



2026 BEAR TREE FARMS SEDIMENT INVESTIGATION REPORT

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Bear Tree Farms HOA

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Introduction

Concerns about sediment accumulation, shoreline erosion, and overgrowth of algae and vegetation have prompted the HOA of Bear Tree Farms (DeForest, WI) to request a sediment investigation to better understand sedimentation in their three ponds and determine the scope of a potential dredging project, among other general ecological improvements.

This report includes the following:

- Bathymetric, sediment thickness, and total depth maps of the three ponds at normal water level
- Calculations of sediment volume and average sediment thickness
- Management recommendations based on the data collected.

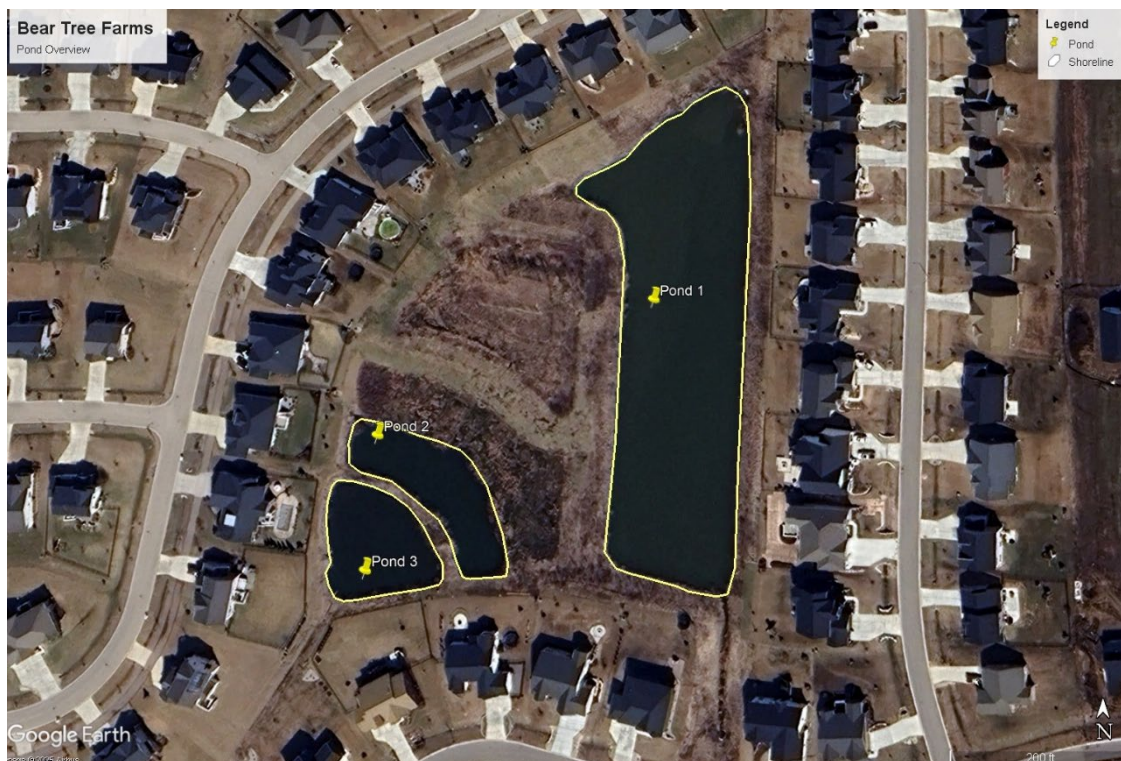


Figure 1. Aerial view of the Bear Tree Farms pond in DeForest, WI. Source: Google Earth, 2026.



Methods

On May 8, 2026, ILM staff launched a boat and made transects through the three ponds. 75 sample points were taken at Pond 1, 27 points were taken at Pond 2, and 23 points were taken at Pond 3. During the visit, water levels were measured at NWL (Normal Water Levels) based upon hydrological indicators including the waterline at the outflow structures. Prior to the probe, DeForest received under 0.03" of precipitation on May 5, 2026.

The sediment was probed with a graduated measuring device calibrated to the nearest tenth 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 as the difference between total depth and the water depth. Locations were determined with a Trimble R1 series GNSS receiver. The data was downloaded and mapped in ArcGIS Pro. 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 presented in Appendix B.



Observations

The following observations were made during the visit:

- The surface of Pond 1 was mostly clear, with <5% of the pond's total surface area covered with algae growth that was confined to the shorelines (Photo 1).
- Ponds 2 and 3 had clear surfaces, with <5% of their respective surface areas covered in Filamentous algae, Oscillatoriales mats, and Common Duckweed (*Lemna minor*) (Photos 2 and 3).
- A long compact sandbar extends from a projection of rocks on Pond 1. Historical imagery shows that this was a terrestrial separation during new pond installations in 2020-2021 before the ponds were filled into the single 1.9-acre basin that is currently present (Appendix C).
- Sediment accumulation in Pond 1 is thickest adjacent to the sandbar.
- Sediment composition in all three ponds was silty, with a rock bottoms.
- Aquatic plants observed included invasive Curly-leaf Pondweed (*Potamogeton crispus*) (Photo 5). Native species included Horned Pondweed (*Zannichellia palustris*), Sago Pondweed (*Stuckenia pectinata*), and American Pondweed (*Potamogeton nodosus*).
- Plant growth was very dense throughout Pond 2 (Photo 5).
- Leopard frogs at Pond 2 are a species indicative of generally good water quality.
- Mild to moderate erosion was visible along the shorelines of all ponds and was most apparent at Pond 1 (Photos 7-9).
- A tree is growing in the West culvert at Pond 1 and should be removed before it causes structural damage (Photo 10).
- The inflow culverts at Ponds 2 and 3 have been partially impacted by sediment accumulation, but are still functional.
- Ditches are being created along the shorelines where stormwater and resident pipe infrastructure flow through the buffers (Photo 11).
- Buffers around the ponds were naturalized, composed of native and non-native plants, including turfgrasses, invasive Reed Canary Grass (*Phalaris arundinacea*), and Willows (*Salix spp.*) (Photos 12-14)



Photo 1. Pond 1, facing south



Photo 2. Pond 2, facing southeast





Photo 3. Pond 3, facing west



Photo 4. Rocky projection at inflow culvert, Pond 1



Photo 5. Invasive Curly-leaf Pondweed (*Potamogeton crispus*)



Photo 6. Dense native plant growth in Pond 2



Photo 7. Shoreline erosion facilitates algae growth, Pond 1



Photo 8. Shoreline tree eroding into Pond 1





Photo 9. Moderate erosion exposing soil along the shore



Photo 10. Tree growing in Pond 1 West Culvert



Photo 11. Ditches created in the buffers by pipes



Photo 12. Representative shoreline of Pond 1



Photo 13. Vegetation separating Ponds 2 and 3



Photo 14. Naturalized buffer around Pond 2



Results

Sediment Thickness Survey – Pond 1

The results of the sediment mapping survey are shown in Table 1 below. Bathymetric, Sediment Thickness, and Total Depth maps are available in Appendix A. To determine the percentage of accumulated sediment, the average sediment volume is divided by the average total volume.

