Management of Rooted Aquatic Vegetation, Algae, Leeches, and Swimmer's Itch, 2014

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Executive Summary 2014 Aquatic Plant Management Program

In Minnesota the state is the owner of wild rice and other aquatic vegetation growing in public waters (*Minnesota Statutes* 84.091). The Minnesota Department of Natural Resources (DNR) regulates the harvest, transplanting, and destruction of aquatic plants in public waters through a permit program (*Minnesota Statutes* 103G.615). The purpose of the aquatic plant management (APM) permit program is to protect the beneficial functions that aquatic plants provide to lakes, while allowing riparian property owners to obtain reasonable access to public waters.

The 2014 legislature amended *Minnesota Statutes* 103G.615 to include a definition for invasive aquatic plant management permits. The amendment defined an invasive aquatic plant management permit as an APM permit that authorizes the selective control of invasive aquatic plants to cause a significant reduction in the abundance of the invasive aquatic plant.

In 2012 the coordinator of the APM program was moved from the Division of Ecological and Water Resources to the Section of Fisheries where the APM program specialists are located. This was a consequence of a reorganization of the program in the fall of 2011. In addition, the responsibility for the issuance of permits for the management of invasive aquatic plants was transferred from the Section of Fisheries to the Division of Ecological and Water Resources, invasive species program (ISP).

In 2014 the ISP received 306 applications for invasive aquatic plant management permits. Of the 306 applications received 38 applications were withdrawn, four applications were denied, and 264 permits were issued for the selective management of invasive aquatic plants on a lake or bay-wide basis.

Public Waters/Permits/Properties/Fees

In 2014 there were 2,112 public waters with active APM permits. Of the 2,112 public waters with active permits, 829 public waters had permits that were issued during 2014. The number of public waters where aquatic plant management is permitted increased gradually from 1953 until 2000. In recent years the number of lakes with permitted APM activity stabilized at around 900 per year. In 2014 there were 14 fewer lakes with permitted APM activity than in 2013.

The number of APM permits issued statewide reached its peak in 2007 at 4,633 permits. In 2014 the Central Region issued 30 more permits than in 2013. The largest regional increase in the number of permits issued in 2014 was in the Northwest Region, where they issued 39 more permits than in 2013. Statewide permit numbers have decreased from 2008 through 2014. In 2014 there were 3,676 permits issued, 21 fewer permits than in 2013.

The number of property owners applying for APM permits statewide continued to decline in 2014. The number of properties with permitted aquatic plant management activities decreased in regions 1, 2, and 3, and increased slightly in Region 4, the South Region. There were 439 fewer properties participating in the APM program in 2014 than in 2013.

In 2012 it was determined that invasive aquatic plant management permits would be issued without a fee. This policy (in addition to the decline in the numbers of properties applying for a permit) and the decrease in permit fees for property owners on lakes 20 acres or less in size, contribute to the decline in permit fee revenue. In 2013 permit fees generated $213,000 in revenue and in 2014 permit fees generated approximately $207,000 a reduction of $6,000.

Automated Aquatic Plant Control Devices

The Department first began issuing permits for Automated Aquatic Plant Control Device's (AAPCD's) in 1997. In 2014 permits for AAPCD's accounted for about 28% of the total number of APM permits issued. The remaining 72% of APM permits issued allowed treatment with pesticides or mechanical removal as the method of control.

The APM rules provide two permit options for AAPCD operation. A person applying for a permit to operate the device in an area greater than 2,500 square feet is required to obtain an annual permit. However, a three-year permit option is available for persons who limit the size of the area of AAPCD operation to 2,500 square feet or less (*Minnesota Rules*, part 6280.0450, subp.3, item A). Revisions to the APM rules implemented in the 2009 permit season restrict submersed aquatic plant removal to 100 feet of shoreline or one-half the owner's frontage whichever is less (*Minnesota Rules*, part 6280.0350, subp. 1a). As a result of this change many more permit holders became eligible for an AAPCD permit of three year duration in 2009.

In 2014 there were 637 three-year AAPCD permits issued, 152 fewer than in 2013. The number of single season AAPCD permits issued in 2014 (392) decreased by 22 from 2013. The total number of AAPCD permits issued in 2014 was down by 174 permits when compared to 2013. Persons who obtained a three-year permit in 2014 will not have to apply for a permit again until the year 2017.

Most AAPCD permits are issued to a single property owner. In 2014 AAPCD's made up 28% of the permits issued and accounted for 14% of the total number of properties permitted.

Summary of Aquatic Plant Management permits issued by type in 2014 and active permits.

Region	Mechanical Pesticidal***	2014 Issued Channel *	<2013 Valid Channel **	AAPCD's with pesticide control	AAPCD Issued 2014 1 year	AAPCD Issued 2014 3 year	AAPCD Issued 2013 3 year	AAPCD Issued 2012 3 year	All Valid Permits	Restoration Permits Issued
Reg 1	532	46	-	92	227	254	323	718	2,100	5
Reg 2A	59	10	-	0	0	5	8	10	92	2
Reg 2B	547	26	-	36	69	220	205	296	1,363	9
Reg 3A	873	19	-	10	53	27	45	49	1,066	14
Reg 3B	319	14	-	8	35	87	149	169	773	9
Reg 4	198	4	-	1	8	44	59	58	371	1
All	2,528	119	1,292	147	392	637	789	1,300	7,057	40

* Channel permits are of unlimited duration and issued to the property owner to mechanically maintain a channel no more than 15 shoreline feet wide in emergent vegetation.

** All valid permits as of 03/26/2015. Total by Region cannot be calculated because Region boundaries were changed in 2003. *All Valid Permits* = Permits issued in 2014 and all valid AAPCD and channel permits excluding restoration permits.

*** Excludes permits for AAPCD's and channel permits.

It is important to note that the numbers of permits and applicants in a single year is only part of the story. In addition to AAPCD permits that can be issued for up to 3-years, a lakeshore property owner can obtain a permit of unlimited duration to mechanically maintain a channel 15 feet wide through emergent vegetation. Multi-year AAPCD permits account for roughly 39% of the total number of valid permits in 2014. In 2013 there were 1,292 valid channel permits, about 18% of the total number of valid permits. The total number of valid permits in 2014 was 7,057 including 2,920 annual permits. This does not include 264 permits issued by the Division of Ecological and Water Resources for lake or bay-wide management of invasive aquatic plants.

Commercial Harvest

The Department also issues permits that allow commercial harvest and sale of aquatic plants. Reporting on the use of these permits is not an established practice. The Northwest region issued 2 commercial harvest permits. These permits allowed commercial harvest of aquatic plants on three lakes. Total harvesting from these permits include 265 lbs of Sago tubers (Unnamed lake, Clay County), 105 lbs wild celery tubers (Osakis, Todd County), and 161 lbs of wild celery seed pods (Big Sugar Bush, Becker County).

Summary of all APM permits issued for control of aquatic plants and nuisances, numbers of public waters and participating properties in 2014.

Region	All Permits Issued in 2014*	Public waters permitted in 2014**	Public waters permitted in 2013**	Change in public water permitted	Properties Permitted in 2014	Properties Permitted in 2013	Change in properties permitted by Region
Reg 1	1,059	256	239	+17	1,059	1,087	-28
Reg 2A	74	36	38	-2	74	78	-4
Reg 2B	862	126	130	-4	1,034	1,145	-111
Reg 2 total	936				1,108	1,223	-115
Reg 3A	972	219	235	-16	3,351	3,531	-180
Reg 3B	455	121	128	-6	1,344	1,482	-138
Reg 3 total	1,427				4,695	5,013	-318
Reg 4	254	71	80	-9	618	596	+22
2014 TOTAL	3,676	829	843	-14	7,480	7,919	-439
2013 TOTAL	3,697						
CHANGE	-21						

* Permits issued for restoration work are excluded.
** Includes all lakes, ponds, ditches and streams listed on APM permits for 2014.

Trends and Observations

Aquatic plant control in Minnesota is highly seasonal. Most aquatic plant control in Minnesota takes place in the months of June, July and August. This trend has been consistent for many years because much of the aquatic plant control is recreationally motivated.

Lakeshore residents often hire commercial services to perform aquatic plant control. Statewide commercial services performed approximately 64% of permitted aquatic plant control. However, in the Central Region commercial services perform about 81% of permitted aquatic plant control.

Many APM permits are issued on an annual basis. Approximately 73% of 2014 permit holders responding to the survey indicated that they would reapply for a permit in 2015. Of the APM permit holders that did their own control in 2014 77% reported using their permit. Permits that were issued to property owners that hired a commercial service were more likely to be used (93% of these permits were used).

Lakeshore property owners may apply for a permit to control filamentous algae and chara (a form of macro-algae) with copper sulfate. Applications requesting filamentous algae control were up (11%) over 2013. The control requests for chara also increased (11.5%) from 2013.

Blue green algae blooms are a common nuisance in eutrophic Minnesota lakes. Copper sulfate, a common algaecide, can provide temporary relief from nuisances caused by blue green algae. However, the control obtained by lake-wide application of copper sulfate is usually temporary and treatment is often required at least twice per season. In addition, there is the threat of fish kill from oxygen depletion caused by the decomposition of dead algae. The numbers of lakes where the residents seek a permit to control blue green algae with copper sulfate has been declining since 1997 and continued to decline in 2014 (see Figure 13, page 36).

Swimmer's itch, an infection caused by an immature life stage of flukes common in waterfowl, is present in many Minnesota lakes. Lakeshore property owners can get a permit to use copper sulfate to control snails that harbor the immature life stage. The numbers of permits requesting swimmer's itch control has been increasing steadily since 1997 and was up (11%) in 2014 compared to 2013.

INTRODUCTION

Value of Aquatic Plants

Aquatic plants are essential components of most freshwater ecosystems. The habitat aquatic plants provide in the shallow near-shore areas is important to both aquatic and terrestrial animals. They also serve important functional roles in lakes by stabilizing the lake bottom, cycling nutrients, and preventing shoreline erosion.

Many of Minnesota's most sought-after fish species depend on aquatic vegetation throughout their life histories. Yellow perch, northern pike, muskellunge, panfish, and bass all depend on aquatic vegetation to provide food, spawning habitat, and nursery areas. Juvenile fish of most species feed on small crustaceans and insects that are abundant in stands of aquatic vegetation. Even species that may not require vegetation for spawning depend on the cover and forage found in aquatic vegetation.

Many species of wildlife are dependent on aquatic plants for food and nesting sites. Ducks eat the seeds and tubers produced by various water plants. Other aquatic plants, which are not eaten directly by waterfowl, support many insects and other aquatic invertebrates that are important food sources for migratory birds and their young. Ducks have been known to alter migration patterns in response to food availability. Emergent aquatic vegetation provides nesting cover for a variety of waterfowl, wading birds, shorebirds and songbirds. The reproductive success of ducks that nest near lakes is closely tied to available aquatic plants and the cover they provide to hide young birds from predators.

The muskrat, an important furbearer, is almost entirely dependent on aquatic vegetation for food and shelter. Minnesota's largest mammal, the moose, also relies heavily on aquatic vegetation for food.

The distribution of many amphibians and reptiles is directly linked to the vegetation structure of aquatic habitats. Species preference for particular habitat types is related to food availability, types of escape cover, and specific microclimates. Emergent and submerged vegetation support invertebrate populations that are an important food source for amphibians and reptiles. During the breeding season some species of frogs call from emergent vegetation at the water's edge and their egg masses are often attached to aquatic plants. Freshwater turtles often eat submerged vegetation, which is an important source of calcium.

Beyond providing food and shelter for fish and wildlife, aquatic vegetation is important in maintaining a stable lake environment. Aquatic vegetation helps maintain water clarity by limiting the availability of nutrients and preventing suspension of bottom sediments. Aquatic plants limit erosion of shorelines by moderating the effects of wave and ice erosion. A healthy native plant community is also important in preventing the establishment of non-native invasive aquatic plants. In short, aquatic plants serve many important functions for lakes, fish, and wildlife. Many of the things that we enjoy most about lakes are directly linked to aquatic vegetation.

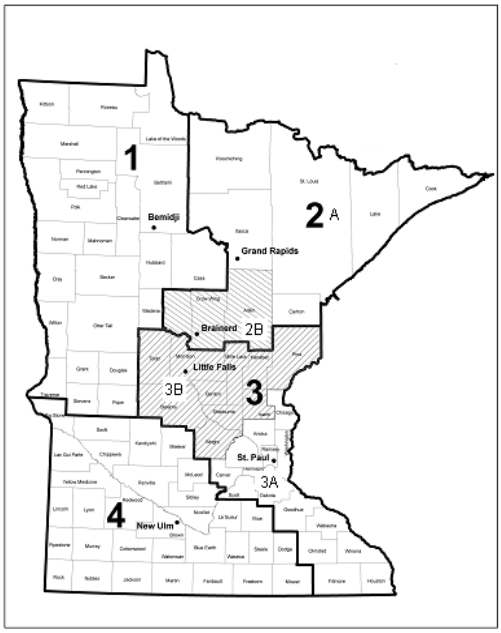
The Aquatic Plant Management Program (APM)

Riparian property owners (lakeshore property owners) in Minnesota have a right to use and access the lake adjacent to their property. Aquatic vegetation may interfere with a lakeshore homeowner's ability to exercise that right. The purpose of the DNR's APM program is to regulate how much aquatic vegetation lakeshore residents can control to ensure that the beneficial functions aquatic plants provide are preserved.

Other aquatic organisms can also interfere with the lakeshore property owner's enjoyment of the lake. Swimmer's itch, caused by the immature life stage of a parasite common in waterfowl, can cause significant and sometimes severe discomfort in humans depending upon a person's sensitivity to the organism. Algae (plankton and filamentous) can also create a nuisance and occasionally unhealthy conditions when they become overabundant. Relief from these nuisances may also be sought under an APM permit.

Administrative Regions

DNR Administrative Regions by county as of October 2006



NW Region 1

Bemidji
Kittson
Roseau
Lake of the Woods
Marshall
Polk
Pennington
Red Lake
Beltrami
Norman
Mahnomen
Clearwater
Hubbard
Cass
Clay
Becker
Wadena
Wilkin
Otter Tail
Traverse
Grant
Douglas
Stevens
Pope

NE Region 2

Grand Rapids (2A)
Koochiching
Itasca
St. Louis
Lake
Cook
Carlton

Brainerd (2B)
Crow Wing
Aitkin
Cass

Central Region 3

St. Paul (3A)
Anoka
Carver
Chisago
Dakota
Hennepin
Ramsey
Scott
Washington
Goodhue
Wabasha
Olmstead
Winona
Fillmore
Houston

Little Falls (3B)
Benton
Isanti
Kanabec
Pine
Mille Lacs
Morrison
Sherburne
Stearns
Todd
Wright

South Region 4

Big Stone
Swift
Kandiyohi
Meeker
McLeod
Renville
Chippewa
Lac Qui Parle
Yellow Medicine
Lincoln
Lyon
Redwood
Nobles
Jackson
Martin
Faribault
Freeborn
Mower

The DNR's Division of Fish and Wildlife is responsible for the administration of the APM permit program. Riparian property owners apply for an aquatic plant control permit to the Regional Fisheries Manager in the region where their lake property is located. APM specialists in each region conduct application review, site inspections when necessary, and make permit recommendations.

The recommendation for the decision on the permit application (approval, modification, or denial) is determined during the review process. This decision may involve a discussion with the lakeshore property owner. When applications for APM permits are received for shallow lakes where waterfowl management is the primary focus, the APM specialist will seek the advice of the Area Wildlife Manager. When applications are modified or denied, the applicant may appeal to the Commissioner's Office for review of the permit decision. The purpose of this review is to determine if the permit decision was based upon rule standards. Finally, permit decisions can be appealed to an Administrative Law Judge through the contested case hearing process.

The APM program coordinator is the Department's contact with commercial mechanical control businesses, commercial aquatic pesticide applicators, and the Minnesota Department of Agriculture (MDA). The coordinator provides technical expertise on aquatic plant control methods and permitting requirements to lakeshore property owners and Department staff. The coordinator works to insure consistent interpretation of the APM rules throughout the Department. This position administers exams and issues operating permits to commercial mechanical control companies. This person also reviews appeals of permit decisions for the Commissioner. The program coordinator prepares an annual report on program activities (this document) and coordinates the development of informational materials and forms provided to riparian property owners interested in aquatic plant management.

The APM program coordinator supervises staff whose job responsibilities include enforcement of aquatic pesticide rules and pesticide label requirements. The Aquatic Pesticide Enforcement Specialist conducts inspections of herbicide treatments in public waters to monitor compliance with state and federal pesticide law and responds to reports of pesticide misuse (Appendix Table A & B). The U.S. Environmental Protection Agency (EPA) partially funds DNR's aquatic pesticide enforcement activities through a grant administered by MDA.

Regulations

Authority for the DNR's APM program is found in Minnesota Statutes M.S. 84.091 Subdivision 1, which designates ownership of wild rice, and other aquatic vegetation growing in public waters, to the State and M.S. 103G.615 which authorizes the Commissioner of the DNR to issue permits to harvest or destroy aquatic plants, establish permit fees, and prescribe standards to issue or deny permits for aquatic plant control. The standards for the issuance of permits to control aquatic vegetation and the permit fee structure are found in MN Rules Chapter 6280. Minnesota Statutes and Rules can be reviewed at the Revisor of Statutes website http://www.leg.state.mn.us/leg/statutes.asp.

The 2012 legislature amended *Minnesota Statutes* 103G.615 to include a definition for invasive aquatic plant management permits. The amendment defined an invasive aquatic plant management permit as a permit that authorizes the selective control of invasive aquatic plants to cause a significant reduction in the abundance of the invasive aquatic plant. Invasive aquatic plant management permit applications are reviewed, and permits issued, by invasive species program staff within the Division of Ecological and Water Resources.

The invasive species program received 306 applications for invasive aquatic plant management permit in 2014. Of the 306 applications received 38 applications were withdrawn, 3 applications were denied and 264 permits were issued for selective management of invasive aquatic plants on a lake or bay-wide basis. Invasive aquatic plant management permits are issued without fee.

The rules governing aquatic plant management (M.R. chapter 6280) were last revised in 2009. Significant changes to the APM rules included:

- The addition of specific criteria used to evaluate applications for permit. The decision to issue, modify or deny permits is based on these criteria;
- The revised rules specify conditions that can be placed on permits such as limits on amount of control, restrictions on method and timing of control, and restrictions on the species of plant targeted by the control.
- The revised rules reduce the maximum amount of near shore vegetation that can be removed under permit by individuals to 100 feet or one-half their frontage whichever is less.
- The revised rules specify that automated plant control devices may not be used in areas of soft sediment with an average sediment depth of 3 inches or greater.
- Under the revised rules a provision that allowed certain lakes to exceed the 15% littoral zone limit on plant control with herbicides will sunset. This provision also required DNR to work with the affected lake associations to develop a lake vegetation management plan (LVMP). These plans were completed in 2014.
- The revised rule clarifies conditions for "commercial harvest permits" that allow the harvest of aquatic plants, and plant parts from public waters for purposes of sale.
- The revised rules specify when variances may be issued, the criteria to be considered, and allows for mitigation for adverse effects on aquatic habitat caused by an APM permit that includes a variance.

