLETTE, BURNETT COUNTY

INTRODUCTION

Wisconsin's inland lakes are among the state's most critical natural resources and have incalculable aesthetic, environmental and economic value. In the interest of public health, safety, and/or welfare including the public's interest in preserving natural resources, and protection of the environment and outdoor recreation, the Town of LaFollette ("Town") has the authority to enact ordinances covering waters within its jurisdiction, if the ordinances are not contrary to or inconsistent with Chapter 30, Wis. Stats., and they relate to the equipment, use, or operation of boats or to any activity regulated by Wis. Stats. Sections. 30.60 to 30.71 and 30.77 (3)(a).

PURPOSE OF THE ORDINANCE

The purpose of this ordinance is to

(1) prevent the environmental degradation caused by artificially enhanced wakes and downward propeller wash generated by boats for enhanced wake sports such as wake surfing;

(2) prevent the transfer of aquatic invasive species through ballast water intake and discharge between lakes;

(3) prevent property damage from enhanced wakes hitting privately owned shoreline, docks, shoreline structures and boats;

(4) prevent enhanced wake activities driving other water sports of of the lakes;

(5) protect the nesting sites of loons and other water birds;

(6) protect fish spawning grounds;

(7) protect water quality and prevent enhanced algae bloom; and

(8) protect public safety.

Specifically, the proposed ordinance would prohibit the use of ballast tanks, ballast bags or fins to cause a boat to operate in a bow-high manner or which increase or enhance a boat's wake. It also would prohibit continuously operating a boat in an artificially bow-high manner having the effect of increasing the boat's wake; this would include prohibiting wake enhancement using ballast tanks, ballast bags, mechanical fins or continuous operation at transition speed (the speed below planing speed in which a boat is operating in plowing mode). In no event would any of the following operations be deemed a violation of the ordinance, provided such operations do not use ballast tanks, wave shapers or electro- mechanical fins: 1) water skiing, 2) tubing, 3) wakeboarding using a tow rope, 4) brief transition operation to empty a boat of bilge water, or 5) brief transition operation of a boat accelerating into a planing condition. Thus, restrictions on water skiing and other tow rope activities are not within the intended scope of the proposed ordinance.

Moreover, nothing in the proposed ordinance would preclude the use of ballasted wake boats, provided the ballast tanks and other features intended to create enhanced wakes or cause the boat to operate in a bow-up stern-down orientation are not deployed. These boats could continue to be used for cruising, water skiing and other activities provided the ballast tanks and other wave-enhancing features are not deployed.

Various studies and surveys (see Appendix 1) have been conducted that reveal the negative efects of enhanced wakes on inland lakes. The results suggest that these negative efects can largely be avoided if the lake size is more than 1,500 acres; and the distance of the enhanced wake boating activity is at least 700 feet from the shoreline or other lake users and in water depths at least 30 feet.

By increasing displacement of the boat and equipped with very powerful engines, wake boats impart very large quantities of energy. The energy of these waves increases with the square of their amplitude, such that a two-fold increase in wave height generates four times more energy and a three-fold increase in wave height generates nine times more energy[1]. Also, the energy of the waves is directly proportional to the square of the wave period, such that 20% increase in the wave period effects a 44% increase in wave energy, for waves of equivalent heights. This is important because the waves created for wake surfing have a longer period than most other waves created by boats on inland lakes. Most of this wave energy is conserved until it encounters shallow water, concentrating energy on all materials or objects present, including the shoreline, lake bottom, wildlife habitat, docks, moored boats, swim rafts and other people enjoying the lake. Details of the

[1] Formulas for Boat Wakes, webpage http://boatwakes.homestead.com/files/form.htm

environmental impact can be found in a recent literature study by Wisconsin Green Fire, a well-regarded environmental non-profit formed principally by retired Wisconsin DNR personnel. https://wigreenfire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

When wake boats operate in a bow-up stern-down manner, the propeller wash may scour the lake bottom to depths of 30 feet or more, destroying aquatic vegetation and fish spawning beds, and churning the sediment into the water column, degrading the water quality. See the previously referenced Wisconsin Green Fire report.