Bear Tree Farms Pond 1 is 13% full of sediment (Table 1). The maximum sediment thickness recorded was 1.9 feet. The average water depth was 3.2 feet. If the entire area were dredged of all sediment, around 1,489 cubic yards, the average water depth would increase by about 0.5 feet. This would increase the basin's volume by approximately 0.9 acre-feet, or 309,558 gallons at NWL.

Bathymetric Results	Survey area	1.9	acres
	Average water depth *	3.2	feet
	Maximum water depth *	7.2	feet
	Water volume *	6.7	acre-feet
Sediment Results	Average sediment thickness *	0.5	feet
	Maximum sediment thickness	1.9	feet
	Estimated wet sediment volume **	1,489	cubic yards
Total Depth Results (sediment + water)	Average total depth *	3.8	feet
	Maximum total depth	8.8	feet
	Total volume *	7.2	acre-feet

Percent full of sediment = 13%

Table 1. Results of the sediment probing at Bear Tree Farms Pond 1

* 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.



Sediment Thickness Survey – Pond 2

Bear Tree Farms Pond 2 is 29% full of sediment (Table 2). The maximum sediment thickness recorded was 1.8 feet. The average water depth was 2.4 feet. If the entire area were dredged of all sediment, around 378 cubic yards, the average water depth would increase by about 0.9 feet. This would increase the basin's volume by approximately 0.2 acre-feet, or 74,945 gallons at NWL.

Bathymetric Results	Survey area	0.3	acres
	Average water depth *	2.4	feet
	Maximum water depth *	4.5	feet
	Water volume *	0.6	acre-feet
Sediment Results	Average sediment thickness *	0.9	feet
	Maximum sediment thickness	1.8	feet
	Estimated wet sediment volume **	378	cubic yards
Total Depth Results (sediment + water)	Average total depth *	3.1	feet
	Maximum total depth	6.3	feet
	Total volume *	0.8	acre-feet

Percent full of sediment = 29%

Table 2. Results of the sediment probing at Bear Tree Farms Pond 2

* 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.



Sediment Thickness Survey – Pond 3

Bear Tree Farms Pond 3 is 16% full of sediment (Table 3). The maximum sediment thickness recorded was 1.3 feet. The average water depth was 3.5 feet. If the entire area were dredged of all sediment, around 250 cubic yards, the average water depth would increase by about 0.6 feet. This would increase the basin's volume by approximately 0.15 acre-feet, or 48,878 gallons at NWL.

Bathymetric Results	Survey area	0.3	acres
	Average water depth *	3.5	feet
	Maximum water depth *	5.8	feet
	Water volume *	0.8	acre-feet
Sediment Results	Average sediment thickness *	0.6	feet
	Maximum sediment thickness	1.3	feet
	Estimated wet sediment volume **	250	cubic yards
Total Depth Results (sediment + water)	Average total depth *	3.8	feet
	Maximum total depth	6.9	feet
	Total volume *	1.0	acre-feet

Percent full of sediment = 16%

Table 3. Results of the sediment probing at Bear Tree Farms Pond 3

* 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 visit, data collected, and the goals for the pond, ILM has developed the following management recommendations. Please refer to the appendices for additional details on these management practices.

Shoreline Restoration

Shorelines around all three ponds were exhibiting signs of mild to moderate erosion. Erosion adds sediment to the ponds, decreasing their functional lifespans and increasing the nutrients available to fuel algal blooms and the growth of weedy aquatic flora. Additionally, erosion washes away property that cannot be restored. Management of shorelines and increased stabilization will reduce this loss of property and curb the stressors of external nutrient loading on the ecosystem, often improving the overall aesthetic of the pond.

Expanding and restoring the current natural buffer with biodiverse deep-rooted native species can help reduce the impacts of erosion by stabilizing the surrounding soil. This will require stewardship to remove and manage the invasive and nuisance terrestrial growth among native flora in the current buffer. Further installation of emergent shelves along the shoreline and in shallow areas can benefit the area by stabilizing sediment in the water, minimizing the effects of wave erosion and fluctuating water levels. These plants can also sequester nutrients (phosphorus and nitrogen) in stormwater runoff before they enter the pond and contribute to algae blooms. Tall native plant buffers also deter geese, which contribute to nutrient loading through their waste, while encouraging the presence of other native wildlife, including pollinators, songbirds, and fish in emergent buffers.

Biotechnical stabilization may be necessary in areas exhibiting more severe erosion, which were primarily located along Pond 1. Stabilizing eroding shorelines should take priority to achieve the greatest reduction in pond sedimentation following any potential dredging projects. This will increase the longevity of the dredge by addressing one of the primary sources of sediment loading. Different options for biotechnical stabilization exist based on the severity of erosion.

Refer to Appendix D for more details on shoreline restoration.



Aquatic Ecosystem Management

Invasive Curly-leaf Pondweed is present in all three ponds. Managing it is important to control the spread of this invasive plant. Biotic decay from large-scale aquatic herbicide treatments can contribute to the accumulation of nutrient-rich sediment. Managing the invasive Curly-leaf Pondweed early in the season with targeted preventative treatments can greatly reduce the need for additional aquatic herbicide applications later in the season. Specific herbicides are designed to inhibit the early-season growth of this invasive species and allow for native species to grow later in the season. Allowing for native aquatic growth, as seen during the ILM visit, can sequester nutrients that would otherwise be used to fuel algae blooms.

Testing for phosphorus levels in water and sediment can determine whether the ponds have an overabundance of nutrients that fuel plant and algae growth. Phosphorus levels can be reduced by applying products that render it unavailable to vegetation. Clay pellets, along with a rare earth mineral (lanthanum), bind with reactive phosphorus in the water column as it is applied. The clay then sinks to the sediment, where it continues to bind with phosphorus as it is released from the sediment. It is recommended that this be done following any large-scale herbicides, as the resulting biotic decay can quickly raise phosphorus levels in the pond. Nutrient deactivation bags can also be placed at the large inflow of Pond 1 to capture some of the upstream phosphorus before it enters the pond.

Dredging

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

- The waterbody is > 30% full of sediment.
- The pond's hydrology is impacted.
- Sediment occurs near the surface.
- Nutrient-rich sediments are causing heavy algae and/or aquatic plant growth.

The ponds at Bear Tree Farms range from 13-29% full of sediment, indicating that **full pond dredging is not recommended at this time for ponds 1 or 3** based on how much sediment is present. However, Pond 2 is very close to 30% full of sediment, so dredging may be considered in the future to prolong the basin's functionality. It should be noted that dredging will not stop sediment accumulation from erosion, biotic decay, or upstream deposits. Partial dredging options exist for areas of high sediment accumulation, but since these areas are located along more severe erosion zones, it is recommended that the shorelines are repaired first before any partial dredging takes place.

Refer to Appendix E for further information regarding dredging.



Culvert Maintenance

Maintaining the functionality and structural integrity of the culverts will allow water to flow in and out of the basins as originally engineered, reducing the capacity for flooding, erosion from water fluctuations, or stagnation that encourages algae growth. Removing the tree from the west culvert on Pond 1 is highly recommended to preserve its functionality before additional damage to the structure occurs.

Monitoring culverts, especially after rain events, is important to ensure flow is not impeded. This will help mitigate the erosion caused by fluctuating water levels by reducing the intensity and duration of said fluctuations.

ILM has helped clients with similar conditions find solutions that meet their needs. We can help you develop cost estimates or budgets for any of the options listed.



