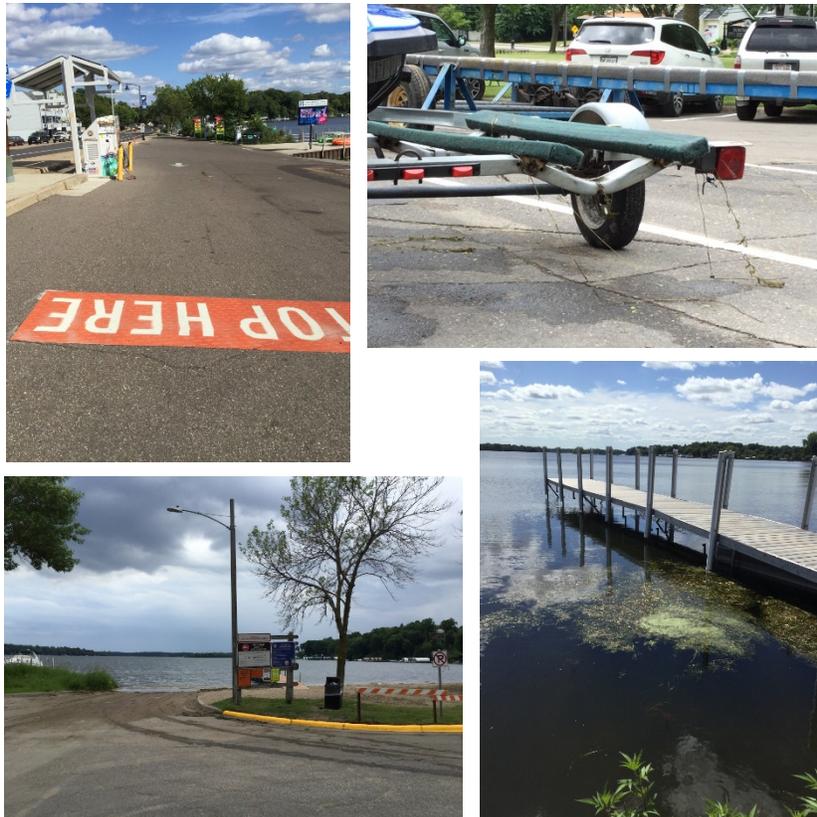


# Lake public access observations for Aquatic Invasive Species prevention behaviors



Prepared for Hennepin County Environment and Energy

By Fortin Consulting, Inc.

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## Executive summary

This project is part of an effort to identify and manage pathways for the introduction and spread of invasive species into and within Hennepin County. The purpose of this project is to conduct observation research of aquatic invasive species (AIS) prevention behavior for those using public lake accesses in Hennepin County.

The observation summarized in this report were made incognito and when access inspectors were not present. Observations were conducted at four Hennepin County public accesses with a variety of signage types, equipment, and inspector frequency. Accesses included Lake Minnetonka-Spring Park (Spring Park), Lake Minnetonka-Surfside (Surfside), Long Lake, and Weaver Lake. This report summarizes three years of observations, which include observations at Spring Park and Long Lake accesses from 2017-2019, and observations at Surfside and Weaver Lake accesses in 2017 and 2019.

The four accesses have various levels of AIS prevention redesign and inspector presence. Redesign occurred at the accesses in different years. Spring Park access has a programmable electronic message board, pavement markings for traffic flow, CD3 self-serve waterless cleaning stations, and a high frequency of Minnesota Department of Natural Resources (MN DNR) inspector presence. Long Lake access has updated AIS prevention prompt signs, pavement markings, a CD3 self-serve waterless cleaning station, and an infrequent MN DNR inspector presence. Weaver Lake has updated AIS prevention prompt signs, pavement markings, a CD3 outpost self-serve cleaning station, and does not have an inspector presence. Surfside access has standard MN DNR signage and has not been recently enhanced with AIS prevention actions, and does not have an inspector present.

Overall, there were 109 observation dates with 1,156 non-commercial boats observed. An additional 189 commercial boats were observed entering Spring Park, Surfside, and Long Lake accesses. For the majority of this report, commercial boats are excluded from the data and observations were not summarized or analyzed.

During the observations, four AIS prevention violations were considered; entering access with plug already installed in boat, entering boat access with vegetation on boat/trailer, leaving access with plug remaining in boat, leaving access with vegetation on boat/trailer. The overall violation rate for all years and accesses is 16.6% (192 observations). Weaver Lake had the highest violation rate of 27.8%, followed by Surfside (23%), Spring Park (14.4%), and Long Lake access (11.2%). The most common violation was boats entering accesses with plugs already installed, which made up 44% of the violations. The remaining three violation types considered were distributed evenly (18-20%).

Findings (Observations when inspectors were not present):

- The overall AIS violation rate of 16.6% is similar to what is reported at MN DNR roadside checks on public roads.
- AIS violation rates were lower at the access with an active access inspector program (14.4%, 11.2%) compared to accesses without an inspector program (27.8%, 23%).
- The highest violation rates were observed with wakeboats, ski/cruiser, and fishing boats.
- The year after the addition of improved signage, pavement markings, and CD3 stations, there was an observed increase in self-inspection rates, violation rates were lower, and those observed glancing at the signage increased.
- Violation rates changed consistently per month with the highest rates in May and lower rates in August and October.
- About ¼ of the boaters leaving the accesses used the CD3 stations where available.

- Violation rates were higher at accesses that were described as weedy.

AIS programs, including education/outreach, can use these findings to identify where they will have the greater effect on AIS prevention actions.

## Introduction and purpose

This project is part of an effort to identify and manage pathways leading to the introduction and spread of invasive species into and within Hennepin County. The project observational data can be used to indicate if the latest type of signage and equipment present at lake accesses affects the aquatic invasive species (AIS) prevention behavior of those using public lake accesses in Hennepin County. It can also help to indicate if AIS prevention behavior changes when inspectors are not present.

## Methods

### Public lake accesses

Four public accesses were chosen as observation locations, including Lake Minnetonka-Spring Park (Spring Park), Lake Minnetonka-Surfside (Surfside), Long Lake, and Weaver Lake. The frequency of AIS inspector presence and the type of signage and equipment were considered when selecting access sites. Table 1 lists the frequency of AIS inspector presence at each access.

Three years of observations were conducted for this project. Spring Park and Long Lake accesses were observed three consecutive years (2017-2019). Surfside and Weaver Lake accesses were observed two years, in 2017 and 2019. Since the implementation of these observations in 2017, three of the four accesses have been redesigned. Access redesigns included the addition of CD3 stations, pavement markings, and signs. Tables 2 and 3 outline the type and timing of redesign for each access.

Table 1. Access operation information

Access	Owned/Operated by	AIS Inspections	Use	Years of Observation
Spring Park	Hennepin County	Frequent	Moderate	2017, 2018, 2019
Surfside	City of Mound	None	Heavy	2017, 2019
Long Lake	City of Long Lake	Few	Moderate	2017, 2018, 2019
Weaver Lake	City of Maple Grove	None	Low	2017, 2019

Table 2. Access redesign schedule

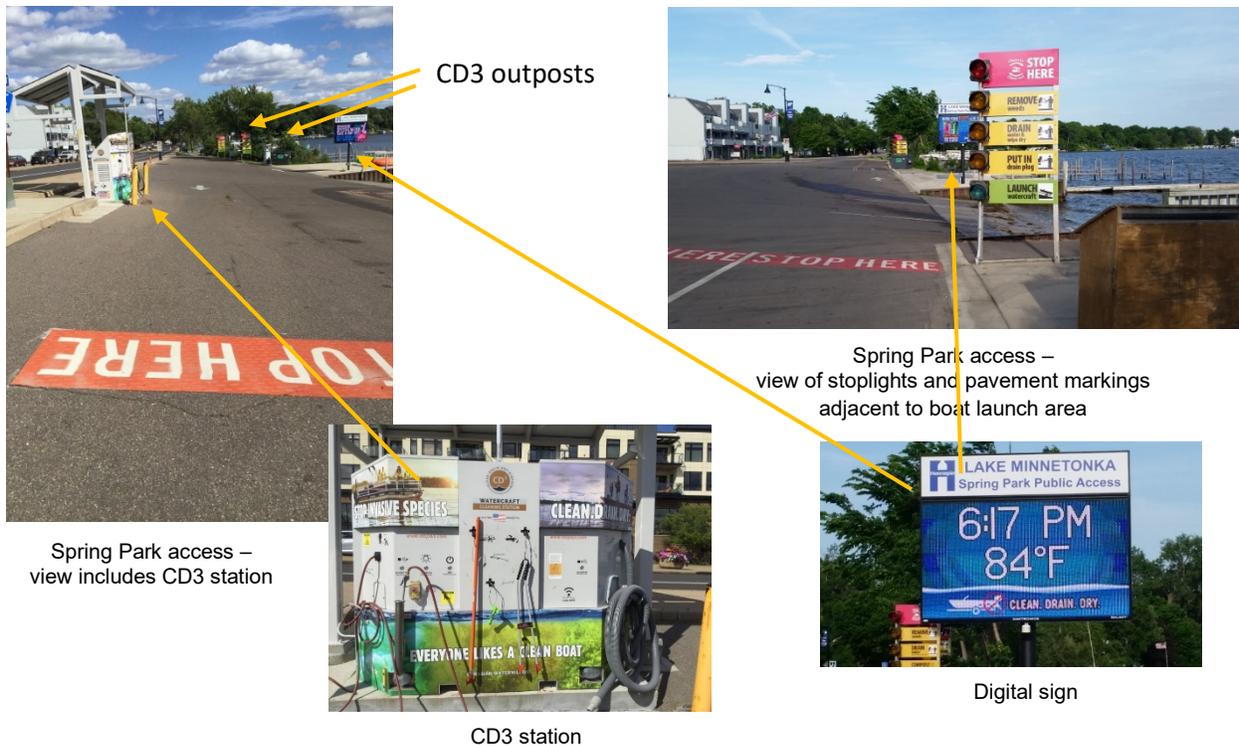
Access	2017	2018	2019
Spring Park	1 <sup>st</sup> year with redesign	2 <sup>nd</sup> year with redesign	3 <sup>rd</sup> year with redesign
Surfside	No redesign	No redesign	No redesign
Long Lake	No redesign	1 <sup>st</sup> year with redesign	2 <sup>nd</sup> year with redesign
Weaver	No redesign	No redesign	1 <sup>st</sup> year with redesign

Table 3. Access AIS redesign

Access	Signage	Prevention equipment
Spring Park	2017-2019 – High tech, many directional signs with lights, pavement markings, digital board with changing messages	2017 – CD3 installed 2018 – 2 CD3 outposts installed 2019 – same as 2018
Surfside	2017-2019 – Several signs on one board	2017 – None 2018 – None 2019 – None
Long Lake	2017 – Few signs on one board 2018 – added directional signs, pavement markings 2019 – same as 2018	2017 – None 2018 – CD3 installed 2019 – same as 2018
Weaver Lake	2017-2019 – Two small signs on one board when entering; Series of signs when exiting (from Lake Assoc.)	2017 – None 2018 – None 2019 – CD3 outpost installed

### Lake Minnetonka - Spring Park

The Spring Park access on Lake Minnetonka is owned by Hennepin County. It has the most sophisticated signage of the accesses observed, and it is the most frequently inspected. In 2016 a programable message board was installed. In 2017, one pilot CD3 station was installed. In 2018, two CD3 outposts were installed at exiting locations. Minnesota Department of Natural Resources (DNR) AIS inspections occur most days from about 7:30 a.m. to 4:30 p.m. Observations were conducted at the Spring Park access in 2017, 2018, and 2019.



