2024

SEDIMENT INVESTIGATION REPORT

PREPARED FOR:

Mundelein Park & Recreation District

PREPARED BY:

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TRUSTED CARE OF LAND & WATER

Contents

Introduction

The focus of this sediment study was the approximately 1.1-acre West Channel of Diamond Lake in Mundelein, Illinois. The west channel is part of the larger Diamond Lake with multiple mooring locations for nearby homeowners. Multiple tributaries lead into the channel, which can often act as a "catch basin" design, gathering sediment before it enters the lake. For this reason, channels often require dredging before the main body of the lake. Concerns about sediment buildup and navigability have prompted Mundelein Park and Recreation District to request a sediment investigation report to determine the scope of a potential dredging project.

This report includes the following:

- Bathymetric, sediment thickness and total depth maps
- Calculations of sediment volume and average sediment thickness
- Management recommendations

Figure 1. Google Earth image of the West Channel of Diamond Lake.

Methods

ILM staff launched a canoe on March 25th, 2024. Transects were made throughout the channel. Probing was also performed from docks. During the visit, water levels were at NWL (Normal Water Levels) based upon indicators of hydrology and historical maps.

The sediment was probed with a measuring device graduated in tenths of a foot. Each location had two measurements recorded. One was the depth to the top of the sediment (water depth), and the second was the total depth to firm substrate below the sediment (water depth + sediment thickness = total depth).

Sediment thickness was calculated by subtracting the water depth from the total depth. Locations were mapped in the field and the maps created in ArcGIS ArcMap 10. Sediment volume was calculated by measuring the area of each contour and multiplying by the average depth between the contour lines. This data typically varies somewhat from the average of the data points in Appendix B.

Observations

The following observations were made during the visits:

- Very few aquatic plants were observed, as expected based upon the timing of the visit.
- Water levels were at NWL, and some inflow was noted at each inlet.
- Much of the shoreline would be considered as experiencing moderate to severe erosion.
- The site exhibited obvious scouring patterns from wave-based erosion, many shoreline protections were in poor shape.
- Projects being conducted on the shoreline are unprotected and leading to additional sediment entering the lake.
- The channel had an average water depth of 2.2 feet. The average sediment thickness was 1.4 feet, and the channel is approximately 37% full of sediment.

Photo 1. Sediment actively being probed (3/25/24).

Photo 2. View of the Channel.

Photo 3. Example of failing seawall on the channel.

Photo 4. Shoreline project with exposed sediment piles, excavated soils, construction debris which impact overall channel and lake health.

Photo 5. Closer view of exposed soils.

Photo 6. Seawalls no longer offer shoreline protection.

Results

Sediment Thickness Survey

The results for the sediment mapping survey can be found in Table 1 below. To determine percent full of sediment, we divide the average sediment volume by average total volume. The West Channel of Diamond Lake was 37% full of sediment (Table 1). The maximum sediment thickness recorded was 3.7 feet. The average water depth was 2.2 feet. If the entire area was dredged of all sediment, the average water depth would increase by 1.4 feet.

Table 1: Results for the sediment probing at the bays in the West Channel of Diamond Lake.

Bathymetric Results	Survey area	1.1	acres
	Average water depth *	2.2	feet
	Maximum water depth *	3.9	feet
	Water volume *	2.4	acre-feet
Sediment Results	Average sediment thickness *	1.4	feet
	Maximum sediment thickness	3.7	feet
	Estimated wet sediment volume**	2,375.0	cubic yards
Total Depth Results (sediment + water)	Average total depth *	3.6	feet
	Maximum total depth	5.9	feet
	Total volume *	4.0	acre-feet

Percent full of sediment = 37%

* Based on average depth multiplied by area determined from ArcGIS.

**Wet sediment volume, which is typically 20-60% water. Dried material has a smaller volume.

Recommendations

Based on observations from the onsite visits, data collected, and the goals for the channel, ILM has developed the following management recommendations. Please refer to the Appendices for additional detail on these management practices.