- The revised rules specify when an LVMP can be used and what information the LVMP should contain.

A permit from the DNR is required to use pesticides for aquatic plant and nuisance control in public waters (generally any body of water 2.5 acres or larger within an incorporated city limit, or 10 acres or larger in rural areas, *Minnesota Statutes* 103G.005, subd. 15 and 15a), to use an automated aquatic plant control device, to control emergent vegetation such as cattails, wild rice, or bulrush and to control submerged or floating leaf vegetation above specified limits. A riparian property owner may, without a permit, physically remove (cut, pull, or harvest) *submerged* vegetation along one half the individual's lake frontage or 50 feet, whichever is less. The total area may not exceed 2,500 square feet. In addition, a boat channel up to 15 feet wide, and as long as necessary to reach open water, may also be maintained by mechanical means without a permit. If floating leaf vegetation is interfering with riparian owner access a channel, not more than fifteen feet wide, extending to open water, may be mechanically maintained without a permit. Aquatic plants that are cut or pulled must be removed from the lake and the managed area must remain in the same location each year.

The mechanical control of purple loosestrife, a plant on the Minnesota Department of Agriculture's noxious weed list, does not require a permit from the DNR. However, herbicide control of purple loosestrife below the ordinary high water level on public waters does require a permit. Because of the plant's status as a noxious weed, these permits are issued free of charge.

Beyond the permit requirement, pesticides used in surface waters must be registered with the Department of Agriculture for sale and use in Minnesota. The product must also be registered for aquatic use by the United States Environmental Protection Agency. When using an aquatic herbicide all label instructions and precautions must be followed. The permittee must post areas treated with herbicides so that anyone entering the area is informed of the herbicide application. The signs contain the following information: the name of the applicator, the treatment date, the name of the product used, expiration dates of any water use restrictions on swimming, fishing, irrigation, household, and other uses. The DNR provides these signs to permit holders and commercial applicators at no cost. A list of herbicides commonly used for aquatic plant control and the amounts used under permit in Minnesota from 1987-2014 is found in Appendix Tables C and D.

NPDES/SDS Permit

In November of 2011 the Minnesota Pollution Control Agency (MPCA) published the National Pollution Discharge Elimination System (NPDES) permit for the application of pesticides to water. This is the MNG87D000 Vegetative Pests and Algae Control Pesticide General Permit. Because the DNR's aquatic plant management rules are more restrictive in many ways than the NPDES permit requirements, the DNR and the MPCA entered into an interagency agreement that allows DNR's aquatic plant management permit to satisfy requirements of the NPDES/SDS permit. The threshold for a notice of intent (NOI) is for treatment of greater than 15% of the littoral zone of lakes that are 20 acres or larger in size. DNR rules require a permit for all aquatic

pesticide applications for aquatic plant and nuisance control in Minnesota public waters. Persons who obtain an aquatic plant management permit do not need to apply for an NPDES permit for pesticide control of aquatic plants or nuisances in public water.

SUMMARY OF APM PROGRAM ACTIVITIES IN 2014

The following summary of APM program activities in 2014 comes from four sources: permittee survey forms (Appendix Tables E and F), commercial aquatic applicator and commercial mechanical control reports, and the APM permit database. When we describe information taken from permit holder or commercial company surveys in a table or figure in the report, the term "*reported*" is used. When we discuss data in the report taken from the APM permit database the term "*permitted*" is used.

Commercial applicators, mechanical control companies, and riparian property owners who do control work in public waters are required to provide a yearly summary of their APM activity. With this information the past year's activities can be summarized, the control of aquatic vegetation in public waters is monitored, and trends in aquatic plant management are identified.

Survey forms are mailed to permit holders that did their own aquatic plant control work. Prior to 2000, permit holders that hired commercial applicators to perform the control work for them were included in the survey. They were asked to answer only those few questions pertinent to their situation. This often caused confusion and permittees would either not respond or would send the form to the commercial service for completion. In addition, when commercial applicators do the control work there are usually many customers on a single permit. Nevertheless, only one of those customers is listed as the permittee. Hence, this approach relied on one individual to provide accurate information for up to 100 or more other lakeshore property owners. Since commercial pesticide applicators are required by law to keep detailed records and their reporting is generally more precise, permit holders who hire a commercial firm are no longer asked to complete a survey form. Survey forms were sent to all permittees that did their own pesticidal or mechanical control work in 2014. Of the 1,244 surveys mailed 1108 (89%) were returned. A separate survey was sent to 1,027 AAPCD permit recipients and 917 (89%) were returned.

Permit Issuance

In 2014, a total of 3,676 permits were issued statewide for APM activities (this excludes 40 shoreline habitat restoration permits), 24 fewer than in 2013 (Appendix Table G provides the county by county distribution of permits and permitted properties). Figure 1 provides the regional breakdown of permit issuance, including the number of lakes in each region with permitted APM activity. The number of permitted properties continued to decline in 2014 (Figure 2).

Figure 1. All APM permits issued, and the number of lakes with permitted aquatic plant control, by region, in 2014.

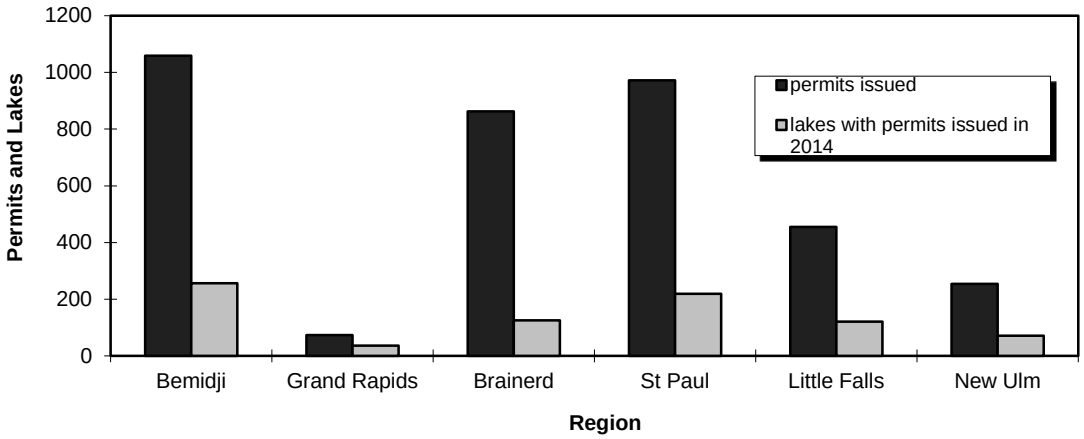
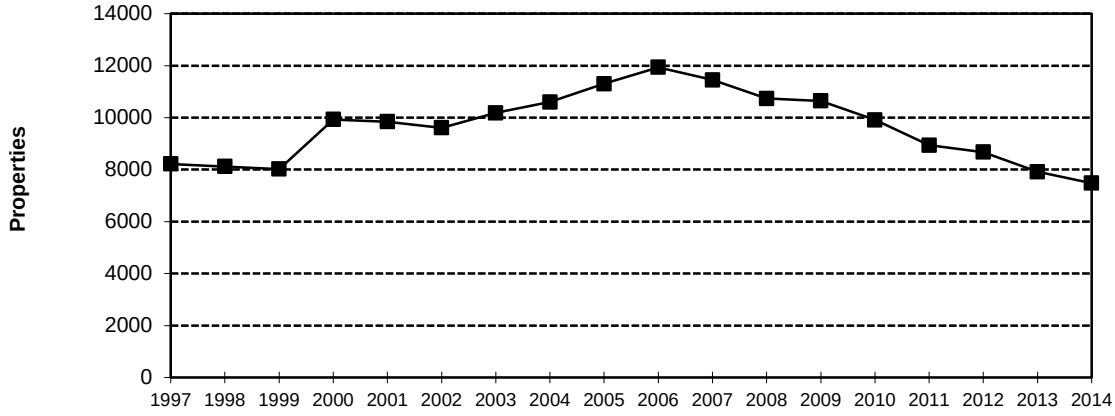
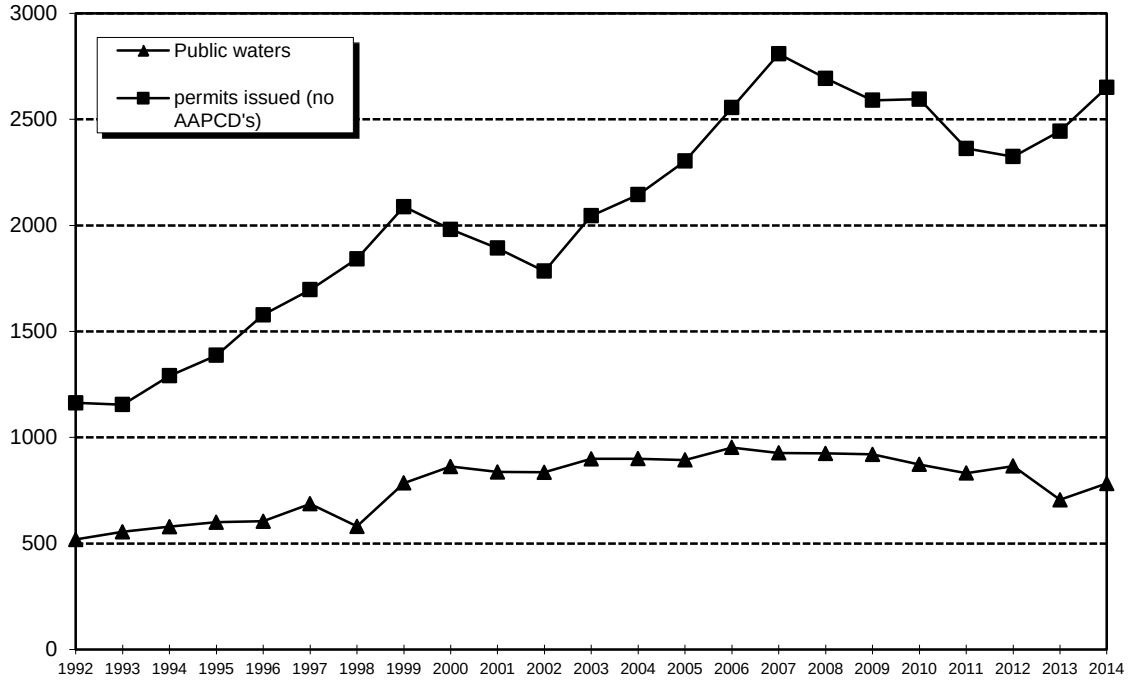


Figure 2. Numbers of properties issued APM permits for aquatic plant control statewide, 1997-2014.



In 2014, there were 1,027 permits issued for the operation of Automated Aquatic Plant Control Devices (AAPCD). The remaining 2,647 aquatic plant control permits were issued to municipalities and lakeshore homeowners for pesticide use (includes algae and swimmer's itch control), and mechanical control (cutting, pulling, or harvesting) of aquatic vegetation (Figure 3).

Figure 3. Numbers of APM permits issued for mechanical pesticidal control (excluding AAPCD) of aquatic vegetation, algae, and swimmer's itch, and numbers of lakes where permits were issued 1992-2014.



Over the last 17 years, the number of public waters where permits are issued has increased. Minor increase occurred until 1999 when the number of public waters with permitted APM activity increased sharply. The number of public waters permitted in 2014 for APM activity (excluding AAPCD) was 783, an increase of 77 lakes from 2013.

There were 100 lakes with APM permits in 2013 where APM permits were not issued in 2014. In addition, 609 lakes had permitted APM activity in both 2013 and 2014. These numbers exclude lakes with multiple year permits (3-year AAPCD and channel permits of unlimited duration).

In 2014, 497 of the APM permits issued were reported not used for various reasons, and 162 of these were for AAPCD use. Of the remaining 335 permit holders (excluding the AAPCD permit holders) that did not use their permit, 118 indicated that they would reapply for APM permit in 2015. This only includes permittees performing their own control.

APM permit issuance increased annually from 1992 until about 1999. In the early 2000's, the numbers of permits issued decreased and there was a corresponding decrease in the numbers of participating properties. Permit numbers and properties began to increase again in 2003 through 2006. In 2014 the total number of property owners participating in the aquatic plant management program decreased for the eighth year in a row. Cooler temperatures in the early part of the open water season resulting in slower plant growth, colder water for swimming, or high water may have contributed to the decline in lakeshore property owners participating in the APM program in 2014.

Lakeshore homeowners can apply for an APM permit as a group. The average number of properties per permit statewide in 2014 was 2.0; similar to the average for 2013 (2.1). Group permits are more popular in the Twin Cities metropolitan area than in Greater Minnesota (Table 1). Homeowner's on large group permits can benefit from the $750 cap on permit fees. The individual permit fee ($35.00 per property) begins to decrease for multiparty permits with more than 21 applicants. There are a few permits with more than 100 applicants, or properties, participating on a single permit. In 2014 there were 7,480 properties on 3,676 permits. This number excludes the 40 permits issued to lake shore property owners for restoration of aquatic habitat.

The Central Region, which includes the Twin Cities metropolitan area, typically has larger group permits than other areas of the state. In 2014, the Central Region averaged 3.6 properties per permit, relatively the same property per permit from 2013 (3.4). The Northwest averaged one property per permit. The Northeast Region averaged 1.3 properties per permit. The average number of properties per permit in the Southern Region in 2013 (2.1) increased slightly in 2014 to 2.8 properties per permit.

Table 1. APM Permits grouped by the number of properties listed (excluding AAPCD) by Region, 2014.

Region		1	2A	2B	3A	3B	4
Properties/permit	>100	0	0	0	1	0	0
	51-100	0	0	1	3	5	0
	21-50	0	0	0	30	10	7
	11-20	0	0	3	42	11	4
	2-10	1	0	5	138	37	30
	1	578	69	565	680	270	161

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

The rules regulating aquatic plant removal from public waters require an inspection of the treatment site for properties with no previous permit history, or when there are changes in the size of the treatment area, methods used, or the target plant species, requested from the previously issued permit. APM specialists and area fisheries staff visit these sites to determine if the permit application is consistent with the criteria for permit issuance in APM rules. In 2014 there were about 1,040 site inspections conducted. The site inspection provides an opportunity to determine what kinds of plants and habitat are present in the proposed treatment area. During the inspection, the size of the area may be reduced to protect important habitat based on the observations and professional judgment of the APM specialist. Approximately 80% of all near-shore control permit requests were issued unchanged (Table 2).

Table 2. Percent of permits requesting near-shore control that are issued as requested by region in 2014.

	Region						
	1	2A	2B	3A	3B	4	Statewide
number of applications requesting near-shore control	947	54	791	684	343	139	2,958
permits issued as requested*	785	45	605	525	278	117	2,355
% of permits issued as requested	83	83	76	77	81	84	80

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

*Includes permits that allowed more shoreline than requested

Permit Duration

Until 1997 aquatic plant management permits were issued for a one year term. However, in 1997 the APM rules were revised allowing two types of permits to be issued for longer than a single season. Emergent vegetation control permits can be issued for a period of unlimited duration if the control is limited to a channel not more than 15 feet wide, that remains in the same location each year, and is maintained mechanically after the first year. A person requesting a permit to use an automated aquatic plant control device can obtain a permit of three years duration if they agree to

operate the device in an area not to exceed 2,500 square feet and the device remains in the same location each year. The permit fee for the longer term permits is the same as the permit fee for annual permits.

These longer term permits are intended to offer an incentive to the property owner to remove less aquatic vegetation. In exchange for the smaller area of control the property owner does not have to make an application for a permit on an annual basis and they receive a permit of extended duration at the same cost as a permit issued for a single year. The extended duration permit also benefits the DNR by reducing the annual permit work load for program staff.

As shown in Figure 3a the number of permits of more than annual duration (active permits) is greater than the number of annual permits issued in 2014. Figure 3 also shows an increasing proportion of multi-year permits following the 1997 rule revision. Permits issued for more than one year are most often issued to individuals. The number of emergent vegetation permits of continuous duration and the number of three year duration AAPCD permits represents an additional estimated 4,147 properties under DNR APM permit in 2014. Figure 3b shows the number of emergent vegetation channel permits issued annually since 1997. The difference in the total number of permits between years is the number of permits issued that year. For example the total number of active emergent vegetation channel permits in 2013 was 1,292. The total number of active emergent vegetation channel permits in 2014 was 1,411, therefore 119, the difference between the two totals, is the number of emergent vegetation unlimited duration permits issued in 2014.

