

**Appendix I**

**LOCAL ORDINANCES RELATING TO HOOKER LAKE**

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## Chapter 330. Lakes and Beaches

### § 330-1. Intent.

The intent of this chapter is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public needs and the capacity of the water resource.

### § 330-2. Applicability.

[Amended 4-10-2000 by Ord. No. 00-04-10] The provisions of this chapter shall apply to the lakes within the jurisdiction of the Town and to the rivers within the Town wherever the provisions of this chapter would be applicable to river traffic, except to the waters of Silver Lake, which shall be enforced exclusively by the Village of Silver Lake.

### § 330-3. Incorporation of state statutes.

A.

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*Town of Salem, WI Friday, March 25, 2016*

[HISTORY: Adopted by the Town Board of the Town of Salem 7-18-1991 by Ord. No. 91-07-18 (Ch. 20 of the 1991 Code). Amendments noted where applicable.] **GENERAL REFERENCES** Public Safety Department — See Ch. 119. Fees — See Ch. 272. Parks and recreation — See Ch. 396.

The following sections of the Wisconsin Statutes and any subsequent amendments thereto are hereby adopted and by reference made a part of this section as though fully set forth herein:

[Amended 6-13-2011 by Ord. No. 11-06-13] **Wis. Stats. Section Title** 30.50 Definitions  
30.51 Certificate of number and registration; requirements; exemptions 30.52 Certificate of number and registration; application; certification and registration period; fees; issuance 30.53 Certificate of origin; requirements; contents 30.531 Certificate of title; requirements; exemptions 30.54(2) Lost, stolen or mutilated certificates 30.55 Notice of abandonment or destruction of boat or change of address 30.60 Classification of motorboats 30.61 Lighting equipment 30.62 Other equipment 30.635 Motorboat prohibition 30.64 Patrol boats

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**Wis. Stats. Section** 30.65 30.66 30.67 30.675 30.68 30.681 30.682 30.683 30.684 30.686 30.687 30.69 30.70 30.71 Any act required to be performed or prohibited by the provisions of any of the above-referenced statutory sections incorporated herein is required or prohibited by this section.

## § 330-4. Definitions.

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### Title

Traffic rules Speed restrictions Accidents and accident reports Distress signal flag Prohibited operation Intoxicated boating Preliminary breath screening test Implied consent Chemical tests Report arrest to department Officers action after arrest for violating intoxicated boating law Water skiing Skin diving Disposal of waste from boats equipped with toilets

As used in this chapter, the following terms shall have the meanings indicated: **MOORAGE** An area where continuous mooring of boats for more than 24 hours is permitted. **PUBLIC ACCESS** A marina or landing facility and the adjoining public shoreline under the ownership of the state, county or other municipality. **SHORE ZONE** The water area within 200 feet of any lakeshore within the Town of Salem, except: [Amended 6-13-2011 by Ord. No. 11-06-13C] A. On Silver Lake, where the shore zone shall mean the water area from the shore to five-foot depth as shown on the hydrographic map bearing legend DNR 1968. B. On Lake Shangri-La, where the shore zone shall mean the water area within 100 feet of any lakeshore. **SLOW NO-WAKE BENCHMARK** The elevation of the surface of inland waters within the Town of Salem at which operation of motorboats on such waters at a speed in excess of slow no-wake speed tends to create or cause property damage or abnormal shore erosion due to excessive wake or wash. The slow no-wake benchmark shall be the surface elevation of such inland waters as indicated by markers established for that purpose, the locations of which are depicted on the attached Marker Maps A and B. [1] The slow no-wake benchmarks for inland waters within the Town shall be as follows: [Added 4-17-2008 by Ord. No. 08-04-17; amended 6-13-2011 by Ord. No. 11-06-13C] **Body of Water**

Marker Location	Marker Level
Cross Lake	N42° 29' 53.0", W88° 05' 39.3"

4.00

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Voltz Lake

**Body of Water**

Camp Lake

Center Lake

Lake Shangri-La

Hooker Lake

**Marker Location** Cross Lake Gauging Station No. 1 is located on the west side of Cross Lake approximately 160 feet north of the intersection of S.T.H. "83" and 127th Place. The datum elevation for Cross Lake Gauging Station No. 1 is 810.00. Cross Lake Gauging Station No. 1 is scaled from 3.33 to 6.67 feet. N42° 30" 32.8', W88° 08" 51.9' Camp Lake Gauging Station No. 1 is located on the south side of Camp Lake north of C.T.H. "C" approximately 800 feet southwest of 277th Avenue. The gauging station is located approximately 40 feet north of the center line of C.T.H. "C" and approximately 30 feet west of the dam. The datum elevation for Camp Lake Gauging Station No. 1 is 730.00. Camp Lake Gauging Station No. 1 is scaled from 10.00 to 16.67 feet. N42° 31" 56.7', W88° 08" 18.7' Center Lake Gauging Station No. 1 is located on the south side of Center Lake adjacent to Camp Lake Road (C.T.H. "SA") in the waterway that connects Center Lake and Camp Lake. The gauging station is located north of C.T.H. "SA" approximately 400 feet northwest of 271st Avenue. The gauging station is located approximately 60 feet north of the center line of C.T.H. "SA" and approximately 10 feet northwest of a small dam in the waterway. The datum elevation for Center Lake Gauging Station No. 1 is 730.00. Center Lake Gauging Station No. 1 is scaled from 10.00 to 16.67 feet. N42° 30" 31.7', W88° 04" 16.6' Lake Shangrila Gauging Station No. 1 is located on the north side of Lake Shangrila adjacent of 118th Street. The gauging station is located southeast of 118th Street approximately 800 feet southwest of 117th Street. The gauging station is located approximately 30 feet southeast of the center line of 118th Street and approximately 10 feet northeast of the culvert under 118th Street. The datum elevation for Lake Shangrila Gauging Station No. 1 is 790.00. Lake Shangrila Gauging Station No. 1 is scaled from 3.33 to 6.67 feet. N42° 33" 21.9', W88° 06" 26.9' Hooker Lake Gauging Station No. 1 is located on the southwest side of Hooker Lake approximately 300 feet east of the intersection of 83rd Street and 249th Avenue. The gauging station is located approximately 30 feet east of the east end of 83rd Street. The datum elevation for Hooker Lake Gauging Station No. 1 is 745.00. Hooker Lake Gauging Station No. 1 is scaled from 8.50 to 13.33 feet. N42° 30" 32.9', W88° 05" 17.1'

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**Marker Level**

11.50

12.00

5.85

9.80

8.25

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### Body of Water

## § 330-5. Speed restrictions.

**Marker Location** Voltz Lake Gauging Station No. 1 is located on the northwest side of Voltz Lake adjacent to 231st Court. The gauging station is located east of 231st Court approximately 250 feet south of 117th Street. The gauging station is located approximately 25 feet east of the center line of 231st Court and approximately 30 feet south of Trevor Creek. The datum elevation for Voltz Lake Gauging Station No. 1 is 805.00. Voltz Lake Gauging Station No. 1 is scaled from 6.67 to 10.00 feet.

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### Marker Level

**SLOW NO-WAKE SPEED** That speed at which a boat moves as slowly as possible while still maintaining steering control. **SWIMMING ZONE** An authorized area marked by official buoys to designate a swimming area. [1]*Editor's Note: The maps are on file at the office of the Town Clerk.*

In addition to the speed restrictions set forth in § 330-3 of this chapter, adopting § 30.66, Wis. Stats., no person shall operate a boat in excess of the slow no-wake speed: [Amended 6-14-1993 by Ord. No. 93-06-14D; 6-19-1995 by Ord. No. 95-06-19; 3-9-1998 by Ord. No. 98-03-09B; 4-11-2005 by Ord. No. 05-04-11A] (1) On any lake within a defined shore zone. (2) Except as otherwise provided in this section, on any lake between the hours of 7:00 p.m. and 10:00 a.m. on either the shore zone or the traffic lane. [Amended 12-14-2009 by Ord. No. 09-12-14] (3) On that part of the Fox River bounded on the north by the Highway C bridge and on the south by the Wisconsin-Illinois border. (4) On that part of the Fox River bounded on the south by the south face of the bridge on CTH F and on the north by a slow no-wake regulatory buoy placed at 42.32768 north latitude, 88.10749 west longitude. Additional slow no-wake buoys shall be placed to implement the speed restriction as follows: 1 buoy at 42.32517 north latitude and 88.10305 west longitude 1 buoy at 42.32495 north latitude and 88.10413 west longitude 1 buoy at 42.32553 north latitude and 88.10492 west longitude 1 buoy at 42.32675 north latitude and 88.10492 west longitude 1 buoy at 42.32675 north latitude and 88.10509 west longitude 1 buoy at 42.32674 north latitude and 88.10730 west longitude 1 buoy at 42.32701 north latitude and 88.10761 west longitude (5) On Lake Shangri-La in the area of the lake known as "the narrows." Slow no-wake buoys shall be placed to implement the speed restrictions as follows: 1 buoy 140 feet from the shore of the property identified as 12026 214th Avenue. 1 buoy 140 feet from the shore of the property identified as 21401 121st Street (6)

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On Camp Lake within the shore zone. Slow no-wake buoys shall be placed in the following locations to implement the restrictions: [Added 9-10-2007 by Ord. No. 07-09-10B; amended 4-5-2010 by Ord. No. 10-04-05] 1 buoy at 42.31749 north latitude and 88.08702 west longitude 1 buoy at 42.31914 north latitude and 88.08609 west longitude 1 buoy at 42.31990 north latitude and 88.08583 west longitude 1 buoy at 42.31958 north latitude and 88.08466 west longitude 1 buoy at 42.31811 north latitude and 88.08421 west longitude 1 buoy at 42.31697 north latitude and 88.08499 west longitude 1 buoy at 42.31544 north latitude and 88.08435 west longitude 1 buoy at 42.31691 north latitude and 88.08547 west longitude 1 buoy at 42.31467 north latitude and 88.08397 west longitude 1 buoy at 42.31472 north latitude and 88.08385 west longitude 1 buoy at 42.31545 north latitude and 88.08475 west longitude 1 buoy at 42.31401 north latitude and 88.08308 west longitude 1 buoy at 42.31296 north latitude and 88.08231 west longitude 1 buoy at 42.31196 north latitude and 88.08193 west longitude 1 buoy at 42.31132 north latitude and 88.08206 west longitude 1 buoy at 42.31005 north latitude and 88.08353 west longitude 1 buoy at 42.30942 north latitude and 88.08468 west longitude 1 buoy at 42.30870 north latitude and 88.08575 west longitude 1 buoy at 42.30833 north latitude and 88.08691 west longitude 1 buoy at 42.31211 north latitude and 88.08966 west longitude 1 buoy at 42.31501 north latitude and 88.08692 west longitude 1 buoy at 42.31601 north latitude and 88.08723 west longitude 1 buoy at 42.31699 north latitude and 88.08749 west longitude On Hooker Lake between the hours of sunset and 10:00 a.m. either in the shore zone or the traffic lane. [Added 12-14-2009 by Ord. No. 09-12-14; amended 10-14-2013 by Ord. No. 13-10-14] On Lake Shangri-La/Benet between the hours of sunset and 10:00 a.m. either in the shore zone or the traffic lane during the months of July and August. [Added 6-13-2011 by Ord. No. 11-06-13C] (9) On Camp Lake between the hours of sunset and 10:00 a.m. either in the shore zone or the traffic lane. [Added 6-13-2011 by Ord. No. 11-06-13C; amended 3-12-2012 by Ord. No. 12-03-12A] (10) On Center Lake within the restricted areas marked by buoys placed at the following locations: [Added 5-14-2012 by Ord. No. 12-05-14A; amended 11-12-2013 by Ord. No. 13-11-12]

**LocationBuoy TypeLatitudeLongitude** Center Lake Woods Swim area42° 32' 16.04" N88° 8' 1.12" W Beach Center Lake Woods Swim area42° 32' 16.64" N88° 8' 0.82" W Beach Center Lake Woods Swim area42° 32' 16.80" N88° 7' 59.14" W Beach Center Lake Woods Swim area42° 32' 16.32" N88° 7' 58.62" W Beach Swim area42° 32' 15.78" N88° 7' 58.25" W

(7)

(8)

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**Location** Center Lake Woods Beach Boat launch channel Center Lake Beach Center Lake Beach Camp Wonderland Camp Wonderland Center Lake Beach Pursuant to § 30.635, Wis. Stats., no person shall operate a motorboat on Rock Lake in excess of the slow no-wake speed. No person shall operate a motorboat on any inland waters subject to the jurisdiction of the Town of Salem at a speed in excess of slow no-wake speed when the surface water level of such inland bodies of water exceeds the slow no-wake benchmark as indicated by markers placed and maintained by the Town for that purpose. [Added 4-17-2008 by Ord. No. 08-04-17]

No wake Swim area Swim area No wake No wake Swim area

**Buoy Type**

**§ 330-6. Capacity restrictions.**

**§ 330-7. Buoys, piers and rafts.**

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**Latitude**

42° 32' 14.63" N 42° 32' 19.24" N 42° 32' 19.67" N 42° 32' 24.77" N 42° 32' 26.99" N 42° 32' 28.13" N

**Longitude**

88° 8' 20.60" W 88° 8' 15.21" W 88° 8' 15.01" W 88° 8' 6.58" W 88° 8' 3.86" W 88° 8' 1.81" W

No person shall operate or loan, rent or permit a boat to leave the place where it is customarily kept for operation on the waters covered by this chapter with more passengers or cargo than shall be stated on the capacity information plate as required by § 30.501, Wis. Stats.

Removal. The Town may remove or cause to be removed all buoys, markers, piers and their supports, privately owned or placed, which are not removed by December 1 of each year and charge the cost and expense of such removal to the riparian owner. If such charge is not paid within 30 days after request therefor, a penalty of 10% shall be added to such charge, and the same shall constitute a lien on the property of the riparian owner and be inserted on the Town tax roll by the Town Clerk upon order of the Town Board and after notice to the riparian owner. [Amended 4-10-2000 by Ord. No. 00-04-10] Compliance. All buoys and aids to navigation must comply with § 30.74(2), Wis. Stats., and administrative regulations and shall have affixed thereto such numbers as assigned to them by the permit. Such numbers shall be located at least 12 inches above the waterline and shall be not less than three inches in height. Wharves and piers. [Amended 4-10-2000 by Ord. No. 00-04-10; 11-13-2001 by Ord. No. 01-11-13C] (1) No person shall erect or maintain any wharf or pier contrary to the statutes and regulations of the state or extending more than 100 feet from the shore, unless prior written approval is obtained from the Town, on all lakes and waters within the Town's jurisdiction. (2) No person may erect, place or maintain a wharf or pier on waters within the Town's jurisdiction which is so old, dilapidated or out of repair as to be dangerous, unsafe or otherwise unfit for normal use. (3)

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If a water patrol officer or public safety officer shall determine that a violation of this section exists within the Town, the officer shall serve notice on the owner or occupant of the premises where such violation exists, either by personal delivery thereof to such person or by posting a copy of said notice in a conspicuous location on the premises. Such notice shall direct the owner or occupant of the premises to abate or remove such violation within 10 days. The notice shall also state that, unless such violation is so abated, the Town will cause the same to be abated and will charge the cost thereof to the owner or occupant of the premises where such violation exists. Pier or mooring buoy. No pier or mooring buoy shall be placed in the waters located within the boundary of a designated fire lane (extended into the water) unless so authorized, in writing, by the Town Board as to all waters under the jurisdiction of the Town Board, including those waters of Silver Lake into which designated Town fire lanes are extended. [Amended 4-10-2000 by Ord. No. 00-04-10] Rafts and platforms. (1) No person shall place or maintain any raft or platform more than 100 feet from shore. (2) Each raft or platform must: (a) Be firmly anchored with at least 18 inches of freeboard above the waterline; (b) Be painted white; and (c) Have attached thereto, not more than 12 inches from each corner or projection, a red reflector of not less than three inches in diameter. [Amended 3-11-1996 by Ord. No. 96-03-11] Buoy permits. (1) No bathing beach marker, speed zone marker, information marker, mooring buoy, fishing buoy or other marker shall be anchored or placed on any of the waters under the jurisdiction of the Town unless a written application therefor is made to and approved by the Town Board. The Town shall issue numbers for buoys as required in Subsection B above. [Amended 4-10-2000 by Ord. No. 00-04-10] (2) Permit fee established. Any person making application for the placement of a mooring buoy or other approved marker in the waters of any lake within the Town of Salem in accordance with the above section shall pay to the Clerk a permit fee as provided in Chapter 272, Fees, § 272-6. Such permit shall remain in effect so long as the applicant owns or rents the property for which such permit is granted. The permits granted hereunder shall automatically expire when an applicant sells or no longer occupies the premises for which the permit has been granted. Placement of authorized markers. The Chief of the Water Safety Patrol is authorized and directed to place authorized markers, navigation aids and signs in such water areas as shall be appropriate to advise the public of the provisions of this chapter and to post and maintain a copy of this chapter at all public access points within the jurisdiction of the Town.

