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Technical Memorandum

To: Commissioners, Black Dog Watershed Management Organization (BDWMO)
From: Barr Engineering Co.
Subject: 2022 Orchard Lake Habitat Monitoring
Date: April 12, 2023
Project: 23190457

This memorandum presents the results of the BDWMO's 2022 habitat monitoring of Orchard Lake.

1.0 Introduction and Background to the BDWMO Habitat Monitoring Program and Executive Summary

The BDWMO lies south of the Minnesota River in the northwest portion of Dakota County. **Figure 1** shows the subwatersheds to the BDWMO's strategic water bodies. From 2003-2009 Barr staff annually evaluated the habitat quality of all of the strategic water bodies. Beginning in 2011, the BDWMO revised the program to monitor the habitat quality at one strategic water body per year, such that the BDWMO monitors all five strategic water bodies over a five-year cycle. The 2011 through 2015 reports provided a new baseline for the strategic water bodies. The lakes and their monitoring dates are listed below:

1. Kingsley Lake: 2011, 2016, and 2021
2. **Orchard Lake: 2012, 2017, and 2022**
3. Crystal Lake: 2013 and 2018
4. Lac Lavon: 2014 and 2019
5. Keller Lake: 2015 and 2020

This report provides the results of the Orchard Lake 2022 habitat monitoring.

Habitat quality was evaluated within three vegetation zones:

- Submergent zone refers to the areas of the water body where water depths are typically 2 to 20 feet and the vegetation is typically submerged or has floating leaves.
- Emergent zone typically refers to the areas of the water body where water depths are less than 2 feet and vegetation grows out of the water.
- Upland buffer is characterized as the upland area immediately surrounding the water body.

Wildlife habitat characteristics were evaluated based on diversity of native plant communities present within each vegetation zone and an assessment of wetland functions and values. The lake was also evaluated for sedimentation and shoreline erosion problems. **Table 1** shows the 2012, 2017 and 2022 habitat quality ratings for Orchard Lake. **Table 2** provides a summary of identified problems,

recommended management activities, and past actions. Section 3.2 of this memorandum describes five recommendations which include:

1. Continue to monitor for and treat curly-leaf pondweed and Eurasian watermilfoil.
2. Continue to control and manage non-native and invasive vegetation along the shoreline and in the upland buffer.
3. Install a pre-treatment system such as a rain garden, pervious pavement, or sediment trap to collect sediment prior to discharge into the lake.
4. Improve the shoreline by increasing the width and continuity of naturalized upland buffer.
5. Re-vegetate bare areas to prevent soil erosion into Orchard Lake.

Additional detail describing the habitat assessment is provided in the technical reference section following this memorandum, which includes:

- Orchard Lake aquatic plant survey results and assessments (**Appendix A**),
- floristic quality assessment data and methods (**Appendix B**),
- previous habitat assessment monitoring results from 2003 through 2021 (**Appendix C**),
- previous recommended and completed management actions from 2003 through 2021 (**Appendix D**),
- 2012 Orchard Lake Minnesota Routine Assessment Method (MNRAM 3.4) wetland functional assessment results (**Appendix E**),
- descriptions of the MNRAM wetland functions (**Appendix F**),
- examples of shoreline and buffer restoration projects (**Appendix G**),
- buckthorn management guidelines (**Appendix H**), and
- example pollinator brochure (**Appendix I**).

2.0 Orchard Lake Habitat Monitoring

Orchard Lake is a 243-acre lake located in Lakeville. The lake is used primarily for fishing, but swimming, boating, and aesthetic and wildlife viewing are also popular recreational uses of the lake. There is a public boat access on the south shore, a public beach on the west shore, and a public park on the northeast shore of Orchard Lake. Orchard Lake outlets through the Murphy-Hanrehan Park Reserve to the Credit River. Therefore, Orchard Lake is part of the Credit River hydrologic watershed. **Figure 2** shows the 2021 aerial imagery of Orchard Lake.

2.1 Orchard Lake 2022 Habitat Monitoring Results

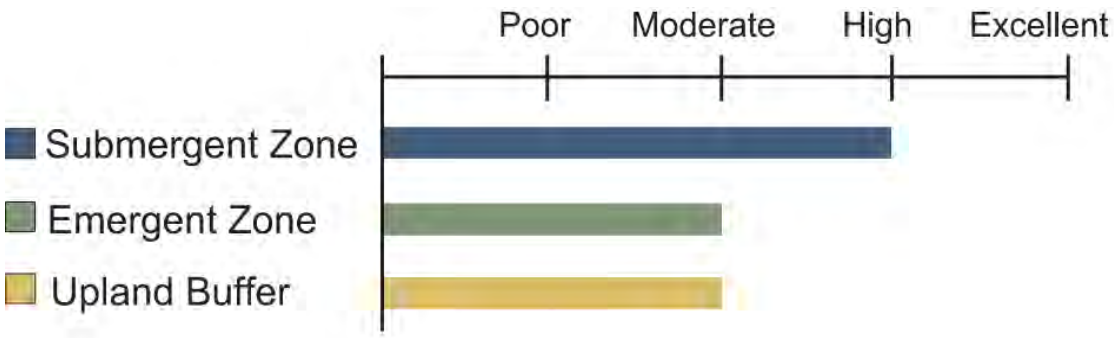
Habitat monitoring for Orchard Lake was conducted from 2003 through 2009, 2012, 2017, and 2022. The 2022 field monitoring of Orchard Lake was performed on June 6, July 20, and August 17, 2022. Vegetation

data were collected in, within, and along the fringe of Orchard Lake's three vegetation zones: (1) submergent, (2) emergent, and (3) upland.

