Cooperative Enhancement Plan for

Lake Wakanda (34-169), Kandiyohi County

Blomkest Sportsmen's Club
Board of Water and Soil Resources
CROW- Crow River Organization of Water
Ducks Unlimited
Kandiyohi County
Kandiyohi County SWCD
Lake Wakanda Association
Minnesota Department of Natural Resources
Minnesota Pollution Control Agency

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Executive Summary

The lake

Lake Wakanda is a large (1,754 acres) shallow lake located approximately 3 miles southeast of the City of Willmar. It lies within a chain of lakes including: Little Kandiyohi, Swan, Kasota, Minnetaga and Big Kandiyohi, which form the headwaters of the South Fork of the Crow River. The current management plan for Lake Wakanda was adopted in 1991 and is in need of updating.

The situation

Lake Wakanda is classified as "impaired waters" due to excessive nutrients by the Minnesota Pollution Control Agency. Historically, lake water quality has been degraded by over-enriched lake sediments through decades of pollution from municipal wastewater effluent discharge by the cities of Willmar and Kandiyohi, and from untreated urban and agricultural runoff.
Watershed hydrology is impacted by:

- increased runoff from large impervious surfaces within the City of Willmar which don't allow water to flow through, such as asphalt,
- loss of wetlands,
- accelerated runoff from intensive row crop agriculture throughout the majority of the watershed.

Fish and wildlife habitat is impacted by frequent algal blooms, turbid water and low oxygen concentrations. It is considered highly degraded except following periods of drought when extensive winterkill occurs.

The approach

The primary focus of this collaborative effort is to restore the water quality of Lake Wakanda and downstream receiving waters. The plan calls for replacing the existing water control structures at both lake outlets and installing at least one variable crest structure to allow for temporary drawdowns to help induce winter kill conditions. This will allow for more effective management of carp and bullhead populations, and help reduce their negative effects on water quality, aquatic plant communities and ecosystem health. Additionally fish barriers will be constructed at the outlets of Lake Wakanda and Lake Minnetaga to prevent the rapid repopulation of these lakes with carp and bullheads following winter kill.
This plan recognizes that a lake is a reflection of its watershed. Efforts to reduce the effects of urban and agricultural runoff throughout the watershed are critical to restore water quality and improve the aquatic ecosystems. Projects such as the restoration of Grass Lake, the MPCA's Watershed Restoration and Assessment Project Strategies (WRAPS) for the South Fork Crow River' and the NRCS's Kandi Creek Assessment will help guide implementation of Best Management Practices in the watershed and play a

valuable role in improving Lake Wakanda and downstream receiving waters. Cooperating partners plan to seek grant funds through the Legacy Amendment to achieve the plan goals of improved water quality through lake management and watershed restoration.

Introduction

Lake Wakanda is a 1,754 acre shallow lake, located approximately 3 miles southeast of Willmar, MN. It lies within a chain of connected lakes including Eleanor, Little Kandiyohi, Kasota, Swan, and Minnetaga which form the headwaters of the South Fork of the Crow River. Grass Lake, a large drained lake bed (1,227 acres), is located just upstream of Wakanda and is adjacent to the southeast side of Willmar.

Shorelines along Wakanda are generally undeveloped and wooded with willow, elm, cottonwood and ash trees. The lake has a maximum depth of 14 feet and contributing watershed of 39 square miles. Predominant land use in the watershed is row crop agriculture. However, municipal wastewater and storm water discharge from the cities of Willmar and Kandiyohi have had a significant impact on water quality, hydrologic response and habitat.

The lake has extremely poor water quality due to a variety of factors that have contributed to nutrient overloading, particularly phosphorous. Lake Wakanda was listed as impaired in 2008 by the Minnesota Pollution Control Agency (MNPCA) for not meeting Lake Aquatic Recreation Standards due to eutrophication caused by excessive nutrients. Abundant rough fish populations, especially carp, excessive nutrient loading, along with accelerated runoff and the resulting high water levels, have aggravated the water quality and shoreline erosion problems which in turn have severely degraded fish and wildlife habitat in the lake. Additionally, Big Kandiyohi Lake receives most of its water supply from Lake Wakanda via the overland channel. It too is listed as impaired for excessive nutrients and eutrophication that exceed the Lake Aquatic Recreation Standards. Accordingly both lakes are subject to frequent algae blooms including extensive blooms of toxic blue green algae.

Historically, Wakanda had a limited fishery and was an important lake for migrating waterfowl during the spring and fall. In 1991, a collaborative management plan was drafted for Lake Wakanda with the goal of improving water quality and fish and wildlife habitat. Soon thereafter, the lake was designated as a Migratory Waterfowl Feeding and Resting Area, a subsurface aeration system was installed (1995/96), a walleye stocking program was initiated (1994) and a new public access was put in on the north side of the lake. Many of the goals of that plan, including the restoration of Grass Lake, were not achieved. There is continued interest in better managing Lake Wakanda for improved water quality, shoreline stabilization and fish and wildlife habitat.