Dredging

Dredging is typically recommended when at least one of the following occurs:

- the channel is > 30% full of sediment,
- the hydrology of the channel is impacted,
- sediment occurs near the surface,
- nutrient rich sediment is causing heavy algae and/or aquatic plant growth.

The channel exceeds the recommended 30% cutoff (currently 37%), indicating dredging should be conducted in the channel. It is likely this sediment is leading to nuisance algae growth and impacting navigability of the channel for boat traffic as well.

Refer to the Dredging Appendix for more detail on dredging options.

Shoreline Management

Most of the shoreline around the channel includes scoured and degraded slopes with limited erosion control. This adds to sediment in the channel. Numerous projects seem to be in progress along the shoreline. These activities require permitting and regulation because they often lead to sediment entering the lake. Based on visual assessment of the in-progress projects, it is likely property owners are conducting these activities without proper permitting in place through the county.

Refer to the Shoreline Management Appendix for more detail on native shorelines.

Tributary Management

It is highly probable the tributaries that lead to the channel contain excess nutrients and pollutants, which generally remain unfiltered before entering the channel. Many of these nutrients and pollutants could be intercepted before entering the channel through the waterway. Restoring these tributaries with high-quality, deep-rooted natives will help reduce sediment from entering the channel, as well as the pollutants and nutrients which may result in lake management issues.

Appendix A. Survey Maps

The following figures include the maps that were developed using data collected onsite.

Bathymetric Map

This map represents the topography of the waterbody, using contour lines to indicate depth. Deeper areas are illustrated by darker coloring, while the shallower areas are lighter. The numbers on the map represent the current water depth.

Sediment Thickness Map

This map represents the thickness of sediment, as measured through sediment probing. The points and numbers on the map illustrate locations where the sediment was probed, and how thick it was at each point, in feet. The darker colors represent areas where thicker sediment was identified, and the lighter colors show areas that are not as thick.

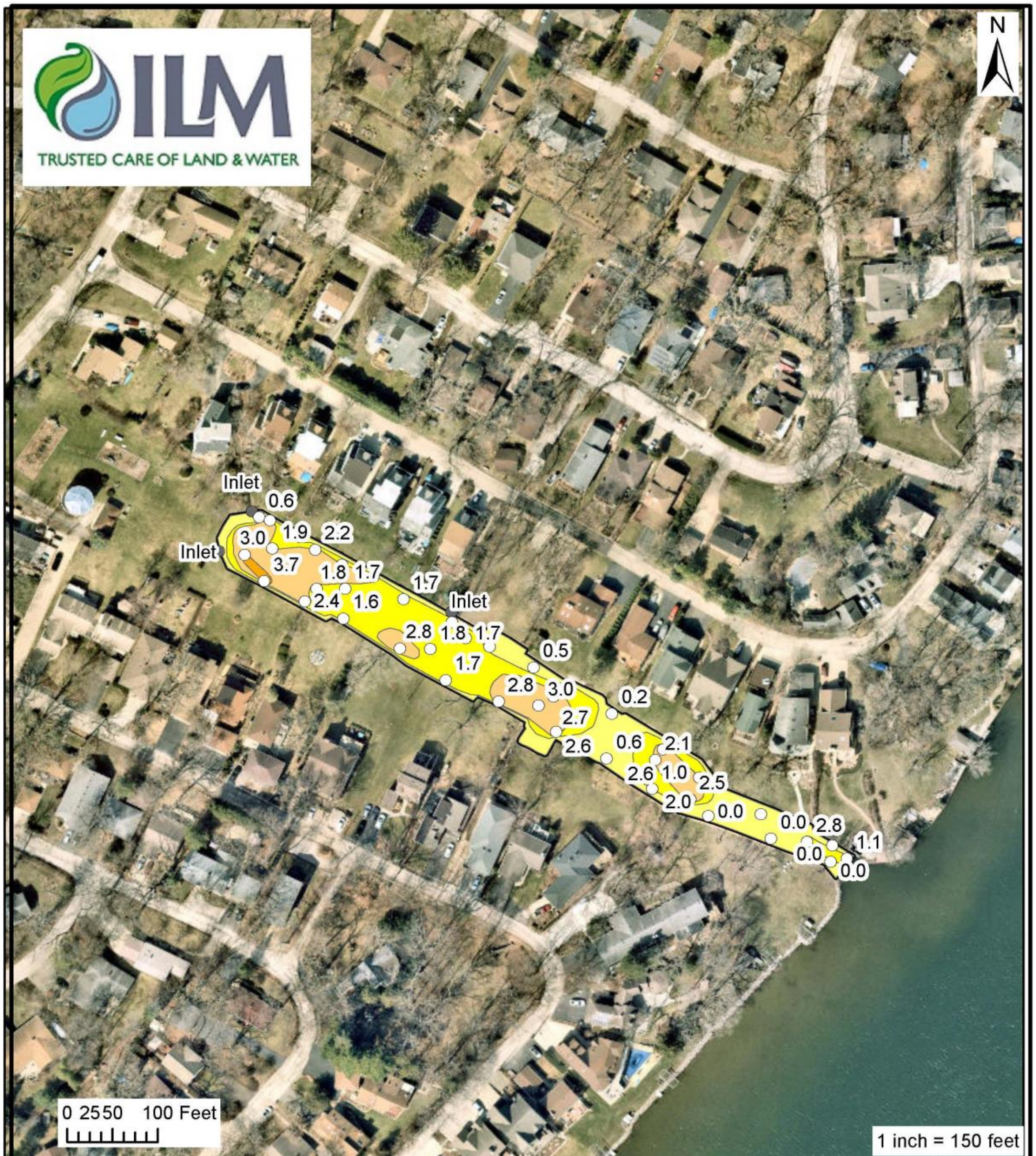
Total Depth Map (water + sediment)