LOCAL CONDITIONS NECESSITATING A LOCAL ORDINANCE

In recent years, there has been an increase in boats equipped to generate artificially enhanced wakes on Town lakes. More lake residents and others within the Town are expressing concern about the effects of enhanced wakes on their environment and on public safety. The Wisconsin DNR's Spring 2023 Survey and Spring 2024 Survey results indicate that both Burnett County residents and those who recreate in Burnett County are overwhelmingly in favor of legislation that would prohibit the operation of boats in a manner that creates artificially enhanced wakes.[2]

- Town of LaFollette has 6 lakes greater than 50 acres[3] wholly within its boundaries and another 3 on its borders (see Appendix 2).

- The general consensus among most researchers is that to dissipate wave height and intensity from enhanced waves from wake boats requires a boat to be 700 feet from shore. To prevent lake bottom disturbance from these wake boats/wake surfing requires a lake depth of 30' or more. Given the crowding of the bigger lakes, none of the lakes in LaFollette have a combination of depth and distance from shore suitable for wake surfing[4]

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[2] https://dnr.wisconsin.gov/sites/default/files/topic/About/WCC/2023/SpringHearing/2023_CountyResults.pdf

[3] Per 30.635, Wis. Stats, on lakes 50 acres or less having public access, motorboats may not be operated in excess of slow-no-wake speed, except when such lakes serve as thoroughfares between 2 or more navigable lakes.

[4] *Lake Waramaug Wave Impact Study*, *Final Report"* Nov 15 2024. https://www.warrenct.gov/sites/g/files/vyhlif3991/f/uploads/lake_waramaug_final_report.pdf

- Artificially enhanced wakes can cause irreversible damage to shorelines, lake beds, moored boats, and shoreline structures. Enhanced wakes and the associated propeller wash can uproot aquatic plants and re-suspend the lake sediment. This churning action can increase phosphorus levels in the water column that lead to algae blooms[5]. Any toxic substances that may be present in the sediment can re-enter the water column from prop wash, degrading water quality and posing additional risks to aquatic wildlife, plants and people.

- Effect on wildlife: Birds, particularly waterfowl such as loons, nest close to shorelines and are especially vulnerable to shoreline disturbances. Studies have shown that when boaters pass repeatedly too close to shorelines inhabited by birds and wildlife creating large wakes, the following impacts can occur: relocation of nesting sites, abandonment of nests and loss of young. There can also be long term impacts as many species of birds that normally would return year after year to the same nesting area are forced elsewhere. In many cases, this may be to less desirable bodies of water. Many of the lakes have nesting shoreline birds including loons. Loons are particularly susceptible to enhanced wakes, as their nests are frequently just a few inches above water level. See the previously referenced Wisconsin Green Fire report.

- Effect on shoreline and water quality: Maintaining water quality is in the best interest of all property owners and all others who use or otherwise enjoy lakes-- not only for recreational activities such as boating, skiing, and tubing, but also for fishing and swimming. Increased sedimentation which can reduce light penetration and inhibit primary production, abrade and clog fish gills, and prevent feeding by sight feeders, will negatively alter fish populations. While shoreline erosion can be reversed with much cost and effort within years, changes to water quality by disturbance of the lake beds can be even more difficult to remedy. Disturbances of the lake bed can release nutrients such as phosphorus that took decades to accumulate. Once released and re-suspended, it can take decades for a lake to return to its former status. Phosphorus is the limiting nutrient for enhanced growth of algae and its associated detrimental impacts. Work by the WDNR indicate that phosphorus levels over 20 ug/L can lead to accelerated algal blooms.

- Without adequate protection, erosion and sedimentation will accelerate lake eutrophication with a negative impact on all who use these water resources.