The 2022 Orchard Lake monitoring included transect, plot, and meandering surveys. Plot locations were designated in 2003 based on representative characteristics for emergent and upland vegetation zones. Returning to the same plot locations allows for consistent comparisons over time. In addition, the 2011 revised program provides evaluation and documentation of vegetation zones along the entire shoreline. Photographs were taken to document conditions and are included at the end of this memorandum. Analysis and reporting of the monitoring data includes a floristic quality assessment and a four-tiered rating system (poor, moderate, high, and excellent). The current rating system is detailed in footnotes on **Table 1**. Private versus public ownership was identified along the entire shoreline. The survey results, along with parcel data, were used to identify possible locations for restoration and preservation.

Blue Water Science staff conducted aquatic vegetation surveys within the submergent zone on June 6 and July 20, 2022 (**Appendix A**). On August 17, Barr staff and City of Lakeville Environmental Resource Specialist Ann Messerschmidt conducted emergent vegetation and upland buffer zone surveys by walking along the shoreline. In addition, the discrete plots (shown in **Figure 2**) were monitored in the emergent zone and upland buffer, as done in 2003-2009, 2012, and 2017. **Figure 3** shows the shoreline parcels identifying private versus public ownership and plot locations. An overall quality rating for each vegetation zone was computed using the field variables evaluated in each zone. **Table 1** shows the 2012, 2017 and 2022 habitat quality ratings for Orchard Lake and **Table 2** shows the recommended management action items. (Note: previous monitoring reports provide the sampling methodology for monitoring conducted before 2011.)

The following schematic diagram shows the overall ratings in 2022 for each vegetation zone within and adjacent to Orchard Lake:



2.1.1 Orchard Lake Overall Vegetation Zone Ratings

Table 1 shows the 2012, 2017 and 2022 Orchard Lake habitat monitoring results. **Appendix C** provides habitat ratings for the Orchard Lake monitoring conducted prior to 2011.

Submergent Zone

The total number of native species in the submergent zone is **excellent** (16), the average native plant density rating is **excellent** (1.2), the average exotic species density is rated **moderate** (1.3), and the Mean Coefficient of Conservatism Value (C-Value) Rating is **moderate** (5.3). Averaging these four criteria results in a **high** rating overall for the submergent zone of Orchard Lake. This is consistent with the overall rating in 2017.

Since 1999, the City of Lakeville has contracted with Blue Water Science to conduct aquatic plant surveys twice per year. Non-native and invasive species found within Orchard Lake include curly-leaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*). Curly-leaf pondweed is common every year in Orchard Lake in the early spring. This invasive plant often out-competes native vegetation early in the growing season and dies off in early to mid-summer, which creates a sudden loss of habitat and releases nutrients into the water that can produce algal blooms and create turbid water conditions. Eurasian watermilfoil was initially found in only one location of Orchard Lake in 2017 and has since increased to 21 locations in 2022. Eurasian watermilfoil has fast growing stems and often branches out and covers the water surface, which impedes boating, makes water recreation difficult, and often shades out slower-growing native plants. The city conducts herbicide treatments annually to manage both species.

Coontail (*Ceratophyllum demersum*) is the dominant native species present in the submergent zone. Moderate and light densities of native plants were well distributed on Orchard Lake, including flatstem pondweed (*Potamogeton zosteriformis*), muskgrass (*Chara sp*.), and largeleaf pondweed (*Potamogeton amplifolius*). Filamentous algae was also present on the lake in 2022. A full list of submergent species is provided in **Appendix B**.

The Mean C-Value Rating was added to the analysis in 2011 to provide an additional assessment of floristic quality. The C-value is a numerical rating of an individual species' conservatism and habitat fidelity in relation to disturbance. C-values range from 0 to 10. Species that are least conservative, or show the least fidelity to specific natural habitats are often opportunistic invaders of natural communities, or are native species typical of disturbed communities, and are assigned a low value. For example, coontail (*Ceratophyllum demersum*) has a C-value of 2 and curly-leaf pondweed has a C-value of 0. High values indicate the species is found in undisturbed communities and has a narrow range of ecological tolerances. For example, in Orchard Lake, Fries pondweed (*Potamogeton friesii*) has a C-value of 8 and white stemmed pondweed (*Potamogeton praelongus*) has a C-value of 7. The

mean C-value for vegetation found in the submergent zone of Orchard Lake in 2022 was 5.3 (**Appendix B**). For purposes of this habitat assessment, the mean C-value and the number of species are given separate ratings, and are averaged along with the density ratings to provide an overall rating for the submergent zone. The ratings used in this assessment are based on Minnesota Pollution Control Agency (MPCA) C-value guidelines (Floristic Quality Assessment for Minnesota Wetlands, MPCA, May 2007, Floristic quality assessment/evaluating wetland vegetation | Minnesota Pollution Control Agency (state.mn.us)).

A healthy aquatic plant community is an essential part of lakes and provides many important benefits such as nutrient assimilation, sediment stabilization, and habitat for fish. Eutrophication may have detrimental effects on a lake, including reductions in the quantity and diversity of aquatic plants. The ability to assess the biological condition of a lake plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR will use this Lake Plant Eutrophication IBI to identify lakes that are likely stressed from anthropogenic eutrophication. The Plant IBI can provide important context to understanding information about water quality, shoreline health, and the fish community.

