Black Dog Watershed Management Commission

AGENDA
Wednesday, April 19, 2023
5:00 P.M.

COMMISSIONERS:
Curt Enestvedt, Chair
Mike Hughes, Vice Chair
Scott Thureen, Secretary/Treasurer
Rollie Greeno
Lynette Dunsworth
Greg Helms, Alternate
Natalie Walker, Alternate

I. Approval of Agenda

II. Approval of Minutes – February 15, 2023

III. Approval of Accounts Payable

IV. Review Budget Performance Reports

V. Review 2022 Lac Lavon Water Quality Report

VI. Review 2022 Orchard Lake Habitat Monitoring Report

VII. Review 2022 Watershed Annual Report (Newsletter)

VIII. Miscellaneous

IX. Adjournment

BLACK DOG
Watershed Management Organization

Agenda Background
April 19, 2023

I. Approval of Agenda

Agenda enclosed.

Action Requested: A motion be considered to approve the Agenda.

II. Approval of Minutes from the February 15, 2023 Meeting

Minutes enclosed.

Action Requested: A motion be considered to approve the Minutes of the February 15, 2023 meeting.

III. Approval of Accounts Payable

Accounts payable list enclosed.

Action Requested: A motion be considered to approve the accounts payable list as submitted by staff.

IV. Review of Budget Performance Reports

Current Budget Performance Reports enclosed.

Action Requested: No formal action required

V. Review the 2022 Lac Lavon Water Quality Report

In 2022 Barr Engineering performed increased water quality monitoring on Lac Lavon. Staff from Barr will review the monitoring performed and the results of the monitoring at the meeting. Enclosed in your packet is a copy of the report. The technical memo provides information that most people will find beneficial. The technical reference document provides more detailed information and data

Action requested: Consider a motion accepting the report with any suggested edits at the meeting.

VI. Review 2022 Orchard Lake Habitat Monitoring Report

Habitat Monitoring was performed on Orchard Lake in 2022. Barr Engineering staff will review this report at the meeting. A copy of the report is enclosed in the packet. The technical memo provides information that most people will find beneficial. The technical reference document provides more detailed information and data.

Action Requested: Commissioners consider a motion accepting the report with any suggested edits at the meeting.

VII. Review 2022 Watershed Annual Report (Newsletter)

Enclosed in the packet is a copy of the draft 2022 Annual Watershed Report. Barr staff will go over the report at the meeting and gather comments from staff and Commissioners.

Action requested: Consider a motion approving the 2022 Annual Watershed Report with any approved changes discussed at the meeting.

VIII. Miscellaneous

IX. Adjournment

BLACK DOG
Watershed Management Organization

DRAFT
Meeting Minutes
February 15, 2023

MEMBERS PRESENT
Curt Enestvedt, Chair
Mike Hughes, Vice Chair
Scott Thureen, Secretary/Treasurer
Rollie Greeno *(arrived 5:01pm)*
Lynette Dunsworth

MEMBERS ABSENT
Natalie Walker, Alternate
Greg Helms, Alternate

OTHERS PRESENT
Karen Chandler – Barr Engineering
Jared Shepherd – Campbell Knutson
Samantha Berger – City of Apple Valley
Ann Messerschmidt – City of Lakeville
Daryl Jacobson – BDWMO Administrator
Tammi Carte – BDWMO Secretary

Curt Enestvedt, Chair, called the February 15, 2023 meeting to order at 5:00 pm.

I. Approval of Agenda

Motion by Thureen, second by Hughes, to approve the February 15, 2023 Agenda as presented.

Ayes – Enestvedt, Hughes, Thureen, Dunsworth
Nays – None

Motion Carried Unanimously

II. Approval of Minutes from the January 18, 2023 Meeting

Motion by Hughes, second by Greeno, to approve the January 18, 2023 Minutes as presented.

Ayes – Enestvedt, Hughes, Thureen, Dunsworth, Greeno
Nays – None

Motion Carried Unanimously

III. Approval of Accounts Payable

Motion by Greeno, second by Hughes, to approve accounts payable to Barr Engineering in the amount of $3,099.22 for services from December 31, 2022 through January 27, 2023; and, to Campbell Knutson in the amount of $630.00 for January 2023 general services; and, to the City of Burnsville in the amount of $24,032.91 for 2022 support services; and, to Dakota County Soil & Water Conservation District in the amount of $1,005.00 for website maintenance and Landscaping for Clean Water.

Ayes – Enestvedt, Hughes, Thureen, Dunsworth, Greeno
Nays – None

Motion Carried Unanimously

IV. Review Budget Performance Reports

Daryl Jacobson, BDWMO Administrator, shared the Commission's finances are good.

No Formal Action Required

V. Approval of $12,000 Amendment to the 2023 Budget for Barr Engineering to Develop a Tracking Tool for Measurable Goals

A copy of the amended 2023 budget was provided to the Commission for review prior to tonight's meeting. The amendment increases Barr's section of the budget by $12,000 and includes language for developing a goal tracking tool. All other areas of the budget have been updated to account for this $12,000 increase.

This funding was approved with the 2022 budget as part of the plan update. The amendment simply moves these funds to the 2023 budget allocating the expense to this year. It is not a request to increase spending.

Motion by Hughes, second by Thureen, to amend the 2023 budget for Barr Engineering by $12,000 to develop a tracking tool for measurable goals.

Ayes – Enestvedt, Hughes, Thureen, Dunsworth, Greeno
Nays – None

VI. Miscellaneous

1. The next meeting is scheduled for March 15, 2023. This meeting may be canceled due to multiple Commissioners being unavailable to attend the meeting.

VII. Adjournment

Motion by Greeno, second by Hughes, to adjourn at 5:07 pm.

Ayes – Enestvedt, Hughes, Thureen, Dunsworth, Greeno
Nays – None

Motion Carried Unanimously

BLACK DOG
Watershed Management Organization

Accounts Payable - April 19, 2023 Meeting

Barr Engineering - Services from January 28, 2023 through March 31, 2023

Engineering	$	2,361.72
Special Projects: General Fund - 2022 Water Quality Monitoring - Lac Lavon	$	571.50
Special Projects: General Fund - 2023 Mang Level Mon - Keller Lake	$	290.50
Water Quality Monitoring - 2022 Orchard Lake Habitat Monitoring	$	6,075.00
Water Quality Monitoring - Update Trend Analyses	$	270.00
Public Education - Watershed Annual Report	$	1,990.00
	$	**11,558.72**

Campbell Knutson

General Services - January 2023	$	210.00
	$	**210.00**

Dakota County Soil & Water Conservation District - Services for July 2022 - September 2022

Website Updates & Maintenance	$	212.50
Landscaping for Clean Water Workshops	$	5,950.00
Technicial Assistance - Landscaping for Clean Water Grants - 7 Projects	$	1,750.00
Technicial Assistance Landscaping for Clean Water - 7 Projects	$	3,500.00
	$	**11,412.50**

Dakota County Soil & Water Conservation District - Services for October 2022 - December 2022

Website Updates & Maintenance	$	270.00
Website Hosting	$	900.00
	$	**1,170.00**

Accounts Payable Total $ 24,351.22

resourceful. naturally.
engineering and environmental consultants

BARR

Remittance address:
Lockbox 446104
PO Box 64825
St Paul, MN 55164-0825

April 10,, 2023

Black Dog Watershed Management Commission
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

Attn: Mr. Daryl Jacobson

RE: Engineering & Environmental Consulting Services

Invoice of Account with
BARR ENGINEERING COMPANY

For professional services during the period of January 28, 2023 through March 31, 2023

TOTAL PAYABLE THIS INVOICE:	**$ 11,558.72**
Allocation:	
Engineering	**$ 2,361.72**
Special Projects: General Fund	
• **Reporting on Lac Lavon 2022 Water Qual Mon**	**$ 571.50**
• **Reporting on Keller Lake 2023 Mang Level Mon**	**$ 290.50**
Water Quality Monitoring	
• **Reporting on 2022 Orchard Lake Habitat Mon**	**$ 6,075.00**
• **Update Trend Analyses**	**$ 270.00**
Public Education	
• **Watershed Annual Report**	**$ 1,990.00**

4-10-23

Barr declares under the penalties of law that this account, claim, or demand is just and that no part of it has been paid.