Appendix A. Survey Maps

The following figures include the maps that were developed using data collected onsite. Maps are presented without visible survey points to preserve contour readability. Maps with survey points and associated measurements are available upon request.

Bathymetric Map – Pond 1

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.



Figure 2. Bathymetric survey map of Bear Tree Farms Pond 1



Sediment Thickness Map – Pond 1

This map represents the thickness of sediment, as measured through sediment probing. The darker colors represent areas where thicker sediment was identified, and the lighter colors show areas that are not as thick.

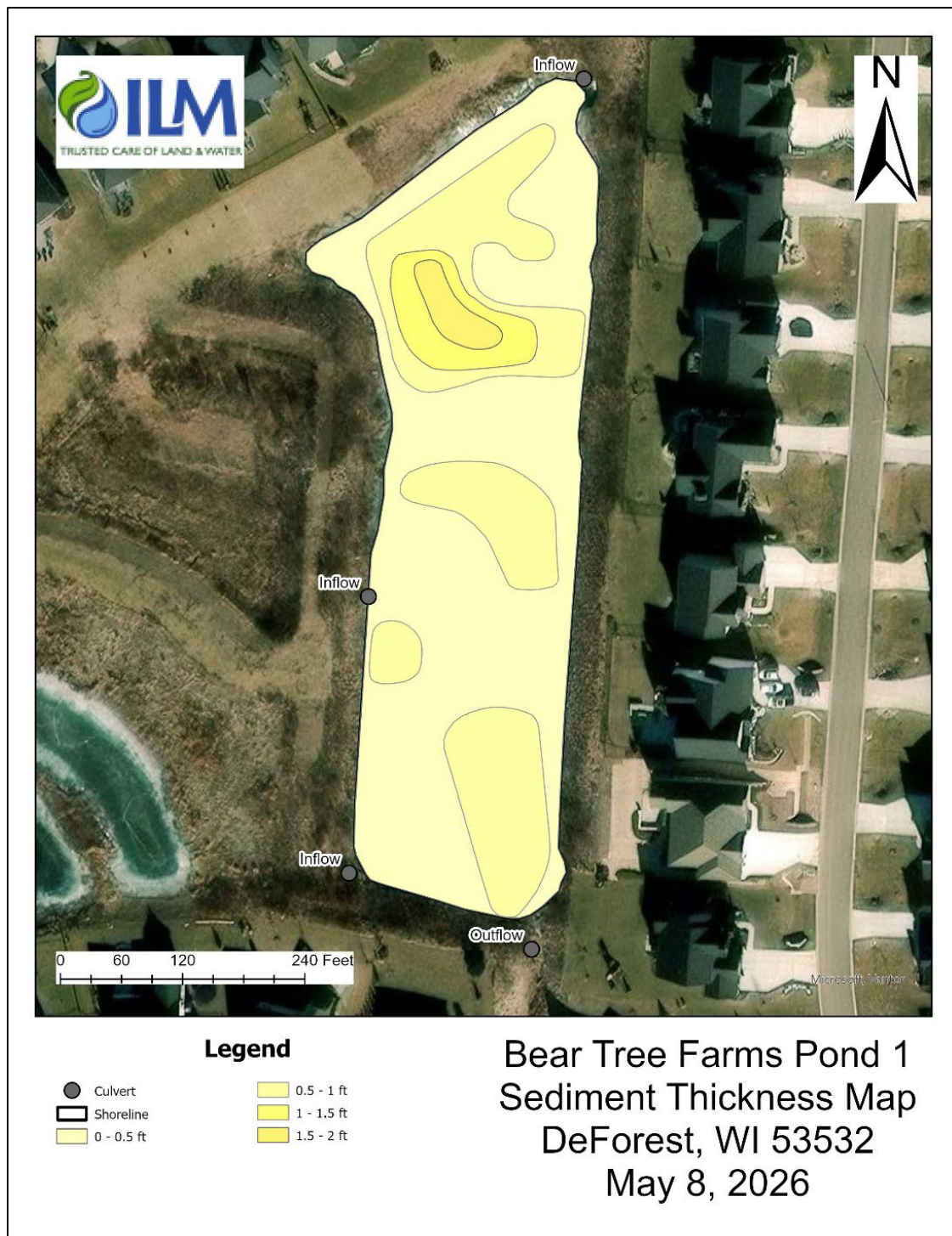


Figure 3. Sediment thickness survey map of Bear Tree Farms Pond 1



Total Depth Map (water + sediment) – Pond 1

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.