## § 330-8. Swimming regulations.

Swimming from boats prohibited. No person shall swim from any unmanned boat unless such boat is anchored.

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Distance from shore or boats. No person shall swim beyond the shore zone or more than 50 feet from any pier unless within marked or authorized areas or more than 25 feet from anchored rafts or boats unless accompanied by a boat manned by a competent person and having readily available a ring buoy. Such boat shall stay reasonably close to and guard such swimmer; not less than one boat for each two swimmers. Hours limited. No person shall swim more than 200 feet from the shoreline between the hours of 7:00 p.m. and 10:00 a.m.

## § 330-9. Waterskiing regulations.

[Amended 12-14-2009 by Ord. No. 09-12-14; 6-11-2012 by Ord. No. 12-06-11] A. Hours. No person shall operate a boat for the purposes of towing a water skier, aquaplane or similar device or engage in waterskiing during those hours within which operation in excess of slow no wake is prohibited by § 330-5A. B. Traffic lane. Any boat engaged in towing a person on water skis, aquaplane or similar device must conform to all sections of this chapter and, in addition, must operate in a counterclockwise pattern on the lake in the traffic lane. There shall be no waterskiing, aquaplaning or similar activity within the shore zone. C. Water ski towing. (1) There shall not be more than two persons on water skis being towed by one boat at any one time, and each shall have an individual tow line. (2) Persons being towed must wear personal flotation devices as defined in § 30.62(3), Wis. Stats. (3) Persons being towed behind a vessel on water skis or similar device or engaged in a similar activity may not come or allow the tow rope to come within 100 feet of a personal watercraft. D. Towing of water tubes. (1) There shall not be more than two towing lines per boat. (2) The human capacity of each water tube shall not exceed that recommended by the manufacturer. (3) No vessel towing a person or persons on a water tube may come within 100 feet of other occupied anchored vessels, a personal watercraft, a buoy-marked swimming area or a public boat landing. E. Exceptions. The limitations of this section shall not apply to participants in ski meets or exhibitions authorized and conducted as provided in § 330-11 of this chapter.

## § 330-10. Houseboats; littering prohibited.

Any boat or craft which is designed for persons to use for living, sleeping or camping activities, commonly referred to as a "houseboat," shall be equipped with suitable sanitation facilities and comply with § 330-3 of this chapter, adopting § 30.71, Wis. Stats. No person shall leave, deposit, place or throw on the waterways, ice, shores of waterways or upon any other public or private property adjacent to waterways any cans, bottles, debris, refuse or other solid waste material of any kind or any liquid waste, gasoline, oil or similar pollutant.

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[Amended 11-13-2001 by Ord. No. 01-11-13D]

### § 330-11. Races, regattas, sporting events and exhibitions.

Permit required. No person shall direct or participate in any boat race, regatta, water-ski meet or other water sporting event or exhibition on Silver Lake unless such event has been authorized jointly by the Village Board of Silver Lake and the Town Board. On all other waters under the jurisdiction of the Town, such permit shall be authorized by the Town Board. Permit. A permit issued under this section shall specify the course or area of water to be used by participants in such event, and the permittee shall be required to place markers, flags or buoys approved by the Chief of the Water Safety Patrol designating the specified area. Permits shall be issued only when the proposed use of the water can be carried out safely and without danger to or substantial obstruction of other watercraft or persons using the lake. Right-of-way of participants. Boats and participants in any such permitted event shall have the right-of-way on the marked area, and no other persons shall obstruct such area during the race or event or interfere therewith. Permit fee required. Upon making application for a special event permit, the applicant shall pay a permit fee as provided in Chapter 272, Fees, § 272-6, to the Town Clerk.

### § 330-12. Driving of motor-driven vehicles on ice.

Speed. No person shall use or operate any automobile at a speed in excess of 10 mph on the ice of any lake or waterway within the Town of Salem. Hours. No person shall use or operate any automobile on the ice of any lake or other waterway within the Town of Salem after 9:00 p.m. Definition. The word "automobile," as used in this chapter, shall be construed to mean all motor vehicles of the type and kind permitted to be operated on the highways in the state. Risk and liability. All traffic on the icebound waters within the Town of Salem shall be at the risk of the traveler as set forth in § 30.81(3), Wis. Stats. Nothing in this chapter shall be construed as rendering the Town liable for any accident to those engaged in permitted traffic while this chapter is in effect.

### § 330-13. Joint jurisdiction over Silver Lake.

Recognizing the joint jurisdiction of the Village of Silver Lake and the Town over the waters of Silver Lake, it is the intent of this chapter that the Village of Silver Lake and the Town shall cooperate and coordinate ordinances, rules and regulations and shall have joint jurisdiction for enforcement purposes, except that violations occurring in the Town shall be brought before the Municipal Court of the Town, and those violations under the jurisdiction of the Village of Silver Lake shall be brought before the Municipal Court of the Village of Silver Lake.

### § 330-14. Water patrol officers; public safety officers.

[Added 4-13-1992 by Ord. No. 92-04-13B; amended 4-12-1993 by Ord. No. 93-04-12]

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Qualifications. The Town Board of the Town of Salem may appoint one or more water patrol officers who shall be adults of good moral character with no prior criminal record. A water patrol officer shall be a certified law enforcement officer. Authority. Water patrol officers of the Town of Salem shall have the authority to make arrests in the course of duty enforcing the provisions of this chapter, including those provisions of the Wisconsin Statutes incorporated by reference. Water patrol officers shall have the authority to carry firearms in the course of duty, subject to the restrictions and policies established by the Town Board from time to time. [Amended 2-13-1995 by Ord. No. 95-02-13B] Public safety officers. Town of Salem public safety officers may perform the additional duties of water patrol officers and shall have the power of arrest and may issue citations for violations of this chapter, including those provisions of the Wisconsin Statutes incorporated by reference. Town of Salem public safety officers shall have the authority to carry firearms in the course of duty, subject to the restrictions and policies established by the Town Board from time to time. [Amended 11-13-2001 by Ord. No. 01-11-13D]

### § 330-15. Boats in marked swim areas prohibited; exceptions.

[Added 11-13-2001 by Ord. No. 01-11-13B] No boat of any type is permitted within a water area which has been clearly marked by buoys or some other distinguishing device as a bathing or swimming area. This section does not apply in the case of emergency or to patrol or rescue craft.

### § 330-16. Fertilizer applications.

[Added 6-12-2006 by Ord. No. 06-06-12B] A. Definitions. As used in this section, the following terms shall have the meanings indicated: **FERTILIZER** Has the meaning specified under § 94.64(1)(e), Wis. Stats. **IMPERVIOUS SURFACE** A highway, street, sidewalk, parking lot, driveway, or other material that prevents infiltration of water into the soil. **LAWN AND TURF FERTILIZER** Has the meaning specified under § 94.64(1)(e), Wis. Stats., except the manufacturer has designated the product to be used for the promotion of lawn and turf growth. B. It shall be unlawful for any person to apply within the Town any lawn and turf fertilizer, liquid or granular, that contains more than a trace of phosphorus or other compound containing phosphorus, such as phosphate. C. It shall be unlawful for any person to apply or deposit any fertilizer on an impervious surface. If such application occurs, the fertilizer must be immediately contained and either legally applied to turf or any other lawful site or returned to the original or other appropriate container. D. Time of application. It shall be unlawful for a person to apply lawn and turf fertilizer when the ground is frozen or when conditions exist which promote or create runoff.

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Exceptions. (1) Subsection B shall not apply when: (a) A tissue, soil or other test by UW-Extension Laboratory, or another state-certified soil-testing laboratory, and performed within the last three years indicates that the level of available phosphorus in the soil is insufficient to support healthy turf growth, as determined by the University of Wisconsin Extension Service, provided that the proposed lawn and turf fertilizer application shall not contain an amount of phosphorus exceeding the amount and rate of application recommended in the soil test evaluation. (b) The property owner or an agent of the property owner is first establishing or reestablishing turf via seed or sod procedures, and only during the first growing season. (2) Subsection B shall not apply to fertilizers used in any agricultural use as defined in § 91.01(2), Wis. Stats., to promote crop or product growth. (3) Any person who applies a lawn and turf fertilizer containing phosphorus pursuant to the aforementioned exception shall, consistent with the product label instructions, water such lawn and turf fertilizer into the soil where it is immobilized and generally protected from loss by runoff.

### § 330-17. Operation of aircraft on water prohibited; exceptions.

[Added 9-10-2007 by Ord. No. 07-09-10A] No person, firm or corporation shall operate or authorize the operation of any aircraft capable of landing on water on any river or lake within the jurisdiction of the Town of Salem, with the exception of Camp Lake. For purposes of this section, the term "operation" shall include but not be limited to landing or takeoff and any contact of any portion of such aircraft with the surface of any affected body of water. This section shall not apply to any operation on such bodies of water by duly authorized government or law enforcement officials or any operation necessitated by an emergency situation outside of the control of the operator of such aircraft.

### § 330-18. Violations and penalties.

Unless otherwise provided herein, any person violating any provisions of this chapter shall, upon conviction, be subject to the penalty provided in § 1-4 of this Code. [Amended 6-13-2011 by Ord. No. 11-06-13] Any person violating the provisions of § 330-3 of this chapter, incorporating § 30.681 or 30.684, Wis. Stats., shall, upon conviction, be subject to a forfeiture of not less than \$150 nor more than \$300. Any person violating any provision of the Wisconsin Statutes incorporated herein, which violation is punishable by the imposition of a fine or imprisonment, or both, shall be referred to state authorities for prosecution. Citations for violations of this chapter shall be issued on forms prepared by the Department of Natural Resources, and the Uniform Wisconsin Schedule, adopted pursuant to § 23.66, Wis. Stats., shall be effective for the posting of bonds for violations under this chapter.

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The provisions relating to citations, arrests, questioning, releases, searches, deposits and stipulations of no contest in §§ 23.51(1m), (3) and (8); 23.53; 23.54; 23.56 to 23.64; 23.66; and 23.67, Wis. Stats., shall apply to violations of this chapter. [Added 1-12-2004 by Ord. No. 04-01-12C]

### § 330-19. Operation of motorboats on Rock Lake.

[Added 8-13-2012 by Ord. No. 12-08-13; amended 12-10-2012 by Ord. No. 12-12-10A] The propulsion of boats on Rock Lake shall be limited to the use of oars, paddles, sails or electric motors. This section shall not apply to: A. Any operation by duly authorized government or law enforcement officials in the course of the performance of their duties. B. Any operation necessitated by an emergency situation outside of the control of the operator of the motor boat. C. Any operation necessary for the mechanical or chemical management of weeds or other aquatic growth or shoreline restoration on Rock Lake by the holder of a permit issued by the Wisconsin Department of Natural Resources. D. Any operation necessary to complete a salvage operation on Rock Lake.

### § 330-20. Boat launch fees.

[Added 10-14-2013 by Ord. No. 13-10-14A] A. Any person, firm or corporation launching a boat at any public boat launch on Camp Lake or Center Lake shall pay a fee, as established below: (1) Daily fee: Town of Salem resident (single boat/single day launches): \$3. (2) Daily fee: nonresident (single boat/single day launches): \$4.50. (3) Daily launch fee for senior citizens over the age of 65 years: \$0. (4) Annual launch fee: Town of Salem resident (unlimited launches in calendar year): \$20. (5) Annual launch fee: nonresident (unlimited launches in calendar year): \$30. B. The Town shall install and maintain a secured collection box at the public launches to accept the daily fees, shall post notice of the fee requirement in a prominent place at the public launches, and shall provide envelopes for payment with a receipt. In addition, the Town shall make annual fee launch stickers available for purchase at the Town Hall during the Town's normal business hours. C. All persons launching a boat at a public boat launch on Camp Lake or Center Lake shall display, at the request of any water patrol or public safety officer, a receipt for payment of the daily fee. D. Any person launching a boat at the public launch on Camp Lake or Center Lake in violation of the provisions of this section shall be subject to forfeiture as provided in § 330-18 of this Code.

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## Chapter 16

### REGULATION OF HOOKER LAKE

- 16.01 Intent
- 16.02 Applicability and Enforcement
- 16.03 State Boating and Water Safety Laws Adopted
- 16.04 Definitions
- 16.05 Speed Restrictions
- 16.06 Capacity Restrictions
- 16.07 Buoys, Piers and Rafts
- 16.08 Swimming Regulations
- 16.09 Water Skiing
- 16.10 Littering Waterways Prohibited
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- 16.12 Driving Automobiles or Other Vehicles on the Ice
- 16.13 Penalties
- 16.14 Jurisdiction
- 16.15 Use of Hooker Lake Boat Launch

16.01 INTENT.

The intent of this Chapter is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public needs on the waters of Hooker Lake.

16.02 APPLICABILITY AND ENFORCEMENT.

The provisions of this Chapter shall apply to Hooker Lake and shall be compatible with Chapter 29 of the Ordinances of the Town of Salem, passed the 13th day of July, 1978, as said Town Ordinances relates to the waters of Hooker Lake. This Chapter shall be enforced jointly by the Water Patrol officers of the Town of Salem and the Village of Paddock Lake.

16.03 STATE BOATING AND WATER SAFETY LAWS ADOPTED.

The statutory provisions describing and defining regulations with respect to water traffic, boats, boating and related water activities in the following enumerated sections of the Wisconsin Statutes, exclusive of any provisions therein relating to the penalties to be imposed or the punishment for violation of said Statutes, are hereby adopted by reference and made a part of this Chapter:

- 30.50 Definitions.
- 30.51 Operation of unnumbered boats prohibited; exemptions.
- 30.52 Certificates of number; applications; issuance; renewals; fees.
- 30.53 Identification number to be displayed on boats; certificate to be carried.
- 30.54 Transfer of ownership of numbered boat.
- 30.55 Notice of abandonment or destruction of boat or change of address.
- 30.60 Classification of motorboats.
- 30.61 Lighting equipment.
- 30.62 Other equipment.
- 30.635 Motorboat prohibition.
- 30.64 Patrol boats exempt from certain traffic regulations.



- 30.65 Traffic rules.
- 30.66 Speed restrictions.
- 30.67 Accidents and accident reports.
- 30.675 Distress signal flag.
- 30.68 Prohibited operation.
- 30.69 Water skiing.
- 30.70 Skin diving.
- 30.71 Boats equipped with toilets.

#### 16.04 DEFINITIONS.

(a) "Shore Zone" shall mean the water area within 200 feet of the lake shore.

(b) "Swimming Zone" shall mean an authorized area marked by official buoys to designate a swimming area.

(c) "Moorage" shall mean an area where continuous mooring of boats for more than twenty-four (24) hours is permitted.