Karen L. Chandler

Karen L. Chandler
Vice President

BUDGET SUMMARY - 2023 FY
Black Dog Watershed Management Commission
through March 31, 2023

Work Description	Pre-2023 Costs	2023 Barr Budget	Current Invoice	Spent This Year	Balance
Engineering	-----	43,000.00 [1]	2,361.72	3,798.44	39,201.56
Special Projects: General Fund					
Reporting on Lac Lavon 2022 Water Quality Monitoring	-----	4,700.00	571.50	1,116.00	3,584.00
Keller Lake 2023 Management Level Monitoring		19,100.00	290.50	290.50	18,809.50
Subtotal -- Special Projects: General Fund	-----	23,800.00	862.00	1,406.50	22,393.50
Water Quality Monitoring					
Reporting on 2022 Orchard Lake Habitat Monitoring	-----	9,200.00	6,075.00	6,525.00	2,675.00
Update Trend Analyses	-----	2,000.00	270.00	270.00	1,730.00
Subtotal -- W.Q. Monitoring	-----	11,200.00	6,345.00	6,795.00	4,405.00
Public Education					
Watershed Annual Report	-----	4,500.00	1,990.00	2,658.00	1,842.00
Annual Activity Report (BWSR)	-----	2,100.00	0.00	0.00	2,100.00
Subtotal -- Public Education	-----	6,600.00	1,990.00	2,658.00	3,942.00
Total Services	-----	84,600.00	11,558.72	14,657.94	69,942.06

Notes:

[1] 2023 budget increase from $31,000 to $43,000 authorized at 2/15/2023 meeting for BDWMO Plan goal tracking

INVOICE

Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Remittance address:
Lockbox 446104
PO Box 64825
St Paul, MN 55164-0825

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

April 10, 2023
Invoice No: 23190374.23 - 2

Total this Invoice $4,351.72

Regarding: BDWMO 2023 Engineering Services

Professional Services from January 28, 2023 to March 31, 2023

Job: 2023 Engineering Services

Task: 001 Attend BDWMO Meetings

Labor Charges

		Hours	Rate	Amount	
Vice President					
Chandler, Karen		1.50	200.00	300.00	
		1.50		300.00	
Subtotal Labor					**300.00**

Expense Charges

Travel				
2/15/2023	Chandler, Karen	Mileage	15.72	
Subtotal Expenses				**15.72**
		Task Subtotal		**$315.72**

Task: 002 Miscellaneous Consulting

Labor Charges

	Hours	Rate	Amount	
Vice President				
Chandler, Karen	8.40	200.00	1,680.00	
Support Personnel II				
Nypan, Nyssa	.60	110.00	66.00	
Young, Jayne-Anne	.90	150.00	135.00	
	9.90		1,881.00	
Subtotal Labor				**1,881.00**
		Task Subtotal		**$1,881.00**

Task: 004 Newsletter/Watershed Report

Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

Labor Charges

	Hours	Rate	Amount	
Vice President				
Chandler, Karen	3.30	200.00	660.00	
Support Personnel I				
Kaul (Contracted), Karen	14.00	95.00	1,330.00	
	17.30		1,990.00	
Subtotal Labor				**1,990.00**
			Task Subtotal	**$1,990.00**

Task: 005 BDWMO Plan Goal Tracking

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Williams, Sterling	1.00	165.00	165.00	
	1.00		165.00	
Subtotal Labor				**165.00**
			Task Subtotal	**$165.00**
			Job Subtotal	**$4,351.72**
			Total this Invoice	**$4,351.72**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**4,351.72**	**2,104.72**	**6,456.44**	**2,104.72**	**4,351.72**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Karen Chandler, your Barr project manager, at (952) 832-2813 or email at kchandler@barr.com.

INVOICE

Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Remittance address:
Lockbox 446104
PO Box 64825
St Paul, MN 55164-0825

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

April 10, 2023
Invoice No: 23190375.23 - 2

Total this Invoice	**$862.00**

Regarding: Management Level Water Quality Monitoring

Professional Services from January 28, 2023 to March 31, 2023

Job: KEL Keller Lake 2023 Water Quality Monitorin

Task: 100 Monitoring Data Mgmt & Proj Mgmt

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Olson, Terri	.70	160.00	112.00	
Technician II				
Melmer, David	1.70	105.00	178.50	
	2.40		290.50	
Subtotal Labor				**290.50**
			Task Subtotal	**$290.50**
			Job Subtotal	**$290.50**

Job: LAC Lac Lavon 2022 Reporting

Task: 100 Letter Report

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist II				
Menken, Kevin	4.00	135.00	540.00	
Engineer / Scientist / Specialist I				
Hankard, Madeline	.30	105.00	31.50	
	4.30		571.50	
Subtotal Labor				**571.50**
			Task Subtotal	**$571.50**
			Job Subtotal	**$571.50**
			Total this Invoice	**$862.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**862.00**	**544.50**	**1,406.50**	**544.50**	**862.00**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Kevin Menken, your Barr project manager, at (952) 832-2794 or email at kmenken@barr.com.

Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

INVOICE

Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Remittance address:
Lockbox 446104
PO Box 64825
St Paul, MN 55164-0825

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

April 10, 2023
Invoice No: 23190457.23 - 2

Total this Invoice	**$6,075.00**

Regarding: Orchard Lake 2022 Reporting

Professional Services from January 28, 2023 to March 31, 2023

Job: ORCH Orchard Lake 2022 Reporting

Task: 001 Analysis, Report & Presentation

Labor Charges

	Hours	Rate	Amount	
Vice President				
Chandler, Karen	1.50	200.00	300.00	
Engineer / Scientist / Specialist III				
Rattei, Margaret	1.20	150.00	180.00	
Wold, Karen	37.30	150.00	5,595.00	
	40.00		6,075.00	
Subtotal Labor				**6,075.00**
			Task Subtotal	**$6,075.00**
			Job Subtotal	**$6,075.00**
			Total this Invoice	**$6,075.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**6,075.00**	**450.00**	**6,525.00**	**450.00**	**6,075.00**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Karen Wold, your Barr project manager, at (952) 832-2707 or email at kwold@barr.com.

Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

INVOICE

Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Remittance address:
Lockbox 446104
PO Box 64825
St Paul, MN 55164-0825

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

April 10, 2023
Invoice No: 23190375.99 - 10

Total this Invoice	**$270.00**

Regarding: Trend Analysis

Professional Services from January 28, 2023 to March 31, 2023

Job: 2023 2022 Data

Task: 100 Trend Analysis 2022 Data

Labor Charges

	Hours	Rate	Amount
Engineer / Scientist / Specialist II			
Menken, Kevin	2.00	135.00	270.00
	2.00		270.00

Subtotal Labor **270.00**

Task Subtotal **$270.00**

Job Subtotal **$270.00**

Total this Invoice **$270.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**270.00**	**5,505.00**	**5,775.00**	**5,505.00**	**270.00**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Greg Wilson, your Barr project manager, at (952) 832-2672 or email at gwilson@barr.com.

Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

CAMPBELL KNUTSON
Professional Association
Attorneys at Law
Federal Tax I.D. #41-1562130
Grand Oak Office Center I
860 Blue Gentian Road, Suite 290
Eagan, Minnesota 55121
(651) 452-5000

Black Dog Watershed Management Organization
Attention: Daryl Jacobson
City of Burnsville
100 Civic Center Parkway
Burnsville MN 55337-3817

February 28, 2023
Account # 602-0000G
383

RE: GENERAL SERVICES
RENDERED TO DATE:

			HOURS	
02/02/2023	JDS	Email from T. Carte re: meetings; email to Carte re: same.	0.20	35.00
	JJJ	Review agenda; emails from and to Tammi re: transition; follow-ups.	0.30	52.50
02/15/2023	JDS	Attend meeting.	0.70	122.50
		AMOUNT DUE	1.20	210.00
		TOTAL CURRENT WORK		210.00
		PREVIOUS BALANCE		$630.00
02/21/2023		Payment - thank you		-630.00
		TOTAL AMOUNT DUE		$210.00

OK
3-7-23

Amounts due over 30 days will be subject to a finance charge of .5% per month (or an annual rate of 6%). Minimum charge - 50 cents.

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT

Dakota County Soil & Water Conservation District
4100 220th Street West, Ste 102
Farmington, MN 55024
(651) 480-7777
DakotaSWCD.Accounting@CO.Dakota.MN.US

Invoice

DATE	INVOICE #
10/13/2022	3228

BILL TO
Black Dog WMO Daryl Jacobson, Administrator 13713 Frontier Court Burnsville, MN 55337

Agreement	BILLING PERIOD	TERMS
2022 Agreement	Jul - Sep 2022	Net 30 Days

DESCRIPTION	HRS/COUNT	RATE	AMOUNT
EDUCATION AND ASSISTANCE OUTREACH Website Updates and Maintenance	2.5	85.00	212.50
Landscape for Clean Water Workshops (50% of Annual Workplan - 2nd half)	1	5,950.00	5,950.00
TECHNICAL ASSISTANCE AND COST SHARE Landscaping for Clean Water Grants: Vinar, Dayus, Anderson, Knutsen, Therior, Grannes and Adams (7 Projects @ $250 each)	7	250.00	1,750.00
Technical Assistance for Landscaping for Clean Water (7 Projects @ $500 each)	7	500.00	3,500.00

OK
2-21-23

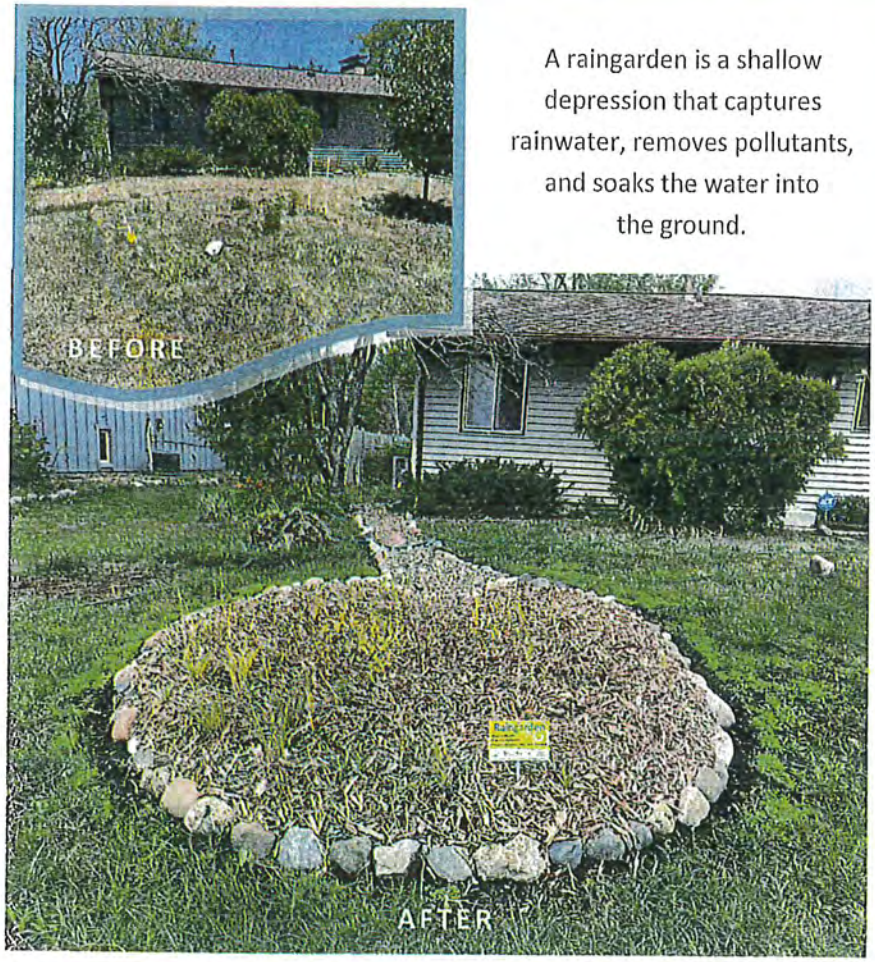
It's been a pleasure working with you!