Figure 4. Total depth survey map of Bear Tree Farms Pond 1



Bathymetric Map – Pond 2

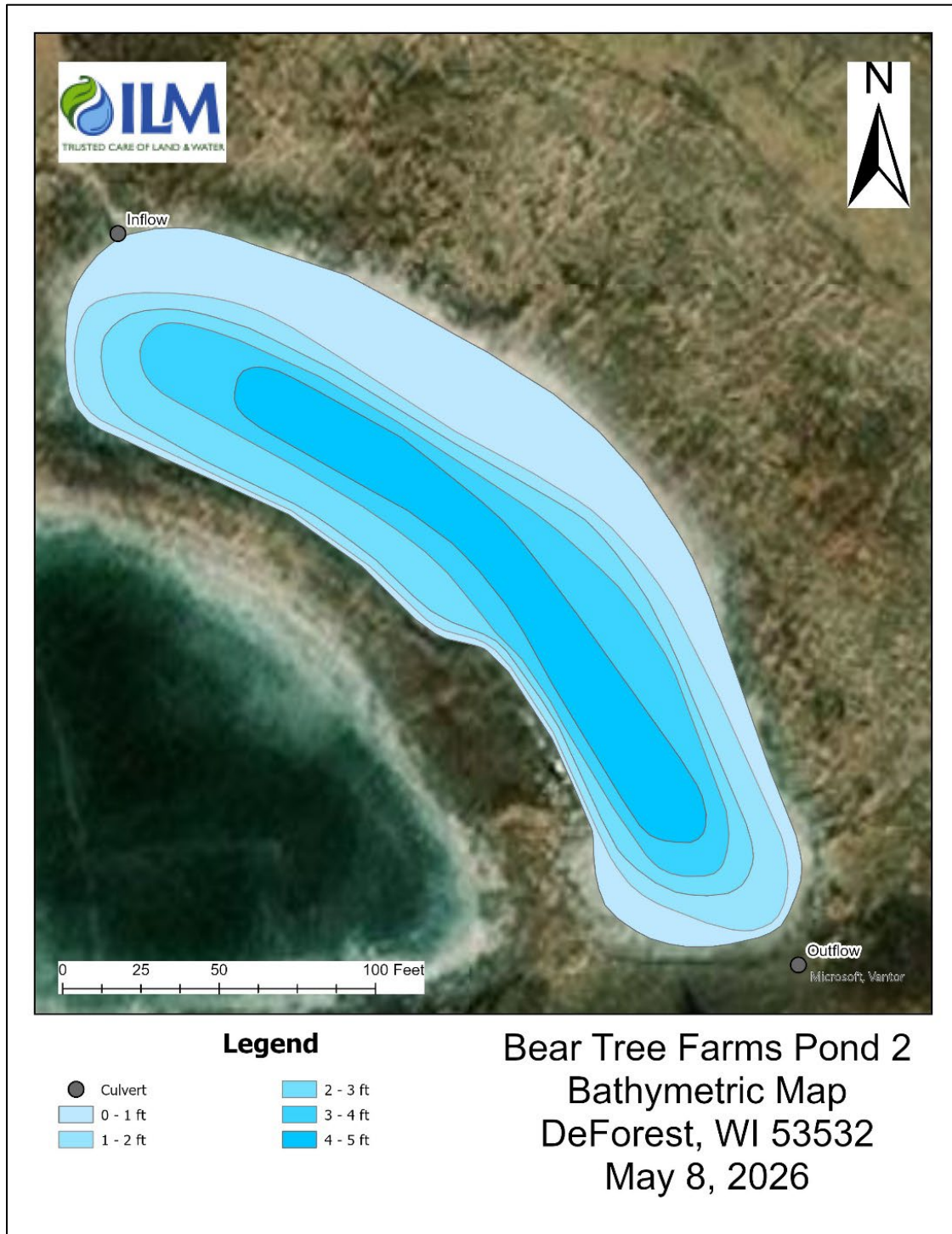


Figure 5. Bathymetric survey map of Bear Tree Farms Pond 2



Sediment Thickness Map – Pond 2

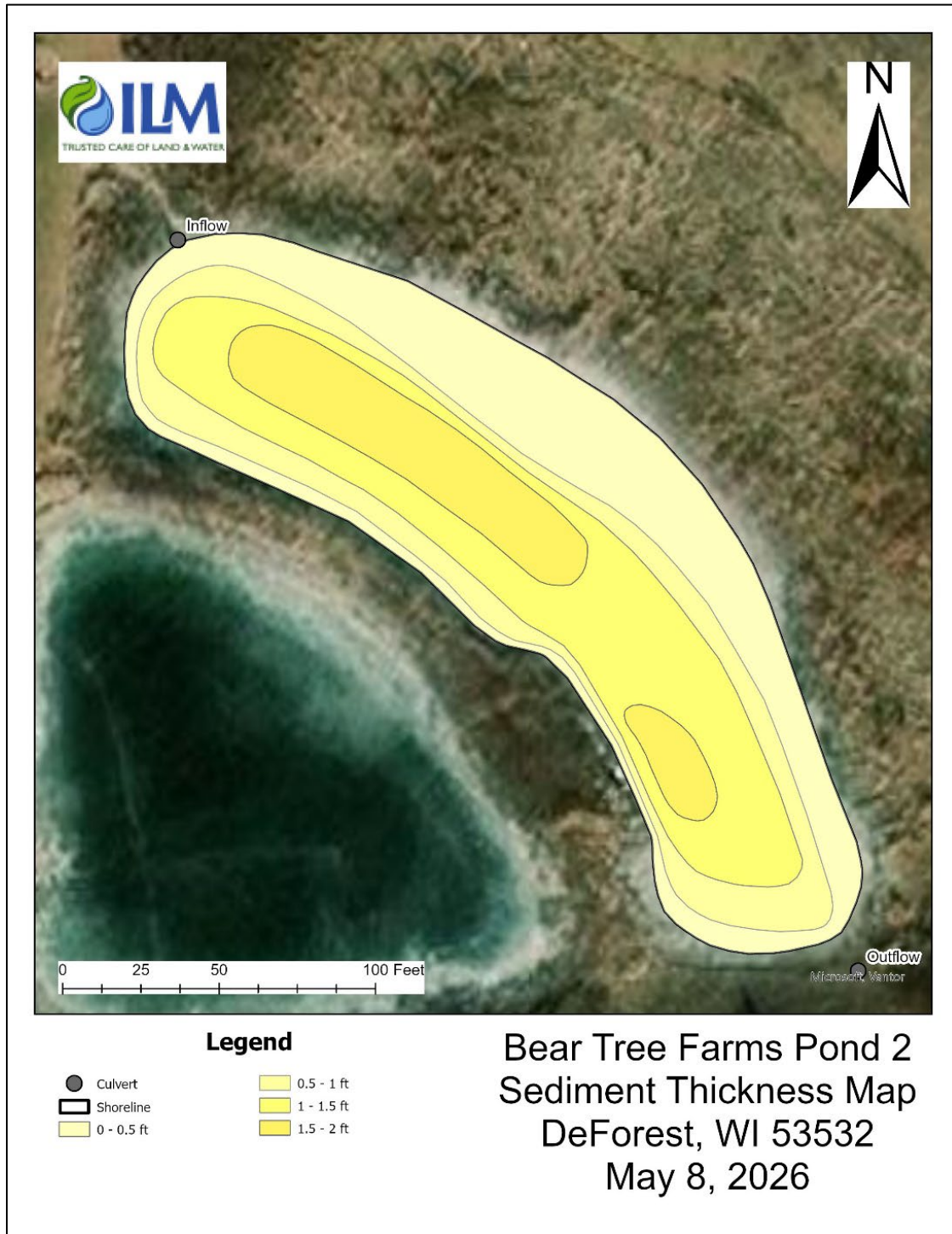


Figure 6. Sediment thickness survey map of Bear Tree Farms Pond 2



Total Depth Map (water + sediment) – Pond 2

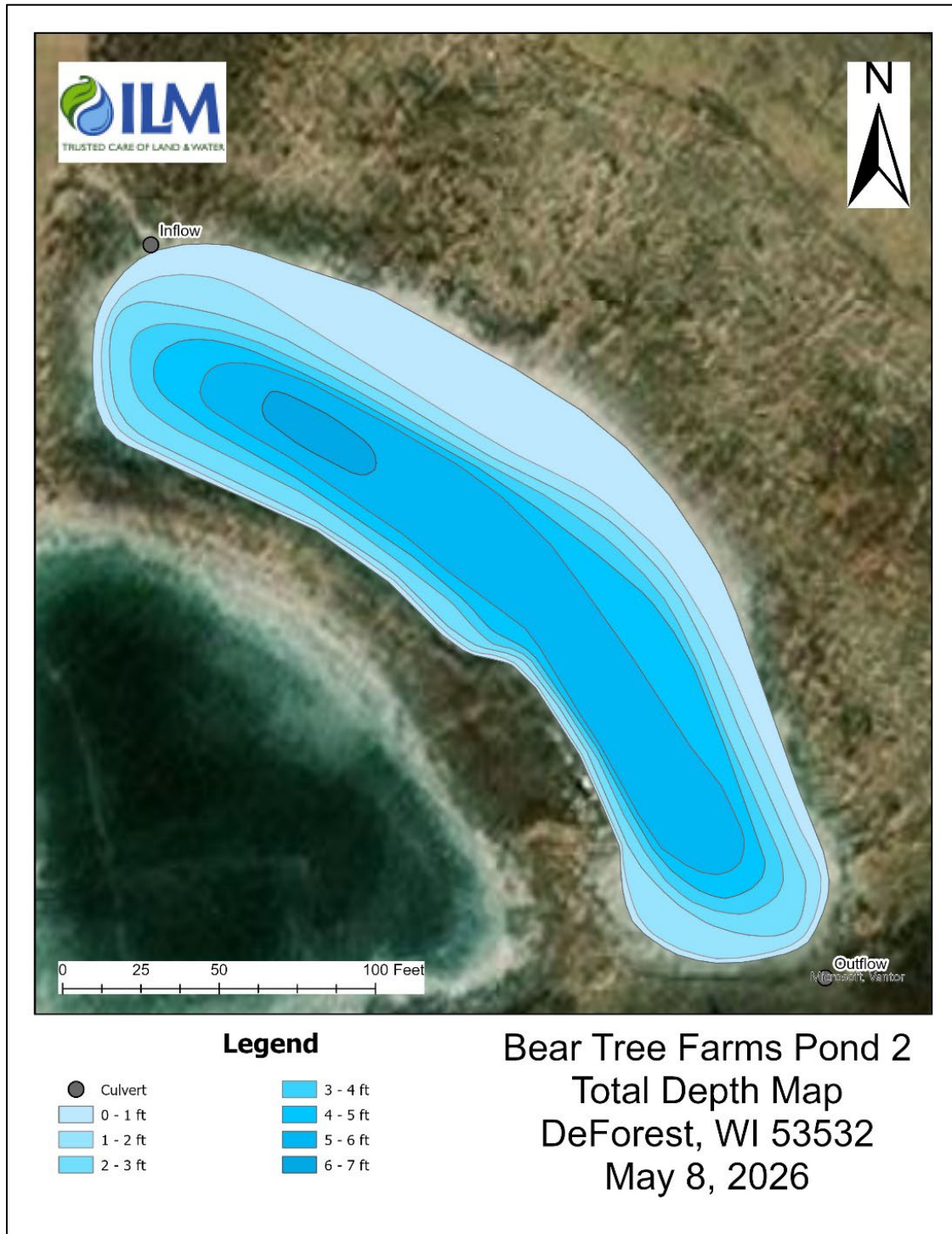


Figure 7. Total depth survey map of Bear Tree Farms Pond 2



Bathymetric Map – Pond 3

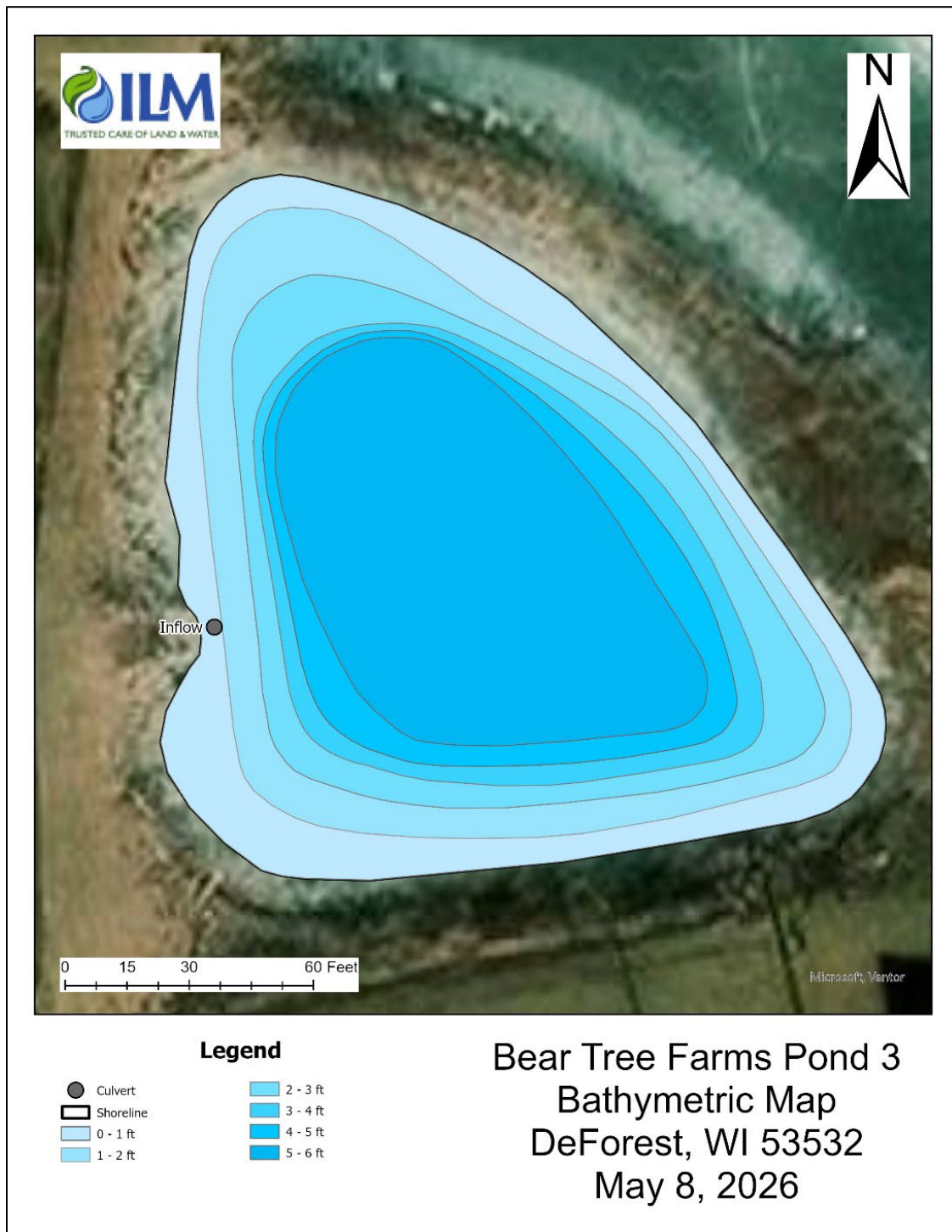


Figure 8. Bathymetric survey map of Bear Tree Farms Pond 3



Sediment Thickness Map – Pond 3

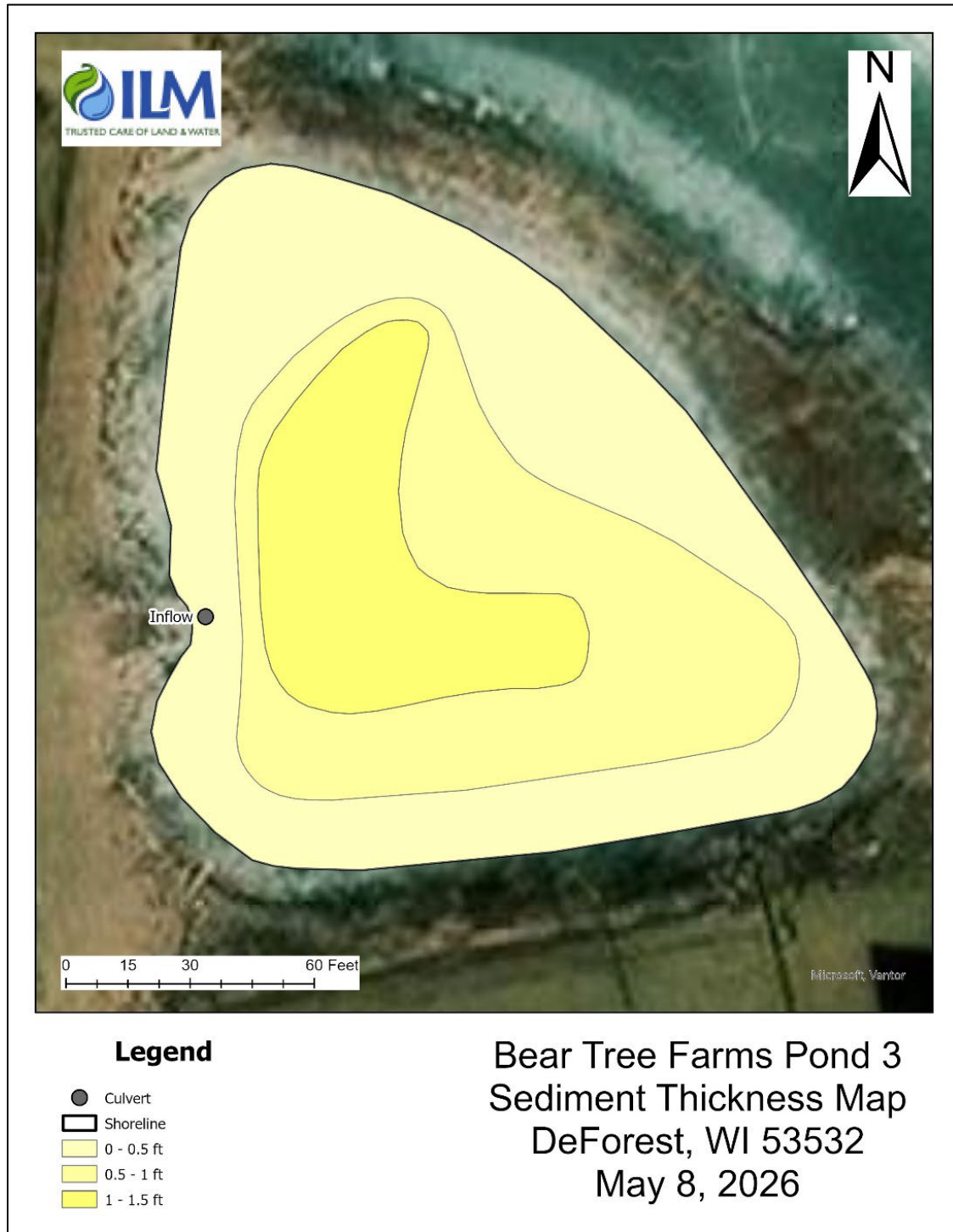


Figure 9. Sediment thickness survey map of Bear Tree Farms Pond 3



Total Depth Map (water + sediment) – Pond 3