**Lake Minnetonka - Surfside**

The Surfside Park access on Lake Minnetonka is owned by the City of Mound. It is the most heavily used access of the four locations. No AIS inspections are conducted at this site. MN DNR AIS signs are posted at the access. No other redesign efforts have occurred. Observations were conducted at the Surfside Park access in 2017 and 2019.



Surfside Park – view of access



Surfside Park – view of exit route



AIS signs

**Long Lake**

The Long Lake public access is owned by the City of Long Lake. It is fairly-well used and is inspected infrequently by the MN DNR. In 2017, two small AIS signs were posted at the access. In 2018, AIS prevention prompt signs, pavement markings, and a CD3 station were installed. Observations were conducted at the Long Lake access in 2017, 2018, and 2019.



2017 Long Lake – view of access before redesign



2018 Long Lake – view of access redesign with new instructional signs and pavement markings



2017 Long Lake – view of exit route



2018 Long Lake – view of exit route redesign with CD3



CD3 installation at Long Lake 2018

### Weaver Lake

The Weaver Lake public access is owned by the City of Maple Grove. It is the least visited site and is not inspected. In 2017, there were two small AIS signs at the access, plus four small signs visible when leaving the access. In 2019, a CD3 outpost station was installed and AIS prevention prompt signs installed for incoming traffic. The Weaver Lake access was observed in 2017 and 2019.



2017 Weaver Lake access – view of access water entry



2019 Weaver Lake access – view of access water entry



AIS sign at Weaver Lake



2019 Weaver Lake access – view of exit route with newly installed CD3 and original posted signs



CD3 outpost installed at Weaver Lake access in 2019

## **Observation plan**

A plan for observing the accesses was developed in consultation with Hennepin County staff. An observation form was developed for tracking observations for each boat entering or leaving the access (Appendix 1). Observations focused on actions related to AIS prevention, AIS regulations, following signs or traffic markings, boat type, and access conditions. Many of the observation details collected for this project are derived from Minnesota State laws pertaining to AIS. These regulations are found on the Minnesota Department of Natural Resources (DNR) website. Appendix 2 includes relevant wording from Minnesota Department of Natural Resources AIS rules.

In addition to noting AIS prevention behaviors, locations of where the vehicles stopped when entering or leaving the access were noted on a printed map for each date inspected. This provided a visual understanding of where traffic stopped when entering and leaving the accesses, helping to determine if the posted signs at the accesses are effective in directing traffic and influencing AIS prevention behaviors.

Fortin Consulting (FCI) staff conducted all observations incognito and when inspectors were absent to avoid influencing the actions of boaters utilizing the accesses. Staff were stationed close enough to observe actions, but far enough away to remain inconspicuous. Sometimes it was necessary to walk around to be able to see actions, usually when the access was crowded, and the view was obstructed by other boats and vehicles.

Observations were scheduled to occur during the summer (May-September) at times of expected high boat traffic. Visits were scheduled to occur in three-hour intervals. If special circumstance interfered with the productivity of the observations, including poor weather conditions or low boat traffic, the visit was shortened or postponed to another date. If DNR inspectors were known to be present, the observation time was adjusted to avoid overlap.

Most observations were conducted between the hours of 3:00-7:30 p.m. Some, morning, mid-day, weekend, and holiday observations were completed.

## **Results and discussion**

### **Boat observations**

Table 4 shows the number of observations conducted at each access as well as the number of boats observed. These numbers include all styles of watercrafts observed entering or exiting the access, as well as commercial/non-commercial watercrafts. Some observations included multiple boats launching from the same trailer (i.e. kayaks, personal watercraft, or paddleboards).

FCI completed 109 access observation visits during the three years of the project. A total of 1,345 boats were observed entering or leaving the Spring Park, Surfside, Long Lake, and Weaver Lake accesses. In 2017, 36 visits resulted in 412 boat observations at the four access locations. In 2018, 28 visits resulted in 308 boat observations at the Spring Park and Long Lake public accesses. In 2019, 45 visits resulted in 625 boat observations at the four access locations. Appendix 3 includes the dates and number of boat observations per visit.

Table 4. Annual totals of visits and boats observed (2017-2019)

Lake Access	2017		2018		2019		Total		Average #boats/observation
	# days	# boats							
Spring Park	10	113	8	82	17	204	35	399	11
Surfside	8	171	na	na	10	217	18	388	22
Long Lake	9	79	20	226	9	127	38	432	11
Weaver	9	49	na	na	9	77	18	126	7
Total:	36	412	28	308	45	625	109	1345	12

It was attempted to visit the four accesses in rotation with the purpose to evenly disperse the observations throughout the observation months. However, in 2018, observations at Spring Park access were delayed due to redesign activity at that access, so more visits were made to the Long Lake access. In 2019, additional visits to Spring Park were completed to increase the number of visits and observations to more closely match the other accesses.

The number of boats observed varied from site to site, ranging from 126 at Weaver Lake to 432 at Long Lake. The Spring Park and Surfside accesses had 399 and 388 boat observations, respectively. Surfside was the busiest access with an average of 22 boats per observation while Weaver Lake was the least utilized access with an average of 7 boats per observation. Spring Park and Long Lake each had an average of 11 visits per observation.

Table 5. Number of boats entering and leaving accesses (2017-2019)

	Entering	Leaving	Total
Total boats observed:	786	559	1345
Commercial boats:	108	81	189
Non-commercial boats:	678	478	1156

### Boat types

Each boat observed was recorded by type, from non-motorized to large recreational boats. This helps provide an indication of the potential for spread of AIS. For example, wake boats carry ballast tanks that are difficult to clean and are a potential source of AIS when the boat is used in another lake. Non-motorized boats, including canoes, kayaks and paddle boards, are likely a low risk for the spread of AIS. Boats not specifically listed, such as sailboats, were marked as “other”. Ski/cruiser boats and fishing boats were the most frequently used type of boat at three of the four accesses. Personal watercraft were the most popular boat type at the Surfside access. Other boats including wake boats, pontoon boats, personal watercraft (PW) and non-motorized boats were also observed at the accesses. Most of the personal watercrafts used at Surfside and most of the kayaks used at Spring Park were commercially owned. Table 6 show the breakdown for types of boats observed at the accesses. A discussion of commercial vs non-commercial boats follows.

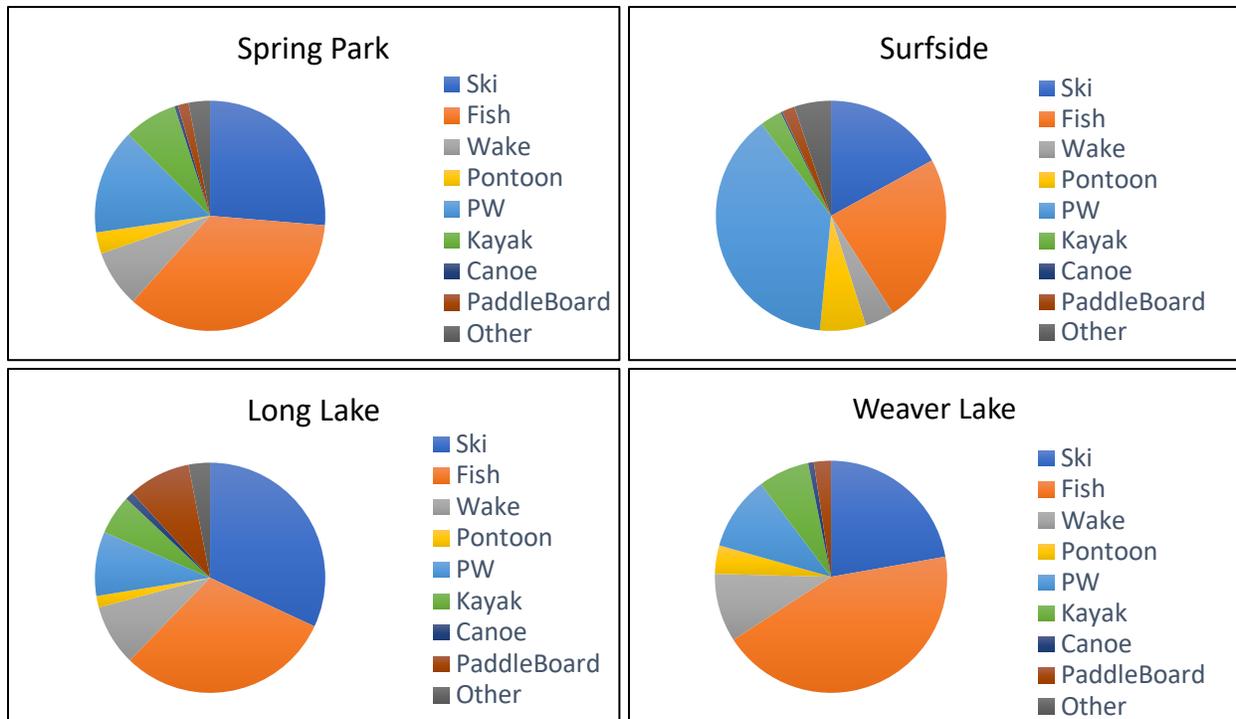


Figure 1. Boat types observed at accesses (2017-2019)

Table 6. Number of boats per access per type

Spring Park	Ski	Fish	Wake	Pontoon	PW	Kayak	Canoe	Paddle Board	Other	Total
Non-commercial	100	139	30	10	54	9	2	0	11	355
Commercial	5	2	2	2	5	21	0	6	1	44
Total	105	141	32	12	59	30	2	6	13	399

Surfside	Ski	Fish	Wake	Pontoon	PW	Kayak	Canoe	Paddle Board	Other	Total
Non-commercial	58	92	16	17	47	6	1	2	18	257
Commercial	8	1	0	8	101	6	0	5	2	131
Total	66	93	16	25	148	12	1	7	20	388

Long Lake	Ski	Fish	Wake	Pontoon	PW	Kayak	Canoe	Paddle Board	Other	Total
Non-commercial	133	131	37	7	39	24	5	30	12	418
Commercial	5	0	0	0	0	0	0	8	1	14
Total	138	131	37	7	39	24	5	38	13	432

Weaver Lake	Ski	Fish	Wake	Pontoon	PW	Kayak	Canoe	Paddle Board	Other	Total
Non-commercial	28	55	12	5	13	9	1	3	0	126
Commercial	0	0	0	0	0	0	0	0	0	0
Total	28	55	12	5	13	9	1	3	0	126

## Commercial vs non-commercial

Commercial marinas/rental companies hauling boats were observed at Spring Park, Surfside, and Long Lake accesses. Many observations were of the same company hauling boats in and out. They pick up and drop off boats for customers. Commercial boats were recognized by insignia marked on vehicles, boats, or trailers, as well as recognizing the commercial personnel or vehicles and a few interactions with customers.