Total $11,412.50

PROJECT FACTSHEET

GRANNES
RESIDENTIAL RAINGARDEN

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT



A raingarden is a shallow depression that captures rainwater, removes pollutants, and soaks the water into the ground.

PROJECT: Installation of a 160 square foot residential raingarden.

COST: Project materials cost estimated at $826

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:
Baldwin Drive
Apple Valley

PRACTICE:
- Raingarden

BENEFITS:
- Runoff volume reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:
- Black Dog Watershed Management Organization

WATERSHED:
- Black Dog

INSTALLATION:
- Summer 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 8/31/2022

PROJECT FACTSHEET

VINAR
RESIDENTIAL RAINGARDEN

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT

A raingarden is a shallow depression that captures rainwater, removes pollutants, and soaks the water into the ground.

PROJECT: Installation of a 113 square foot residential raingarden.

COST: Project materials cost estimated at $920

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:
Dana Drive
Burnsville

PRACTICE:

- Raingarden

BENEFITS:

- Runoff volume reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

- Spring 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 6/16/2022

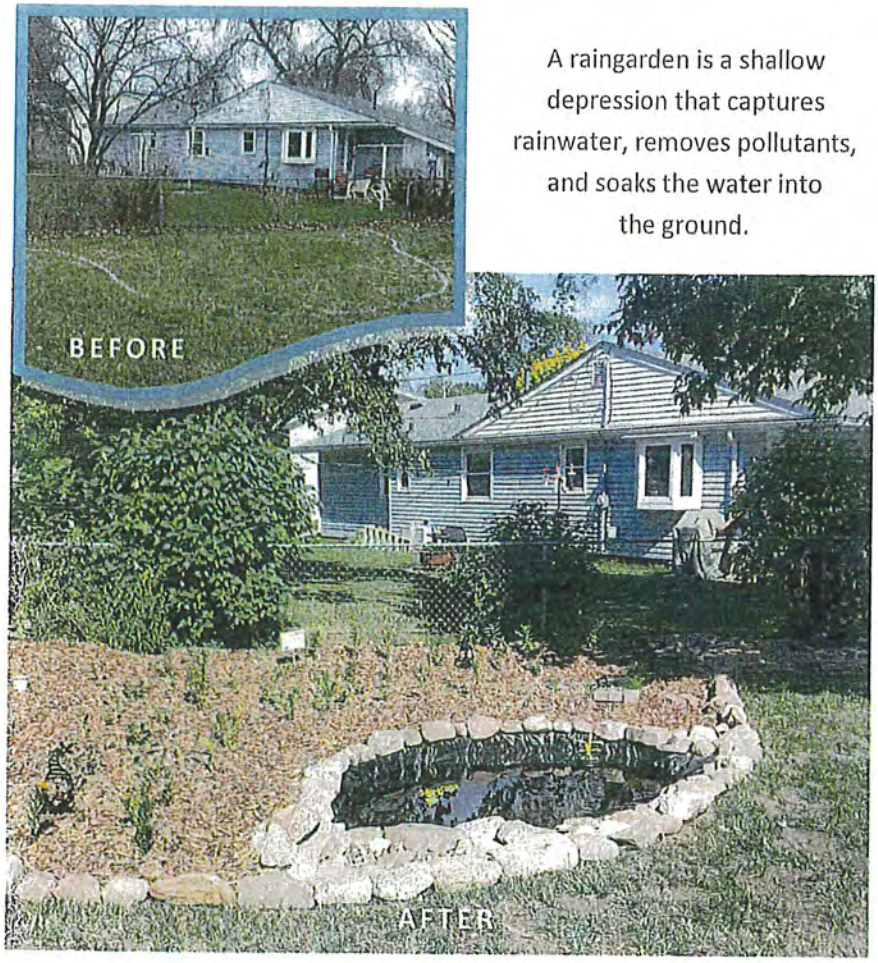
PROJECT FACTSHEET

DAYUS

RESIDENTIAL RAINGARDEN

DAKOTA COUNTY

SOIL & WATER CONSERVATION DISTRICT



A raingarden is a shallow depression that captures rainwater, removes pollutants, and soaks the water into the ground.

PROJECT: Installation of a 250 square foot residential raingarden.

COST: Project materials cost estimated at $941

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:

Strese Lane
Apple Valley

PRACTICE:

- Raingarden

BENEFITS:

- Runoff volume reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

- Spring 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 6/24/2022

PROJECT FACTSHEET

WALKER-ANDERSON RESIDENTIAL NATIVE GARDEN

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT

A native garden, also called natural landscaping, uses plants, trees and grasses that are suitable for growth in a particular geographical area

PROJECT: Installation of a 250 sq. ft. residential native garden.

COST: Project materials cost estimated at $343

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:

Judicial Road
Burnsville

PRACTICE:

- Native Garden

BENEFITS:

- Runoff volume reduction
- Slope stabilization
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

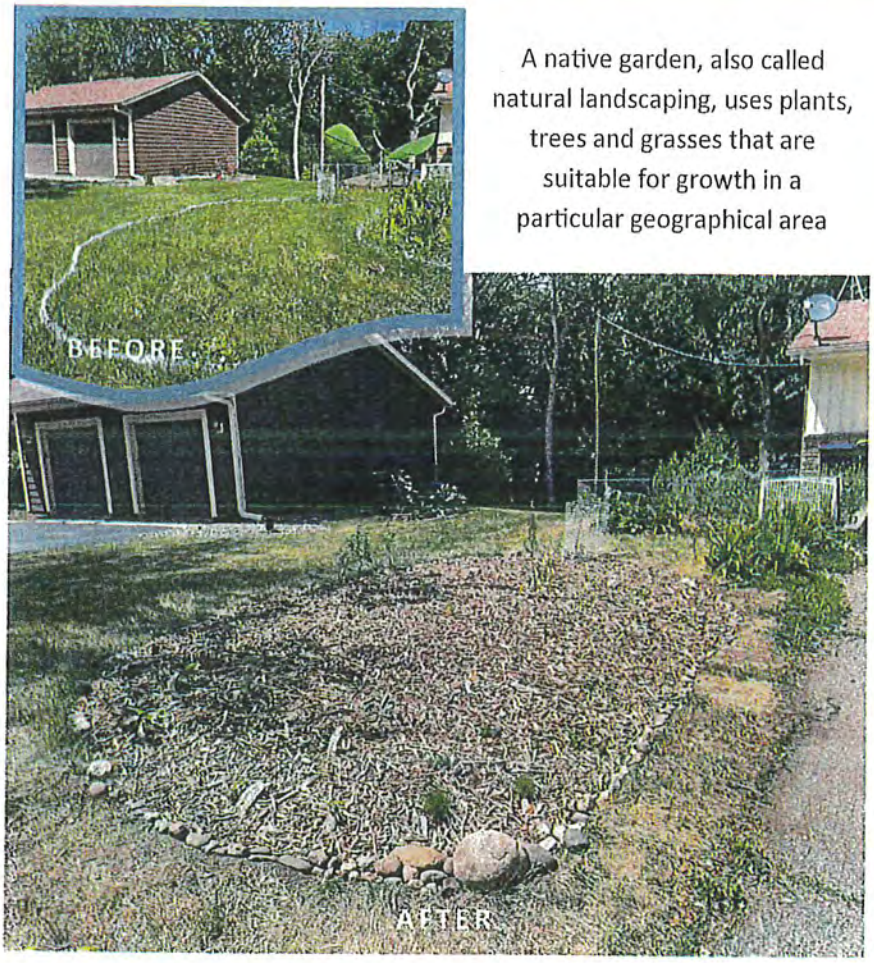
- Summer 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 7/7/2022

PROJECT FACTSHEET

KNUTSEN
RESIDENTIAL NATIVE GARDEN

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT



A native garden, also called natural landscaping, uses plants, trees and grasses that are suitable for growth in a particular geographical area

PROJECT: Installation of a 200 sq. ft. residential native garden.