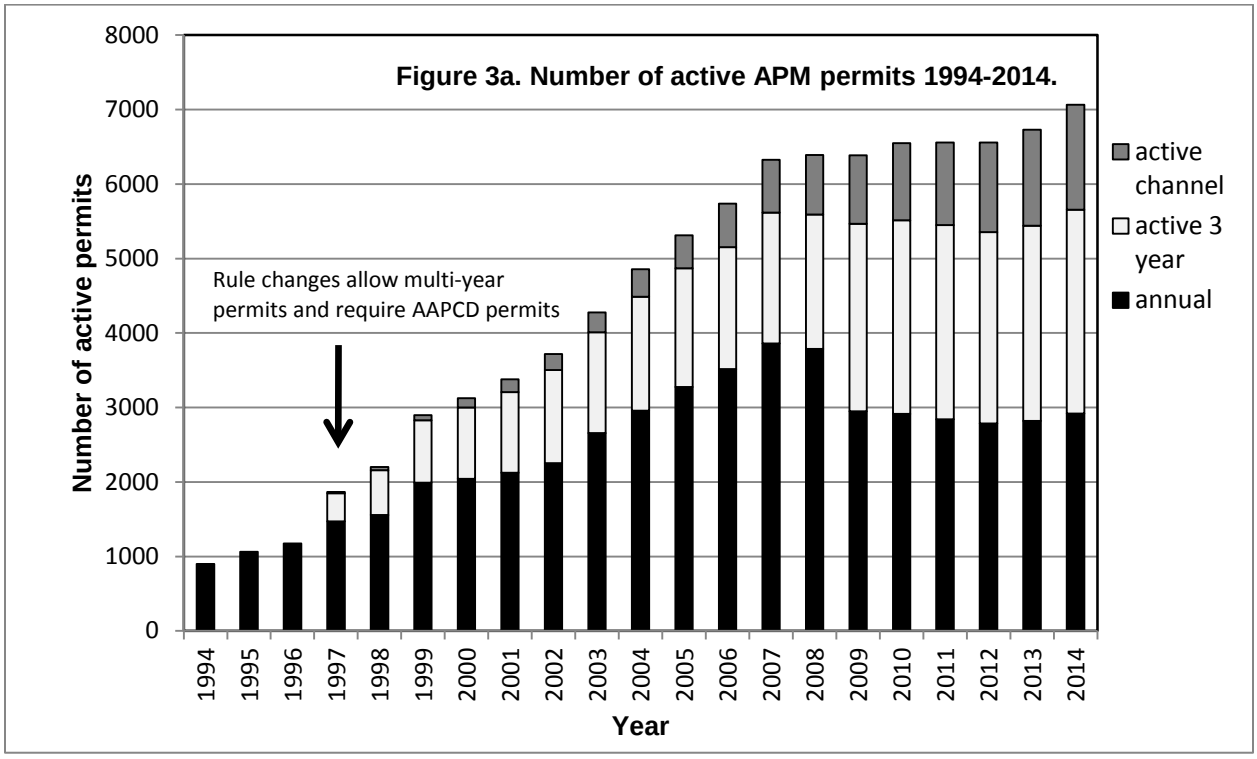


Figure 3a. Number of active APM permits 1994-2014.
Number of active permits
Year
Rule changes allow multi-year permits and require AAPCD permits
active channel
active 3 year
annual
0
1000
2000
3000
4000
5000
6000
7000
8000
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

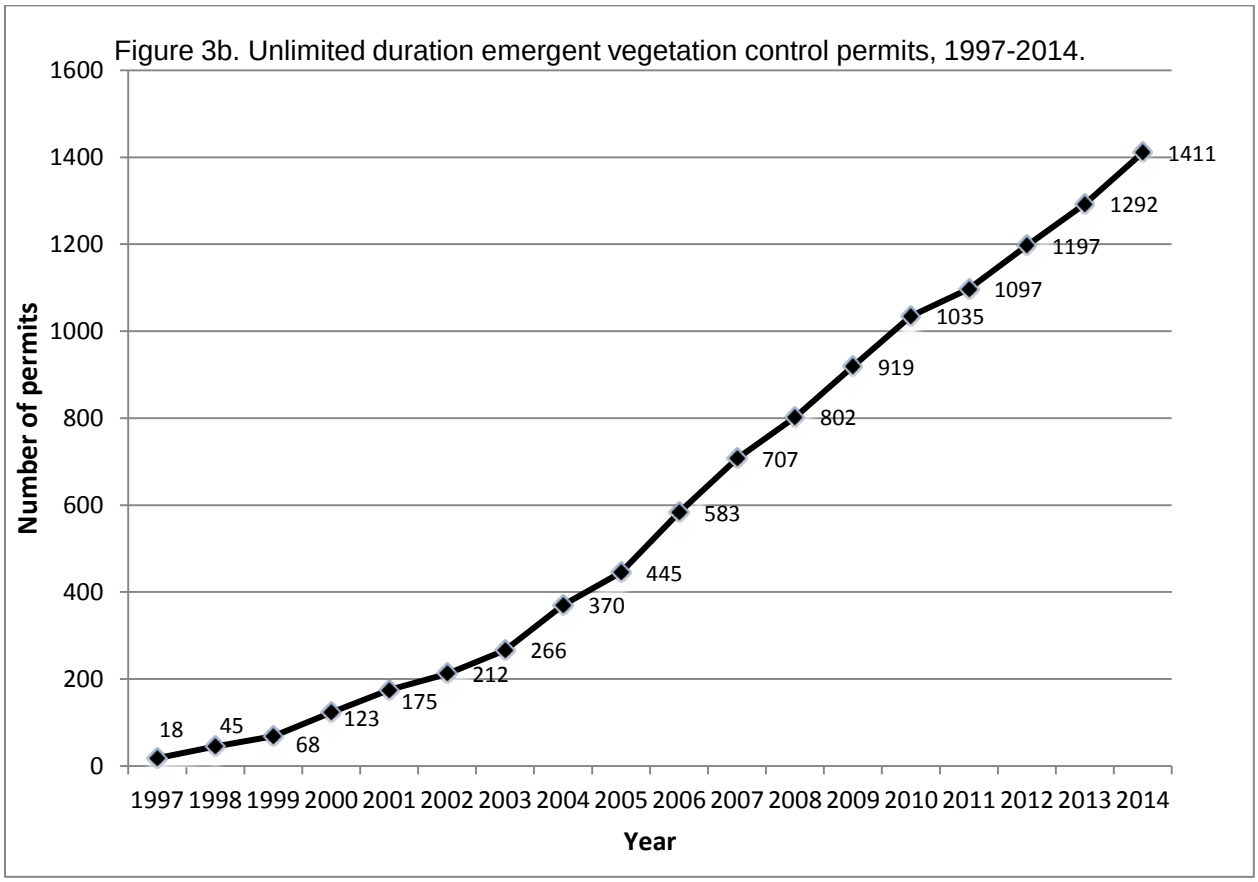


Figure 3b. Unlimited duration emergent vegetation control permits, 1997-2014.
Number of permits
Year
0
200
400
600
800
1000
1200
1400
1600
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
18
45
68
123
175
212
266
370
445
583
707
802
919
1035
1097
1197
1292
1411

Permit Fees

Fees for APM permit were last increased during the 2003 legislative session. The fee increased applications for most aquatic plant control permits from $20.00 per property to $35.00 per property. The cap on group permits to control submersed vegetation was increased from $200 to $750.

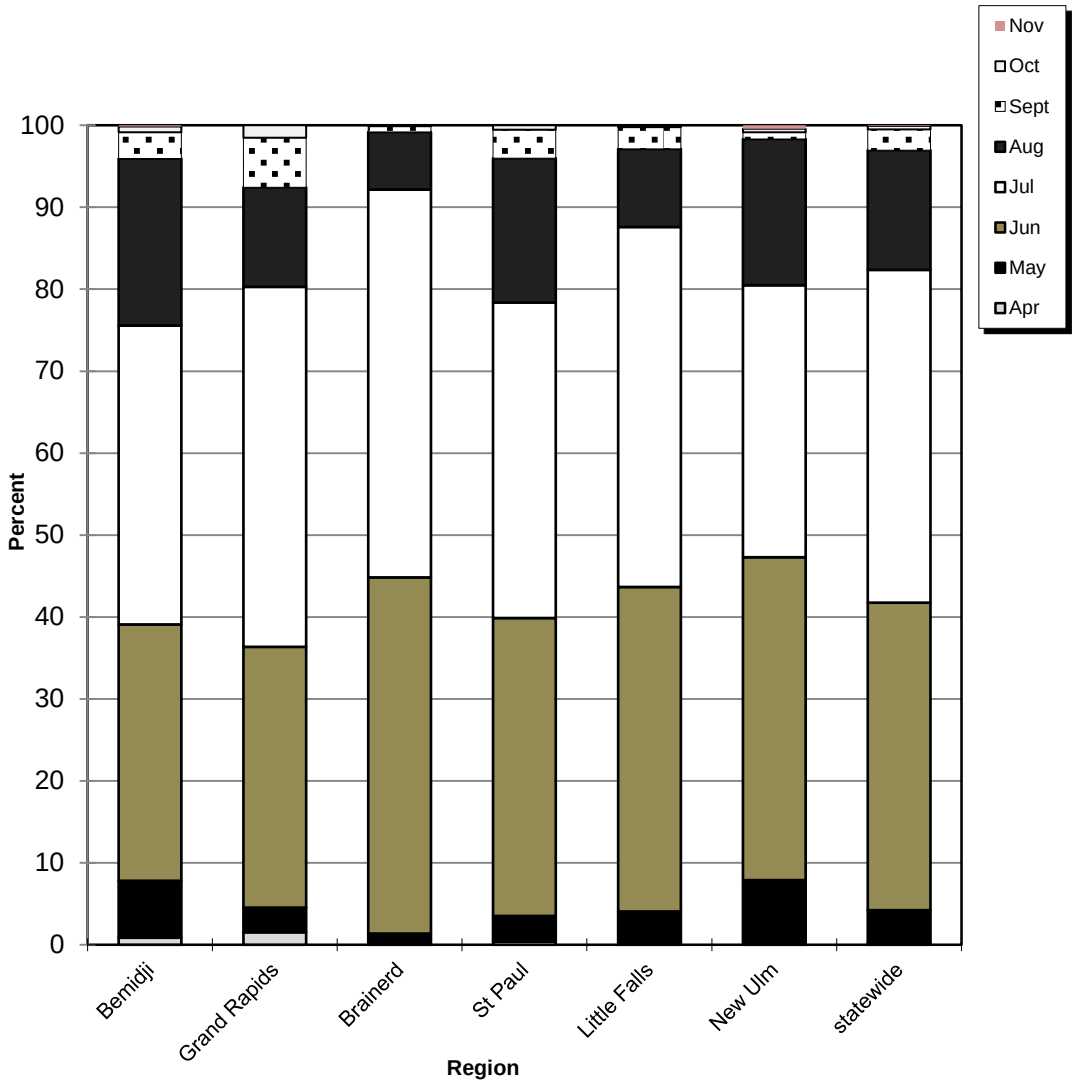
During the 2010 legislative session some permit fees were reduced. The fee for aquatic plant control on water bodies 20 acres or less was reduced to half of the permit fee for larger lakes. The fee for aquatic plant control on water bodies 20 acres or less in size for an individual is $17.50 and the cap on permit fees for group permits is $375.00. The reduction went into effect after most permits had been issued for 2010, therefore the reduction was not evident until 2011.

Permit fee revenues in 2014 were lower than 2013 and 2012 revenues. In 2014, permit fees were approximately $207,000, about $6,000 less than 2013 ($16,000 less than 2012). Prior to the legislative change during the 2011 session that defined an invasive aquatic plant management permit (IAPM), these permits were issued with fee. Issuing the IAPM permit free of charge also contributes to the reduction in permit fee revenues.

Timing of Treatment

Permits are issued for the open water season, generally from May through September 1. However, aquatic plant control can begin as early as January and extend through November. In 2014 94% of the permitted work, reported statewide, was completed in June, July, and August (Figure 4).

Figure 4. Percent of reported APM work by month for each region in 2014.

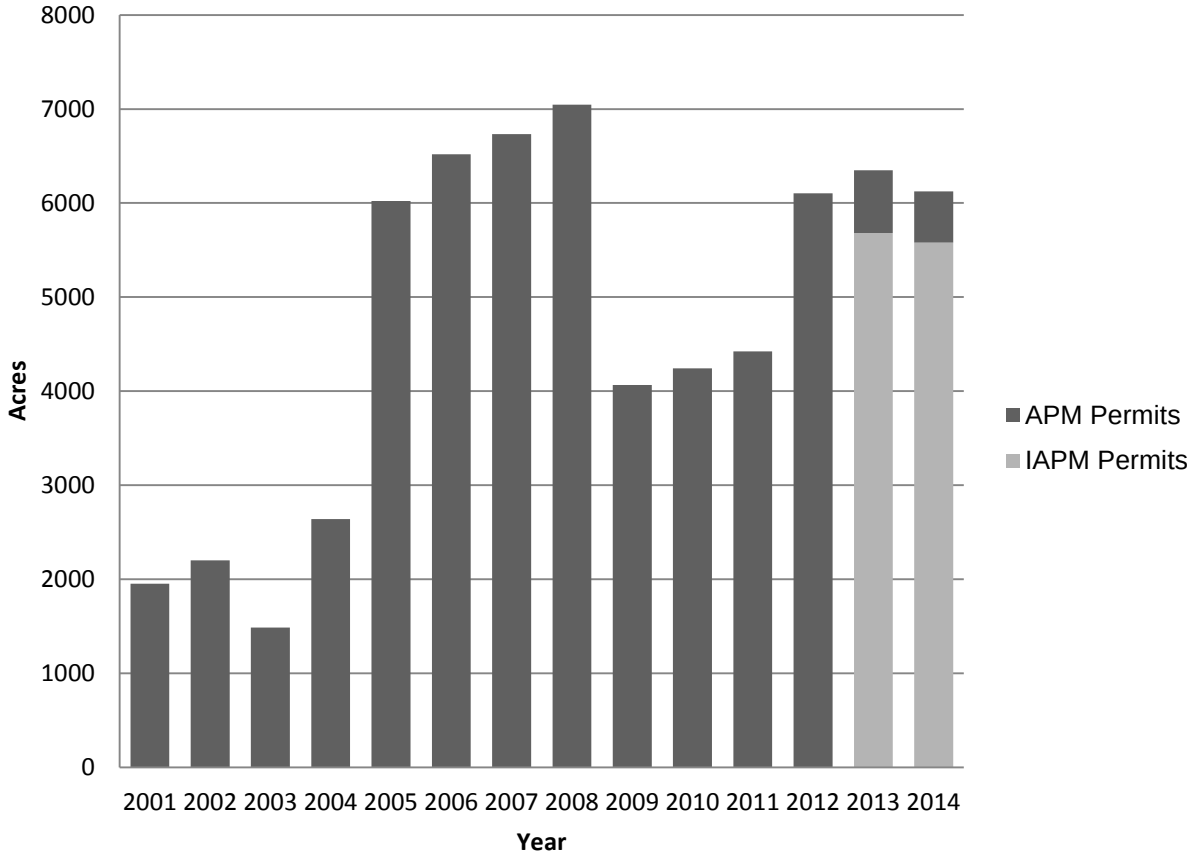


Permitted Off-shore Acres of Herbicide Control of Aquatic Plants

The number of acres permitted for control of submersed aquatic plants using pesticides has fluctuated annually until 2005 when a sharp increase was recorded (Figure 5). The largest contributing factor is the offshore control of aquatic vegetation focused primarily on non-native invasive species. A few large Eurasian watermilfoil and curly-leaf pondweed treatments can have a significant influence on the total number of acres permitted for treatment. This was evident between 2004 and 2005. In 2005, several lake-wide treatments of curly-leaf pondweed in the Central Region were responsible for the increase in treated acres. These lakes, in addition to Lake Benton, a 3000-acre lake in Lincoln County (South Region), were treated again in 2006, 2007, and 2008 with an aquatic herbicide to manage curly-leaf pondweed. In 2009, the curly leaf-pondweed treatment in Lake Benton was reduced to 254 acres. In 2010 approximately 120 acres of curly-leaf pondweed was treated in Lake Benton, resulting in a 2,630 acre decrease from Lake Benton alone.

In 2012, permits issued for the management of invasive aquatic plants were separated from the APM program and issued by the invasive species program staff in the Division of Ecological and Water Resources. In Figure 5, which shows the acres of offshore control with herbicides, the bar representing offshore control for 2014 is separated into two segments. The bottom segment represents the acres permitted for offshore herbicide control of invasive aquatic plants (5,580 acres) and the top portion represents the acres permitted for the offshore herbicide control for native species (545 acres).

Figure 5. Permitted off-shore pesticidal control acreage of aquatic vegetation statewide from 2001-2014.



** Acreage reported prior to 2013 did not distinguish between permits issued for the control of invasive aquatic plants (IAPM permits) and permits issued for native aquatic plant control (APM permits). Therefore, it should not be concluded that there were no permits issued for invasive species management prior to 2013.*

Aquatic Plant Control Methods

In 2014, about 29% of all permits issued for aquatic plant control allowed plant removal with AAPCD's, down 3% from 2013. Aquatic plant control using herbicides, commercial mechanical control, and plant removal by hand, accounted for the remaining 71% of the APM permits issued (Figure 6). It is important to remember that a limited amount of mechanical control of submerged and floating leaf vegetation can be done without a permit and a permit is always required when herbicides or automated devices are used for aquatic plant control. The total area permitted statewide for the various methods of near shore aquatic plant removal and the average area permitted per property in 2014 are found in Table 3. Permit holders were asked if they performed the control over the entire area allowed in their permit. Nearly 25% of those responding indicated that they treated less than the area permitted; identical to what was reported in 2013.

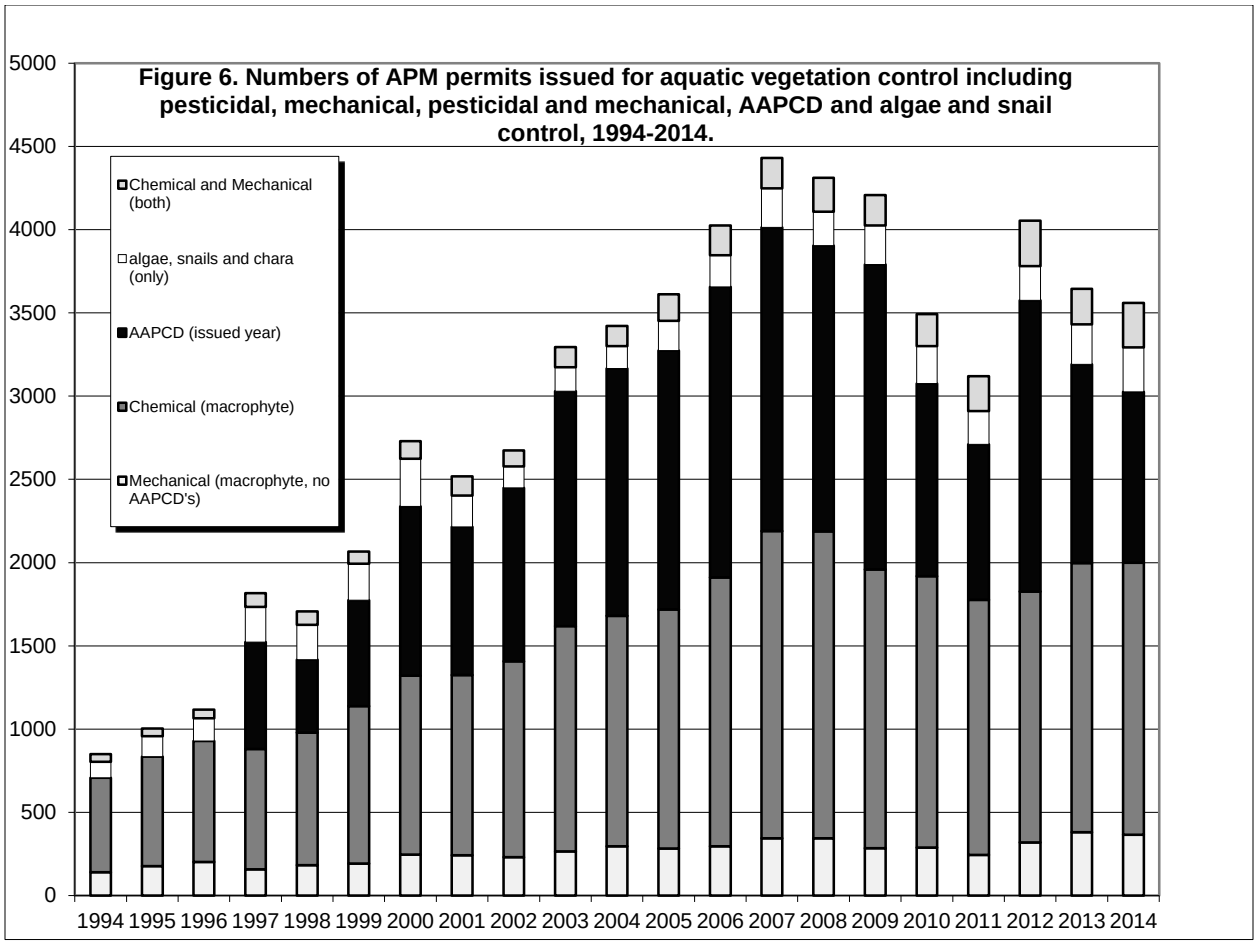


Figure 6. Numbers of APM permits issued for aquatic vegetation control including pesticidal, mechanical, pesticidal and mechanical, AAPCD and algae and snail control, 1994-2014.
Chemical and Mechanical (both)
algae, snails and chara (only)
AAPCD (issued year)
Chemical (macrophyte)
Mechanical (macrophyte, no AAPCD's)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

Table 3. Total near-shore area permitted, in acres, by region, for control of submerged vegetation, swimmer's itch, and AAPCD use in 2014.

