LAKE KAMPESKA
MASTER PLAN

12.16.2019
CITY OF WATERTOWN, SOUTH DAKOTA

WATERTOWN
SOUTH DAKOTA'S RISING STAR
CONFLUENCE
AE2S
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design group, inc.

INTRODUCTION

The Lake Kampeska Master Plan is an innovative, organized vision designed to define lake management priorities and to guide both immediate and long-term land use and public investment decisions. As development adjacent to the lake has grown over time, a variety of strategies have been employed to manage land use and zoning, fish and wetland habitats, and water quality and lake operations. This Master Plan aims to review the existing strategies, evaluate the effectiveness of those strategies, and set forth a new plan for development while highlighting opportunities for increased public amenities, recreation and access.

Lake Kampeska aspires to be a premier regional destination for water recreation promoting lake front amenities and a revitalized fishery. To accomplish this, the City of Watertown, along with the residents and stakeholders of Lake Kampeska will work through the short and long term recommendations presented herein to improve the lake and associated wetlands, providing a better habitat for wildlife and improved recreation opportunities for the community and tourists.

This Master Plan was adopted by the City of Watertown City Council in December of 2019.

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ACKNOWLEDGMENTS

The City of Watertown would like to acknowledge the support and contributions of the following people for their help in compiling this Master Plan document:

Sarah Caron, City of Watertown Mayor
Lake Kampeska Comprehensive Plan Selection Committee
Roger Foote, Project Coordinator for Upper Big Sioux River Watershed Project
Upper Big Sioux River Watershed Project
Lake Kampeska Water Project District
Brandi Hanten, City of Watertown Urban Planner
First District Planning Association

BACKGROUND, PURPOSE & GOALS

Lake Kampeska is a natural lake, with approximately 5,250 surface acres and 13.5 miles of lakefront, located in Watertown, South Dakota. The lake connects to the Big Sioux River via a man-made channel that leads to a single inlet/outlet weir structure on the northeast side of the lake. The weir was installed during the 1990s to reduce the amount of sediment and nutrients transported by the river into the lake.

Lake Kampeska is a popular site for boating, swimming, fishing, camping, and picnicking, with several public access locations and parks scattered throughout the lakefront. It is primarily managed as a smallmouth bass and walleye fishery, although crappie, bluegill, channel catfish, northern pike and white bass are also important components of the fishery.

Sediment accumulation and declining water quality in the lake has dampened tourism numbers, reduced fishery populations, and curtailed water recreation opportunities. The primary source of Lake Kampeska's sediment and nutrient loading comes from the Big Sioux River. Several previous studies have explored the health of the lake over the years, and that information has been incorporated within this plan as appropriate.

Additionally, in the spring of 2019, the Big Sioux River and Lake Kampeska experienced a flooding event that significantly raised water levels and transported sediment and nutrients into the lake. Water sampling that occurred during the event reinforced two important conclusions: 1) The quality of the water was consistent with previous studies that indicated inflow from the Big Sioux River was one of the main drivers of decreased water quality in the lake; and 2) Phosphorous, the main nutrient leading to poor water quality, was primarily in dissolved phase meaning that removing the phosphorous from the water column is not just tied to removing sediment.

The primary goal of this Master Plan is to increase the recreational use of the lake by improving water quality, enhancing fish habitat, increasing lake access and adding public amenities. With a clear, phased strategy this document will provide a pathway to Lake Kampeska's successful future.

LAKE KAMPESKA
WATERSHED MANAGEMENT

Lake Kampeska is fed from a broad watershed which includes the Big Sioux River. See below for more information on how watershed management affects Lake Kampeska.

* THE PURPOSE AND VALUE OF WATERSHED MANAGEMENT

»Watershed: the area of land that drains into a river or lake

»Rainfall and snow melt runoff collects sediments and other pollutants and transports them into streams and lakes.

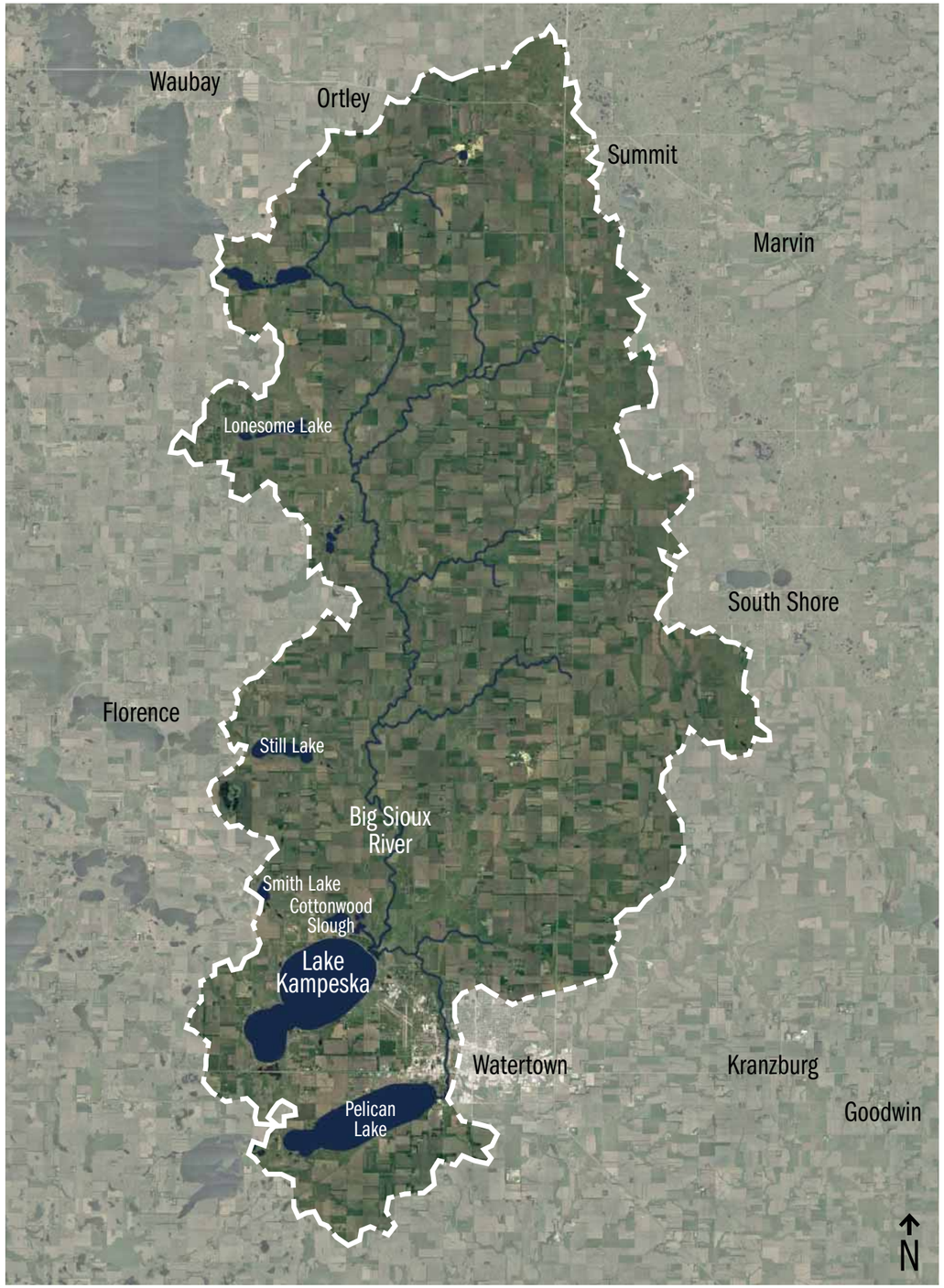
»This runoff can contribute significant amounts of pollution either in a single event or over long periods of time.

»Watershed management identifies land uses and activities that may negatively impact water quality and works to remedy the impacts.

»Strategies include riparian area management, grassed waterways, small ponds, targeted zoning, stormwater management, nutrient management, and animal waste management.

»The efforts of the Upper Big Sioux River Watershed Project are a significant contributor to the overall success of this Master Plan.

THE UPPER BIG SIOUX RIVER WATERSHED



LAKE KAMPESKA

LAKE AS INFRASTRUCTURE

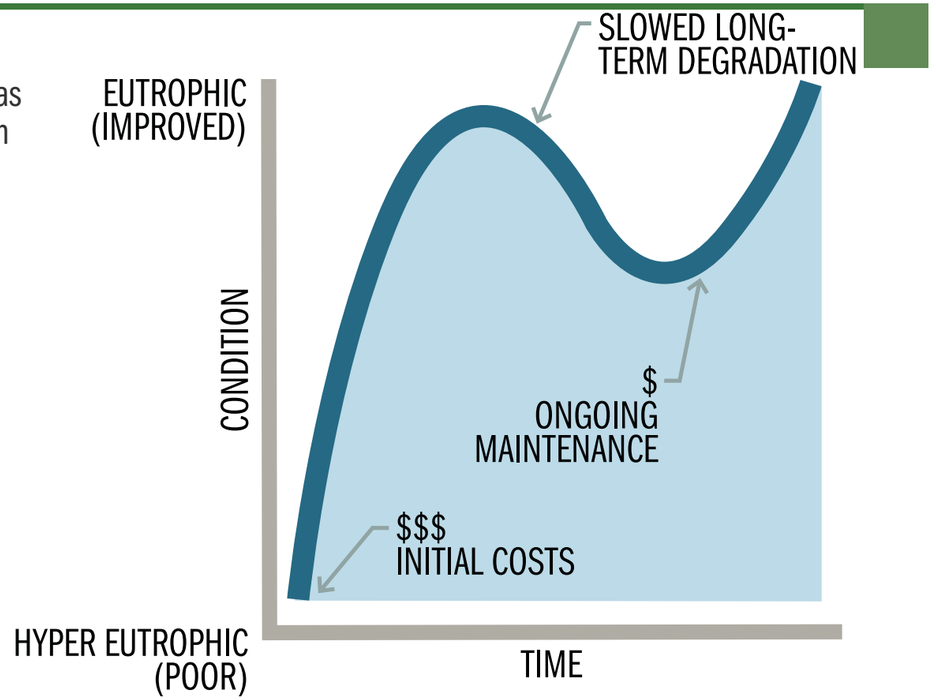
Lake Kampeska is an invaluable resource that will require financial investments and interventions to improve water quality from conditions as exist today. To begin to better understand the costs and benefits of such improvements it is vital to begin to think of the lake as infrastructure.

* WHERE DO WE GO FROM HERE

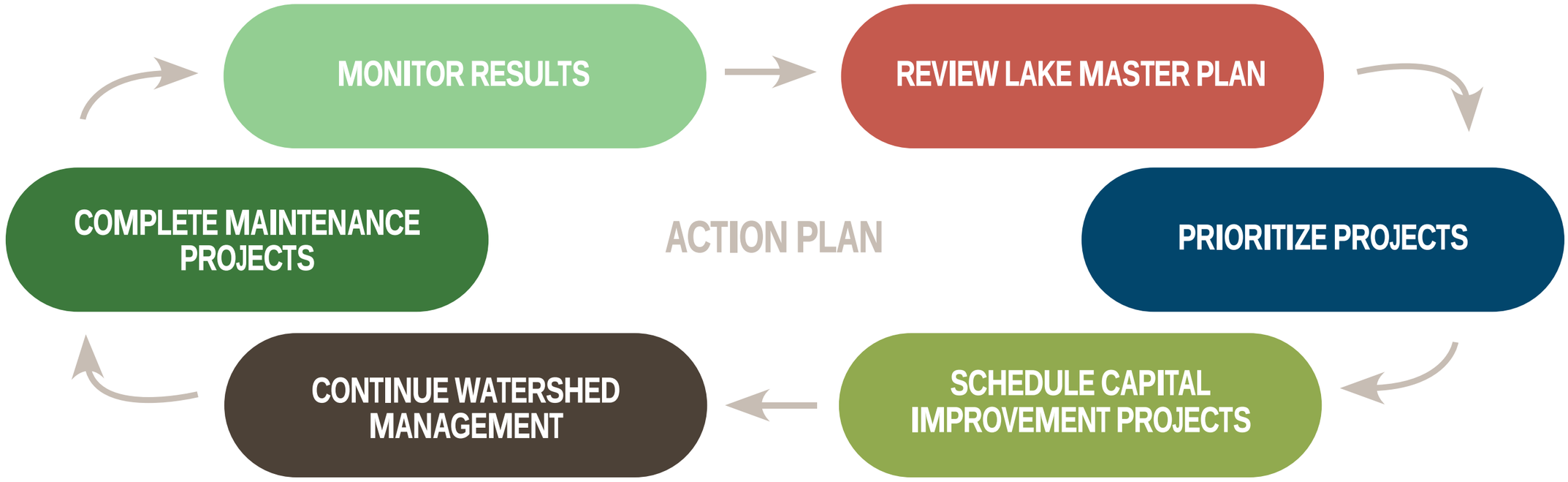
»Lake Kampeska is a vital resource and a necessary component of the region's livelihood.

»Long term improvements in water quality will require both initial investments in projects and long term maintenance of both the lake and the Upper Big Sioux River watershed.

»The entire process is fluid and needs to be monitored and re-evaluated over time.



* WATER QUALITY OVER TIME WITH INITIAL & ONGOING INVESTMENT




Things you like

INITIAL PUBLIC ENGAGEMENT

Public engagement was a key component of the planning process for the Lake Kampeska Master Plan. The City of Watertown recognized the importance of Lake Kampeska to the community and sought input through multiple channels to ensure adequate opportunity for feedback. Initial public engagement included a public meeting and community survey.

The first public meeting was held on June 8, 2018 and included a brief presentation and several engagement exercises. The presentation reviewed the project scope and schedule with the over 100 attendees. Then, participants took part in a postcard exercise in which they were asked to write a pretend postcard to friends or relatives about what they hope is happening at Lake Kampeska in the year 2038. After the presentation, attendees took part in a visual preference exercise. Four large boards were put on display, each with imagery of lake-related features, development types and amenities. Participants were given four green and four red sticker dots meant to be placed on the images they most liked and disliked.