COST: Project materials cost estimated at $276

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:

161st Street West
Lakeville

PRACTICE:

- Native Garden

BENEFITS:

- Runoff volume reduction
- Slope stabilization
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

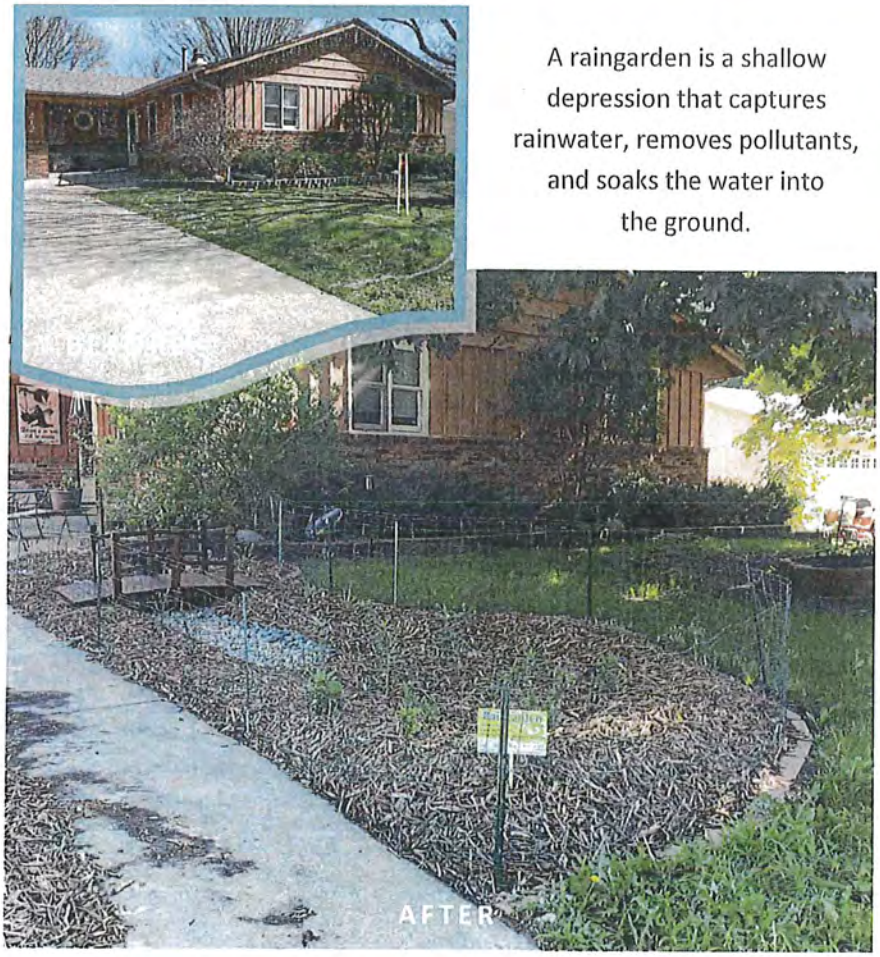
- Summer 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 7/7/2022

PROJECT FACTSHEET

THERIOR RESIDENTIAL RAINGARDEN

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT



A raingarden is a shallow depression that captures rainwater, removes pollutants, and soaks the water into the ground.

PROJECT: Installation of a 150 square foot residential raingarden.

COST: Project materials cost estimated at $1,081

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:
Heritage Circle South
Burnsville

PRACTICE:

- Raingarden

BENEFITS:

- Runoff volume reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

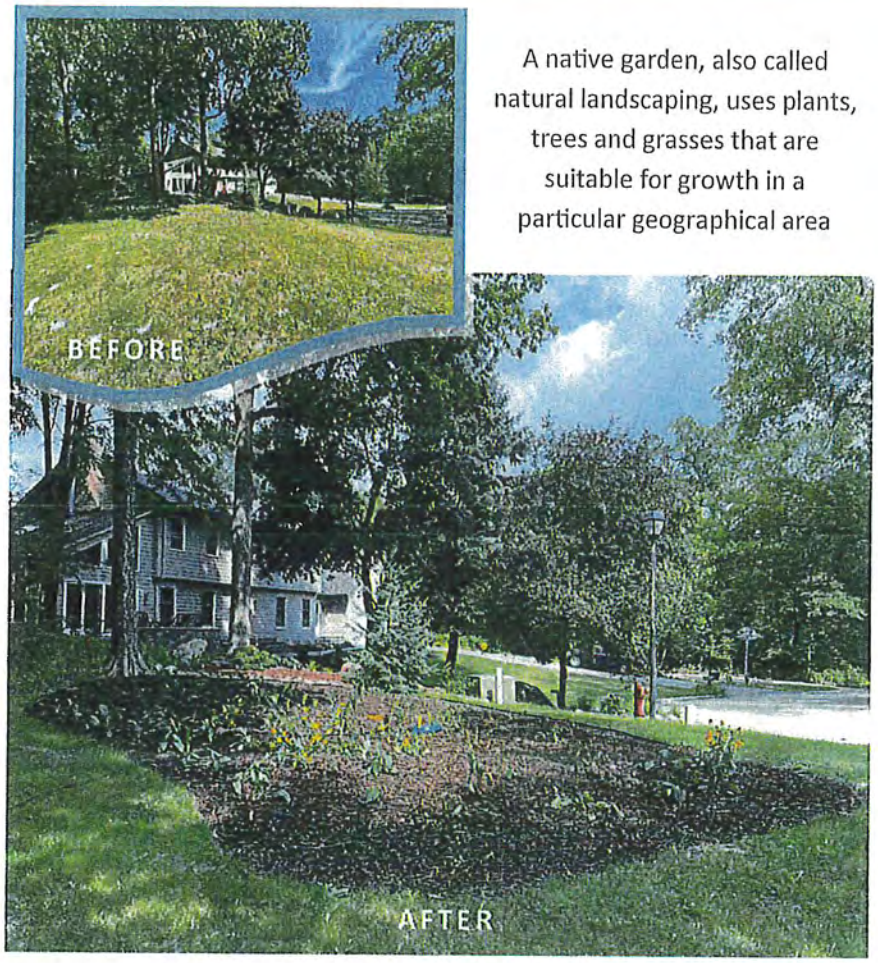
- Summer 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 7/28/2022

PROJECT FACTSHEET

ADAMS
RESIDENTIAL NATIVE GARDEN

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT



A native garden, also called natural landscaping, uses plants, trees and grasses that are suitable for growth in a particular geographical area

PROJECT: Installation of a 250 sq. ft. residential native garden.

COST: Project materials cost estimated at $974

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

BLACK DOG
Watershed Management Organization

LOCATION:

Woods Trail South
Burnsville

PRACTICE:

- Native Garden

BENEFITS:

- Runoff volume reduction
- Slope stabilization
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

- Summer 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 8/31/2022

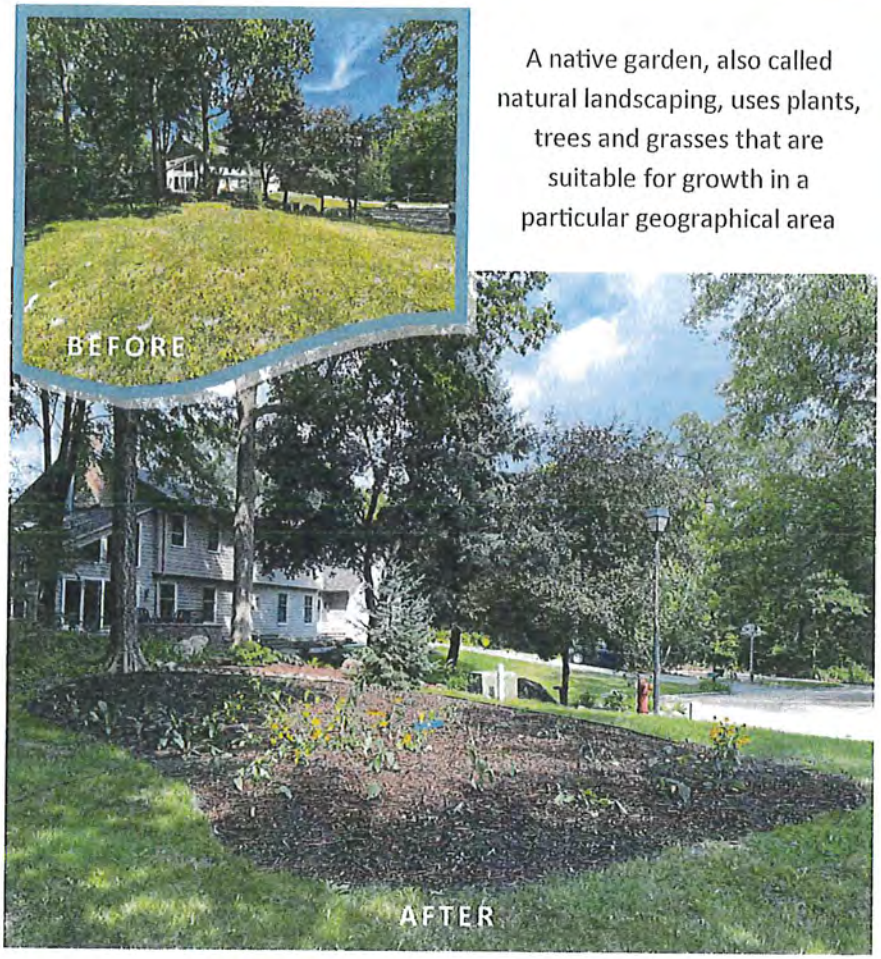
PROJECT FACTSHEET

ADAMS

RESIDENTIAL NATIVE GARDEN

DAKOTA COUNTY

SOIL & WATER CONSERVATION DISTRICT



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WATERSHED:

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- Summer 2022

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 8/31/2022

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT

Dakota County Soil & Water Conservation District
4100 220th Street West, Ste 102
Farmington, MN 55024
(651) 480-7777
DakotaSWCD.Accounting@CO.Dakota.MN.US

Invoice

DATE	INVOICE #
4/3/2023	3280

BILL TO

Black Dog WMO
Daryl Jacobson, Administrator
13713 Frontier Court
Burnsville, MN 55337

Agreement	BILLING PERIOD	TERMS
2023 Agreement	Jan - Mar 2023	Net 30 Days

DESCRIPTION	HRS/COUNT	RATE	AMOUNT
EDUCATION AND ASSISTANCE OUTREACH			
Website Updates and Maintenance	3	90.00	270.00
Fee: Website Hosting	1	900.00	900.00
Landscaping for Clean Water Intro Class	0	3,600.00	0.00
Landscaping for Clean Water Design Course	0	7,200.00	0.00
Landscaping for Clean Water Maintenance Workshop	0	1,800.00	0.00
TECHNICAL ASSISTANCE			
Landscaping for Clean Water Technical Assistance	0	500.00	0.00
COST SHARE			
Landscaping for Clean Water Grant	0	250.00	0.00

OK
4-6-23

It's been a pleasure working with you!