Control	Region						Total number of acres	Props	Ave. Prop. (sq. Ft.)
	1	2A	2B	3A	3B	4			
Herbicide control excluding open water treatment	45.0	5.0	70.0	277.0	42.0	11.0	451.0	3053	7443
Mechanical control excluding open water removal	7.0	1.0	6.0	13.0	1.0	0.5	29.0	378	3071
Herbicide & mechanical control excluding open water treatment	15.0	1.0	4.5	11.0	0.5	6.0	38.0	223	6838
Swimmer's itch control *	41.0	4.0	64.0	217.0	36.0	13.0	374.0	2700	6752
AAPCD 2014 issued	39.0	0.1	17.0	6.0	8.0	3.0	73.0	1009	3160

* includes all permits with swimmers itch control

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

Percent of Aquatic Plant Removal Permits Used

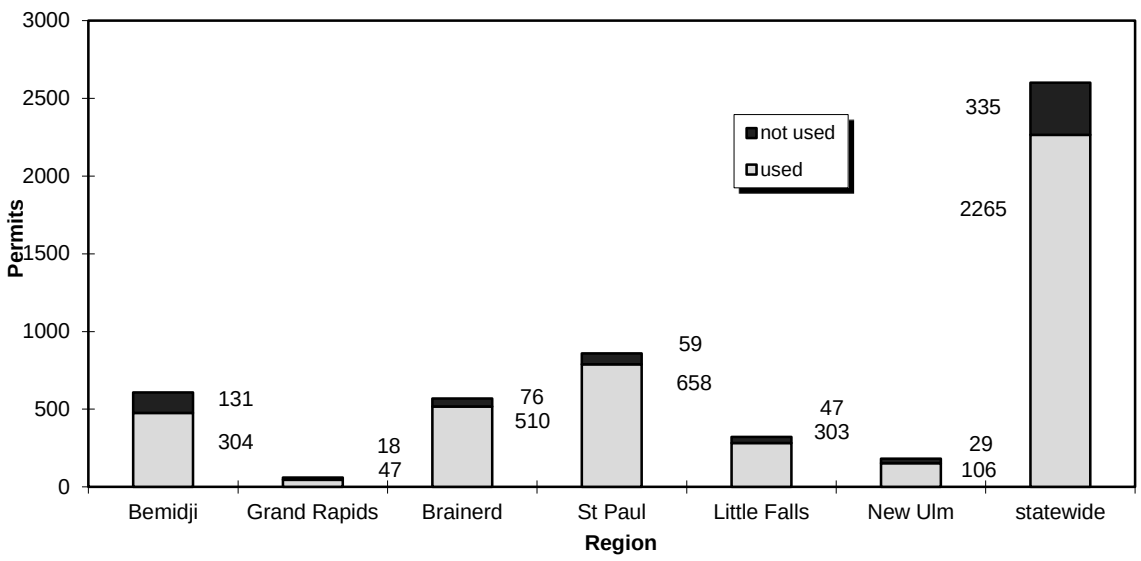
Each year some permits issued for aquatic plant management activities are not used (Figure 7). Statewide, 77% of permits issued were reported used by permittees who did their own control. Commercial applicators/operators reported using 94% of the permits issued for work they did. Permittees indicating that their permit was not used were asked to indicate why by responding to one or more choices provided on the survey. The results are summarized in Table 4, below. In 2014, the reason most frequently given (47%) for not using an APM permit was because the permittee was unable to do the work for any given reason.

Table 4. Response by permit holders to choices indicating that their APM permit was not used, expressed as a percent by region in 2014.

Region	1	2A	2B	3A	3B	4	Statewide %
nuisance condition did not develop	17	2	11	3	5	7	19
got permit too late	8	1	5	2	4	3	10
unable to do the work	48	5	20	18	14	6	47
other	22	5	8	10	6	7	24

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

Figure 7. Total reported number of permits used and not used by region (excluding AAPCD permit holders), 2014.



Who Does Control

Commercial applicators and mechanical control companies performed about 64% of the permitted control statewide in 2014. This represents a 9% increase from the percent of the permitted control done by commercial applicator and commercial mechanical control companies in 2013. Permit holders in the Central Region hire commercial services more frequently than any other region (Figure 8a). In 2014 commercial aquatic plant control companies performed about 81% of the permitted control in the Metro Area. In 2014, 69% of the permitted control in the Northeast Region was performed by commercial service. Most of this control is in the Brainerd Lakes Area of the NE Region. In the Grand Rapids area (2A) of the NE Region most permitted control (78%) is done by the homeowner. Permit holders perform about 61% of the permitted control in the Northwest Region and 46% in the South Region. Property owner conducted control in 2014 decreased from 2013(Figure 8b).

Satisfaction

Permittees who personally undertook aquatic plant control activities were asked to indicate their satisfaction with the results of the aquatic plant control. Generally, permit holders were satisfied with the results of the control. About 52% of the respondents were satisfied with the results of herbicide control. About 76% of those responding were satisfied with the results of treatments to control swimmer's itch and 62% of respondents were satisfied with results of mechanical control. It is important to remember that permit holders hiring commercial services were not included in the survey.

Figure 8a. Percent of reported permitted APM work done by permittee and by commercial service for each region in 2014.

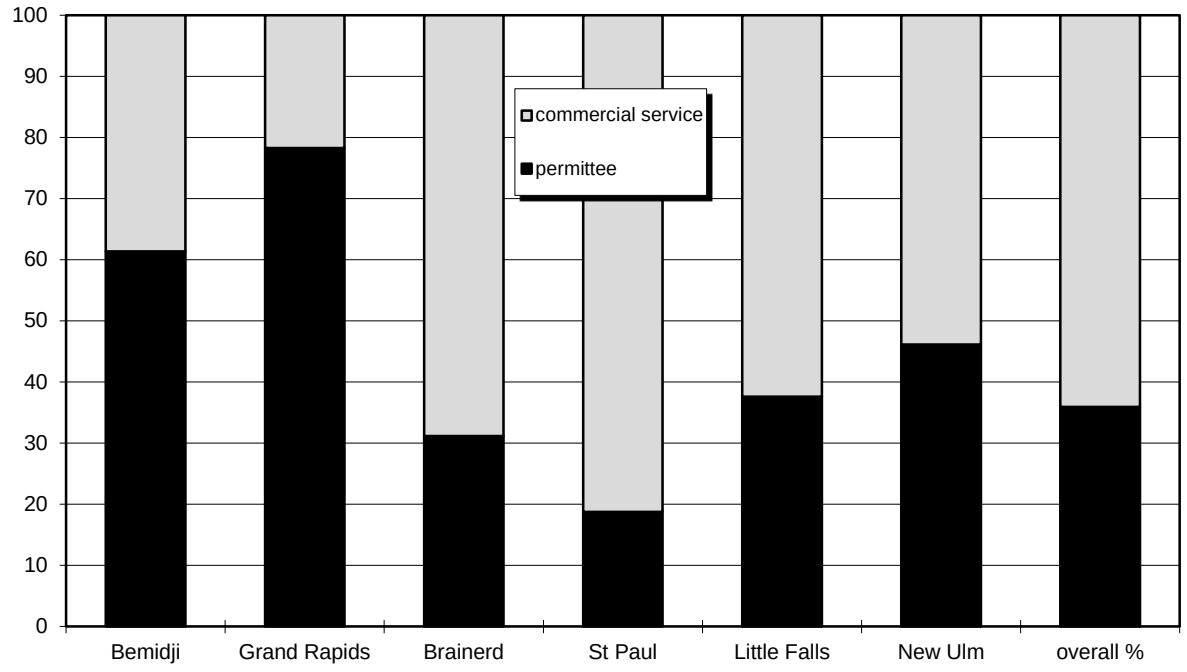
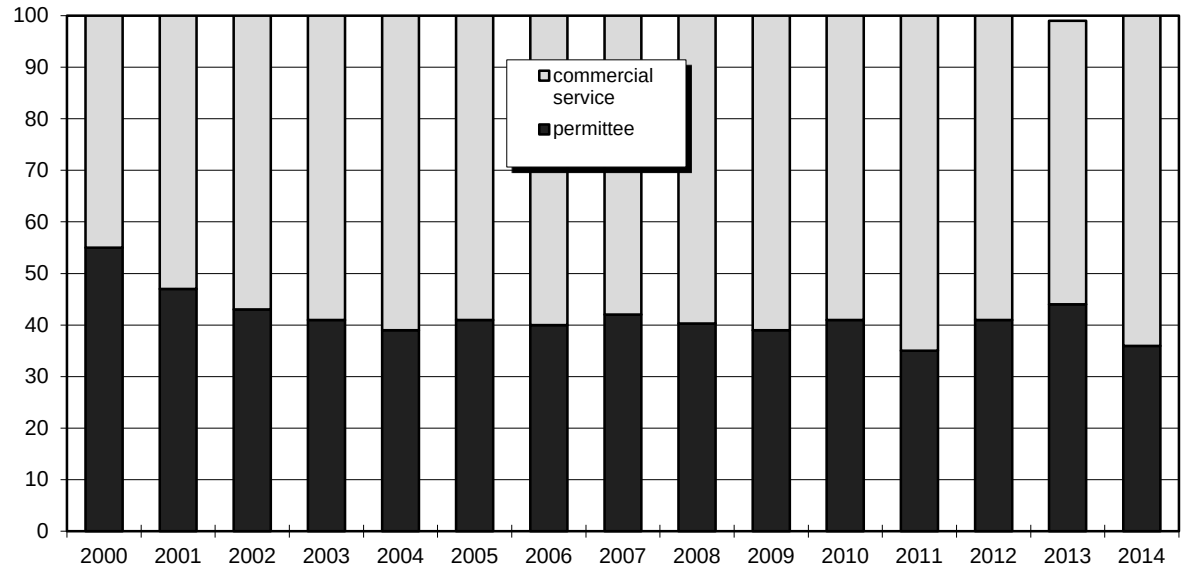


Figure 8b. Percent of reported permitted APM work done by permittee and by commercial service statewide from 2000-2014.



Reapply for Permit

Permit holders, excluding AAPCD permittees, were asked if they would apply for a permit in 2014. Of the 1051 responses, 763 (73%) said they would reapply for an APM permit next year, the same as in 2013. Approximately 14% (143) of the permit holders responding indicated that they were unsure if they would reapply for a permit in 2015. The number of permittees reporting that they would not apply (23 or 2%) was less than in 2013. Regardless of their response, all 2014 permit holders, whose permits expire, will receive permit application materials prior to the start of the 2015 open water season.

Automated Aquatic Plant Control Devices (AAPCD)

Before 1997 the operation of an AAPCD did not automatically require an APM permit, and few AAPCD permits were issued. The APM Rules were revised in 1997 to require a permit for the operation of these devices because of their potential to excavate bottom sediments, and impact fish spawning habitat. In 2014 there were 1,027 permits issued for these devices statewide (Figure 9a). Of those permits 392 were issued for a one-year term, down by 25 permits from 2013, and 637 were issued for a three-year permit term. About 75 percent of the AAPCD permits were issued in the Northwest and Northeast Regions. In addition to the permits issued in 2014, there are active three-year permits issued in 2012 and 2013 (1,313 and 789 respectively). Of the 1,027 surveys mailed to AAPCD permit holders, 917 (89%) responded to the survey. Three-year AAPCD permit holders issued permits in 2012 and 2013 were not surveyed.

The APM rules provide two permit options for AAPCD operation. A person applying for a permit to operate the device in an area greater than 2,500 square feet is required to obtain an annual permit. However, a three-year permit option is available for persons who limit the size of the area of AAPCD operation to 2,500 square feet or less (*Minnesota Rules*, part 6280.0450, subp.3, item A). In addition, revisions to the APM rules implemented in the 2009 permit season restrict submersed aquatic plant removal to 100 feet of shoreline or one-half the owner's frontage whichever is less (*Minnesota Rules*, part 6280.0350, subp. 1a). Due to this rule change many more permit holders became eligible for an AAPCD permit of three year duration in 2009.

In 2014, 637 three year AAPCD permits were issued (Figure 9a). Three year AAPCD permit issuance in 2014 decreased by 152 permits over 2013. There were 1,027 total AAPCD permits issued in 2014, 177 fewer than in 2013. The number of single season permits issued in 2014 decreased by 25 over 2013.

Figure 9a. Numbers of permits issued allowing the use of AAPCDs in Minnesota public waters, 1997-2014.

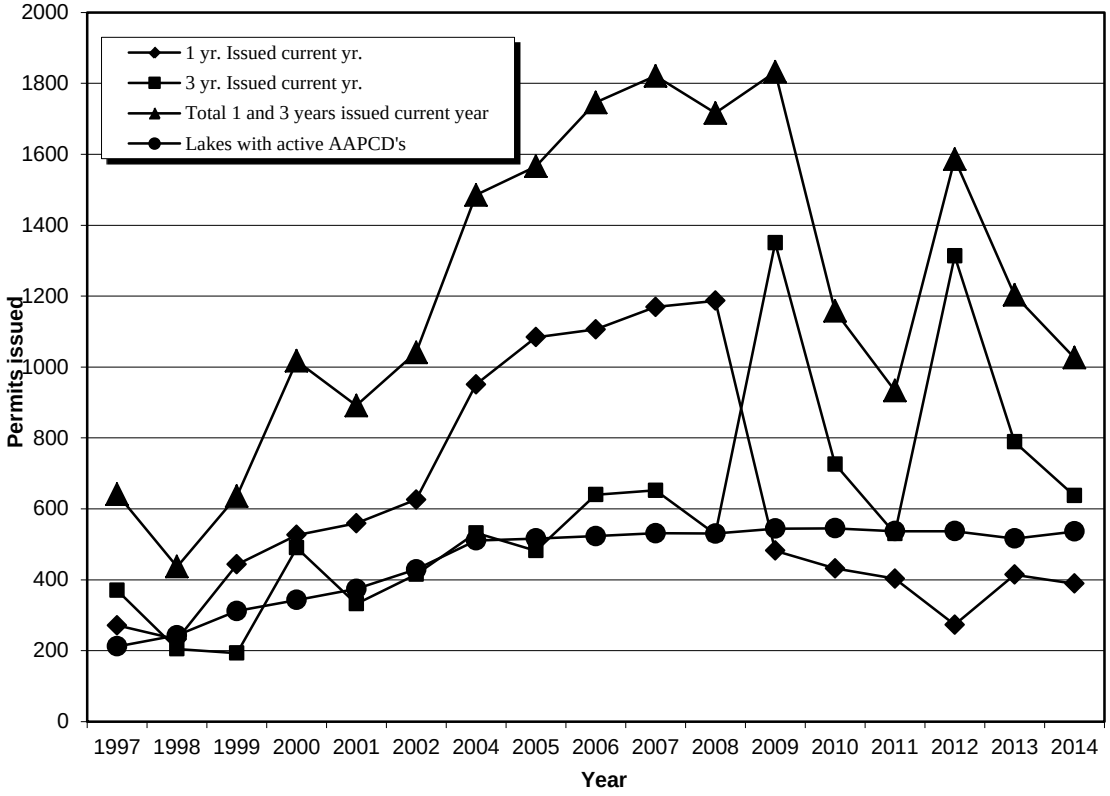
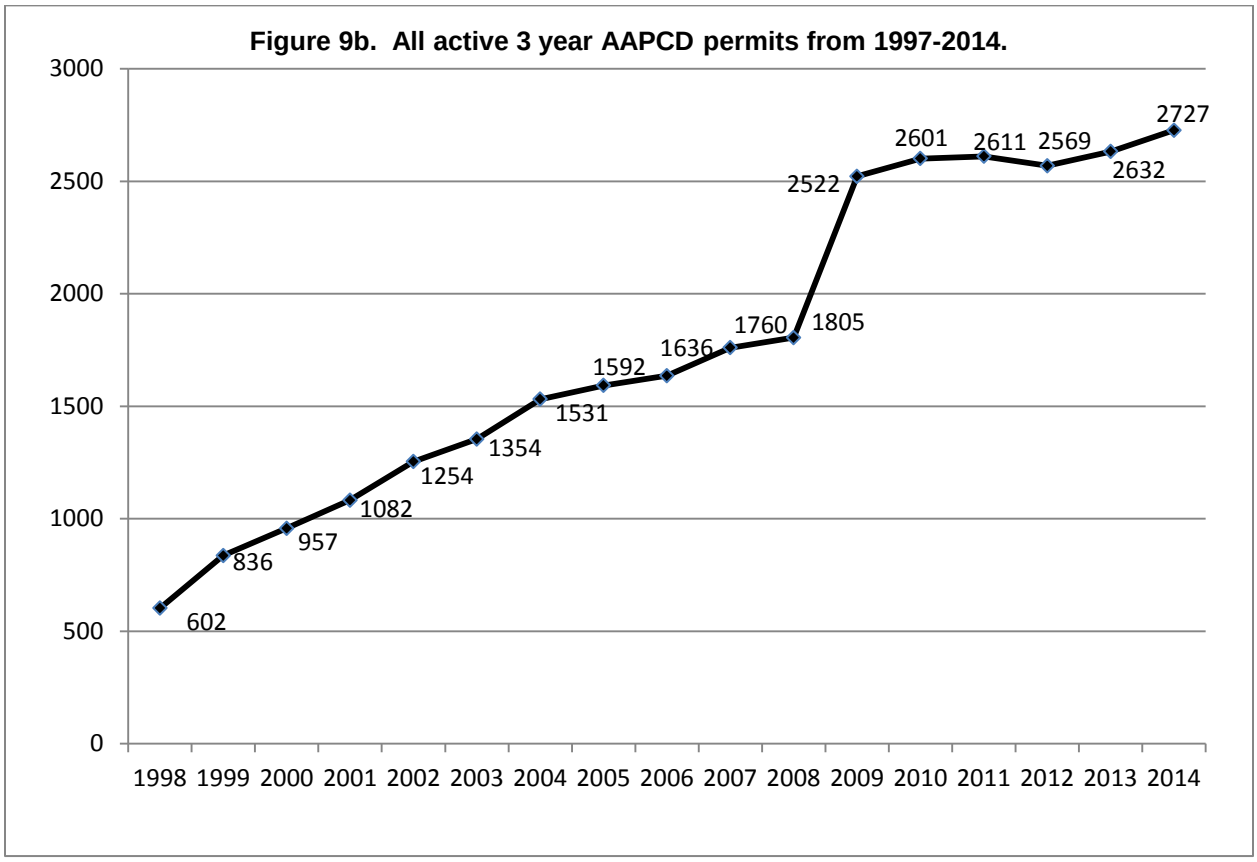
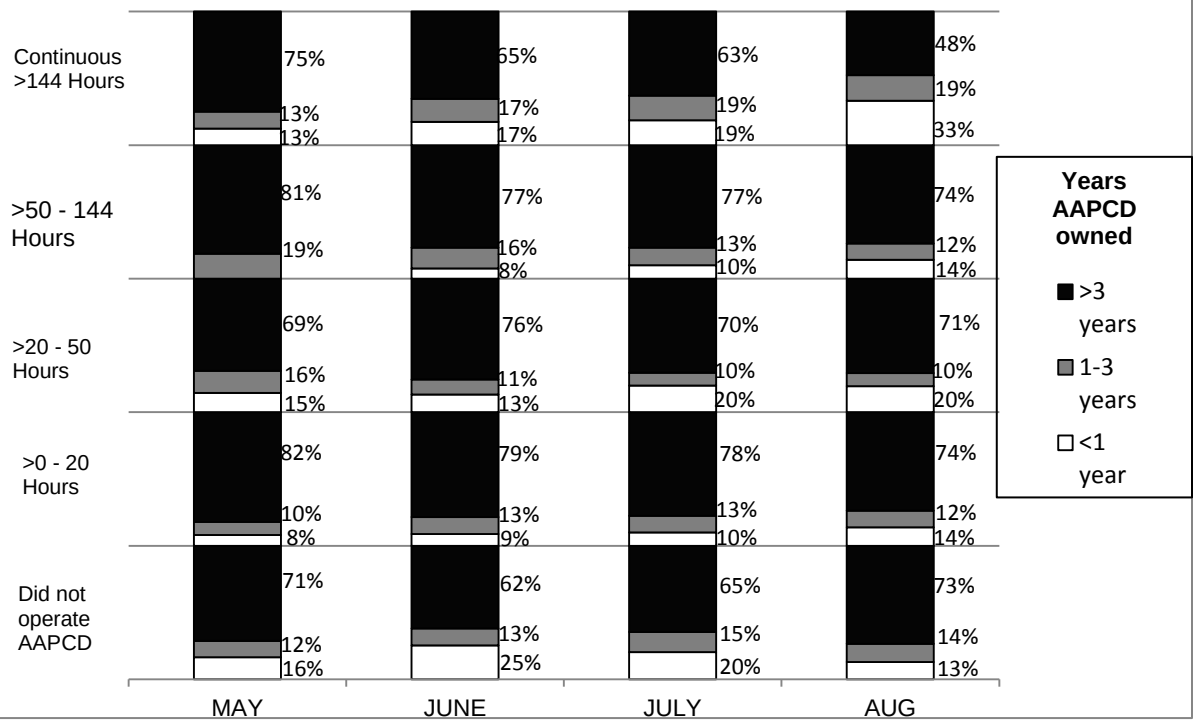


Figure 9b compares active 3-year AAPCD permits from 1997 to 2014. In 2013 there were approximately 2,727 active 3-year AAPCD permits authorized to operate in 536 Minnesota public waters. There were about 152 more active 3-year AAPCD permits in 2013 than in 2014. Although there are more active 3-year AAPCD permits in 2014, the number of permits issued for AAPCD use decreased overall.