In addition to Lake Wakanda and Big Kandiyohi Lake, other lakes in this chain are in generally poor condition. *Little Kandiyohi and Kasota lakes were added to the State of Minnesota's list of impaired waters in 2008.* Lake Minnetaga and Lake Lillian are still being studied by MNPCA. The official diagnostic study to determine sources of nutrients has not been completed yet, but likely sources are accelerated runoff from highly developed urban and agricultural areas within the watershed.

Lake Wakanda receives water from several ditches which includes runoff from the City of Willmar and a large agricultural watershed. Until recently (fall 2010), wastewater effluent from the City of Kandiyohi discharged into this ditch but has since been re-routed to the Green Lake Wastewater Treatment Plant for additional treatment. The City of Willmar also installed a new wastewater treatment system in the fall of 2010 which no longer discharges into the ditch system entering Lake Wakanda. *These two improvements will help improve lake water quality.*

Lake Wakanda continues to receive city storm-water and agricultural runoff from the surrounding watershed. Loss of wetlands and extensive impervious surface areas within the watershed, have led to a watershed hydrology that is characterized by frequent and exaggerated response in lake levels due to precipitation events. This condition, in combination with a wetter climate pattern over the past 30 years, creates conditions which greatly increase the potential for shoreline erosion. *Accelerated runoff from the watershed needs to be mitigated through wetland restorations (including Grass Lake), establishment of riparian buffers, improved cropping and tillage practices that dampen runoff, and improved storm water management in the City of Willmar.*

Poorly functioning outlet barriers/aeration system, high numbers of carp and black bullhead have also exacerbated high nutrient levels by contributing to internal nutrient loading. *Excessive nutrients, runoff and uncontrolled rough fish populations have caused an overall degradation of water quality, water clarity, and fish and wildlife habitat.*

The goal of this restoration plan is to improve water quality which will improve fish and wildlife habitat conditions in Lake Wakanda. The plan will identify what contributing stakeholders feel are the "best" available alternatives to meet the goals of this plan. It is the intent of this plan to be a joint plan with consideration given to fisheries and wildlife resources (primarily waterfowl) but to particularly focus on improving water quality, clarity and submersed and emergent vegetation levels. A comprehensive watershed approach coupled with in-lake management techniques (outlet water control structures capable of allowing partial drawdown coupled with effective fish barriers and effective winter aeration/predator fish management) will be key to improving water quality, clarity and submersed/emergent vegetation levels while maintaining recreational fishing opportunities for at least 2/3 of the time in Lake Wakanda. Partial drawdowns of 1.5 feet could be infrequently conducted no more than once every 6 years (time period between partial drawdowns are from full refill to start of next partial drawdown) with the hopes of 8-10 years between partial drawdowns if predator fish management is effective. Liberalized fishing opportunities will be sought just prior to any partial drawdown. Partial drawdowns will last no longer than 2 winters and 1 summer and will be conducted only under certain conditions (low-to-normal water levels, high rough fish populations, poor water clarities and low submersed/emergent vegetation levels).

Lake Vegetation Survey Information

Lake Wakanda has a long history of management for fish and wildlife habitat. There are several historical game lake surveys dating back to 1947. Table 1 includes a summary of aquatic vegetation

information collected during game lake/shallow lake surveys. The percent of vegetation in the basin has fluctuated since the earliest surveys.

- Game Lake Survey of 1947: Twelve (12) species of emergent vegetation were present at 7.5% of the 80 sampling stations, and the submersed plant sago pondweed was found at 10% of the sampling stations. Emergent plants were noted in occasional abundance along the shore-lines, marshy edges and SW/NE bays.

- Game Lake Survey of 1965: Five (5) species of emergent vegetation covered less than 1% of the present lake area; they were mostly located in the outlet channel on the northeast bay and one small stand off the wooded point on the north shore. Five (5) species of submersed vegetation occurred at 41% of the sampling stations. Sago pondweed was scattered throughout the lake in water less than 8 feet deep, while four (4) other species were found in the shallower areas of the bays and shore-lines.

- Game Lake Survey of 1988: Common cattail was the only emergent described in small pockets along the shore-line at the northeast end of the lake. Submersed vegetation consisted of four (4) species, the majority being sago pondweed, which occurred at 20% of the sampling stations and was found scattered along the shore-line in depths of 5 feet or less.