(d) "Public Access" shall mean a marina or landing facility and the adjoining public shoreline under the ownership of the state, county or municipality.

(e) "Slow No Wake Speed" shall mean the slowest possible speed needed to maintain steerage.

(f) "Traffic Lane" shall mean the area beyond two hundred feet (200') of the shoreline.

#### 16.05 SPEED RESTRICTIONS.

In addition to speed restrictions set forth in Sec. 16.03 of this Chapter adopting Sec. 30.66, Wis. Stats., no person shall operate in excess of the "slow no wake speed":

(a) Within a defined shoreline zone, or

(b) Between sunset and 10:00 a.m. in either the shore zone or the traffic lane.

(c) In the event that the Village Board declares a state of emergency because of high water or other reason, such speed limit to remain in effect until such time as the emergency

situation no longer exists as determined by the Board of Trustees.

#### 16.06 CAPACITY RESTRICTIONS.

No person shall operate, loan, rent or permit a boat to leave the place where it is customarily kept for operation on the waters covered by this Chapter with more passengers or cargo than shall be stated on the Capacity Information Plate as required by Sec. 30.501, Wis. Stats.

#### 16.07 BUOYS, PIERS, AND RAFTS.

(a) The Village of Paddock Lake or the Town of Salem may remove all buoys, markers, piers and their supports, privately owned or placed, which are not removed by December 1st of each year, and charge the cost and expense of such removal to the riparian owner. If such charge is not paid within thirty (30) days after request therefore, a penalty of ten percent (10%) shall be added to such charge and the same shall constitute a lien on the property of the riparian owner and be inserted on the Village of Paddock Lake tax roll by the Village Clerk/Treasurer upon order of the Village Board and after notice to the riparian owner.

(b) All navigation aids must comply to Sec. 30.74(2), Wis. Stats., and shall also have affixed to them any numbers issued by their permit pursuant to subsection (f) below. Such number shall be located at least twelve inches (12") above the water line, and shall not be less than three inches (3") in height.

(c) No person shall erect nor maintain any wharf or pier contrary to the Statutes and regulations of the State of Wisconsin, nor which extends more than one hundred (100') from the shore unless prior written approval is obtained from the Village of Paddock Lake and the Town of Salem.

(d) No pier or mooring buoy shall be placed in the waters located within the boundary of a designated fire lane (extended into the water) unless so authorized in writing by the Village Board of the Village of Paddock Lake and by the Town Board of the Town of Salem.

(e) Rafts and Platforms. No person shall place or maintain any raft or platform more than one hundred feet (100') from the shore. Rafts and platforms shall be anchored, have at least eighteen inches (18") of free board above the water line, be painted white, and have attached thereto, not more than twelve inches (12") from each corner or projection a red reflector at least three inches (3") in diameter.

(f) Buoy Permits. No bathing beach marker, speed zone marker, information marker, mooring buoy, fishing buoy or other marker shall be anchored or placed on Hooker Lake, unless a written application is approved by both the Village Board of the Village of Paddock Lake and the Town Board of the Town of Salem. As to such markers and buoys located on Hooker Lake, an application must be made jointly to the Village of Paddock Lake and to the Town of Salem and approved by both bodies. The Town of Salem shall issue numbers for such markers and buoys.

(g) Placement of Authorized Markers. The Chief of Water Safety Patrol is authorized and directed to place authorized markers, navigation aids and signs in such water areas as shall be appropriate to advise the public of the provisions of this Chapter and to post and maintain a copy of this Chapter at all public access points within the jurisdiction of the Village of Paddock Lake.

#### 16.08 SWIMMING REGULATIONS.

(a) Swimming from Boats Prohibited. No person shall swim from any unmanned boat unless such boat is anchored.

(b) Distance from Shore or Boats. No person shall swim beyond the shore zone or more than fifty feet (50') from any pier (unless within marked authorized areas) or more than twenty-five feet (25') from anchored rafts or boats unless he is accompanied by a boat manned by a competent person and having readily available a ring buoy. Such boat shall stay reasonably close to and guard such swimmer, and there must be at least one (1) boat for each two (2) swimmers.

(c) Hours Limited. No person shall swim more than two hundred feet (200') from the shoreline between the hours of 7:00 p.m. and 10:00 a.m.

#### 16.09 WATER SKIING.

(a) Hours. No person shall operate a boat for the purpose of towing a water skier, aquaplane or similar device between the hours of 7:00 p.m. and 10:00 a.m. tats.

(b) Traffic Lane. Any boat engaged in towing a person on water skis, aquaplane or similar device must conform to all sections of this Chapter and in addition, must operate in a counter-clockwise pattern on the lake in the traffic lane. There shall be no water skiing, aquaplaning or similar activity within the shore zone.

(c) Towing. There shall be not more than two (2) persons being towed by one (1) boat and each shall have an individual tow line. Persons being towed must wear personal

flotation devices as defined in Sec. 30.62(3), Wis. Stats.

(d) Exceptions. The limitations of this section shall not apply to participants in ski meets or exhibitions authorized and conducted as provided in Section 16.11 of this Code.

#### 16.10 LITTERING WATERWAYS PROHIBITED.

(a) Any boat or craft which is designed for living, sleeping or camping activities (commonly referred to as a "House Boat") shall be equipped with suitable sanitation facilities and comply with Sec. 30.71, Wis. Stats.

(b) No person shall leave, deposit, place or throw on the waterways, ice, shores or waterways or upon any other public or private property adjacent to waterways, any cans, bottles, debris, refuse or other solid waste materials of any kind.

#### 16.11 RACES, REGATTAS, SPORTING EVENTS AND EXHIBITIONS.

(a) Permit Required. No person shall direct or participate in any boat race, regatta, waterski meet or other water sporting event or exhibitions on Hooker Lake unless such event has been authorized by the Village Board of the Village of Paddock Lake and the Town Board of the Town of Salem.

(b) Permit. A permit issued under this section shall specify the course or area of water to be used by participants and require the permittee to place markers, flags or buoys approved by the Chief of the Water Safety Patrol designating the specified area. Permits shall be issued only when the proposed use of the water can be carried out safely and without danger to or substantial obstruction of other watercraft or persons using the lake.

(c) Right-of-way of Participants. Boats and participants in any such permitted event shall have the right-of-way on the marked area and no other persons shall obstruct such area during the race or event or interfere therewith.

#### 16.12 DRIVING AUTOMOBILES OR OTHER VEHICLES ON THE ICE.

(a) Speed. No person shall use or operate any automobile at a speed in excess of ten (10) miles per hour on the ice.

(b) Hours. No person shall use or operate any automobile on the ice after 9:00 p.m.

(c) Definitions.

(1) "Automobile" as used in this Chapter shall be construed to mean all motor vehicles of the type and kind permitted to be operated on the highways in the State of Wisconsin.

(2) "Other Vehicles" includes, but is not limited to, snowmobiles, go-carts, bicycles and motorcycles not permitted on state highways.

(d) Risk and Liability. All traffic on the icebound waters shall be at the risk of the travelers as set forth in Section 30.18(3) of the Wisconsin Statutes. Nothing in this Chapter shall be construed as rendering the Village of Paddock Lake or the Town of Salem liable for any accident to those engaged in permitted traffic.

#### 16.13 PENALTIES.

Any person violating any provision of this Chapter shall, upon conviction, be subject to a forfeiture of not more than Fifty Dollars (\$50.00) for the first offense, and not more than One Hundred Dollars (\$100.00), for each subsequent offense with one (1) year. Any person violating Section 30.67(1) or (2), Wis. Stats., or 30.68(1) or (2), Wis. Stats., shall be referred to State authorities for prosecution.

Citations for violations of this Chapter shall be drafted on forms prepared by the Department of Natural Resources. Bonds may be posted for violations pursuant to Section 23.66, Wis. Stats.

#### 16.14 JURISDICTION.

Recognizing the joint jurisdiction of the Village of Paddock Lake and the Town of Salem over the waters of Hooker Lake, it is the intent of this Chapter that the Village of Paddock Lake and the Town of Salem shall cooperate and coordinate ordinances, rules and regulations and shall have joint jurisdiction for enforcement purposes. However, violations occurring in the jurisdiction of the Town of Salem shall be brought before the Municipal Court of the Town of Salem and those violations under the jurisdiction of the Village of Paddock Lake shall be brought in the Municipal Court of the Village of Paddock Lake.

#### 16.15 USE OF HOOKER LAKE BOAT LAUNCH.

(a) Policy. It is the declared policy of the Village to encourage the use of the facilities constructed by the Village for access to Hooker Lake in a fashion so as to allow equal access to all who wish to use this facility.

(b) Prohibitions. No operator of any vehicle shall park or stop or leave standing such vehicle on any street or highway or public way or in any parking space at or adjacent to the Hooker Lake boat launch, except in conformance with the permitting provisions of this ordinance. For purposes of this ordinance, vehicles shall include all motor vehicles as well as trailers, boats, motor homes or any other device which is defined as a vehicle under the Wisconsin Statutes, which are incorporated herein by reference.

(1) Presumption. Ownership of a vehicle is sufficiently related to causing, allowing, permitting or suffering a vehicle parked so as to require the owner to be responsible for the parking of said vehicle. It shall be presumed, upon a showing by the Village, that a parking violation occurred and upon a showing that the party charged pursuant to this ordinance, was the registered owner of the unlawfully parked vehicle on the date of the violation that said registered owner is responsible for and guilty of the violation charged.

(2) Overcoming Presumption. The presumption stated in the preceding subparagraph, when established as therein specified, shall constitute a prima facie case and a basis for judgment, except where the person or other legal entity to which the vehicle is registered overcomes said presumption by the submission of proof of any of the following:

(a) The vehicle is stolen at the time the violation occurred, and reported as such to law enforcement authorities within a reasonable time thereafter.

(b) The vehicle was lawfully parked.

(c) The ownership of the vehicle was lawfully transferred to another prior to the violation.

(c) Parking Passes. Parking passes are printed passes issued by the Village for a designated period of time, to an individual for the purpose of allowing such individual to legally park in a properly marked parking stall at the Hooker Lake boat launch for the period of time specified on the pass. Parking passes shall be of two (2) types as follows: Daily and seasonal.

(d) Fees. Fees for parking passes shall be as follows:

(1) Seasonal (May 1 through October 31)

(a) Wisconsin resident - \$35.00

(b) Non-resident - \$40.00

(2) Daily - \$7.00

(3) Seasonal (May 1 through October 31) good for both Paddock Lake and Hooker Lake

(a) Wisconsin resident - \$45.00

(b) Non-resident - \$55.00

(e) Properly Displayed Passes. A properly displayed parking pass means that the parking pass must be displayed in the inside lower left hand corner of the front windshield. Operators of vehicles lawfully possessing and displaying valid parking passes, shall be permitted the privilege of parking in a lawful and orderly manner in a properly marked parking stall at the Hooker Lake boat launch without incurring the issuance of legal process and the imposition of forfeiture or penalty for failure to pay said fee.

(f) Form. Parking passes shall be obtained from the office of the Village Clerk/Treasurer and shall contain the date(s) for which the pass is valid and the name and address of the parking pass holder.

(g) Fine. Violation of this section shall result in the imposition of a fine of Twenty-five (\$25.00) Dollars for a first offense and Fifty (\$50.00) Dollars for a second and any subsequent offense.

*Source: Village of Paddock Lake.*

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**Appendix J**

**WDNR SENSITIVE AREA REPORT FOR  
HOOKER LAKE**

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# Hooker Lake (Kenosha County, Wisconsin) Integrated Sensitive Area Report

Date of Original Assessment: September 4, 2001  
Date of Reassessment: June 12<sup>th</sup>, 2007

Number of Sensitive Areas Surveyed: 2

Site Evaluators: Doug Welch, Fisheries Biologist  
Heidi Bunk, Lakes Biologist  
Marty Johnson, Wildlife Biologist  
Heidi Hopkins, Water Management Specialist  
Craig Helker, Water Quality Biologist

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## General Lake Information

Hooker Lake is an 87-acre lake with a maximum depth of 24 feet. The lake is located in south central Kenosha County, Township 1 North, Range 20 East, Section 11. Hooker Lake is characterized as a drainage lake. The lake receives its water from two tributaries, groundwater seepage, precipitation, and runoff. An outlet connects the lake to Salem Brook which ultimately discharges to the Des Plaines River.

Two public boating access sites are located on Hooker Lake. One access meets the requirements of "adequate public access" as defined by NR 1.91(11), Wis. Adm. Code. Hooker Lake is host to a variety of recreational uses including, but not limited to fishing, hunting, canoeing, kayaking, boating and swimming. The Department of Natural Resources and Kenosha County both own land along the shoreline of Hooker Lake.

The mix of wetlands and submergent vegetation present on Hooker Lake provides critical habitat for a variety of fish and wildlife species. According to the DNR Fish Master File, 25 fish species have been documented in Hooker Lake. These species include: northern pike, largemouth bass, smallmouth bass, walleye, yellow perch, bluegill, pumpkinseed, black crappie, green sunfish, warmouth, grass pickerel, common carp, yellow bullhead, black bullhead, brown bullhead, channel catfish, Iowa darter, golden shiner, white sucker, common shiner, spotted sucker, emerald shiner, bluntnose minnow, central mudminnow and a State Special Concern species, lake chubsucker.

The aquatic plant management on Hooker Lake consists only of selective treatment of eurasian water milfoil with 2,4-D products. No mechanical harvesting takes place. Manual harvesting is conducted by many riparian landowners. The Hooker Lake Management District oversees aquatic plant management activities for Hooker Lake. In 2007, 9 acres in Hooker Lake were chemically treated for eurasian water milfoil.

## Exotic Species

Exotic species, most notably curly leaf pondweed, eurasian water milfoil, and purple loosestrife have invaded southeastern Wisconsin lakes. Boaters traveling from lake to lake often facilitate the propagation of exotic species. The introduction of exotic species into a lake ecosystem can lead to a decline in the native plant population and cause problems with nutrient loading. Also, the disturbance of lake bottoms from human activity (boating, plant harvesting, chemical treatments, etc.) enhances the colonization and/or expansion of exotic species. Two simple steps to prevent the spread of exotic species include 1) Removing aquatic plants, animals, and mud from trailers and boats before leaving the water access; and 2) Draining water from boats, motors, bilges, live wells, and bait containers before leaving the water access.

Eurasian water milfoil is present in Hooker Lake. Eurasian water milfoil is one of eight milfoil species currently found in Wisconsin. It is often misidentified as one of its seven native cousins, and vice versa. In many areas within the Lakes, this non-native milfoil has established large monotypic stands that out compete many native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters.

The regenerative ability of eurasian water milfoil is another obstacle when attempting to control this species. Fragments of eurasian water milfoil detached by harvesting, boating, and other recreational activities can float to non-colonized areas of the lake or downstream to additional lakes in the drainage system and create new colonies. Therefore, when controlling eurasian water milfoil, selective chemicals and harvesting, coupled with skimming, often produces the best results. In some lakes, biological agents such as the milfoil weevil have helped suppress milfoil populations. However, the most effective “treatment” of exotic milfoil is prevention through public education.

Curly leaf pondweed is another submerged, exotic species found Hooker Lake. Like eurasian water milfoil, curly-leaf often grows into large, homogenous stands. It can crowd out native vegetation, create navigational problems, and limit fish movement. Curly-leaf pondweed dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality.

The unusual life cycle of curly leaf pondweed makes management difficult. The plant germinates as temperatures decrease in fall. Curly leaf is highly tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly leaf is most susceptible and a small window of opportunity exists for chemical treatment. Therefore, prevention through public education is once again very important.

Purple loosestrife, a hardy perennial native to Europe, is another exotic species common to Wisconsin. Since its introduction to North America in the early 1800s, purple loosestrife has become common in gardens and wetlands, and around lakes, rivers, and roadways. The species is highly invasive and thrives in disturbed areas. Purple loosestrife plants often outcompete native plants, resulting in the destruction of food, cover, and nesting sites for wildlife and fish. Several stands of purple loosestrife have been documented on Hooker Lake.