- Lake residents are very concerned that if enhanced wakes and downward prop wash are not regulated, that these wake boat/wake surfing activities using enhanced waves will become increasingly common resulting in more extensive and more permanent

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[5] *Lake Waramaug Wave Impact Study*, *Final Report"* Nov 15 2024. https://www.warrenct.gov/sites/g/files/vyhlif3991/f/uploads/lake_waramaug_final_report.pdf

damage. Then it will be too late to regulate and the damage to Town of LaFollette lakes will be permanent. The lakes in Town of LaFollette are relatively clear lakes and need to stay that way. Damage to shorelines and green algae blooms (from resuspension of lake bottom phosphorous) will eventually devastate the lakes in Town of LaFollette. It may not be right away, but eventually the damage that these boats' enhanced waves and prop wash cause will aggregate and become permanent.

- Wake boats are unable to fully drain the different wake boat ballast systems. This is now one of their primary vectors for invasive species contaminating lake waters.

- Removing a ballasted boat from a lake without fully emptying the ballast tanks is a violation of state law. See NR 19.055. Because it is not possible to fully empty the ballast tanks of wake surf boats, bringing a wake surf boat to any lake in LaFollette from any other lake represents a violation of NR 19.055

- The use of ballast and wake-enhancing fins, vanes, wake shapers (trim tabs) or other such devices puts the boat in a bow-up stern-down position. This may obstruct the driver's view, leading to increased safety risks for others on the lake: anglers, kayakers, paddle boarders, and swimmers. There have been various reports of close-call encounters between wake boats and other water sport enthusiasts.

- Ballast systems are virtually impossible to empty completely, thereby increasing the risk of carrying aquatic invasive species from one lake to another, which is illegal in the state of Wisconsin. Ballast tanks are a vector to transmit invasive species as well as a breeding ground for transmitting invasive species to lakes.

Most of the foregoing points are supported by the previously referenced Wisconsin Green Fire report. https://wigreenfire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

WITHIN THE TOWN OF LAFOLLETTE AND FROM ELSEWHERE IN WISCONSIN, PROPERTY OWNERS AND BOATERS HAVE REPORTED MANY PROBLEMS FROM WAKE SURF BOATS:

- Damage to docks, piers, seawalls and boats as well as moored boats breaking their ties due to enhanced wakes

- Shoreline damage, severe erosion and high turbidity with clear lakes turning murky as sediment re-enters the water column.

- Fish and habitat damage, including significant amounts of weed floating on the water and washing up on shore.

- Lake users also report they are unable to use the lake out of concerns for safety when just one or two boats are out operating in wake-surf mode. For example:

- Kayakers and paddlers not able to use the lake when wake surfing is occurring.

- Boats towing skiers or tubers returning to their docks out of safety concerns.

- Anglers having to move to other areas of the lake as a wake surf boat approaches to ensure they can safely fish.

- Pontoon boats getting swamped or completely re-routing to avoid entire areas of the lake when a wake boat is generating enhanced wakes.

- Young children not being able to play in the shallows given the wave energy from a wake boat's enhanced wakes.

- Skiers knocked down by the very large waves of wake surfing, and being injured.
- Boat occupants being knocked down and injured

HOW A TOWN ORDINANCE WOULD SOLVE THE ABOVE ISSUES FOR TOWN OF LAFOLLETTE

A Town ordinance prohibiting boats from generating artificially enhanced wakes would result in the following benefits for the Town:

- The negative environmental impacts associated with boats generating artificially enhanced wakes, described above, would be prevented.

- The safety risks associated with boats generating artificially enhanced wakes, noted above, would be eliminated. Everyone enjoying the lakes would be that much safer.

- The likelihood of ballast tanks used by these boats transferring aquatic invasive species from one lake to another would be reduced or eliminated.

- Shoreline and shore structure damage eliminated by eliminating the massive waves from wake surfing.
- Other lake users would not be driven of the lake

Upon adopting the proposed ordinance, appropriate signage would be placed at all public landings, in accordance with Wisconsin law. Based on the experiences of other Wisconsin

municipalities that have adopted ordinances regulating the creation of enhanced wakes, such signage and general education regarding the ordinance will help ensure compliance.