Total $1,170.00

BLACK DOG WMO
CASH ACTIVITY REPORT 2023

Date	Description	Deposits		Check #	Check Amount	Monthly Cash Balance	Expenditures: General Engineering Support	Special Projects (General)	Special Projects (Capital)	Special Projects (Gen. Reserve)	Insurance	Legal & Audit	Admin Support	Public Education	Water Quality Monitoring	Conf Public	Contin-gency
	Balance as of 12/31/22					**533,464.61**											
18-Jan	Barr Engineering Co (2022)			1797	7,639.50		2,155.00	1,832.00		3,130.50					522.00		
18-Jan	Campbell Knutson (2022)			1798	175.00							175.00					
18-Jan	Metropolitan Counci -Enviro Srvc (2022)			1799	3,420.00										3,420.00		
31-Jan	Interest Income	1,880.84															
	01/31/22 Balance	1,880.84			11,234.50	**524,110.95**	2,155.00	1,832.00	-	3,130.50	-	175.00	-	-	3,942.00	-	-
15-Feb	Barr Engineering Co			1800	3,099.22		1,436.72	544.50						668.00	450.00		
15-Feb	Campbell Knutson			1801	630.00							630.00					
15-Feb	City of Burnsville (2021)			1802	24,032.91								24,032.91				
15-Feb	Dakota County Soil & Water (2021)			1803	1,005.00									1,005.00			
28-Feb	Interest Income	1,759.91															
	02/28/22 Balance	1,759.91			28,767.13	**497,103.73**	1,436.72	544.50	-	-	-	630.00	24,032.91	1,673.00	450.00	-	-
31-Mar	Interest Income	1,977.10															
	03/31/22 Balance	1,977.10			-	**499,080.83**	-	-	-	-	-	-	-	-	-	-	-
	Total Revenue	5,617.85	**Total Expense**		40,001.63		3,591.72	2,376.50	-	3,130.50	-	805.00	24,032.91	1,673.00	4,392.00	-	-
	Less: 2022 A/R	-	**Less: 2022 A/P**		(36,272.41)		(2,155.00)	(1,832.00)	-	(3,130.50)	-	(175.00)	(24,032.91)	(1,005.00)	(3,942.00)	-	-
	December LMC insurance reclass	-			-												
	Total YTD 2023 Revenue	5,617.85	**Total YTD 2023 Exp**		3,729.22		1,436.72	544.50	-	-	-	630.00	-	668.00	450.00	-	-
			2023 Budget		158,200.00		43,000.00	37,300.00	-	-	2,500.00	5,000.00	24,000.00	25,700.00	15,200.00	500.00	5,000.00
			Budget Remaining		154,471.00		41,563.00	36,755.50	-	-	2,500.00	4,370.00	24,000.00	25,032.00	14,750.00	500.00	5,000.00
	YTD Interest Income	*5,617.85*															

BLACK DOG WATER MANAGEMENT COMMISSION

Budget Performance Report
March 31, 2023

	CURRENT MONTH	YEAR TO DATE			
	ACTUAL	GENERAL FUND BUDGET	CAPITAL IMPROVEMENT FUND BUDGET	ACTUAL	VARIANCE FAVORABLE (UNFAVORABLE)
Opening Fund Balance		$ 393,703	$ 103,489	$ 497,192	
REVENUES :					
Member Contributions:					
City of Apple Valley	$ -	$ 10,412	$ 992	$ -	$ (11,404)
City of Burnsville	-	94,014	9,186	-	(103,200)
City of Eagan	-	586	-	-	(586)
City of Lakeville	-	25,988	2,322	-	(28,310)
Total Member Contributions	-	131,000	12,500	-	(143,500)
Other Revenues:					
Interest	$ 1,977	$ 40	$ -	$ 5,618	$ 5,578
Grant (State of MN BWSR)	-	-	-	-	-
Total Other Revenue	1,977	40	-	5,618	5,578
Total Revenues	$ 1,977	$ 131,040	$ 12,500	$ 5,618	$ (137,922)
EXPENDITURES :					
General Engineering Support	$ -	$ 43,000	$ -	$ 1,437	$ 41,563
Special Projects - General Fund	-	37,300	-	545	36,756
Special Projects - Capital Improvement Func	-	-	-	-	-
Special Projects - General Fund Reserve	-	-	-	-	-
Insurance	-	2,500	-	-	2,500
Legal and Audit	-	5,000	-	630	4,370
Administrative Support	-	24,000	-	-	24,000
Public Education	-	25,700	-	668	25,032
Water Quality Monitoring	-	15,200	-	450	14,750
Conference/Publications	-	500	-	-	500
Contingency	-	5,000	-	-	5,000
Total Expenditures	-	158,200	-	3,729	154,471
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	1,977	(27,160)	12,500	1,889	
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES PLUS OPENING FUND BALANCE				499,081	

TOTAL CASH AVAILABLE 3/31/2023	499,081
Fund Balance 3/31/2023	$ 499,081

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: Black Dog Watershed Management Organization (BDWMO)
From: Kevin Menken, Barr Engineering
Subject: Lac Lavon 2022 Water Quality Assessment
Date: April 11, 2023
Project: 23190375

This memorandum presents the results of 2022 management-level water quality monitoring of Lac Lavon, as well as discussion of aquatic macrophyte surveys conducted in June and August 2022. Management-level water quality monitoring was conducted by Barr Engineering Co. (Barr) on behalf of the BDWMO in 2022. Monitoring was also performed by a citizen volunteer participating in the Metropolitan Council sponsored Citizen Assisted Monitoring Program (CAMP).

Introduction and Background

Lac Lavon lies on the Burnsville/Apple Valley border, and its 184-acre watershed encompasses portions of both Burnsville and Apple Valley. The only surface water outlet from Lac Lavon is a 12-inch diameter emergency overflow outlet to Keller Lake. A valve controls the flows in the overflow pipe; normally the valve is closed. Lac Lavon is unique in that it is an abandoned gravel pit and therefore not part of the original Minnesota Department of Natural Resources (MDNR) public waters inventory. However, the MPCA considers Lac Lavon to be a fully-supporting deep lake that can be listed on the impaired waters list.

The lake's primary water source is groundwater. Lac Lavon's surface area is approximately 60 acres, with 65 percent of the lake less than 15 feet (4.6 meters) deep, and a maximum depth of approximately 32 feet (9.8 meters).

The Lac Lavon watershed land use is low density residential and park. Two city parks are located on Lac Lavon —a City of Burnsville park on the west shore, and a City of Apple Valley park on the northeast shore. Very little, if any, change in land use development is expected in the Lac Lavon watershed. Lac Lavon is used for a variety of recreational purposes, including fishing, swimming, aesthetic viewing, and wildlife habitat. The City of Burnsville park has access for launching canoes and the City of Apple Valley park has a path to a fishing pier on the shoreline. These park amenities provide for most of the recreational use of the lake. There is no public boat ramp for launching trailered boats on Lac Lavon.

The City of Apple Valley has conducted fish surveys (years 2020 and 2022) and fish stocking (2020) on Lac Lavon. The Lac Lavon fish community includes bluegill, northern pike, black crappies, hybrid sunfish, pumpkin-seed sunfish, largemouth bass, and bullhead. In 2020, a total of 500 walleye and 500 largemouth bass were stocked in Lac Lavon.

2022 Water Quality Monitoring Activities

The 2012 BDWMO Watershed Management Plan calls for "management-level" water quality monitoring of Lac Lavon once every three years. Management-level monitoring involves a more detailed collection of water quality data than the Metropolitan Council's Citizen-Assisted Monitoring Program (CAMP). This expanded effort was conducted by Barr in 2022 and included collection of the following data:

- Measurement of Secchi disc transparency (a measure of water clarity).
- Field probe measurements of water temperature, dissolved oxygen concentration, specific conductivity, and pH levels at 1-meter depth intervals.
- Composite water samples from the surface of Lac Lavon (0–2 meters); these samples were sent to RMB Environmental Laboratories for analyses of total phosphorus and chlorophyll *a* concentrations. Chlorophyll *a* is a pigment that algae use for photosynthesis, and concentrations indicate the abundance of algae in the water. Phosphorus is the nutrient that drives algae growth in most Minnesota lakes.
- Water samples from 3 meters to 9 meters, taken at 1-meter depth intervals; these samples were sent to RMB Environmental Laboratories for analyses of total phosphorus concentrations.

Also, a citizen volunteer conducted CAMP water quality monitoring in 2022. The volunteer collected three samples in May, one sample in June, and one sample in August, but did not collect samples in July or September. Tabulated water quality data collected by Barr (Table 2) and the CAMP volunteer (Table 3) are attached at the end of this memorandum.