Purple loosestrife most often spreads when seeds adhere to animals. Humans should be aware of picking up seeds on clothing and equipment when in the vicinity of the plant. Loosestrife can be controlled manually, biologically, or with a broad-leaf herbicide. Young plants can be pulled, but adult plants have large root structures and must be excavated with a garden fork. Biological control is most effective on large stands of purple loosestrife. Five different insects are known to feed on this plant. Four of those have been used as control agents in the United States. Of the five species, *Galerucella pusilla* and *G. calmariensis* are leaf-eating beetles; *Nanophyes brevis* and *N. marmoratus* are flower-eating beetles; and *Hylobius transversovittatus* is a root-boring weevil. Only *N. brevis* has not been released in the United States (WDNR 2003). Lastly and most importantly, prevention through public education plays an important role in the management of this species.

Zebra mussels are native to the Baltic and Caspian Sea region or Eastern Europe, and were introduced to the great lakes via ballast water discharged from ocean-going vessels. These mussels attach to nearly every available surface – boats, docks, intake pipes, and are a great threat to native mussel populations. They are filter feeders, and thus eat plankton in the water column that many young fish and native mussels rely on for food. Zebra mussels begin their life cycle at a microscopic level. This stage of life stage is called a veliger. Water that is transferred from water body to water body can lead to new infestations by these veligers. Adults may also hitch a ride on aquatic plants that are transported from one body of water to another by means of boat trailers, river flow, or animal dispersion. Zebra mussels have not been documented in Hooker Lake.

## **Shoreland Management**

Wisconsin's Shoreland Management Program, a partnership between state and local governments, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal, and other activities within the shoreland zone. The shoreland zone includes land within 1000 feet of lakes, 300 feet of rivers, and floodplains. Current research shows that present standards are probably inadequate for the protection of water resources. (Woodford and Meyer 2003, Garn 2002) Therefore, many communities have chosen to go beyond minimum standards to ensure protection of our natural resources. This report provides management guidelines for activities within the lake and in the immediate shoreland areas. Before any recommendations in this

report are completed, please check with the Department of Natural Resources and local units of government for required approvals.

A vital step in protecting our water resources is to maintain effective vegetative buffers. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Studies have shown that buffers less than 35 feet are not effective in reducing nutrient loading. (Wenger, 1999) Wider buffers of 50 feet or more can help provide important wildlife habitat for songbirds, turtles, frogs, and other animals, as well as filter pollutants from runoff. (Castelle 1994) In general, no mowing should occur in the buffer area, except perhaps in a viewing access corridor. The plant composition of a buffer should match the flora found in natural Wisconsin lakeshores. A buffer should include three layers - herbaceous, shrub, and tree.

In addition, citizens living around Hooker Lake and the community at large should investigate other innovative ways to reduce the impacts of runoff flowing into the lake while improving critical shoreline habitat. (A. Greene 2003) This may include the use of phosphorus-free fertilizers, installing rain gardens, setting the lawnmower at a higher mower height, decreasing the area of impervious surfaces, or restoring aquatic plant communities.

## **Introduction**

Department personnel conducted sensitive area designation surveys on Hooker Lake both on September 4th, 2001 and June 12<sup>th</sup>, 2007 following the Wisconsin Department of Natural Resources' sensitive area survey protocol. This study utilized an integrated team of DNR resource managers with input from multiple disciplines: water regulation and zoning, fisheries, lake biology, wildlife, and aquatic plant management. Two sites were identified on Hooker Lake as containing critical habitat and were therefore designated as sensitive areas. Map 1 provides the boundaries of each sensitive area.

Department biologists observed fifteen native aquatic plant species in sensitive area #1 and ten native aquatic plant species in sensitive area #2. Three exotic aquatic plant species were observed in these sensitive areas as well. These included eurasian water milfoil (*Myriophyllum spicatum*), curly leaf pondweed (*Potamogeton crispus*) and purple loosestrife (*Lythrum salicaria*).

## **Overview of Sensitive Area Designations**

Sensitive areas have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A sensitive area designation alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem, or may feature an endangered

plant or animal. Information presented in a sensitive area report is often utilized in the process of making Chapter 30 (Wisconsin State Statutes) permit decisions.

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05 (3)(i)(1) as *areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water.* **Department resource managers determined that two areas of Hooker Lake met the criteria.**

## Whole Lake Recommendations

These recommendations apply to Hooker Lake as a whole rather than a specific sensitive area.

1. Native aquatic plant beds should be protected and maintained for species diversity and to discourage invasion of exotic species.
2. Prevent the spread of exotic species through signage, education, etc. and control exotic species where established.
3. Compliance with Shoreland Zoning standards including setbacks, removal of nonconforming structures and limiting impervious surfaces.
4. Create shoreline buffers and maintain existing buffers, especially in areas not currently developed.
5. Monitor water quality for early detection of change and possible degradation.
6. Use phosphorus free lawn care to control nutrient runoff.
7. Establish a citizen lake monitor on Hooker Lake.

## Resource Value of Sensitive Area #1

Sensitive Area #1 is located on the north side of Hooker Lake. The site is approximately 4000 feet long and has an average depth of 2 feet. Approximately two thirds of the frontage is owned by the Department of Natural Resources. This site was chosen because of the high value of the wetland plants for wildlife. Sensitive area #1 provides crucial habitat for many wildlife species. The aquatic bed/marsh wetland complex in this area provides quality habitat for marsh hawks, songbirds, ducks, geese, wading birds and some types of reptiles and amphibians. The wetland complex is important due to its relatively large size and adjacency to a large undeveloped upland corridor to the west.

The site was also chosen for the floating leaf and submergent aquatic vegetation, which provides spawning, nursery, feeding and protective habitat for northern pike, largemouth bass, panfish and minnow species. The aquatic plant diversity in this area is good with 16 native aquatic plant species documented as well 3 exotic aquatic plant species. Table 1 below lists the plant species observed and shows their relative abundance within sensitive area #1.

The plants create a nutrient buffer zone, utilizing lake nutrients (especially phosphorus) as part of their growth process, reducing the amount available for algal blooms. The root systems of the plants help stabilize the lake sediments. A biological and physical buffer zone is created by the dense plant beds. The dense beds reduce the ability for exotic plant species to invade Hooker Lake and protect properties from shoreline erosion. The shoreland buffer zone is wetland and dominated with herbaceous and shrub vegetation. The west half of the sensitive area's substrate is primarily silt, muck and detritus while the east portion is mostly sand. The natural scenic beauty in this area is average with minimal human impact.

**Table 1. Plant Species Observed in Hooker Lake Sensitive Area #1**

<b>PRESENT (0-25%)</b>	<b>COMMON (26-50%)</b>	<b>ABUNDANT (51-75%)</b>	<b>DOMINANT (76-100%)</b>
<b>Shrubs</b> <i>Salix</i> (willow)	<b>Emergents</b> <i>Impatiens</i> (jewelweed)	<b>Algae</b> Filamentous Algae	<b>Emergents</b> <i>Typha</i> (cattail)
<b>Floating Leaf</b> <i>Nuphar</i> (yellow water lily) <i>Nymphaea</i> (white water lily)	<b>Pondweeds</b> <i>P. richardsonii</i> (clasping-leaf)	<b>Pondweeds</b> <i>Stuckenia pectinatus</i> (sago)	<b>Algae</b> <i>Chara</i> (muskgrass)
<b>Submergents</b> <i>Ceratophyllum</i> (coontail) <i>Zosterella</i> (water stargrass) Native milfoil	<b>Exotics</b> <i>P. crispus</i> (curly leaf) <i>Myriophyllum spicatum</i> (eurasian water milfoil)	<b>Submergents</b> <i>Vallisneria</i> (wild celery)	
<b>Pondweeds</b> <i>P. Illinoensis</i> (Illinois) <i>P. amplifolius</i> (Large-leaf pondweed) <i>P. Foliosus</i> (leafy pondweed)			
<b>Exotics</b> <i>Lythrum salicaria</i> (purple loosestrife)			

The vegetation and substrates in this area provide excellent spawning, nursery, feeding and protective habitat for northern pike and yellow perch. Largemouth bass and other sunfish will utilize this area for feeding, nursery and protective cover. In areas where the sunfish species can locate sand or sand/gravel bars under the fine substrates associated with this area, they too will use this area for establishing spawning nests. Table 2 below portrays the habitat each species relies on for the different stages of their respective life cycles.



**Table 2. Sensitive Area #1 Plant Species and Substrates (Habitat)  
Utilized by Hooker Lake Resident Fish Species (2002 Survey)**

<b>Fish Species</b>	<b>Spawning</b>	<b>Nursery</b>	<b>Feeding</b>	<b>Protective Cover</b>
Walleye	Habitat lacking	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Coontail, wild celery, milfoil, pondweeds	Coontail, milfoil, pondweeds
Northern Pike	Cattail, chara	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Smallmouth Bass	Habitat lacking	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	milfoil, pondweeds	Milfoil, pondweeds
Largemouth Bass	Coontail, watermilfoil  Sand/gravel	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris
Bluegill and Pumpkinseed	Sand/gravel	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Black Crappie	<i>Chara</i> (muskgrass)  Fine gravel and sand	Water lily, chara, coontail, wild celery, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, cattail, coontail, milfoil, pondweeds	Water lily, chara, coontail, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Golden Shiner	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, <i>Chara</i> , milfoil, pondweeds)	Submergent vegetation (coontail, <i>Chara</i> , milfoil, pondweeds)	Submergent vegetation (coontail, <i>Chara</i> , milfoil, pondweeds)

Bluntnose Minnow	Underside of submerged objects (logs, rocks, bark or mussel shells)  Sand/gravel shoals	Submergent vegetation (coontail, <i>Chara</i> , milfoil, pondweeds)	Submergent vegetation (coontail, <i>Chara</i> , milfoil, pondweeds)	Submergent vegetation (coontail, <i>Chara</i> , milfoil, pondweeds)
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### Management Recommendations for Sensitive Area #1

1. Do not remove fallen trees along shoreline, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.
2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian water milfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.
3. No chemical treatment of eurasian water milfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or northern water milfoil.
4. Maintain the “Slow, No Wake” ordinance in this area of Hooker Lake. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.
5. Minimize disturbance of the diverse stands of native aquatic vegetation.
6. Provide seasonal protection of fish spawning habitat.
7. Minimize disturbance of herbs, shrubs and trees on the shoreline to maintain wildlife habitat.
8. Mechanical harvesting should not be permitted.
9. New piers may be considered for a permit. However, additional piers are restricted to the existing, privately owned, developed shoreline. The number of moorings allowed will be less than listed in State Statutes 30.12 (1g) (f). The number of moorings permitted will be limited and based on the carrying capacity of the resource.
10. Limit manual harvesting to minimal swim/wading areas along the privately owned frontage. No manual harvesting should take place along the frontage of the state owned property. (*Manual removal of aquatic plants in Sensitive Areas must be permitted by DNR according to Wis. Adm. Code NR 109*).

11. Shoreline stabilization should not be needed in most areas of Sensitive Area # 1. If shoreline stabilization is needed, it must be accomplished by bioengineering.
12. A DNR permit should not be issued for any of the following:
 

Dredging	Pea gravel/sand blankets
Filling of wetlands	Recreational floating devices
Aquatic plant screens	Boat Ramps
Sea Walls/Retaining Walls/Riprap	Boardwalks

### Resource Value of Site #2

Sensitive Area #2 is located in the southwestern corner of Hooker Lake. The approximate length of this site is 1000 ft with an average water depth of 4.5 ft. Kenosha County owns a small parcel on the north/northwest part of the bay. The location of the sensitive area habitat is the shoreline and littoral zone. The lake bed substrate consists of sand and muck. The shoreland area is approximately 33% wetland and 66% developed land with an abundance of lawns, some trees and herbaceous plants as well as a few shrubs. The natural scenic beauty rating in this area is poor, with major human disturbance. Important habitat components present at this site are emergent and submergent aquatic vegetation, floating leaf vegetation, and over-hanging vegetation.

This site was chosen due to the value of the aquatic plants for fish, amphibians and reptiles, as well as migratory waterfowl. The emergent vegetation is utilized by birds, frogs and turtles. Floating vegetation provides overhanging cover and shading for fish species and resting areas for frogs. Insect larvae hide underneath the blades of the plants, providing food for fish, frogs, turtles and birds. Table 3 below exhibits the plant species observed in sensitive area # 2 on Hooker Lake.

<b>Table 3. Plant Species Observed in Sensitive Area # 2</b>			
<b>PRESENT (0-25%)</b>	<b>COMMON (26-50%)</b>	<b>ABUNDANT (51-75%)</b>	<b>DOMINANT (76-100%)</b>
<b>Emergents</b> <i>Impatiens</i> (jewelweed)	<b>Emergents</b> <i>Typha</i> (cattail)	<b>Floating Leaf</b> <i>Nuphar variegata</i> (spatterdock) <i>Nymphaea odorata</i> (white water lily)	<b>Submergents</b> <i>Ceratophyllum</i> (coontail) <i>Ranunculus longirostris</i> (white water crowfoot)
<b>Submergents</b> <i>Myriophyllum sibiricum</i> (northern water milfoil)	<b>Pondweeds</b> <i>P. richarsonii</i> (clasping-leaf pondweed)	<b>Pondweeds</b> <i>P. illinoensis</i> (Illinois pondweed) <i>P. zosteriformis</i> (Flat stem pondweed)	<b>Exotics</b> <i>Myriophyllum spicatum</i> (Eurasian Water milfoil)
		<b>Exotics</b> <i>P. crispus</i> (curly leaf)	

The combination of emergent vegetation and the silt/muck substrate provide an ideal spawning habitat for northern pike. Largemouth bass and other sunfish species will seek out sand and gravel areas for placement of spawning nests. Yellow perch will drape fertilized egg masses over woody debris and existing vegetation where available. All fish species can utilize the vegetative cover in sensitive area #2 for feeding, cover and resting areas. Table 4 below illustrates how some of resident fish species on Hooker Lake utilize the habitat in sensitive area #2.