In addition to the June public meeting, a community survey was created to gain feedback from residents. The survey was available both online and in a paper format. The survey asked questions about common lake activities, what respondents do and do not want to see at the lake, fears for the lake and desired amenities. The paper survey included a mapping exercise to identify possible locations for new amenities.

Overall, 526 surveys were completed including 79 paper surveys. Results from the survey and the public meeting were used to inform final recommendations for this master plan. A summary of the results from both the public meeting and the survey are provided on the following pages.

LAKE KAMPESKA
PUBLIC INPUT

* PUBLIC MEETING #1 I JUNE 08, 2018

POSTCARD EXERCISE

VISIONING EXERCISES

» Which Activities are Popular at Lake Kampeska?

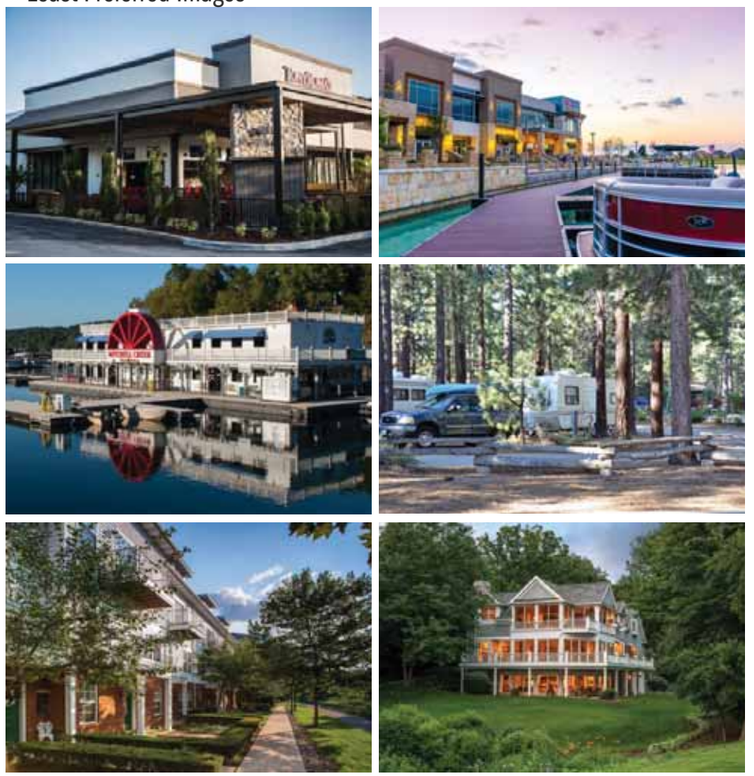
» What Things Do You Want to See at Lake Kampeska?

» What Things Do You Not Want to See at Lake Kampeska?

VISUAL PREFERENCE EXERCISE

» Most Preferred Images

» Least Preferred Images



LAKE KAMPESKA
PUBLIC INPUT

* COMMUNITY SURVEY | SUMMER 2018

SURVEY RESULTS

Do you live in Watertown?	Total	Percent
Yes	471	89.5%
No	53	25.9%
No Response	2	0.4%
Total	526	100.0%

Do you live on Lake Kampeska?	Total	Percent
Yes	136	25.9%
No	388	73.8%
No Response	2	0.4%
Total	526	100.0%

WANT TO SEE:

» Cleaner water
» Increased water quality
» Flood control / plan
» Marina
» Restaurant
» Better fishing
» Nice beaches
» Public access
» Less silt / deeper water
» Reduced water pollution
» Completed trail around lake
» Better swimming / recreation
» More events
» More fish
» More amenities like bathrooms / showers
» More commercial opportunities
» Lodging on the lake
» More trees
» More fishing docks

DO NOT WANT TO SEE:

» Dirty water
» Degraded water quality
» Higher taxes for lake residents
» Over commercialization
» Overcrowding / congestion
» Marina
» More houses
» Fee areas
» Flooding
» Poorly planned development
» More people
» Tree-less shoreline
» More sedimentation / silt
» Big housing developments
» Shallow water
» Bad fishing
» Decreased safety
» Habitat destruction
» Rock piles
» For nothing to be done
» Huge homes
» Algae growth

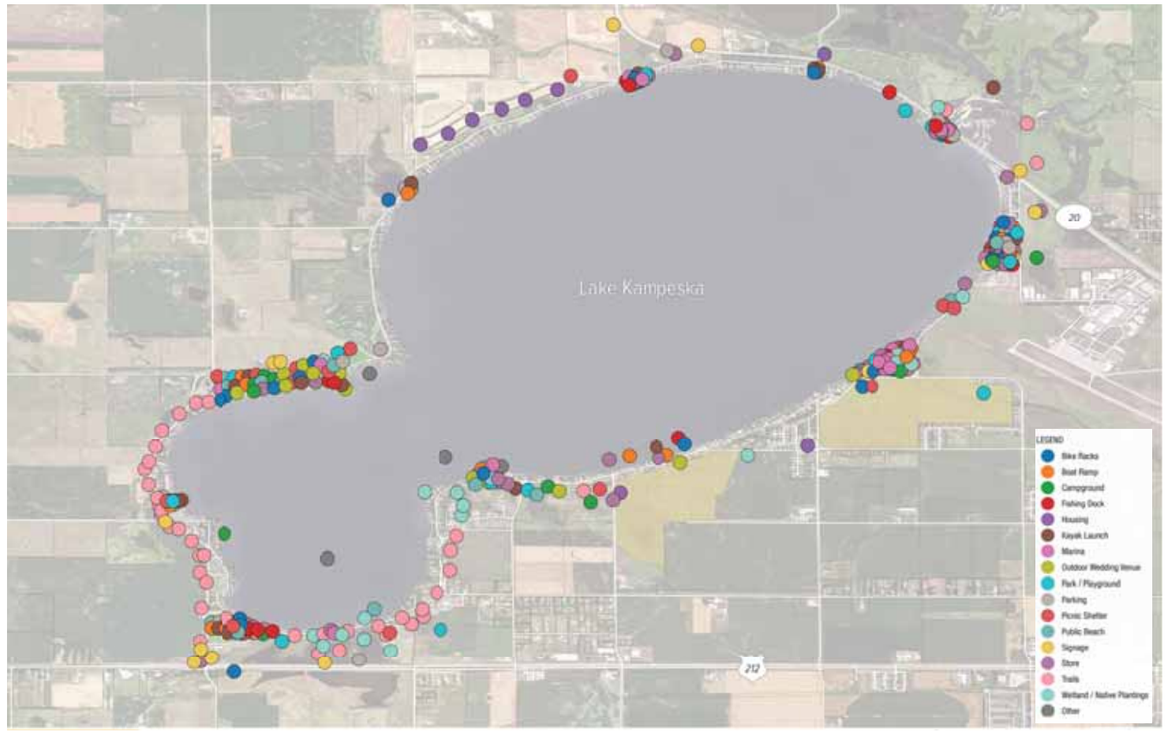
FEARS:

» Water quality
» Silt build-up
» Shallow water / become unusable for recreation etc.
» Too much housing
» Flooding
» Decreased wildlife
» Pollution
» Bad planning
» Over commercialization
» Incomplete bike path
» Less access / under-utilized
» Resorts
» Congestion

MOST DESIRED AMENITIES:

	Amenity	Total
*	Improved Water Quality	453
*	Restaurant	401
*	Improved Fishing	265
*	Public Beaches	252
	Marina	246
	Docks	185
	Playground / Parks	179
	Kayak Launches	172
	Amphitheater	157
	More Wildlife	130
	Boat Launches	130
	Wedding Venue	128
	Retail	100
	Mini Golf	92
	Parking	72
	Sports Fields	38

PROPOSED AMENITY LOCATION MAP:



PROJECT PRIORITY RANKING:

	Potential Project	Average	Median	Mode
*	Dredging	2.6	1.0	1.0
*	Fish Habitat Improvement	3.8	3.0	2.0
*	Increased Beach / Public Access to Lake Kampeska	4.3	4.0	3.0
*	Walking / Biking	4.9	5.0	7.0
	Dock / Fishing Pier	5.3	5.0	5.0
	Kayak / Canoe Launches	5.9	6.0	6.0
	Additional Boat Launches	6.1	4.0	4.0
	Boat Marina	6.1	7.0	8.0
	Amphitheater	7.3	8.0	9.0
	Wayfinding Signage	8.1	9.0	10.0

WATER QUALITY

Water quality is vitally important for the increased recreational use of the lake, including improvement to the fishery. A variety of environmental processes can cause changes in the water quality of a lake, some of which can occur quickly while others happen over a long period of time.

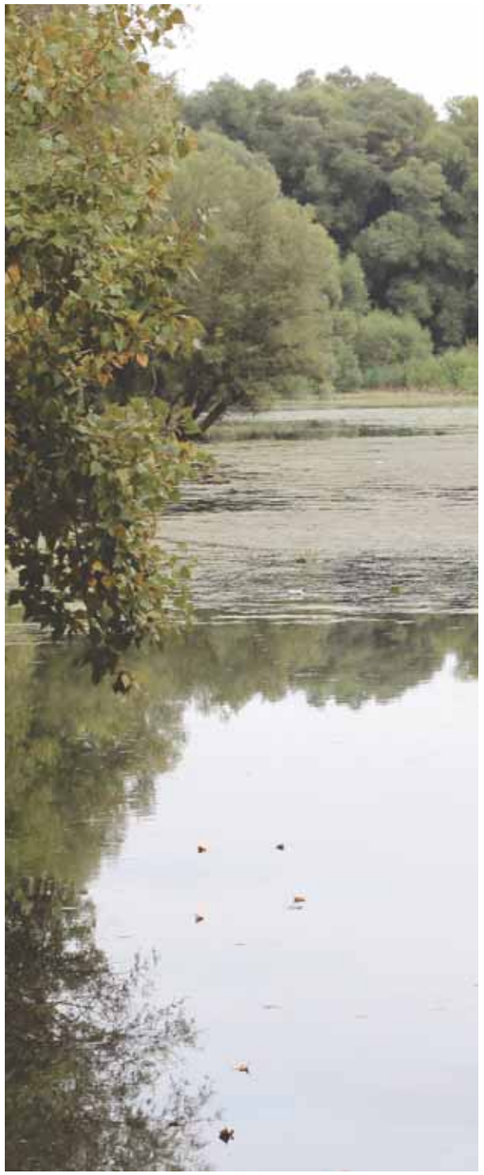
Eutrophication is the process by which lakes receive nutrients and sediment from the surrounding watershed and is the natural aging process of a lake. Natural eutrophication often takes over hundreds to thousands of years, but human influence speeds that process. In developed or agricultural watersheds, eutrophication can often happen in a matter of decades.

There are a number of options that can slow the eutrophication process and improve water quality. The following pages explain the review of these options in more detail.

The level of eutrophication for a given water body can be quantified by calculating the Trophic Status Index (TSI). The TSI relates nutrient biomass and lake transparency to trophic classes. One of the most commonly used TSIs is the Carlson index, which was developed in 1977 by Robert Carlson and is currently used by the United States Environmental Protection Agency (USEPA). The TSI, associated nutrients, and transparency values used in the Carlson index are listed below in Table 1.

Table 1 Carlson's Trophic Classification

TSI	Chlorophyll-a mg/L	Phosphorus mg/L	Secchi Depth (m)	Trophic Class
<40	0-0.0026	0-0.012	>4	Oligotrophic
40-50	0.0026-0.02	0.012-.024	2-4	Mesotrophic
50-70	0.02-.056	0.024-0.096	0.5-2	Eutrophic
70-100+	>.056	>0.096	<0.5	Hypereutrophic



Physical characteristics of each trophic class are described below.

- Oligotrophic-Low nutrient content, low aquatic plant and algal production, clear water, and high oxygen levels
- Mesotrophic-Intermediate nutrient content, intermediate plant and algal production, moderately clear waters with submerged rooted plants, and moderate oxygen levels
- Eutrophic-High nutrient content, high algal production, low transparency, and occasional oxygen depletion associated with algal blooms
- Hypereutrophic-Very high nutrients, excessive nuisance algal blooms, very low transparency, and very low oxygen levels during algal blooms.

Lake Kampeska is currently classified by the USEPA as hypereutrophic based on Secchi depth and total phosphorus levels. Since improving water quality is typically a surrogate for other goals such as decreased algae blooms, improved water clarity, improved fishery, or other aesthetic/recreational reasons, the team has evaluated a quantitative goal consistent with the 1996 TMDL to transition Lake Kampeska from a Hypereutrophic to a Eutrophic status.

Previous studies have noted extremely high phosphorus concentrations within the water column. In fact, water column concentrations typically ranged from 0.4 mg/l to 0.7 mg/l or five to ten times the upper eutrophic limit of 0.07 mg/l. Phosphorus loading into Lake Kampeska continues through internal and external sources. Internal loading occurs when phosphorus releases from the existing lake sediment. External loading mainly occurs as inflow from the Big Sioux River, with smaller amounts coming directly from the Lake Kampeska watershed. As noted, sampling data from the 2019 spring flooding further reinforced the past studies and conclusions that the Big Sioux River is the main source of external loading to Lake Kampeska.