- The 2005 Wildlife Lake Survey, which was a partial survey focused on the southwest and northeast bay area's only, found submersed vegetation almost entirely lacking, with only one sample point with sago pondweed present at only 1 sample point. Cattails were observed along the north shore and the northeast bay area.

- The 2010 Wildlife Lake Survey was also a partial survey focused on the southwest and northeast bay areas. Only one submersed plant species, coontail, was present at three sample stations, a frequency of 3.9%. Cattails were observed along the north shore and the northeast bay area.

- The 2012 Wildlife Lake Survey again focused on the southwest and northeast bay areas. Submersed vegetation was again absent except for one point where sago pondweed was found. The scarce cattail fringe along the north shore still exits. Observed mean Secchi depth was 1 foot.

- The 2013 comprehensive vegetation survey was completed to monitor vegetation persistence after the 2012/13 severe winterkill. In the east and west shallow bays, vegetation was very abundant and secchi depths averaged 1.5 feet. Secchi readings were to the bottom at all points in the east bay. Submersed species richness included 6 different species. In the main basin, submersed vegetation was found at 35.3% of the sample points, average secchi depth was 1.7 feet, and wildlife utilization was high.

- The 2014 comprehensive vegetation survey was completed to monitor the health of the lake following a partial winterkill in 2013/14. In the bays, submersed vegetation was dense to the extent that travel by boat was difficult. There was a species richness consisting of 8 submersed vegetation species, and 88% of survey points in the bays were vegetated. Average secchi readings in the bays were 2.4 feet. In the main basin, water quality was improved from the prior year with secchi depths

averaging 2.9 feet. Submerged vegetation was found at 23% of points. Species richness included 8 different submerged vegetation species.

Year	Percentage of sample stations with emergent vegetation (no. of species)	Percentage of sample stations with submersed vegetation (no. of species)	Notes
1947	7.5 (12)	10 (1)	80 sample stations, emergent vegetation found in bays and near shorelines.
1965	<1.0 (5)	41 (5)	Sago pondweed was scattered in water <8ft deep
1988	<1.0 (1)	20 (4)	Sago pondweed most common species found in water < 5 ft. deep
2005	<1.0 (1)	1.2 (1)	Only the SW and NE bays were surveyed as those shallow areas were most likely to have vegetation
2010	1.3 (1)	3.9 (1)	Water clarity <1.0 feet
2012	2.3 (1)	1.2 (1)	Water clarity 1.0 feet
2013	3.0 (1)	52 (6)	1.7 feet mean secchi in main basin 1.5 feet mean secchi in bays
2014	2.5 (1)	49 (5)	2.9 feet mean secchi in main basin 2.4 feet mean secchi in bays.

Table 1. Lake survey vegetation summary

Fisheries Information

Historical fish management activities include rough-fish removal, game fish winter rescue operations, and game fish stocking. The lake is currently managed as a put-grow-and-take walleye fishery with 1.6 million fry stocked every other year. Each fry stocking is assessed in late summer-early fall with night electrofishing and if catches of young-of-the-year (YOY) walleye are poor (e.g., less than 30 YOY netted per hour of electrofishing), fry are re-stocked the following spring instead of waiting a year. Walleye fry are also stocked following severe winterkills after verification with ice-out netting assessments. Supplemental stockings of costly walleye fingerlings, yearlings and adults have also periodically occurred, but have been discontinued. There is little or no indication of natural walleye reproduction in the lake.

Lake Wakanda is susceptible to partial/severe winterkill, especially when water levels are moderate to low going into and during the winter. Dissolved oxygen levels have historically been monitored during the winter months. Prior to aeration in 1995/96, the lake was opened to liberalized fishing at least 11 times since 1944. Past winterkills will reduce fish populations for a few years, but a sufficient number of fish survived and/or the basin was quickly re-populated through the numerous connections to other water bodies. The over-abundance of rough-fish and decline of water quality and habitat led to walleye

being stocked beginning in 1994 to provide a fishery and to control excessive black bullhead populations. In an effort to minimize the possibility of winterkill and support a predator fish population, an aeration system was installed in the fall of 1995 as part of the original Lake Wakanda Cooperative Management Plan. Despite operation of the 12 unit "bubbler" aeration system, partial to severe winterkill of fish still periodically occurred (1995/96, 1999/00, 2003/04, 2007/08, 2008/09 and most recently 2012/13). After the 1995/96 winterkill, attempts to turn on the aerator to distribute soft sediments a few weeks prior to ice-up became a common practice with only variable success. The overall conclusion is that the current "bubbler" aeration system location is unsuitable and may even exacerbate winterkill and cannot be depended upon to reduce winterkill conditions. Despite subpar aerator performance, the walleye stocking program created periodic abundant walleye populations which rebounded quickly after winterkills and created a popular early season/early winter fishery which some control over black bullhead populations. Walleye fry have shown excellent survival and extremely fast growth in Wakanda capable of producing keeper-size walleye prior to the second winter after severe winterkill.