The manufacturer of the WeedRoller® has stated that with time people will need to use the WeedRoller® less frequently to achieve acceptable control. The company explained that once the plants were gone there would be little need to use the machine. AAPCD permit holders were asked, "How frequently do you operate your AAPCD?" These responses were sorted by the length of time people had indicated they had owned the machine. AAPCD owners that have owned the device for three or more years are at least as likely to operate their device longer and more frequently than those people who are recent owners (Figure 10). However, permit holders that have owned the device for three or more years are more likely not to operate the device than more recent permit holders. There are also many more permit holders that have had their device for three or more years. About 162 (18%) persons permitted to operate an AAPCD stated that, for various reasons, they did not operate the device in 2014, up from 2013.

Figure 10. AAPCD use from May through August, 2014 categorized by length of ownership expressed as a percent of all AAPCD permittees reporting.



Filamentous Algae Control

The APM rules allow the control of filamentous algae with copper sulfate. Filamentous algae can become a nuisance by interfering with swimming and wading. Permit issuance for filamentous algae control mirrors permit issuance for submerged vegetation control (Figure 11). Filamentous algae control is commonly requested on applications for control performed by commercial services. Requests for filamentous algae control have been increasing slightly since 2011. Compared to 2013, there was an increase of about 124 permits requesting filamentous algae control in 2014.

Chara Control

The APM rules allow the control of chara with copper sulfate. As a result of revisions to the APM rule in 2009, the limits on submersed aquatic plant control (lake shore property owners may receive a permit to control submersed aquatic plants on up to 100 ft, or one-half their frontage whichever less) now apply to the management of Chara. Chara is a macro-algae that can interfere with recreation in some lakes. In 2014 there were approximately 247 lakes where permits were issued for chara control (Figure 12). This was a slight increase from 2013.

Figure 11. Numbers of permits issued for filamentous control, and numbers of lakes where permits were issued 1997-2014.

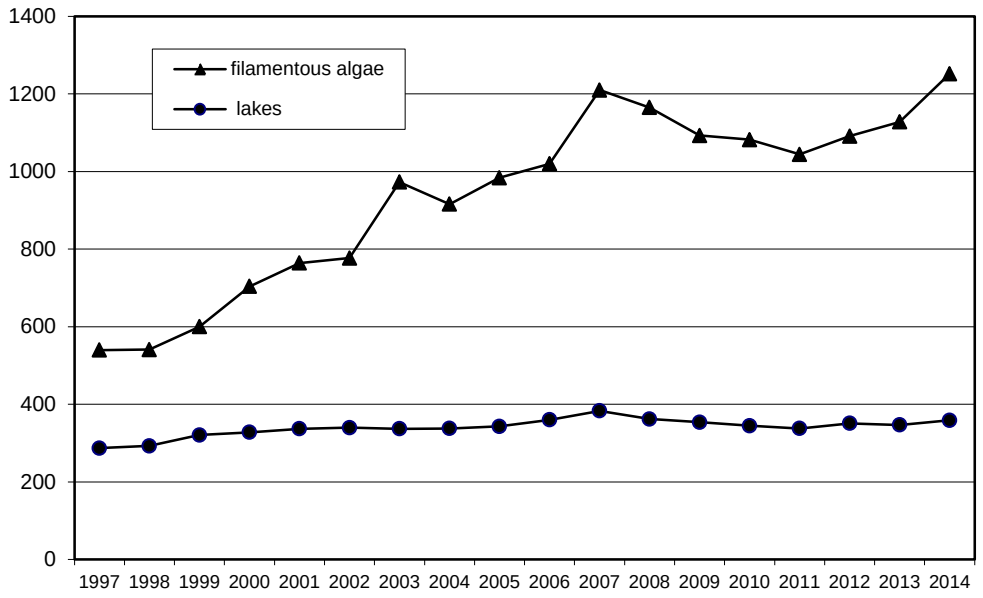
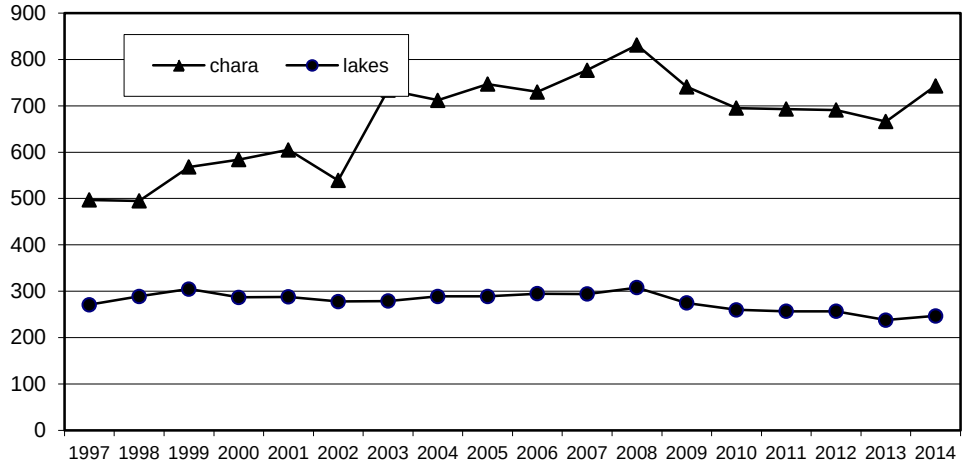


Figure 12. Numbers of permits issued for chara control, and numbers of lakes where permits were issued 1997-2014.



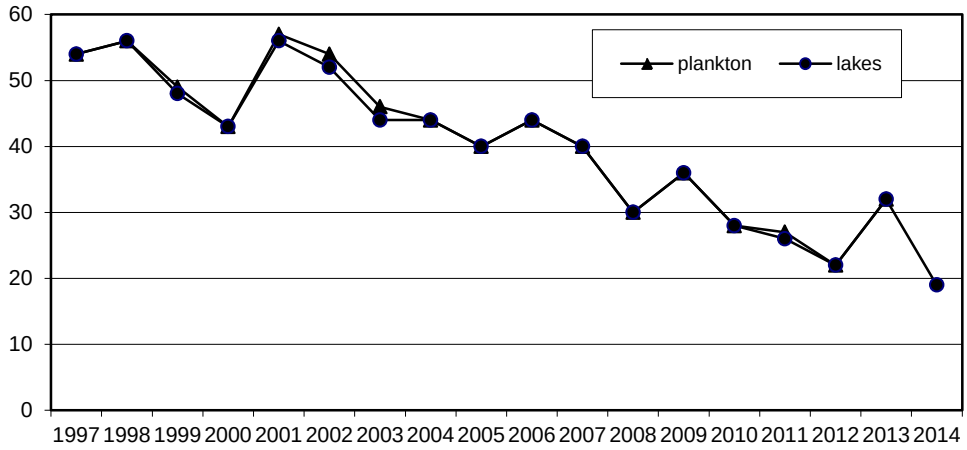
Plankton Algae Control

The APM rules allow the control of plankton algae when there is an "excessive algae bloom." The characteristics of an "excessive algae bloom" as defined by the rules are: *"…an algae population dominated by blue green algae, a Secchi disc reading typically 2 feet or less, floating mats or scums of algae accumulating on the downwind shore, or*

decomposition of accumulated algae has occurred releasing a blue-green pigment and causing an offensive odor."

The numbers of lakes treated with algaecides to control plankton algae has been decreasing over the last ten years (Figure 13). In 2014, there was a decrease of 13 permits issued for lakewide plankton algae control. Copper sulfate treatments can cause an increase in water clarity when the turbidity is due to algae, but the increased water clarity is usually temporary and the treatment may need to be repeated. Due to the temporary nature of control, the possibility of a fish kill caused by a dissolved oxygen decline from decomposing algae, the buildup of copper in lake sediments, and the potential for algae to become resistant to copper, lake-wide plankton algae treatments are discouraged.

Figure 13. Numbers of permits issued for lake-wide plankton algae control, and numbers of lakes treated 1997-2014.



Swimmer's Itch Control in Minnesota Lakes

A condition known as Swimmer's itch (a.k.a. lake itch, wader's itch) has garnered complaints from swimmers in Minnesota lakes since at least the 1800's and has likely been around for much longer. The cause of this irritating skin condition was discovered by W.W. Cort in 1928 at the University of Michigan Biological Station (Blankespoor and Reimink, 1991). Cort discovered that swimmer's itch (cercarial schistosome dermatitis) is caused by the immature life stage of common non-human schistosome trematodes called the cercaria.

These parasites have a complex life history. The adult fluke lives in the blood vessels lining the intestine of its definitive host where it reproduces and releases eggs. The eggs enter the gut and leave the animal in the feces. The eggs hatch when they enter the water becoming a larvae called a miracidia. The miracidia then infects a snail where it develops into a life stage called the cercaria. The cercaria, upon release from the snail, seeks its definitive host, usually some sort of waterfowl. The cercaria does not feed and will only live for about 24 hours unless it finds a proper host. When a proper

host is located the cercaria penetrates the skin, finds its way to the blood vessels lining the gut, and becomes an adult completing its life history.

The problem for humans occurs when the cercaria mistakes us for its proper host. When a cercaria penetrates a human's skin it is attacked and killed by the person's immune system. Although the organism cannot complete its life history in humans, individuals sensitive to the infection can suffer from an allergic reaction. The symptoms will appear on areas of the body submersed in the lake and are typified by areas of redness and swelling, similar to a mosquito bite, and are accompanied by a severe itching sensation. These symptoms can last up to two weeks.

Not everyone is bothered by swimmer's itch; about 30 to 40% of the population is sensitive to swimmer's itch infection. This explains why some people swimming in a lake at the same time and place as a person severely affected, experience no symptoms. Like other allergic reactions, a person's degree of sensitivity increases with each exposure.

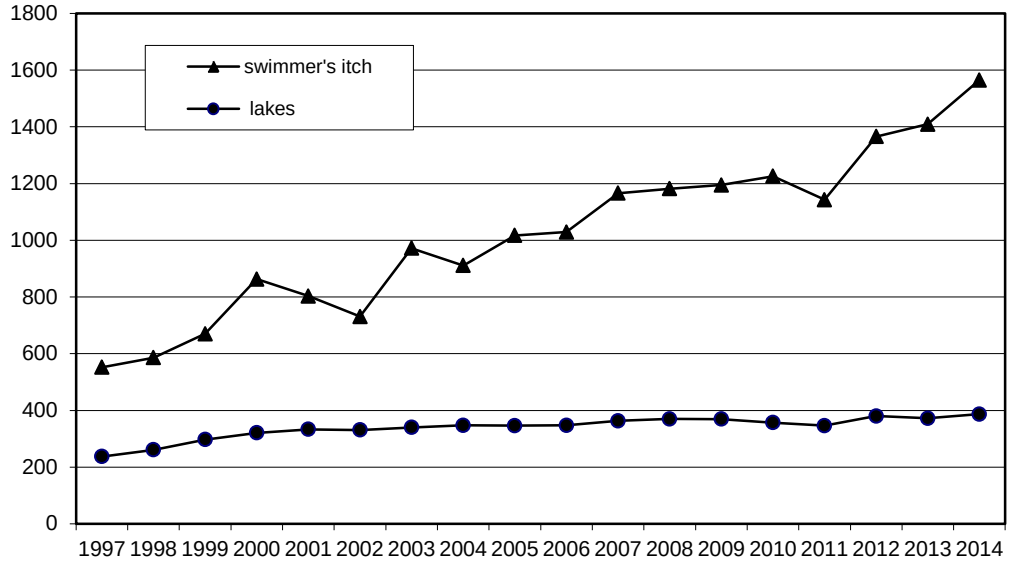
Lakeshore property owners may get a permit from the DNR that allows the application of copper sulfate to the lake for the control of swimmer's itch. The intent of the copper sulfate application is to kill snails that harbor the immature life stage of the fluke that causes swimmer's itch. Individuals receiving a permit to control swimmer's itch with copper sulfate are generally allowed to treat the permitted area 2 times per summer if allowed by the products label.

There are several actions you can take to reduce your odds of getting swimmer's itch.

- **Keep waterfowl away from your dock and shoreline.** If you are feeding waterfowl (ducks and geese) from your dock, stop. If ducks like to rest on your dock, do what you can to discourage them. You can try putting an owl wind sock or statue on your dock and move it around occasionally so the ducks don't become accustomed to it.
- **Stay out of the water by the shore.** The swimmer's itch organism may originate somewhere else in the lake and is being brought to your shoreline by wave action or currents. You may want to try swimming from a raft or boat farther out from shore where you are less likely to come into contact with the cercaria. Of course, this strategy may not be practical if you don't swim or have young children who want to play in the water near shore.
- **Apply a water repellant substance** such as petroleum jelly, waterproof sunscreen or other skin oils to reduce the ability of the Cercariae from penetrating the skin.
- **Dry off with a towel as soon as you get out of the water.** When you get out of the lake, don't let the water evaporate off your skin. The organism in the droplets of water on your skin will look for somewhere to go as the droplet of water evaporates.

The numbers of permits issued for swimmer's itch has increased steadily since 1997. In 2014 there were 387 lakes statewide where 1,565 permits were issued that allowed swimmer's itch control (Figure 14 & Appendix Table H). About 76% of those responding were satisfied with the results of treatments to control swimmer's itch in 2014 (Appendix Table E).

Figure 14. Numbers of permits issued for swimmer's itch control, and numbers of lakes where permits were issued 1997-2014.



Management of Invasive Aquatic Plants

In addition to oversight (permitting) responsibilities for aquatic plant management efforts conducted by individuals to improve access or recreational use, the DNR has statewide control programs for four, non-native invasive aquatic plants: curly-leaf pondweed, purple loosestrife, flowering rush, and Eurasian watermilfoil.

Invasive Aquatic Plant Management (IAPM) permit is defined in *Minnesota Statues* 103G.615, subd. 3a. The purpose of this aquatic plant management (APM) permit is to authorize "the selective control of invasive aquatic plants to cause a significant reduction in the abundance of the invasive aquatic plant." The IAPM permit was first implemented in 2012.

Prior to 2012, APM permits authorizing lake or bay wide control of invasive aquatic plants were issued by the DNR's Division of Fish and Wildlife, aquatic plant management program. After a series of stakeholder meetings in the fall of 2011 it was determined that permits for lake or bay wide control of invasive aquatic plants would be issued by the Division of Ecological and Water Resources, where the invasive species program is located. Other changes made in 2012 to facilitate the management of invasive aquatic plants include; control of invasive aquatic plants may include significant near-shore areas and numerous property owners; the commissioner may waive the

property owner signature requirement in rule, where obtaining signatures from all property owners would create a hardship (M.S. 103G.615, Subd. 3a.,(c)); the new statutory provision requires the notification of property owners near treated areas; and IAPM permits are issued without fee.

In 2013 there were approximately 242 permits issued for the lake or bay-wide treatment of invasive aquatic plants. In 2014 there was a total 264 IAPM permits issued. The increase in invasive aquatic plant management permits issued for control of curly-leaf pondweed and Eurasian watermilfoil (Figure 15) is likely due to the addition of regional invasive species program staff, plus the expanded availability of grants for control of these plants. Table 5 provides a breakdown of IAPM permits issued in 2014 by DNR region.

Table 5. Numbers of Invasive Aquatic Plant Management Permits issued in 2014 classified by district and type.

