Thief Lake Management Plan
Public Water No. 45-1 (45000100)
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Prepared by:

Kyle Arola, Thief Lake WMA, Wildlife Area Supervisor
Kyle Point, Thief Lake WMA, Assistant Wildlife Area Manager
Tammy Baden, Shallow Lakes Program, Wildlife Lake Specialist

Send comments to:
Kyle Arola, Wildlife Area Supervisor
42280 240th Avenue Northeast
Middle River, MN 56737
Phone: 218-633-7671
Email: Kyle.Arola@state.mn.us

or

Tammy Baden, Wildlife Lake Specialist
Minnesota Department of Natural Resources
14583 County Highway 19
Detroit Lakes, MN 56501
Phone: (218) 846-8474
Email: tammy.baden@state.mn.us

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General Lake Information

- County: Marshall
- Location: T158N, R41W, Sections 13-16, 21-28; T158N, R40W, Sections 18-20, 29-30
- Size: 7,430 acres
- Shoreline: 16 miles completely within the Thief Lake Wildlife Management Area (WMA)
- Access: There are four public boat launches; three of them are on the main lake and one is on the Moose River (Attachment A).
- Major watershed: Thief River Watershed
    - Upstream watershed area: 146,547 acres or 229 square miles (Attachment B)
    - Upstream watershed-to-lake area ratio: 21:1
    - Land use: mixture of wetlands, agriculture (mostly row crop and small grains) and forest
- Inlets: The Moose River flows in on the east side of the lake. There are also five public drainage ditches that empty into the lake.
- Depth: At normal water level the average depth is 3.1 feet (ft), and maximum depth is 4.25 ft.
- Outlet: The Thief River flows out of the west side of the lake through a concrete water control structure with six, 6.4-ft stoplog bays and two, 10.9-ft radial gates. The Thief River flows southwesterly for about 8 miles where it enters the 10,000-acre Agassiz Pool within the Agassiz National Wildlife Refuge.
- Normal runout elevation: 1158.5 National Geodetic Vertical Datum of 1929 (NGVD 29)[1]
- Management Authority: Complete shoreline ownership within the Thief Lake WMA

Background Information

Thief Lake is a large, shallow lake within the Tallgrass Aspen Parklands Province of northwestern Minnesota. The lake provides important breeding and migratory habitat for waterfowl and other wetland wildlife as well as opportunities for wildlife-related recreation.

Prior to 1915, Thief Lake was reportedly an excellent area for waterfowl with shallow water interspersed with reeds, rushes, and cattails that provided prime nesting habitat for diving ducks. Growing demand for agricultural lands in northwest Minnesota in the early 1900s resulted in the creation of extensive drainage projects. Efforts to drain Thief Lake occurred from 1914-1916 when a floating dredge was used to create a channel through the lake to the outlet at the Thief River, as part of the Judicial Ditch 21 (JD21) system. Few agricultural crops were grown due to frequent flooding and the lakebed was soon overgrown with emergent vegetation.

Efforts to restore the lake were led by local chapters of the Izaak Walton League, beginning in 1929. In 1930, the Department of Conservation (now the Department of Natural Resources, DNR) received approval to restore the lake and began condemnation proceedings on the affected lands. Construction of a dam also began in 1930 under the Works Progress Administration. The dam was completed in 1931, but due to drought conditions, the lake remained dry until heavier rains returned in 1937.

The sill level of the original dam was 1160.0, with the ability to install stoplogs up to 1163.0, the maximum allowed by the District Court Order. Widespread flooding in 1939 resulted in threats by the public to dynamite the dam (as had occurred in what is now the Agassiz National Wildlife Refuge) unless

[1] All elevations are reported in the National Geodetic Vertical Datum of 1929 (NGVD 29). If necessary, 1.30 ft may be added to convert to the North American Vertical Datum of 1988.

the dam was lowered. As a result, the sill level was lowered to 1158.5 with stoplogs maintained at 1160.0 except when there was a need to increase outflow from the lake.

In 1951, the summer target lake level was reduced to 1158.5 by removing the stoplogs except when it was necessary to store water in the lake to protect downstream assets. This new summer lake level mimicked pre-drainage conditions and restored the widespread stands of emergent and submerged aquatic vegetation. This shallower lake level generated criticism due to more difficult access conditions for recreationalists but was supported by waterfowl breeding pair and brood counts so was retained.

In 1968, the dam was again modified to replace four of the central stoplog bays with two vertical lift gates. The sill of the lift gates was reduced to 1155.5 but when closed they maintained the 1158.5 water level. The lift gates allowed greater flexibility in controlling water flow and provided the ability to drawdown the basin, prior to which could only be achieved by natural dry cycles.

In 2017, the dam was again renovated to address deteriorating concrete and difficult operations. The eight stoplog bays were reduced to six and those sill elevations were reduced to 1157.5. The two lift gate sill levels were maintained at 1155.5. Water levels up to the maximum elevation of 1163.0 can still be set by using stoplogs. Hydrological analysis shows that during extraordinarily high flows, the dam can pass the necessary water, so there is no emergency spillway incorporated in the current alignment. A photo of the Thief Lake dam as of August 2022 is shown in Figure 1.

Figure 1. A photo of the Thief Lake dam taken in August 2022.

There are no formal agreements with other entities that dictate water level management other than the maximum runout elevation of 1163.0 established by District Court Order. Resource considerations and impacts to up- and downstream landowners are taken into consideration during lake level manipulations. Lake levels are most contentious during periods of high runoff, such as those associated with spring breakup and extreme summer rain events. The highest known water surface elevation of the lake was 1164.5 in 1948. Downstream channel capacity is approximately 500 cubic feet per second (cfs) and the maximum discharge recorded was 780 cfs in the flood of 1978. Thief Lake water level elevation data for the open water periods of 2021 and 2022 are presented in Figure 2.

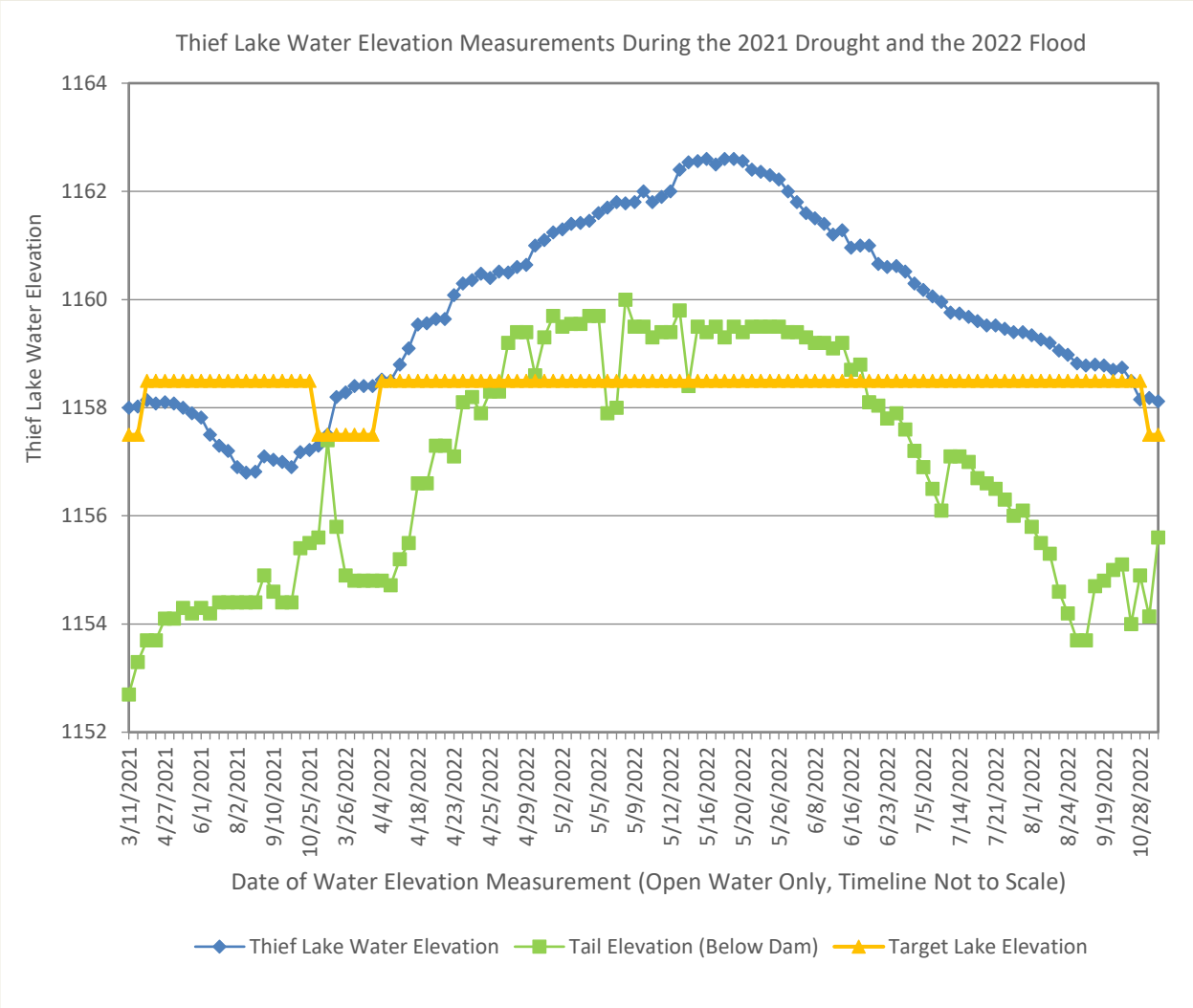


Figure 2. Thief Lake water elevation measurements from the open water periods of 2021 (a drought year) and 2022 (a major flood year).