Carp have not been successfully controlled in Lake Wakanda. Carp have been shown to produce strong year-classes after winterkill events (University of Minnesota research). Periodic DNR fisheries surveys and special assessments show that carp have produced strong year-classes in Lake Wakanda directly after winterkill. Small mesh trap nets and seining were conducted in August 2013 after the 2012/13 extensive winterkill. *An estimated 4,000+ "young of the year"(YOY) carp and 1,000 YOY black bullhead were caught per trap net.* The severe winterkill of 2012/13 littered the shorelines of Wakanda, Little Kandiyohi and Kasota with a massive population of dead and decaying carp. Lake Minnetaga is the headwaters to Kasota and Little Kandiyohi lakes, and is the least susceptible lake to winterkill in the entire chain, including Wakanda. A large carp population overwintered in Minnetaga in 2012/13 which likely provided ample brood-stock capable of creating the strong carp year-class in 2013. The "Overland Ditch" and Little Kandiyohi Lake outlets also provide migration routes back into the Wakanda chain; however, water flows were low enough in spring/early summer 2013 to potentially prevent carp immigration back into the Wakanda chain-of-lakes. Nevertheless, the mechanical barriers in the Wakanda chain system (Overland Ditch and County Road 8 on Lake Wakanda, Little Kandiyohi outlet, Minnetaga outlet) are easily and often breached by carp and other fishes.

To attempt carp and black bullhead "control" through the use of predator fishes, an effective winter aeration system in combination with effective fish barriers at the Wakanda outlets (i.e., Overland Ditch, County Road 8) are needed**.** The 12-unit helixor aeration system was moved slightly shallower to firmer substrates in the fall of 2014 with hopes of better success. The mild 2014/15 winter precluded an effective evaluation of the effectiveness of the aerator.

Waterfowl Use

Lake Wakanda is not currently a significant waterfowl production lake due to do its degraded character and associated watershed. The lake's primary importance for waterfowl has been as a staging and rest area for migrating waterfowl in spring and fall. Historically, these gatherings of waterfowl have been noted anecdotally. Some years, significant numbers of birds were noted utilizing the lake, and in other years there was very little use. The majority of this use was by mallards and various species of diving ducks. As an example, several thousand mallards and Canada geese used the West end of the lake for

roosting and resting for several weeks in the fall of 2012, feeding in area fields twice a day. The fall use by waterfowl was the main reason the lake was designated as a Waterfowl Feeding and Resting Area in 1995. Designation prevents the disturbance of waterfowl by motorized watercraft during the waterfowl season.

Currently, excessive nutrients, sediment, high water levels, and the abundance of carp have virtually eliminated the available aquatic food sources for migrating waterfowl. The overall water quality in the lake needs to be improved so that aquatic plants and invertebrates are available for resident and migrating waterfowl.

Water Quality

Lake Wakanda is considered a ***Hyper-Eutrophic Lake*** with excessive levels of nutrients (phosphorus and nitrogen), poor water clarity and high levels of fecal coliform bacteria. The U.S. Environmental Protection Agency (EPA) recommends a total phosphorus (TP) value of 50 ppb (parts per billion) for streams where they enter a lake and 25 ppb within a lake. The Minnesota Pollution Control Agency (PCA) determined normal TP levels for shallow lakes in the Western Corn Belt Plains region of Minnesota to be within the range of 65-105 ppb, and should not exceed 90 ppb on average. An excessive amount of phosphorus is a sign of a polluted water body and can lead to increased algal growth and a decline in dissolved oxygen necessary to support aquatic life.

Water quality sampling done by the Fisheries Research Laboratory in 1947 found TP levels of 75 ppb in Lake Wakanda. Since then, Lake Wakanda has had a history of very high TP levels. In 1969 the MPCA found average TP levels at 1,030 ppb. In subsequent years, phosphorus levels were measured as high as 3,220 ppb (8/31/1977), averaging around 1,410 ppb. The most recent samples collected in 2013 had total phosphorus levels that exceeded 350 ppb in July and averaged approximately 200 ppb. Correspondingly summer Secchi disk readings averaged 0.2 meters (8 inches) below the surface.

The Friends of the Lake Wakanda Chain Association and others have witnessed declining water quality for many years. In 2005, the lake association and Ducks Unlimited (DU) started monitoring water quality. Enough monitoring was completed so the PCA could evaluate the basin for impairment. ***As a result, the lake was deemed impaired for nutrients and added to the State's list of impaired water bodies in 2008.*** Currently the lake is being studied as part of the MNPCA's Watershed Restoration and Protection Strategy (WRAPS) for the South Fork Crow River.