The 2022 Barr and CAMP measurements of Secchi disc transparency (SDT), total phosphorus, and chlorophyll *a* measurements are plotted in Figure 1, with Barr and CAMP data identified separately. Chlorophyll *a* and total phosphorus results were overall similar between Barr and CAMP measurements, with the exception of late-May. The CAMP total phosphorus and chlorophyll *a* measurements collected on May 30 were much lower compared to Barr measurements collected on May 24 and June 7. Barr measurements of SDT were generally lower (worse) than CAMP measurements throughout the season. SDT measurements are somewhat subjective, and can be influenced by time of day of measurements (e.g., wave action and sun angle). Barr measurements of SDT have been lower (worse) than CAMP measurements in previous years (2019) as well. Observed differences in Barr and CAMP measurements of total phosphorus and chlorophyll *a* concentrations could be due to the manner of sample collection – a composite of top 2 meters of lake water (Barr) versus dipping a sample bottle below the lake surface (CAMP).

Summer Averages of Water Quality Parameters and Associated Goals

The 2022 summer (June-September) averages of water quality parameters were calculated for Lac Lavon and plotted with previous years' summer averages. The summer averages for Secchi disc transparency,

total phosphorus, and chlorophyll *a* are plotted in Figure 2. The 2012 BDWMO Watershed Management Plan classified Lac Lavon as a Category I water body (supporting swimming and other direct contact recreational activities). The water quality action level for summer average (June-September) Secchi disc transparency (SDT) for Lac Lavon in 2022 is 4.0 meters (13.1 feet), determined by calculating the 25th percentile of the most recent 10-years of SDT summer averages. When a statistical trend analysis indicates that water transparency has degraded beyond this level (i.e., SDT less than 4.0 meters), then a diagnostic study of potential causes is recommended according to the BDWMO's 2012 Watershed Management Plan. The summer average SDT in 2022 was 3.5 meters (11.5 feet), which is worse than the action level of 4.0 meters. However, there was no statistically significant trend in summer average SDT for the most recent 10-year period. There were no statistically significant trends in summer averages of total phosphorus and chlorophyll *a* for the most recent 10-year period, and summer averages of SDT, total phosphorus, and chlorophyll *a* all indicate continued excellent water quality in Lac Lavon. Based on results of 2022 water quality monitoring and considering that the BDWMO's 2022 Watershed Management Plan no longer relies on action levels, a diagnostic study of Lac Lavon is not required or recommended.


Figure 1a: Lac Lavon 2022 Total Phosphorus
Total Phosphorus (µg/L)
25
20
15
10
5
0
4/1/22
5/2/22
6/2/22
7/3/22
8/3/22
9/3/22
10/4/22
Barr
CAMP

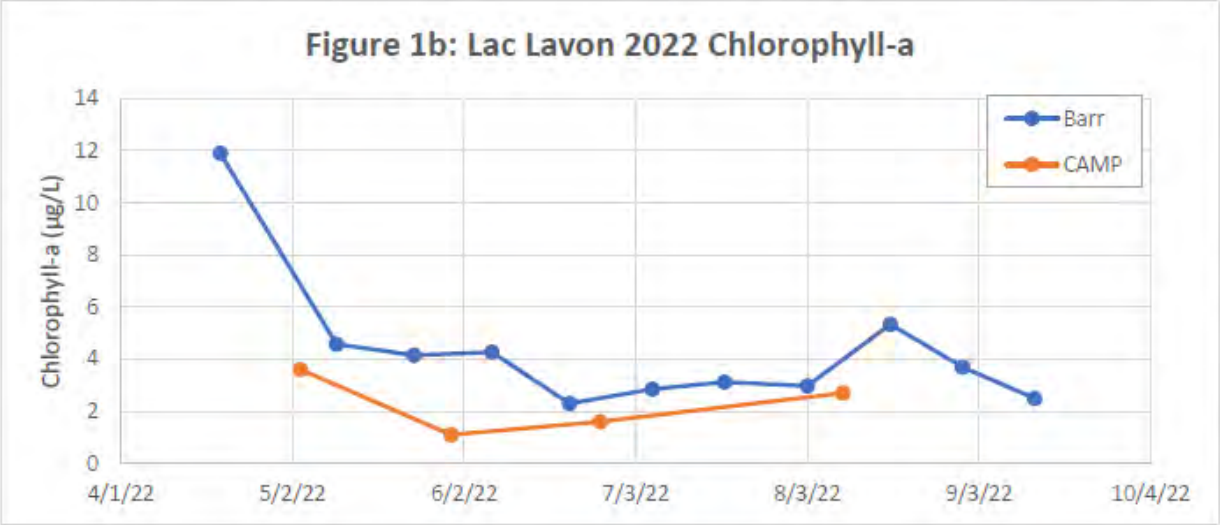


Figure 1b: Lac Lavon 2022 Chlorophyll-a
Chlorophyll-a (µg/L)
14
12
10
8
6
4
2
0
4/1/22
5/2/22
6/2/22
7/3/22
8/3/22
9/3/22
10/4/22
Barr
CAMP


Figure 1c: Lac Lavon 2022 Secchi Disc Transparency
4/1/22
5/2/22
6/2/22
7/3/22
8/3/22
9/3/22
10/4/22
SDT (m)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Barr
CAMP

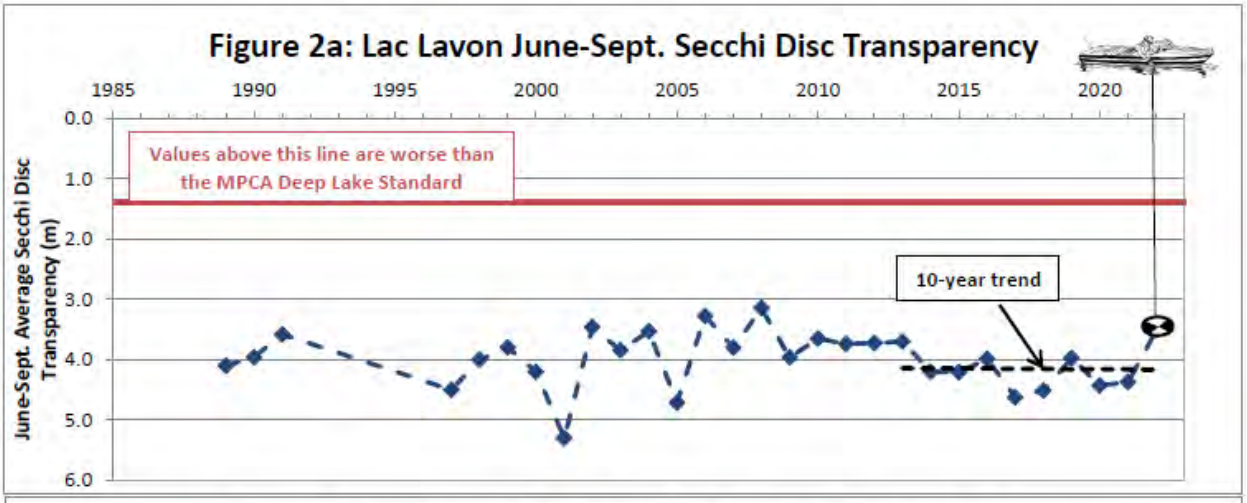


Figure 2a: Lac Lavon June-Sept. Secchi Disc Transparency
June-Sept. Average Secchi Disc Transparency (m)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
1985
1990
1995
2000
2005
2010
2015
2020
Values above this line are worse than the MPCA Deep Lake Standard
10-year trend

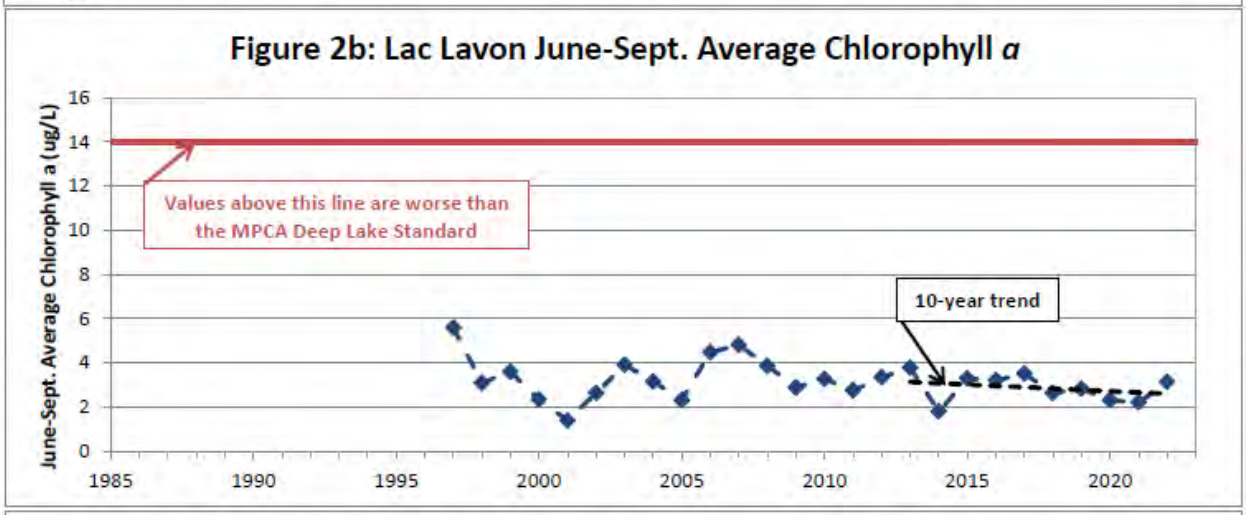


Figure 2b: Lac Lavon June-Sept. Average Chlorophyll a
June-Sept. Average Chlorophyll a (ug/L)
0
2
4
6
8
10
12
14
16
1985
1990
1995
2000
2005
2010
2015
2020
Values above this line are worse than the MPCA Deep Lake Standard
10-year trend