<b>Table 4. Sensitive Area # 2 Plant Species and Substrates (Habitat) Utilized by Hooker Lake Resident Fish Species</b>				
<b>Fish Species</b>	<b>Spawning</b>	<b>Nursery</b>	<b>Feeding</b>	<b>Protective Cover</b>
Walleye	Habitat lacking	Cattail, water lily, coontail, milfoil, pondweeds	Coontail, milfoil, pondweeds	Coontail, milfoil, pondweeds
Northern Pike	Cattail	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Smallmouth Bass	Habitat lacking	Cattail, water lily, coontail, milfoil, pondweeds	Milfoil, pondweeds	Milfoil, pondweeds
Largemouth Bass	Coontail, watermilfoil  Sand/gravel	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris
Bluegill and Pumpkinseed	Sand/gravel	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Black Crappie	<i>Chara</i> (muskgrass)  Fine gravel and sand	Water lily, coontail, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, cattail, coontail, milfoil, sago, clasping leaf	Water lily, coontail, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Golden Shiner	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, Chara, milfoil, pondweeds)	Submergent vegetation (coontail, Chara, milfoil, pondweeds)
Bluntnose Minnow	Underside of submerged objects (logs, rocks, bark or mussel shells) Sand/gravel shoals	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, Chara, milfoil, pondweeds)	Submergent vegetation (coontail, Chara, milfoil, pondweeds)

### Management Recommendations for Sensitive Area #2

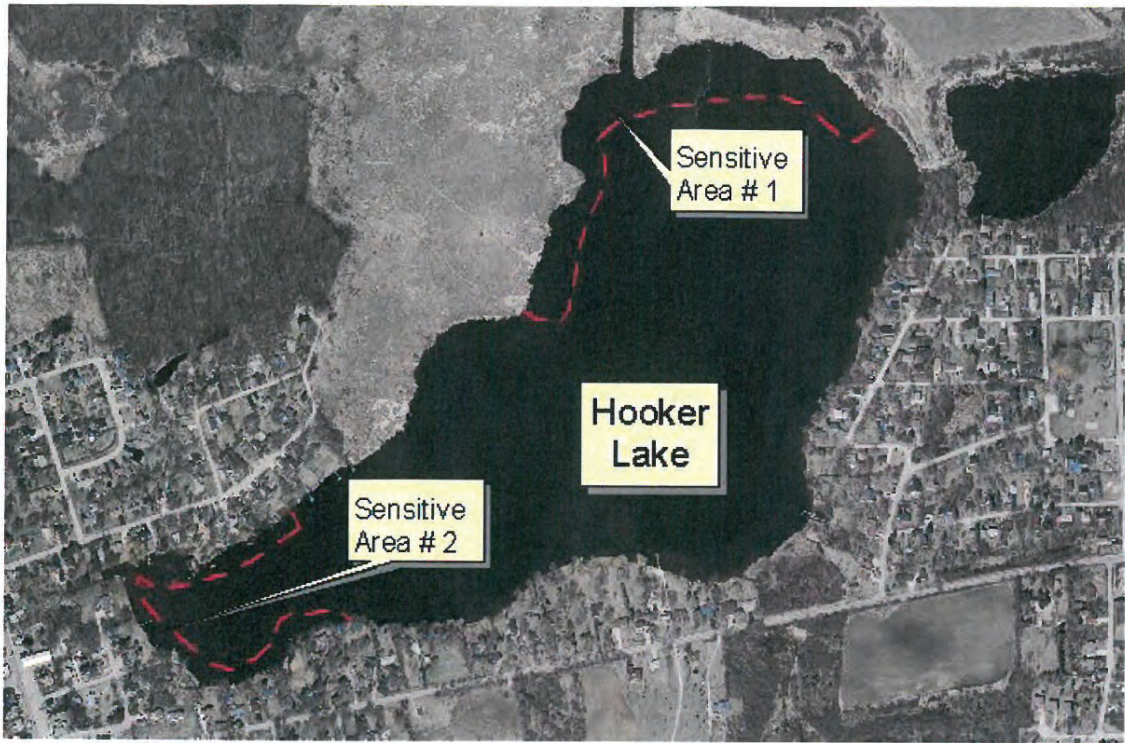
1. Do not remove fallen trees in the bay, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.
2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian water milfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.
3. No chemical treatment of eurasian water milfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or northern water milfoil.
4. Maintain the “Slow, No Wake” ordinance in this area of Hooker Lake. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.
5. Minimize disturbance of the diverse stands of native aquatic vegetation, especially the lily pads and bulrushes on the northern side of the bay.
6. Mechanical harvesting should not be permitted.
7. New piers may be considered for a permit. The number of moorings allowed will be equal to that listed in State Statutes 30.12 (1g) (f). The shoreline is already extensively developed. As a result, the number of additional moorings permitted will be limited and based on the carrying capacity of the resource.
8. Limit manual harvesting to minimal swim/wading areas along the privately owned frontage. (*Manual removal of aquatic plants in Sensitive Areas must be permitted by DNR according to Wis. Adm. Code NR 109*).
9. Any replacement of the existing shoreline stabilization practices must include an element of bioengineering such as vegetated rip rap and biologs.

10. Installation of buffer strips along the highly developed shoreline is strongly recommended.
11. A DNR permit should not be issued for any of the following:
  - Dredging
  - Pea gravel/sand blankets
  - Filling of wetlands
  - Aquatic plant screens

## **Conclusion**

Two sensitive areas were designated on Hooker Lake. Three quarters of the shoreline is highly developed. The lake is heavily used for fishing and pleasure boating. The wetland complex located on the north and northwest shorelines of the lake provides a reasonably large refuge for wildlife. The protection of the submergent and floating leaf aquatic plants found in the two sensitive areas is critical to maintaining the fishery in Hooker Lake.

Eurasian water milfoil has increased in coverage and density in recent years. Boating disturbance through the milfoil beds is likely the cause of much of the spread of eurasian water milfoil. The Hooker Lake Management District is currently applying for a lake planning grant. The grant, if awarded, would be used to conduct a plant survey and develop an aquatic plant management plan.



Source: Wisconsin Department of Natural Resources.

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**Appendix K**

**MEASURING STREAM FLOW**

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# Stream Flow:

## Flow Speaks Volumes

### Why are we concerned?

**S**tream flow, or *discharge*, is the volume of water moving past a cross-section of a stream over a set period of time. It is usually measured in cubic feet per second (cfs). Stream flow is affected by the amount of water within a *watershed*, increasing with rainstorms or snowmelt, and decreasing during dry periods. Flow is also important because it defines the shape, size and course of the stream. It is integral not only to water quality, but also to habitat. Food sources, spawning areas and migration paths of fish and other wildlife are all affected and defined by stream flow and velocity. Velocity and flow together determine the kinds of organisms that can live in the stream (some need fast-flowing areas; others need quiet, low-velocity pools). Different kinds of vegetation require different flows and velocities, too.

Stream flow is affected by both forces of nature and by humans. (*continued on page 2*)

#### Time Needed: Equipment Needed:

30 minutes



- Tape Measure
- Yardstick or marked D-frame net pole
- Surveying flags/flagging
- Float (an orange works best)
- Net (Can use D-frame net to catch the float)
- Stopwatch or digital watch
- Calculator
- Form to record data
- Pencil
- Hip boots or waders
- String (optional)
- Stakes (optional)

#### DEFINITION OF TERMS

*Discharge: Another term for stream flow, or the volume of water moving past a designated point over a set period of time.*

*Flow Regime: The pattern of stream flow over time, including increases with stormwater runoff inputs and decreases to a base-flow level during dry periods.*

*Impervious Surface: A surface that does not allow water (e.g., rain) to pass through (infiltrate).*

*Rating Curve: A graphical representation of the relationship between the stage height and the discharge (flow).*

*Run: An area of a stream that has swift water flow and is slightly deeper than a riffle (a run will be about knee / thigh deep).*

*Stage Height: Height of the water in a stream above a baseline.*

*Watershed: An area of land that drains to a main water body.*

In undeveloped watersheds, soil type, vegetation, and slope all play a role in how fast and how much water reaches a stream. In watersheds with high human impacts, water flow might be depleted by withdrawals for irrigation, domestic or industrial purposes. Dams used for electric power generation may affect flow, particularly during periods of peak need when stream flow is held back and later released in a surge. Drastically altering landscapes in a watershed, such as with development, can also

change *flow regimes*, causing faster runoff with storm events and higher peak flows due to increased areas of *impervious surface*. These altered flows can negatively affect an entire ecosystem by upsetting habitats and organisms dependent on natural flow rates.

Tracking stream flow measurements over a period of time can give us baseline information about the stream's natural flow rate.

## Safety considerations

You will need to enter the stream channel to make width and depth measurements and to calculate velocity. Be aware of stream velocity, water depth, and bottom conditions at your stream-monitoring site. Do not attempt to measure stream flow if water velocity appears to be fast enough to knock you down when you are working in the stream. If you are unsure of water depth across the width of the stream, be sure to proceed with caution as you move across the stream, or choose an alternate point from which to measure stream flow.

### Determining Stream Flow (Area x Velocity = Flow)

The method you are going to use in determining stream flow is known as a velocity-area approach. The task is to find out the volume of water in a 20-ft. (at least) section of stream by determining both the stream's velocity and the area of the stream section. You will first measure the width of the stream, and then measure water depth at a number of locations across the width to find the average depth at your monitoring site. Then by multiplying the average depth by the width, you can determine the average cross-sectional area (ft<sup>2</sup>) of the stream. Water velocity (ft/sec) is determined simply by measuring the number of seconds it takes a float to travel along the length of stream you are studying. Since water velocity varies at different depths, (surface water moves more quickly than subsurface water because water moving against rough bottom surfaces is slowed down by friction) you will need to multiply velocity by a correction factor to adjust your measurement to account for the effect of friction. The actual equation you will use to determine flow is this: Flow=Area x Corrected Velocity. This method was developed and adapted from several sources (see bibliography). Alternative methods that may be better for your monitoring site are featured in the sidebar below.



### Stream Flow Monitoring Methods: Professional and Home-Made

The type of monitoring station used by professionals depends on the conditions at the site including size, slope, accessibility, and sedimentation of the stream. Flow can also be measured at spillways, dams, and culverts or by using a weir or flume, which are man-made structures within a stream that provide a fixed stage-flow relation. Another method, using a home-made combination staff/crest gage, allows volunteer monitors to measure the water level (stage) both at the time of inspection and at the highest level reached since last inspected. This tool is made of PVC pipe, granulated cork and other materials. For more information, including how to make your own, visit:

[www.epa.gov/owow/monitoring/volunteer/newsletter/volmon07no2.pdf](http://www.epa.gov/owow/monitoring/volunteer/newsletter/volmon07no2.pdf)

# Measuring and Calculating Stream Flow

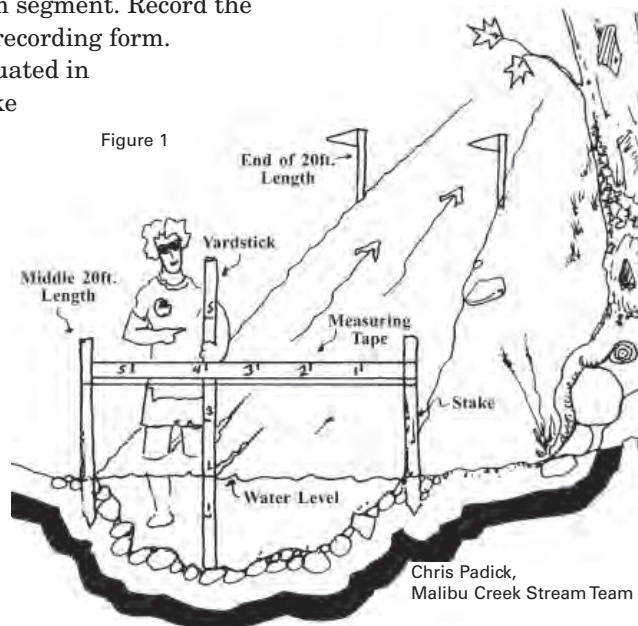
## Site location

1. At your monitoring site, locate a straight section of stream that is at least 20 feet in length and has a uniform width. The water should be at least 6 inches deep, and have some movement. Unobstructed runs or riffles are ideal sites to choose.
2. Measure 20 feet along the length of your chosen stream segment with your measuring tape and mark both the up and downstream ends of the section with flagging.

## Width and depth measurements

3. Working with a partner, measure stream width (wetted edge to wetted edge) by extending a measuring tape across the stream at the midway point of your marked stream segment. Record the width in feet on your recording form. (A tape measure graduated in tenths of feet will make calculations easier.)

4. Secure the measuring tape to both shores so that the tape is taut and above the surface of the water. You might choose to attach the tape or a length of string to two stakes secured on opposite banks to create a transect line across the stream if it is impractical to secure the tape using shoreline vegetation. (Figure 1)



5. Using your yardstick or pre-marked (in tenths of feet) D-frame net pole, measure the water depth (ft) at one-foot intervals across the stream where you measured width (and secured the measuring tape). Be sure to measure depth in tenths of feet, not in inches (See conversion chart from inches to tenths of feet on data recording form). Record depth measurements (ft) on the recording form. If your stream is greater than 20 feet wide, measure depth in 20 equal intervals across the stream.

## Velocity measurement

Velocity will be measured by tracking the time it takes a floating object to move the marked 20-

foot length of stream. You will time the floating object (in seconds) a total of four times, at different locations across the stream. Repeating your measurements across the stream, in both slower and faster areas, will help to ensure the closest approximation to the stream's true velocity. This in turn will make your flow calculations more accurate. However, be sure your float travels freely downstream (during every float trial) without catching in slack water areas of the stream. For narrower streams (less than 10 feet), you can conduct only three float trials to assess velocity.

6. Position the person who will release the float upstream from the upper flag. Position the timekeeper on the stream bank (or out of the main flow path) at the downstream flag with the stopwatch. Position the person who will catch the float downstream from the timekeeper (Note: Unless velocity is very fast, the timekeeper should be able to catch the float with a net after they have finished timing its run down the stream).

7. The float-releaser will gently drop the float into the stream a few feet upstream from the upper flag, and will alert the timekeeper to begin timing as the float passes the upstream flag (the

float should have time to get up to speed by the time it passes the upper flag into the marked length of stream). If the float gets stuck on a log, rock or other obstruction, it should be released from the starting point again.

8. The timekeeper should stop the stopwatch as the float passes the downstream flag and retrieve the float using the net.
9. Record the float time for the first trial on the recording form.
10. Repeat steps 7-9 for each of the remaining float time trials in different sections of the stream. Record the float time (seconds) for each trial on the recording form.

## Calculating stream flow

11. To determine the average depth at the site, first find the sum of your depth measurements. Then divide the sum of the depths by the number of depth measurements (intervals) you made. Record the average depth (ft) in the appropriate location on your recording form.
12. Next, multiply your average depth by the stream width. This is the average cross-sectional area (ft<sup>2</sup>) of the stream. Record this in the appropriate box on your recording form.
13. Determine the average float time by first determining the sum of float times measured. Then divide the sum of the times by the number of float time measurements taken. Record this average float time (seconds) on your recording form.
14. Divide the length of your stream segment (e.g., 20 feet) by the average float time (seconds) to determine the average surface velocity at the site. Record the average surface velocity (ft/sec) on your recording form.
15. Determine the correction factor below that best describes the bottom of your stream and multiply it by the average velocity measurement to account for the effects of friction with the stream bottom on water velocity. Record your corrected average surface velocity on your recording form.
  - a. **Correction factor for rough, loose rocks, coarse gravel or weeds: 0.8**
  - b. **Correction factor for smooth mud, sand, or bedrock: 0.9**
16. Multiply the average cross-sectional area (ft<sup>2</sup>) by the corrected average surface velocity (ft/sec) to determine stream flow. Record stream flow (ft<sup>3</sup>/sec or cfs) in the space provided on your recording form.

### Bibliography:

We reviewed and adapted information and methods from Missouri Stream Team Program, the WI DNR, the *EPA Volunteer Stream Monitoring Methods Manual* (EPA 841-B-97-003), the *Nohr Network of Monitors*, the Washington Co. (WI) Waterways Program, Hoosier Riverwatch, Project SEARCH, and California's Nonpoint Source Pollution Control Program as well as other technical information.

©2006 University of Wisconsin. This publication is part of a seven-series set, "Water Action Volunteers- Volunteer Monitoring Factsheet Series" and is available from the Water Action Volunteers Coordinator at 608/264-8948.

Water Action Volunteers is a cooperative program between the University of Wisconsin-Extension and the Wisconsin Department of Natural Resources. For more information, contact the Water Action Volunteers Coordinator at 608/264-8948.

## What is a Staff Gage?



A staff gage is a tool that is often used in conjunction with other methods to determine stream flow. It looks like a large ruler placed vertically within a stream in a position least likely to catch floating debris, and that will be stable during high water flows and the winter freeze. Staff gages are calibrated in tenths of feet and allow a monitor to read and record the stage height (the height of water in the stream at a certain level) any time a monitor has the opportunity to visit the stream site. Staff gages are often placed at the stream's edge on a bridge abutment. WAV monitors may choose to place a staff gage at their monitoring site. You may need a permit to do this, however. Contact your local DNR Service Center for more information on permits.

If a staff gage is installed, monitors can simply record the water level on the staff gage without measuring flow. This method will provide added detail when assessing other parameters. However, scores cannot be compared between sites because each reading is germane only to that site.