Abundant carp and bullheads have exacerbated the water quality problem by uprooting aquatic vegetation and stirring up sediment, thereby increasing turbidity problems, and re-distributing nutrients from the lake bed into the water column. Consequently, shoal water areas are prone to erosion from wave action, fish spawning areas are disturbed or destroyed, vegetation used for food and cover by various fish and wildlife species is lost, and algal bloom frequency and intensity are increased.

Hydrologic Information

Lake Wakanda is long (maximum length 6.17 miles) and shallow with an irregular shoreline (14.9 miles) and a littoral area of 1,560 acres. It has a maximum depth of 14 feet (DNR Lake Mapping Unit 1991)

and an average depth of 7 feet. There have been fluctuations in these measurements through the years. Historic surveys have found maximum depths of 19 feet in 1947, 12 feet in 1988 (drought year), 17 feet in 1965, and a littoral acreage as high as 1,664.

Water levels have been recorded on Lake Wakanda since at least 1950; however the vast majority of readings have occurred after 1980. The average level for the period of record is 1,105.1(N.G.V.D. 1929) which is 0.4 feet above the run out (dam overflow) elevation of 1,104.7 and 0.9 feet below the Ordinary High Water Level (OHW) of 1,106.0. Water levels fluctuate through the seasons and through the years due to changes in weather patterns. The highest recorded level was 1,107.8 on April 4, 1997, and the lowest in recent history was 1,102.88 feet on November 3, 1988 (figure 1).

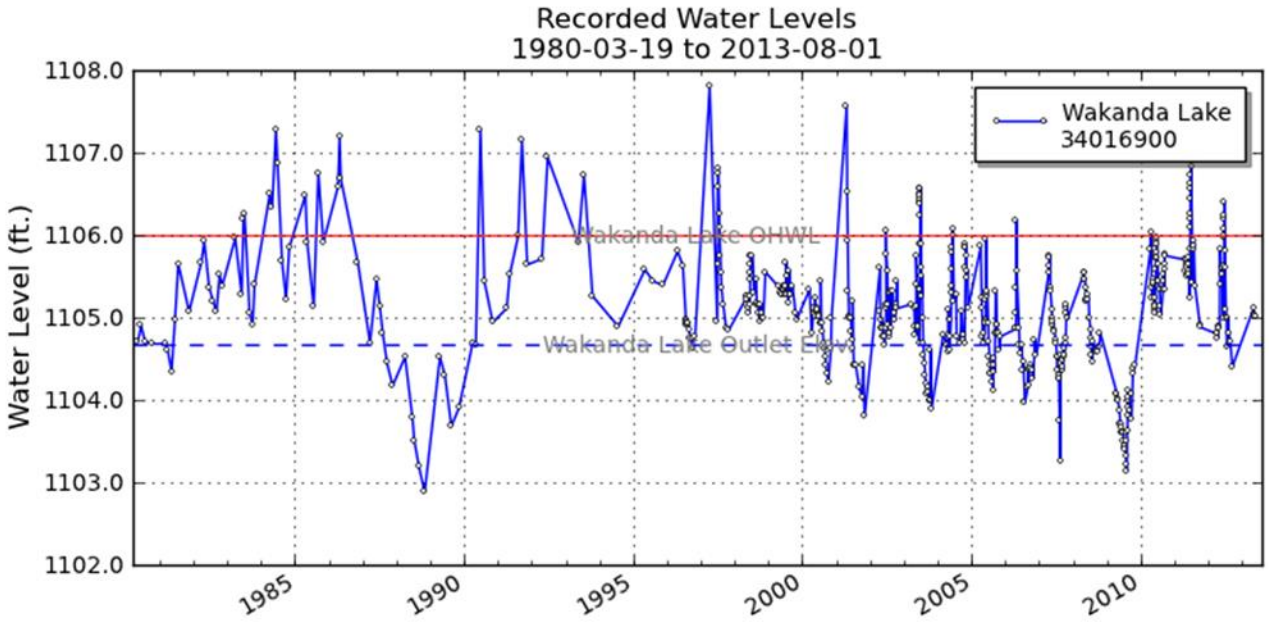

Figure 1. Water level readings for Lake Wakanda.

As stated earlier, the lake is a part of a complex system of interconnected lakes that includes Little Kandiyohi, Kasota and Minnetaga Lakes. It has a large watershed that covers an area of approximately 39 square miles, resulting in a watershed to Lake Ratio of 14:1. There are three major sub watersheds: County Ditch 23A, Peach Creek and Kandiyohi Creek (see Figure 2). While there is a significant amount of topographical relief from the headwaters of Peach Creek (140 feet) and Kandiyohi Creek (180 feet) to Lake Wakanda, the CD 23A Watershed has an extremely low gradient.