The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric. Lakes that score below the thresholds contain degraded plant communities and are likely stressed from anthropogenic eutrophication. Orchard Lake is considered a deeper lake because its maximum depth is greater than or equal to 15 feet. For deeper lakes, the number of plant species must be at least 12 and the FQI must be at least 18.6 to meet the IBI standard. The FQI is calculated by multiplying the mean C-value by the square root of the number of species. For 2022, Orchard Lake had 18 species in the submergent zone and the FQI was 22.39 (see Appendix B for more details).

In December of 2012, the MPCA published the Rapid Floristic Quality Assessment (Rapid FQA) Method, which is another method that can be used to evaluate and rate vegetation quality. The Rapid FQA method also uses the C-value, though the rating is weighted based on percent coverage and percent of each community type. However, the Rapid FQA method uses only select species in the rating. This means that many of the species found during a plant survey will not be included in the rating calculation. Because of this significant drawback, we do not recommend changing the BDWMO's assessment method to use the Rapid FQA. For information purposes only, we calculated the Rapid FQA for Orchard Lake in 2022; the results are provided in **Appendix B.**

The mean C-value was rated as **moderate** in the submergent zone, and the Rapid Floristic Quality Assessment rating was **fair** condition for floristic quality in the shallow open water community.

Emergent Zone

The overall emergent vegetation zone quality is rated **moderate** for Orchard Lake; this is the same as the overall 2017 rating. The emergent zone includes 64 native wetland plant species resulting in an **excellent** rating and percent cover of exotic species (51-75%), which is a **moderate** rating. The approximate percent cover of vegetation (51-75%) is a **high** rating. The emergent zone represents fifteen percent total areal coverage primarily located in the northeastern portion of the lake. The mean C-value rating is **poor** (2.9) and the Rapid Floristic Quality assessment calculation rates the deep marsh community as **fair** condition (**Appendix B**).

Non-native species, such as hybrid cattail (*Typha glauca*) and narrowleaf cattail (*Typha angustifolia*), are dominant within the vegetated emergent zone near the boat launch at the south end and in the northeastern portion of Orchard Lake. At the northeastern portion, the cattails are growing with many desirable native species including sedges (*Carex spp*.), rushes (*Juncus spp*.), bulrush (*Scirpus* and *Schoenoplectus spp*.), bur-reed (*Sparganium*), iris (*Iris versicolor*), bluejoint (*Calamagrostis canadensis*), and marsh fern (*Thelypteris palustris*). Channels and pools of shallow open water are present within the cattail marsh where native watershield (*Brasenia schreberi*) and bladderwort (*Utricularia macrorhiza*) are dominant. See **Appendix B** for a full vegetation list. The city installed a new culvert under railroad tracks in this area to maintain through-flow of surface hydrology. Leopard frogs, wood ducks, great blue heron, and green herons were observed during the monitoring event. The marsh areas may also provide habitat for the state threatened Blanding's turtle (*Emydoidea blandingii*).

One shoreline restoration located north of the beach area on the western side of the lake, is well maintained by the residential landowner providing aesthetically pleasing shoreline pollinator habitat and erosion protection with dense coverage of native emergent species including bluejoint, sedges, rushes, bulrush, bur-reed, iris, Joe-pye weed (*Eutrochium maculatum*), cardinal flower (*Lobelia cardinalis*), beggarticks (*Bidens*), bugleweed (*Lycopus*), water parsnip (*Sium suave*), Canadian anemone (*Anemone candensis*), sneezeweed (*Helenium autumnale*), and swamp milkweed (*Asclepias incarnata*).

Purple loosestrife (*Lythrum salicaria*) is present in the northeast portion, at the south side near the boat launch, and in a bay at the southwest side of Orchard Lake (**Appendix A** and **Figure 4**). Purple loosestrife is an invasive non-native species that has been managed for years through the release of beetles which eat the purple loosestrife plants. MNDNR monitoring of the purple loosestrife beetles previously indicated that populations are sufficient within the Twin Cities metropolitan area to keep purple loosestrife from becoming a significant problem. However, based on increases observed in recent years, we recommend requesting a status update from the MNDNR.

Upland Buffer

The overall upland buffer quality is rated **moderate** for Orchard Lake. A total of 41 native species and 24 exotic plant species were observed in the upland buffer area in 2022. Exotic plants make up greater than 40 percent of the vegetative cover. The mean C-value rating (2.2) in the upland buffer is poor (**Appendix B**).

The upland buffer in the residential properties is dominated by maintained lawn grasses with little to no naturalized vegetation. Non-native invasive species recommended for control in the upland buffer include common buckthorn (*Rhamnus cathartica*), Chinese silver grass (*Miscanthus sinensis*), and Siberian elm (*Ulmus pumila*).

Native species in a residential raingarden within the upland buffer of Orchard Lake include bee balm (*Monarda fistulosa*), black-eyed Susan (*Rudbeckia hirta*), tall coneflower (*Rudbeckia laciniata*), meadow blazing star (*Liatris ligulistylis*), and butterfly weed (*Asclepias tuberosa*).

Native tree species within upland buffer areas include silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), chokecherry (*Prunus virginiana*), several oak species (*Quercus spp.*), basswood (*Tilia americana*), and American elm (*Ulmus americana*). See **Appendix B** for a full vegetation list. Oak wilt has infected many of the oak trees in the area.

No significant erosion or sedimentation problems were noted within the lake or on the shoreline, but some shoreline areas with direct stormwater drainage from impervious surfaces into wetland and bare soil areas could be improved.