Water Quality

Water quality information has been intermittently gathered from Thief Lake during wildlife lake habitat surveys and an intensive watershed monitoring effort by the Minnesota Pollution Control Agency (MPCA). Total phosphorus and chlorophyll-a records from these efforts are presented in Figure 3.

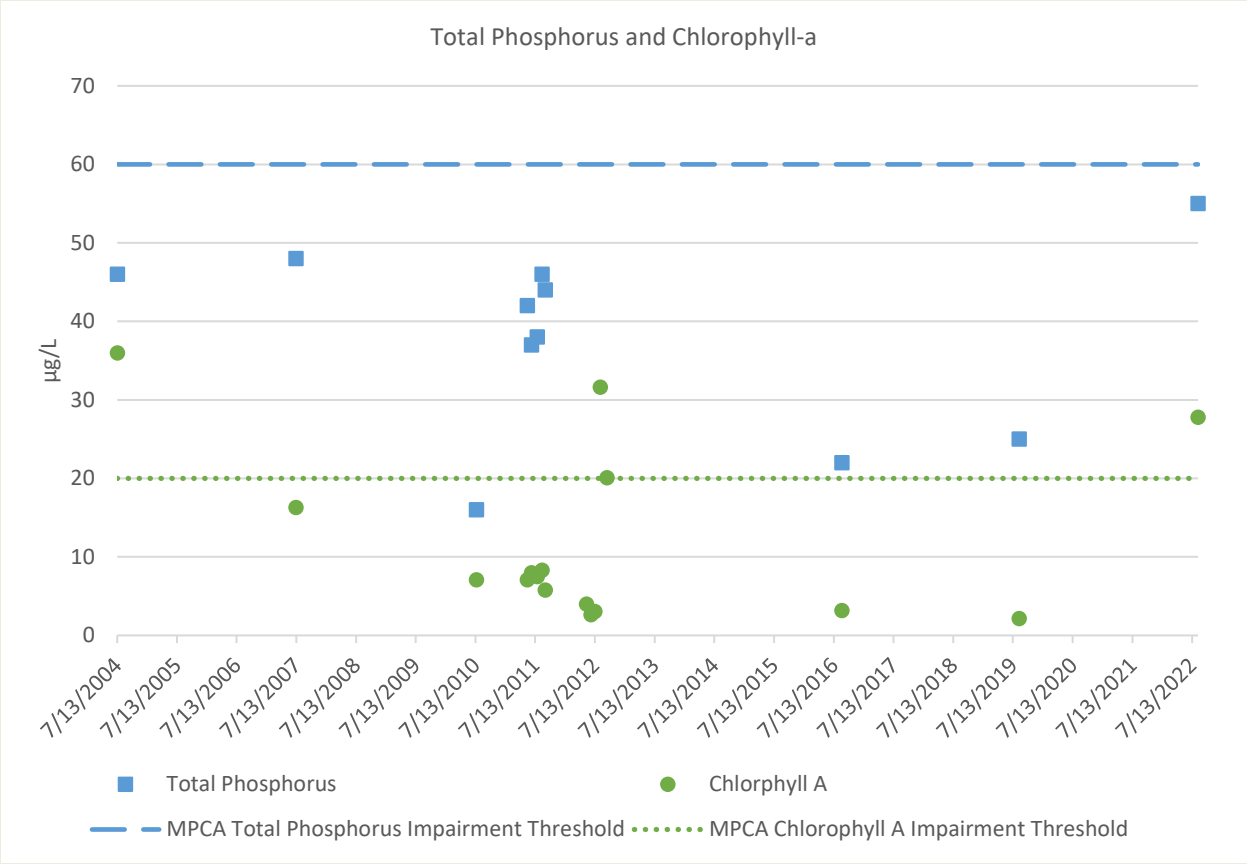


Figure 3. Total phosphorus and chlorophyll-a records with associated MPCA impairment thresholds, 2004-2022.

Thief Lake lies within the Lake Agassiz Plain Ecoregion. The MPCA sets aquatic recreation impairment thresholds for shallow lakes in this ecoregion on a case-by-case basis, but the adjacent ecoregion may be used as a guide. In this case, the aquatic recreation impairment threshold for class 2B shallow lakes in the North Central Hardwood Forest Ecoregion would be based on the summer-average total phosphorus of more than 60 micrograms per liter (µg/L), and either chlorophyll-a of more than 20 µg/L, or Secchi disk transparency of less than 1.0 meter (3.3 feet). In 2013, the MPCA determined that Thief Lake fully supports aquatic recreation use.

In 2006, the Moose River upstream of Thief Lake was listed as impaired for dissolved oxygen. In 2020, the Thief River downstream of Thief Lake was listed as impaired for fish bioassessments. The Total Maximum Daily Load (TMDL) allocations for these impairments are expected to be completed by MPCA by 2025. Management of Thief Lake is not expected to impact these impairments.

Thief Lake is a large basin, approximately three miles from north to south and approximately five miles east to west, making wind fetch a significant factor in evaluating water clarity. Mean depth and mean Secchi records documented during wildlife lake surveys are shown in Figure 4. Abundant emergent and aquatic vegetation growth likely reduces potential wind fetch effects and promotes higher water clarity.

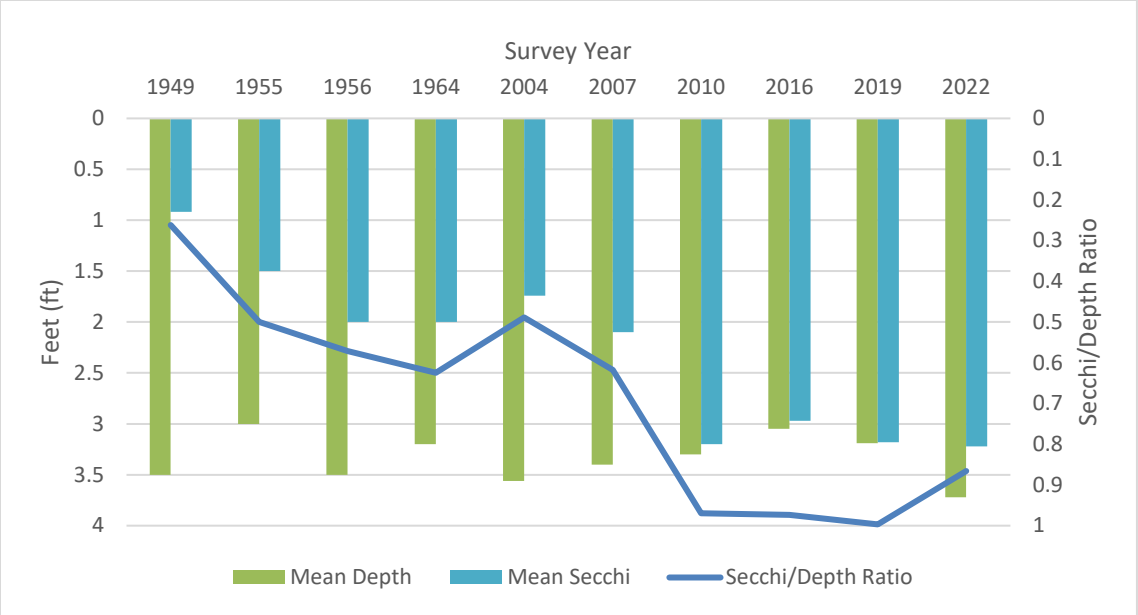


Figure 4. Mean water and Secchi depth readings and ratios documented during wildlife lake habitat surveys, 1949 to 2022.

Fish and Wildlife Habitat

Thief Lake is completely within the 54,957-acre Thief Lake WMA. The Thief Lake WMA lies within a transition zone with forested areas to the east transitioning to prairie in the west. The topography is very flat with lowlands consisting of woody and emergent herbaceous wetlands, aspen forests, and distinct beach ridges that are topped by oak savannah and prairie.

Thief Lake is in an area rich with public land. There are 21 WMAs within 15 miles of the lake as well as the Agassiz National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (USFWS) (Attachment C). Notable open water lakes and impoundments in the area include the Agassiz pools, the Moose River Impoundment, East Park WMA Impoundment, and the Nereson Impoundments. Management activities on these areas can affect wildlife use and water conveyance at Thief Lake and vice versa. DNR mangers closely coordinate with USFWS managers, watershed district administrators, and adjacent landowners to ensure diverse habitat availability and that water conveyance needs are considered during management activities.

Various methods have been used through the years to assess the wildlife habitat within Thief Lake. Shortly after the lake was restored, an effort was made to document the changes that occurred in the aquatic plant community. In 1938, a general observation of the area noted that the aquatic plants largely consisted of free-floating or poorly rooted species such as bladderworts, duckweeds, and liverworts. Coontail and sago pondweed were noted as being rare. By 1941, when another general check was made, it was reported that much of the free-floating and poorly rooted vegetation had been replaced by more well-rooted species such as sago pondweed, clasping-leaf pondweed, milfoil, and chara.