Since observations were completed from a distance without direct contact with any of the commercial businesses, it is not known if they were licensed service providers and if each staff member was trained as required.

Boats that were brought to the dock by a commercial company for delivery or rental use were denoted as “commercial.” Boats being used by private owners were labeled as “non-commercial” users.

Because commercial boats were not observed at all accesses, data of commercial and non-commercial boats were separated (Figure 2). Figure 3 compares the violation rates of all boats observed vs non-commercial boats. The overall violation rate of commercial boats, including all years and accesses is 14.8%. The observed violation rates for Spring Park, Surfside, and Long Lake were 18.2%, 13.7%, and 14.3%, respectively.

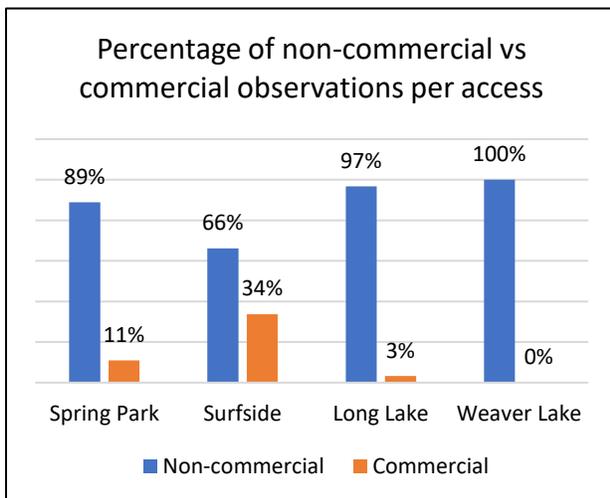


Figure 2. Comparison of non-commercial vs commercial boat observations per access

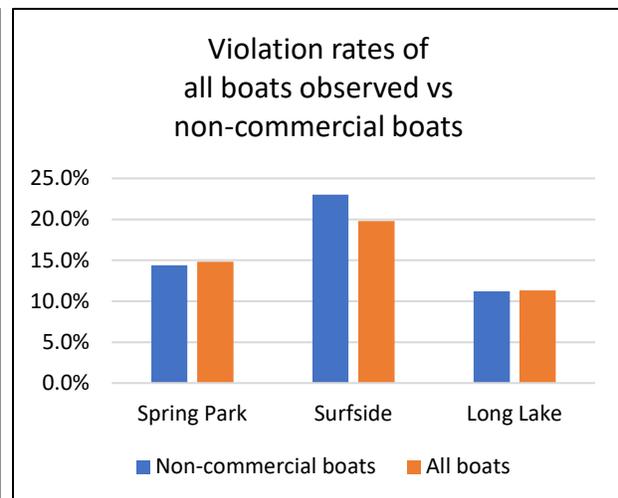


Figure 3. Comparison of violation rates of all boats observed vs non-commercial boats observed per access

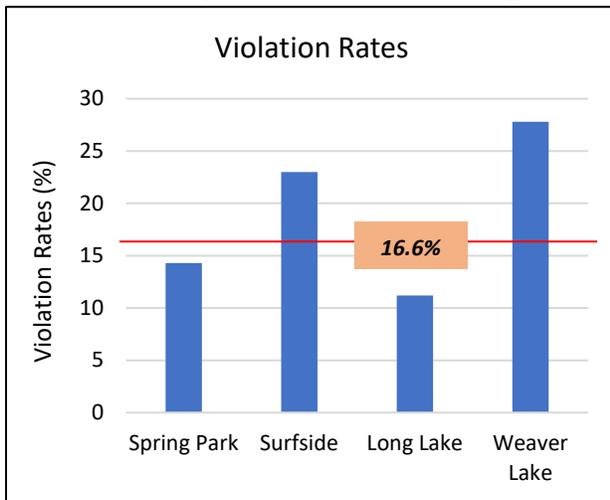
Though the base data for commercial and non-commercial boats are each listed for reference, this report mainly addresses the non-commercial data. Commercial data is excluded from analyses in this report.

## Observed violations (non-commercial)

Behaviors considered violations were based on Minnesota state laws pertaining to AIS. Potential violations of AIS regulations were observed at all four accesses. The main actions observed as potential violations were:

- 1) Entering with plug in boat
- 2) Entering with vegetation on boat or trailer
- 3) Leaving with plug in boat
- 4) Leaving with vegetation on boat or trailer

### Violation rate (non-commercial boats)



Of 1,156 non-commercial boats observed, 192 of them were observed committing violations while entering or leaving the boat access. The overall violation rate for non-commercial boats for all years and accesses is 16.6%.

Weaver Lake had the highest violation rate of 27.8%. Surfside had a violation rate of 23.0%, Spring Park had a violation rate of 14.4%, and Long Lake had a violation rate of 11.2%.

Figure 4. Violation rates of non-commercial boats per access (2017-2019)

Table 7. Violation observation tallies for non-commercial boats 2017-2019.

	Spring Park	Surfside	Long Lake	Weaver Lake	Totals
Total Boat Observations	355	257	418	126	1,156
Total Violations	54	68	50	38	210
Total Boats w/ Violations	51	59	47	35	192
<b>% boats w/ Violations</b>	<b>14.4%</b>	<b>23%</b>	<b>11.2%</b>	<b>27.8%</b>	<b>16.6%</b>
Entering with veg	3	23	6	9	41
Entering with plug	23	27	26	16	92
Leaving with plug	11	8	14	5	38
Leaving with veg	17	10	4	8	39

### Violation types

The most common violation observed was entering the access with the plug already installed (44%). Violation rates for entering with vegetation (19%), leaving with vegetation (19%), or leaving with plug in (18%) were similar in distribution. Figure 5 shows the distribution of types of violations observed at each access between 2017 and 2019.

Plug violations upon entering the access was highest at Weaver Lake. The violation rate for entering with the plug installed ranged from 10 to 23 percent (Figure 6). The Weaver Lake and Surfside accesses had the highest violation rates for all four violation types. Neither of these lakes have AIS inspectors at the accesses.

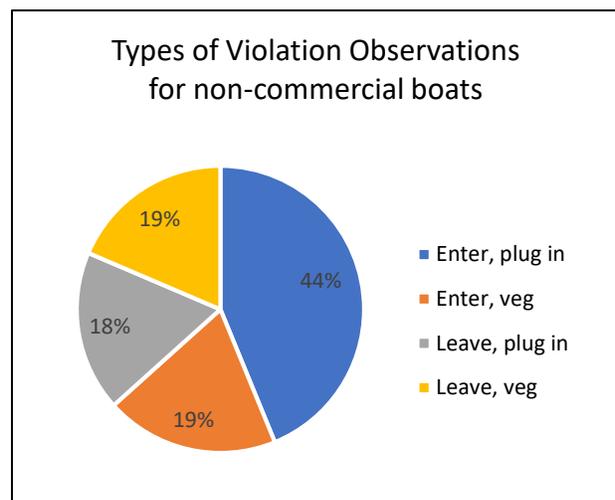


Figure 5. Violations for non-commercial boats

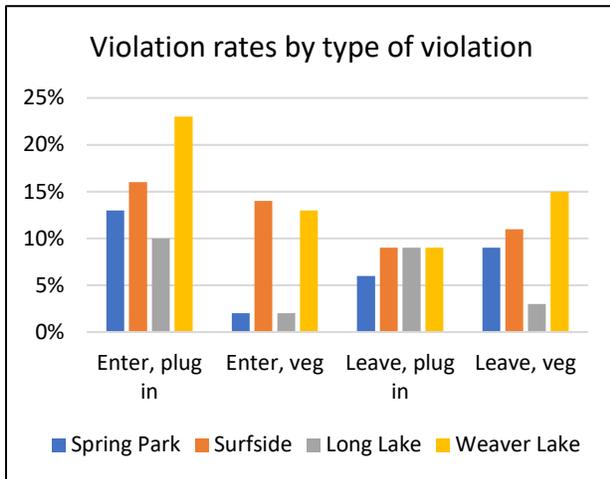


Figure 6. Violation rates per type of violation

Some boats were observed committing multiple violations. For example, a single boat was observed leaving the access with the boat plug still installed and dragging vegetation. Two sets of violation tallies are recognized: the total number of violations observed which includes counting multiple violations per boat; and the total number of boats observed committing violation(s). Eighteen boats were observed committing multiple violations. The total number of violations observed was 210. Table 7 above shows the violation tallies at each lake access.

### Violations per type of boat

Wake boats had the highest violation rates (23.2%), followed by Ski/cruiser boats (21.0%) and fishing boats (20.6%). Fishing boats and ski/cruiser boats had the highest number of violations, mostly due to entering the accesses with plugs already installed. Only one non-motorized boat violation was observed by a paddleboard leaving the access with vegetation. Table 8 shows violations per type of boat observed. Additional outreach to more common violators may improve AIS prevention.

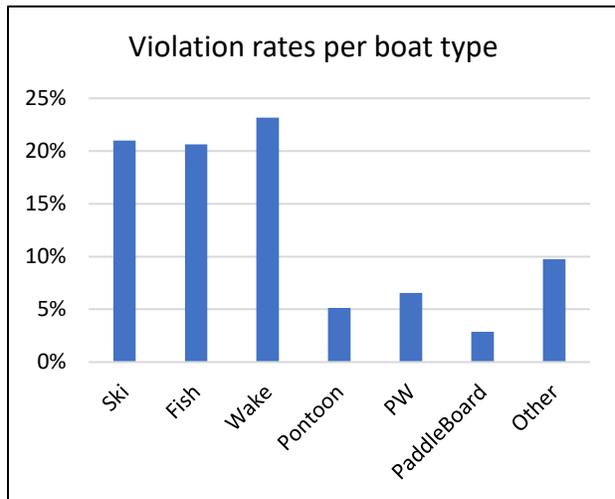


Figure 7. Violation rate per type of boat (2017-2019)

Table 8. Number of violations per boat type

	Ski	Fish	Wake	Pontoon	PW	Kayak	Canoe	Paddle Board	Other	Total
Boat Observations	319	417	95	39	153	48	9	35	41	1,156
Total Violation	76	93	23	2	10	0	0	1	5	210
Total Boats with Violations	67	86	22	2	10	0	0	1	4	192
<b>Violation Rates (%)</b>	<b>21.0</b>	<b>20.6</b>	<b>23.2</b>	<b>5.1</b>	<b>6.5</b>	<b>0</b>	<b>0</b>	<b>2.9</b>	<b>9.8</b>	<b>21.0</b>
Entering with vegetation	15	17	5	0	4	0	0	0	0	41
Entering plugs in	33	51	6	0	0	0	0	0	2	92
Leaving with plug in	14	16	4	2	0	0	0	0	2	38
Leaving with vegetation	14	9	8	0	6	0	0	1	1	39

### Violation rates per month

Overall violation rates were highest in the months of May (32%) and June (24%). The violation rates dropped more than 50% in July, August, and September. Figure 8 shows the violation rate per month at all accesses. Observations per hour were the busiest in June, July, and August (see Figure 9).