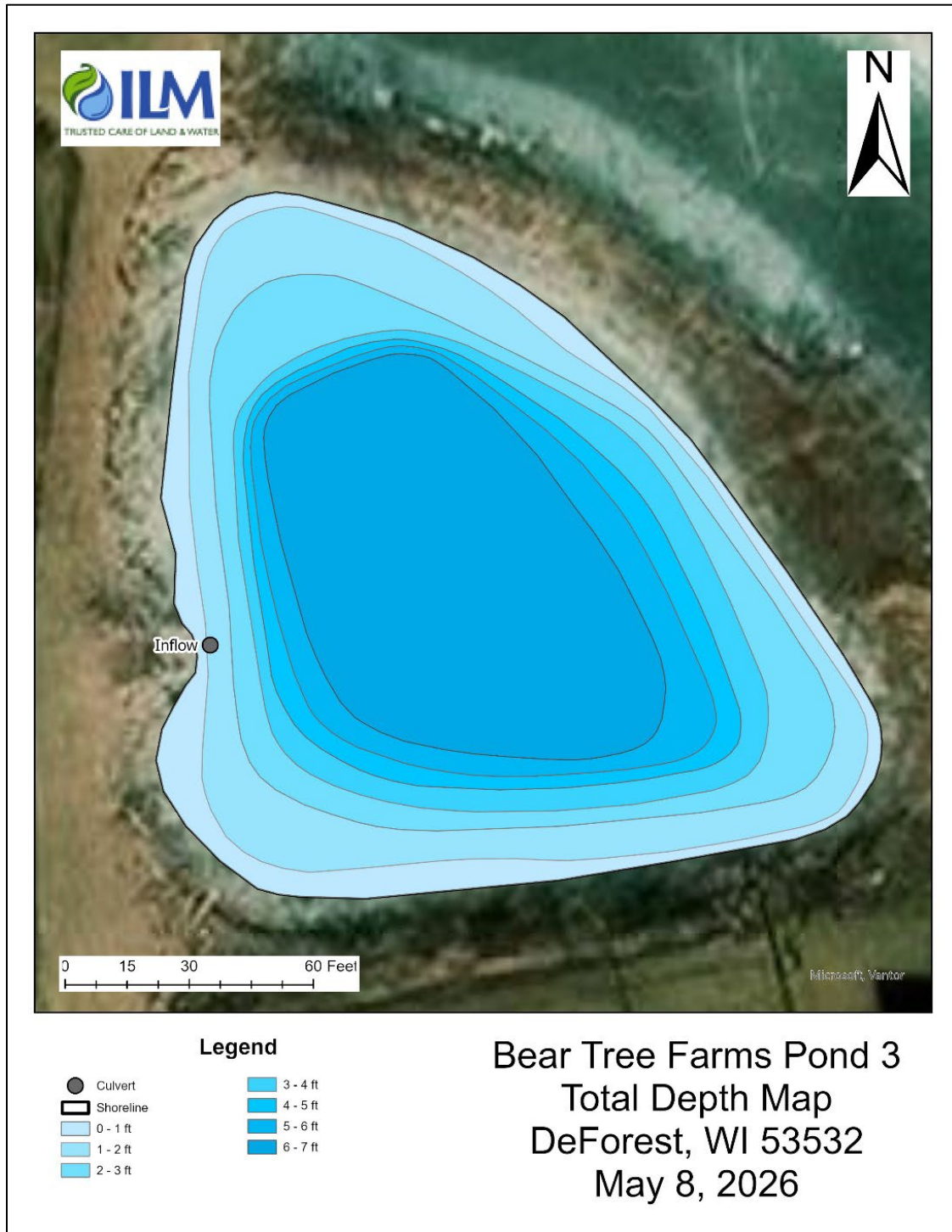


Figure 10. Total depth survey map of Bear Tree Farms Pond 3



Appendix B. Sediment Survey Data

Pond 1

Point	Water	Total	Sed	Point	Water	Total	Sed
1	0.4	0.8	0.4	39	6.0	6.5	0.5
2	0.6	1.0	0.4	40	6.2	6.7	0.5
3	0.5	0.7	0.2	41	1.2	1.5	0.3
4	0.9	1.3	0.4	42	1.2	1.7	0.5
5	0.7	1.1	0.4	43	6.1	6.3	0.2
6	0.6	1.0	0.4	44	6.0	6.7	0.7
7	0.6	0.8	0.2	45	1.1	1.6	0.5
8	0.7	1.0	0.3	46	0.6	1.1	0.5
9	4.0	4.8	0.8	47	6.1	6.6	0.5
10	3.5	4.1	0.6	48	6.0	6.3	0.3
11	2.5	3.0	0.5	49	0.9	1.1	0.2
12	1.6	2.4	0.8	50	0.9	1.6	0.7
13	0.6	0.8	0.2	51	6.0	6.3	0.3
14	0.6	0.7	0.1	52	6.0	6.4	0.4
15	2.9	3.6	0.7	53	0.6	0.9	0.3
16	5.7	6.4	0.7	54	6.1	6.4	0.3
17	6.9	8.6	1.7	55	6.0	6.4	0.4
18	1.1	1.5	0.4	56	1.0	1.4	0.4
19	7.2	8.4	1.2	57	6.1	6.3	0.2
20	0.9	1.0	0.1	58	4.5	5.0	0.5
21	4.5	5.0	0.5	59	0.6	1.0	0.4
22	0.7	1.0	0.3	60	0.8	1.0	0.2