Buffer width recommendations vary according to the intended goal, such as bank stabilization, water quality protection (e.g., sediment and nutrient removal), and wildlife habitat. Even within these categories, an adequate buffer width can depend on shoreline slopes, species of wildlife to be protected, and publicized study results. For this report, the Orchard Lake shoreline buffers were evaluated against the following buffer width criteria:

- 50-foot average buffer width to protect water quality and prevent erosion
- 25-foot average buffer width (i.e., 50% of the recommended buffer width) to identify areas providing some level of benefit
- 100-foot average buffer width to protect wildlife habitat

The shoreline property ownership around Orchard Lake is about 70% residential and 30% city ownership.

For Orchard Lake residential shoreline properties:

- The average buffer width is approximately 8 feet.

- Approximately 4% have an adequate buffer width to protect water quality and prevent erosion (≥50 feet).
- Approximately 11% have at least half of the recommended buffer width to protect water quality and prevent erosion (≥25 feet).
- One residential property along the shoreline of Orchard Lake has a naturalized buffer width adequate for wildlife protection (≥100 feet).
- Approximately twenty of the residential shoreline properties on Orchard Lake do not have the potential to provide a 50-foot naturalized buffer without altering any structures. However, most of these properties could provide at least a 25-foot naturalized buffer.

For Orchard Lake city-owned public property:

- The average buffer width is approximately 20 feet.
- The buffers on the portion of the city-owned property near Klamath Trail Road average 50 feet wide. These cannot be expanded due to the location of the roadway.
- The City owned property in the boat launch area currently has a 5-foot-wide naturalized buffer, but could have a naturalized upland buffer ranging from 25 feet wide at the west side to 200 feet wide at the east side.
- At the beach area, there is a concrete retaining wall north of the beach, which extends to the edge of the water. South of the beach, the current 5-foot-wide naturalized buffer has the potential for a naturalized buffer ranging from 20 feet to as much as 100 feet wide.
- One city-owned property identified as Lakeview Gardens, located south of 168th Street West, currently has a 20-foot-wide naturalized buffer, with the potential for a 50-foot-wide naturalized buffer.
- The Wayside Park area currently has a 20-foot-wide naturalized buffer, with the potential for a 200-foot-wide naturalized buffer.

Minnesota Routine Assessment Method (MNRAM) for Wetlands

In 2012, based on the MNRAM, Orchard Lake rated **low** for overall vegetative diversity and integrity. The Orchard Lake shoreline wetland community rated **moderate** for shoreline protection. Maintenance of characteristic wildlife habitat and fish habitat were rated as **moderate** and amphibian habitat was rated as **low**. Aesthetics/recreation/education rated **high**. The MNRAM assessment also indicates that many of the integral hydrologic and land use processes that affect the lake are intact and in relatively good condition with **moderate** ratings for flood stormwater attenuation, downstream water quality, maintenance of wetland water quality, wetland sensitivity to stormwater and urban development, and additional stormwater treatment needs. The wetland management classification is **Manage 1** due to the **moderate** rating for shoreline protection. The 2012 Orchard Lake MNRAM

summary is provided in **Appendix E.** The MNRAM assessment was not repeated in 2022, as it would likely not result in significant changes from the 2012 assessment.

3.0 Orchard Lake Management Recommendations

3.1 Past and Current Actions

- ✓ The City of Lakeville conducts annual herbicide treatments to control curly-leaf pondweed and Eurasian watermilfoil in areas identified through aquatic plant survey results conducted twice per year.
- ✓ In 2010, an aeration system was installed in Orchard Pond adjacent to the southwest end of Orchard Lake, to precipitate out phosphorus and improve water quality flowing into Orchard Lake.
- ✓ The City of Lakeville installed a new culvert under railroad tracks in the northeastern portion of the shoreline to maintain through-flow of surface hydrology within deep marsh habitat.
- ✓ The City of Lakeville treated poison ivy within the Wayside Park to protect users.
- ✓ The City of Lakeville continues to monitor and control invasive species, prevent shoreline erosion, and plant native species within city owned parks, including:
  - Restoring an area of lakeshore near the boat launch using native plants.
  - Installing a concrete retaining wall north of the beach to prevent shoreline erosion.
  - Removing a dilapidated timber wall and attempting a native shoreline restoration south of the beach.
- ✓ The City of Lakeville has provided residential lakeshore owners with shoreline restoration information since 2004 and continually promotes and encourages lakeshore property owners each year to take advantage of the Dakota County SWCD Landscaping for Clean Water shoreline restoration program.
- ✓ The City of Lakeville has invited residents to attend educational workshops and view demonstration projects to show how a native upland buffer can improve functions and values of the lake and improve aesthetics.
- ✓ In 2012, because of these programs, one resident began a shoreline stabilization project and raingarden on Judicial Road that included adding native plants.
- ✓ Two raingardens and one shoreline restoration project were completed on 175th St W.

Future shoreline restoration projects (especially contiguous) on residential properties will help improve emergent and upland buffer habitat.

3.2 Recommendations

The 2022 habitat assessment results suggest several recommended management activities that could help maintain and improve the overall wildlife habitat, vegetation diversity, aesthetics, and water quality of the

lake. **Table 2** provides a summary of identified problems, recommended management activities, and past actions. The management recommendations are presented below:

1. Continue to monitor for and treat curly-leaf pondweed and Eurasian watermilfoil. See **Appendix A** for the location of these species found in 2022.