In general, the four violation types follow the same trend of decreasing as the season progresses (Figure 10). Boats entering accesses with plugs already installed increased between July and September, but still maintained lower violation rates compared to May and June.

Overall violation rates for all accesses decreased as the boating season progressed. Figure 11 diagrams violation rates per month per year for each access. Though each access and year shows a different pattern, the majority of the data shows that violation rates are highest at the beginning of the season and are lowest at the end of the season. Table 9 details the number of violations per month per year per access.

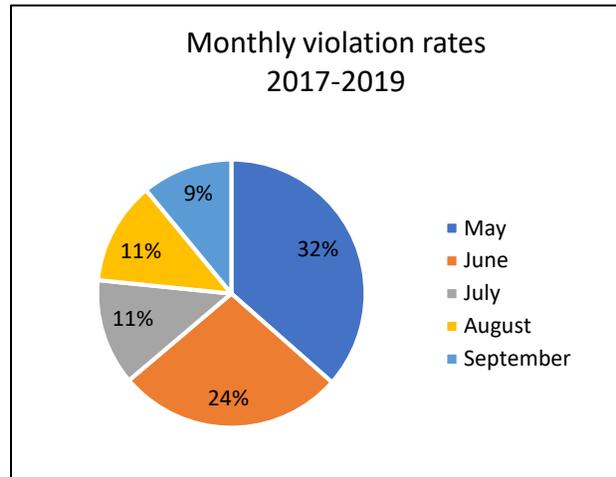


Figure 8. Violation rates of non-commercial boats per month

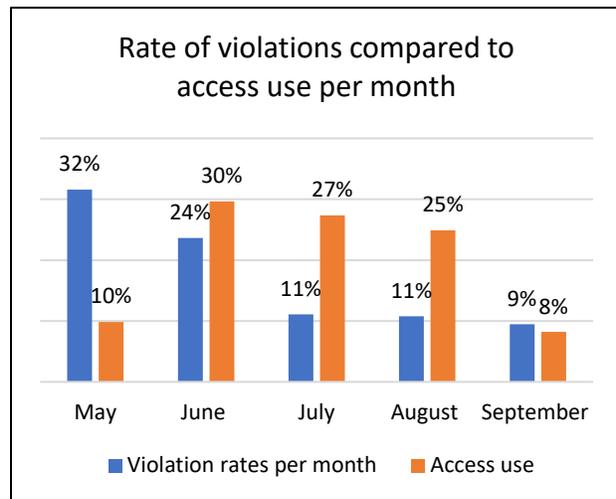


Figure 9. Rate of violations per month compared to the number of boats per month

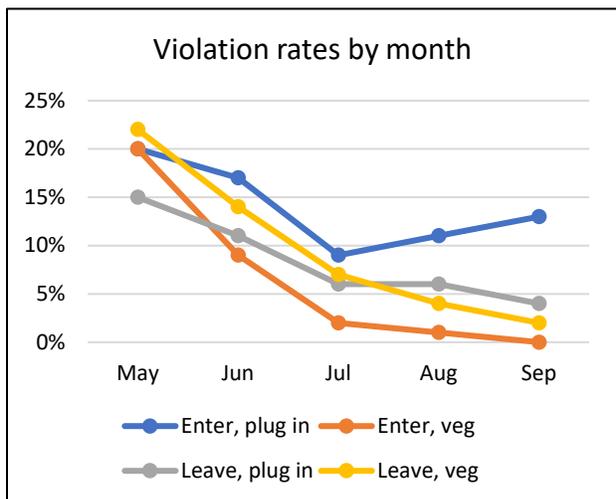


Figure 10. Violation rates per type per month per year

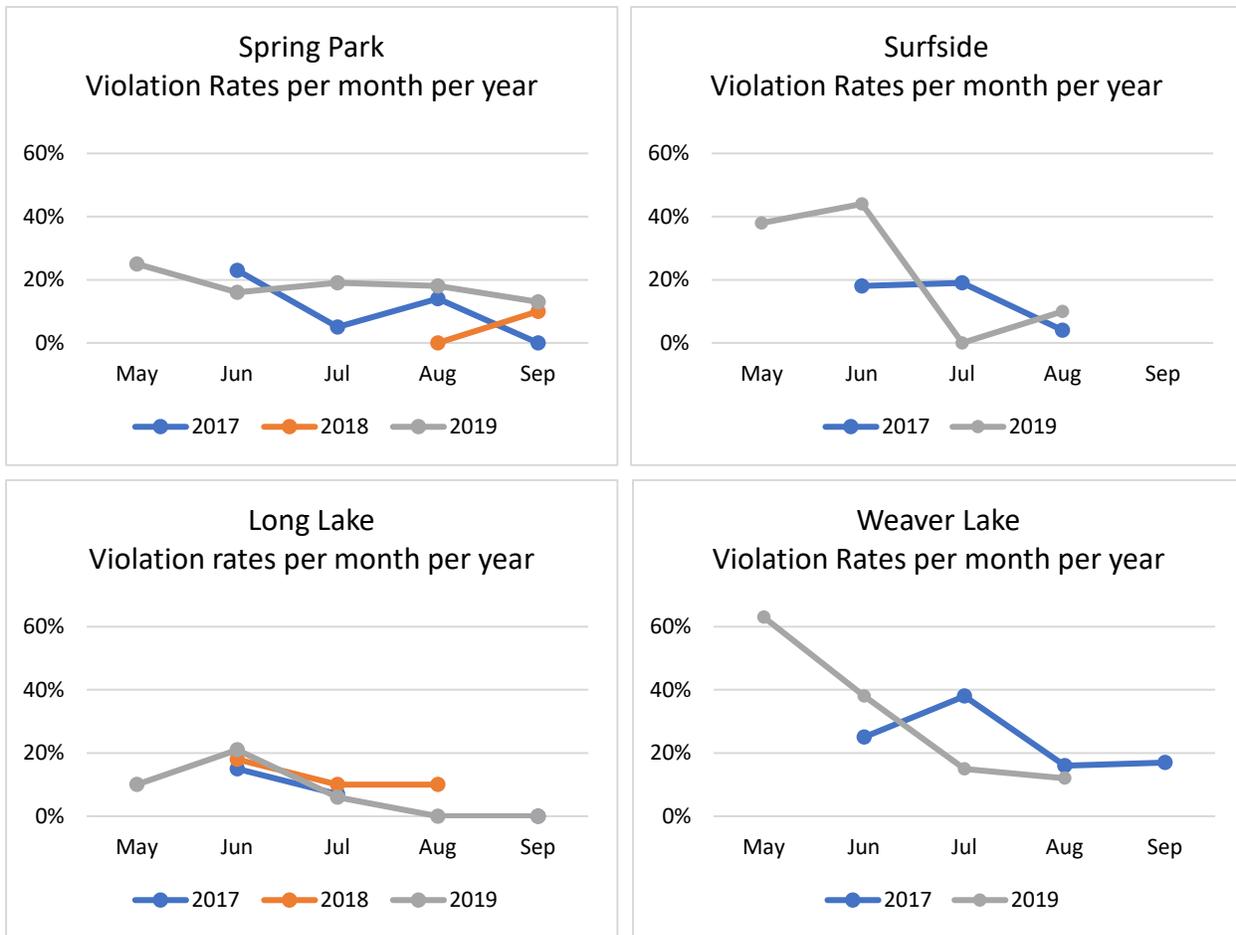


Figure 11. Violation rates per month per year for each access

Table 9. Violations for non-commercial boats per month per access per year

# of violations	Spring Park			Surfside		Long Lake			Weaver Lake		Total
	2017	2018	2019	2017	2019	2017	2018	2019	2017	2019	
May	na	na	6	na	23	na	na	2	na	5	36
Jun	7	na	5	11	15	5	10	9	4	15	81
Jul	1	na	8	6	0	3	9	3	3	2	35
Aug	5	0	11	1	3	na	6	0	3	2	31
Sep	0	5	3	0	0	0	na	0	1	na	9
Total violations:	13	5	33	18	41	8	25	14	11	24	192
Violation rates (%):	14.3	6.3	17.9	15.1	29.7	10.1	11.8	11.0	22.4	31.2	16.6
Annual observations:	91	80	184	119	138	79	212	127	49	77	1,156

na - indicates no observations occurred during this period

### Violations per year

Violation rates varied per year (Figure 12). At three of the four accesses, violation rates increased in 2019 from prior years. Long Lake violation rates were steady all three years. Surveys were not conducted at Surfside and Weaver Lake in 2018.

### Boater AIS self-inspections

Observations included assessing how thoroughly each boat owner or user inspected their boat and trailer for vegetation or zebra mussels when leaving the access. The options were: “thorough – bent over to search”, “quick look”, “didn’t look”, and “unsure”. A thorough search required that a person look over, across, and under the entire boat and trailer for vegetation. A quick look was counted as an inspection.

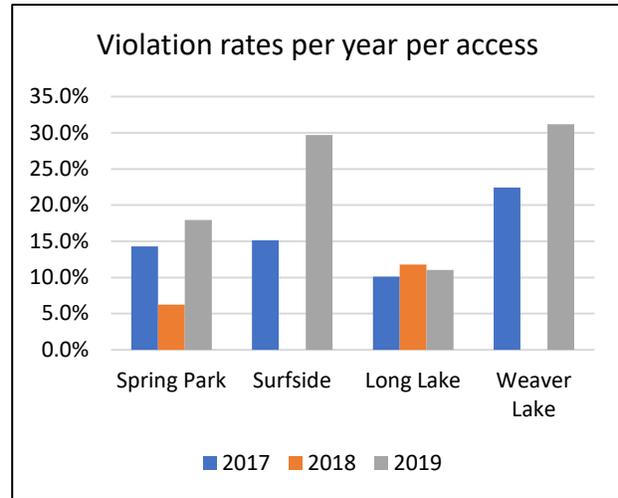


Figure 12. Violation rates per year per access 2017 – 2019

The overall inspection rate was 73.4%. Redesigned accesses had a higher rate of boater AIS inspections than standard accesses when comparing behavior pre and post access redesign. Table 10 shows that, overall, redesigned accesses had higher rates of boater AIS inspections and lower rates of no-inspections than standard accesses.