Four game lake surveys were completed in 1949, 1955, 1956, and 1964 that used a subjective scale to describe the aquatic vegetation. There have been six wildlife lake habitat surveys conducted in 2004, 2007, 2010, 2016, 2019, and 2022 that used a standardized point intercept method to document water depth, water clarity, and aquatic plant species frequency. A review of historic and current aerial photography and survey maps show that the coverage of emergent vegetation has been remarkably

consistent through time. Hardstem bulrush has been a prevalent species on the basin that tends to grow in dense stands in water up to three to four feet deep. Emergent vegetation typically covers 30-50% of the basin as judged by aerial photography and commonly consists of bulrush, common reed, and cattail. Wild rice was documented on the basin in the 1949 survey but has not been noted in any surveys since but has been observed in the river near the Moose River Landing. The submerged aquatic plant community has been abundant and diverse. Prominent submerged aquatic plant species include chara, northern water milfoil, sago pondweed, and clasping-leaf pondweed. A graph of frequency of occurrence for some common submerged plant species is presented in Figure 5. Lakewide species richness and the percent of survey points vegetated have been high during each of the recent wildlife lake habitat surveys and are presented in Figure 6.

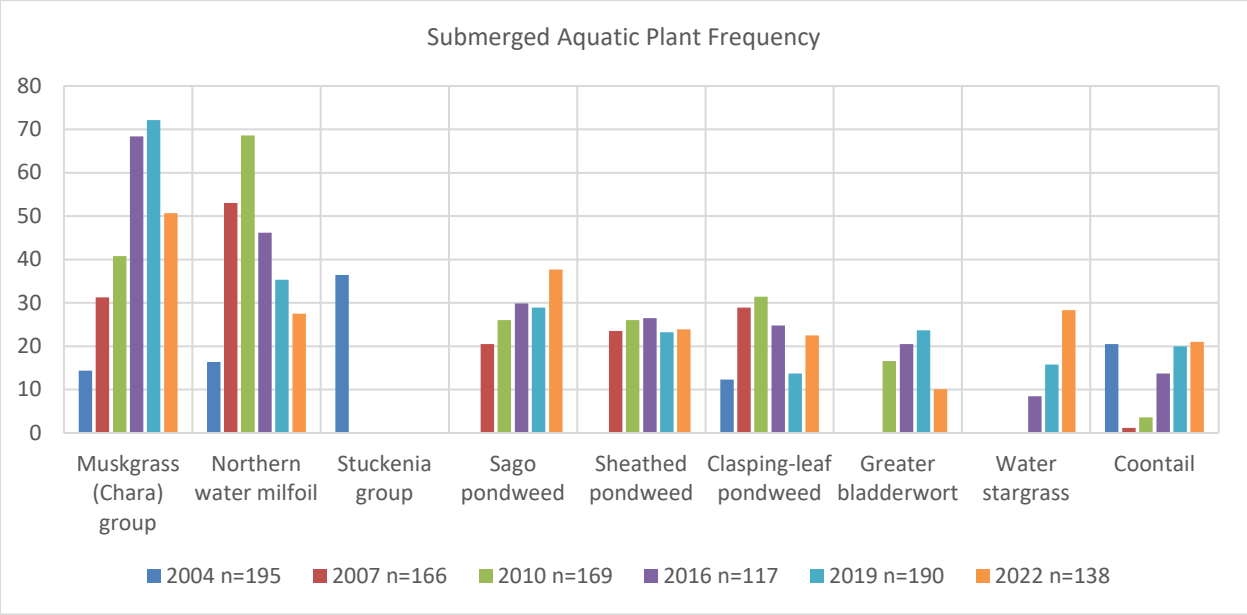


Figure 5. Percent frequency for some of the common submerged aquatic vegetation species documented during wildlife lake habitat surveys, 2004 to 2022. In 2004, sago pondweed and sheathed pondweed were combined as the Stuckenia group.

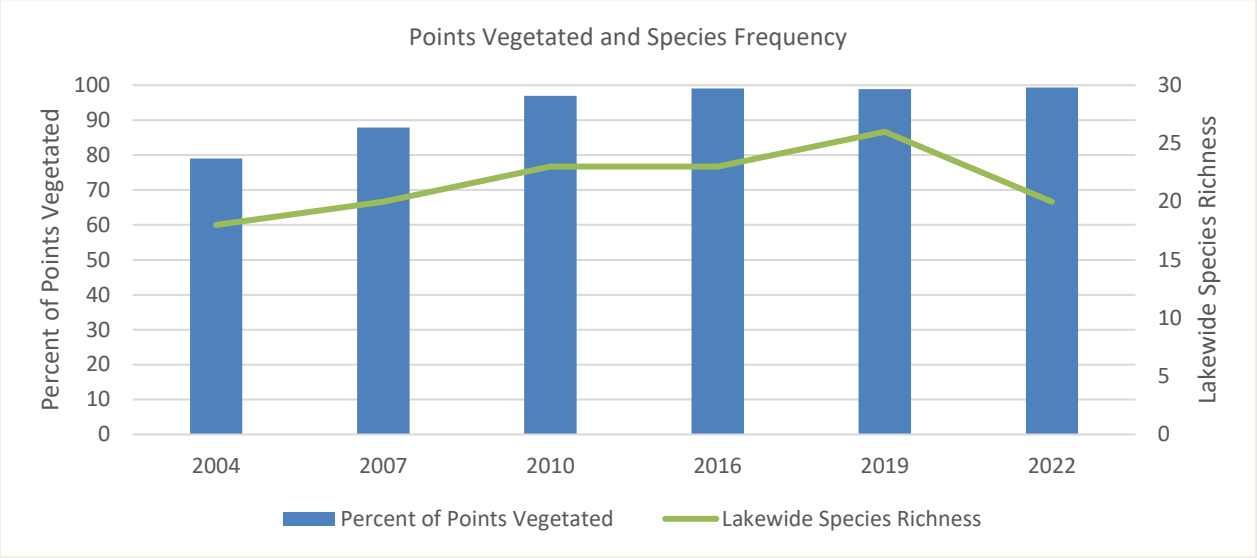


Figure 6. Percent of survey points that were vegetated with the lakewide species richness documented in recent wildlife lake habitat surveys, 2004 to 2022. Vegetated points do not include free-floating species such as duckweed (Lemna species).

There are 10 records of rare features documented in the Rare Natural Features database within one mile of Thief Lake. Two of the features are submerged aquatic plants, sheathed pondweed (*Stuckenia vaginata*) is listed as state endangered and spiny naiad (*Najas marina*) is a species of special concern. Sheathed pondweed has been routinely documented as present in lake habitat surveys going back to 1949. Wildlife lake habitat surveys from 2007-2022 have documented sheathed pondweed at 23% to 27% of the stations sampled (Figure 5). Spiny naiad was more recently discovered in 2019 when one plant was documented but it was not found in the subsequent 2022 survey, so its persistence in the community is unknown at this time. The other features are birds that are species of special concern including marbled godwit, short-eared owl, Forster's tern, Franklin's gull, and American white pelican.

Wildlife Use

Thief Lake provides important habitat for an abundance of wetland-dependent species. Waterfowl has been the primary focus of management, but other waterbirds such as black and Forster's terns and Franklin's gulls commonly nest in great numbers within the expansive stands of emergent vegetation. Other waterbirds commonly found on the lake include grebes (red-necked, eared, western, and pied-billed), American white pelicans, common loons, numerous species of shorebirds, herons (great blue, green, and black-crowned night), and sandhill cranes. Aquatic mammals such as muskrats, mink, beaver, and river otter are frequently seen on the lake. Reptiles, amphibians, and invertebrates are also important members of the community.

Waterfowl

Thief Lake has long been known as a prime area for waterfowl breeding, brood rearing, and migration, particularly for diving ducks such as lesser scaup, ring-necked ducks, redheads, and canvasbacks. Dabbling ducks are also abundant on the lake including mallards, blue-winged teal, American wigeon, and northern pintails. Canada geese and trumpeter swans can also be found in large numbers on the lake.

Several different waterfowl surveys are conducted annually on Thief Lake. These include breeding pair counts for geese and ducks (by species), brood counts, weekly fall goose counts (ground based), and aerial fall waterfowl counts. Breeding pair counts and brood counts are indices based on counts from a standardized route (road or boat based) that attempt to track populations without projecting total use or production of the area. Fall counts are based on sampling that attempts to project total use of the lake. The number of indicated breeding pairs of Canada geese in the Thief Lake vicinity from 1980 to 2019 is presented in Figure 7. The number of indicated breeding pairs of all duck species combined from the Thief Lake road survey route from 1960 to 2022 is presented in Figure 8. Caution needs to be used when interpreting these numbers since several factors can influence the detection of breeding waterfowl on these surveys. High water levels on the lake can displace breeding birds (particularly over-water nesters, but also upland nesters in years of extreme flooding such as 2022) into areas visible from unit roads or into heavy cover that is not normally inundated. Good nesting habitat within the basin can hold birds where they are not easily observed from unit roads. Additionally, phenological differences in nest initiation dates among different duck species make timing this annual survey to capture a representative snapshot of breeding effort on the lake difficult. Annual variations in the count also reflect variations in nesting habitat quality tempered by regional conditions.