Region	District	Curly-leaf pondweed	Milfoil	Curly & Milfoil	Flowering rush	Purple loosestrife	Yellow Iris	Phragmites	Zebra Mussels	Sum
1	N	4	2	0	0	0				6
	S	9	3	0	4	1				17
2	-	23	13	0	2	1				39
3	N	50	26	2						78
	S	44	35	1	4		1	3	4	92
4	N	7	6							13
	S	15	3	1						19
Total		152	88	4	10	2	1	3	4	264

Invasive species specialist are located in: Northwest Region: Park Rapids and Fergus Falls; Northeast Region; Grand Rapids and Brainerd; Central Region: St. Cloud and St. Paul; Southern Region: New Ulm and Hutchinson

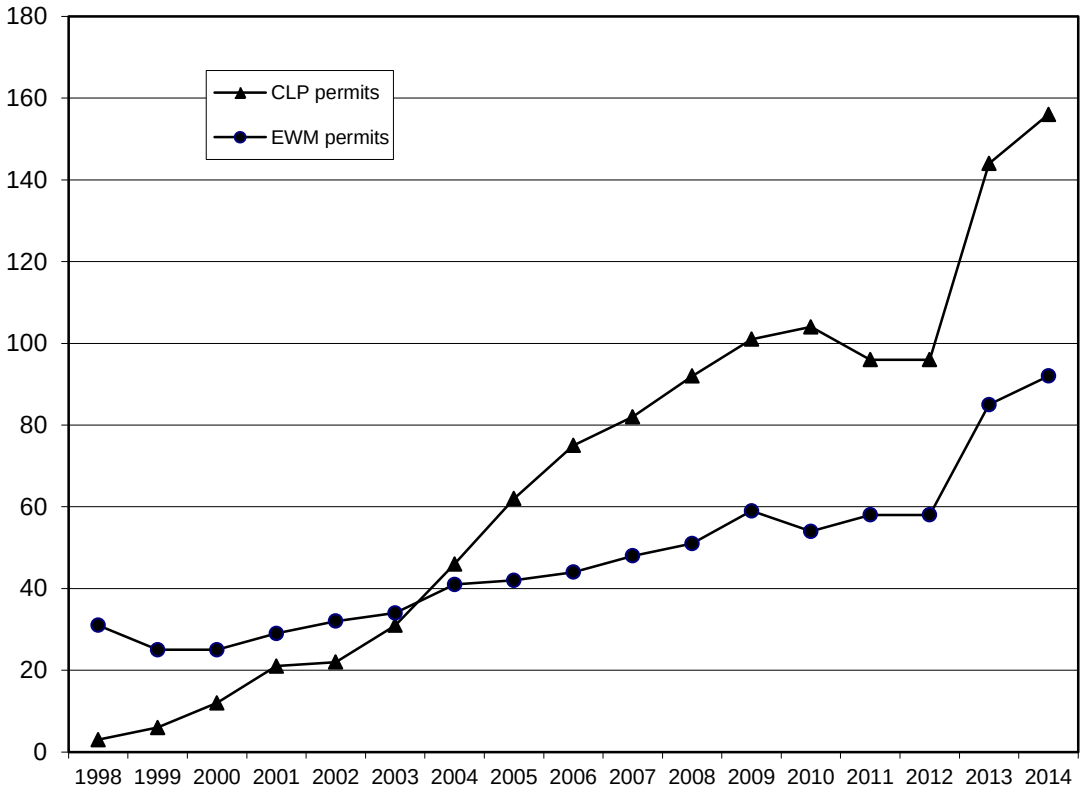
Curly-leaf Pondweed

Curly-leaf pondweed (*Potamogeton crispus*) is a non-native invasive, submersed aquatic plant species introduced to Minnesota at the turn of the 20th century. Curly-leaf pondweed is known to occur in more than 750 Minnesota lakes in 70 of the 87 counties in Minnesota. In many lakes this plant causes significant recreational nuisances.

Curly-leaf pondweed thrives in lake environments with moderate to high total phosphorous concentrations (Heiskary and Valley 2012). Curly-leaf pondweed's life cycle is considerably different than native aquatic plants. New plants sprout from vegetative propagules called turions (hardened stem tips) in the fall (Catling and Dobson 1985). When native aquatic plants are just beginning to grow (mid to late May) curly-leaf pondweed may already be forming dense mats on the lakes surface that can interfere with recreation and the growth of native aquatic plants. By midsummer, (early to mid July) curly-leaf plants begin to die back, which results in rafts of dying plants piling up on shorelines. Before the plants die, they form turions which will be the source of next year's growth. The die back may also be followed by an increase in phosphorus (Bolduan et al. 1994) and undesirable algal blooms. These algae blooms interfere with light penetration and can also reduce native plant abundance.

Standard control methods provide relief to lakeshore property owners from the recreational nuisances caused by surface mats of curly-leaf pondweed, but have little or no long-term effect on the abundance of the plant.

Figure 15. Numbers of permits issued for curly-leaf pondweed and Eurasian watermilfoil control 1998-2014.



Management History

Following the establishment of an Invasive Species Program at the Minnesota Department of Natural Resources, interest in possible management of curly-leaf pondweed increased in the 1990s. In the late 1990s, researchers with the Army Corps of Engineers learned that there is potential to selectively control curly-leaf growing during early spring by treatment with endothall or diquat herbicides. Not only did these treatments reduce growth of the plant, they also appeared to have the potential to disrupt reproduction. Production of turions can be prevented by early season treatment with herbicide.

Following the early work by the Army Corps on control of curly-leaf, the MnDNR initiated a number of lake-wide, pilot projects in Minnesota. These efforts were called pilot projects because it was not known whether the goals of the projects could be met. To determine whether ecological benefits such as increases in native submersed plants and water clarity could be obtained by repeated lake-wide treatment, the DNR

supported a limited number of well-planned and well-monitored projects. Some of these lakes were monitored by the University of Minnesota under a contract with the MnDNR. In 2012, researchers at the University published results of their efforts (Johnson et al. 2012 and Jones et al. 2012). It is important to note that they reported results for eight (Jones et al. 2012) or nine (Johnson et al. 2012) treated lakes. Of these, six were eutrophic or hypereutrophic, i.e. Secchi depth less than 1.6 m for the lakes studied, and the other two or three were mesotrophic, i.e. Secchi depth greater than 2 m. As a consequence, the conclusions based on this research probably are more helpful in understanding effects of management in eutrophic lakes as compared to mesotrophic lakes. Additional analysis of observations from mesotrophic lakes would be useful. Based on these publications and review of results from additional lakes, it is evident that:

- Lake-wide treatments with herbicides can reduce curly-leaf pondweed during the year of treatment.

- Lake-wide treatments with herbicides may or may not reduce curly-leaf pondweed beyond the year of treatment.

- Although treatment can reduce or prevent production of turions, significant numbers of turions can remain in the lakes after as many as five years of lake-wide treatment.

- Overall, most native aquatic plants were not harmed by lake-wide treatments of curly-leaf pondweed with endothall.

- Overall, there did not appear to be a consistent trend of increasing water clarity following lake-wide treatments to control curly-leaf pondweed. The plant does not appear to be a significant driver of water quality in these lakes.

- Three to five years of successive lake-wide treatment generally were not followed by a number of years when lake-wide monitoring or large treatment would not be necessary.

- Based on the research described above, the most successful projects – in terms of meeting project goals and costs – done to control curly-leaf pondweed are those that involved partial-lake treatments. These treatments usually are focused on enhancement of recreational use.

Additional information on this project can be found in the Invasive Species Program Annual report: http://www.dnr.state.mn.us/invasives/aquatic_programs.html.

Purple Loosestrife

Purple loosestrife, a non-native invasive plant that can out compete native wetland vegetation, was introduced to North America from Europe in the 1800's and until 1987 was a common ornamental sold by nurseries and landscape companies. Natural

resource managers became aware of the plant's invasive nature and disruptive effects on native wetland vegetation in the early 1980's. The DNR, concerned about the plants impact on native species and wildlife habitat, conducted preliminary surveys to determine the status of the plant in Minnesota. The survey revealed that 77 of Minnesota's 87 counties had populations of purple loosestrife in wetlands, lakeshore, stream banks and ditches. In 1987 Minnesota became one of the first states in the nation to develop a program to control this invasive plant. Minnesota has designated purple loosestrife as a noxious weed, which makes it illegal to import, buy, sell, propagate and transport.

The main components of the purple loosestrife program are:

1. Inventory purple loosestrife sites to prioritize control efforts.
2. Carry out management activities including pesticidal and biological control.
3. Support research to evaluate and improve control efforts.
4. Monitor and evaluate the success of biological control and other management efforts.
5. Public education/awareness efforts to involve the public in the management of this plant.

Purple loosestrife management is performed using herbicides as well as biological control. Large stands of purple loosestrife are extremely difficult to control using herbicides because of their enormous seed bank. These stands are candidates for biological control using introduced beetles. Minnesota's herbicide control effort has been reduced dramatically since the introduction of bio-control agents began in 1992.

The highest priority stands for herbicide treatment are small, recently established stands, located near the top of the watershed. Because of their small size these newly established sites are poor candidates for biocontrol. Rodeo, a broad-spectrum glyphosate herbicide, is used to spot treat high priority purple loosestrife sites with a backpack sprayer. In 2014, DNR staff visited a total of 29 purple loosestrife sites for treatment with herbicide. Most of these sites were very small with the majority having fewer than 100 plants. For more detailed information on Minnesota's purple loosestrife program, see the Invasive Species Annual Program Report. http://www.dnr.state.mn.us/invasives/aquatic_programs.html.

Eurasian Watermilfoil

Eurasian watermilfoil, hereafter called milfoil, is an invasive, aquatic plant introduced to North America in the mid-1900's. It was first identified in Minnesota in 1987 in Lake Minnetonka. The plant reproduces by fragmentation and establishes itself readily in disturbed areas. Milfoil can interfere with recreational and other uses of lakes and rivers by producing dense mats at the water's surface. These mats are similar to, but can be more extensive than, those produced by native vegetation. Matted milfoil can displace native aquatic plants.

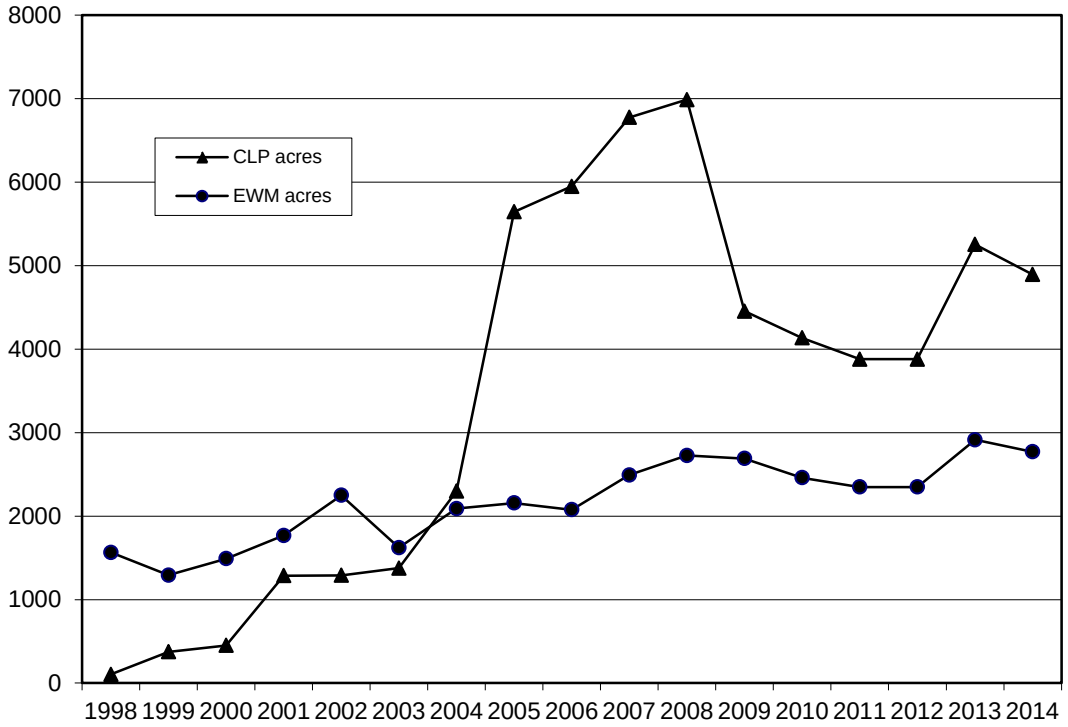
The main strategies of the Eurasian watermilfoil program are:

1. Slow the spread of the plant through public education and awareness activities.
2. Support management by lake associations and local units of government of problems caused by milfoil.

3. Maintain an accurate inventory of populations.
4. Investigate new control methods and the biology of the plant.

Eurasian watermilfoil was discovered in 16 additional water bodies in 2014. There are now 296 water bodies in Minnesota known to have populations of this invasive submersed aquatic plant. The acres of Eurasian watermilfoil and curly-leaf pondweed control managed in offshore areas since 1998 is found in Figure 16 (includes herbicide control and harvesting).

Figure 16. Acres of off-shore curly-leaf pondweed and Eurasian watermilfoil control 1998-2014.



The most commonly used herbicide for control of milfoil from 1997 until 2009 was a granular 2,4-D ester product labeled for aquatic use (Table D). In 2001, a liquid dimethylamine salt 2,4-D product was registered for aquatic use and has been applied to milfoil in Minnesota. Late in 2002, a liquid trimethylamine salt, triclopyr product, was registered for aquatic use and is available for control of milfoil in Minnesota. From 2010 to 2013, triclopyr herbicide had exceeded 2,4 D as the reported product used for the control of Eurasian watermilfoil in Minnesota. Reported product totals in 2014 show that more granular 2,4-D ester than triclopyr is now being applied.

The total reported granular 2,4-D ester use in 2014 for milfoil was 22,265 pounds (Figure 17). The total reported annual use of granular 2,4-D ester products since 1987 is also provided. Figure 18 shows the use of granular triclopyr since 2006. See Appendix Table D. for reported quantities of liquid triclopyr formulations (reported in gallons).

For more detailed information on the management of invasive species see the Invasive Species Program Annual Report. The report may be reviewed on line at http://www.dnr.state.mn.us/invasives/aquatic_programs.html.

Figure 17. Permitted granular 2,4D Ester (lbs) use in Minnesota after identification of Eurasian watermilfoil in Minnesota.

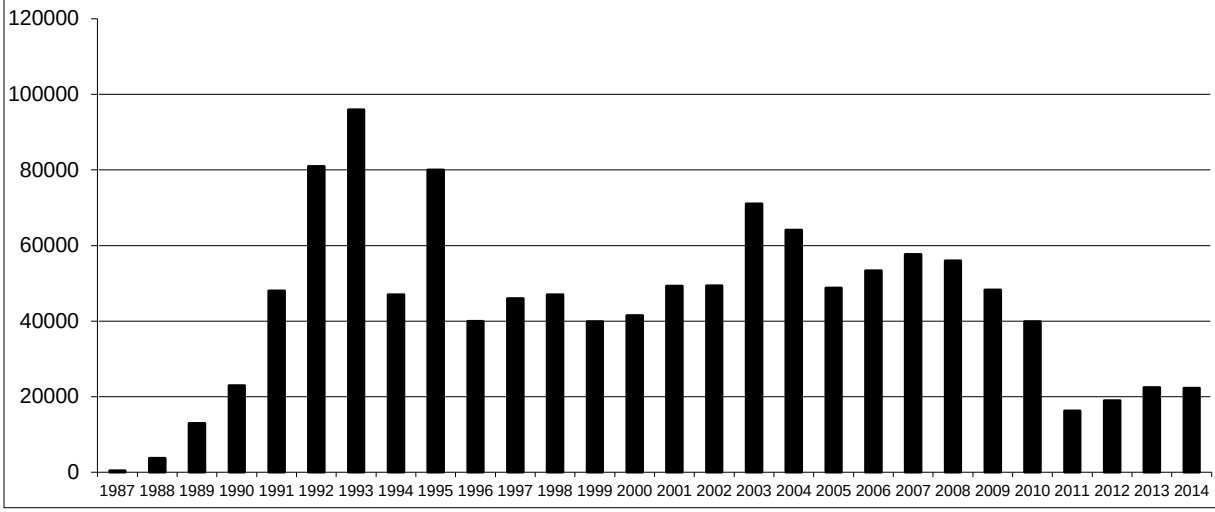
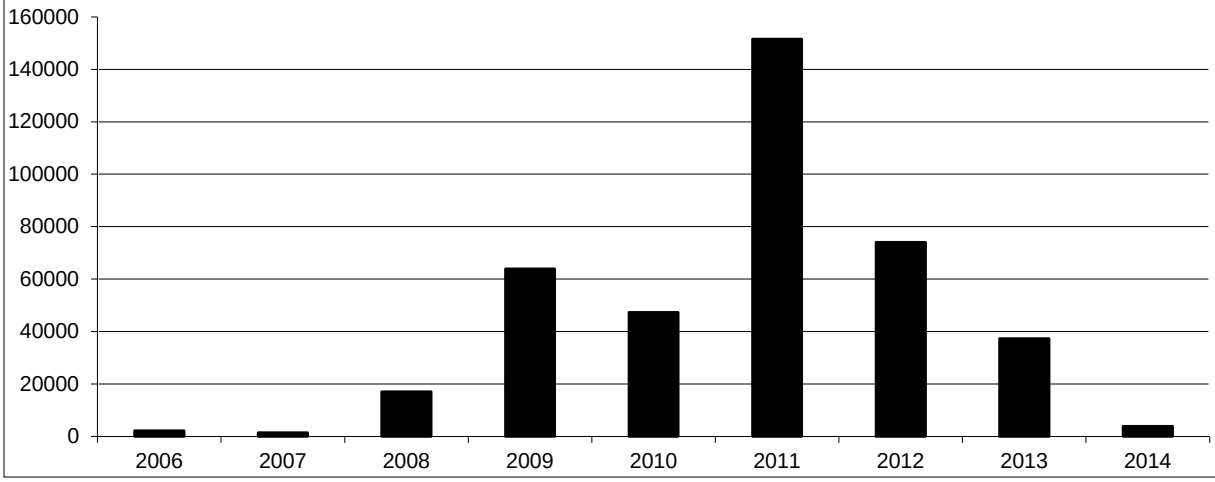


Figure 18. Permitted granular triclopyr (lbs) use in Minnesota after identification of Eurasian watermilfoil in Minnesota.



Mention of trademarks or proprietary products does not constitute a warranty of the products by the Minnesota Department of Natural Resources and does not imply its approval to the exclusion of other products that may also be suitable.

References Cited

Blankespoor, H.D., and R.L. Reimink. 1991. The Control of Swimmer's Itch in Michigan: Past, Present, and Future. Michigan Academician XXIV, 7-23.

Bolduan, B.R., G.C. Van Eeckhout, H.W. Quade, and J.E. Gannon. 1994. Potamogeton crispus - the other invader. Lake and Reservoir Management 10(2):113-125.

Catling, P.M. and I. Dobson. 1985. The biology of Canadian weeds. 69. Potamogeton crispus L. Canadian Journal of Plant Science 65:655-668.

Heiskary, S., and R. D. Valley. 2012. Curly-leaf pondweed trends and interrelationships with water quality. Minnesota Department of Natural Resources Investigational Report 558, Saint Paul.

Johnson, J.A., A.R. Jones, and R.M. Newman 2012. Evaluation of lakewide, early season herbicide treatments for controlling invasive curly-leaf pondweed (Potamogeton crispus) in Minnesota lakes. Lake and Reservoir Management 28:346-363.

Jones, A. R. J.A. Johnson, and R.M. Newman 2012. Effects of repeated early season, herbicide treatments of curlyleaf pondweed on native macrophyte assemblages in Minnesota lakes. Lake and Reservoir Management 28:364-374.

APPENDIX

Appendix Table A. Aquatic Pesticide Enforcement Use Inspections, 2014.