Table 10. Boater AIS inspections upon leaving access

	Access with Re-design		Standard Access	
Thorough Check	128	38.1%	44	31.0%
Quick Look	125	37.2%	54	38.0%
Didn't Look	75	22.3%	42	29.6%
Not sure	8	2.4%	2	1.4%
<b>Totals</b>	<b>336</b>		<b>142</b>	

The Spring Park access had the highest percentage that inspected their boats (either thorough or quick look) at 83%. Weaver Lake had an inspection rate of 71% post-design, and 57% pre-design. Long Lake had an inspection rate of 66% post-design, and 48% pre-design. See Figure 13. The Spring Park access had the AIS redesign features for all three years of observations. The Long Lake access included two years of redesign data. Weaver Lake had only one year of data following access redesign. Boater AIS inspection behavior improved for Long Lake and Weaver Lake following redesign. Surprisingly, boat AIS inspections were high at the Surfside access.

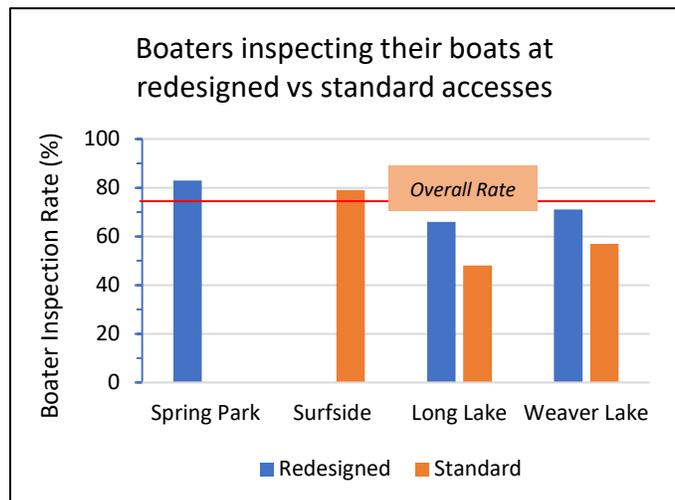


Figure 13. Rate of boaters completing AIS inspections (including thorough checks and quick looks)

## Impact of signs on boater behavior

One of the objectives of this project was to determine if the different types of signage influenced traffic movement and if that affects boater AIS prevention behavior. It was difficult to tell if people were reading the signs, and there were very few that went up to the signs and read them. At the Spring Park access it was especially unclear if people read signs from their car or at a distance because signs were big enough to read without going up to them. Many followed the proper direction for traffic flow, even if they didn't appear to read the signs. This data should be viewed with an understanding of these limitations.

Table 11. Number of boaters reading signs upon entering access

	Access with re-design features		Standard Access	
	Count	Percentage	Count	Percentage
Read signage	9	2.1%	1	0.4%
Glanced at signage	77	17.7%	20	8.2%
Didn't read signage	336	77.2%	221	91.9%
Unknown	13	3.0%	1	0.4%
<b>Total</b>	<b>435</b>		<b>243</b>	

The overall sign reading rate was 15.8%. Table 11 shows that the signs are more often viewed at the redesigned accesses; however, it appears that most people do not read signs at all. Weaver Lake had the highest sign reading rate post redesign at 33%, followed by Spring Park with 23%, and Long Lake at 14%. Surfside had a sign reading rate of 9% (no redesign). Spring Park and Long Lake with redesigned accesses had the lowest violation rates. Spring Park, the only access with electronic signs, had a greater percentage of boaters reading the signs than Long Lake and Surfside. Weaver Lake had a high rate of sign reading, but with a high violation rate. Data for the Surfside access shows a high violation rate with the lowest rate of sign reading. This suggests that the correlation of the type of signs present and AIS prevention behavior may be complex and vary per access. The large, easy to read signs present at the Spring Park, Long Lake and Weaver Lake accesses appear to be more likely to be read and may promote AIS prevention behaviors.

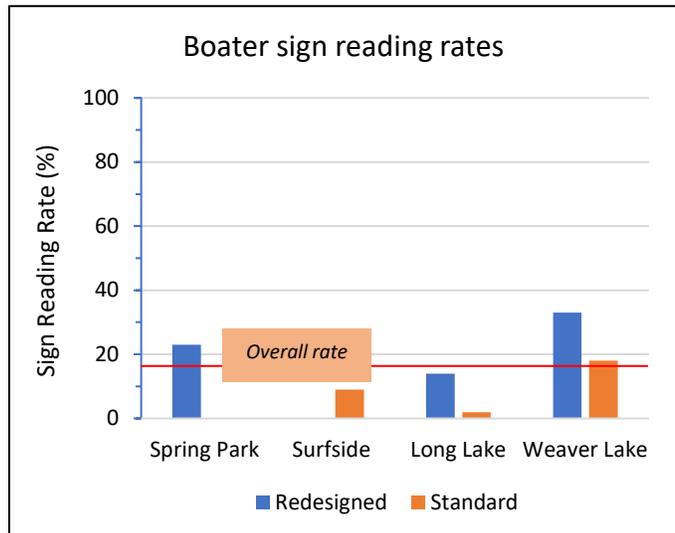


Figure 14. Rate of boaters reading posted signs (includes reading and quick glance)

## Traffic flow

Access observers recorded the location in which boaters parked to prepare or clean their boats upon arriving or leaving the accesses. The purpose was to learn if prompt signs and markings aided traffic flow. A boater who parked their boat at an indicated location at the access when arriving or leaving was considered to follow traffic markings. If a boater parked anywhere other than the posted locations, then it was deemed that they did not follow traffic markings. An example of not following traffic markings is a boat that enters an empty access ramp and directly backs the boat down the ramp to prepare their boat for launch. Another example would be if a boater drove the boat straight out of the access when leaving

without stopping to inspect and clean their boat. Exceptions to parking would be if multiple boats were in line to use the access at the same time, these boats were considered to be following traffic markings if they fell in line behind other waiting boats. It was determined that a boater who stopped to either prepare or clean their boats upon entering or leaving followed traffic markings.

Overall, 66% of boaters followed traffic markings. Figure 15 shows that traffic markings were followed slightly better at redesigned accesses. The Spring Park access had the highest level of traffic markings, followed by the Long Lake access and then the Weaver Lake access, while the Surfside Park access had no markings related to AIS prevention. Traffic markings appear to have little impact for boats entering accesses. In general, more boaters stopped in marked locations when leaving the accesses compared to arriving. It was not uncommon to observe boaters backing right down empty access ramps without stopping at designated areas. Figures 16 and 17 show the rates of following traffic markings in and out of the accesses per access. Surfside shows a high rate of following traffic flow, despite there being no redesign. This may be due to the layout of the access. Boaters really don't have a choice in traffic direction.

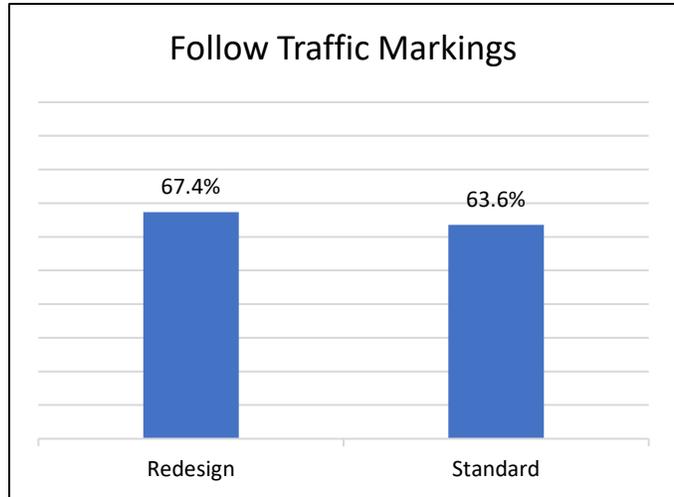


Figure 15. Rate at which boaters follow traffic markings, comparing redesigned vs standard accesses

Surfside shows a high rate of following traffic flow, despite there being no redesign. This may be due to the layout of the access. Boaters really don't have a choice in traffic direction.

In addition, Surfside access is busy enough that boaters line up to wait to launch their boats. From observations at other accesses, we saw that boaters will drive directly into the ramp if the access is open. We didn't have a chance to observe this behavior at Surfside due to high volume of traffic. Maps with stopping locations for each location are included in Appendix 5.

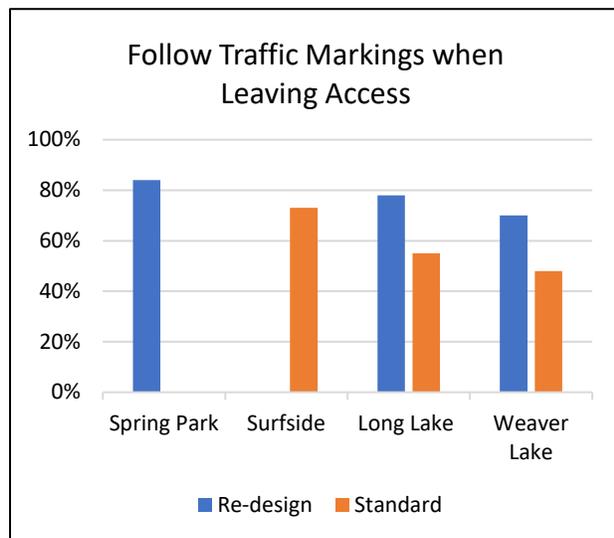


Figure 16. Rate at which boaters follow traffic markings when leaving from accesses

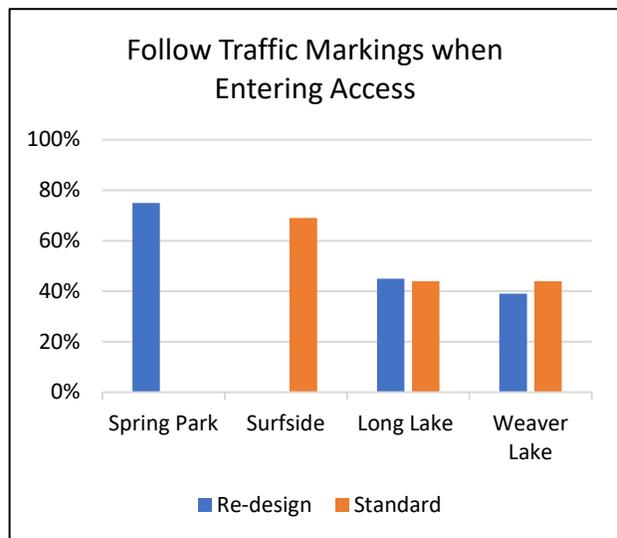


Figure 17. Rate at which boaters follow traffic markings when leaving arriving to accesses

The traffic flow data excludes non-motorized boats (i.e. kayaks, canoes, and paddleboards). Most frequently, these boaters parked in regular parking spots and boats were carried to and from the access upon arrival and departure. A total of 133 kayaks, canoes, and paddleboards were observed.