Improving water quality within Lake Kampeska must address the existing high levels of phosphorous in the water column, the potential for internal phosphorous loading from existing lake bottom sediment, and external loading of sediment and phosphorous from the Big Sioux River. In order to address these items, a comprehensive management plan was developed as follows (see also chart on the next page):

1. In-Lake Phosphorus Loading
    - Water Column Treatment
    - Sediment Treatment
2. Big Sioux River Sediment and Nutrient Loading
    - Continued Watershed Management
    - River Disconnection

Improving Water Quality

Lake Loading Interventions

Solutions for phosphorous reduction

- **Water Column Treatment**: Alum Treatment ✓
- **Sediment Treatment**: Alum Treatment ✓
- **Long-Term Maintenance**: Alum Treatment ✓

River Loading Interventions

Minimize phosphorous & sediment from the Big Sioux River

- **Watershed Management**: On-going Education & Initiatives ✓
- **Disconnection**: Partial Disconnection *(Raise the Weir)** ✓

Sediment Treatment

Targeted Dredging in Conjunction with Private Development* ✱

**Targeted dredging isn't a long term phosphorous removal option, but it does provide possible economic, habitat or recreational advantages.*

Sediment Treatment

Full Lake Dredging *(Cost Prohibitive)*** ✗

***Partial lake dredging would not meet the targeted lake loading requirements; Full lake dredging is cost prohibitive.*

Disconnection

Complete Disconnection *(Not Viable Due to Downstream Flood Impacts)* ✗

**If weir modification isn't attainable, alum treatments will still be on-going.*

In-Lake Phosphorus Reduction (Lake Loading Interventions)

Meeting the phosphorus reduction goal would require 46,000-87,000 pounds of phosphorus to be removed or inactivated from the water column. Since phosphorus is continually released from the existing sediment, in-lake management approaches based solely on water column treatment would not achieve desired results. Therefore, a combination of both water column and sediment phosphorus inactivation should be considered.

Water Column Treatment: Alum

Two phosphorus management approaches were considered: do nothing and aluminum sulfate (alum) treatment. Eutrophication is the natural tendency for lakes. Given the historic internal and external loads to the lake, it is likely that phosphorus levels will continue to be elevated if not actively managed. Therefore, alum treatment was considered for this management plan.

Alum is a water-soluble chemical compound used as a coagulating agent. When added to water, it binds to phosphates to form a precipitate called floc, which is heavier than water and settles to the lake bottom. The North American Lake Management Society (NALMS) position is that alum is both a safe and effective tool for lake management.

The treatment process requires alum to be manually injected into the water column, typically using a boat or small barge that traces paths across the lake. The amount of alum required is directly proportional to the level of phosphorus to be bound. Phosphorus bonds are permanent; meaning that once inactivated, the phosphorus will not become reactivated. It would take an estimated 1.9 million gallons of alum and 1 million gallons of sodium aluminate buffer to achieve the water column phosphorus inactivation goal for Lake Kampeska.

Sediment Treatment: Alum
Alum applied to the lake bottom would bind phosphorus in the upper 2-4 inches of sediment and act as a partial barrier to internal loading. Although long-term results can be anticipated, this is not a permanent solution as deep sediment phosphorus eventually migrates beyond the barrier. It is anticipated that approximately 1.4 million gallons of alum and 0.7 million gallons of sodium aluminate buffer would be required to inactivate the sediment phosphorus. However, these estimates are based on typical midwestern lakes. Therefore, we recommend a sediment phosphorus survey be completed to better quantify sediment treatment needs.

Lakes treated with alum require subsequent maintenance treatments to maintain results. The length of time between treatments is unique for each lake but on average lasts 20 years if properly treated.

Sediment Treatment: Targeted Dredging in Conjunction with Private Development
Partial lake dredging will not remove an adequate amount of sediment phosphorous to significantly affect the lake loading. It is not a long term phosphorous removal option. However, as the lake continues to redevelop, the opportunity may arise to partner with private development on targeted dredging in specific areas. Dredging of these areas may provide economic, recreational, or habitat advantages. These situations shall be evaluated as they arise. Full lake dredging is cost prohibitive.

<u>Phosphorous Reduction from Big Sioux River Inflows (River Loading Interventions)</u>

Lake Kampeska is connected to the Big Sioux River by a single inflow/outflow channel located on the east side of the lake. A weir control structure approved in 2002 under South Dakota Flood Control Permit No. FC-29 with a crest elevation of 1719.2 NAVD88 spans the channel. There are two gates in the weir that help control lake levels and allow for fish passage.

The Big Sioux River drainage basin upstream of Lake Kampeska is approximately 213,000 acres in size. Due to the large drainage area and predominantly agricultural land use, the river contains high phosphorus concentrations and suspended sediment loads. When river elevations are less then the weir crest elevation, Lake Kampeska is disconnected from the Big Sioux River, and the nutrients and sediment do not enter the lake.

When the river stage exceeds the weir crest elevation, water overtops the weir and Lake Kampeska functions as a flood reservoir for the river. The weir often overtops during spring runoff events and flood events, both of which deposit significant sediment and nutrients in the lake.

Phosphorus concentrations observed to enter the lake from the Big Sioux River range from 0.18 mg/l (1991-1993 study) to 0.3 mg/l (data collected from 2004-2018), well above the upper eutrophic limit of 0.07 mg/l. The net phosphorus loading to Lake Kampeska is approximately 7,000 pounds per year with the vast majority entering the lake during spring runoff events.

To have an appreciable impact on loading to Lake Kampeska, the spring runoff events need to be treated or disconnected. Three potential management approaches were considered including watershed management, complete disconnection of the Big Sioux River, and partial disconnection of the Big Sioux River.

Watershed Management Practices

A number of existing watershed management practices are already employed within the Big Sioux River watershed. Maintaining and expanding those practices will aid in the water quality improvements both within the river and Lake Kampeska. Though these practices do and would benefit the Big Sioux River and Lake Kampeska, they would likely be less effective during spring runoff events which create much of the external loading to Lake Kampeska. Furthermore, these practices are unlikely to reduce phosphorous loading to the extent required to transition the lake to a eutrophic status.

Disconnection of the Big Sioux River

Complete Disconnection

Since Lake Kampeska plays an important role in routing of floods, it is unlikely that a complete disconnection is possible without having flooding impacts to both upstream and downstream landowners.

Partial Disconnection
The Big Sioux River is already partially disconnected from Lake Kampeska during low-flow conditions when the water surface elevation in the river is below the weir crest elevation of 1719.2 NAVD88. Increasing the partial lake disconnection from the Big Sioux could be achieved through modification of the existing weir/gate structure. Raising the weir approximately 2-feet in elevation would disconnect discharges below the 10-year flood while still providing storage for more extreme flood events.

While this option has the potential to reduce external phosphorus loading, it is understood that a potential impact is the reduced storage capacity in small to modest flood events. We recommend that a floodplain impact study be conducted to determine whether a modification of the weir results in floodplain impacts to upstream or downstream properties and, if so, what mitigative measures could be used to offset the impacts. If modifications to the weir are unattainable, continued alum treatments in this area will improve river loading.

Dredging to Improve Water Quality
Sediment accumulated in Lake Kampeska impacts the aesthetic/recreational value of the lake and is the source of internal nutrient loading. Since sediment has consistently been a concern for lake users, various studies have been completed to quantify the amount of accumulated lake sediment. One of the most comprehensive lakes studies, written by the South Dakota Department of Environment and Natural Resources (SD DENR), included nearly 2,200 sediment thickness measurements and numerous water sediment samples.

Results of the study indicate the following:

- The average sediment thickness is approximately 6.9-feet
- The volume of accumulated sediment is approximately 50,922,000 cubic yards
- An average of 945,000 pounds of sediment enters the lake from the Big Sioux River each year. This load equates to a few hundred cubic yards which is fairly insignificant in comparison to the existing sediment already in place.

Subsequent sampling efforts performed by the USGS recorded similar accumulated sediment depths. To assess the feasibility of dredging, two alternatives were explored: Full Lake Sediment Removal and Partial Lake Sediment Removal.

Full Lake Sediment Removal
Full lake sediment removal would likely increase the aesthetic/recreation value of the lake and reduce internal nutrient loading; however, the feasibility and cost associated with removing approximately 51 million cubic yards of sediment likely makes this alternative cost prohibitive.

For example, dredging costs for a project of this magnitude typically range from $10 per cubic yard to more than $20 per cubic yard, not including land costs for the disposal of the dredge material. Therefore, several hundreds of millions of dollars would be necessary to remove all of the accumulated lake sediment.

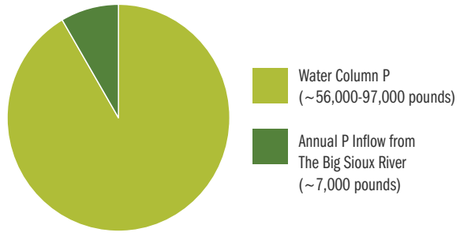
Partial Lake Sediment Removal
Targeted dredging in key areas to enhance fishery/public access would increase the aesthetic/ recreational value of the lake, but would not impact internal phosphorous loading. This option is less cost prohibitive but must balance project costs with benefit.

Either mechanical or hydraulic dredging could be used to remove sediment from key locations in Lake Kampeska. During this conceptual planning phase of the project there are still many unknown factors such as the volume of sediment to be removed, area that the removal will occur, depth, and the disposal method and location of the dredged sediment. All of these factors impact the cost of a project. Given the complexities and uncertainties, an estimated value of $20/cubic yard plus disposal requirements should be used when evaluating specific targeted dredging programs.

LAKE KAMPESKA WATER QUALITY

KEYS TO IMPROVING LAKE KAMPESKA WATER QUALITY

EXISTING PHOSPHORUS(P) LEVEL



TROPHIC STATUS LEVEL

Trophic Status	Phosphorus (mg/L)
Eutrophic (Good)	0.024 - 0.07
Hypereutrophic (Compromised)	> 0.07
Lake Kampeska (Current)	0.4-0.7 mg / L

* REDUCE PHOSPHORUS

» Convert lake from Hypereutrophic to Eutrophic

+

* IMPROVE FISHERY

» Decrease algae blooms
» Improve Habitat

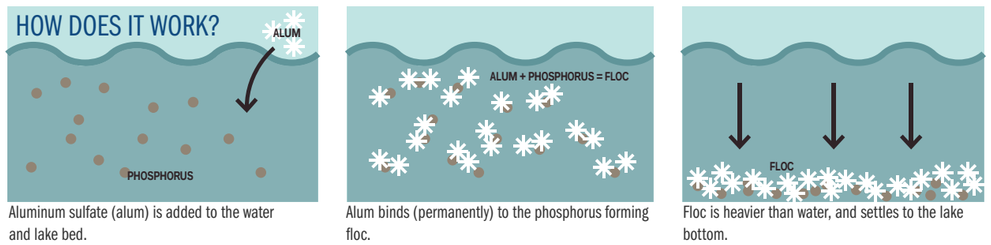
=

* IMPROVE AESTHETICS / RECRUITMENT

» Increase water clarity

PHOSPHORUS REMOVAL OPTIONS

ALUM TREATMENT: Phosphorus Inactivation; In-Lake Removal



Aluminum sulfate (alum) is added to the water and lake bed.

Alum binds (permanently) to the phosphorus forming floc.

Floc is heavier than water, and settles to the lake bottom.

NOTES: Alum treatments can take a few weeks to a month to apply, and will last approximately 10 - 20 years before reapplication is necessary.

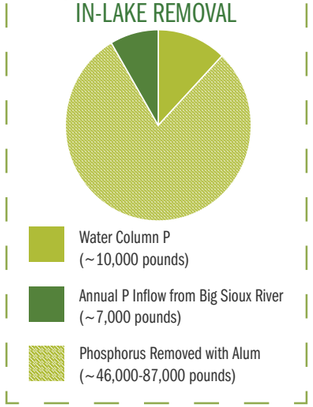
WATER COLUMN ALUM TREATMENT

» Removes 46,000 to 87,000 lbs per treatment
» Costs $8 - $10 million

SEDIMENT ALUM TREATMENT

» Treat top 2-4 inches of sediment per treatment
» Costs $6 - $8 million

PHOSPHORUS LEVEL AFTER IN-LAKE REMOVAL



Minimize Inflow From Big Sioux River and On-Going Maintenance (CLEARAS TREATMENT)

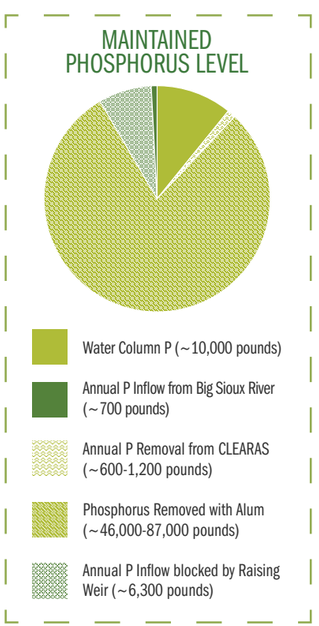
MINIMIZE PHOSPHOROUS + SEDIMENT LOAD FROM BIG SIOUX RIVER

» Adjust weir elevation; a 2-foot increase in weir height will eliminate the 10-year flood stage inflow (and associated phosphorus load)
» Costs $500,000 - $1 million

CLEARAS TREATMENT

» Intended for on-going maintenance after initial treatments have lowered phosphorus loads
» Removes 600 - 1,200 lbs per year
» Annual operation costs $30,000/year
» Costs $2 - $3 million

MAINTAINED PHOSPHORUS LEVEL



LAKE KAMPESKA

DREDGING

EXISTING LAKE KAMPESKA CONDITIONS

* EXISTING CONDITIONS

- »According to the USGS Sediment Survey, there's a 6 foot depth of sediment over the entire lake
- » This is approximately 50,000,000 cubic yards of sediment

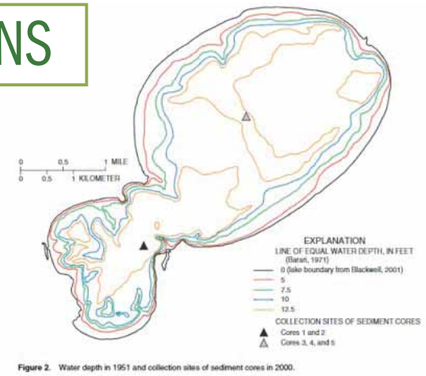


Figure 2. Water depth in 1951 and collection sites of sediment cores in 2000.