2. Continue to control and manage non-native invasive vegetation along the shoreline and in the upland buffer.

    - This work could be organized by the City of Lakeville, Orchard Lake Association, and/or volunteers involved in programs such as the Minnesota Water Stewards, Minnesota Master Naturalists, or Master Gardeners and could recruit student assistance through schools, 4H, JROTC, National Honor Society, or scouting programs (see **Potential Restoration Areas #1, 3, 5, 8, and 9, as shown in Figure 4, Appendix A**, **and photos**).

    - Based on increases of purple loosestrife observed in recent years, we recommend requesting a status update from the MNDNR (see **Figure 4** for location of abundant purple loosestrife populations).

    - Remove common buckthorn at beach area, Wayside Park, and boat launch area (see **Potential Restoration Areas #1 and #2**).

    - Remove burdock and reed canary grass in overflow swale structure at beach area (see **Potential Restoration Area #1**)

    - Remove Siberian elm at boat launch area (see **Potential Restoration Area #2**).

    - Remove Chinese silver grass at boat launch (**Potential Restoration Area #2**).

    - Consider control of non-native invasive cattail in the northeastern portion (see **Areas B and C**)**.**

3. Install a pre-treatment system such as a rain garden, pervious pavement, or sediment trap to collect sediment from impervious surfaces prior to discharge into the lake. A pre-treatment system combined with routine maintenance of sediment clean-out could help to improve lake water quality and prevent algae blooms and degradation of the vegetation community in this area. This project could potentially receive funding assistance from the Dakota County SWCD's Community Conservation Partnership Incentives program (see **Potential Restoration Area #6, as shown in Figure 4 and photos**).

4. Improve the shoreline by increasing the width and continuity of the naturalized upland buffer.

- Rather than manicured turf grass, residential shorelines and adjacent upland buffer could be vegetated with native grasses and wildflowers.

- Adjust mowing distance further away from the shoreline on the City of Lakeville properties at Wayside Park and the boat launch area near the east parking lot. The mowed lawn in the Wayside Park has dry and bare patches. This could be seeded with a fescue or a native seed mixture that would tolerate dry conditions better. Maintenance crews could also set the mower at a higher height.

- Providing a wider buffer of native vegetation could help protect water quality, prevent erosion, and improve wildlife habitat, vegetative diversity, and aesthetics, potentially through funding assistance from the Dakota County SWCD Conservation Initiative Funding Program Guidance, assistance and potential funding may be available through the Xerces Society (Pollinator Conservation Program | Xerces Society) and the Minnesota Board of Water and Soil Resources Pollinator Initiative and Lawns to Legumes Program (Pollinator Habitat | MN Board of Water, Soil Resources (state.mn.us) (see **Figure 4, Potential Restoration Areas #1 through 3, 7 and 8, and site photos**. See **Appendix G** for examples of improvements.

5. Re-vegetate bare areas by establishing native vegetation to prevent soil erosion on steep slopes and to protect water quality, prevent erosion, and improve wildlife habitat, vegetative diversity, and aesthetics.

    - Improve soil for more successful vegetation establishment south of beach area and/or strategically place stone walkways in locations where shoreline fishing and viewing is common. Directing foot traffic to these stone walkways will allow for vegetation to grow in other surrounding locations, decreasing exposed bare soil.

        - Note that maintenance crews may want to treat poison ivy at the beach area and along the paved trail adjacent to Klamath Trail to protect users.

        - Also, note that the beach area lacks recycling and trash containers; trash was evident on the ground.

    - An established canoe and kayak launch at the Wayside Park could help prevent shoreline erosion along a sloped area with bare soil that is currently being used for canoe and kayak access, and shoreline fishing.

- Property owners could potentially receive assistance for erosion and slope stabilization through funding from the Dakota County SWCD's Community Conservation Partnership Incentives program. See **Figure 4, Potential Restoration Areas #4 and #5, and site photos.**

Tables

Table 1: Orchard Lake 2012 - 2022 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone								
	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
				Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
2012	20%	**Moderate**	75%	2.0 (Moderate)	13 (High)	5.4 (Moderate)	1	1.7 (Moderate)	3.0 (Poor)
2017	20%	**High**	75%	1.2 (Excellent)	16 (Excellent)	5.2 (Moderate)	2	1.1 (Moderate)	1.5 (Moderate)
2022	20%	**High**	75%	1.2 (Excellent)	16 (Excellent)	5.3 (Moderate)	2	1.3 (Moderate)	1.5 (Moderate)

Monitoring Year	Emergent Zone						
	Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
						Number of Species	Total Exotic Emergent Percent Coverage[9]
2012	**Moderate**	5%	26-50% (Moderate)	43 (Excellent)	3.1 (Moderate)	12	51-75% (Moderate)
2017	**Moderate**	15%	51-75% (High)	50 (Excellent)	2.7 (Poor)	13	51-75% (Moderate)
2022	**Moderate**	15%	51-75% (High)	64 (Excellent)	2.9 (Poor)	14	51-75% (Moderate)

Monitoring Year	Upland Buffer								Erosion/Sedimentation	
	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Number of Species	Percent of Total Coverage[15]		
2012	**Poor**	<10 ft. (Poor)	>95% (High)	19 (Moderate)	1.6 (Poor)	0-25% (Poor)	20	>40% (Poor)	0-10%	No
2017	**Moderate**	<10 ft. (Poor)	>95% (High)	25 (High)	1.9 (Poor)	0-25% (Poor)	21	>40% (Poor)	0-10%	No
2022	**Moderate**	<10 ft. (Poor)	>95% (High)	41 (Excellent)	2.2 (Poor)	0-25% (Poor)	24	>40% (Poor)	0-10%	No