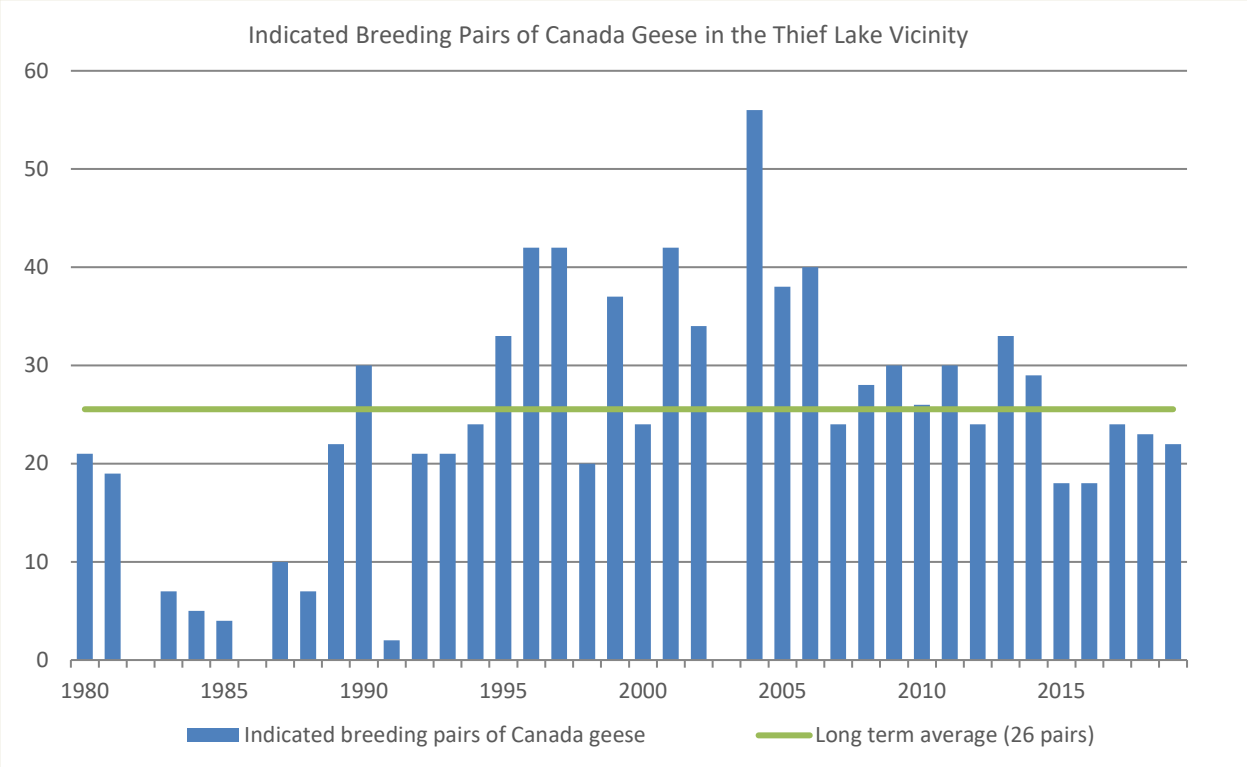


Figure 7. Indicated breeding pairs of Canada geese in the Thief Lake vicinity, 1980 to 2019.

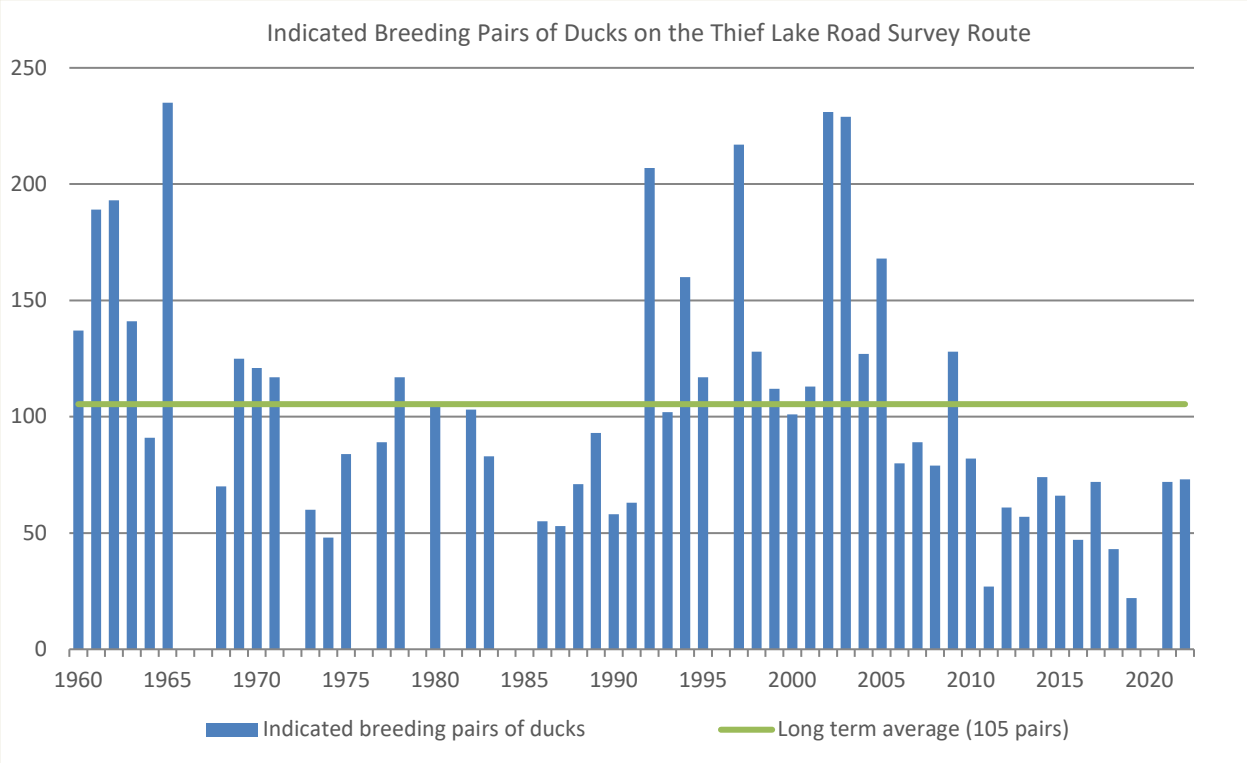


Figure 8. Indicated breeding pairs of ducks on the Thief Lake road survey route, 1960 to 2022.

Invertebrates

Invertebrate communities in wetlands have long been recognized as an extremely important food resource for a variety of birds, including waterfowl (Kaminski and Prince 1981). This is particularly true for nesting females and ducklings but is also true for some species of waterfowl throughout the year such as scaup who specialize in being invertebrate predators. Thief Lake has a history of scaup use and scaup hunting, and aquatic amphipods (hereafter scuds) are a preferred food resource for these birds (Afton 1990). Apparent fall use of Thief Lake by scaup, as indicated by hunter bag checks and aerial surveys, showed that scaup use had declined in the late 1990s from traditional levels. Anecdotal reports indicated that amphipod densities had declined during this same period. It was decided to initiate annual invertebrate sampling to provide some measure of food resources available during fall migration for those species that rely on invertebrates during this time of year, in an effort to examine factors that influence scaup use of Thief Lake during fall migration. It was suggested that the wet conditions experienced during the 1990s had allowed better over winter survival of fish, which in turn preyed upon invertebrates (Hanson and Riggs 1995) and reduced food availability for migrating scaup. Initially, management efforts to increase scud numbers, and in turn scaup use, appeared to be effective. However, scud and scaup numbers have declined and remained depressed for the last several years. These declines are evident on a continental scale, and more research is ongoing in Minnesota and elsewhere to determine why scud and scaup numbers have declined. Figure 9 illustrates fall scud density and scaup harvest on Thief Lake.