Monitors may also choose to install a staff gage at their monitoring site and then, at a number of different water levels, record the stage height and determine the flow in the stream by following methods provided in this fact sheet. This type of monitoring is similar to what professionals do to determine a *rating curve* for a stream discharge monitoring station. The rating curve will reveal the stream's unique relationship between flow and stage height. Eventually, a monitor could determine stream flow simply by reading the stage height on the staff gage and looking at the site's rating curve to see what the flow is at that stage height. Caution must be used with this method since weeds, ice, or other factors can cause ponding of the stream water or movement of the staff gage over time, thus affecting rating curve results.

UW  
**Extension**



**Appendix L**

**HEALTHY LAKES INITIATIVE**

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Green Lake, Green Lake County - Lisa Reas

# WISCONSIN'S HEALTHY LAKES IMPLEMENTATION PLAN



# 2014-2017



*Wisconsin  
Lakes  
Partnership*

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Team Members:

Dave Ferris, Burnett County Land and Water Conservation Department  
 Pat Goggin, Lake Specialist, UW-Extension Lakes  
 Jane Malischke, Wisconsin DNR Environmental Grants Specialist  
 Tom Onofrey, Marquette County Zoning Department  
 Carroll Schaal, Wisconsin DNR Lakes and Rivers Section Chief  
 Pamela Toshner, Wisconsin DNR Lake Biologist



*The statewide Healthy Lakes initiative is a true, collaborative team effort. The Healthy Lakes Implementation Plan describes relatively simple and inexpensive best practices that lakeshore property owners can implement. The Plan also includes funding/accountability, promotion, and evaluation information so we can grow and adapt the Plan and our statewide strategy to implement it into the future. Working together, we can make Healthy Lakes for current and future generations.*

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Wisconsin's lakes define our state, local communities, and our own identities. Fond memories of splashing in the water, seeing moonlight reflect off the lake, and catching a lunker last a lifetime. With over 15,000 lakes dotting the landscape, it's no surprise that fishing alone generates a \$2.3 billion economic impact each year, and the majority of property tax base rests along shorelines in some of our counties. Unfortunately, we've learned through science that our love for lakes causes management challenges, including declines in habitat and water quality. In fact, the loss of lakeshore habitat was the number one stressor of lake health at a national scale. Lakes with poor lakeshore habitat tend to have poor water quality. Working together to implement *Wisconsin's Healthy Lakes Implementation Plan* (Plan), we can improve and protect our lakes for future generations to enjoy, as well.

This Plan identifies relatively simple habitat and water quality best practices that may be implemented on the most typical lakeshore properties in Wisconsin. We encourage do-it-yourselfers to use these practices but have also created a Wisconsin Department of Natural Resources (DNR) Lake Classification and Protection Grant *Healthy Lakes* sub-category for funding assistance. Furthermore, local partners like lake groups and counties may choose to integrate the Plan into their lake management, comprehensive planning, and shoreland zoning ordinance efforts.

It's important to consider this plan in the context of the lake and local community's management complexity. The best practices' effectiveness will increase cumulatively with additional property owner participation and depend on the nature and location of the lake. For example, if every property owner implemented appropriate Healthy Lakes best practices on a small seepage lake, also known as a pothole or kettle lake, within a forested watershed, the impact would be greater than on a large impoundment in an agricultural region of Wisconsin. Nevertheless, all lakes will benefit from these best practices, and even with limited impact, they are a piece of the overall lake management puzzle that lakeshore property owners can directly control. More lakeshore property owners choosing to implement Healthy Lakes best practices through time means positive incremental change and eventually success at improving and protecting our lakes for everyone.



**GOALS AND OBJECTIVES**

Wisconsin’s Healthy Lakes Implementation Plan goal is to protect and improve the health of our lakes by increasing lakeshore property owner participation in habitat restoration and runoff and erosion control projects.

- Statewide objective: single-parcel participation in Healthy Lakes will increase 100% in 3 years (i.e. 2015 to 2017).
- Individual lake objective: lake groups or other partners may identify their own habitat, water quality, and/or participation goal(s) through a local planning and public participation process.
  - ◆ Partners may adopt this Plan, as is by resolution, or integrate the Plan into a complimentary planning process such as lake management or comprehensive planning.

Wisconsin’s Healthy Lakes Implementation Plan, and the diversion and rock infiltration practices in particular, are not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design. Technical assistance and funding are still available for these sites; contact your county land and water conservation department or local DNR lakes biologist for more information.

The target audience for this Plan and implementation of the associated practices is lakeshore property owners, including: permanent and seasonal homeowners, municipalities, and businesses.

It will be necessary to do additional planning work to implement Wisconsin’s Healthy Lakes Plan and, again, the level of effort will depend on the complexity of the lake and its local community. Planning could be as simple as site-specific property visits and development of design plans, to integrating the Plan into a broader and more comprehensive effort. Your lake group, county land and water conservation department, non-profit conservation association, UW-extension lakes specialist or local educator, and/or DNR lake biologist can provide planning guidance or contacts.

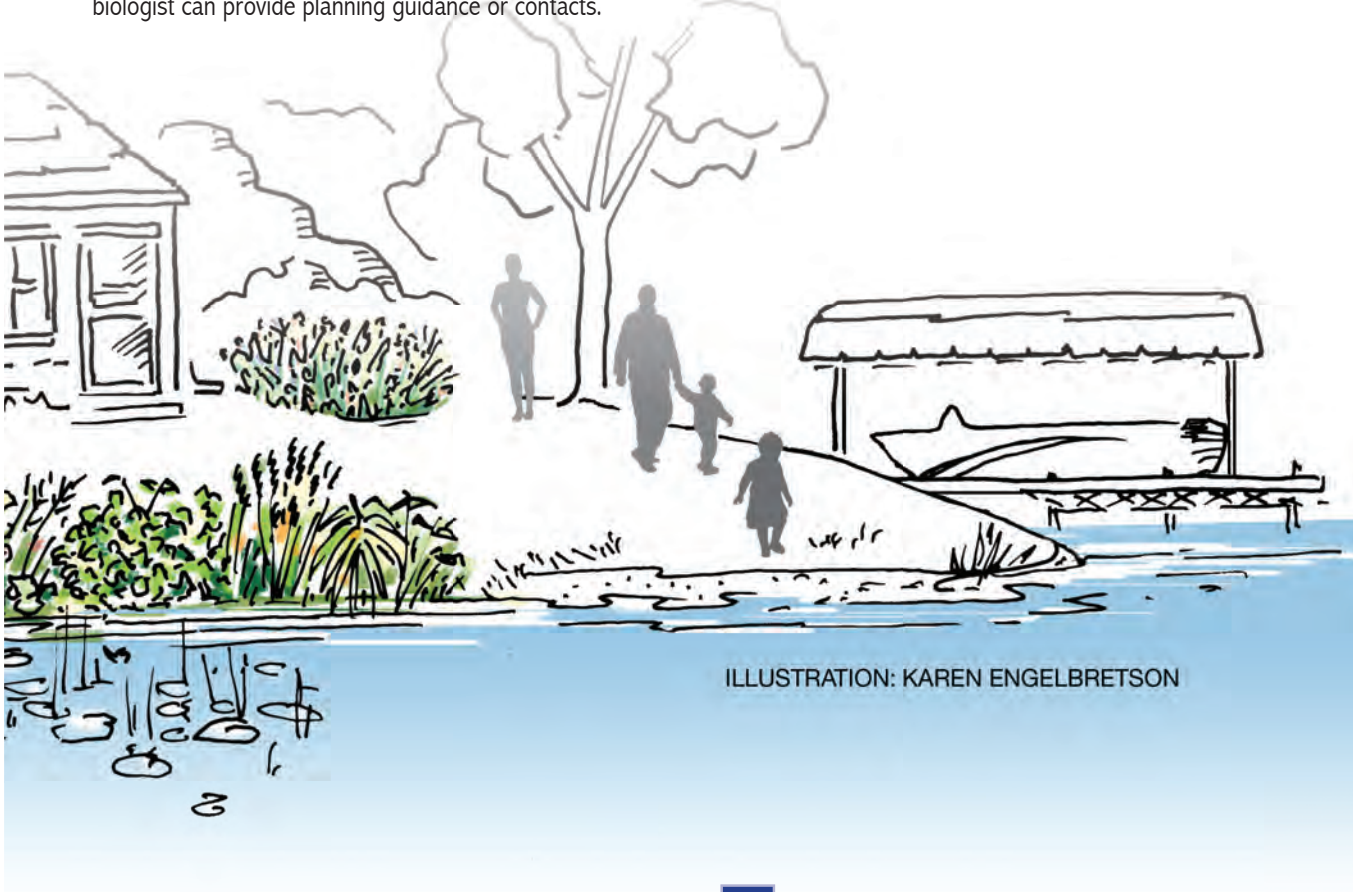


ILLUSTRATION: KAREN ENGELBRETSON

**DEFINITIONS**

**Best**

**practice:** a working method, described in detail, which has consistently shown results.

**Divert:** redirect runoff water.

**Habitat:** where a plant or animal lives.

**Infiltrate:** soak into the ground.

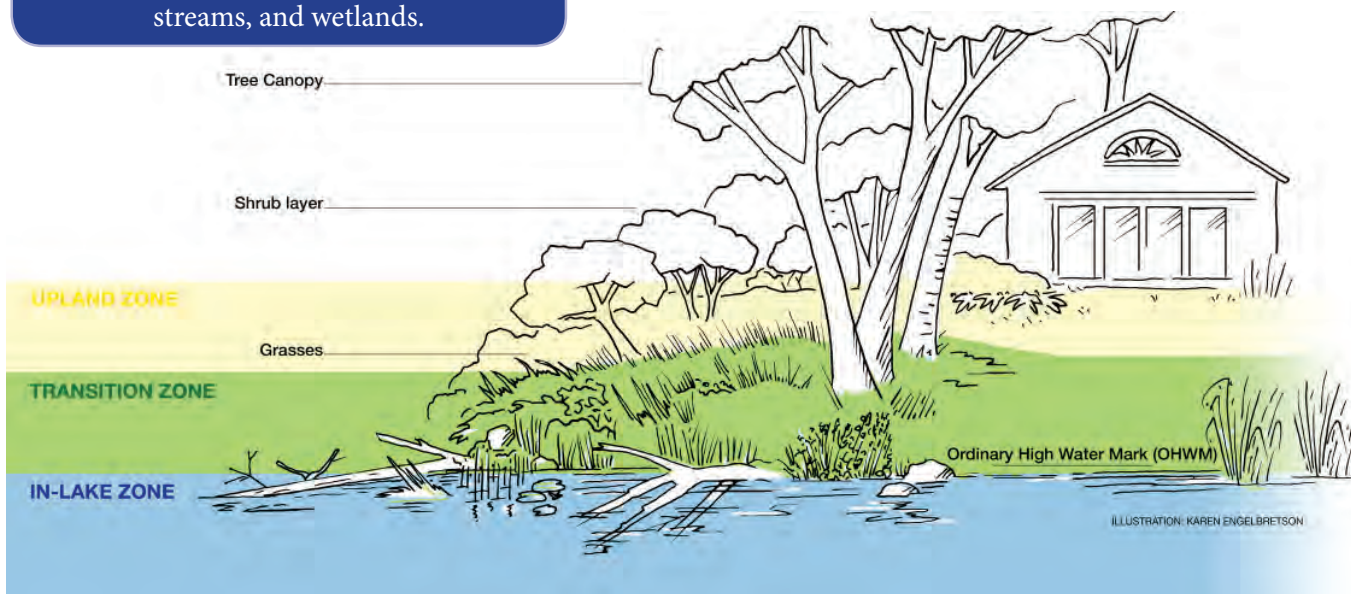
**Installed:** project cost that includes all materials, labor, and transportation.

**Runoff:** rain and snowmelt that doesn't soak into the ground and instead moves downhill across land and eventually into lakes, streams, and wetlands.

*Wisconsin's Healthy Lakes Implementation Plan* divides a typical lakeshore parcel into the following 3 management zones: 1) in-lake, 2) transition, and 3) upland (see illustration below). Best practices are identified for each zone. A team selected these practices based on customer feedback. These practices are:

- relatively simple and inexpensive to implement,
- appropriate for typical lakeshore properties, and
- beneficial to lake habitat and/or water quality.

The Plan also provides cost ranges and averages and technical, regulatory, and funding information for each practice. Fact sheets for each best practice support the Plan and provide more technical detail, and additional guidance is referenced if it currently exists. There is also a funding and administration FAQ fact sheet for those considering pursuing Healthy Lakes grants.



**HEALTHY LAKES PLAN**

**BEST PRACTICES**



Best practice descriptions follow. Each description defines the practice, identifies lake health benefits, provides cost ranges and averages based on recent projects, and identifies additional technical and regulatory information. The costs provided are installed costs, which include all materials, labor, and transportation but do not include technical assistance, including design and project management/administration work. Cost ranges are a result of geographic location, property conditions like soils and slopes, and contractor supply and proximity to the project site.

PRACTICE 1 | FISH STICKS

...large woody habitat structures that utilize whole trees grouped together resulting in the placement of more than one tree per 50 feet of shoreline. Fish Sticks structures are anchored to the shore and are partially or fully submerged.



Bony Lake, Bayfield County - Pamela Toshner

<p><b>LAKE HEALTH BENEFITS</b></p>	<p>Improve fish and wildlife habitat Prevent shoreline erosion</p>	
<p><b>COSTS</b></p>	<p><b>Range</b> - \$100-\$1000 per cluster (3-5 trees), installed <b>Average</b> - Cost per unit (3-5 trees) averages \$500, installed</p>	
<p><b>TECHNICAL REQUIREMENTS</b></p>	<p>Healthy Lakes Fact Sheet Series: <i>Fish Sticks</i> <a href="http://tinyurl.com/healthylakes">http://tinyurl.com/healthylakes</a>  DNR Fish Sticks Best Practices Manual <a href="http://dnr.wi.gov">http://dnr.wi.gov</a> (search for <i>Fish Sticks best practices</i>)</p>	
<p><b>REGULATORY INFORMATION</b></p>	<p>DNR: <b>Habitat Structure - Fish Sticks General Permit</b> (\$303 fee unless DNR grant-funded)  Fish Sticks must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.</p>	
<p><b>HEALTHY LAKES GRANT FUNDING</b></p>	<p>Maximum of \$1000/cluster of 3-5 trees  Fish Sticks may be a stand-alone grant activity only if the vegetation protection area (i.e. buffer) complies with local shoreland zoning. If not, the property owner must commit to leaving a 350 ft<sup>2</sup> area un-mowed at the base of the cluster(s) or implement native plantings (Practice 2).</p>	

**PRACTICE 2 | 350 FT<sup>2</sup> NATIVE PLANTINGS**

*...template planting plans with corresponding lists of native plants suited to the given function of the plan. The 350 ft<sup>2</sup> area should be planted adjacent to the lake and include a contiguous area, rather than be planted in patches. Functions are based on the goals for the site. For example, one property owner may want to increase bird and butterfly habitat while another would like to fix an area with bare soil. Native planting functions include the following: lakeshore, bird/butterfly habitat, woodland, low-growing, deer resistant, and bare soil area plantings.*