The aerial photos below show the designated traffic flow for the four accesses. Yellow arrows indicate traffic coming into the access and black indicates traffic leaving the access. The red marks indicate where pavement markings (stop bars) were added as part of the redesign. CD3 stations are also noted.



Figure 18. Spring Park access traffic flow. Photo: Hennepin County



Figure 19. Surfside access traffic flow. Photo: Hennepin County

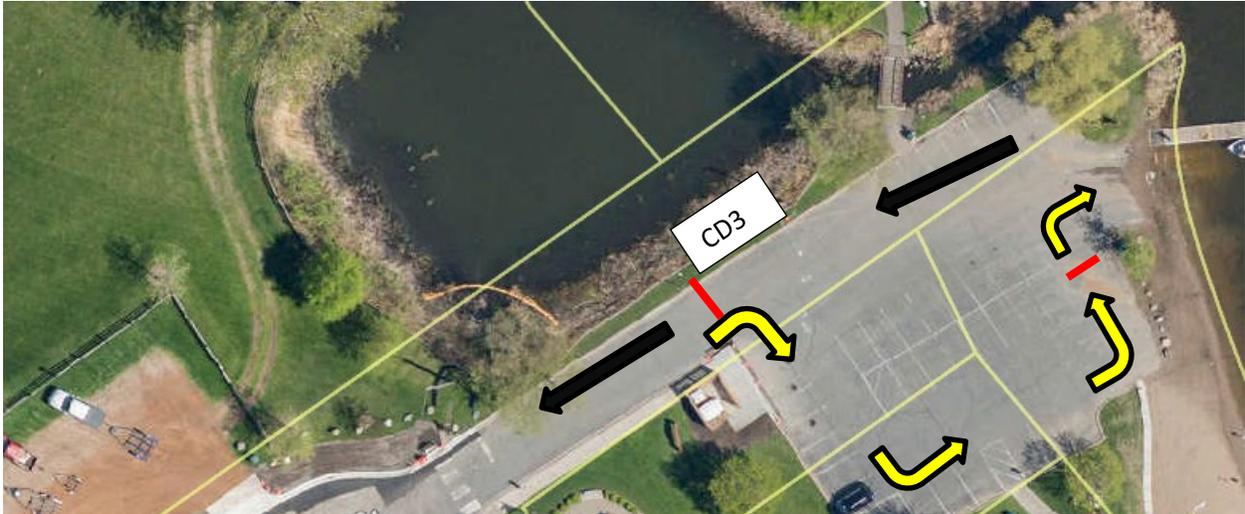


Figure 20. Long Lake access traffic flow. Photo: Hennepin County

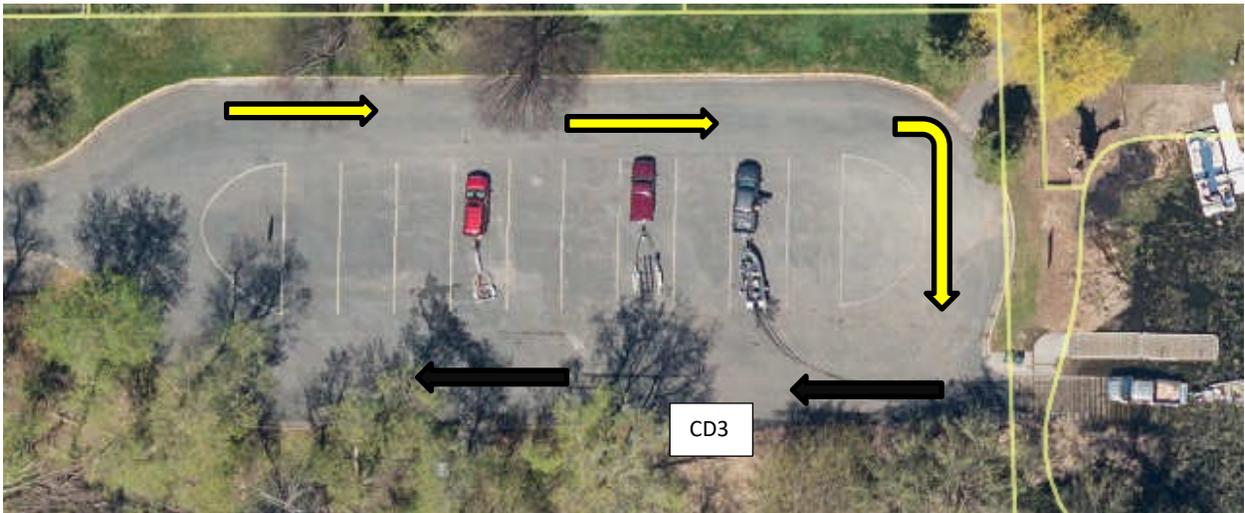


Figure 21. Weaver Lake access traffic flow. Photo: Hennepin County

### CD3 station use

CD3 self-serve waterless cleaning stations or CD3 outposts were installed at the Spring Park, Long Lake and Weaver Lake accesses as part of access redesign. The CD3 stations provide tools for boaters to use to better remove AIS from their boats and trailers (see photos under the access descriptions). Spring Park and Long Lake accesses have the full CD3 stations which are equipped with power and include a vacuum and air hose as well as other tools like a grabber, brush and plug wrench. CD3 outposts, were installed at the Spring Park access in 2018 and the Weaver Lake access in 2019. CD3 outposts are smaller, do not have power, but have many of the tools.

Overall, 23.8% of the boaters used the CD3 stations or outposts at the three lake accesses. Figure 23 shows the rate of CD3 use.

The most commonly observed tools used were the compressed air hose, grabber, and vacuum. Figure 24 shows how many times tools were used at the redesigned accesses. Sometimes, more than one tool was used to clean a single boat.

The redesigned accesses with CD3 stations at Spring Park and Long Lake showed a lower rate of violations for boaters using the CD3 stations than for boaters that did not use CD3 stations. Weaver Lake did not show reduced violation rates. However, the sample size was low with only seven observations at Weaver Lake in 2019, the year the CD3 station was installed.

The CD3 use data excludes non-motorized boats (i.e. kayaks, canoes, and paddleboats). Most frequently, these types of boats directly parked in regular parking spots and were carried to and from the water upon arrival and departure. A total of 133 kayaks, canoes, and paddleboards were observed.

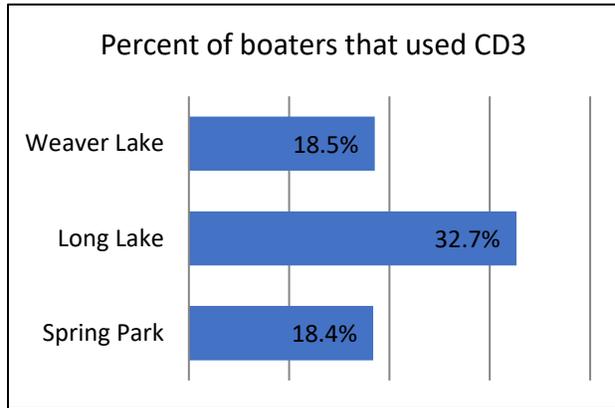


Figure 22. The percentage of boaters observed using CD3 tools at redesigned accesses 2017-2019.

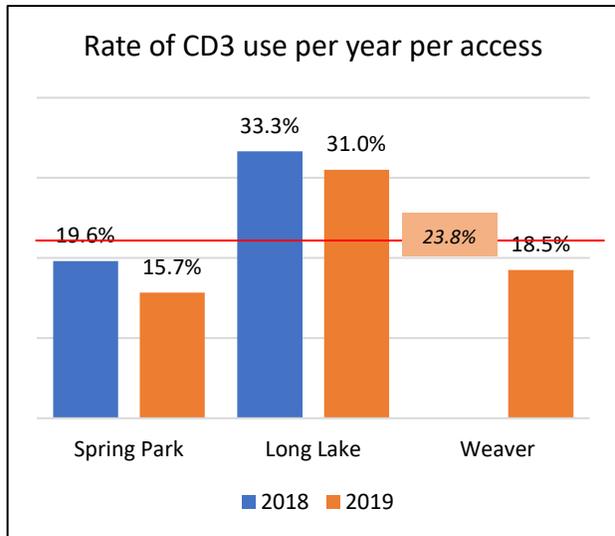


Figure 23. Percentage of CD3 use per year per redesigned access. 2018-19 data

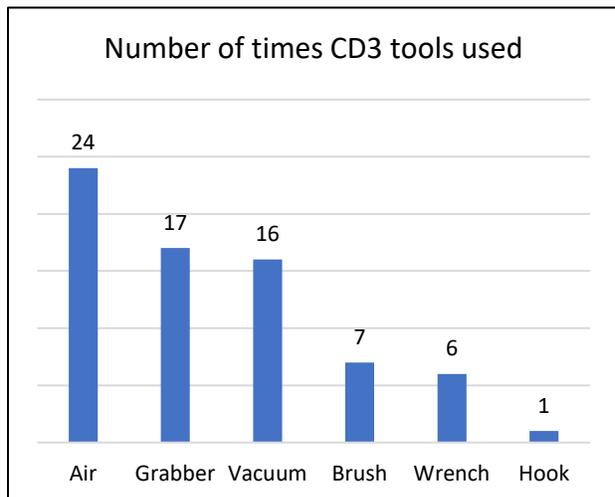


Figure 24. Number of times tools of CD3 station were observed being used at redesigned accesses 2017-2019.

Table 12. Violation tracking of boats that used the CD3 stations

Totals	# of boats	# Violations	Violation Rate	Vegetation - leaving	Plug - leaving
Used CD3	62	7	11.3%	6	1
Did not use CD3	199	30	15.1%	16	14

Spring Park (2017-2019)					
Used CD3	25	2	8.0%	2	0
Did not use CD3	111	16	14.4%	11	5

Long Lake (2018-2019)					
Used CD3	32	3	9.4%	2	1
Did not use CD3	66	7	10.6%	1	6

Weaver (2019)					
Used CD3	5	2	40.0%	2	0
Did not use CD3	22	7	31.8%	4	3

**Access condition - “clean” or “weedy”**

Observations of the “weediness” of the access ramp were noted, as this would influence the chance of leaving with aquatic plants on the boat/trailer. The Spring Park access was rated as “weedy” 63% of the observation dates; Surfside access was rated “weedy” to “very weedy” for 53% of the observation dates; Weaver Lake access was rated “weedy” for 17% of the observation dates; and Long Lake was rated “weedy” 13% of the observation dates. The accesses were most likely weedy at times when the wind was blowing toward the access. As expected, boaters leaving weedy accesses had more vegetation violations than boaters leaving non-weedy accesses (Figure 25). However, boats arriving to access with vegetation already present on boats/trailers occur at weedy and non-weedy accesses. Incorporating a practice to clean accesses may reduce vegetation violations.