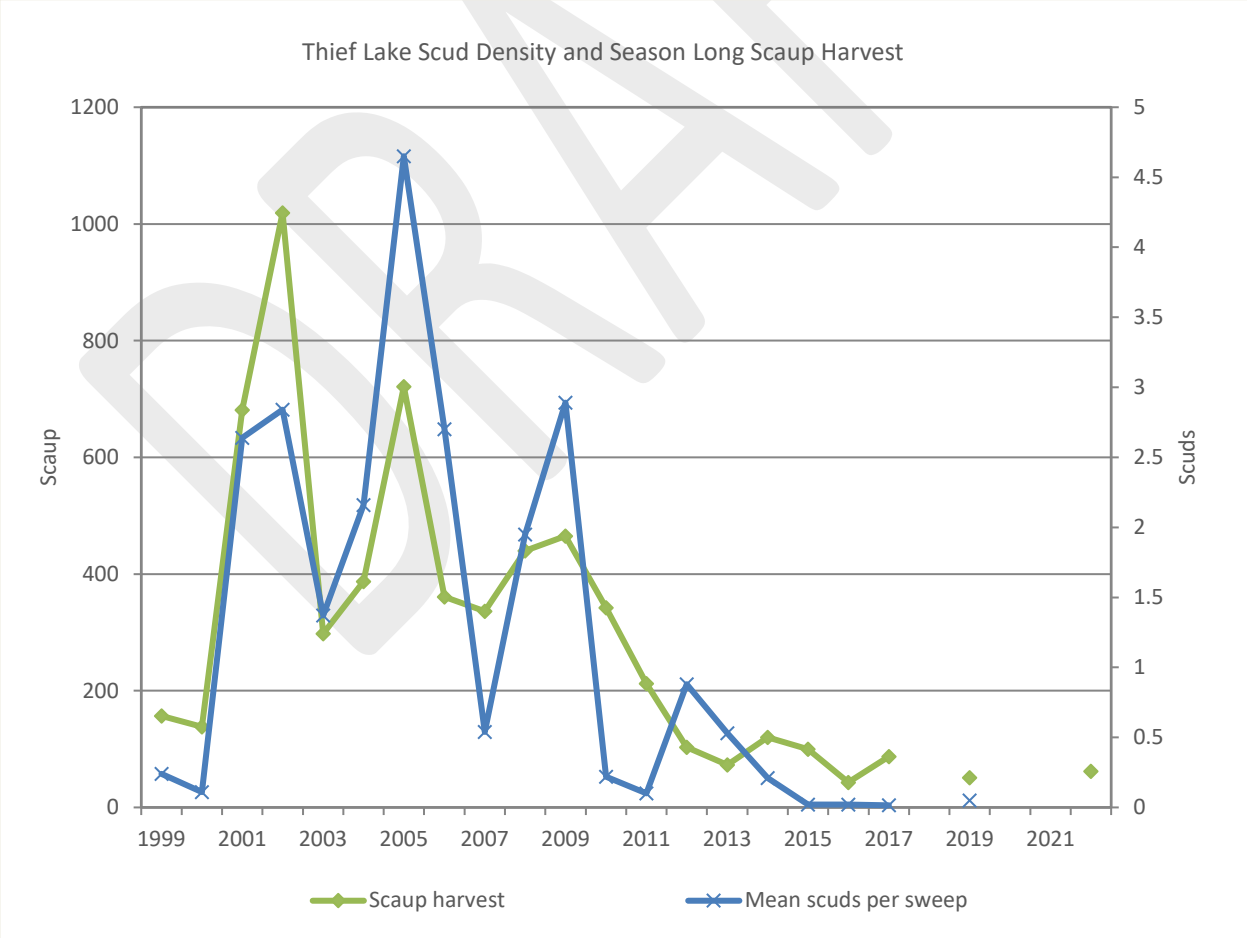


Figure 9. Annual fall scud (amphipod) density and total scaup harvest on Thief Lake, 1999 to 2022.

Muskrats

Muskrats join scaup and scuds as species of concern due to their decline on Thief Lake. Muskrat trapping was an important recreational opportunity on the lake in the past. It became so popular that beginning in 1976 only 10 trappers (2 in each of 5 zones) were allowed to trap muskrats on Thief Lake and they caught 2,422 muskrats – the highest number on record. Declining fur prices and subsequent reduced trapping effort factor into the reduced muskrat catches in recent decades, but periodic muskrat house surveys and staff observations also indicate a much-reduced muskrat population. The number of muskrats trapped on Thief Lake and the number of muskrat houses documented on the lake during sporadic surveys are presented in Figure 10. Similar to the scaup and scud declines, this is a phenomenon noted across the continent that requires more research. Muskrats can be negatively impacted by water level fluctuations. Drought and low water conditions in 2021 followed by extreme spring flooding in 2022 were likely detrimental to Thief Lake's remaining muskrat population. Efforts can be made to reduce fluctuations in lake level, but floods and droughts are part of a natural cycle that cannot be entirely controlled for.

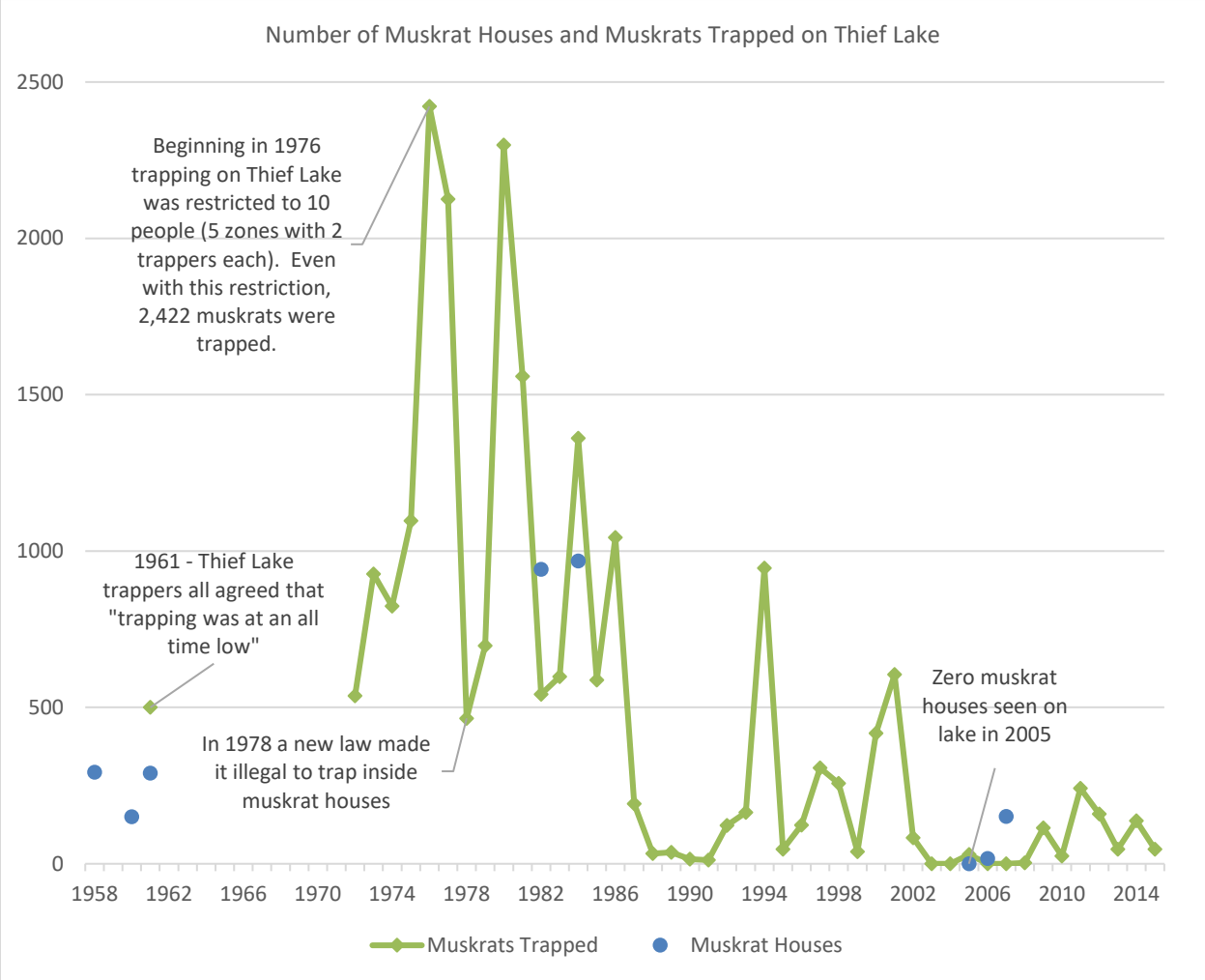


Figure 10. Numbers of muskrat houses observed, and muskrats trapped on Thief Lake, 1958 to 2015.

Fishery

Wildlife lake habitat surveys and invertebrate sampling have documented that fathead minnows and brook stickleback can at times be prolific in the lake. White sucker, central mudminnow, Iowa darter, and green sunfish have also been seen on the lake. Due to the shallow depth of Thief Lake, game fish populations are unlikely to be sustained. There is no bait harvest that occurs on the lake.

Waterfowl Hunting

Waterfowl hunting was one of the reasons that Thief Lake was restored in the 1930s after being drained in the 1910s in a failed attempt to farm the lakebed. Waterfowl hunter bag checks have been conducted on Thief Lake since 1949. Estimates of total hunter effort and duck harvest on the lake began in the late 1950s, as presented in Figure 11. Several factors can affect hunter use of the area. These include fall flight forecasts, fuel costs, freeze up date, lake level as it relates to ease of access and ability to hide in emergent cover, variations in season length and bag limits, and extreme weather events (particularly on weekends).