Treatment Date	County	Lake Name	Applicator	Permit Number
7/30/2014	Cass	Margaret	Central Minnesota Aquatics	14F-2B0210
7/2/2014	Cass	Margaret	Central Minnesota Aquatics	14F-2B0679
7/30/2014	Crow Wing	Little Pine	PLM - Lake and Land Management	14F-2B0848
7/17/2014	Washington	Clear	Lake Management, Inc.	14F-3A025
7/3/2014	Hennepin	Minnetonka - Black Lake	Lake Management, Inc.	14F-3A027
6/2/2014	Hennepin	Minnetonka - Phelps Bay	Lake Management, Inc.	14F-3A035
7/15/2014	Washington	Forest	Lake Restoration, Inc.	14F-3A134
6/18/2014	Hennepin	Libbs	Midwest Aqua Care	14F-3A163
5/29/2014	Carver	Minnewashta	Jacobson Environmental	14F-3A240
7/29/2014	Carver	Minnewashta	Jacobson Environmental	14F-3A240
8/4/2014	Washington	Big Carnelian	Lake Management, Inc.	14F-3A245
6/10/2014	Chisago	Rabour	Lake Improvement Consulting, Inc.	14F-3A253
6/30/2014	Ramsey	Sherwood Pond	Lake Restoration, Inc.	14F-3A278
6/17/2014	Washington	Big Marine	Lake Management, Inc.	14F-3A296
7/9/2014	Ramsey	Johanna	Lake Restoration, Inc.	14F-3A332
7/28/2014	Carver	Bavaria	Lake Management, Inc.	14F-3A337
7/24/2014	Carver	Minnewashta	Lake Restoration, Inc.	14F-3A441
7/17/2014	Chisago	South Center	Lake Restoration, Inc.	14F-3A477
6/10/2014	Chisago	South Center	Lake Restoration, Inc.	14F-3A477
7/28/2014	Hennepin	Minnetonka - Wayzata Bay	Lake Restoration, Inc.	14F-3A526
6/23/2014	Washington	White Bear lake	Lake Management, Inc.	14F-3A532
6/4/2014	Scott	O'Dowd	Midwest Aqua Care	14F-3A538
7/23/2014	Scott	O'Dowd	Midwest Aqua Care	14F-3A538
6/13/2014	Scott	Thole	Midwest Aqua Care	14F-3A599
7/16/2014	Ramsey	Gervais	Lake Improvement Consulting, Inc.	14F-3A716
7/21/2014	Dakota	Blackhawk	Midwest Aqua Care	14F-3A763
7/15/2014	Chisago	Chisago	Lake Management, Inc.	14F-3A869
8/12/2014	Hennepin	Schmidt	PLM - Lake and Land Management	14F-3A874
9/18/2014	Ramsey	Wallmark Ditch Complex	Critical Connections Ecological Services	14F-3A976
6/13/2014	Wright	Mink-Somers	Clarke Aquatic Environmental	14F-3B229
6/23/2014	Wright	Bass	Lake Management, Inc.	14F-3B259
7/2/2014	Isanti	Spectacle	Midwest Aqua Care	14F-3B354
8/18/2014	Stearns	Sylvia	Lakeshore Property Owner	14F-3B450
6/3/2014	LeSuer	Tetonka	Lake Restoration, Inc.	14F-4111
6/24/2014	Meeker	Washington	PLM - Lake and Land Management	14F-4138
7/8/2014	Rice	Mazaska	Lakescape Enterprises	14F-4166
6/25/2014	Anoka	Coon	PLM - Lake and Land Management	14W-3A005
6/3/2014	Scott	Lower Prior Lake	Aquatic Solutions of MN	14W-3A013
7/23/2014	Hennepin	Minnetonka - North Arm	PLM - Lake and Land Management	14W-3A059
8/12/2014	Hennepin	Sarah	Aquatic Solutions of MN	14W-3A113
6/26/2014	Chisago	Green	Green Lake Association	14W-3B040
7/10/2014	Wright	Augusta	Lake Restoration, Inc.	14W-3B069
6/17/2014	Wright	Indian Lake	Indian Lake Improvement District	14W-3B071
5/22/2014	Wright	Lake Sylvia	Greater Lake Sylvia Association	14W-3B076
8/25/2014	Wright	Howard	Howard Lake Watershed	14W-3B081
5/27/2014	LeSuer	East Jefferson	Lakescape Enterprises	14W-4024
8/5/2014	Waseca	Clear	Lakescape Enterprises	14W-4031
7/10/2014	Meeker	Minnie Belle	Clarke Aquatic Environmental	14W-4037

Table B. Aquatic Plant Management Violations Resulting in Enforcement, 2014.

Date	Location	Company	Violation	Permit Citation
5/20/2014	Lake Owasso	Jacobson Environmental	Incomplete treatment signs posted.	6280.0250 Subp. 6.
7/17/2014 & 9/16/2014	Bald Eagle Lk	Jacobson Environmental	Treated without notification. Treated without valid APM permit.	6280.0250 Subp. 6. & 6280.0250 Subp. 2.
7/17/2014	Spring Lk	Lake Restoration	Treated property not authorized under APM permit.	6280.0250 Subp.2A.
6/30/2014	LeSuer County	Lakescapes, LLC	Treated without a valid Applicator's License.	18B.30
6/4/2014	Lake Tetonka	Lakescapes, LLC	Treated property not authorized under APM permit.	6280.0250 Subp.2A.
9/10/2014	Sugar Lake	Lake Restoration/Sugar Lake Association	Treatment without notification & improper posting of treatment area.	6280.0250 Subp. 6.
6/9/2014	Lake Minnetonka	Jacobson Environmental	Treated property without valid APM permit.	6280.0250 Subp. 2.

Appendix Table C. A list of commonly used herbicides registered by the EPA for aquatic use & approved by the MN DNR.

Product Name	Selective	Broad Spectrum	Active Ingredient (Formulation)
Part 1. Aquatically labelled systemic herbicides:			
Aquacide (Pellet)	X		2,4 Dichlorophenoxyacetic Acid (Sodium Salt)
Navigate® (Granular)	X		2,4 Dichlorophenoxyacetic Acid (Butoxyethyl Ester)
SEE 2,4-D (Liquid)	X		2,4 Dicholorphenoxyacetic (Isooctyl Ester)
Weedtrine II (Granular)	X		2,4 Dicholorphenoxyacetic (Isooctyl Ester)
DMA-4 IVM (liquid)	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt)
Sculpin-G (granular)	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt)
Sonar (Liquid or Granular)		X	Fluridone
Rodeo, Refuge, AquaPro, AquaNeat (Liquid)		X	Glyphosate
Renovate, Kraken (Liquid or Granular)	X		Triclopyr
Habitat		X	Imazapyr
Clearcast		X	Imazamox
Clipper		X	Flumioxazin
Part 2. Contact herbicides:			
Aquathol (Liquid or Granular)	X		Dipotassium salt of endothall
Hydrothol (Liquid or Granular)	X		Mono-amine salt of endothall *(liquid by licensed applicator only)*
Reward, Redwing, Tribune (Liquid)		X	Diquat dibromide*(use by licensed applicator only)*
Part 3. Copper Compounds (Algaecides & Herbicides):			
Captain, Nautique (Liquid)	X		Copper Carbonate
Mizzen, Symmetry (Liquid)	X		Copper Triethanolamine Complex
Cutrine Plus (Granular & Liquid)	X		Copper Ethanolamine Complex
Clearigate, Komeen (Liquid)	X		Copper Ethanolamine Complex
Part 4. Other:			
Copper sulfate	X		CuSO4 (wide variety of registered brands)

Mention of trademarks or proprietary products does not constitute a warranty of the products by the Minnesota Department of Natural Resources and does not imply its approval to the exclusion of other products that may also be suitable.

Table D. Reported various aquatic herbicide use statewide 1981-2014.

	2,4-D ester lbs.	2,4-D ester gal.	2,4-D salt lbs.	2,4-D salt gal.	2,4-D amine/ acid gal.	2,4-D amine/ acid lbs.	Aquathol lbs.	Aquathol gal.	Diquat gal.	Hydrothol 191 lbs.	Hydrothol 191 gal.	copper sulfate lbs.	Triclopyr lbs.	Triclopyr gal.	2,4-D salt Triclopyr lbs.	Imazapyr gal.	Imazamox gal.	Flumioxazin lbs.	Glyphosate gal.
Year																			
1981	150	*	370	*	0	*	1,900	1,300	730	3,200	390	*	*	*	*	*	*	*	*
1982	120	*	320	*	0	*	1,700	1,500	550	4,200	44	*	*	*	*	*	*	*	*
1983	0	*	350	*	0	*	1,400	1,500	560	11,900	31	*	*	*	*	*	*	*	*
1984	110	*	130	*	0	*	730	980	780	7,300	80	*	*	*	*	*	*	*	*
1985	25	*	270	*	0	*	740	1,200	870	14,000	100	*	*	*	*	*	*	*	*
1986	25	*	370	*	0	*	1,100	1,400	1,200	6,900	170	*	*	*	*	*	*	*	*
1987	100	*	1,400	*	0	*	1,100	1,400	1,400	13,000	62	*	*	*	*	*	*	*	*
1988	3,700	*	600	*	0	*	950	1,300	1,300	11,000	100	*	*	*	*	*	*	*	*
1989	13,000	*	470	*	0	*	910	1,300	1,700	12,000	200	*	*	*	*	*	*	*	*
1990	23,000	*	290	*	0	*	680	1,100	1,500	9,500	130	*	*	*	*	*	*	*	*
1991	48,000	*	1,300	*	0	*	1,400	850	1,400	9,600	210	55,400	*	*	*	*	*	*	*
1992	81,000	*	320	*	0	*	870	1,600	1,700	9,000	67	64,000	*	*	*	*	*	*	*
1993	96,000	*	400	*	0	*	830	1,000	1,600	5,000	240	34,600	*	*	*	*	*	*	*
1994	45,000	*	700	*	0	*	710	940	1,800	10,000	510	59,800	*	*	*	*	*	*	*
1995	80,000	*	87	*	0	*	930	700	2,300	8,300	420	55,000	*	*	*	*	*	*	*
1996	39,000	*	400	*	0	*	1,000	730	1,900	8,900	830	32,500	*	*	*	*	*	*	*
1997	46,000	*	290	*	0	*	1,200	700	2,400	7,800	820	39,700	*	*	*	*	*	*	*
1998	47,000	*	440	*	0	*	790	1,280	2,580	4,460	670	50,800	*	*	*	*	*	*	*
1999	39,800	*	650	*	0	*	1,050	740	2,280	4,190	740	31,600	*	*	*	*	*	*	*
2000	41,500	*	700	*	0	*	1,380	1,850	2,970	5,820	530	41,900	*	*	*	*	*	*	*
2001	49,300	*	1,000	*	0	*	700	2,600	2,700	3,900	950	58,200	*	*	*	*	*	*	*
2002	49,400	*	700	*	20	*	540	2,660	2,530	4,220	760	42,200	*	*	*	*	*	*	*
2003	71,100	*	634	*	336	*	339	2,515	2,370	7,610	429	47,100	*	*	*	*	*	*	*
2004	64,100	*	1,068	*	216	*	366	5,200	2,856	8,040	643	53,700	*	*	*	*	*	*	*
2005	48,800	*	1,154	*	533	*	1,077	7,054	2,773	6,744	715	63,500	*	*	*	*	*	*	*
2006	53,400	*	805	*	215	*	1,530	8,757	2,953	11,653	126	47,000	2,189	28	*	*	*	*	*
2007	57,700	*	971	*	85	*	1,320	9,838	3,665	10,105	782	46,000	1,400	46	*	*	*	*	*
2008	56,000	*	655	*	7.4	*	2,462	13,208	2,643	10,693	550	32,290	17,025	1,882	*	*	*	*	*
2009	48,250	*	655	*	939	*	725	13,801	1,791	7,963	1,758	25,234	63,896	662	*	*	*	*	*
2010	39,932	*	731	*	1,070	*	737	10,238	1,501	7,973	900	23,200	47,379	1,371	*	*	*	*	*
2011	16,233	*	775	*	1,066	*	578	10,936	1,760	5,426	626	22,341	151,593	587	3120	*	*	*	*
2012	19,007	*	847	*	7,233	*	1,140	12,992	2,197	5,967	493	36,810	74,086	1,014	2488	*	*	*	*
2013	22,486	2,005	753	*	6,108	2	5,423	8,778	2,489	4,889	440	20,442	37,305	573	*	5.68	9113	146	
2014	22,265	0	450.8	11,147	894	585	424	12,524	2,214	6,027	169	22,766	3,847	1,047	*	4.38	11.55	155.09	2,647

* Data not available

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Appendix Table E. Aquatic Plant Management Survey. Pesticidal-Mechanical, 2014.

1 Was your 2014 permit used?

814 Yes, permitted work was done.

45 No, because: The nuisance conditions did not develop.
23 No, because: I got the permit too late.
111 No, because: I was unable to get the work done.
58 No, because: Thanks! Please use the back for comments

1051 total

2 When my permit expires:

763 I will reapply for a permit. 23 I will not apply for a permit. 143 I am undecided at this time.
48 Permanent and Non-transferable

3 The method of control was: 74 did not answer the question

255 mechanical or hand removal. 423 chemical treatment. 116 mechanical and chemical treatment.
20 bog removal/relocation

4 A. Were you satisfied with the aquatic plant control work done (**for Swimmers Itch control only skip to 4.B)** ?

438 YES 44 NO 164 wasn't as good as expected
168 did not answer the question

B. If you treated for **Swimmers Itch** were you satisfied with the control ?

154 YES 16 NO 46 wasn't as good as expected
598 did not answer the question (may not have treated for swimmer's itch)

5 When was the work done?

11 April 113 May 393 June 373 July 216 August 63 September 13 October 2 November 17 uncertain

6 To provide us with some idea of how much control actually took place we would like to know if the control work done was the entire area allowed by the permit or less than the allowed area.

567 Yes, control work was done on the entire area permitted
202 No, less control work was done than the permit allowed
45 did not answer the question

7 **If you used herbicide**, please indicate what you used and how much?

Excludes products applied by commercial companies

What Did You Use?	**How Much Did You Use?**		**What Did You Use?**	**How Much Did You Use?**	
Copper sulphate	3949.00	lbs.	Navigate	384.00	lbs.
gran.Hydrothol 191	5955.75	lbs.	Renovate	0.05	gal.
liq. Aquathol K	51.64	gal.	Redwing	X	gal.
Super K Aquathol	182.50	lbs.	Aquacide	584.50	lbs.
liq. Hydrothol 191	10.53	gal.	liq Cutrine Plus	1.56	gal.
Tribune	0.00	gal.	Renovate OTF	0.00	lbs.
Habitat	0.00	gal.	gran Cutrine Plus	36.00	lbs.
Aqua Neet	0.00	gal.	DMA	0.00	gal.
Rodeo	0	gal.	Glyphosate	0.00	gal.
Shoreclear	0.00	gal.	Weedtrine D	0.00	gal.
Reward	0	gal.	AquaKleen	0	lbs.
Mizzen	0	gal.	AquaPro	0.06	gal.
Diquat	0.06	gal.	Pondmaster	1	gal.
Unknown 2,4-D	X	lbs			

Appendix Table F. Aquatic Plant Management Survey for automated aquatic plant control device (AAPCD) permit holders 2014.

2014 AQUATIC PLANT MANAGEMENT SURVEY

Automated Aquatic Plant Control Device (AAPCD)

1. The type of AUAPCD device I use is a:

780	Crary WeedRoller®
15	Lake Restoration Lake Maid
100	Colman Beach Groomer
14	Other
8	Unknown device
917	Total

2. I used an AUAPCD this year:

754 Yes 1 unanswered

162 No, I did not use an AUAPCD this year.

916

3. The AUAPCD I used in 2014:

I have owned for:

115 less than 1 year
91 1 - 3 years
539 more than 3 years

Is jointly owned and shared with the other co-owners and has been for:

10 less than 1 year
6 1 - 3 years
86 more than 3 years

1 was rented.
8 was borrowed.

4. How often monthly did you operate the AUAPCD you used?

	not used	few hours (>0-20)	several hours (>20-50)	many hours (>50-144)	continuous (144 +)
In May:	381	202	58	19	9
In June:	85	315	213	78	26
In July:	45	306	247	108	30
In August:	102	349	184	62	24

Appendix Table G. Statewide numbers of APM permits and properties by county, 2014.

County	Permits	Properties
Aitkin	127	130
Anoka	58	123
Becker	154	154
Beltrami	33	33
Blue Earth	11	44
Carlton	17	17
Carver	85	263
Cass	225	235
Chisago	125	335
Clay	3	3
Clearwater	9	9
Cottonwood	1	1
Crow Wing	567	729
Crow Wing/Morrison	3	119
Dakota	60	256
Douglas	160	160
Faribault	3	25
Freeborn	6	6
Grant	7	7
Hennepin	326	1088
Hubbard	74	74
Isanti	23	67
Itasca	33	33
Jackson	1	1
Kanabec	7	73
Kandiyohi	70	85
Kittson	1	1
Koochiching	1	1
Lac Qui Parle	1	1
Lake of the Woods	1	1
LeSueur	56	251
Lincoln	1	1
Mahnomen	2	2
Martin	7	7
Meeker	36	72
Mille Lacs	13	13
Morrison	61	137
Nicollet	1	1
Olmsted	1	1
Otter Tail	434	434
Pine	28	85
Pipestone	1	1
Polk	5	5
Pope	56	56
Ramsey	102	684
Rice	30	86
Rock	1	1
Scott	58	160
Sherburne	58	160

St. Louis	20	20
Stearns	96	127
Steele	1	1
Stevens	1	1
Swift	1	1
Todd	104	115
Todd & Stearns	1	1
Wadena	9	9
Waseca	7	14
Washington	159	443
Watonwan	2	2
Wilkin	1	1
Wright	153	512

Appendix Table H. Lakes with permits issued for swimmer's itch in 2014.