Table 1: Orchard Lake 2012-2022 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2022 monitoring and analysis:

- Monitor one water body per year. Orchard Lake in 2012, 2017, and 2022, Kingsley Lake in 2011, 2016, and 2021, Crystal Lake in 2013 and 2018, Lac Lavon in 2014 and 2019, Keller Lake in 2015 and 2020 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2022 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2011 through 2022 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3.
[3]Density data for Orchard Lake were collected by Blue Water Science using a stratified line transect survey throughout the lake.
[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season. However, curlyleaf pondweed was treated prior to the survey of density ratings.
[5]The Total Number of Native Species within the submergent zone for Orchard Lake was collected by Blue Water Science using a stratified line transect survey, and additional species documented by Barr.
The additional category of "High" was added in 2011 through 2022 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.
[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Orchard Lake 2012-2022 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three plot locations and a visual survey walking around the water body. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.

[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 plot locations, and a visual survey walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.

[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on three plot locations, and a visual survey walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)

[10]**Overall Upland Buffer Quality** is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.

[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.

[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on three plot locations and a meandering visual survey along the shoreline.

[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.

[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.

[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Table 2 2022 Recommended and Completed Management Actions for Orchard Lake – Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Submergent zone contains non-native and invasive vegetation. Curly-leaf pondweed is common in early spring. Eurasian watermilfoil is present since 2017.	Continue to monitor the extent and density of curly-leaf pondweed and Eurasian watermilfoil.	Treat curly-leaf pondweed and Eurasian watermilfoil where growth is predicted to be heavy. See **Appendix A** Aquatic Plant Survey for more details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	From 1999-2022, the City of Lakeville contracts Blue Water Science to conduct aquatic plant surveys twice per year. Curly-leaf pondweed was harvested annually from 2004-2009 Herbicide treatments were conducted annually from 2009-2012, and 2015-2022 for control of curly-leaf pondweed. Herbicide treatments were conducted annually from 2017-2022 for control of Eurasian watermilfoil.
Emergent zone and upland buffer areas contain non-native and invasive vegetation.	Continue to control and manage non-native and invasive vegetation, including, but not limited to purple loosestrife, reed canary grass, cattail, common buckthorn, Chinese silver grass, and Siberian elm.	Continue to control and manage non-native and invasive vegetation. Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide. **See Figure 4, Potential Restoration Areas #1 and #2**. Small colonies of purple loosestrife can be hand pulled or dug before plants go to seed. **See Figure 4 for purple loosestrife locations**. The MN DNR may require a permit for cattail treatment and purple loosestrife, if below the OHW. Dense invasive cattail is located at **Areas B and C**. Treat or remove non-native invasive vegetation and then seed with an appropriate native seed mix.	Increase wildlife habitat, improve vegetative diversity and aesthetics.	Spring-Fall	Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up with MnDNR to verify whether beetles are still present at a population that the MnDNR feels is appropriate for biological control. The City of Lakeville continues to monitor for invasive species.
Stormwater drainage from impervious surfaces is directed into the lake.	Pre-treat or redirect stormwater for infiltration prior to discharge.	Install a rainwater garden, pervious pavement, or other suitable method for infiltration. **See Figure 4, Potential Restoration Area #6.**	Improve water quality	Open	Two raingardens were completed on 175th St W. In 2010, adjacent to the southwest end of the lake, an aeration system was installed in Orchard Pond to precipitate out phosphorus and improve water quality flowing into Orchard Lake.
Upland buffer areas lacking naturalized vegetation.	Increase width and continuity of native upland buffer.	Rather than manicured turf grass, gravel, and managed plantings with bare soil, the shoreline could be vegetated with native grasses and wildflowers. Adjust mowing distance further away from shoreline on City properties. **See Figure 4 and Site Photos, Potential Restoration Areas #1- 8**. See Appendix G for examples of improvements.	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring – Fall	2004 through 2022: The City of Lakeville annually provides lakeshore owners with shoreline restoration information and encourages homeowners to take advantage of the Dakota County SWCD Landscaping for Clean Water shoreline restoration program. Two residential shoreline restoration projects have been completed. One is located north of the beach area, and one is on 175th St. W. The City of Lakeville restored an area of lakeshore, near the boat launch, using native plants.
Bare soil along shoreline could cause erosion and sedimentation into lake.	Re-vegetate bare areas to prevent soil erosion and sedimentation into Orchard Lake.	Improve soil and plant vegetation along shoreline to prevent erosion. Establish a canoe and kayak access at Wayside Park. **See Figure 4 and Site Photos, Potential Restoration Areas #4 and #5**.	Improve water quality	Spring - Fall	The City of Lakeville removed a dilapidated timber wall and attempted a shoreline restoration south of the beach; however, the soil was too poor for the plantings to become established. North of the beach, a concrete wall was built to prevent shoreline erosion.