Aquatic plants were found on trailers parked after boaters launched their boats (see photos below). Note that photographs were not taken during the actual observations so as not to attract attention. The photos were taken of parked trailers. Vegetation on trailers was recorded only if the trailer/boat had vegetation on when arriving or

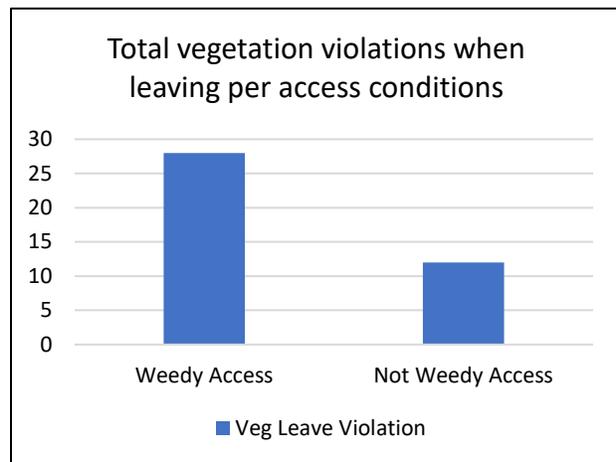


Figure 25. Comparing vegetation violations when leaving accesses at weedy vs non-weedy accesses



Figure 26. Photo of weeds left on asphalt near CD3 station.

when leaving. The photos below indicate how easy it is to pick up vegetation on the trailer when launching the boat.



Figure 27. Vegetation observed on boat trailers

### Impact of access inspections

MN DNR conducts inspections at two of the four accesses observed. For the non-commercial observations, the Spring Park access is the most inspected access and had the second fewest observed violations and best AIS Prevention behavior for boaters. The Long Lake access is inspected infrequently and had the fewest observed violations. The Surfside and Weaver Lake accesses are not inspected, and had the highest violation rates.

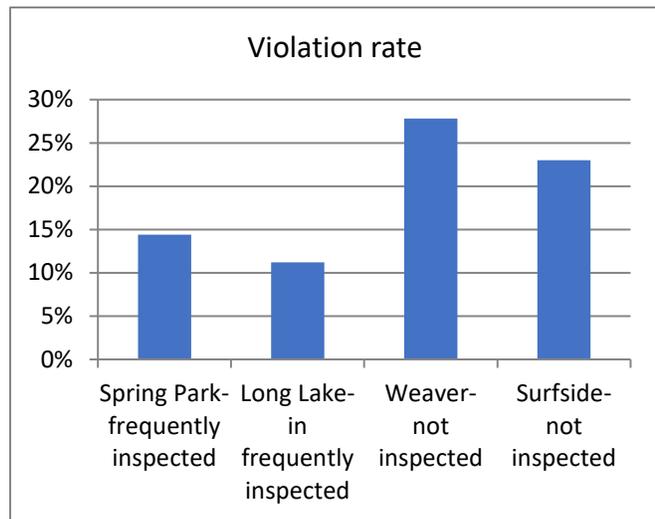


Figure 28. Overall violation rate of each access observed 2017-19, noting frequency of inspector presence.

## Other observations

Notes pertaining to atypical behavior were recorded to add insight to the observations. Some activities can be identified as a potential source or transport of AIS. Following is a list of other observed and unobserved activities.

- Improper disposal of bait – one individual was observed dumping bait on the ramp at Surfside where the water and some minnows may make their way into the lake (Figure 29). Note that these were not included in the violation totals since it was difficult to determine if bait was disposed of properly.
- Bait observations were difficult to make and thus the results are unclear. Observations were conducted at a far enough distance away that it was difficult to observe if there were any bait containers in the boats. We rarely saw anyone with a fishing boat dispose of anything. If something was disposed of it was unclear if it was general trash or bait. We did observe incorrect bait disposal occasionally, but in most cases, we did not see any bait disposal.
- Draining water upon arrival to lake – one boater was observed draining water from somewhere in the boat into the lake upon arrival. For another, it was noted that bilge water was pumping out into the lake once the boat was launched.
- It was very uncommon to observe anyone trimming (raising) their boat motors to drain the water out. Similarly, very few personal watercraft owners started their engines out of the lake to blow out the water.
- Some boaters towel dry their boat; though it is unclear if they are diligently checking for AIS (though they may remove vegetation while drying).
- One person put gloves on to remove plants.
- No boat rage was observed. If an access/prep area was busy most people just prepped at a parking spot or further back. The only instance of one boater interacting with another boater who was slowing the entry into the access was to offer help.
- The AIS laws regarding drain plugs apply to boats without plugs too. They are required to empty out water by other means such as turning the boat over or using pumps or sponges. Some kayaks were observed that were not drained at the access, but had water in them. They were from a rental company, so it is assumed that they were drained and cleaned at the business location nearby.
- Several individuals were overheard discussing AIS and AIS laws. Some families were teaching their children how to remove boat plugs and plants.
- On several occasions, children were in charge of removing vegetation from the boat and trailer.
- Several times, boaters were observed conducting thorough inspections of boats and removing vegetation, but still overlooked a vegetation fragment (perhaps out of view or out of reach).
- Some people use the CD3 stations for things other than the purpose of AIS prevention. For example, a person was observed inflating a large floaty device with the CD3 air hose.
- One unique CD3 use was a mosquito control staff using the blower at Long Lake to clean her waders prior to heading out into the field.
- Several people were curious about the CD3 stations and approached them on foot to inspect.



Figure 29. Bait (minnows) dumped at the ramp

## Violation rates from other programs

### Hennepin County North Arm Access

In 2017, observations were conducted at Lake Minnetonka-North Arm access to evaluate the results of new signs and traffic markings, and increased DNR inspections. A 20% violation rate was reported.

### Access inspection violation rates

In 2019, an overall violation rate of all Hennepin County accesses inspected was 6.4%. (Violation rate compiled from DNR preliminary data on ftp site.)

### Lake Minnetonka inspection results

In 2019, records of AIS violation upon entering accesses were compiled as a result of DNR inspections at different accesses around Lake Minnetonka. Violation rates ranged between 7.71 and 10.16 percent. (Violation rates compiled from DNR preliminary data on ftp site.) This is about half the rate found in this study. However, the violation rate for Lake Minnetonka accesses is higher than the County average.

Table 13. Inspector Violation rates of accesses around Lake Minnetonka (2019)

North Arm	Spring Park	Maxwell	Grays Bay	Long Lake
10.16%	7.94%	7.71%	8.39%	8.02%

### Statewide roadside inspections by the Minnesota Department of Natural Resources

The Minnesota Department of Natural Resources conducts roadside checks in several counties throughout Minnesota. The inspections involved observing drain plugs, livewells, and aquatic plant presence. Statewide averages for 2017 to 2019 were 15 to 19%, with the highest rate found in 2019. These DNR roadside checks were also done when boaters weren't expecting the inspections.

Table 14. Violation rates of statewide roadside inspections

DNR AIS Inspections	2017	2018	2019
Average violation rate	16%	15%	19%
Range	5-33%	0-28%	0-36%
Inspections	397	612	484

### Watercraft inspection program expansion by Three Rivers Park District

Watercraft inspections were conducted at six lake accesses by Three Rivers Park District in 2018 and 2019 with funding from the Hennepin County Aquatic Invasive Species Grant Program. Hennepin County lakes included, Bryant, Fish, Little Long, Medicine, Lake Minnetonka Regional Park and Twin. The number of boats inspected varied significantly by lake.

Table 15. Violation rates at accesses inspected by Three Rivers Park District staff

	Bryant	Fish	Little Long	Medicine	Mtka Park	Twin
2018	5.6%	1.5%	10.5%	8.1%	14.6%	5.8%
2019	6.5%	2.1%	2.8%	6.8%	16.6%	4.1%

Excluding the Lake Minnetonka Regional park access, the average violation rate was 6.2% in 2018 and 5.7% in 2019 observed by Three Rivers Park District (1.5% – 10.5%) was much lower than observed through this project (11.2% – 27.8%) The violation rate for the Lake Minnetonka Regional Park access was much higher at 14.6% in 2018 and 16.6% in 2019 due to the location of the inspections and where boaters prepare to leave the access.

## Conclusions and recommendations

Observations were conducted at four boat accesses for two to three years. The following are the conclusions of these observations and some recommendations for how they can be used to improve AIS prevention behavior.

- AIS violation rates are lower when access inspectors are present. Violation rates recorded by Three Rivers Park District and MN DNR are lower than those recorded through observations conducted under this project when inspectors were absent. The presence of inspectors influences boater AIS prevention behavior.
- An overall violation rate of 16.6% was observed when access inspectors were not present over the three years of study. This violation rate is similar to that reported from MN DNR Conservation Officer roadside check stations. However, this is higher than the average reported from MN DNR access inspections and Three Rivers Park District Inspections. Efforts to address the group of boaters that represent the approximately 9-10% difference in violation rates in inspected versus uninspected accesses will help to target education efforts where most needed. This also suggests access inspector programs would be most effective if coverage is provided 100% of the time or the inspection programs are randomized to assure boaters do not know when and where an inspector will be present.
- The highest violation rate occurred with wakeboats, ski/cruiser, and fishing boats. Other boat types had low violation rates. Education should be targeted at the boaters with the highest violation rates.
- AIS signage and traffic markings at the Spring Park access are positively influencing the behavior of boaters. Most are following the correct traffic flow, stopping where they are supposed to and removing vegetation and plugs. AIS prevention behavior was observed to be the best at this access compared to the other three, as evidenced by fewer violations.
- The accesses with the most sophisticated redesign had the lowest violation rates.
- The likelihood of leaving with vegetation on trailers was influenced by how much vegetation was observed floating at the access. At some accesses, especially the Spring Park access, this was influenced by wind direction. Plants blown into the access are easily picked up on boats. This suggests that project that reduce floating vegetation at the access (source) will be effective at reducing AIS violation rates.
- Violation rates changed from month to month over the boating season. The rates decreased from May to October. This finding suggests that more education and more inspection hours efforts should occur early in the spring through June.
- Although it was difficult to determine if bait was being used through this type of observation, the lack of people draining bait buckets indicates that bait violations were likely occurring. It may be prudent to target programs to educate on correct bait procedures. Live bait is expensive, so a source of clean water to replace the bait bucket water (as required if keeping live bait) may also help with compliance and education.
- It is concerning regarding the number of violations observed at the Surfside Park access. This is a busy access. Future AIS prevention efforts are warranted at this access.
- CD3 stations were used by 23.8% of the boaters. Violation rates were generally lower for those using the CD3 stations. It may be possible to improve the use rate and lower the violation rates with some in-person targeted education at the accesses promoting and demonstrating the use of these stations. This may also assist in a better understanding for actions needed for each user specific to their watercraft.