23	2.5	2.7	0.2	61	6.0	6.6	0.6
24	6.9	8.8	1.9	62	6.1	6.6	0.5
25	0.7	1.2	0.5	63	1.4	1.6	0.2
26	1.1	1.3	0.2	64	1.0	1.3	0.3
27	2.5	3.0	0.5	65	6.2	6.5	0.3
28	1.1	1.4	0.3	66	6.1	6.8	0.7
29	6.5	7.4	0.9	67	1.0	1.5	0.5
30	0.4	1.0	0.6	68	0.8	1.3	0.5
31	1.3	1.7	0.4	69	0.5	0.8	0.3
32	1.5	1.7	0.2	70	1.0	1.6	0.6
33	1.2	1.4	0.2	71	0.7	0.9	0.2
34	1.5	2.2	0.7	72	2.1	2.6	0.5
35	5.9	6.5	0.6	73	6.5	7.0	0.5
36	1.1	1.5	0.4	74	6.4	7.3	0.9
37	0.5	0.6	0.1	75	1.7	2.1	0.4
38	1.0	1.4	0.4				

Table 4. Sediment survey point data at Bear Tree Farms Pond 1



Pond 2

Point	Water	Tot	Sed
1	1.9	2.9	1.0
2	0.7	1.4	0.7
3	3.3	4.8	1.5
4	2.1	2.9	0.8
5	0.5	1.0	0.5
6	4.5	6.3	1.8
7	2.1	2.6	0.5
8	4.1	5.7	1.6
9	0.7	0.9	0.2
10	4.3	5.9	1.6
11	4.1	5.8	1.7
12	0.9	1.0	0.1
13	4.1	5.8	1.7
14	2.1	2.8	0.7
15	3.8	4.9	1.1
16	3.0	4.0	1.0
17	0.6	0.7	0.1