DREDGING APPROACHES: Hydraulic & Mechanical Operations

HYDRAULIC DREDGING

- »Works by sucking up a mixture of sediment and water, known as slurry, from the bottom of the lake and transfers it by pipe to another location
- »Slurry can be transported to a dewatering pit or a dewatering geotextile bag**
- »Costs for dredge & dewatering: $10 - $15 per cubic yard with adjacent dewatering pit; $20 - $25 per cubic yard with geotextile dewatering bag
- »Cost estimates do not include property acquisition

MECHANICAL DREDGING

- »Works by digging or gathering sediment from the bottom of the lake, usually with a bucket, from the shoreline or a barge
- »Due to size of lake, may require special considerations
- »Costs for dredge & dewatering: $10 - $15 per cubic yard, assuming a dewatering pit will be located in close proximity
- »Cost estimates do not include property acquisition

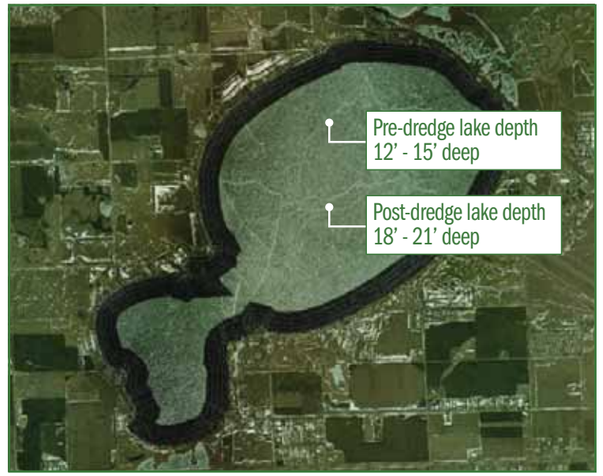
DREDGING APPROACHES: Whole Lake & Targeted Scenarios

WHOLE LAKE DREDGING

- »Dredge 6' depth of sediment from entire lake
- »Dredge volume: 50 million cubic yards
- »Costs for dredge & dewatering: $0.5 - $1 BILLION*
- »Costs do not include property acquisition for dewatering or disposal of material if located separate than dewatering site**

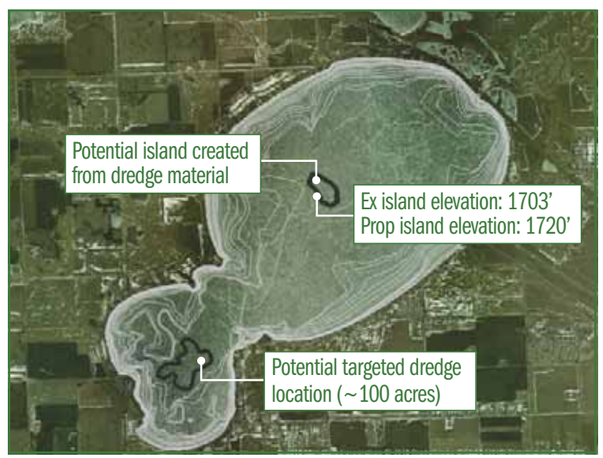
*Estimate does not include permitting or mitigation costs. Permitting costs will be minimal as compared to the overall dredging costs, and mitigation costs can not be estimated as this stage in the design process.

**Dredged material must be removed, dried, and then placed after it has been dried - a process referred to as dewatering.



EXAMPLE OF TARGETED LAKE DREDGING

- »Due to large volume of sediment in lake, it is cost prohibitive to dredge entire lake
- »Dredge 1 million cubic yards from the lake and create an island with the dredge material
- »Provides increased fish habitat and reduced phosphorous
- »Dredge volume: 1 million cubic yards
- »Costs for dredge & dewatering: $10 - $25 MILLION*
- »Costs do not include property acquisition for dewatering**
- »Exact island shape & location to be determined



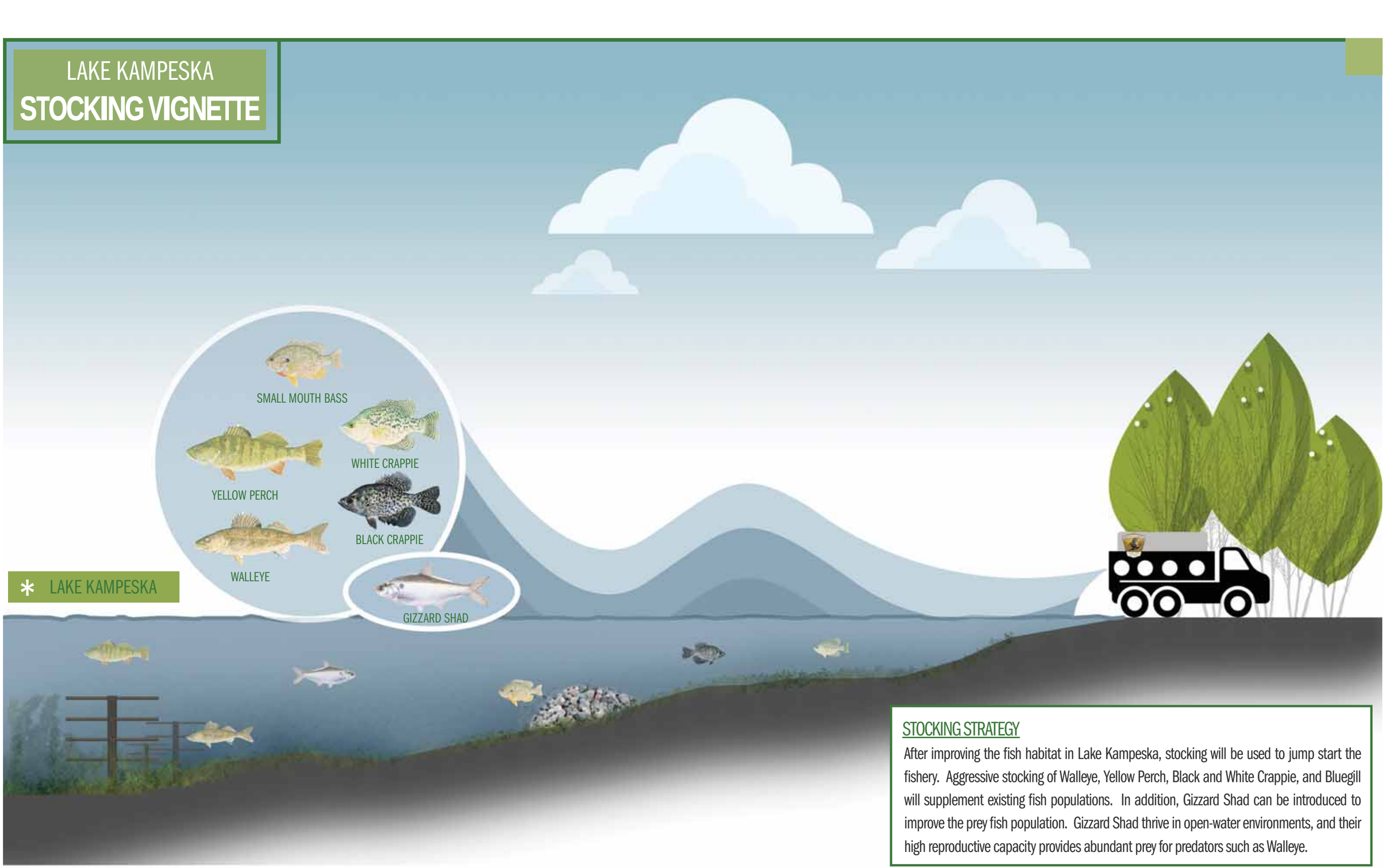
AMENITIES & FISHERIES

Quality fisheries are built on a foundation of diverse habitat. We will enhance fisheries in Lake Kampeska by improving habitat within the lake and reconnecting the lake to surrounding wetlands. Our goal is to enhance 20% of the shoreline. This will be particularly beneficial to enhanced recruitment of young fishes. Lake Kampeska has approximately 13 miles of shoreline, most of which is privately owned. Our plan enhances habitat on public shoreline. In addition, we identified several wetlands that could be reconnected to Lake Kampeska with structures that are fish friendly. These actions will result in more than 20% enhancement of the shoreline area. Finally, we will enhance habitat for larger predators (Walleye, Smallmouth Bass, and Northern Pike) through the creation of several offshore habitat structures. These areas will be designed as themed fishing areas that are easy to locate and provide diverse experiences for anglers. The lake will be aggressively stocked with gizzard shad to provide predator fish with an early food source until water quality improves and fish populations can be replenished.

We have identified two types of in-lake amenities, fishing piers and marinas, that can be designed to provide fish habitat and increase angler access. Fishing piers can be located in areas with steeper shorelines to provide bank anglers access to deeper water. The piers will be armored with rip-rap, have several angling platforms, and will be surrounded by habitat within casting distance of the structure. The piers will be located along public access points and near the bike trail to provide easy access for young anglers. There are several opportunities to build marinas in Lake Kampeska. We provide design guidelines that will maximize fish habitat and angler access. Marinas provide protected embayments for young fish. Our recommendations ensure that these areas provide great rearing areas for young fish, as well as being attractive to larger fish and anglers.

LAKE KAMPESKA

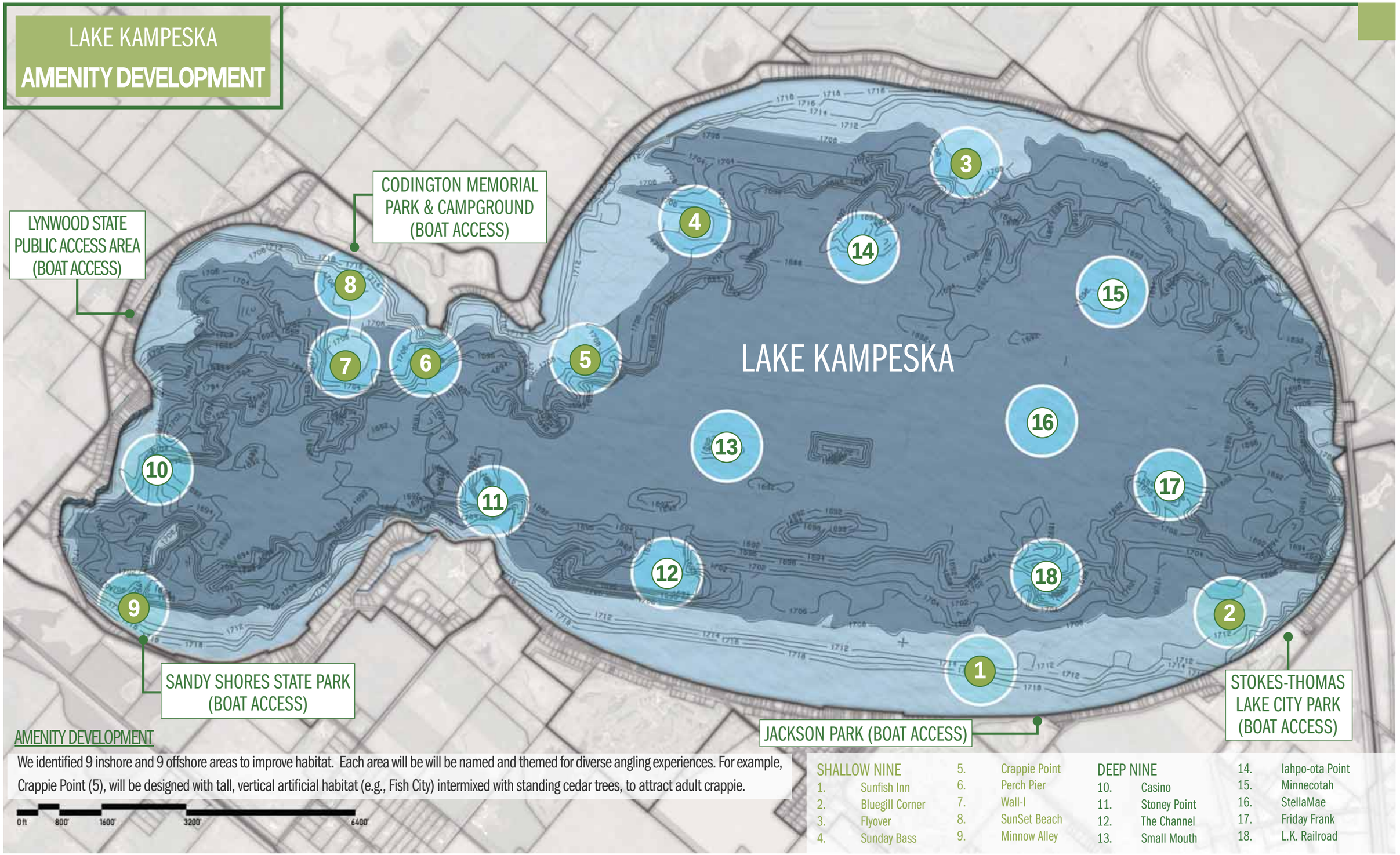
STOCKING VIGNETTE



STOCKING STRATEGY

After improving the fish habitat in Lake Kampeska, stocking will be used to jump start the fishery. Aggressive stocking of Walleye, Yellow Perch, Black and White Crappie, and Bluegill will supplement existing fish populations. In addition, Gizzard Shad can be introduced to improve the prey fish population. Gizzard Shad thrive in open-water environments, and their high reproductive capacity provides abundant prey for predators such as Walleye.

LAKE KAMPESKA
AMENITY DEVELOPMENT



AMENITY DEVELOPMENT

We identified 9 inshore and 9 offshore areas to improve habitat. Each area will be will be named and themed for diverse angling experiences. For example, Crappie Point (5), will be designed with tall, vertical artificial habitat (e.g., Fish City) intermixed with standing cedar trees, to attract adult crappie.