- The lack of compliance by commercial haulers is concerning. It may be less of a concern for the spread of AIS if they are going to the same access, and lake service providers have some permitted exemptions. Additional education or research for this user group may be prudent.

These findings can help target education/outreach and access design efforts where they will have the most effect on AIS prevention behavior. Additional observations in 2021 are recommended to determine trends, changes as they occur, or to help verify this report conclusions.

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# Appendices

## Appendix 1. Observation form

**Hennepin County Lake Access Inspections**  
 Date: \_\_\_\_\_ Lake: \_\_\_\_\_  
 Access Information: \_\_\_\_\_ Staff: \_\_\_\_\_  
 Time/ Boat # \_\_\_\_\_ Weedy (Y/N)? \_\_\_\_\_  
 Start time: \_\_\_\_\_ End time: \_\_\_\_\_  
 Weather \_\_\_\_\_ Temp \_\_\_\_\_  
 ? = Unsure N/A = Not Applicable  
 Page \_\_\_\_ of \_\_\_\_

Boat type							
Commercial (Y/N)							
<b>On Arrival to Access</b>							
Influenced by traffic markings (Y/N)							
Boat plugs out or open (Y/N)							
Plants on boat/trailer (Y/N)							
Read signage (1-4)							
Stop bar busy (Y/N)							
Comments							
<b>Leaving lake</b>							
Influenced by traffic markings (Y/N)							
Remove/open drain plugs (Y/N)							
Inspect boat & trailer/remove plants (1-4)							
Properly dealt with bait/water (1-4)							
Trim engine/ use CD3 to drain (outboard) (Y/N)							
PW- start engine to drain water (Y/N)							
Leaving with vegetation on trailer/boat (Y/N)							
<b>Used CD3 (Y/N)</b>							
CD3 1/2/3? (1-3) (Spring park only)							
CD3 Busy? (Y/N)							
Tool: Vacuum (V), Air (A), Wrench(W), Grabber (G), Brush (B), Hook (H)							
Violation (Y/N)							
Comments (NT = Not trailered)							

**Read signs/inspection**  
 1 Thorough- bent over to search 3 Didn't look  
 2 Looked- quick look 4- unsure

**Proper Bait/water disposal**  
 1- yes 2- No 3- not applicable 4- unknown

Fishing (F), Pontoon (P), Wakeboat (W),  
 Ski or cruiser (S), personal watercraft (PW),  
 Kayak (K), Canoe (C), Paddleboard (B), Other (O)

**Weather:** Sunny (S), Partly Cloudy (PC)  
 Cloudy (C), Rain (R), Windy (W)

## Appendix 2. Minnesota Department of Natural Resources AIS Rules

The information below is quoted from the DNR website.

Under state law, it is unlawful to:

- transport aquatic plants, except as allowed in [statutes](#) (\$100 civil penalty or misdemeanor)
- transport zebra mussels and other **prohibited** species of animals (\$500 civil penalty or misdemeanor)
- place or attempt to place into waters of the state a boat, seaplane, or trailer that has aquatic plants (\$200 civil penalty), zebra mussels, or other **prohibited** invasive species attached (\$500 civil penalty or misdemeanor)
- a boat lift, dock, swim raft, or associated equipment that has been removed from any water body may not be placed in another water body until a minimum of 21 days have passed.

Regulations regarding transport of water:

- A person leaving waters of the state must drain all water from water-related equipment, including bait containers, live wells, and bilges, by removing the drain plug before transporting the watercraft and equipment from the water access or riparian property;
- Drain plugs, bailers, valves, or other devices used to control the draining of water from ballast tanks, bilges, and live wells must be removed or opened while transporting watercraft and water-related equipment;

The following regulations apply to the transport of water from infested waters:

- water from infested waters may not be used to transport fish except by permit
- water from infested waters may not be transported on a public road or off riparian property on infested waters except in emergencies or under permit (\$200 civil penalty or misdemeanor)

## **Minnesota Department of Natural Resources Lake Service Provider (LSP) Permit Requirements- excerpts for the LSP permit**

**Transporting Prohibited Invasive Species** – The permittee is authorized to possess and transport zebra mussels and faucet snails that are attached to water-related equipment being removed and transported from waters to the permittee’s decontamination site for the purpose of decontamination and disposal. The permittee is authorized to transport zebra mussels and faucet snails from the decontamination location to a disposal site in accordance with the conditions in this permit and the applicable state laws. (Minnesota Statutes, Chapter 84D.11, Subdivision 1)

**Transporting Contaminated Bilge Water** – The permittee is authorized to transport inboard and inboard-outboard power boats from a waterbody to the service provider’s designated decontamination location(s) without draining bilge water or removing the drain plugs, when necessary. This authorization is only to minimize discharge of oil and other liquids that may be in the bilges at the water accesses and into waters of the state. Outboard boats and sailboats must be drained at the water access and drain plugs removed as required by Minnesota law. (Minnesota Statutes, Chapter 84D.10, Subdivision 4)

**Section 3: Decontamination Requirements at Water Access** The permittee must take the following decontamination measures at all waters to prevent the spread of aquatic invasive species to other waters when providing services under this permit. Before transporting from a water access or riparian property: A. All water-related equipment being transported must have all aquatic plants (excluding duckweed) removed before transport; (Minnesota Statutes, Chapter 84D.09) B. water must be drained from any water-related equipment components that hold water prior to transporting unless authorized by this permit (Minnesota Statutes, Chapter 84D.10, Subdivision 4); and C. accessible sediment must be removed from anchors, dock components, boat lifts, and other water-related equipment.

### Appendix 3. Observation dates and Observation Totals (2017-2019) per lake

Mtka Spring Park			Mtka Surfside			Long Lake			Weaver Lake		
Year	Date	# boats	Year	Date	# boats	Year	Date	# boats	Year	Date	# boats
2017	6/7	12	2017	6/6	19	2017	6/8	16	2017	6/1	9
2017	6/29	1	2017	6/21	23	2017	6/20	6	2017	6/15	7
2017	6/29	18	2017	6/27	21	2017	6/27	11	2017	7/6	4
2017	7/20	21	2017	6/29	15	2017	7/12	7	2017	7/20	4
2017	8/2	10	2017	7/5	16	2017	7/14	15	2017	8/1	2
2017	8/11	16	2017	7/11	8	2017	7/19	4	2017	8/5	10
2017	8/17	3	2017	7/25	17	2017	7/26	7	2017	8/8	7
2017	8/29	6	2017	8/2	29	2017	7/27	12	2017	9/30	4
2017	8/31	4	2019	5/26	47	2017	9/12	1	2019	5/30	8
2017	9/12	5	2019	5/31	31	2018	6/13	10	2019	6/5	14
2018	8/22	4	2019	6/6	13	2018	6/14	12	2019	6/13	8
2018	8/23	7	2019	6/14	26	2018	6/20	1	2019	6/25	16
2018	8/29	6	2019	6/20	8	2018	6/21	12	2019	7/2	2
2018	8/30	12	2019	6/21	2	2018	6/27	12	2019	7/16	11
2018	8/31	4	2019	7/24	27	2018	6/29	16	2019	8/6	8
2018	9/3	34	2019	8/21	25	2018	7/6	20	2019	8/20	2
2018	9/6	8	2019	8/22	31	2018	7/7	23	2019	8/22	7
2018	9/7	7				2018	7/11	9			
2019	5/16	3				2018	7/12	6			
2019	5/31	28				2018	7/13	6			
2019	6/6	16				2018	7/18	13			
2019	6/25	19				2018	7/27	23			
2019	7/6	27				2018	8/1	3			
2019	7/18	12				2018	8/2	15			
2019	7/25	4				2018	8/3	10			
2019	8/1	20				2018	8/9	9			
2019	8/8	10				2018	8/10	16			
2019	8/14	4				2018	8/16	8			
2019	8/27	1				2019	5/20	9			
2019	8/28	2				2019	5/26	12			
2019	8/29	9				2019	6/19	15			
2019	8/30	24				2019	6/26	26			
2019	9/4	5				2019	7/2	19			
2019	9/5	9				2019	7/12	19			
2019	8/6	12				2019	7/31	12			
						2019	8/22	4			
						2019	9/6	10			

#### Appendix 4. Violations by non-commercial boaters observed per month

<b>VIOLATIONS BY MONTH</b>	<b>Spring Park</b>	<b>Surfside</b>	<b>Long Lake</b>	<b>Weaver</b>	<b># violations per month</b>	<b># boats per month</b>	<b>% violation per month</b>
<b>May</b>	<b>6</b>	<b>23</b>	<b>2</b>	<b>5</b>	<b>36</b>	<b>114</b>	<b>31.6%</b>
Enter, plug in	2	12	1	2	17		
Enter, veg	0	13	1	3	17		
Leave, veg	4	2	0	0	6		
Leave, plug in	1	2	0	1	4		
<b>June</b>	<b>12</b>	<b>26</b>	<b>24</b>	<b>19</b>	<b>81</b>	<b>343</b>	<b>23.6%</b>
Enter, plug in	7	8	12	10	37		
Enter, veg	1	9	5	4	19		
Leave, veg	1	8	4	5	18		
Leave, plug in	3	4	6	2	15		
<b>July</b>	<b>9</b>	<b>6</b>	<b>15</b>	<b>5</b>	<b>35</b>	<b>316</b>	<b>11.1%</b>
Enter, plug in	1	4	10	1	16		
Enter, veg	1	1	0	1	3		
Leave, veg	7	0	0	2	9		
Leave, plug in	1	1	5	1	8		
<b>August</b>	<b>16</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>31</b>	<b>288</b>	<b>10.8%</b>
Enter, plug in	8	3	3	2	16		
Enter, veg	1	0	0	1	2		
Leave, veg	4	0	0	1	5		
Leave, plug in	4	1	3	1	9		
<b>September</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>9</b>	<b>95</b>	<b>9.5%</b>
Enter, plug in	5	0	0	1	6		
Enter, veg	0	0	0	0	0		
Leave, veg	1	0	0	0	1		
Leave, plug in	2	0	0	0	2		
Total # boats with violations	51	59	47	35	192	1,156	<b>16.6%</b>
Total Violations (including multiple violations per boat)	54	68	50	38	210		

### Appendix 5. Maps indicating where vehicles with boats stopped at accesses

The maps indicate where vehicles with boats stopped when entering the access and where they stopped when leaving the access. Several of the maps are in the process of creation and will be updated when possible. Maps included are Spring Park 2018, Spring Park 2019, and Long Lake 2019.



Figure 30. Spring Park 2019 – stopping locations



Figure 31. Spring Park 2018 - stopping locations



Figure 32. Long Lake 2019 – stopping locations