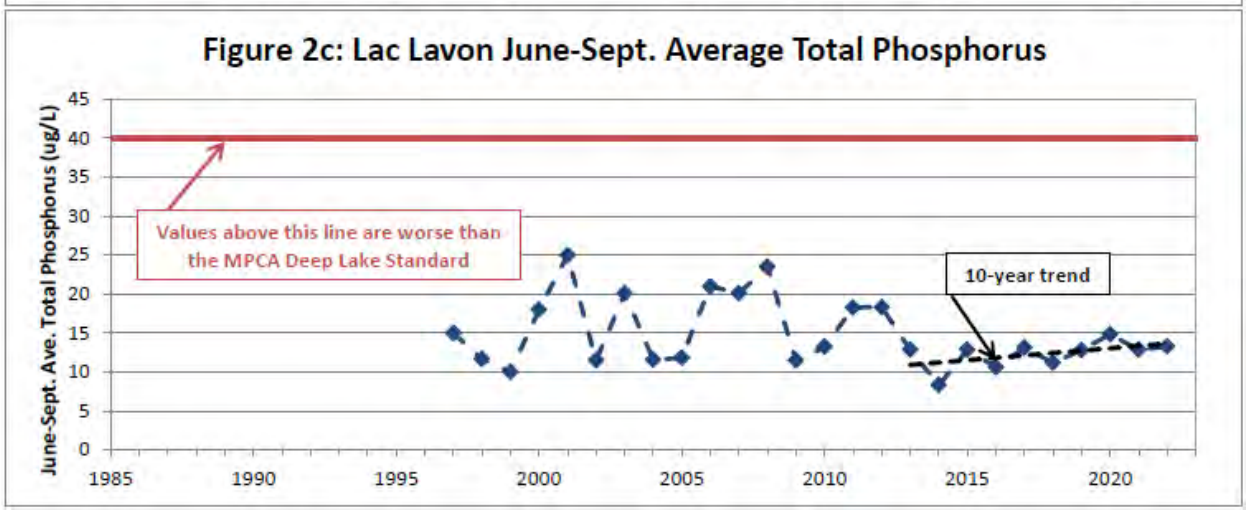


Figure 2c: Lac Lavon June-Sept. Average Total Phosphorus
June-Sept. Ave. Total Phosphorus (ug/L)
0
5
10
15
20
25
30
35
40
45
1985
1990
1995
2000
2005
2010
2015
2020
Values above this line are worse than the MPCA Deep Lake Standard
10-year trend

The MPCA's lake eutrophication standards include numeric criteria for summer averages (June-September) of Secchi disc transparency, total phosphorus concentrations, and chlorophyll *a* concentrations. The eutrophication standards for a deep lake within the North Central Hardwood Forest ecoregion are provided in Table 1, along with the averages of the most recent 10 years (2013-2022) of monitoring for Lac Lavon. Summer averages of Lac Lavon water quality parameters are consistently much better than the MPCA's lake eutrophication standards.

Table 1 Lac Lavon Water Quality and the MPCA's Lake Eutrophication Standards for Deep Lakes in North Central Hardwood Forest

Water Quality Parameter	MPCA Lake Eutrophication Standard	Lac Lavon 10-yr Average (2013-2022)
Total Phosphorus (µg/L)	≤ 40	12
Chlorophyll *a* (µg/L)	≤ 14	3
Secchi Disc Transparency (m)	≥ 1.4	4.2

Aquatic Plant (Macrophyte) Surveys

Barr contracted with Endangered Resource Services, LLC to conduct point-intercept surveys in June and August of 2022. Aquatic plant (macrophyte) surveys have previously been completed by Barr staff in 2013, 2014, and 2016; and by Endangered Resources Services in 2019. A total of 11 aquatic plant species were identified in 2022, including 8 native species. Three non-native aquatic invasive plants were also identified in Lac Lavon: curly-leaf pondweed, Eurasian watermilfoil, and brittle naiad. Purple loosestrife, an emergent plant that is also an aggressive non-native species, has been found along the shoreline of Lac Lavon. Brittle naiad (*Najas minor*) had not been reported in the 2019 point-intercept surveys, but had been reported in Lac Lavon as far back as 2003. It had also been observed in the lake in years 2013, 2014, and 2016.

Brittle naiad was observed at multiple locations in Lac Lavon during the August 2016 survey. Unlike curly-leaf pondweed and Eurasian watermilfoil, which have infested numerous Minnesota lakes, brittle naiad has only been reported in a total of six Minnesota lakes, according to MDNR web page on the invasive plant (https://www.dnr.state.mn.us/invasives/aquaticplants/brittlenaiad/index.html). Brittle naiad grows much shorter than curly-leaf pondweed and Eurasian watermilfoil (both of which can create dense surface mats); and does not appear to be growing at nuisance levels in Lac Lavon. Because brittle naiad does not grow very tall, and more easily breaks into small fragments (it truly is "brittle"), it may not show up on the plant rake during surveys even when present, and it's possible its abundance is underreported. It can be transferred to other waterbodies by plant fragments stuck to boats or equipment, or by tiny seeds in mud stuck to boots, anchors, etc.

Eurasian watermilfoil, and the native plant coontail, were the two most abundant plants in both the June and August 2022 surveys. Curly-leaf pondweed was the 3rd most abundant plant during the June survey, but had diminished by the August survey. The mid-summer die-off of curly-leaf pondweed is typical, as it

begins growing much earlier in the spring and dies back earlier in summer than native plants, which can release nutrients and contribute to worse water quality in mid- to late-summer when abundant.

Photograph 1. Non-native Brittle naiad in Lac Lavon, August 10, 2022

In June 2022, curly-leaf pondweed was found at 29% of sampling points with plant growth. No curly-leaf pondweed was observed in August 2022. Curly-leaf pondweed can create dense, nuisance growths, and can also have negative impacts on water quality due to its earlier seasonal life cycle than native aquatic plants. Curly-leaf pondweed dies back in early to mid-summer, resulting in the release of phosphorus from the decaying plant tissue, as well as consumption of oxygen due to decomposition. The decrease in oxygen can further lead to phosphorus release from lake sediments. The water quality of Lac Lavon remained excellent throughout the summer months; therefore, curly-leaf pondweed does not appear to be degrading Lac Lavon water quality.

Eurasian watermilfoil can create dense, nuisance growths at the lake surface, and have a negative impact on recreational activities, including swimming and boating. Eurasian water milfoil may also crowd out native plant species. Eurasian watermilfoil was found at 65% of sampling points with plant growth in June 2022, and 82% in August 2022.

The Floristic Quality Index (FQI) was calculated for the submergent plant zone of Lac Lavon. The FQI utilizes species richness (the number of different species present) and the Mean Coefficient of Conservatism (C-value) for the observed species. A higher C-value is given to species that are sensitive to anthropogenic disturbances or eutrophication, while a lower C-value is given to species that are

opportunistic invaders or do well in disturbed environments, including degraded water quality associated with eutrophication. Four species were identified in June 2022 that have a C-value of 7 or higher, and would therefore be considered indicative of good water quality: muskgrass, Nitella, small pondweed, and white water crowfoot. Four species were identified in August with a C-value of 7 or higher: long-leaf pondweed (not identified in June), Southern naiad (not identified in June), muskgrass, and small pondweed. Nitella and white water crowfoot were not encountered in August. The Mean C-Value rating was determined to be moderate (5.6) in June and moderate (5.6) in August. The June FQI was 16.7 and the August FQI was 17.7.

Lake Levels

Lac Lavon has no regularly flowing outlet (landlocked), and the lake level changes in response to precipitation, evaporation, and groundwater flux. City of Apple Valley staff collected lake elevation data for years 2010-2014, and 2018-2021. Water surface elevations were not measured in 2022, but were observed to be low during summer water quality monitoring visits. During the period of monitoring, the lake elevation has fluctuated from a low of 927.6 feet on June 2, 2010 to a high of 934.13 feet on May 6, 2021, a difference of 6.53 feet (Figure 3). The high lake levels flooded the path leading to the fishing dock in years 2019-2021 (Photograph 2). Many landlocked lakes in the Twin Cities experienced high water levels in 2019-2021 due to record-breaking precipitation in years 2019-2020, combined with above-average precipitation in prior recent years. The last two years have seen below average precipitation, and lave levels have come down, including in Lac Lavon. By August 2022, the receding water levels were visible along the lakeshore (Photograph 3).