This map combines data from the bathymetric map showing water depth and the sediment thickness map to show the depth from the surface of the water body to "hard bottom". If all sediment present was removed, these numbers represent how deep the water body would be.

Legend

- Shoreline
- Sample Points
- Inlets
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot

West Channel of Diamond Lake Bathymetric
19449 Forest Lane
Mundelein, IL
March 25th, 2024



West Channel of Diamond Lake Sediment Map
19449 Forest Lane
Mundelein, IL
March 25th, 2024

West Channel of Diamond Lake Total Depth Map
19449 Forest Lane
Mundelein, IL
March 25th, 2024

Legend

- Shoreline
- Sample Points
- Inlets
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4 - 5 Foot
- 5 - 6 Foot

Appendix B. Sediment Survey Data

Sample Point	Water Depth (ft.)	Total Depth (ft.)	Sediment Thickness (ft.)
1	2.7	3.3	0.6
2	2.6	4.9	2.3
3	2.7	3.5	0.8
4	2.8	5.0	2.2
5	3.0	5.0	2.0
6	2.7	4.7	2.0
7	2.8	4.5	1.7
8	2.5	4.5	2.0
9	1.6	2.5	0.9
10	1.4	1.9	0.5
11	1.4	2.6	1.2
12	1.4	1.6	0.2
13	1.8	4.4	2.6
14	1.8	3.8	2.0
15	1.4	1.4	0.0
16	2.8	2.8	0.0
17	1.4	4.0	2.6
18	1.5	4.5	3.0
19	1.5	5.2	3.7
20	2.0	4.4	2.4
21	2.4	4.0	1.6
22	2.9	5.7	2.8
23	2.4	4.1	1.7
24	1.2	4.0	2.8
25	1.7	4.3	1.3
26	1.5	2.1	0.6
27	1.8	2.8	1.0
28	2.1	2.1	0.0
29	2.0	2.0	0.0
30	3.9	3.9	0.0
31	3.1	4.8	1.7
32	2.0	4.7	2.7
33	2.7	4.8	2.1
34	3.1	5.9	2.8
35	3.3	4.4	1.1
36	2.5	5.0	2.5
37	2.4	5.4	3.0
38	3.5	5.3	1.8

39	3.1	4.9	1.8
40	2.7	4.6	1.9
41	3.2	4.9	1.7
Average	2.2	3.6	1.4
Maximum	3.9	5.7	3.7