Green Lake, Green Lake County - Lisa Reas

<p><b>LAKE HEALTH BENEFITS</b></p>	<p>Improve wildlife habitat Slow water runoff Promote natural beauty</p>	
<p><b>COSTS</b></p>	<p><b>Range</b> - \$480-\$2400 for 350 ft<sup>2</sup> area, installed <b>Average</b> - \$1000 per 350 ft<sup>2</sup>, installed</p>	
<p><b>TECHNICAL REQUIREMENTS</b></p>	<p>Healthy Lakes Fact Sheet Series: <i>350 ft<sup>2</sup> Native Plantings</i> <a href="http://tinyurl.com/healthylakes">http://tinyurl.com/healthylakes</a>  350 ft<sup>2</sup> Native Plantings Best Practices Manual</p>	
<p><b>REGULATORY INFORMATION</b></p>	<p>DNR: an aquatic plant chemical control permit may be necessary if using herbicides in or adjacent to the lakeshore.  Native plantings must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.</p>	
<p><b>HEALTHY LAKES GRANT FUNDING</b></p>	<p>Maximum of \$1000/350 ft<sup>2</sup> native plantings installed and implemented according to the technical requirements. Only one 350 ft<sup>2</sup> native planting per property per year is eligible for funding.  The native plantings dimension must be 350 ft<sup>2</sup> of contiguous area at least 10 feet wide and installed along the lakeshore. Final shape and orientation to the shore are flexible.</p>	





**PRACTICE 3 | DIVERSION PRACTICE**

...includes a water bar, diverter, and broad-based dip. These practices use a berm or shallow trench to intercept runoff from a path or road and divert it into a dispersion area. Depending on the site, multiple diversion practices may be necessary.



http://awwatersheds.org



<p><b>LAKE HEALTH BENEFITS</b></p>	<p>Divert runoff water.</p>	
<p><b>COSTS</b></p>	<p><b>Range</b> - \$25-\$3750, installed <b>Average</b> - \$200, installed</p>	
<p><b>TECHNICAL REQUIREMENTS</b></p>	<p>Healthy Lakes Fact Sheet Series: <i>Diversion Practice</i> <a href="http://tinyurl.com/healthylakes">http://tinyurl.com/healthylakes</a></p>	
<p><b>REGULATORY INFORMATION</b></p>	<p>DNR: none. Diversion practices must comply with the local shoreland and floodplain zoning ordinance. Consult with your county or municipal zoning staff.</p>	
<p><b>HEALTHY LAKES GRANT FUNDING</b></p>	<p>Maximum of \$1000/diversion practice installed and implemented according to the technical requirements. Healthy Lakes diversion practice grant funding is not intended for large, heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.</p>	

**PRACTICE 3 | DIVERSION PRACTICE**

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http://awwatersheds.org

<p><b>LAKE HEALTH BENEFITS</b></p>	<p>Divert runoff water.</p>	
<p><b>COSTS</b></p>	<p><b>Range</b> - \$25-\$3750, installed <b>Average</b> - \$200, installed</p>	
<p><b>TECHNICAL REQUIREMENTS</b></p>	<p>Healthy Lakes Fact Sheet Series: <i>Diversion Practice</i> <a href="http://tinyurl.com/healthylakes">http://tinyurl.com/healthylakes</a></p>	
<p><b>REGULATORY INFORMATION</b></p>	<p>DNR: none. Diversion practices must comply with the local shoreland and floodplain zoning ordinance. Consult with your county or municipal zoning staff.</p>	
<p><b>HEALTHY LAKES GRANT FUNDING</b></p>	<p>Maximum of \$1000/diversion practice installed and implemented according to the technical requirements. Healthy Lakes diversion practice grant funding is not intended for large, heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.</p>	

**PRACTICE 4 | ROCK INFILTRATION PRACTICE**

...ian excavated pit or trench filled with rock that reduces runoff by storing it underground to infiltrate. A catch basin and/or perforated pipe surrounded by gravel and lined with sturdy landscape fabric may be integrated into the design to capture, pre-treat, and redirect water to the pit or trench. Pit and trench size and holding capacity are a function of the area draining to it and the permeability of the underlying soil.



Deer Lake, Polk County - Cheryl Clemens



<p><b>LAKE HEALTH BENEFITS</b></p>	<p>Divert runoff water. Clean runoff water. Infiltrate runoff water.</p>	
<p><b>COSTS</b></p>	<p><b>Range</b> - \$510-\$9688 per rock infiltration practice, installed <b>Average</b> - \$3800 per rock infiltration practice, installed</p>	
<p><b>TECHNICAL REQUIREMENTS</b></p>	<p>Healthy Lakes Fact Sheet Series: <i>Rock Infiltration Practice</i> <a href="http://tinyurl.com/healthylakes">http://tinyurl.com/healthylakes</a></p>	
<p><b>REGULATORY INFORMATION</b></p>	<p>DNR: none. Rock infiltration practices must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.</p>	
<p><b>HEALTHY LAKES GRANT FUNDING</b></p>	<p>Maximum of \$1000/rock infiltration practice installed and implemented according to the technical requirements. Healthy Lakes rock infiltration practice grant funding is not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.</p>	

**PRACTICE 5 | RAIN GARDEN**

*...a landscaped shallow depression with loose soil designed to collect roof and driveway runoff.*



Shell Lake, Washburn County - Brent Edlin

<p><b>LAKE HEALTH BENEFITS</b></p>	<p>Improve wildlife habitat. Divert runoff water. Clean runoff water. Infiltrate runoff water. Promote natural beauty.</p> 
<p><b>COSTS</b></p>	<p><b>Range</b> - \$500-\$9000 per rain garden, installed <b>Average</b> - \$2500 per rain garden, installed</p>
<p><b>TECHNICAL REQUIREMENTS</b></p>	<p>Healthy Lakes Fact Sheet Series: <i>Rain Garden</i> <a href="http://tinyurl.com/healthylakes">http://tinyurl.com/healthylakes</a></p> <p><i>Rain Gardens: A How-to Manual for Homeowners</i> <a href="http://dnr.wi.gov/topic/Stormwater/documents/RgManual.pdf">http://dnr.wi.gov/topic/Stormwater/documents/RgManual.pdf</a></p> 
<p><b>REGULATORY INFORMATION</b></p>	<p>DNR: none.</p> <p>Rain gardens must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.</p>
<p><b>HEALTHY LAKES GRANT FUNDING</b></p>	<p>Maximum of \$1000/rain garden installed and implemented according to the technical requirements.</p> <p>Healthy Lakes rain garden grant funding is not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.</p>

**FUNDING AND ACCOUNTABILITY**

Administrative details and the application process are described in detail in the DNR’s Water Grant Application and Guidelines (<http://dnr.wi.gov/> search for surface water grants) and the Healthy Lakes website ([http://tinyurl.com/healthy\\_lakes](http://tinyurl.com/healthy_lakes)) and *Administration and Funding FAQ* fact sheet.

**Healthy Lakes grant funding highlights:**

- 75% state share grant with a maximum award of \$25,000, including up to 10% of the state share available for technical assistance and project management. Technical assistance and project management do not include labor and are based on the entire state share of the grant, not the best practice caps.
- 25% match from sponsors, participating property owners or other partners. The grant sponsor may determine individual property owner cost share rates, provided the state’s share of the practice caps (\$1000) and total grant award (75%) are not exceeded. The grant sponsor’s match may include technical assistance and project management costs beyond the state’s 10% share.
- Sponsor may apply on behalf of multiple property owners, and the property owners do not have to be on the same lake.
- Standard 2-year grant timeline to encourage shovel-ready projects.
- Landowners may sign a participation pledge to document strong interest in following through with the project.
- Standard deliverables, including a signed Conservation Commitment with operation and maintenance information and 10-year requirement to leave projects in place. Also:
  - ◆ Native plantings must remain in place according to local zoning specs if within the vegetation protection area (i.e. buffer).
  - ◆ Fish Sticks projects require a 350 ft<sup>2</sup> native planting at shoreline base or commitment not to mow, if the property does not comply with the shoreland vegetation protection area (i.e. buffer) specifications described in the local shoreland zoning ordinance.
- Standardized application and reporting forms and process.
- 10% of projects randomly chosen each year for self-reporting and/or professional site visits.

**PROMOTION**

Wisconsin’s Healthy Lakes Implementation Plan will be supported and promoted as a statewide program. Lake groups, counties, towns, villages, cities, and other partners may choose to adopt and implement the Plan as is or to integrate into their own planning processes. Statewide promotion, shared and supported by all partners, includes the following:

- A Healthy Lakes logo/brand.
- A website with plan, practice, and funding detail to be housed on the Wisconsin Department of Natural Resources’ and University of Wisconsin-Extension Lakes’ websites. It may also include the following:
  - ◆ Link to science and supporting plans.
  - ◆ Shoreline restoration video.
  - ◆ How-to YouTube clips.
  - ◆ Tips on how to communicate and market healthy lakeshores.
  - ◆ Maps with project locations without personally identifiable information.



Wisconsin's Healthy Lakes Implementation Plan and results will be evaluated annually and updated in 2017, if warranted. Best practices may be modified, removed, or added depending on the results evaluation.

The following information will be collected to support an objective evaluation:

- County and lake geographic distribution and participation in Healthy Lakes projects.
- Lakeshore property owner participation in Healthy Lakes projects, including numbers and locations of best practices implemented.
- Standardized Healthy Lakes grant project deliverable report including:
  - ◆ Numbers of Fish Sticks trees and clusters.
  - ◆ Dimensional areas restored.
  - ◆ Structure/floral diversity (i.e. species richness).
  - ◆ Impervious surface area and estimated water volumes captured for infiltration.



Lime Lake, Portage County - Robert Korth

The results may be used to model nutrient loading reductions at parcel, lake, and broader scales and to customize future self-reporting options, like plant mortality and fish and wildlife observations, for lakeshore property owners.

## ACKNOWLEDGEMENTS

Amy Kowalski



L to R: Patrick Goggin, Jane Malischke, Pamela Toshner, Carroll Schaal, Tom Onofrey, Dave Ferris

Wisconsin's Healthy Lakes Implementation Plan and corresponding technical information and grant funding are the results of a collaborative and participatory team effort. We would like to thank the staff, agency, business, and citizen partners, including *Advanced Lake Leaders*, who provided feedback for our team, including the many partners who completed a customer survey and provided valuable comments during the public

review of proposed DNR guidance. We would like to express our gratitude to the following contributors and information sources, respectively: Cheryl Clemens, John Haack, Dave Kafura, Amy Kowalski, Jeshia LaMarche, Flory Olson, Tim Parks, Bret Shaw, Shelly Thomsen, Scott Toshner, Bone Lake Management District, Maine Lake Smart Program, and Vermont Lake Wise Program.

We appreciate your continued feedback as our Healthy Lakes initiative evolves into the future. Please contact DNR Lake Biologist Pamela Toshner (715) 635-4073 or [pamela.toshner@wisconsin.gov](mailto:pamela.toshner@wisconsin.gov) if you have comments or questions.

**Appendix M**

**TREATING LAKES WITH ALUM**

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# ALUM TREATMENTS TO CONTROL PHOSPHORUS IN LAKES

March 2003

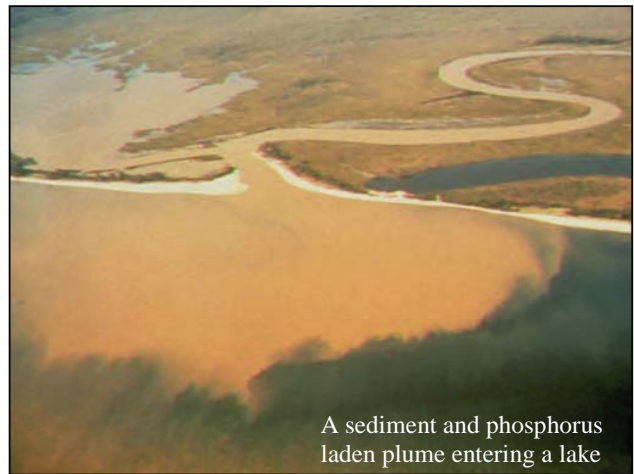
## What is alum and how does it work?

**ALUM** (aluminum sulfate) is a nontoxic material commonly used in water treatment plants to clarify drinking water. In lakes alum is used to reduce the amount of the nutrient **phosphorus** in the water. Reducing phosphorus concentrations in lake water can have a similar clarifying effect by limiting the availability of this nutrient for algae production. Phosphorus enters the water either **externally**, from run-off or ground water, or **internally**, from the nutrient rich sediments on the bottom of the lake. Phosphorus is released from the sediments under anoxic conditions that occur when the lake stratifies and oxygen is depleted from the lower layer. Even when external sources of phosphorus have been curtailed by best management practices, the internal recycling of phosphorus can continue to support explosive algal growth. Alum is used primarily to control this internal recycling of phosphorus from the sediments of the lake bottom. On contact with water, alum forms a fluffy aluminum hydroxide precipitate called **floc**. Aluminum hydroxide (the principle ingredient in common antacids such as Maalox) binds with phosphorus to form an aluminum phosphate compound. This compound is insoluble in water under most conditions so the phosphorus in it can no longer be used as food by algae organisms. As the floc slowly settles, some phosphorus is removed from the water. The floc also tends to collect suspended particles in the water and carry them down to the bottom, leaving the lake noticeably clearer. On the bottom of the lake the floc forms a layer that acts as a phosphorus barrier by combining with phosphorus as it is released from the sediments.

## Why treat a lake with alum?

Increased nutrient loading, particularly phosphorus has accelerated eutrophication of lakes and consequently reduced their ecological health and recreational value. Frequent and pervasive algal blooms, low water transparency, noxious odors,

depletion of dissolved oxygen, and fish kills frequently accompany cultural eutrophication. External sources of phosphorus delivered in run-off from the watershed are often the main contributor of excessive phosphorus to lakes.



A sediment and phosphorus laden plume entering a lake

Typically, the first steps taken in a lake rehabilitation effort target the control the external sources of phosphorus and can include: encouraging the use of phosphorus free fertilizers; improving agricultural practices, reducing urban run-off; and restoring vegetation buffers around waterways.

Lake researchers have learned that lakes are very slow to recover after excessive phosphorus inputs have been eliminated. Furthermore, it's extremely difficult to achieve recovery of lake conditions without additional in-lake management. This is due to the fact that lake sediments become phosphorus rich and can deliver excessive amounts of phosphorus to the overlying water. When dissolved oxygen levels decrease in the bottom waters of the lake (anaerobic conditions), large amounts of phosphorus trapped in the bottom sediments are released into the overlying water. This process is often called **internal** nutrient loading or recycling.

## Is alum toxic to aquatic life?

Some studies have been conducted to determine the toxicity of aluminum for aquatic biota. Freeman and Everhart (1971) used constant flow bioassays, to determine that concentrations of dissolved aluminum below 52 µg Al/L had no obvious effect on rainbow trout. Similar results have been observed for salmon. Cooke, et al (1978) adopted 50 mg Al/L as a safe upper limit for post-treatment dissolved aluminum concentrations. Kennedy and Cooke (1982) indicate that: Since, based on solubility, dissolved aluminum concentrations, regardless of dose, would remain below 50 µg Al/L in the pH range 5.5 to 9.0, a dose producing post treatment pH in this range could also be considered environmentally safe with respect to aluminum toxicity. Guidelines for alum application require that the pH remain within the 5.5-9.0 range.

According to Cooke et al (1993) the most detailed study of the impact of alum treatments on benthic insects was that of Narf (1990). He assessed the long term impacts on two soft water and three hardwater Wisconsin lakes. He found that benthic insect populations either increased in diversity or remained at the same diversity after treatment. The treatment of lakes with alkalinities above 75 mg/L as CaCO<sub>3</sub> are not expected to have chronic or acute effects to biota. Fish related problems associated with alum treatments have been primarily documented in soft water lakes. However, many softwater lakes have been successfully treated with alum, when the treatments are pH buffered.

## Health concerns for people?

Concerns about a connection between aluminum and Alzheimer's have been debated for some time. More recent research points to a gene rather than aluminum as the cause. In addition, aluminum is found naturally in the environment. Some foods, such as tea, spinach and other leafy green vegetables, are high in aluminum. Use of aluminum cookware has not been found to contaminate food sources.

## How much does an alum treatment cost?

Costs of alum application are primarily dependent on the form of alum used (wet or dry), dosage rate, area treated, equipment rental or purchase, and labor. Liquid alum has been used when large alum doses were needed. Treatment costs range from \$280/acre to \$700/acre (\$450=approximate average) depending on the dosage requirements and costs to mobilize equipment.