SHALLOW NINE

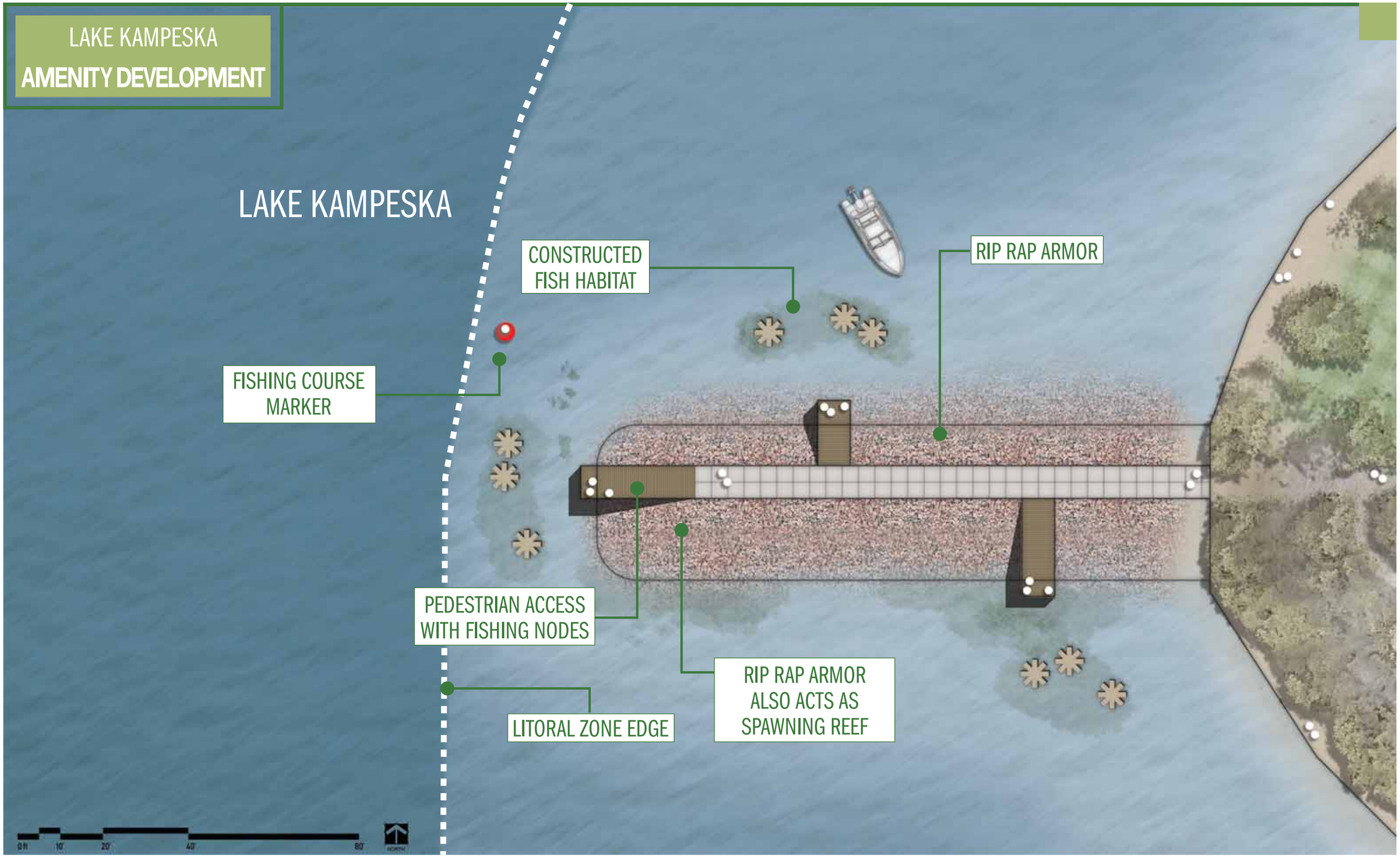
1. Sunfish Inn
2. Bluegill Corner
3. Flyover
4. Sunday Bass
5. Crappie Point
6. Perch Pier
7. Wall-I
8. SunSet Beach
9. Minnow Alley

DEEP NINE

10. Casino
11. Stoney Point
12. The Channel
13. Small Mouth
14. Iahpo-ota Point
15. Minnecotah
16. StellaMae
17. Friday Frank
18. L.K. Railroad

LAKE KAMPESKA

AMENITY DEVELOPMENT



LAKE KAMPESKA

AMENITY DEVELOPMENT

LAKE KAMPESKA

PEDESTRIAN ACCESS WITH FISHING NODES

SHALLOW SLOPE WITH VEGETATION

CONSTRUCTED FISH HABITAT

RIP RAP ARMOR

BOAT SLIPS

BOARDWALK

TRAILER PARKING

LAKESIDE COMMERCIAL & AMENITIES

0 ft 20' 40' 80' 160'

HABITAT VIGNETTES

Constructed fish habitat can take many shapes and forms, depending on both the constraints of the installation site and the preferences of the targeted fish species. Some fish species prefer nooks and crannies deep below the surface for protection from predator species while others appreciate how the same spaces in shallower water can provide habitat for food sources.

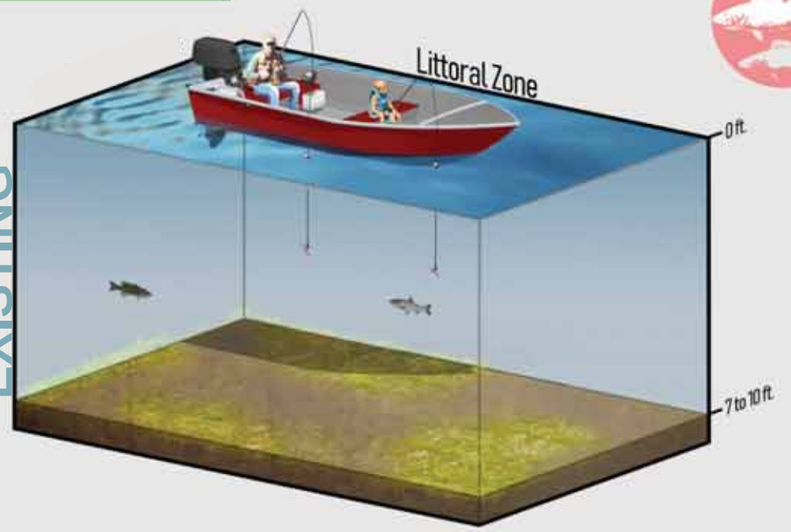
On the following pages are illustrations, or vignettes, of various fish habitats, both as existing at Lake Kampeska and as proposed to boost fish populations and habitat. Installing a mixture of several types of habitat will be most beneficial to the overall health and diversity of fish populations within the lake, although phased establishment may better align with budgetary needs.

Minimal monitoring and maintenance will be required to assure the success of all of the proposed habitat vignettes.

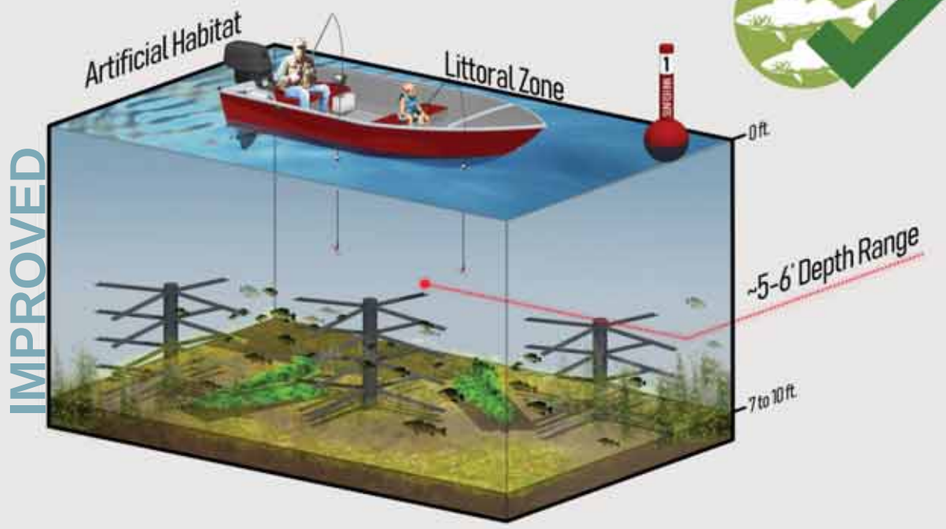
LAKE KAMPESKA

HABITAT VIGNETTES

EXISTING



IMPROVED



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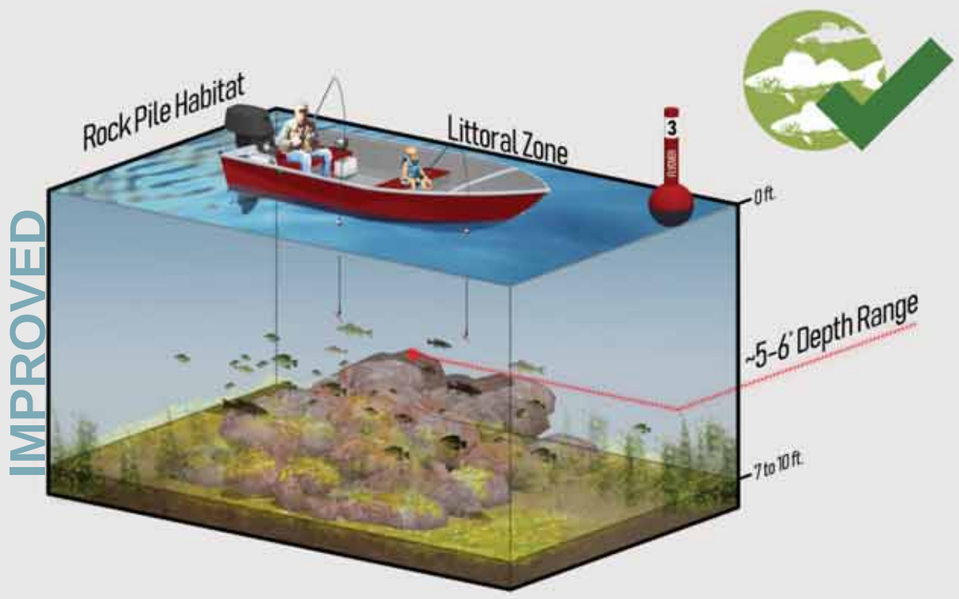
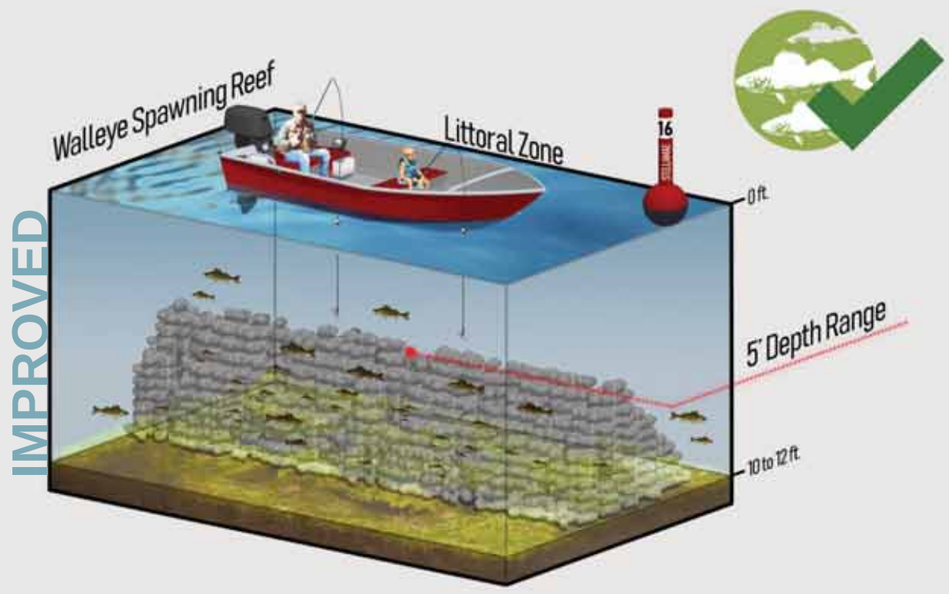
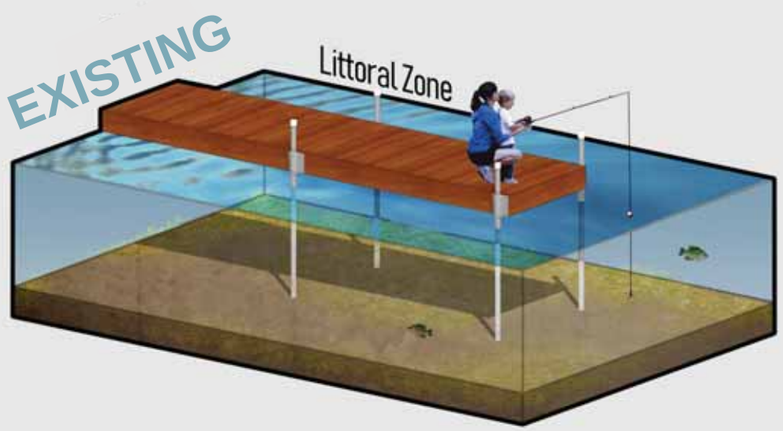