Land use in the watershed is dominated by agricultural row crops (~70%) with very few remaining natural storage areas, due to a loss (> 90%) of natural wetlands in the watershed. Wetland losses are primarily a result of drainage for row crop conversion and filling for residential and commercial development. Lake water level responses to precipitation are characterized by rapid rises and falls or "bounce", typical of watersheds affected by intense urban and agricultural development. Rapid fluctuations in water levels limit the growth of emergent vegetation, increase erosion potential and turbidity and thus degrade habitat and water quality.

More water storage is needed in the watershed to help moderate water levels in Lake Wakanda. Restoration of Grass Lake represents an excellent opportunity to begin to mitigate the impacts of accelerated runoff in the watershed.

There are approximately 12 inlets to Lake Wakanda, most of which are intermittent and drain agricultural land. The largest, County Ditch (CD) #23A, constructed in the early 1900's, is the primary contributor of runoff and nutrients to Lake Wakanda. This public ditch receives a significant amount of storm sewer runoff from the city of Willmar and drainage from surrounding agricultural land as it flows through the Grass Lake bed south to Lake Wakanda.

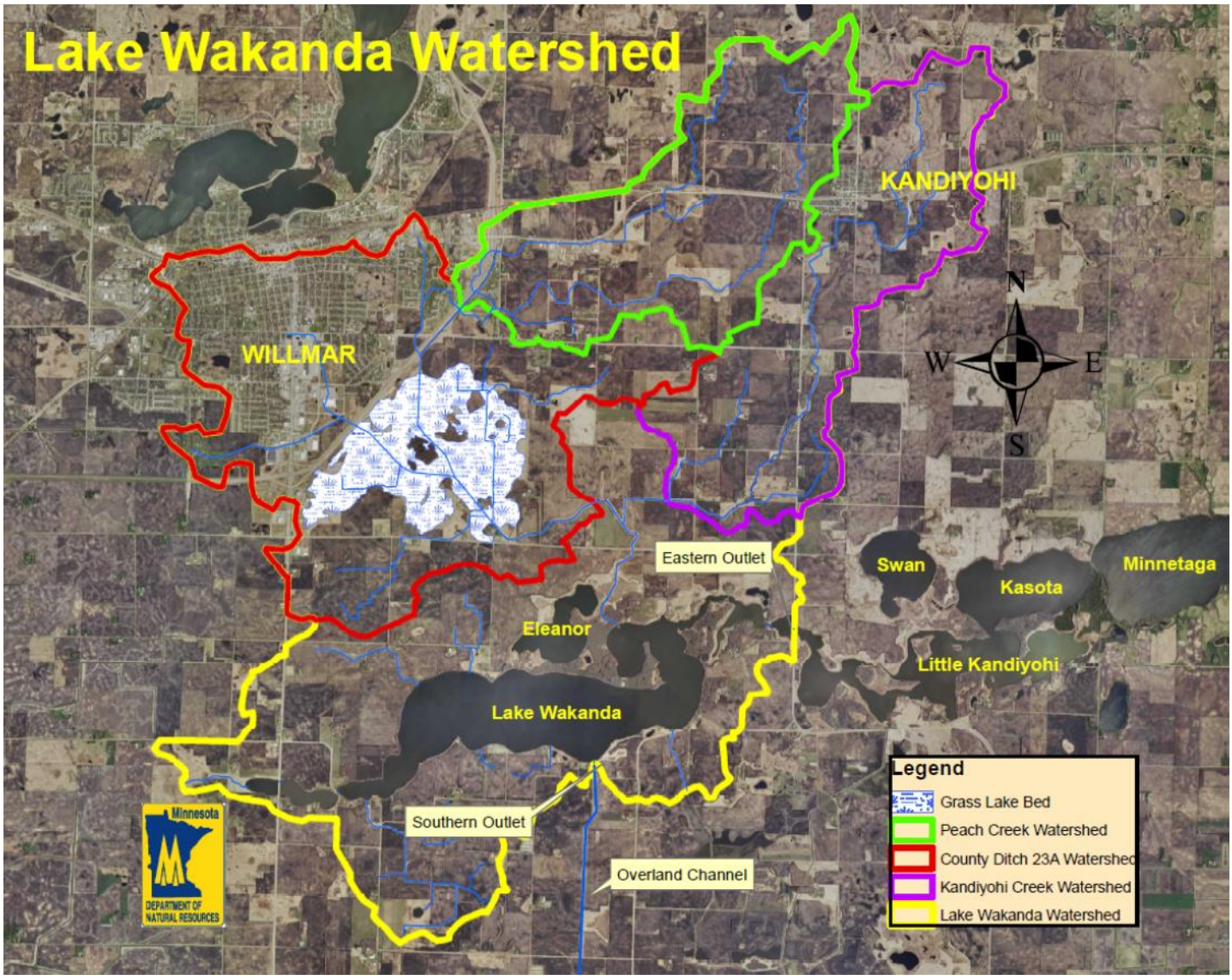

Figure 2. Map of Lake Wakanda and surrounding watershed

There are two outlets to Lake Wakanda: 1) the southerly outlet flows into Big Kandiyohi Lake by way of the Overland Ditch and 2) the easterly outlet flows into Little Kandiyohi Lake. Little Kandiyohi Lake outlets into Judicial Ditch (JD) #1 and forms the headwaters of the South Fork of the Crow River. Water levels on Lake Wakanda are controlled by two steel-sheet-piling dams, constructed in 1990. The eastern dam is set at an elevation of 1,105 feet above sea level (MSL) and the southern dam (Overland Channel) is set at 1,104.7 feet. The lower runout on the southern dam provides minimum flow to help augment water supply to Big Kandiyohi Lake during low flow periods.

The outlet for Little Kandiyohi Lake is a concrete structure, located adjacent to the Bridge on County Road 8 and has a runout elevation of 1,104.3. Kandiyohi County operates the structure and has an agreement with the DNR that allows Little Kandiyohi Lake to de drawn down to elevation 1,103.8 MSL from November 1 – April 30th each year. From May 1-October 31, the lake is to be maintained at the run-out elevation of 1,104.3 feet. This agreement allows water retention in the lakes for flood reduction to the downstream Judicial Ditch #1 area. `

Objectives and Actions