## How effective are alum treatments, and how long do they last?

A number of case studies have been conducted on lakes that have undergone nutrient inactivation with alum. Eugene Welch and Dennis Cooke (1995) evaluated the effectiveness and longevity of treatments on twenty one lakes across the United States. They concluded that the treatments were effective in six of the nine shallow lakes, controlling phosphorus for at least eight years on average. Applications in stratified lakes were highly effective and long lasting. Percent reduction in controlling internal phosphorus loading has been continuously above eighty percent. The study did however find that alum treatment of lakes with high external loading was not effective.



## References

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**Appendix N**

**PREVENTING THE SPREAD OF  
AQUATIC INVASIVE SPECIES**

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## FOR MORE INFORMATION

If you would like more information about aquatic invasive species, the problems they cause, regulations to prevent their spread, or methods and permits for their control, contact one of the following offices:

Wisconsin Department Of Natural Resources  
888-WDNRINFO  
DNR.WI.GOV search "Aquatic Invasives"

University of Wisconsin- Extension  
(715) 346-2116  
WWW.UWSP.EDU/CNR/UWEXLAKES

Wisconsin Sea Grant  
(608) 262-0905  
WWW.SEAGRANT.WISC.EDU  
WWW.PROTECTYOURWATERS.NET

Thanks to the following for supporting educational efforts on aquatic invasive species:

- U.S. Fish and Wildlife Service
- Great Lakes Indian Fish and Wildlife Commission
- National Park Service

The Wisconsin Department of Natural Resources provides equal opportunity in its employment, programs, services, and functions under and Affirmative Action Plan. If you have questions, please write to Equal Opportunity Office, Department of Interior, Washington D.C. 20240.

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# STOP Aquatic HITCHHIKERS



## ENJOYING THE GREAT OUTDOORS

Enjoying the great outdoors is important to many of us. Boating, fishing, hunting, and wildlife watching are traditions that we want to preserve for our children and their children. Today, these traditions are at risk. Aquatic invaders such as zebra mussels, purple loosestrife, Eurasian water-milfoil, bighead and silver carp, threaten our valuable waters and recreation. These and other non-native, or exotic, plants and animals do not naturally occur in our waters and are called invasive species because they cause ecological or economic harm.

These invasive species can get into lakes, rivers, and wetlands by "hitching" rides with anglers, boaters, and other outdoor recreationists, who transport them from one waterbody to another.

Once established, these "aquatic hitchhikers," can harm native fisheries, degrade water quality, disrupt food webs and reduce the quality of our recreational experiences.

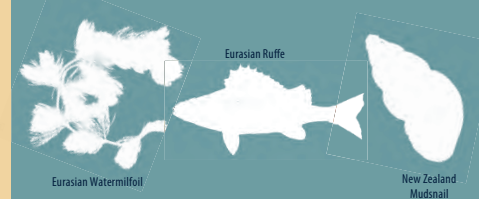


The good news is that the majority of waters are not yet infested with invasive species and by taking the necessary steps you can help protect our valuable waters.

## If you think you have found an INVASIVE SPECIES:

### REPORT NEW SIGHTINGS

If you suspect a new infestation of an invasive plant or animal, save a specimen and report it to a local Department of Natural Resources or Sea Grant office. Wisconsin has "ID" cards, websites, and volunteer monitoring networks to help you identify and report invasive species.



### CONSULT YOUR NATURAL RESOURCE AGENCY

Do-it-yourself control treatments may be illegal and can make matters worse by harming native fish, wildlife, and plants. Before attempting to control an invasive species or add new plants along your shoreline, contact your local Department of Natural Resources office. DNR staff can provide recommendations and notify you what permits are required.



DNR.WI.GOV search "Aquatic Invasives"



## STOP AQUATIC HITCHHIKERS

IS A NATIONAL CAMPAIGN THAT HELPS RECREATIONAL USERS TO BECOME PART OF THE SOLUTION TO STOP THE TRANSPORT AND SPREAD OF AQUATIC INVASIVE SPECIES.

### IN WISCONSIN IT IS THE LAW...



#### INSPECT boats, trailers, and equipment

#### REMOVE all attached aquatic plants, animals, and mud before launching and before leaving the water access.

Many invasive species spread by attaching themselves to boats, trailers, and equipment and "hitching a ride" to another waterbody. Therefore, Wisconsin law requires that you remove these aquatic hitchhikers before you launch your boat or leave the access area.

#### DRAIN all water from your boat, motor, bilge, live wells, bait containers and all equipment before leaving the water access.

Many types of invasive species are very small and easily overlooked. In fact, some aquatic hitchhikers, like zebra mussel larvae, are invisible to the naked eye. To prevent the transport of these aquatic hitchhikers drain water from all equipment before you leave the access area.



Draining ballast water and lake or river water can prevent the spread of aquatic invasive species and fish diseases, like VHS.

For more information visit: **DNR.WI.GOV** and search "bait laws"



#### NEVER MOVE

plants or live fish away from a waterbody.

In Wisconsin, it is illegal to transport any aquatic plants, mud, live fish or live fish eggs away from any state waterbody. This includes live gamefish and roughfish, like gizzard shad. There are exceptions for minnows obtained from a Wisconsin licensed bait dealer or registered fish farm, which may be transported away live and used again:

- On the same waterbody, or
- On any other waterbody if no lake or river water, or other fish were added to their container



#### BUY

minnows from a Wisconsin licensed bait dealer.

For more information on collecting your own minnows visit:

**DNR.WI.GOV** and search "VHS Prevention"



#### DISPOSE

of unwanted bait and other animals or aquatic plants in the trash.

If possible, dispose of ALL unwanted bait (including earthworms) in a trash can at the boat landing or access point. Otherwise, take them home and dispose of them by placing them in the trash, composting them, or using them in a garden as fertilizer. Likewise, other aquatic plants or animals that you collect, or buy in a pet store, should NEVER be released into the wild.



When possible, dispose of unwanted bait in the trash at access points. Never release them into the environment.

Aquatic hitchhikers can spread in many ways such as on recreational equipment, and in water. Fortunately, there are a few simple actions you can take to prevent them from spreading.

#### WISCONSIN REGULATION

Wisconsin has several laws to prevent the spread of aquatic invasive species and the fish disease Viral Hemorrhagic Septicemia (VHS). Failure to follow Wisconsin law can result in fines up to or exceeding \$2000. Don't be caught unaware!

#### ADDITIONAL STEPS:

Although not required by WI law, additional steps are highly recommended, particularly if you are transporting a boat and/or equipment from one waterbody to another. Additional steps include:

**SPRAY, RINSE, or DRY** boats and recreational equipment to remove or kill species that were not visible when leaving a waterbody. Before transporting to another water: *Spray/rinse with high pressure, and/or hot tap water (above 104° F or 40° C), especially if moored for more than a day. OR Dry for at least five days.*

**DISINFECT** boats and recreational equipment to kill species and fish diseases that were not visible when leaving a waterbody. Many aquatic hitchhikers can survive out of water for some period of time. *To prevent their spread, you can sanitize your boat, trailer or equipment by washing it with a mixture of 2 Tbs of household bleach per 1 gallon of water.*

#### OTHER WATER USES:



Don't get caught spreading aquatic invasive plants or animals! Wisconsin laws, as highlighted above, can apply to many types of water activities, not just boating and fishing. Although these activities might not seem dangerous, they CAN establish and spread invasive species. It is important you follow the steps above for all water activities in order to prevent the spread of aquatic invasive species. These activities include:

- Using personal watercraft
- Shore and fly-fishing
- Sailing
- Scuba Diving
- Waterfowl hunting



**FAILURE TO FOLLOW WISCONSIN LAWS CAN LEAD TO FINES.**

For additional information contact your local DNR staff or visit: **DNR.WI.GOV**

## Protect Your Boat

Zebra mussels attach to a variety of materials, including fiberglass, aluminum, wood, and steel and may damage a boat's finish. Veligers are extremely small and can be drawn into engine passages. Once they settle out in the engine cooling system, they can grow into adults and may block intake screens, internal passages, hoses, seacocks, and strainers. The best ways for boat owners to avoid these types of damage are:

✔ **Use a boatlift** to completely remove the watercraft from the water when not in use.

✔ **Run your boat regularly** if it is moored in zebra mussel infested waters. Run the engine at least twice a week at slow speeds (about 4-1/2 mph) for 10 to 15 minutes. Monitor engine temperatures – if you notice an increase, it may mean that zebra mussels are clogging your cooling system. Immediately inspect the system and remove any zebra mussels. The end of boating season is also a good time to inspect and clean the cooling system.

✔ **Lift the motor out of the water between uses if mooring.** Fully discharge any water that may still remain in the lower portion of the cooling system.

✔ **Tip down the motor and discharge the water when leaving a waterbody** to reduce the likelihood of transporting veligers (in water) to another waterbody.



✔ **Clean your boat and equipment.** Physically remove (scrape) adult mussels from your boat, trailer, and equipment by hand. Young zebra mussels and veligers may be too small to see. Wash your boat with high-pressure hot water (use water >104°F if possible). Use high-pressure cold water if hot water is not available. (Avoid pressure washing classic wooden boats or others not made of metal.)

✔ **Apply anti-fouling paints or coatings to the hull and the engine's cooling system** to prevent zebra mussel attachment. It is best to purchase these from an area boat dealer or your local marina. Anti-fouling paints that are copper based can be used in Wisconsin, and typically need to be reapplied every one to two years. In-line strainers can also be installed in the engine's cooling system.

✔ **Use motor "muffs", also known as motor flushers, to remove zebra mussels and other materials from your boat engine or personal watercraft.** Clamp the motor



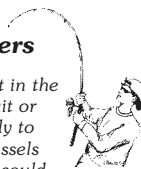
Amy Bellows, WI DNR

flusher onto the lower unit over the cooling inlets on either side of the motor, and screw the nozzle of your garden

hose into it. Run the boat engine for approximately 10 minutes or as suggested by the manufacturer.

### Special note of caution for anglers

Dispose of unwanted bait in the trash - do not transfer bait or water from one waterbody to another. Larval zebra mussels or other invasive species could be present in the water with the bait.



### Help prevent aquatic hitchhikers from catching a ride on your boat or equipment:

- ✔ **Inspect and remove** aquatic plants and animals,
- ✔ **Drain** water,
- ✔ **Dispose** of unwanted bait in the trash,
- ✔ **Rinse** with hot and/or high-pressure water, OR
- ✔ **Dry** for 5 days.

### Clean Boats . . . Clean Waters

**For a list of known zebra mussel infested waters, visit:**  
[www.dnr.wi.gov/org/water/wm/GLWSP/exotics/zebra.html](http://www.dnr.wi.gov/org/water/wm/GLWSP/exotics/zebra.html)

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*This publication is available in alternative format (large print, Braille, audiotape, etc.) upon request. Please call 608/267-7694 for more information.*



Cover photo: L. Pohlod. Inset: Great Lakes Sea Grant Network  
Designed by L. Pohlod, Blue Sky Design, LLC PUB-WT-383 2004

## Zebra Mussel Boater's Guide

*Looking to the future . . . protect your boat and our waters!*

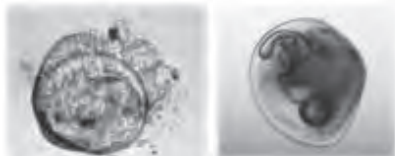
## Zebra mussel identification and life cycle

Mature zebra mussels look like small D-shaped clams. Their yellowish-brown shells have alternating light and dark stripes.

Zebra mussels can reach a maximum of 2 inches in length, though most are smaller than an inch. They are typically found attached to solid objects, often growing in large clusters.



Ohio Sea Grant



Ontario Ministry of Natural Resources

Amy Bellows, WI DNR

Zebra mussels begin as eggs, then develop into free-swimming larvae (called **veligers**), which are microscopic. The veliger photos shown above were taken with the aid of a microscope. Veligers are spread by currents; after about three weeks, they settle out and firmly attach themselves to hard surfaces, where they grow into adults. Their lifespan is typically three to five

years. They begin to reproduce after a year or two - females can release up to one million eggs per year!



James Lubner,

University of Wisconsin Sea Grant

## What do zebra mussels do?

Zebra mussels are **filter feeders** that can filter large volumes of water (up to 1 Liter/day). In some cases they can filter the whole volume of a lake in a few months. They remove plankton - tiny plants and animals - from the water. What they eat (and what they don't eat) ultimately ends up on the lake or river bottom. Plankton is an important food source for young fish, native mussels, and other aquatic organisms. Zebra mussels may concentrate this food at the bottom, leaving open water species with **less to eat!**

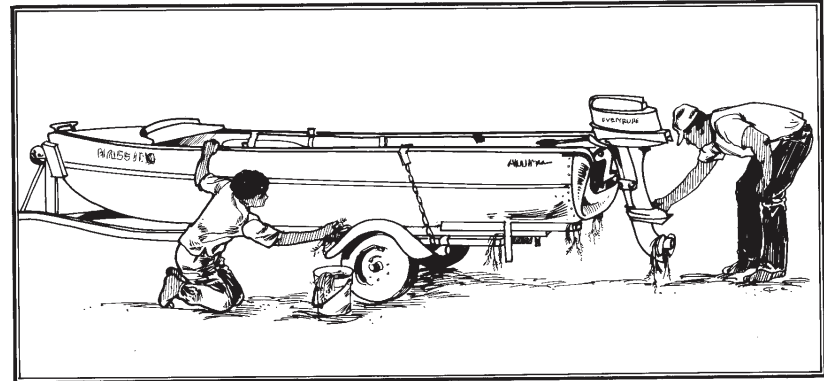
Because they are so good at filtering, zebra mussels often **make water clearer**. This may force **light-sensitive fish**, like salmon and walleye, into deeper water to seek shelter from the sun. Increased light penetration allows aquatic plants to grow in deeper water and spread to a larger area. This may help smaller fish to survive by giving them places to hide, but makes it harder for large, predatory fish to find food. **Thicker plant growth** may also cause problems for boaters and anglers.



Don Schloesser, Great Lakes Science Center, National Biological Services

Zebra mussels cause people additional problems. They **clog water intakes and pipes** - large water users on the Great Lakes spent \$120 million from 1989 to 1994 to combat zebra mussels. They also **attach to piers, boatlifts, boats, and motors**, which can cause damage requiring costly repair and maintenance. Even when they die, their **sharp shells** wash up on beaches, creating foul odors and cutting the feet of swimmers.

## How can I help prevent the spread of zebra mussels?



Microscopic veligers may be carried in livewells, bait buckets, bilge water - any water that's transported to another waterbody. They can also travel in currents to downstream waters. Adults can attach to boats or boating equipment that are moored in the water. They frequently attach to aquatic plants, which themselves may hitch a ride on boats and equipment. For these reasons, it is important to take the following steps to prevent the spread of zebra mussels and other aquatic invasive species while boating:

### Before moving your boat from one water body to another:

- ✓ **Inspect** and **remove** aquatic plants, animals, and mud from your boat, trailer, and equipment,
- ✓ **Drain** all water from your equipment (boat, motor, bilges, transom wells, live wells, etc.),
- ✓ **Dispose** of unwanted bait in the trash, not in the water,

- ✓ **Rinse** your boat and equipment with hot (> 104°F) and/or high pressure water, particularly if moored for more than one day, OR
- ✓ **Dry** your boat and equipment thoroughly (in the sun) for five days.

### Pressure washing note:

- ✘ Avoid pressure washing classic and wooden boats, along with canoes and kayaks that are not made of metal. These types of boats should be drained, cleared of all plant and animal materials, and left in the sun to dry completely.

Effective May 2002, Section 30.715, WI Act 16 prohibits launching a boat or placing a boat or trailer in navigable waters if it has aquatic plants or zebra mussels attached.