18	0.5	0.7	0.2
19	3.8	4.9	1.1
20	4.0	5.5	1.5
21	3.8	4.8	1.0
22	1.5	2.0	0.5
23	4.1	5.8	1.7
24	3.8	5.0	1.2
25	1.4	2.0	0.6
26	0.9	1.4	0.5
27	4.1	5.5	1.4

Table 5. Sediment survey point data at Bear Tree Farms Pond 2

Pond 3

	Water	Total	Sed
1	0.9	1.0	0.1
2	0.9	1.1	0.2
3	1.0	1.2	0.2
4	0.7	0.8	0.1
5	1.0	1.5	0.5
6	3.0	4.3	1.3
7	5.6	6.8	1.2
8	5.5	6.2	0.7
9	2.1	2.8	0.7
10	5.6	6.5	0.9
11	5.5	6.3	0.8
12	4.5	5.0	0.5
13	2.9	3.3	0.4
14	0.8	1.0	0.2
15	1.3	1.5	0.2
16	2.1	2.4	0.3
17	5.0	6.0	1.0
18	5.8	6.8	1.0
19	5.4	6.3	0.9
20	4.7	5.9	1.2
21	5.5	6.5	1.0
22	5.7	6.9	1.2
23	5.8	6.3	0.5

Table 6. Sediment survey point data at Bear Tree Farms Pond 3



Appendix C. Historical Imagery

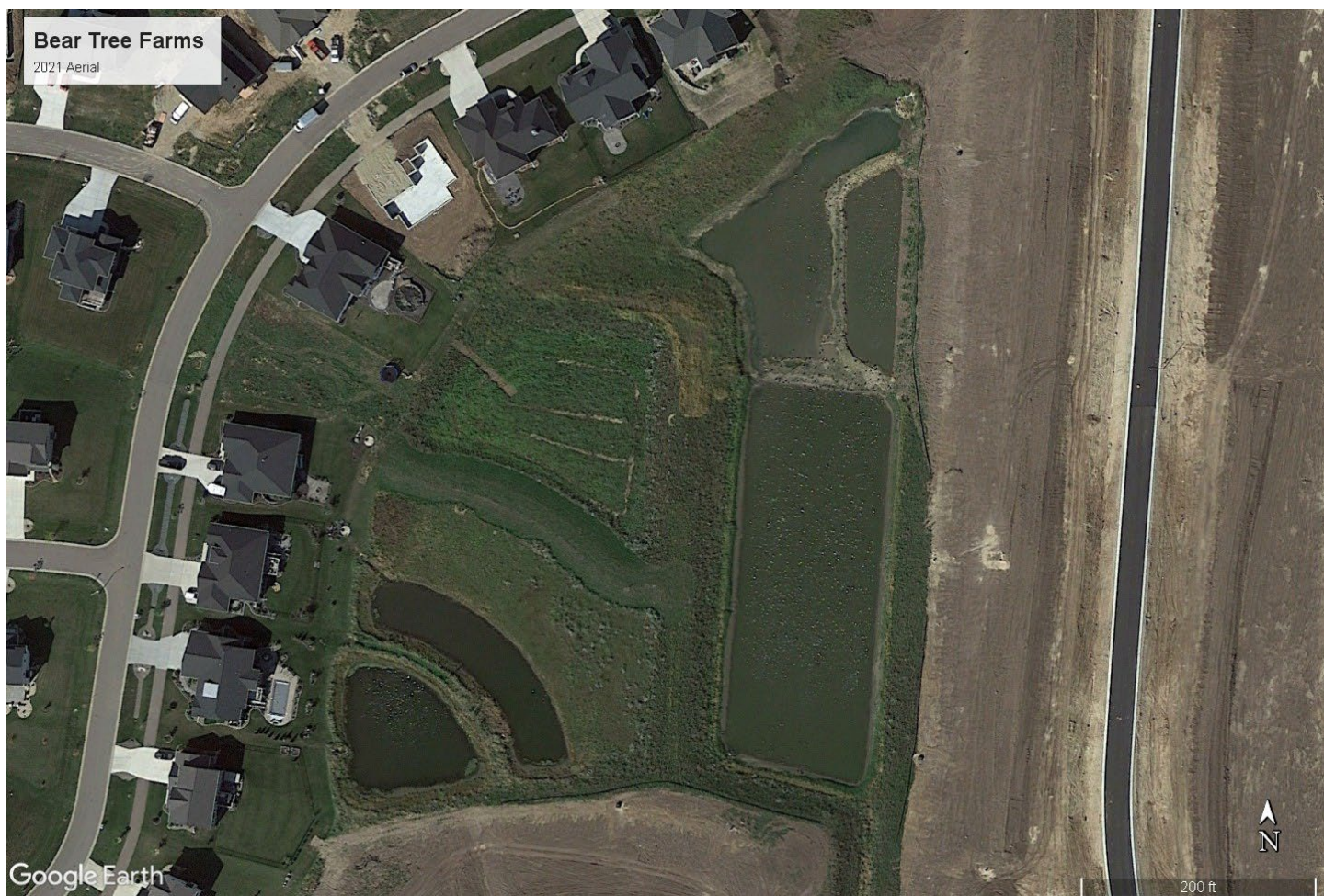


Figure 11. Pond 1 was separated into 3 distinct basins between 2020-2022. Source: Google Earth, 2021.