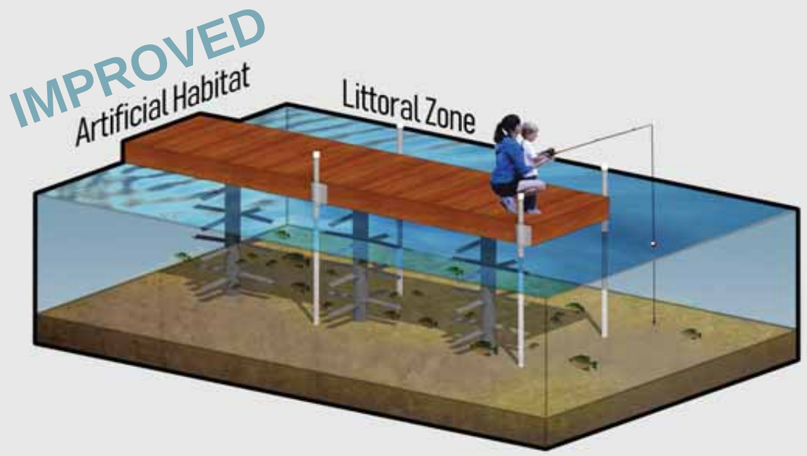
IMPROVED

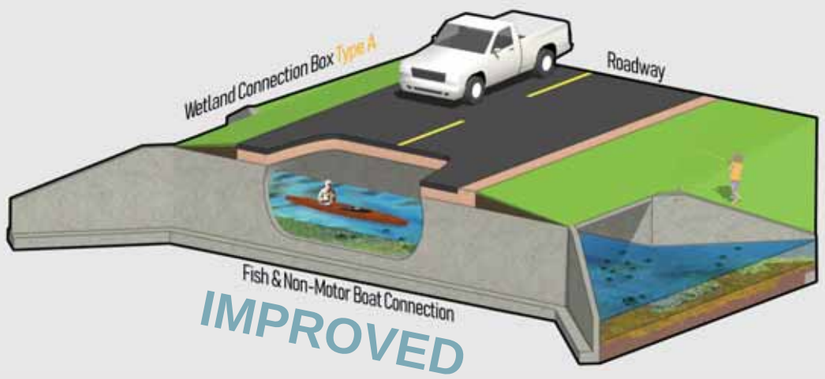


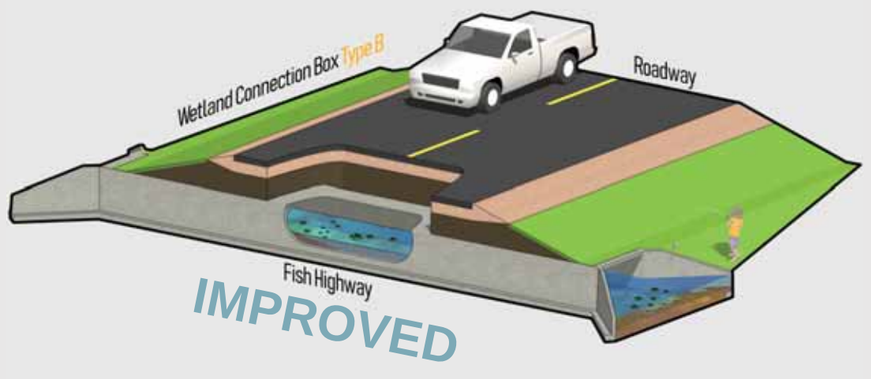
LAKE KAMPESKA

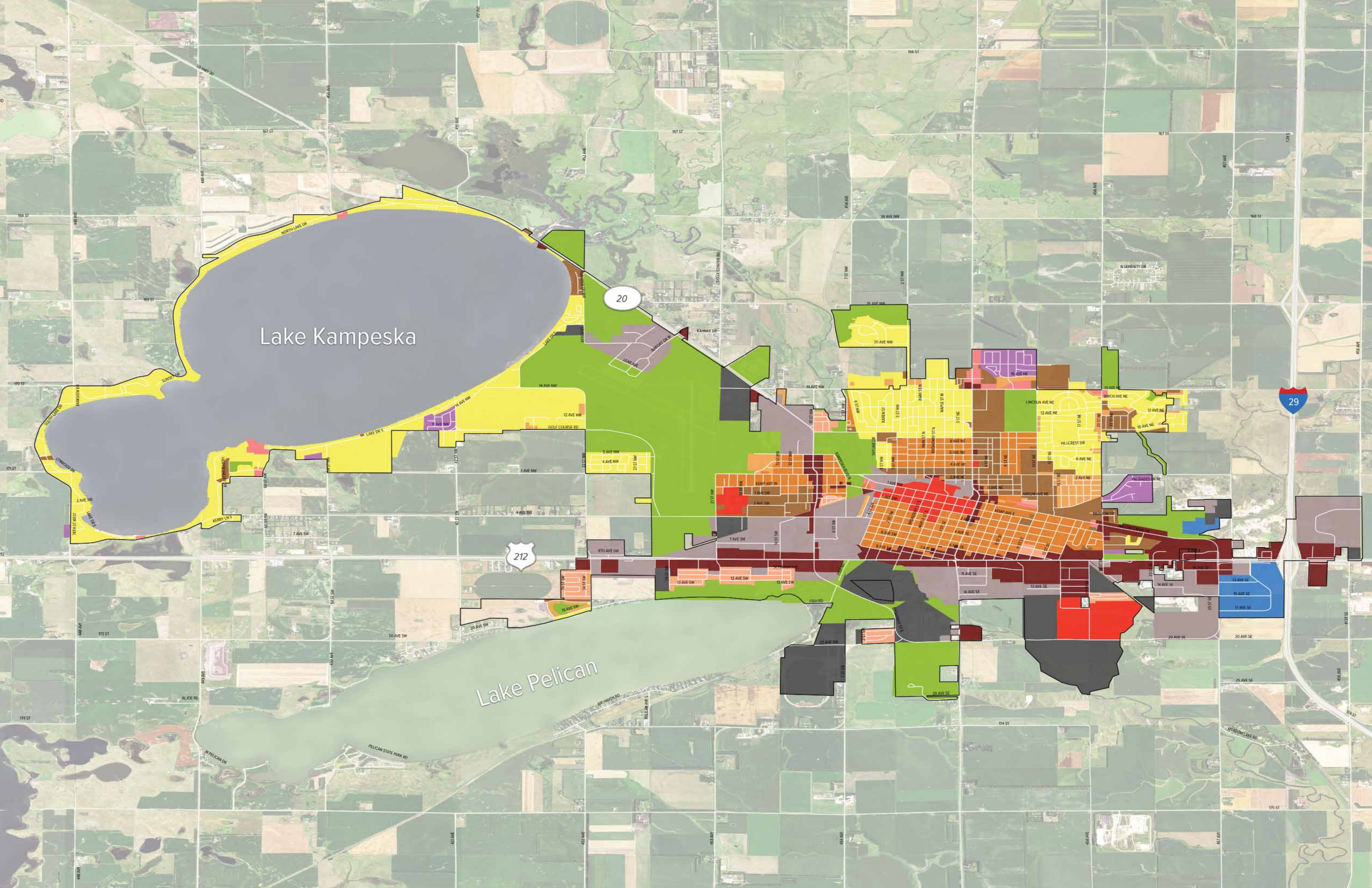
HABITAT VIGNETTES










Lake Kampeska
Lake Pelican
20
212
29

PLANNING & ZONING

As part of the development of the Lake Kampeska Master Plan, issues related to future land use and zoning were identified and evaluated during the public input phase of the plan development. The draft Comprehensive Plan and related Future Land Use Map being proposed for the City of Watertown was also reviewed for its impacts on Lake Kampeska.

Concerns were raised by residents, stakeholders, and various community members regarding the lack of a marinas, restaurants, lodges, and retail amenities around the lake; the negative impact of the short-term rental of homes along and near the lake - also known as party rentals - on neighboring properties; the buffering and screening of incompatible uses next to and near single family homes; changes to the residential nature of the lake, increases in traffic, the strict requirements for new garages on stand-alone lots; and instances of boathouses along the lakeshore blocking views.

The following pages in this section list the seven (7) main goals for land use and zoning regulations and outline the plan's recommendations regarding appropriate land uses around the lake and changes to certain zoning regulations to address the identified concerns. These recommendations are detailed in three (3) categories: Draft Future Land Use Map + Recommendations, Zoning Recommendations, and Development Review Recommendations.

LAKE KAMPESKA PROPOSED **FUTURE LAND USE MAP**

✻ LAND USE CATEGORIES

There are eight (8) major land uses present in the Lake Kampeska area. The map on the right displays the future land uses desired for the area.

» Low Density Residential
Single-family homes located near but not adjacent to Lake Kampeska.

» Lake Residential
Single-family residences with direct access to or located adjacent to Lake Kampeska.

» Medium Density Residential
Multi-family residences such as townhomes, row houses, or duplexes.

» Light Industrial
Manufacturing, storage, warehousing, or land uses related to the municipal airport.

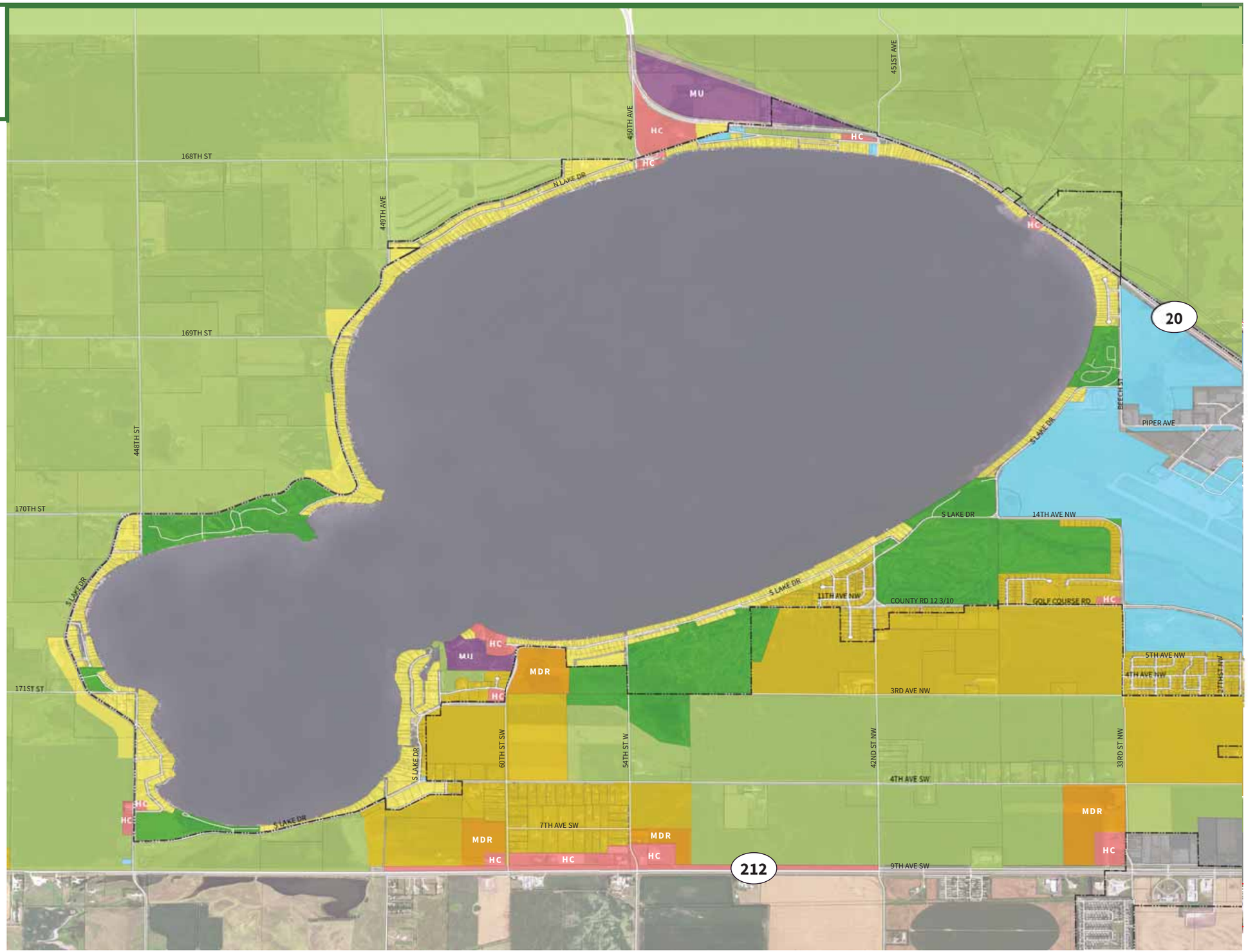
» Open Space
Non-park or camping open space set aside for agriculture, wetlands, or other natural uses.

» Park / Campground
City, regional, or state parks and campgrounds available for public use

» Neighborhood / Highway Commercial
Commercial and retail uses located on or near Lake Kampeska and Highways 212 and 20.

» Civic Land
Publicly-owned land separate from park or campground areas including the municipal airport.

» Mixed Use
A combination of commercial and multi-family uses.



LAKE KAMPESKA PROPOSED **FUTURE LAND USE MAP**

✻ DRAFT FUTURE LAND USE MAP + RECOMMENDATIONS

» Limit development + growth north and west of lake

» Recommend adding future land uses south of lake to Hwy 212

» Create a new Lake Residential land use that is restricted to single-family uses

» Identify limited areas for retail development on the future land use map

» Rezone undeveloped/re-developable properties consistent with the adopted future land use map

✻ ZONING RECOMMENDATIONS

Create a new Lake Residential Zoning District

» Restrict to single-family residential only

» Reduce current setbacks + lot sizes
  - » *Define lake side and road side setbacks*
  - » *Add special regulations for patios, decks, and porches near the lake*

» Consider prohibiting new boathouses, but fully grandfather existing boathouses to facilitate replacement

» Prohibit short-term rentals (including Airbnb) unless permitted under existing Bed and Breakfast regulations (Chapter 21.75)

» In lieu of rezoning properties to the Residential Garage District (R-G), consider stand-alone garages on vacant lots as by-right:
  - » *Follow R-G district standards*
  - » *Require lot-tie agreement*
  - » *Not allowed on lake-side of road (off-lake lots only)*

Create a new Lake Side Commercial District (new)

» Based on C-2 standards

» Clearer setback standards for lake side

» Building and side design standards (paving, landscaping, buffering, signage)

» Add lake specific uses, rental cabins (short-term and party rentals), marina, boat repair, and fueling, boat storage etc.