Figures

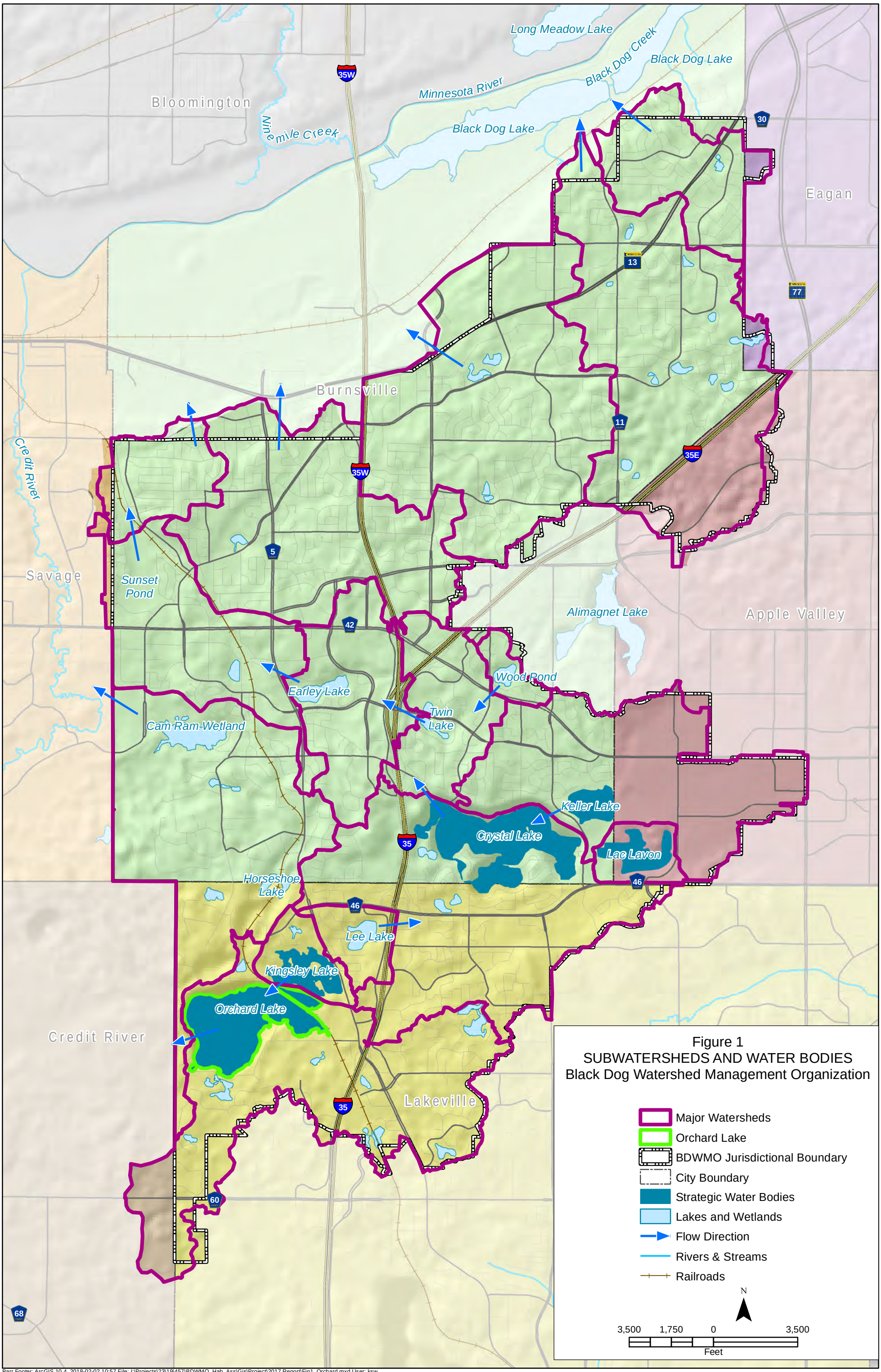


Figure 1
SUBWATERSHEDS AND WATER BODIES
Black Dog Watershed Management Organization

- Major Watersheds
- Orchard Lake
- BDWMO Jurisdictional Boundary
- City Boundary
- Strategic Water Bodies
- Lakes and Wetlands
- Flow Direction
- Rivers & Streams
- Railroads

N

3,500 1,750 0 3,500
Feet

Barr Footer: ArcGIS 10.4, 2018-02-02 10:57 File: I:\Projects\23\19\457\BDWMO_Hab_Ass\Gis\Project\2017 Report\Fig1_Orchard.mxd User: ksw

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2021 Dakota County Aerial Imagery