Figure 12. Pond 1 was smaller in 2020 before being expanded upon in later years. Source: Google Earth, 2020.





Figure 12. Ponds 2 and 3 were constructed first around a wetland depression that was later replaced with Pond 1. Source: Google Earth, 2017.



Appendix D. Shoreline Management

Native Emergent Buffer Installation

Enhancing the vegetative buffer around the perimeter of the ponds with deep-rooted native plants (Photo 15) would be a desirable strategy for stabilizing many of the eroded shorelines. The deep roots of these plants are superior to shallow-rooted turf grasses for soil stabilization. Native vegetation also provides habitat for beneficial pollinators and deters geese from nesting. This can also apply to an emergent shelf buffer, which reduces the capacity of wave erosion and reduces nutrient loading into the pond. Plants can be chosen to provide flowers depending on desired outcome and aesthetic.



Photo 15. Buffer with native vegetation.

There is a vast array of visually attractive native species that can be planted as emergent shelves in shallow aquatic areas. These plants are also important fish and wildlife nursery habitat.

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 16).
- Emergent species for less than 1 foot of water depth, including bur-reed species (*Sparganium spp.*), arrowhead (*Sagittaria spp.*, Photo 17), or blue flag iris (*Iris versicolor*, Photo 18).



Photo 16. Pickerelweed



Photo 17. Arrowhead



Photo 18. Blue flag iris



Biotechnical Stabilization

This technique involves installing a combination of structural materials and vegetation. The goal is to provide more ecological benefit and improve the long-term stability of the site through the roots of established vegetation. Coir logs or rip rap are two common structures used to initially stabilize a shoreline.

Coir Logs

Coir logs are a biodegradable material packed in netting and shaped into a log. This is placed at the base of the shoreline to reduce water velocity on the shoreline. Native vegetation is then planted up the rest of the slope (Figure 13, Photos 19, 20). These “logs” offer biodegradable shoreline protection and easy installation, but they are not effective in high water velocity areas and are moderately expensive.



Photo 19. Before - Eroding streambank.



Photo 20. After – Stabilized with coir logs.

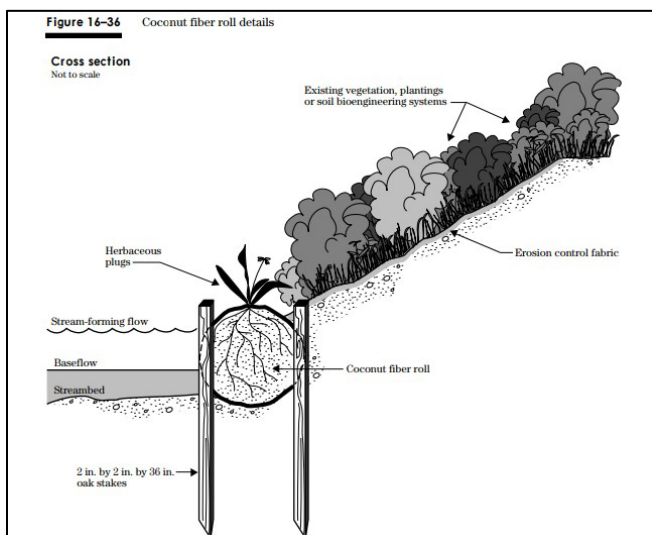


Figure 13 (left). Coir log and vegetative stabilization. USDA-NRCS EFH Chapter 16.



Rip Rap

Reinforcing the shoreline with rip rap can create a more manicured look but generally reduces habitat value. Rip rap consists of loose stone placed strategically on the shoreline to reduce erosion (Figure 14). It is typically used in areas with steep surrounding slopes, but may be used in areas exhibiting severe erosion. Rip rap is a common method for decreasing water velocity and protecting slopes from erosion. Additionally, it is easy to install and maintain. The rocks are loose, allowing them to continually conform to a changing shoreline. Rip rap is more expensive to install than solely vegetated slopes, does not provide habitat enhancement, and there is a possibility of increased erosion at the outside edges of the rip rap installation.



Photo 21. Buffer demonstration area in Round Lake

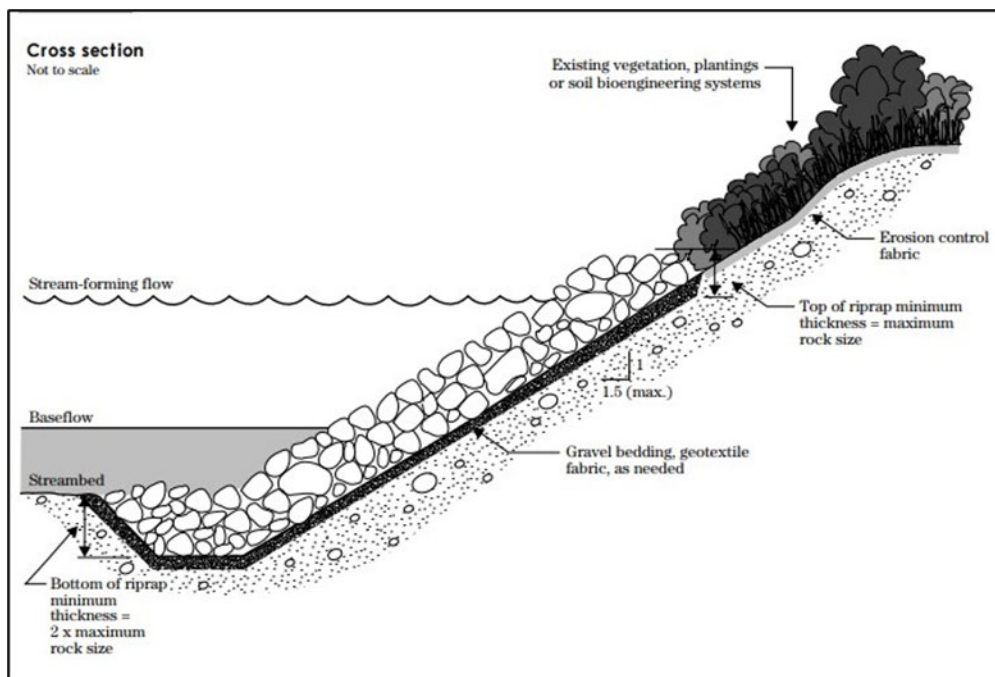


Figure 14. Rip-rap and vegetative stabilization. USDA-NRCS EFH Chapter 16.



Appendix E. 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 22). 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 23). The sediment is captured in the bag and clean water returns to the pond. 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. While there is potential to repurpose sediment to fill in areas of terrestrial property, the sediment must go through many rounds of tests to determine if it is suitable for repurposing. Sediment consistency, composition, and the presence of contaminants are all crucial information to obtain before repurposing sediment.



Photo 22. Mechanical sediment removal



Photo 23. 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 the pond 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 or lawn fertilization) and monitoring biological conditions within the pond are also vital for reducing nutrient loading.