» This district could address the desire for a new Resort Zoning District for short-term and party rentals

✻ DEVELOPMENT REVIEW RECOMMENDATIONS

» Update site plan application requirements and detail building inspection review process

» Review all of development / redevelopment / additions / permits within lake basins and lake front

» Consider adopting certificate of occupancy program to better track building uses and rentals

LAKE KAMPESKA
AMENITY DEVELOPMENT

- PRIVATELY OWNED SHORELINE - 85% [60,635 LF]
- DISCONNECTED WETLAND
- DISCONNECTED OR POORLY CONNECTED WETLAND PROPOSED WITH IMPROVED CONNECTION TYPE - 39,250 LF
- POTENTIAL NEW CONNECTED WETLAND
- A / B POTENTIAL CONNECTION TYPE - SEE DIAGRAMS
- PUBLIC SHORELINE - 15% [10,640 LF]
- TARGETED FISHERIES IMPROVEMENTS ADJACENT TO PUBLIC LAND
- LITORAL ZONE - 0' TO 10' DEPTH
- 10'+ DEPTH

PRIVATELY OWNED SHORELINE
» 85% OF LAKE KAMPESKA SHORELINE

LAKE KAMPESKA
» *13.5 MILES OF SHORELINE*

POTENTIAL FISHING POINT

CODINGTON MEMORIAL PARK & CAMPGROUND

IMPROVED WETLAND

POTENTIAL NEW WETLAND

LYNWOOD STATE PUBLIC ACCESS AREA

SANDY SHORES STATE PARK

STOKES - THOMAS LAKE CITY PARK

JACKSON PARK

POTENTIAL MARINA LEASE

LITTORAL ZONE
» RANGE: 7'-10' DEPTH

0 mil 0.25 0.5 1.0 2.0 NORTH

LAKE KAMPESKA

LAND USE + ZONING

* THE PURPOSE AND VALUE OF LAND USE PLANNING + ZONING

»Manage growth and infrastructure needs

»Prevent/lessen traffic congestion

»Separate/buffer incompatible land uses

»Preserve neighborhood character and quality of life

»Protect property values

»Set expectations and requirements for new development

»Identify needed or desired services and amenities

PUBLIC FEEDBACK

The design team shared the proposed Lake Kampeska Master Plan elements and improvements during a second public open house meeting in the evening of December 11th, 2018, at the Lake Area Technical Institute Student Center's 4th floor Event Center. The event was held as an open house event, from 4:00 to 7:30 pm, with design team members manning stations around the room. Members of the public and interested stakeholders were welcome to visit at any time during the open house hours and interact with each topic at their leisure.

The event included the following stations:

- Public Feedback (reviewing public input from the project thus far)
- Water Quality (analyzing possible methods for improving lake water quality)
- Amenities & Fisheries (evaluating proposed amenity options while improving fish habitat and pedestrian access)
- Planning & Zoning (examining proposed zoning suggestions and a future land use map)
- Sign-in and feedback (understanding attendees main concerns for Lake Kampeska)

Sixty five people attended the meeting. Prior to this open house, 526 members of the public filled out an online survey. All of the same information from the public meeting was available via electronic download from the City's website. The details and results of those surveys and comments cards can be found on the following pages.

LAKE KAMPESKA
PUBLIC FEEDBACK

* RESULTS FROM ONLINE SURVEY




Do you live in Watertown?	Total	Percent
Yes	471	89.5%
No	53	25.9%
No Response	2	0.4%
Total	526	100.0%

Do you live on Lake Kampeska?	Total	Percent
Yes	136	25.9%
No	388	73.8%
No Response	2	0.4%
Total	526	100.0%

Where they live	Total	Percent
Living in Watertown	471	89.5%
Living in Watertown on Lake Kampeska	163	25.9%
Living outside the city	53	10.1%
No response	2	0.4%

Amenity	Total
Improved Water Quality	453
Restaurant	401
Improved Fishing	265
Public Beaches	252
Marina	246
Docks	185
Playground / Parks	179
Kayak Launches	172
Amphitheater	157
More Wildlife	130
Boat Launches	130
Wedding Venue	128
Retail	100
Mini Golf	92
Parking	72
Sports Fields	38

Potential Project	Average	Median	Mode
Dredging	2.6	1.0	1.0
Fish Habitat Improvement	3.8	3.0	2.0
Increased Beach / Public Access to Lake Kampeska	4.3	4.0	3.0
Walking / Biking	4.9	5.0	7.0
Dock / Fishing Pier	5.3	5.0	5.0
Kayak / Canoe Launches	5.9	6.0	6.0
Additional Boat Launches	6.1	4.0	4.0
Boat Marina	6.1	7.0	8.0
Amphitheater	7.3	8.0	9.0
Wayfinding Signage	8.1	9.0	10.0

LAKE KAMPESKA
PUBLIC FEEDBACK

✻ RESULTS FROM PUBLIC MEETING PARTICIPANTS

Comment Card Responses:

Water quality is most important.

I am very interested in correcting of wetlands around the lake to provide fish habitat and spawning areas.

Long range plan needs to be cost effective or affordable.

Quick wins - People like to see things happen!

Do you live in Watertown?	Total	Percent
Yes	59	90.8%
No	4	6.2%
No Response	2	3.0%
Total	65	100.0%

Do you live on Lake Kampeska?	Total	Percent
Yes	48	73.8%
No	15	23.1%
No Response	2	3.0%
Total	65	100.0%

Where they live	Total	Percent
Living in Watertown	65	90.8%
Living in Watertown on Lake Kampeska	48	73.8%
Living outside the city	4	6.2%
No response	2	3.0%

Amenity	Total
Improved Water Quality	59
Retail / Restaurant	39
Improved Fishing	36
Amphitheater	35
Marina	31
Public Beaches	16
Playgrounds / Parks	14
Kayak Launches	13
More Wildlife	12
Boat Launches	12
Wedding Venue	11
Docks	11
Parking	7
Mini Golf	3
Sports Fields	2

Potential Project	Average	Median	Mode
Fish Habitat Improvement	2.8	2.0	2.0
Dredging	3.0	2.0	1.0
Additional Walking / Biking Trails	3.8	3.0	1.0
Boat Marina	5.4	5.0	3.0
Dock / Fishing Pier	5.5	6.0	6.0
Amphitheater	5.8	5.5	5.0
Kayak / Canoe Launches	6.1	6.0	5.0
Increased Beach / Public Access to Lake Kampeska	6.2	7.0	8.0
Wayfinding Signage	7.1	7.0	10.0
Additional Boat Launches	7.5	8.0	9.0

Stony Point, Lake Kampeska, Watertown, S. D.

IMPLEMENTATION PLAN & RECOMMENDATIONS

Improving the water quality of Lake Kampeska will require a variety of phased interventions.

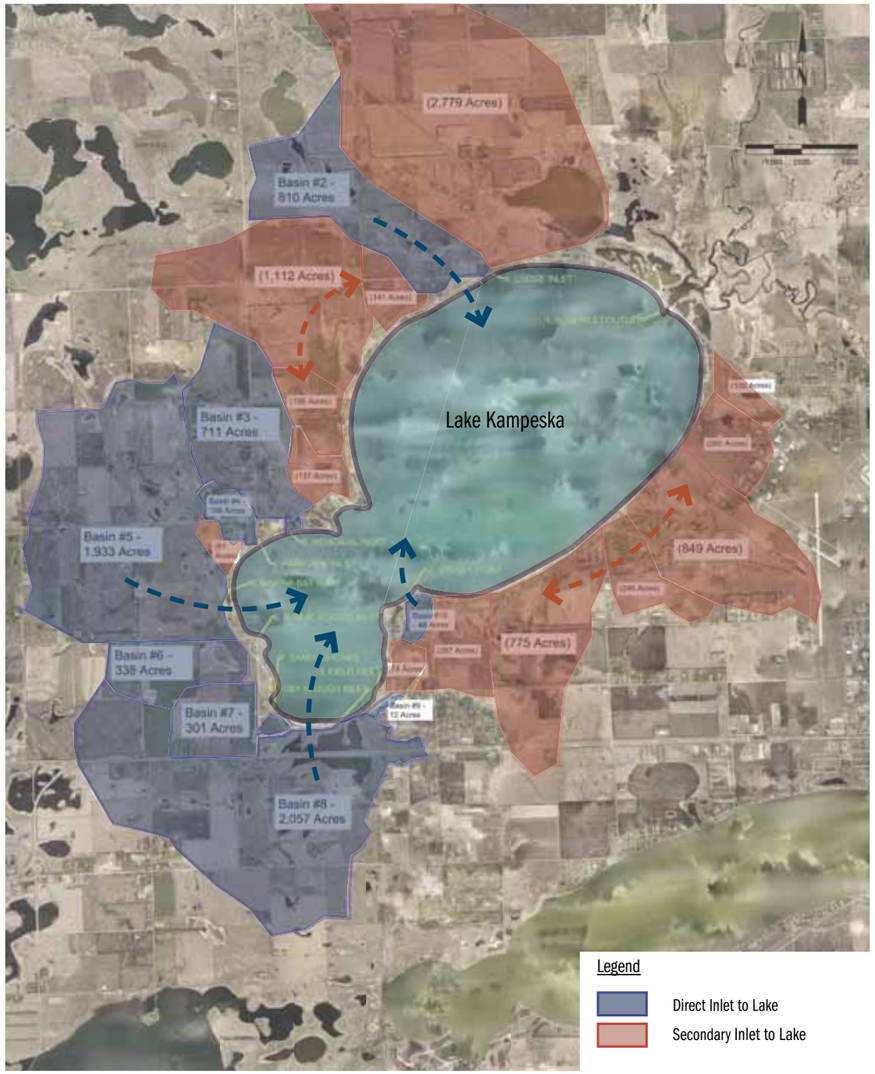
- Reduce sediment and pollutant loads from entering the lake from the Big Sioux River by raising the weir elevation.
- Revise the current land use and zoning regulations to limit development around the lake to an appropriate use that will support lower sediment loading and clean water quality initiatives.
- Enhance and increase Lake Kampeska's shoreline by incorporating wetland connections between nearby and adjacent water bodies.
- Remove or inactivate sediment phosphorus loads from the water column through alum treatments.
- Target dredging in key areas to enhance fishery and public access, in turn increasing the aesthetic and recreational value of the lake. Dredging the entire lake is cost prohibitive.

Constructed fish habitat amenities and stocking strategies may not directly produce cleaner water, but they still serve an important purpose in attracting visitors and promoting active water recreation. Implementation of fish habitat will be important at every phase of improvements.

- Improve fish populations by enhancing habitat on at least 20% of the shoreline.
- Reconnect wetlands to improve essential fish spawning and nursery areas.
- Enhance fish habitat in several shallow areas shallow areas within Lake Kampeska.
- Create offshore habitat for large predator fish.
- Improve angling opportunities by constructing fishing piers with associated habitat enhancements.
- Incorporate fish friendly concepts into marina designs.

Continued education and installation of appropriate watershed management practices will continue to contribute to reduced sediment loading and improved water quality.

LAKE KAMPESKA
WETLAND CONNECTIONS



LAKE KAMPESKA'S ADJACENT WATERSHED DRAINAGE MAPPING

PROPOSED WETLAND CONNECTIVITY IMPROVEMENTS

LAKE KAMPESKA
IMPLEMENTATION PLAN

Cost Summary

First Phase Improvements: 1-5 Years

Total: $18,645,000

Second Phase Improvements: 5-10 Years

Total: $755,000

Third Phase Improvements: 10-15 Years

Total: $16,635,000

*The amounts stated herein are our best estimate of probable construction costs based on current information. Because costs are influenced by market conditions, changes in project scope, and other factors beyond our control, we cannot ensure that actual construction costs will equal this cost opinion.

First Phase Improvements: 1-5 Years

	Proposed Improvements	Timeline	Estimated Cost*
	Implement Lake Kampeska Land Use & Zoning Regulations	2019-2020	--
Water Quality	Toby Slough Fish Passage Structure and Wetland Connection	2019-2020	$220,000
Water Quality	Kampeska Lodge Fish/Canoe Passage and Wetland Connection	2020	$495,000
Water Quality	Marina Bay Drive Fish/Canoe Passage Structure and Wetland Connection	2021-2022	$195,000
Water Quality	Lake Kampeska Weir Modification: Feasibility Analysis	2019-2023	$60,000
Water Quality	Lake Kampeska Weir Modification: Construction	2019-2023	$650,000
Water Quality	Lake Sediment Phosphorus Characterization	2019	$50,000
Water Quality	Water Column Alum Treatment	2019-2023	$9 million
Fish Habitat	Sediment Alum Treatment	2019-2023	$7 million
Fish Habitat	Improve Fish Habitat - Nearshore	2019-2020	$250,000
Fish Habitat	Improve Fish Habitat - Offshore	2021-2023	$350,000
Fish Habitat	Improve Fish Habitat - Fishing Pier	2020	$375,000
	First Phase Improvements Cost Total:		$18,645,000

Second Phase Improvements: 5-10 Years

	Proposed Improvements	Timeline	Estimated Cost*
Water Quality	Jackson Park Fish Passage Structure and Wetland Connection	2025	$110,000
Water Quality	Memorial Park Fish Passage Structure and Wetland Connection	2027	$220,000
Fish Habitat	Improve Fish Habitat - Nearshore	2026	$150,000
Fish Habitat	Improve Fish Habitat - Offshore	2026-2027	$275,000
	Second Phase Improvements Cost Total:		$755,000

Third Phase Improvements: 10-15 Years

	Proposed Improvements	Timeline	Estimated Cost*
Water Quality	North Lake Drive Boat Access Fish Passage Structure and Wetland Connection	2030	$160,000
Water Quality	Lake Sediment Phosphorus Characterization	2030+	$50,000
Water Quality	Water Column + Sediment Alum Treatment	2030+	$16 million
Fish Habitat	Improve Fish Habitat - Nearshore	2030+	$150,000
Fish Habitat	Improve Fish Habitat - Offshore	2030+	$275,000
	Third Phase Improvements Cost Total:		$16,635,000