Appendix C. Dredging

The two common methods for dredging are "mechanical" or "hydraulic" removal. Mechanical removal involves an excavator staging along the shore or deploying an amphibious excavator to scoop out the sediment (Photo 7). The removed material can be placed in a stockpile to dry and then be spread out and seeded or removed and disposed of offsite. With hydraulic removal, a cutterhead is used to suction up a slurry of sediment and water to a dewatering facility, typically in a dewatering bag (Photo 8). The sediment is captured in the bag and clean water returns to the lake. Hydraulic dredging can remove material faster than mechanical dredging depending on the equipment but requires space for the material to dry out for several months before it can be hauled away.

Photo 7. Mechanical sediment removal.

Photo 8. Sediment dewatering bag.

The processes through which nutrients are released from sediment are complex and dependent on various environmental factors. For example, low dissolved oxygen levels alter biotic processes, leading to increased rates of nutrient release from the sediment. Under certain conditions, even low levels of sediment nutrients can lead to increases in nuisance vegetative growth. While dredging this lake may lead to an overall decrease in nutrients in the sediment, reducing sediment volume alone is not a guarantee of a reduction of nuisance algae and plant growth.

Reductions in nutrient inputs from upstream sources (such as shoreline erosion) and monitoring biological conditions within the lake (i.e., ensuring adequate dissolved oxygen levels, limiting carp presence) are also vital for reducing nutrient loading.

Appendix D. Shoreline Management

- **Planting a native vegetated buffer** around the shoreline (Photo 9) is a desirable strategy for stabilizing the shoreline. Native vegetation provides habitat for beneficial pollinators and plants can be chosen to provide flowers throughout the summer and year-round interest. Additionally, taller shoreline vegetation discourages Canada goose residency, reducing nutrient and bacteria contamination carried in their droppings.
- There is a vast array of aesthetically attractive native species that can be planted along shorelines and in shallow aquatic areas. These plants are also important fish and wildlife nursery habitat.

Photo 9. Buffer with native vegetation.

The general types of vegetation that are planted include:

- Emergent species for water depths greater than 1 foot, such as American lotus (*Nelumbo lutea,)* or pickerelweed (*Pontederia cordata,* Photo 10).
- Shoreline species for less than 1 foot of water depth, including bur-reed species (*Sparganium spp.*), arrowhead (*Sagittaria spp*., Photo 11), or blue flag iris (*Iris versicolor*, Photo 12).
- Upland species with deep roots to stabilize the shoreline, which typically consist of native grasses and forbs (Figure 2).

Photo 10. Pickerelweed.

Photo 11. Arrowhead

Photo 12. Blue Flag iris.

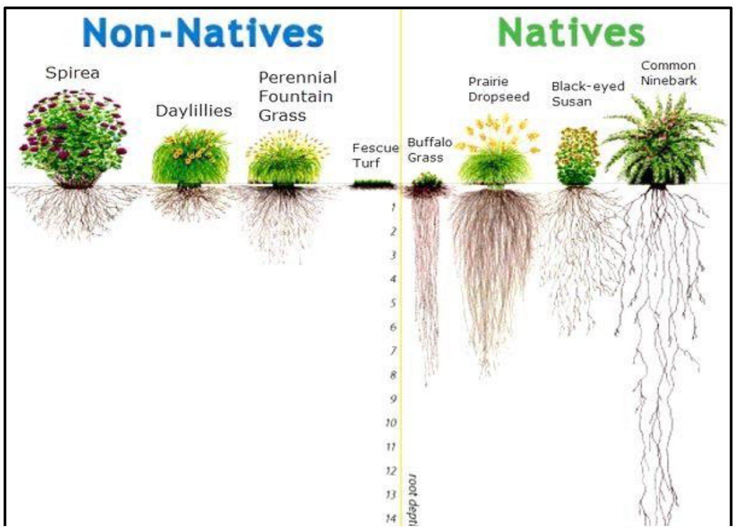


Figure 2. Comparison of root depths of native and non-native vegetation