POSSIBLE NEGATIVE EFFECTS OF ADOPTING THE ORDINANCE

It is hard to imagine any negative effects beyond that wake surfers will need to go elsewhere to enjoy their sport. We have taken care in the ordinance that it does not forbid use of the boats, so the boats can continue to be used for skiing, tubing and tethered wake boarding, provided that the boat is not operated using the wake enhancing features nor wake enhancing methods of operation. But these negatives on the small number of wake surf advocates are greatly justified by preventing environmental damage to the lakes, safety issues for other lake users and preventing the very large waves of wake surfing driving other lake users of the lake and causing shoreline and other property damage .

SUMMARY OF THE ARGUMENTS OF THE INTERESTS OPPOSED TO REGULATION

Certain individuals may be opposed to any or all forms of regulation and a limited number may feel the ordinance is infringing on their rights to lake usage. However, when one or two people can operate boats that intentionally generate artificially enhanced wakes on small or mid-size lakes, many others can't navigate safely or enjoy their activities and the scenic beauty, water quality and aquatic habitat will be damaged or destroyed.

The boating industry claims they can self-regulate. However, this has not proven to be the case given the mounting damage and concerns raised by other lake users.

Some opponents have claimed that any regulation of enhanced wakes would be a violation of the Public Trust Doctrine. However, this issue has been addressed by the Wisconsin Legislative Council (the nonpartisan state agency charged with responsibility for providing legal advice to the Legislature). The Wisconsin Legislative Council issued a Dec 6, 2023 legal memo addressing this very point, concluding that any challenge under the public trust doctrine would be unlikely to succeed.

Other opponents claim that ballast tanks of wake surf boats are no more likely to transfer invasives than live wells and bait buckets. But live wells and bait buckets can be fully emptied and are easily inspected. Ballast tanks cannot be fully emptied and cannot be inspected, as they are sealed within the hull of the boat.

Other opponents claim that existing state laws are sufficient. But existing state law for instance provides only for a 100' set of for shore and even the wakeboat Industry

acknowledges this is insufficient. Indeed, the Industry's own Goudey study shows that when operated in 20' or more water depths, wake surfing makes a wave a full 13" high even 300' from the track of the surf boat.

https://www.wsia.net/wp-content/uploads/2020/03/WSIA_draft_report_Rev_II.pdf

Likewise, existing state law regarding hazardous wakes are inadequate because they are limited as follows

- Wis. Stats 30.68(4)(a) is limited to situations in which one boat commits an "approach or pass" another boat. This requires the boats be well under 100' apart. But wake surf boats can make waves 20" a full 100' from the track of the wake boat and 13" high a full 300' from the wake boat, as detailed in the Wakeboat Industry's own "Goudey Study", referenced above.

Wis. Stats. 30.68(4)(b) provides an apparent remedy for damage to docks and shoreline, but this requires a civil lawsuit. Not only is this expensive, stressful and takes years to resolve, but often the damage occurs when the property owner is not there to identify what surf boat caused the damage.

IMPACT ON PUBLIC HEALTH, SAFETY OR WELFARE IF THE ORDINANCE IS NOT ADOPTED

If the ordinance is not adopted, increasing numbers of wake surf boats will be used on the Town's lakes. This will result in increasing environmental damage, increasing safety issues from the very large wakes and bow up orientation of wake surf boats while in wake surf mode and increases numbers of other boat owners not able to use the lakes because of worry about the large waves and bow up condition of wake surfers.

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After reviewing science-based studies, lake experiences and public input, we believe the Town of LaFollette will conclude that public safety and protection of its valued resources would be best served by adopting the proposed ordinance.

APPENDIX 1

RELEVANT RESEARCH STUDIES AND SURVEYS

Several studies contributing to the facts in this condition report were completed in recent years. Since that time, boats generating enhanced wakes have gotten more powerful and their wakes bigger (e.g., increasing in height from 2-4 ft. to 4-5 ft, and more) and more powerful. Therefore, the figures cited in this report are likely conservative. More studies are underway and in review.