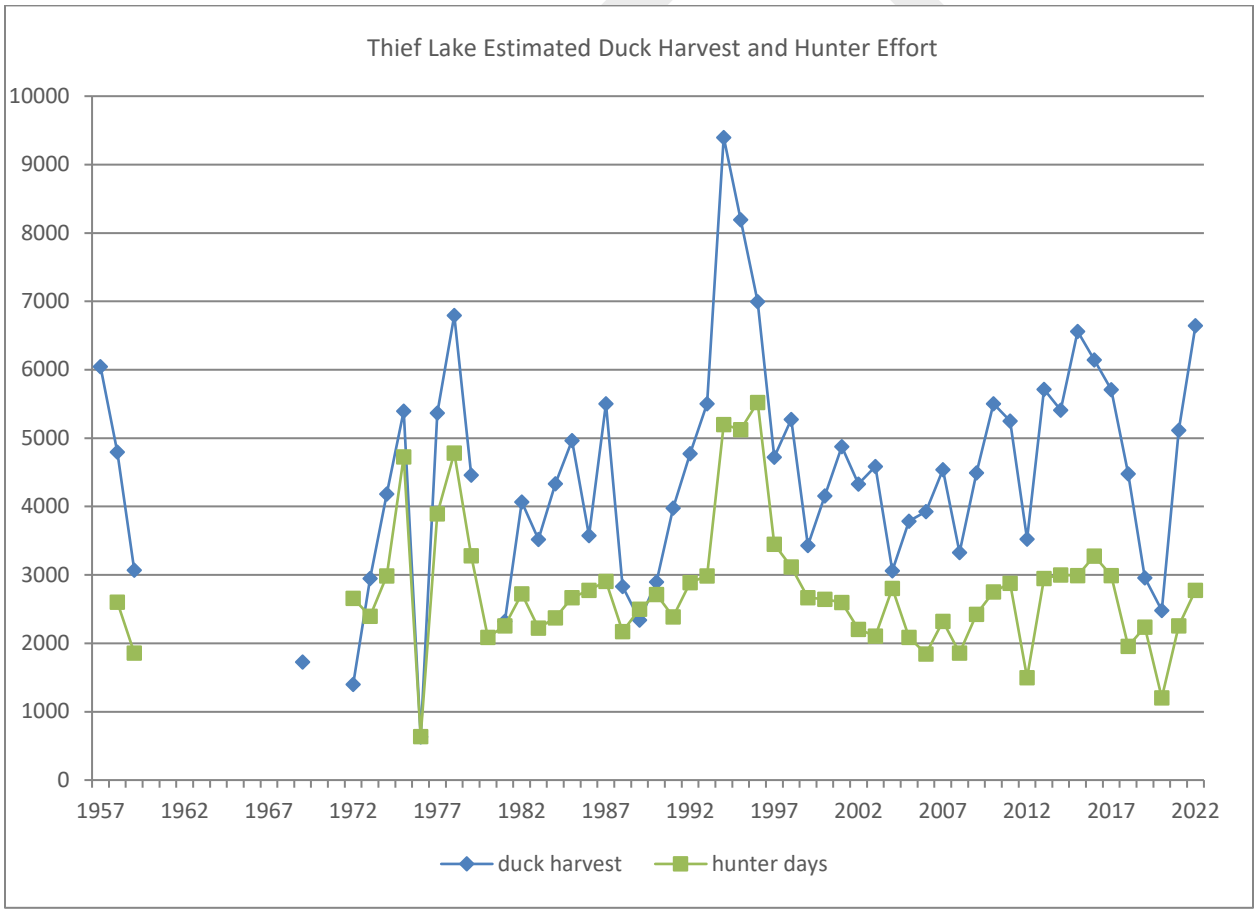


Figure 11. Estimated total duck harvest and hunter effort on Thief Lake, 1957 to 2022.

Duck hunter success on Thief Lake is consistently higher than the statewide average, as presented in Figure 12. Seasonal aberrations in success on Thief Lake can often be explained by local habitat or extreme weather conditions. For example, the night before opening day of the 2019 duck season the Thief Lake drainage received about six inches of rain from a localized storm. The storm reduced hunter participation on opening day, which is when Thief receives the most hunting pressure and harvest. The

extreme rainfall flooded area farm fields, turning them into prime duck habitat. The rain resulted in high water conditions on Thief Lake that flooded out campgrounds, boat landings, and emergent vegetation that hunters use for cover while hunting on the lake. The storm had a higher impact on hunter success on Thief Lake than on the state as a whole, which is reflected in hunter success for that year.

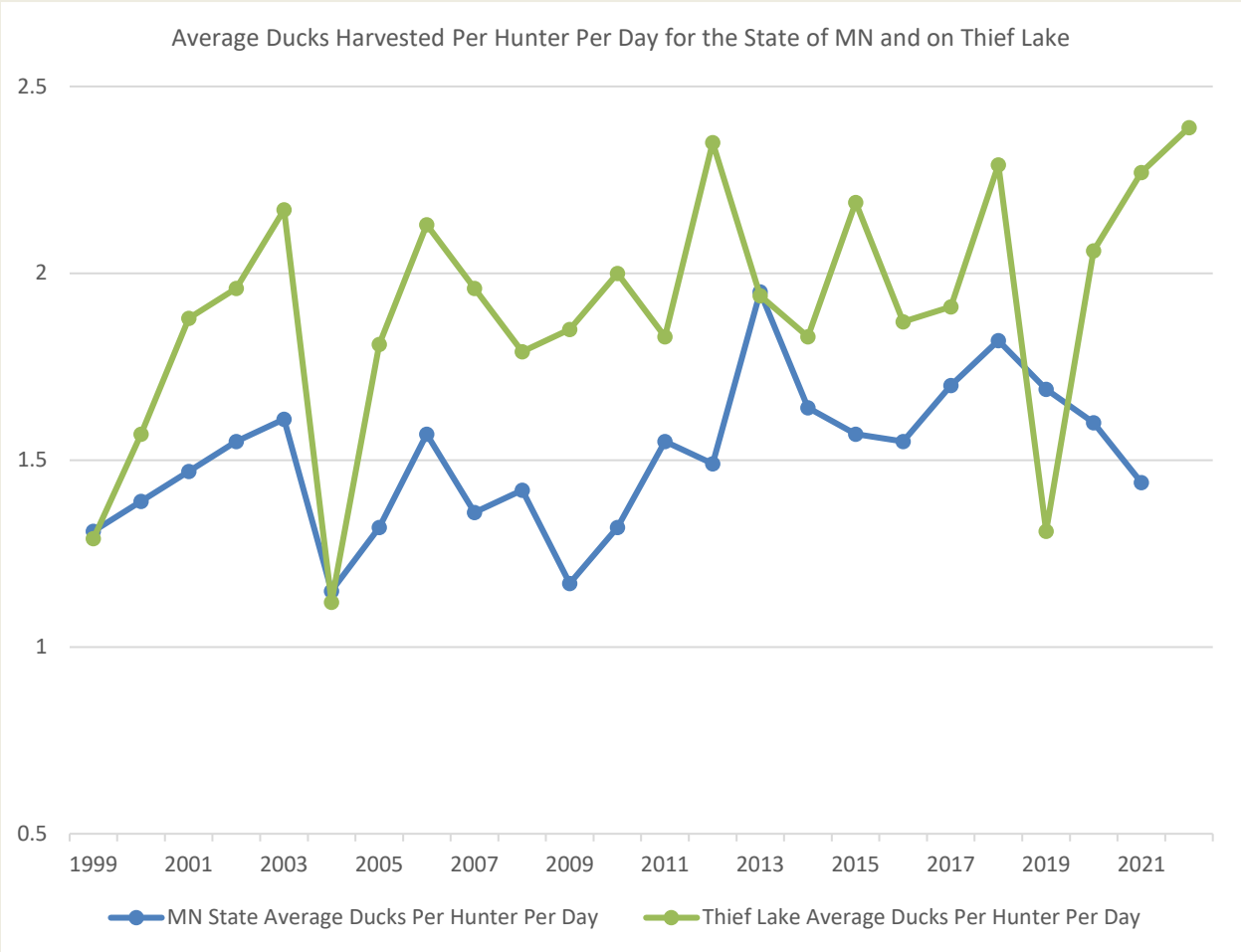


Figure 12. Average number of ducks harvested by each duck hunter per day for the state of Minnesota and on Thief Lake, 1999 to 2022.

Thief Lake has long been known as an important diving duck migration stopover and hunting area. Lesser scaup, more commonly known as bluebills, were abundant on the lake and in hunters' bags from the mid-1970s through the mid-1990s. Continental scaup population estimates began declining in the mid-1980s and have stabilized in recent decades at less than half of their historic highs. The ring-necked duck, closely related to lesser scaup, continental population and the number of them harvested on Thief Lake have been trending upward since those surveys began in the 1950s. Scaup and ring-neck harvest estimates on Thief Lake are presented in Figure 13. Ring-neck harvest surpassed scaup harvest in the mid-1990s. In recent years ring-necked ducks are the most harvested species when fall lake levels are not extremely low due to drought conditions.

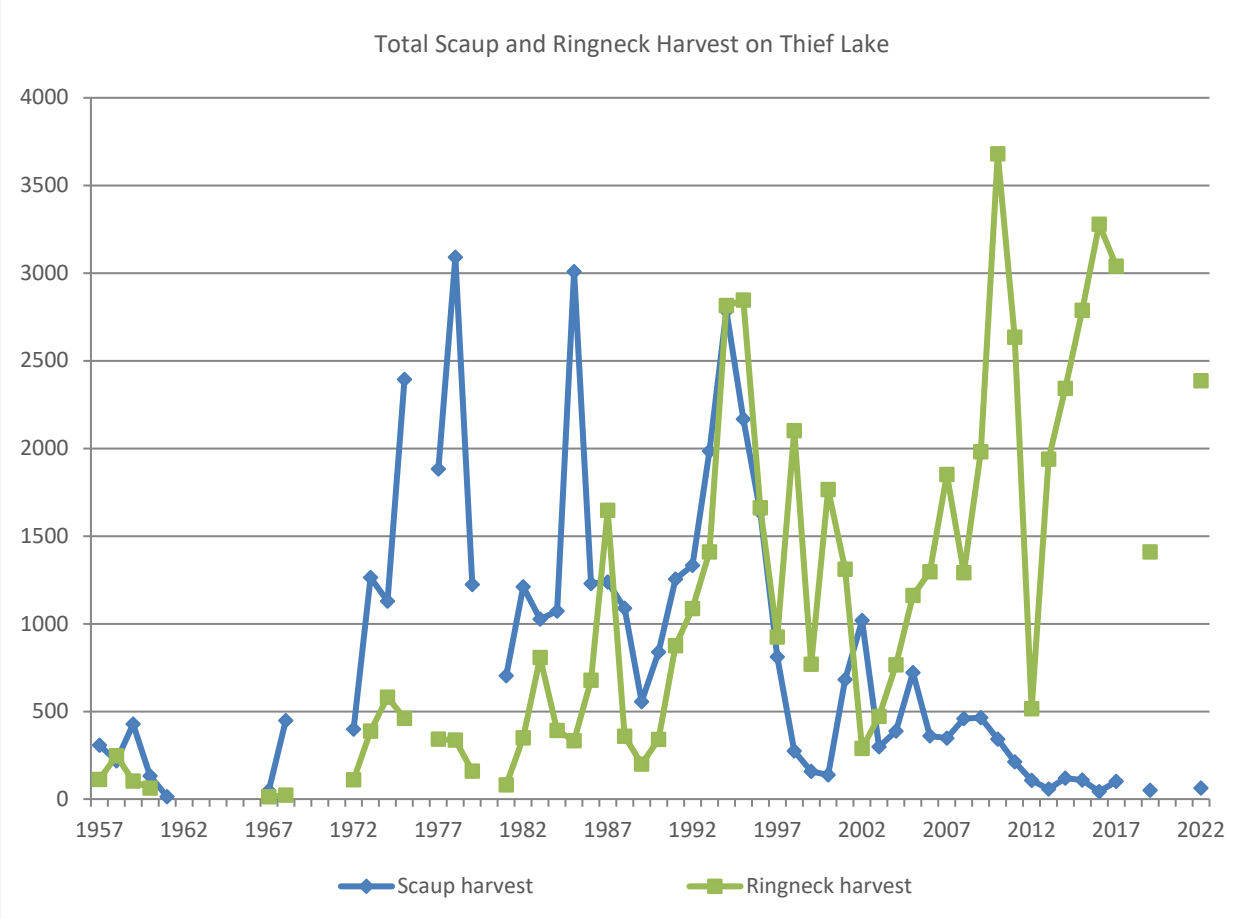


Figure 13. Total scaup (greater and lesser combined, but almost entirely lesser) and ring-necked duck harvest estimates for Thief Lake, 1957 to 2022.