Objective 1: Moderate hydrology to reduce peak flows and nutrients coming into Lake Wakanda.

Action 1-1: Continue to actively support the restoration of Grass Lake for water quality, floodwater retention, waterfowl and other wildlife habitat benefits. The restoration of Grass Lake and the implementation of other watershed improvement practices are imperative for an effective lake management plan to reduce runoff and improve water quality and fish and wildlife habitat (Figure 2). Currently, the lake level can bounce approximately 1 foot following a 2-inch rainfall event. A feasibility study by Barr Engineering indicates restoration of Grass Lake will significantly reduce the bounce in Lake Wakanda (0.5 foot from a 100-year storm event) and will reduce the amount of phosphorus coming into Lake Wakanda from CD 23A by approximately 50%.

- *Lake level bounce needs to be reduced by at least 50% following a 24 hour, 25-year storm event which equals 4.25 inches according to the National Weather Services' Technical Paper #40.*

Action 1-2: Support and promote total phosphorous (TP), Total Suspended Solids (TSS) and fecal coliform bacteria reduction and the implementation of Best Management Practices (BMP's), through the Minnesota Pollution Control's Watershed Restoration and Assessment Project and the Natural Resources Conservation Services Kandi Creek Watershed Assessment, for improved water quality and watershed health.

- Lake Wakanda receives an average of approximately 350 ppb phosphorous from County Ditch (CD) #23A at the County Road (CR) #88 bridge crossing. *Phosphorous levels in the lake typically range from 125-200 ppb. In lake phosphorous levels need to be reduced to 90 ppb or less (long term goal =75ppb).*

- Lake Wakanda has a sediment loading problem. Total suspended solids (TSS) range from 26-47 ppb and the mean at CR #88 on CD #23A is 45 ppb. *TSS levels entering the lake need to be reduced to 25 ppb or less.*

- There is also a high fecal coliform bacteria level going into the lake from CD #23A. In 2005 the fecal coliform counts at CR #88 on CD #23A were 812 organisms per 100 milliliters. *Fecal coliform bacteria counts need to be reduced to less than 200 organisms per 100 milliliters entering the lake.*

Objective 2: Fund and implement the necessary infrastructure (effective outlet barriers/structures with drawdown capability, partial drawdown authority, effective winter aeration) needed to allow fish management utilizing a diverse predator fish population to minimize Carp and Black Bullhead abundances in order to prolong the time period in-between partial drawdowns beyond 6 years and to provide a more diverse recreational fishery at least 2/3 of the time.