County	Lake	DOW #	Number of Swimmer's Itch Permits
AITKIN	AITKIN	1004000	1
AITKIN	BIG SANDY	1006200	7
AITKIN	CEDAR	1020900	2
AITKIN	DAM	1009600	1
AITKIN	ESQUAGAMAH	1014700	1
AITKIN	FARM ISLAND	1015900	23
AITKIN	FLEMING	1010500	1
AITKIN	GUN	1009900	8
AITKIN	HANGING KETTLE	1017000	3
AITKIN	HORSESHOE	1003400	1
AITKIN	LITTLE PINE	1017600	1
AITKIN	MINNEWAWA	1003300	5
AITKIN	SOUTH BIG PINE	1015700	2
AITKIN	SUGAR	1008700	1
AITKIN	UPPER BIG PINE	1000100	1
ANOKA	CENTERVILLE	2000600	3
ANOKA	COON	2004200	19
ANOKA	EAST MOORE	2007501	1
ANOKA	GEORGE	2009100	1
ANOKA	GOLDEN	2004500	2
ANOKA	HAM	2005300	2
BECKER	BIG FLOYD	03038700	2
BECKER	DETROIT	03038100	11
BECKER	LITTLE CORMORANT	03050600	1
BECKER	LONG	03038300	1
BECKER	MELISSA	03047500	3
BECKER	NELSON	03059500	1
BECKER	SALLIE	03035900	4
BECKER	WHITE EARTH	03032800	1
BELTRAMI	JULIA	04016600	1
BELTRAMI	MARQUETTE	04014200	1
BLUE EARTH	MADISON	7004400	9
CARLTON	BIG HANGING HORN	9003800	1
CARLTON	EAGLE	9005700	13
CARVER	ANN	10001200	1
CARVER	BAVARIA	10001900	4
CARVER	BURANDT	10008400	5
CARVER	FIREMANS	10022600	1
CARVER	LOTUS	10000600	10
CARVER	LUCY	10000700	2
CARVER	MINNEWASHTA	10000900	15
CARVER	PIERSON	10005300	6
CARVER	RILEY	10000200	8
CARVER	SCHUTZ	10001800	2
CARVER	SUSAN	10001300	4
CARVER	VIRGINIA	10001500	2

CARVER	WACONIA	10005900	2
CARVER	ZUMBRA	10004100	1
CASS	BIRCH	11041200	1
CASS	GREEN HILL	11078600	2
CASS	GULL	11030500	53
CASS	HARDY	11020900	3
CASS	LAWRENCE	11005300	1
CASS	MARGARET	11022200	7
CASS	NORWAY	11030700	12
CASS	ROOSEVELT	11004300	2
CASS	UPPER GULL	11021800	5
CHISAGO	CHISAGO	13001200	2
CHISAGO	GOOSE	13008300	1
CHISAGO	GREEN	13004100	9
CHISAGO	LITTLE COMFORT	13005400	2
CHISAGO	MANDALL	13007400	2
CHISAGO	NORTH CENTER	13003200	34
CHISAGO	NORTH LINDSTROM	13003500	1
CHISAGO	RABOUR	13007900	1
CHISAGO	RUSH	13006900	13
CHISAGO	SOUTH CENTER	13002700	26
CLAY	BLUE EAGLE	14009300	1
CLEARWATER	LOMAND	15008100	1
CROW WING	ARROWHEAD	18036600	1
CROW WING	BAY	18003400	19
CROW WING	BERTHA	18035500	4
CROW WING	BIG TROUT	18031500	11
CROW WING	BULLDOG	18001400	1
CROW WING	CAMP	18001800	2
CROW WING	CLAMSHELL	18035600	15
CROW WING	CLARK	18037400	1
CROW WING	CROOKED	18004100	4
CROW WING	CROSS	18031200	20
CROW WING	CROW WING	18015500	3
CROW WING	DAGGETT	18027100	18
CROW WING	EDNA	18039600	1
CROW WING	EDWARD	18030500	1
CROW WING	GILBERT	18032000	4
CROW WING	GLADSTONE	18033800	2
CROW WING	HOLT	18002900	2
CROW WING	HUBERT	18037500	1
CROW WING	ISLAND	18026900	1
CROW WING	LITTLE HUBERT	18034000	1
CROW WING	LITTLE PINE	18026600	11
CROW WING	LITTLE WHITEFISH	18000100	1
CROW WING	LOVE	18038800	4
CROW WING	LOWER CULLEN	18040300	1
CROW WING	LOWER HAY	18037800	5
CROW WING	LOWER MISSION	18024300	1
CROW WING	LOWER SOUTH LONG	18013600	15
CROW WING	LOWER WHITEFISH	18031000	5
CROW WING	MAYO	18040800	3

CROW WING	MIDDLE CULLEN	18037700	5
CROW WING	MISSISSIPPI RIVER	00-00000	3
CROW WING	NISSWA	18039900	5
CROW WING	NORTH LONG	18037200	10
CROW WING	OSSAWINNAMAKEE	18035200	4
CROW WING	PELICAN	18030800	4
CROW WING	PERCH	18037100	1
CROW WING	PIG	18035400	3
CROW WING	PLATTE	18008800	1
CROW WING	RABBIT	18009302	2
CROW WING	RED SAND	18038600	3
CROW WING	RICE	18014500	1
CROW WING	ROUND	18037300	6
CROW WING	ROY	18039800	5
CROW WING	RUSH	18031100	22
CROW WING	RUTH	18021200	1
CROW WING	SCOTT	18003300	5
CROW WING	SEBIE	18016100	1
CROW WING	SERPENT	18009000	2
CROW WING	SIBLEY	18040400	2
CROW WING	THOR	11030500	1
CROW WING	UPPER CULLEN	18037600	3
CROW WING	UPPER HAY	18041200	7
CROW WING	UPPER MISSION	18024200	2
CROW WING	UPPER SOUTH LONG	18009600	7
CROW WING	WEST FOX	18029700	2
CROW WING	WHITE SAND	18037900	8
CROW WING	WHITEFISH	18031000	7
CROWWING/MORRISON	PLATTE	18008800	1
DAKOTA	ALIMAGNET	19002100	10
DAKOTA	BLACKHAWK	19005900	2
DAKOTA	CRYSTAL	19002700	9
DAKOTA	FISH	19005700	1
DAKOTA	MARION	19002600	4
DAKOTA	OAK BUSH POND	19024300	1
DAKOTA	ORCHARD	19003100	2
DAKOTA	ROGERS	19008000	1
DAKOTA	ROSEBERGER	19004100	1
DAKOTA	SUNFISH	19005000	2
DAKOTA	VALLEY	19034800	1
DAKOTA	WARRIOR POND	19009300	1
DOUGLAS	AARON	21024200	1
DOUGLAS	CARLOS	21005700	4
DOUGLAS	DARLING	21008000	7
DOUGLAS	GENEVA	21005200	4
DOUGLAS	IDA	21012300	2
DOUGLAS	IRENE	21007600	8
DOUGLAS	LE HOMME DIEU	21005600	8
DOUGLAS	MILTONA	21008300	9
FARIBAULT	BASS	22007400	2
FREEBORN	MORIN	24004300	1
GRANT	PELICAN	26000200	2

GRANT	POMME DE TERRE	26009700	2
HENNEPIN	ANDERSON/ENSIGN	27006200	1
HENNEPIN	ARROWHEAD	27004500	2
HENNEPIN	BASS	27009800	2
HENNEPIN	BRYANT	27006700	6
HENNEPIN	BUSH	27004700	1
HENNEPIN	CHRISTMAS	27013700	1
HENNEPIN	DUCK	27006900	1
HENNEPIN	DUTCH	27018100	1
HENNEPIN	EDINA	27002900	1
HENNEPIN	FISH	27011800	4
HENNEPIN	GLEASON	27009500	5
HENNEPIN	GREENTREE POND	27046600	1
HENNEPIN	HAWKES	27005600	1
HENNEPIN	INDEPENDENCE	27017600	4
HENNEPIN	LIBBS	27008500	1
HENNEPIN	LOWER TWIN	27004200	9
HENNEPIN	MEDICINE	27010400	13
HENNEPIN	MELODY	27066900	2
HENNEPIN	MERILANE	27066700	1
HENNEPIN	MTKA BLACK	27013311	4
HENNEPIN	MTKA BROWNS	27013323	2
HENNEPIN	MTKA CARMANS	27013309	9
HENNEPIN	MTKA CARSONS	27013328	3
HENNEPIN	MTKA COOKS	27013303	8
HENNEPIN	MTKA CRYSTAL	27013317	3
HENNEPIN	MTKA E. UPPER LAKE	27013308	3
HENNEPIN	MTKA EMERALD	27013312	1
HENNEPIN	MTKA EXCELSIOR	27013330	5
HENNEPIN	MTKA FOREST	27013900	1
HENNEPIN	MTKA GIDEONS	27013331	10
HENNEPIN	MTKA GRAYS BAY	27013325	2
HENNEPIN	MTKA HALSTEDS	27013301	6
HENNEPIN	MTKA HARRISONS BAY	27013314	7
HENNEPIN	MTKA JENNINGS	27013315	3
HENNEPIN	MTKA LAFAYETTE	27013321	5
HENNEPIN	MTKA LOWER LAKE N.	27013333	5
HENNEPIN	MTKA LOWER LAKE S.	27013332	2
HENNEPIN	MTKA MAXWELL	27013320	6
HENNEPIN	MTKA NORTH ARM	27013318	5
HENNEPIN	MTKA PHELPS	27013307	5
HENNEPIN	MTKA PRIESTS	27013302	2
HENNEPIN	MTKA ROBINSONS	27013326	1
HENNEPIN	MTKA SMITHS	27013322	1
HENNEPIN	MTKA SMITHTOWN	27013306	3
HENNEPIN	MTKA SOUTH UPPER	27013305	4
HENNEPIN	MTKA SPRING PARK	27013310	4
HENNEPIN	MTKA ST. ALBANS	27013329	5
HENNEPIN	MTKA STUBBS	27013319	4
HENNEPIN	MTKA W. UPPER LAKE	27013304	5
HENNEPIN	MTKA WAYZATA	27013324	5
HENNEPIN	MTKA WEST ARM	27013316	4

HENNEPIN	PARKERS	27010700	3
HENNEPIN	REBECCA	27019200	1
HENNEPIN	RED ROCK	27007600	3
HENNEPIN	ROUND	27007100	1
HENNEPIN	SARAH	27019100	3
HENNEPIN	SCHMIDT	27010200	1
HENNEPIN	SHADY OAK	27008900	1
HENNEPIN	SHAVERS	27008600	1
HENNEPIN	STAUDER POND	27079900	1
HENNEPIN	UNNAMED (7365 Pond)	27038900	1
HENNEPIN	WEAVER	27011700	1
HENNEPIN	WOLFE PARK	27066400	1
HUBBARD	5TH CROW WING	29009200	2
HUBBARD	BAD AXE	29020800	1
HUBBARD	BIG SAND	29018500	1
HUBBARD	KABEKONA	29007500	1
HUBBARD	LONG	29016100	1
HUBBARD	PORTAGE	29025000	17
HUBBARD	UPPER BOTTLE	29014800	1
ISANTI	BLUE	30010700	1
ISANTI	GREEN	30013600	2
ISANTI	SPECTACLE	30013500	2
ITASCA	BASS	31057600	1
ITASCA	BOWSTRING	31081300	1
ITASCA	JESSIE	31078600	1
ITASCA	POKEGAMA	31053200	1
ITASCA	SAND	31082600	4
ITASCA	SWAN	31006700	1
KANABEC	FISH	33003600	1
KANDIYOHI	ANDREW	34020600	1
KANDIYOHI	DIAMOND	34004400	1
KANDIYOHI	EAGLE	24017100	12
KANDIYOHI	ELKHORN	34011900	1
KANDIYOHI	LONG	34006600	1
KANDIYOHI	NORWAY	34025100	1
LESUEUR	FRANCES	40005700	3
LESUEUR	GERMAN	40006300	2
LESUEUR	JEFFERSON	40009202	5
LESUEUR	SAKATAH	40000200	4
LESUEUR	TETONKA	40003100	12
LESUEUR	VOLNEY	40003300	1
LESUEUR	WARNER	40005800	1
LESUEUR	WASHINGTON	40011700	10
MARTIN	FOX	46010900	1
MEEKER	FRANCIS	47000200	2
MEEKER	LONG	47002600	5
MEEKER	MINNIE-BELLE	47011900	4
MEEKER	RIPLEY	47013400	1
MEEKER	SPRING	47003200	4
MEEKER	WASHINGTON	47004600	6
MILLE LACS	MILLE LACS	48000200	7
MORRISON	ALEXANDER	49007900	7

MORRISON	CROOKNECK	49013300	5
MORRISON	FISH TRAP	49013700	3
MORRISON	PLATTE	18008800	2
MORRISON	SULLIVAN	49001600	15
OLMSTED	GEORGE	55000800	1
OTTER TAIL	BIG MCDONALD	56038601	1
OTTER TAIL	BIG PINE	56013000	3
OTTER TAIL	CLITHERALL	56023800	1
OTTER TAIL	DEER	56029800	29
OTTER TAIL	EAST BATTLE	56013800	1
OTTER TAIL	EAST SILENT	56051700	1
OTTER TAIL	LIDA	56074700	1
OTTER TAIL	MARION	56024300	4
OTTER TAIL	OTTERTAIL	56024200	12
OTTER TAIL	PELICAN	56078600	3
OTTER TAIL	PRAIRIE	56091500	1
OTTER TAIL	RUSH	56014100	2
OTTER TAIL	SOUTH LIDA	56074702	1
OTTER TAIL	SOUTH TURTLE	56037700	1
OTTER TAIL	STALKER	56043700	6
OTTER TAIL	WALL	56065800	2
OTTER TAIL	WEST LEAF	56011400	1
PINE	CROSS	58011900	1
PINE	NORTH BIG PINE	58013800	4
PINE	POKEGAMA	58014200	2
PINE	SAND	58008100	3
PINE	UPPER PINE	58013000	1
POPE	AMELIA	61006400	2
POPE	LINKA	61003700	6
POPE	MINNEWASKA	61013000	3
POPE	VILLARD	61006700	2
RAMSEY	BALD EAGLE	62000200	8
RAMSEY	DUMBELL POND	62011300	1
RAMSEY	EVERGREEN POND	62009700	1
RAMSEY	GERVAIS	62000700	5
RAMSEY	ISLAND	62007500	1
RAMSEY	JOHANNA	62007800	2
RAMSEY	JOSEPHINE	62005700	2
RAMSEY	KELLER	62001000	5
RAMSEY	KERRY POND	62009500	1
RAMSEY	KOHLMAN	62000600	3
RAMSEY	M POND	62011300	1
RAMSEY	MCCARRONS	62005400	1
RAMSEY	OWASSO	62005600	5
RAMSEY	PEPPERTREE POND	62008600	1
RAMSEY	SHERWOOD POND	62009600	1
RAMSEY	SNAIL	62007300	3
RAMSEY	TURTLE	62006100	2
RAMSEY	WABASSO	62008200	1
RICE	CEDAR	66005200	7
RICE	FRENCH	66003800	1
RICE	HUNT	66004700	2

RICE	MAZASKA	66003900	6
RICE	ROBERDS	66001800	3
SCOTT	CEDAR	70009100	2
SCOTT	CLEARY	70002200	1
SCOTT	LOWER PRIOR	70002600	19
SCOTT	MILL POND	70011300	1
SCOTT	O'DOWD	70009500	3
SCOTT	SPRING	70005400	5
SCOTT	THOLE	70012000	7
SCOTT	UPPER PRIOR	70007200	6
SHERBURNE	BIG	71008200	7
SHERBURNE	BRIGGS	71014600	1
SHERBURNE	EAGLE	71006700	3
SHERBURNE	JULIA	71014500	1
SHERBURNE	LITTLE ELK	71015500	2
SHERBURNE	LONG	71015900	2
SHERBURNE	MITCHELL	71008100	4
SHERBURNE	ORONO	71001300	1
SHERBURNE	RUSH	71014700	1
ST. LOUIS	BIG STURGEON	69093900	3
ST. LOUIS	PRAIRIE	69084800	1
ST. LOUIS	STURGEON	69093900	1
STEARNS	BOLFING	73008800	1
STEARNS	CEDAR ISLAND	73013300	1
STEARNS	GRAND	73005500	2
STEARNS	KORONIS	73020000	3
STEARNS	MARIE	73001400	1
STEARNS	MIDDLE SPUNK	73012800	3
STEARNS	NORTH BROWNS	73014700	2
STEARNS	PELICAN	73011800	13
STEARNS	RICE	73019600	3
STEARNS	UPPER SPUNK	73011700	1
STEELE	KOHLMEIER	74001900	1
TODD	BIG BIRCH	77008400	9
TODD	BIG SWAN	77002300	3
TODD	CHARLOTTE	77012000	1
TODD	LATIMER	77010500	2
TODD	LITTLE BIRCH	77008400	2
TODD	MOUND	77000700	3
TODD	OSAKIS	77021500	26
WADENA	STOCKING	80003700	1
WASECA	CLEAR	81001400	2
WASECA	ELYSIAN	81009500	1
WASECA	REEDS	81005500	2
WASHINGTON	BIG CARNELIAN	82004900	3
WASHINGTON	BIG MARINE	82005200	2
WASHINGTON	CLEAR	82016300	2
WASHINGTON	DEMONTREVILLE	82010100	1
WASHINGTON	FOREST	82015900	12
WASHINGTON	HALFBREED	82008000	1
WASHINGTON	JANE	82010400	1
WASHINGTON	LONG	82013000	1

WASHINGTON	MCKUSICK	8202000	1
WASHINGTON	OLSON	82010300	1
WASHINGTON	PINE TREE POND	82033000	1
WASHINGTON	POTAMOGETON POND	82021200	1
WASHINGTON	SYLVAN	82008000	1
WASHINGTON	TANNERS	82011500	1
WASHINGTON	WHITE BEAR	82016700	10
WRIGHT	AUGUSTA	86028400	4
WRIGHT	BASS	86023400	2
WRIGHT	CEDAR	86022700	1
WRIGHT	CLEARWATER	83025200	3
WRIGHT	CLEARWATER (EAST)	86025201	1
WRIGHT	CLEARWATER (WEST)	86025202	4
WRIGHT	EAGLE	86014800	1
WRIGHT	FISH	86018300	3
WRIGHT	FRENCH	86027300	2
WRIGHT	GRANITE	86021700	1
WRIGHT	HOWARD	86019900	2
WRIGHT	LOCKE	86016800	1
WRIGHT	LOUISA	86028200	1
WRIGHT	MAPLE	86013400	3
WRIGHT	MARTHA	86000900	2
WRIGHT	MINK/SOMERS	86022900	12
WRIGHT	PLEASANT	86025100	8
WRIGHT	PULASKI	86005300	9
WRIGHT	SUGAR	86023300	7
WRIGHT	SULLIVAN	86011900	1
WRIGHT	WAVERLY	86011400	8
WRIGHT	WEST LAKE SYLVIA	86027900	4

Table I. Summary of Aquatic Plant Management Survey Comments

Total comments	Comment summary
10	Without performing aquatic plant control, I would not be able to use my lake frontage.
43	Lake conditions and/or weather affected my ability to control aquatic plants.
1	I use my AAPCD very little now that plants are being controlled in the permitted area.
7	I received my permit too late to install my AAPCD or conduct plant control.
13	Plant conditions did not warrant control.
3	I struggle with the time frame allowed under the permit.
2	AAPCD was too much work to install.
5	Should not have to pay for a permit and/or obtain a permit.
11	The control area permitted is not sufficient.
1	Provide 3-yr permits for all AAPCDs.
5	AAPCD did not work well in controlling aquatic plants.
14	I did not have enough time or proper site conditions to install my AAPCD and/or perform control.
5	AAPCD was not in working condition; did not use.
38	Generally satisfied with AAPCD control.
1	Allow installation of AAPCD at sites with emergent vegetation.
1	Have not yet purchased an AAPCD
20	Generally satisfied with chemical aquatic plant control.
3	Generally satisfied with mechanical aquatic plant control.
1	Bog relocation did not work.
4	Would like to try additional aquatic plant control methods.
11	Aquatic plant control was not effective.
3	Did not perform chemical control because it was too expensive or not available.
4	Permitting process is working for us.
12	Control did not keep up with plant growth.
2	Permitting process is hard to understand and/or didn't work for me.