N

Feet

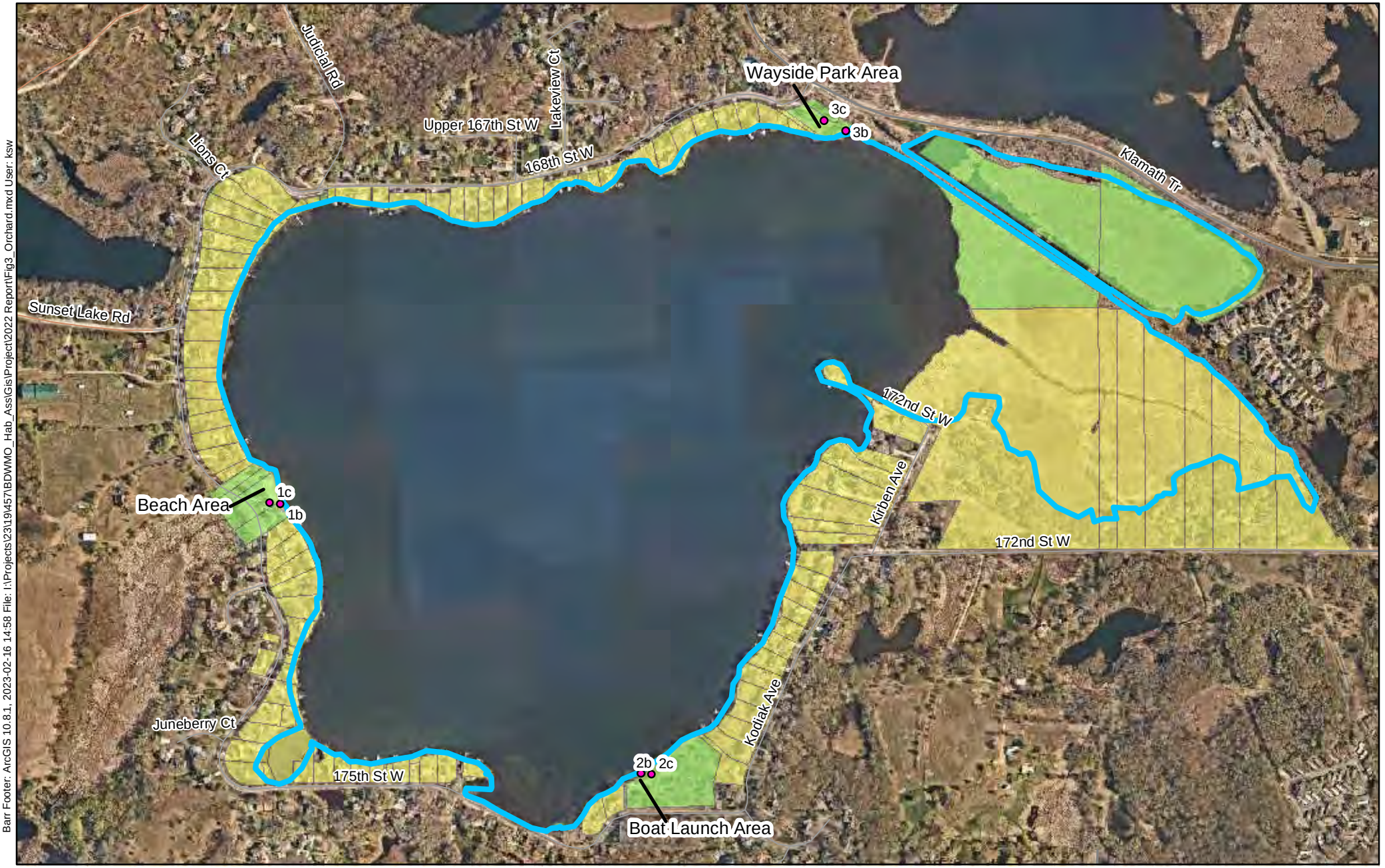
700 350 0 700

Plot Location

Orchard Lake

Figure 2

ORCHARD LAKE
2021 AERIAL IMAGERY AND PLOT LOCATIONS
Black Dog WMO
Lakeville, MN



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2021 Dakota County Aerial Imagery

- Plot Location
- Orchard Lake
- Residential Property
- City of Lakeville Property

N

Feet

700 350 0 700

Figure 3

ORCHARD LAKE
PLOT LOCATIONS AND PARCEL OWNERSHIP
Black Dog WMO
Lakeville, MN

2021 Dakota County Aerial Imagery

Potential Restoration Areas

Residential Property (Potential Restoration Area #8, nearly all Residential Properties)

City of Lakeville Property

Purple Loosestrife (observed in 2012, 2017, and 2022)

N

Feet

700 350 0 700

Figure 4

ORCHARD LAKE
POTENTIAL RESTORATION AREAS
AND PURPLE LOOSESTRIFE LOCATIONS
Black Dog WMO
Lakeville, MN

Photos

Orchard Lake and Shoreline August 17, 2022

Submergent Zone – beach area

Plot 1B Emergent Zone – beach area

Plot 1C Upland Buffer – beach area - Potential Restoration Area #1

Submergent Zone – boat launch area

Plot 2B Emergent Zone – boat launch area

Plot 2C Upland Buffer – boat launch area – Potential Restoration Area #2

Submergent Zone – Wayside Park Area

Plot 3B – Emergent Zone – Wayside Park area

Plot 3C – Upland Buffer – Wayside Park area – Potential Restoration Area #3


Potential Restoration Area #4 – Beach Area – Dilapidated timber retaining wall was taken out and shoreline restoration attempted but failed. Would need soil improvement to be successful. And/or consider placing stone walkways to establish designated shoreline fishing and viewing areas.


Timber wall was replaced by concrete wall at north end of beach area. Poor vegetation establishment and trash above the concrete.

Potential Restoration Area #5 - An established canoe and kayak access at the Wayside Park could help prevent shoreline erosion in this location.

Potential Restoration Area #6 - Stormwater drainage from the road is directed into the lake. A barrier, pre-treatment, and/or naturalized upland buffer could help improve water quality.

Typical residential shorelines lacking naturalized vegetation in the emergent zone and upland buffer
Potential Restoration Area #8 – Nearly All Residential Shoreline properties

Non-native invasive vegetation recommended for removal:

Siberian elm at boat launch area

Chinese silver grass at boat launch area

Purple loosestrife at boat launch area

Purple loosestrife in Area C

Burdock and reed canary grass in overflow swale at beach area

Buckthorn at Wayside Park


A new culvert under railroad tracks was installed under railroad tracks to maintain flow through of surface hydrology between Areas B and C.

A bike trail and bench northeast of Orchard Lake provide recreational and aesthetic viewing opportunities.

Examples of naturalized vegetation which provides wildlife habitat and water quality protection.

Well maintained successful residential shoreline restoration and raingarden north of beach area

Technical Reference

(Provided in separate report)