FIRST PHASE IMPROVEMENTS

First Phase Improvements: 1-5 Years			
	Proposed Improvements	Timeline	Estimated Cost*
	Implement Lake Kampeska Land Use & Zoning Regulations	2019-2020	--
Water Quality	Toby Slough Fish Passage Structure and Wetland Connection	2019-2020	$220,000
Water Quality	Kampeska Lodge Fish/Canoe Passage and Wetland Connection	2020	$495,000
Water Quality	Marina Bay Drive Fish/Canoe Passage Structure and Wetland Connection	2021-2022	$195,000
Water Quality	Lake Kampeska Weir Modification: Feasibility Analysis	2019-2023	$60,000
Water Quality	Lake Kampeska Weir Modification: Construction	2019-2023	$650,000
Water Quality	Lake Sediment Phosphorus Characterization	2019	$50,000
Water Quality	Water Column Alum Treatment	2019-2023	$9 million
Fish Habitat	Sediment Alum Treatment	2019-2023	$7 million
Fish Habitat	Improve Fish Habitat - Nearshore	2019-2020	$250,000
Fish Habitat	Improve Fish Habitat - Offshore	2021-2023	$350,000
Fish Habitat	Improve Fish Habitat - Fishing Pier	2020	$375,000
		First Phase Improvements Cost Total:	$18,645,000

Toby Slough Fish Passage Structure and Wetland Connection

- Consider collaboration with Game, Fish and Parks
- Should be a priority due to current condition of a connection that runs underneath residences
- Gate on current structure is operated by a local resident

Kampeska Lodge Fish/Canoe Passage Structure and Wetland Connection

- Current structure is on Bridge Inventory list and is due for replacement
- Eligible for 80/20 funding through SDDOT BIG Program

Marina Bay Drive Fish/Canoe Passage Structure and Wetland Connection

- Possible incorporation into the Lake Kampeska Recreational Trail Loop Project and Marina Bay Drive Bank Stabilization Project

FIRST PHASE
IMPROVEMENTS

Weir Modification Feasibility Analysis

- Conduct a feasibility study to determine the potential floodplain impacts from a modification of the weir to further decrease sediment and nutrient loading from the Big Sioux River. The feasibility study would determine the proposed modification as well as quantify potential floodplain impacts to upstream or downstream properties and, if so, what mitigative measures could be used to offset the impacts.

Lake Kampeska Weir Modification - Raising the Elevation

- This is for the Lake Kampeska weir only (does not include the Big Sioux River weir). Supplemental mitigative projects resulting from that study are excluded from the project costs
- Raise the weir approximately 2-feet in elevation to disconnect discharges below the 10-year flood while still providing storage for more extreme floods (final height determined based on Weir Modification Feasibility Analysis)

Lake Sediment Phosphorus Characterization

- Define sediment phosphorus concentrations including spatial variations to define alum treatment requirements - Results will refine sediment dosing estimates and costs

Water Column Alum Treatment

- To be performed in conjunction with sediment alum treatment, preferably after Lake Kampeska Weir Modification (Raising the Elevation)

Sediment Alum Treatment

- Dosing requirements and associated costs to be refined after sediment phosphorus characterization study
- To be performed in conjunction with water column alum treatment, preferably after Lake Kampeska Weir Modification (Raising the Elevation)

Improve Fish Habitat - Nearshore

- Improve nearshore habitat (0-8 ft water depth) on publicly owned shorelines: Jackson Park (Fishing Habitat Hole #1 Sunfish Inn); Stokes-Thomas Lake City Park (Hole #2 Bluegill Corner); Sandy Shores State Park (Hole #9 Minnow Alley); Codington Memorial Park (Hole #6 Perch Pier, #7 Wall-I, #8 SunSet Beach)
- Includes a mix of artificial structures, brush piles, and rock/gravel points and humps

Improve Fish Habitat - Offshore

- Provide offshore habitat feeding areas for predators (Walleye, Northern Pike, Smallmouth Bass): Fishing Habitat Holes #10 Casino, #11 Stoney Point, #12 The Channel, #13 Small Mouth, #14 Iahpo-ota Point, #15 Minnecotah

Improve Fish Habitat - Fishing Pier

- Construct fishing pier at Codington Memorial Park point with rip rap armor, constructed fish habitat, and fishing nodes
- Increases angling access, particularly for kids, and provides a possible partnership with SD Game, Fish and Parks

SECOND PHASE IMPROVEMENTS

Second Phase Improvements: 5-10 Years			
	Proposed Improvements	Timeline	Estimated Cost*
Water Quality	Jackson Park Fish Passage Structure and Wetland Connection	2025	$110,000
Water Quality	Memorial Park Fish Passage Structure and Wetland Connection	2027	$220,000
Fish Habitat	Improve Fish Habitat - Nearshore	2026	$150,000
Fish Habitat	Improve Fish Habitat - Offshore	2026-2027	$275,000
		Second Phase Improvements Cost Total:	$755,000

Jackson Park Fish Passage Structure and Wetland Connection
- Consider Incorporating this into a land agreement for future marina lease

Memorial Park Fish Passage Structure and Wetland Connection
- Consider collaboration with Codington County

Improve Fish Habitat - Nearshore
- Improve nearshore habitat (0-8 ft water depth)
  - Fishing Habitat Hole #3 Flyover, #4 Sunday Bass, #5 Crappie Point
- Includes a mix of artificial structures, brush piles, and rock/gravel points and humps

Improve Fish Habitat - Offshore
- Provide offshore habitat feeding areas for predators (Walleye, Northern Pike, Smallmouth Bass)
  - Fishing Habitat Hole #16 StellaMae, #17 Friday Frank, #18 L.K. Railroad
- Partner with angling organizations

THIRD PHASE IMPROVEMENTS

Third Phase Improvements: 10-15 Years			
	Proposed Improvements	Timeline	Estimated Cost*
Water Quality	North Lake Drive Boat Access Fish Passage Structure and Wetland Connection	2030	$160,000
Water Quality	Lake Sediment Phosphorus Characterization	2030+	$50,000
Water Quality	Water Column + Sediment Alum Treatment	2030+	$16 million
Fish Habitat	Improve Fish Habitat - Nearshore	2030+	$150,000
Fish Habitat	Improve Fish Habitat - Offshore	2030+	$275,000
		Third Phase Improvements Cost Total:	$16,635,000

North Lake Drive Boat Access Fish Passage Structure and Wetland Connection

Lake Sediment Phosphorus Characterization
- Define updated sediment phosphorus concentrations including spatial variations

Water Column Alum Maintenance Treatment
- Time frame dependent on load coming in from the Big Sioux River
- Costs dependent on phosphorus levels and volume of alum required to remove accumulated phosphorus
- To be performed in conjunction with sediment alum maintenance treatment

Sediment Alum Treatment
- Time frame dependent on load coming in from the Big Sioux River and rate of deep sediment phosphorus migration
- Costs dependent on phosphorus sediment levels and volume of alum required to remove accumulated phosphorus
- To be performed in conjunction with water column alum maintenance treatment

Improve Fish Habitat - Nearshore
- Improve nearshore habitat (0-8 ft water depth) - Locations to be determined based on needs
- Includes a mix of artificial structures, brush piles, and rock/gravel points and humps

Improve Fish Habitat - Offshore
- Provide offshore habitat feeding areas for predators (Walleye, Northern Pike, Smallmouth Bass)

CONFLUENCE

MEMO

PROJECT: Lake Kampeska Master Plan PROJECT #: 18106

RE: Final Committee Presentation Follow-Up Questions & Items (August 5, 2019)

Comments, additions or corrections to this memo should be communicated in writing to Confluence within seven (7) days of issuance. If no comments are received within that period, this memo will be assumed accurate and filed as part of the permanent record for this project.

FOLLOW-UP NOTES / QUESTIONS:

Planning & Zoning Questions / Coordination:

1. Future Land Use Map Revisions as requested by City of Watertown were emailed to Brandi Hanten for review and comment on 8/23. No comments or feedback have been received by Design Team to date and the revised graphic will be incorporated into the final pdf of the plan.

2. The following questions / comments were received regarding Planning & Zoning Items from a stakeholder:

   Highway 20 around to Kampeska Lodge has some opportunity for development, however it may be limited by utilities. Living in the area, I know the road past Kampeska Lodge will not handle the traffic effectively as it is narrow and has many twists and turns. Boat storage, Convenience stores, cabin rentals, campgrounds and/or motels may work in that area.

   As for short term rentals, we don't have anything on the lake for overnight stays other than the campgrounds. Hopefully hotel/motels and additional multi housing condos…can be added in time and these short term rentals can be limited but we say we want to develop the lake and then get too provincial on how.

   I think a ban on boat houses will have the opposite effect you want in that every junky boathouse building will be saved now because by banning them you increase their value. I have seen some pretty nice structures built around lakes that only enhance the appeal. Again perhaps there needs to be a higher bar set build.

   Creating a C2 zone on the lake still does not address all the issues needed to protect single family homes. Perhaps a combination of C1 and R3 in a larger areas may be better to concentrate traffic to those areas.

   Design team response to above items / comments:

   Our master plan does propose limiting the amount of commercial and multi-family development around the lake taking into consideration the sewer and water capacity constraints and the of the road limitations around the lake.

   The proposed regulation and restrictions on short-term rentals was in response to the public comments we received; however, if there is a strong demand for rentals, hopefully market forces will create new hotels and campgrounds in the areas we have designated on the proposed future land use plan.

   Our recommendations concerning boathouse restrictions was based on the public input we received but does include a provision that existing boat houses be grandfathered and allowed to be repaired and replaced in order to prevent them from becoming junky.

   We agree that any new lake centric commercial zoning district have regulations to protect the existing single family dwellings, whether it is based on C-1 or C-2 standards.

Water Quality Planning:

3. Follow-up question / comment from a stakeholder:

   Pertinent chart from presentation... #23 .... Consulting team does not show any dredging near/at inlet-outlet area, where it's most needed. IMO, targeted dredging needs to be in the plan. (They mention partial dredging here, but blow it off as a solution later on.)

   Design team response to above items / comments:

   Partial lake dredging is suggested to improve access, recreation, and fish habitat rather than to improve water quality. An example of targeted dredging was given to frame the relative extents and associated costs so the stakeholders could prioritize location and balance the amount of dredging with the available funding. A detailed targeted dredging plan for areas that the City and Lake Board prioritize as the most important could be developed but was outside of the scope of this master plan since it does not improve long-term water quality.

4. Follow-up question / comment from a stakeholder:

   At the Ikes meeting tonight we discussed the alum treatment and one of the members commented that in Minnesota he has seen taconite spread on the ice, when the ice melts the iron in the taconite attaches to the phosphorous and settles. Not sure if it has relevance or is even accurate but I am passing it on.

   Design team response to above items / comments:

   We do not believe that taconite over ice is widely used as a lake management tool. It is our understanding that while iron could bind with phosphorous, the iron to

phosphorous bond is not stable in low oxygen conditions, resulting in the P being released back into the lake. The aluminum to phosphorous bond is stable in these conditions.

5. Follow-up question / comment from a stakeholder:

Storm Lake IA spent ~$32-35 million to dredge/clean up a good portion of their 3200 acre lake in the decade of 2002-2013 .... that's a reasonable cost AND scope for dredging a lake. $500 million to $1 billion is just B.S.

Design team response to above items / comments:

Storm Lake is primarily a groundwater fed lake, versus Lake Kampeska, which is primarily a surface water fed lake. Groundwater fed lakes tend to have lower nutrient loads and less sediment loading. Additionally, Storm Lake is approximately 60% the size of Lake Kampeska. Storm Lake's primary water quality concern is water clarity impacted by wind-induced sediment resuspension rather than algae caused by high nutrient levels; therefore, the goal of their dredging was to make the lake deeper to minimize re-suspension of the sediment caused by wind-wave action. However, in addition to sediment, Lake Kampeska has high nutrient levels both within the water column and the estimated 50 million cubic yards of accumulated sediment. A plan that removes only a partial amount of the accumulated sediment will still result in phosphorous (P) being released from the remaining accumulated sediment which will still impact water quality through internal loading. Standard contracted rates for hydraulic dredging range from $10-$20 per cubic yard, resulting in the estimated $0.5 - $1 billion estimate (not including land acquisition for dewatering and final disposal). It is possible that lower unit rates could be obtained, but they are very dependent on timing and the ultimate location of the disposal area (pumping and dewatering costs).

The Storm Lake dredging project removed approximately 7 million cubic yards and utilized existing land owned by the City, a County purchased a dredge, and funds were raised to operate the dredge over time to remove the sediment. A similar model could be used for targeted dredging of Lake Kampeska; however, it won't address the ongoing sediment and nutrient load from the Big Sioux River and without substantially more dredging, won't improve the water quality associated with nutrients. Storm Lake did not have the same ongoing sediment and nutrient load since it is primarily a groundwater fed lake. Therefore, the water quality improvement plan focused on improving the overall water quality by addressing the in-lake nutrients and watershed loading nutrients. Targeted dredging can be used to improve local access and recreation, but is not a cost-effective solution for water quality improvements.

6. Follow-up question / comment from a stakeholder:

I have a concern about the proposed introduction of alum into the Lake. Only the positives were detailed. I would like to see any potential negative effects also listed. If there are no potential negative effects, I would like to see that noted in the report.

Design team response to above items / comments:

Alum has been used widely in lakes for a number of decades and has proven to be safe when used correctly. The North American Lake Management Society released a position statement on the use of alum for lake management (attached), which included a review of safety concerns. The official NALMS position is as follows:

NALMS Positions

a. Alum is a safe and effective lake management tool.
b. Alum applications should be designed and controlled to avoid concerns with toxicity to aquatic life.
c. Watershed management is an essential element of protecting and managing lakes. In cases where watershed phosphorus reductions are neither adequate nor timely, alum is an appropriate tool to accomplish meaningful water quality objectives.

One of the potential negative effects of alum use is a reduction in the pH of the lake, which is mitigated for by properly designing the dose an applying correctly. In some cases, a pH buffer is simultaneously applied to mitigate for the potential pH reduction.

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