General literature study of the impacts of wake surfing: "The Effects of Wake Boats on Lake Ecosystem Health: A Literature Review." Wisconsin Green Fire (May 2024)

https: //wigree nfire.org/wake-boats-lakes -update-may-2024/

Ballast tank water retention and invasive species: "Volume and contents of residual water in recreational watercraft ballast systems," Management of Biological Invasions (2016) Volume 7, Issue 3: 281-286, first published online 04/18/2016, https://www.reabic.net/journals/mbi/2016/3/MBI_2016_Campbell_etal.pdf .

Study showing that residual water in ballast tanks transfer live zebra mussel veligers: Doll, A. 2018. "*Occurrence and survival of Zebra Mussel (Dreissena polymorpha) veliger larvae in residual water transported by recreational watercraft*." Master's thesis. University of Minnesota, St. Paul.

https://conservancy.umn.edu/server/api/core/bitstreams/da582b1c-7880-4adb-af31-5303491ed1a6/content

Wave height, power and energy: "*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, College of Science & Engineering, University of Minnesota, SAFL Project Report No. 600, 02/02/2022, https:// conservancy.umn.edu/handle/11299/226190 .

Wave size, power and turbidity: "*A Phased Study Of The Water Quality And Wave Propagation Dynamics Currently Impacting A Small Southeast Wisconsin Freshwater Lake:*

Waukesha," Terra Vigilis Group, as contained in Responsible Wakes for Vermont Lakes (see pp 16-37 of linked presentation where study is embedded), https://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Additional%20supporting%20Information%20submitted%2007292022.pdf .

Burnett county public sentiment support for regulating artificially enhanced wakes to lakes of greater than 1500 acres , 700 feet from shore, and 20 foot depth-Page 21 Response #43: "*2023 Spring Hearing Statewide Results by County*," Wisconsin Conservation Congress and Department of Natural Resources, 04/26/2024, https://dnr.wisconsin.gov/sites/default/files/topic/About/WCC/2024/SpringHearing/2024_StatewideResultsByCounty.pdf .

Wisconsin Green Fire May 2024 survey of available studies regarding the environmental impacts of wake surfing. https://wigreenfire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

Wave size, shoreline impact, depth of lakebed impact and phosphorus increase from lakebed impact: "*Lake Waramaug Wave Impact Study*, *Final Report*" Nov 15 2024, Terra Vigilis Environmental Impact Services Group, prepared for the Lake Waramaug, Conn. Inter-Local Commission https://www.warrenct.gov/sites/g/files/vyhlif3991/f/uploads/lake_waramaug_final_report.pdf

Wave Impact and Prop Wash Impact, Recommending Surf Boats operate in minimum 8Meter (26 feet) depth "*Lake Windermere (B.C.) Recreational Impact and Sediment Quality Assessment*" Ecoscape Environmental Consultants Ltd. August 22, 2024

https://www.lakeambassadors.ca/lwawp/wp-content/uploads/2024/08/Lake-Windermere-Recreational-Carrying-Capacity-Study-Public-Release-Version.pdf

The Industry's own study showing that a surf boat operating in 20' water depths makes a wave 20" high at 100' from the boat, 16" high at 200' from the boat and a wave 13" high a full 300' from the boat - "*Characterization of Wake-Sport Wakes and their Potential impact on Shorelines*" November 2015, commissioned and paid for by the Water Sports Industry Association

https://www.wsia.net/wp-content/uploads/2020/03/WSIA_draft_report_Rev_II.pdf

APPENDIX 2

TOWN OF LAFOLLETTE LAKES

The Town of LaFollette, Burnett County is home to nine (9) lakes larger than 50 acres wholly within the Town.

LAKES WHOLLY IN TOWN OF LAFOLLETTE, BURNETT COUNTY

Lakes Wholly in Town of LaFollette

Cranberry Lake	80 acres	26' max	6' mean	
Warner Lake	176 acres	75' max	19' mean	boat landing
Bass Lake	82 acres	18' max	5' mean	
Pokegama Lake	224 acres	28' max	9' mean	
Spencer Lake	189 acres	19' max	10' mean	
NONAME Lake west border east of clam lake ~			60 acres	

Lakes partially in Town of LaFollette all shared with Town of Sand Lake

Owl Lake	127 acres	27' max	7' mean	
Big Sand Lake	1434 acres	55' max	9' mean	boat landing
Viola Lake	265 acres	34' max	13' mean	boat landing

Lakes that are less than 50 acres are not shown as they are designated "slow/no wake" for the entire waterbody under Wisconsin Law.