Management Goals and Objectives

Goal: Maintain high quality wetland habitat for waterfowl and other wetland wildlife.

Objective 1: Maintain the abundant and diverse aquatic plant community.

Objective 2: Provide high quality breeding and resting areas for local and migrating wildlife.

Objective 3: Provide the public with quality hunting, trapping, and wildlife watching opportunities.

Proposed Management Actions to Achieve Objectives

Action 1: Use water level management when needed to maintain or restore habitat conditions.

Shallow lake conditions are not static. Even though conditions have been good at Thief Lake recently, future influences such as land use changes within the watershed, the impacts of climate change, and potential invasive species introductions could lead to degraded conditions.

Drawdowns are an effective management tool that can be used to restore aquatic vegetation, improve water clarity, remove, or temporarily reduce undesirable fish populations, and increase invertebrate abundance. Drawdowns will be conducted slowly by removing and eventually replacing stoplogs gradually over time. Releases vary between 35 and 150 cfs under optimal conditions. This will maximize benefits of both upstream and downstream resources and mimic a hydrograph that might naturally occur in a less impacted system. The active drawdown phase may only be conducted when the downstream channel and culverts have enough capacity to conduct the increased flow. Minnesota Rule 6115.0221 prohibits drawdowns during periods when the area is experiencing high water or flooding, as the increased flow could negatively impact downstream resources such as road crossings and private property. When possible, low streamflow of at least 10 cfs will be maintained at all times to provide continuity in downstream habitat. Drawdowns should last at least one season but may not last longer than two years as limited by Minnesota Rule 6115.0271. Spring runoff is usually sufficient to fill the lake to the normal pool elevation after drawdowns. Water surface elevation of the lake will be recorded at least weekly during the open water seasons during drawdown and refill periods.

Winter drawdown:

Use a partial winter drawdown to provide storage for spring runoff and encourage winterkill conditions in the basin as needed.

Partial winter drawdowns can be used to create additional storage for spring runoff that will reduce the peak water surface elevation in the spring, thereby leading to more stable water levels that are favorable to over-water nesting birds. Winter drawdowns may also be used to induce winterkill of undesirable fish populations (mainly fathead minnows and brook stickleback) that are known to increase water turbidity and decrease amphipod abundance. These benefits need to be balanced against potential negative impacts such as inducing winterkill of other overwintering aquatic species like muskrats, turtles, frogs, and invertebrates.

Threshold:

A partial winter drawdown to 1157.5 may be initiated in September when both of the following conditions are met:

1. Mean Secchi disk reading is less than half of the mean lake depth,
2. Undesirable fish are found at levels that will impact water quality and habitat.

Desired outcomes:

1. Mean Secchi disk reading greater than half of the mean lake depth,
2. Undesirable fish occur at low densities.

Summer drawdown:

Use temporary, partial summer drawdowns if needed to maintain aquatic vegetation.

Partial summer drawdowns can be used to expose portions of the lake bottom to allow consolidation of sediment which can increase water clarity and encourage the germination of emergent vegetation. Partial drawdowns also allow more light penetration into the water column which can encourage the growth of submerged vegetation.

Threshold:

A partial drawdown to 1156.5 to 1157.5 may be initiated during July or August when any of the following conditions are met:

1. Submerged aquatic vegetation is present at less than 80% of standard sample points,
2. Emergent vegetation covers less than 20% of the basin.

Desired outcomes:

1. Submerged aquatic vegetation present at greater than 80% of standard sample points,

2. Emergent vegetation coverage over 20% of the basin.

   Increase water levels

   Temporarily raise the water level during the growing season if needed to maintain hemi-marsh conditions.

It has been noted that emergent vegetation, particularly hardstem bulrush, has been increasing in coverage in recent years. When emergent vegetation coverage becomes too dense, it can decrease habitat use by waterfowl and hinder access for recreationists.

Threshold:

The runout elevation may be raised up to 1160.0 for one growing season if emergent vegetation covers more than 75% of the lake as judged from aerial observation or photography.

Desired Outcomes:

Maintain emergent vegetation coverage between 20% to 75%.

Action 2: Actively manage the moist soil units adjacent to the north and west sides of the lake to provide food resources for dabbling ducks during the fall.

Many species of dabbling ducks benefit from the roosting habitat of Thief Lake but prefer the seeds of wetland annual plants. Actively managing the moist soil units adjacent to the lake for these food resources allows greater use of this wetland complex by a greater variety of birds. These units will be managed as equipment, infrastructure, and staff time allow.

Action 3: Monitor vegetation conditions, invertebrate, fish, and muskrat populations to detect changes that may prompt management actions.

Vegetation conditions are formally monitored through wildlife lake habitat surveys, typically every three years and informally during various field work conducted on the lake. Invertebrates are sampled during an annual survey in late summer using protocols established in 1989. All taxa are recorded to detect changes in species diversity. New surveys will be pursued to document changes in fish and muskrat populations, ideally on an annual basis as conditions and staff time allow.

Action 4: Minimize bounce in lake level during open water periods, particularly during the nesting season.

While lakes are dynamic systems with variable water levels, fast increases in water level (bounce) can be detrimental to nesting birds. Bird nests may be destroyed by bounce through inundation or susceptibility to wave action. Long-term high water levels may reduce the vigor of both submerged and emergent vegetation.

Climate change is already occurring in Minnesota. Temperatures are increasing, there are larger and more frequent extreme precipitation events, along with the potential for longer dry spells. While conditions vary from year to year, these changes are expected to continue through the 21st century.

It is desirable to anticipate and allow high runoff events to pass through Thief Lake to the extent possible. While no formal agreements exist to mandate storage during runoff events, a "good neighbor" policy dictates that an assessment of conditions downstream and coordination with other entities such as the Red Lake Watershed District and Agassiz National Wildlife Refuge be considered before releasing water during any flooding event.

Spring runoff typically results in the largest single pulse of water into the basin in most years. With coordination between entities up- and downstream, it is desirable to get to a lake level of less than 1159.0 by May 1, when conditions allow.

Action 5: Maintain the existing sanctuary area on the northern and western portions of Thief Lake and the associated uplands.

There is a long history of having sanctuary areas on and around Thief Lake. The original 3,280-acre sanctuary was established in 1937 by order of the Commissioner of Conservation. This coincided with the first time the lake had filled after the dam was constructed and the precipitation normalized after the drought. Another 760 acres was added in 1962, and additions since then have brought the total area of the sanctuary to 5,120 acres. Waterfowl may use this area free from human disturbance, resulting in higher use of the whole basin.

Action 6: Provide access to the lake for waterfowl hunting while maintaining habitat.

Thief Lake is a shallow system, and subtle changes in lake level can have dramatic impacts on access. Lake levels below 1158.0 make access conditions difficult at both boat launches on the south side of the lake (Maanum's and Hennings's). When conditions allow, management should strive for a lake level above this during October. Water stored in the north pool of the upstream Moose River Impoundment may be considered for early release to increase levels in Thief Lake when it is below 1158.0.

Sediment loads in the Moose River are being released when the flow slows down to enter the lake. The result is that a delta is forming where the river enters the lake, and complicating access to the lake from the boat launch on the Moose River. The delta should be monitored to determine if mechanical removal of some of the sediment is warranted. Actions to reduce sediment loading upstream should be investigated.

Sediment has also filled the access and water conveyance channels that service the boat launches, camp sites, and moist soil units. These channels have been dredged several times over the years, most recently in 2006. Conditions indicate these areas should be dredged again soon, and then be monitored to determine when this may be necessary again.

Action 7: Limit motorized access to the current 10 HP maximum to allow access while minimizing disturbance to waterfowl and other hunters using the lake.

On most wildlife management areas, the use of motors is not allowed. Thief Lake is large enough that prohibitions on motorized access would sharply restrict recreational use of the basin. The compromise that has been reached is to allow motors with a maximum of 10-horsepower on the lake and maintain a sanctuary on the north and west portions of the lake. This has proven to be a workable and equitable compromise that allows recreational use without the increased noise and propellor paths through vegetation that larger motors would cause. As new technologies become available, their effects will have to be monitored to determine whether different regulations are appropriate.

There is very little recreational boating use of Thief Lake outside of the waterfowl season, and that use is largely non-motorized (canoes and kayaks). Non-waterfowl season use should be monitored, especially during the nesting season, and additional restrictions may become necessary if conflicts arise.