Action 2-1: Replace existing outlet structures on Lake Wakanda. Through a DNR Heritage Enhancement Grant to Ducks Unlimited (DU), engineers' evaluated outlet structure design options for both Lake Wakanda outlets to allow for water level management and limit fish entry into Wakanda from the overland channel (south) and from the other lakes connected by the eastern outlet. Additionally, funding to incorporate more effective fish barriers with both south and east structures will be pursued. These will be pursued if partial drawdown authority/outlet easements are attained. *For drawdown purposes, authority to manage water levels would be sought by Kandiyohi County per Minnesota Statute 103G.408. Easements will need to be obtained from adjacent landowners at both sites to allow for installation and future maintenance.*

The Lake Wakanda connection to Little Kandiyohi Lake (i.e., east outlet) would have the existing sheet pile dam/"swinging fingers" fish barrier at Co Rd 8 removed and replaced with a new water level structure/fish barrier just west of that at the old road crossing behind the church.

Action 2-2: A temporary drawdown to elevation 1103.2 feet (NGVD 29) will be used to consolidate fringe sediments, promote emergent and submersed vegetation growth and help induce winter kill when unfavorable water quality, habitat and rough fish populations are present. Attempts to enhance winterkill would be attempted at a frequency of no more than two consecutive winters and one summer with a minimum of six years after full refill (goal of 8-10+ years) in-between temporary drawdowns. This allows for the opportunity to keep the lake in drawdown through one winter and possibly into a second winter if goals are not achieved after the first winter. A drawdown would be conducted to the maximum extent possible (approximately 1.5 feet below the normal run out of 1104.7 to 1103.2 feet). The normal run out elevation (1104.7) would be gradually restored. *Structure design and DNR Permits for the southern outlet need to incorporate maintenance of a minimum flow to Big Kandiyohi Lake, following the completion of the temporary drawdown, and recovery of water levels on Lake Wakanda.*

- *Increase emergent and submergent aquatic plant species diversity and density to 2013 conditions.*

The guidelines below can be used as "triggers" for when to initiate temporary drawdowns to induce winterkill.

- Fish population contains 60% or more relative biomass (weight of carp and bullheads in combined gillnets and trap-nets). This requires recent fish survey data.

- Predator fish (e.g., walleye, northern pike, etc.) relative biomass constitutes 20% or less of the fish population (requires recent fish survey data).

- Submerged vegetation found at 50% or less of sampling stations in water less than 4 feet in depth (requires recent plant sampling data).

- Water clarity (Secchi disc) readings average less than 1.0 foot in July and August. Utilize citizen monitoring data through the MPCA.

- Favorable climate conditions.

Action 2-3: In order to sustain predator fish populations, control carp-bullhead populations and maintain recreational fishing opportunities, aeration will be utilized during winter months. Over-wintering of a predator dominated fish community developed between temporary drawdowns will be key to limiting carp and black bullhead populations in order to maintain water quality and habitat goals while providing a recreational fishery at least 2/3 of the time. To effectively provide an adequate winter oxygenated refuge in Lake Wakanda, the existing helixor aeration system may need to be further modified/moved or replaced/supplemented by a surface winter aeration system which could be located off the North public access.

Action 2-4: Enhance abundance of predator fishes to provide recreational fishing opportunities and exert control over less desirable fish species. Fish stocking will be conducted as indicated in the Fisheries Lake Management Plan (LMP) for Lake Wakanda between and following winterkill and temporary drawdown events. The current Fisheries Lake Management Plan for Lake Wakanda indicates walleye fry will be stocked every other year at a maximum density of 1,000 fry per littoral acre. If fall electrofishing indicates that the fry stocking was not successful, fry will stocked again the next spring rather than waiting another year. Walleye fry and northern pike will also be stocked following winterkill and temporary drawdown events.

If drawdown authority/outlet easements are secured and winter aeration/effective outlet fish barriers are developed, a more aggressive predator stocking program, which includes other fish species in addition to walleye/northern pike (e.g., bluegill, largemouth bass, etc.), will be pursued in order to try and exert some control over carp and black bullhead populations and to diversify the recreational fishery. A successful predator fish population may increase the amount of time between temporary drawdown events to more than 6 years.

Monitoring

- DNR will conduct annual point intercept lake vegetation surveys.

- DNR Fisheries will conduct a full fish population assessment a minimum of once every 5 years. Additional sampling will be conducted as needed (ice-out test nets, fall electrofishing after walleye fry stockings, summer small mesh trap nets and seining to assess young-of-year carp and black bullhead, etc.).

- Secchi Disk readings thru PCA Citizens Lake Monitoring Network

Annual Meeting

The Lake Wakanda Steering Committee will meet at least once per year to: review monitoring data, recommend the length and timing of temporary drawdowns (within the criteria outlined in this plan) and update the management plan when necessary. The Wakanda Steering Committee is comprised of representatives from: Friends of Lake Wakanda, Blomkest Sportsmen's Club, Big Kandiyohi Lake Association, Kandiyohi County, Kandiyohi SWCD, Ducks Unlimited, CROW – Crow River Organization of Water, MNDNR, MNPCA and BWSR.

For questions and comments contact:

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