APPENDIX 3

EXAMPLES OF IMPACT OF WAKE SURFING ON THE ENVIRONMENT, PROPERTY AND OTHER LAKE USERS

- The effect on the lake from the bottom getting churned up causes large amounts of weeds floating on the surface and below and causing the shoreline to get full of debris and much that has to be removed all the time, possibly creating an algae bloom and ruining the lake completely from release of phosphorus and become permanent.

- The angle that the boat is in makes it impossible for the driver to see everything in front of the boat, which is very dangerous.

- We had a huge wave come over the front of our pontoon and soak the interior and everything on the floor and if we were standing up we would have been knocked over and possibly injured.

- The large waves stay big for a long distance so skiers, tubers and paddle boarders can't enjoy the water activities when and where they want to due to safety concerns.

- Fishing is almost impossible due to the waves. They push your boat toward the shore and sometimes into Lilypad's that if you were knocked overboard you could get tangled up in them and possibly drown.

- The large waves beat the heck out of shorelines causing deterioration.

- Boats tied to docks take a beating and get damaged or if a tiedown line breaks the boat can end up on shore or floating away and damaging someone else's property.

- With the arrival of wake-enhancing boats there has been a noticeable decrease of loons and now geese on the lake that have never been on Warner Lake before.

EXAMPLES OF PROBLEMS REPORTED ON OTHER WISCONSIN LAKES

- On Lake Beulah in southern Wisconsin, surf boats have destroyed many areas of submerged vegetation in over 20' of water, leaving large bare areas on the lake bottom and major decrease in fishing. Areas that were fishing hot spots for decades are now wholly bare of aquatic plants and the fish have disappeared.

- Ski boat on the Waupaca chain smashed by large wave from a wake surf boat. Occupants thrown to floor of boat, causing back injury to one person requiring three weeks in bed. Much of the glass and structure in boat was damaged, causing $10,000 worth of damage

- Fishing boat in town of Scott sunk by a wave from a surf boat. Occupants had to be rescued by nearby fisherman

- Other water sports enthusiasts reporting injury; for example, a lifelong Plum Lake water skier was skiing when a wake boat in ballast mode created a wave that swamped her, wrenching her shoulder as she fell. She was unable to ski for the rest of the season because of the shoulder injury.

- Skier fell when she hit the huge wave from a wake surf boat, breaking several ribs

- Residents in the Town of Chicog (Washburn Co) report major areas of submerged vegetation wholly uprooted. This can only occur when the bottom sediment is blown away by downward prop wash from the surf boat on the lake

- Residents of Lipsett Lake in Town of Rusk report that after a weekend of wake surfing by one boat, the lake suffered a major algae bloom

- Residents on a lake in Presque Isle (Vilas Co) report that while canoeing a wake surf boat nearly ran over them. The surf boat was strongly bow up and could not see the canoe. Only by standing in the canoe and waving a paddle over their heads could the canoeists be seen by the surf boat, which veered away when it spotted the waved paddle

- Adults concerned that they now need to discourage children from playing on the lakeshore due to excessive waves from enhanced wakes.

- Property owners reporting weeds washing up after boats operating in enhance wake mode have been operating in their relatively shallow lake.

- Reports of huge waves from wake boats damaging shorelines.

- Riparian owners voicing concerns about the risk of AIS being introduced into their lakes as the ballast tanks used for enhanced wake sports can't be fully emptied.

- On lakes that are irregular, long and narrow, like Plum Lake for example, conflict with other users and potential shoreline damage from enhanced wakes is already a problem.

- Riparian owners being forced to spend significant sums to riprap their shorelines due to severe recent erosion.