Action 8: Manage invasive and non-native species.

Invasive and non-native species have the potential to negatively affect natural resources, so actions will be taken to limit introduction, limit rate of geographic spread, and reduce the impact to natural resources. Newsletter articles and signage at the water access sites remind visitors to ensure their equipment is clean to prevent the unintentional introduction of invasive species. Eurasian water milfoil, curly-leaf pondweed, starry stonewort, invasive phragmites and faucet snails are current threats that could dramatically change the character of Thief Lake. Annual site visits are conducted at each of the water access sites and associated channels to catch any infestations at an early stage.

Hybrid cattail and purple loosestrife have been present along the shoreline of Thief Lake. Aquatic-approved herbicides have been used to treat these populations. While the treatments have shown good results, continued management may be necessary to limit these invasions.

Action 9: Continue to support the efforts of local, state, and federal agencies, and local landowners on conservation projects within the watershed.

Conservation work within the watershed is an important tool in shallow lake management which can reduce inputs of nutrients and sediment and the speed of the water flowing into the basin. Opportunities should be utilized to educate citizens about private land conservation and best management practices such as buffer strips and wetland restoration. The protection of existing habitats and restoration of critical areas are vital to sustaining water quality and wildlife habitat.

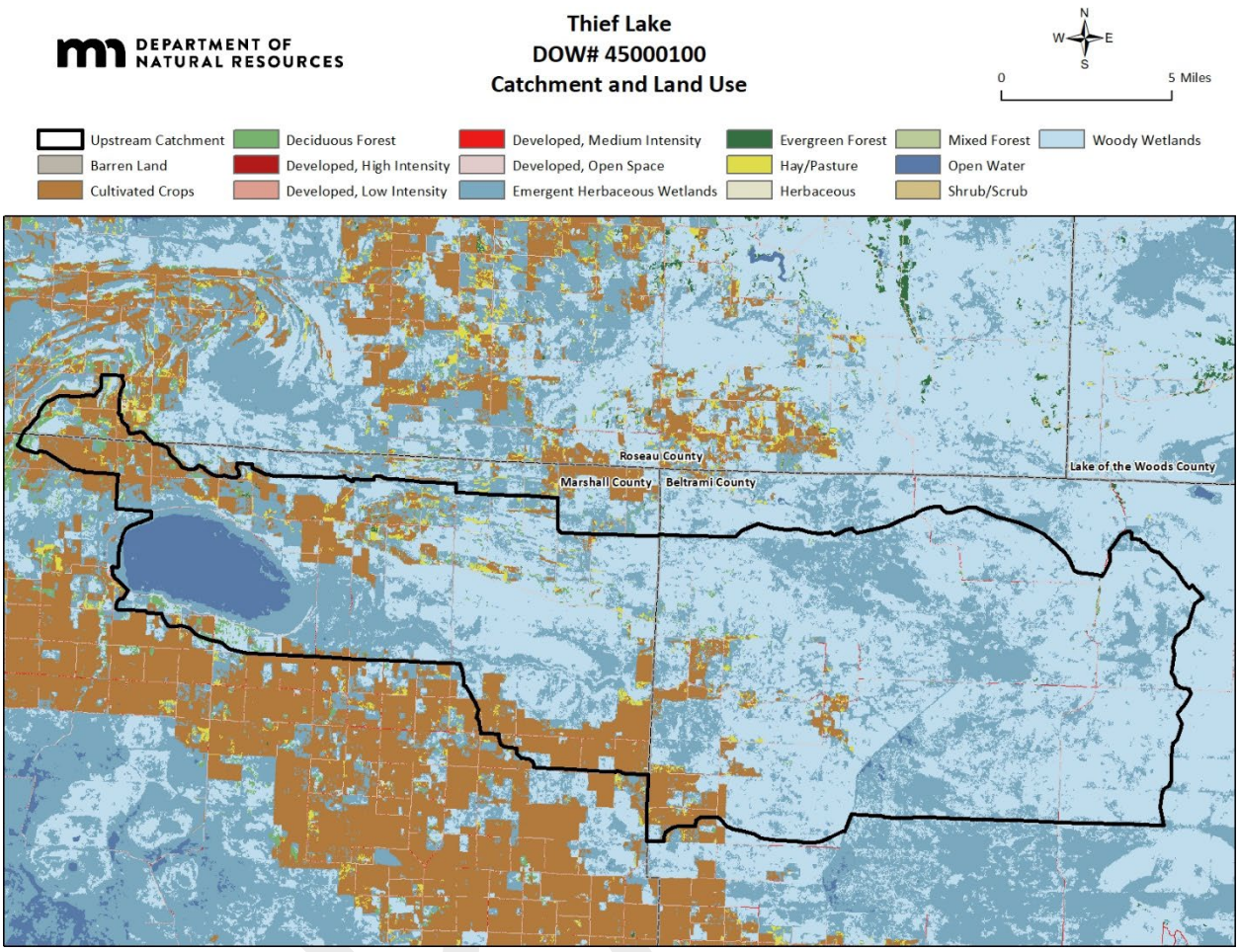
Management Plan Revisions

This management plan will be revisited every 10 years to assess effectiveness and determine if changes or updates need to be made. Local partners and stakeholders will have the opportunity to provide input on proposed modifications to the management plan.

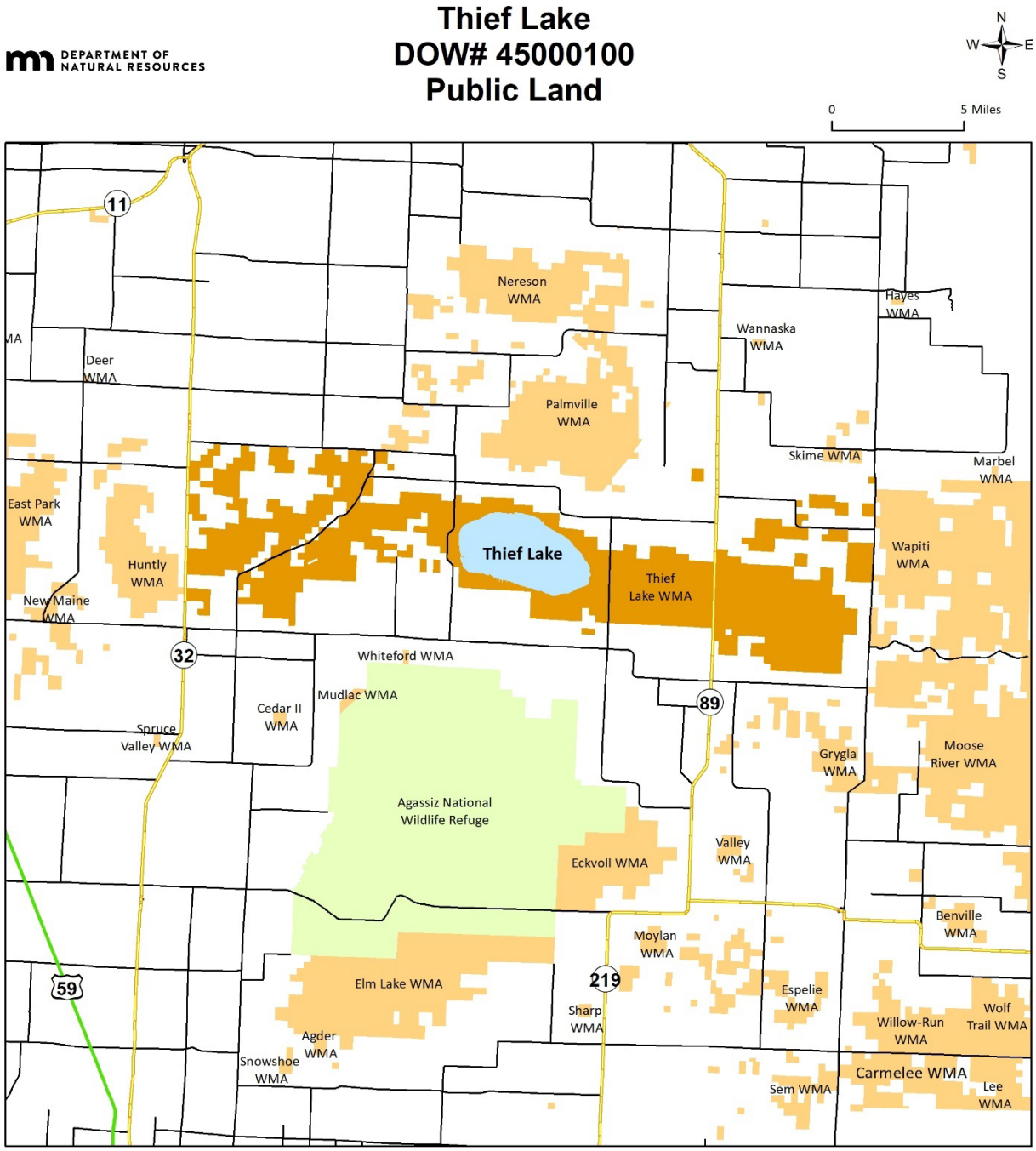
Thief Lake (DOW#45000100), Marshall County Management Plan Signature/Approval Sheet

Signature	Title	Date
	Area Wildlife Manager	
	Regional Wildlife Manager	
	Section Manager	
	Division Director	

Attachment A. Map of Thief Lake with access points.



Attachment B. Map of the upstream catchment of Thief Lake with land cover from the 2019 National Land Cover Database.



Attachment C. Map of the public land in the area around Thief Lake.

Literature Cited

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