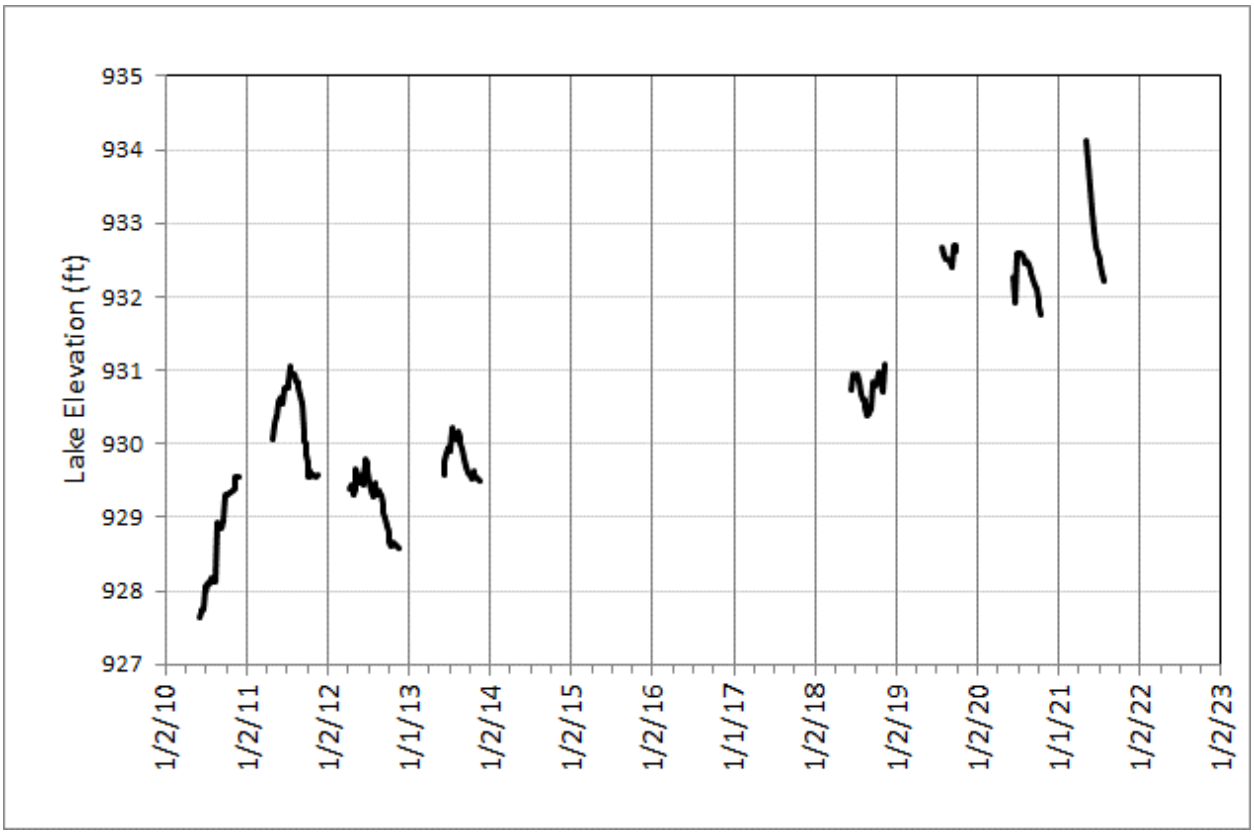


Figure 3: Lac Lavon Water Surface Elevation

Photograph 2: High lake levels in 2019 preventing access to the Lac Lavon fishing dock in city park.

Photograph 3: Low lake levels on August 31, 2022 exposing near shore lake bottom.

Discussion of 2022 Lac Lavon Water Quality and Macrophyte Monitoring

Lac Lavon continues to experience excellent water quality. Summer averages of Secchi disc transparency, chlorophyll *a*, and total phosphorus are consistently better than the MPCA's eutrophication standards. There were no statistically significant trends in water quality for the most recent 10-year period. Barr recommends continuation of the yearly CAMP level water quality monitoring of Lac Lavon, and continuation of the management-level water quality monitoring once every 5 years (per the BDWMO's 2022 Watershed Management Plan).

A variety of native and non-native aquatic plants grow in Lac Lavon. Six different species of native plants that are indicative of good water quality were identified in 2022. However, dense growths of non-native curly-leaf pondweed and Eurasian watermilfoil are occurring in some areas of the lake. Non-native brittle naiad is also present, but do not grow at nuisance levels. Barr recommends continued macrophyte surveys to monitor the aquatic plant community of Lac Lavon.

The City of Apple Valley received a grant to install a rain garden in the parking lot in the city park on the northeast shore of Lac Lavon. The purpose of the rain garden is to collect stormwater from the parking lot, and allow for infiltration into the ground or filtration of stormwater to remove pollutants. Installation of the rain garden is planned for 2023.

Table 2
Lac Lavon 2022 Water Quality Measured by Barr Engineering
BDWMO

Date	Sample Depth (m)	Field Measurements						Laboratory Analyses	
		Dissolved oxygen [mg/L]	pH	Specific conduct-ance @ 25ºC [µS/cm]	Water temperature [ºC]	Secchi disc trans-parency [m]	Turbidity [NTU]	Chloro-phyll a, pheophytin adjusted [µg/L]	Total phosphorus [µg/L]
4/19/2022	0 - 2	--	--	--	--	2.2	4.0	11.9	15
4/19/2022	0	12.6	6.73	596	5.1		--	--	--
4/19/2022	1	12.6	6.86	596	5.1		--	--	--
4/19/2022	2	12.6	7.02	595	5.1		--	--	--
4/19/2022	3	12.6	7.14	593	5.0		--	--	17
4/19/2022	4	12.4	7.22	594	5.0		--	--	18
4/19/2022	5	12.4	7.27	594	5.0		--	--	17
4/19/2022	6	12.5	7.30	594	5.0		--	--	16
4/19/2022	7	12.5	7.32	593	5.0		--	--	17
4/19/2022	8	12.5	7.33	593	4.9		--	--	18
4/19/2022		12.5	7.60	593	4.9		--	--	24
5/10/2022	0-2	--	--	--	--	2.2	2.2	4.6	16
5/10/2022	0	11.0	8.31	598	14.7		--	--	--
5/10/2022	1	11.1	8.30	598	14.6		--	--	--
5/10/2022	2	11.2	8.28	598	14.5		--	--	--
5/10/2022	3	11.1	8.25	595	14.2		--	--	20
5/10/2022	4	11.4	8.23	589	10.4		--	--	22
5/10/2022	5	12.0	8.24	587	8.9		--	--	14
5/10/2022	6	12.0	8.14	589	8.5		--	--	19
5/10/2022	7	12.1	8.01	591	8.3		--	--	23
5/10/2022	8	8.5	7.90	594	8.1		--	--	22
5/10/2022	9	6.1	7.67	606	8.1		--	--	23
5/24/2022	0-2	--	--	--	--	3.4	1.3	4.2	21
5/24/2022	0	10.2	7.82	592	17.4		--	--	--
5/24/2022	1	10.1	8.00	590	17.4		--	--	--
5/24/2022	2	10.1	8.08	591	17.3		--	--	--
5/24/2022	3	9.8	8.14	592	16.9		--	--	13
5/24/2022	4	11.6	8.25	597	13.8		--	--	23
5/24/2022	5	12.1	8.34	589	10.4		--	--	16
5/24/2022	6	12.1	8.17	593	9.2		--	--	17
5/24/2022	7	5.3	7.73	600	8.6		--	--	28
5/24/2022	8	0.9	7.41	617	8.1		--	--	33
5/24/2022	9	0.6	7.36	618	8.0		--	--	56
6/07/2022	0-2	--	--	--	--	3.5	4.6	4.3	20
6/07/2022	0	10.1	8.55	596	20.1		--	--	--
6/07/2022	1	10.1	8.60	595	20.1		--	--	--
6/07/2022	2	10.1	8.60	595	20.1		--	--	--
6/07/2022	3	10.1	8.57	595	19.6		--	--	13
6/07/2022	4	11.0	8.50	600	17.2		--	--	15
6/07/2022	5	12.8	8.61	598	12.1		--	--	17
6/07/2022	6	11.0	8.38	601	10.2		--	--	17
6/07/2022	7	2.5	7.88	616	9.1		--	--	22
6/07/2022	8	0.8	7.72	632	8.5		--	--	39

Table 2
Lac Lavon 2022 Water Quality Measured by Barr Engineering
BDWMO

Date	Sample Depth (m)	Field Measurements						Laboratory Analyses	
		Dissolved oxygen [mg/L]	pH	Specific conduct-ance @ 25ºC [µS/cm]	Water temperature [ºC]	Secchi disc trans-parency [m]	Turbidity [NTU]	Chloro-phyll a, pheophytin adjusted [µg/L]	Total phosphorus [µg/L]
6/21/2022	0-2	--	--	--	--	2.8	1.8	2.3	18
6/21/2022	0	9.6	8.50	535	21.7		--	--	--
6/21/2022	1	9.7	8.50	535	21.7		--	--	--
6/21/2022	2	9.7	8.50	535	21.6		--	--	--
6/21/2022	3	9.7	8.50	535	21.5		--	--	9
6/21/2022	4	11.2	8.40	549	19.4		--	--	16
6/21/2022	5	12.6	8.40	557	15.1		--	--	18.0
6/21/2022	6	10.0	7.90	566	11.0		--	--	33
6/21/2022	7	4.5	7.60	574	8.9		--	--	24
6/21/2022	8	0.2	7.10	610	7.6		--	--	38
6/21/2022	9	0.1	7.10	666	7.2		--	--	58
7/06/2022	0-2	--	--	--	--	3.0	1.0	2.9	13
7/06/2022	0	9.5	9.14	603	25.8		--	--	--
7/06/2022	1	9.6	9.13	602	25.8		--	--	--
7/06/2022	2	9.6	9.12	602	25.8		--	--	--
7/06/2022	3	9.4	9.03	606	24.7		--	--	11
7/06/2022	4	9.4	8.75	618	22.9		--	--	13
7/06/2022	5	15.1	8.95	625	15.9		--	--	14
7/06/2022	6	13.4	8.91	640	12.0		--	--	20
7/06/2022	7	2.1	8.15	661	9.8		--	--	33
7/06/2022	8	0.8	7.86	681	9.0		--	--	64
7/19/2022	0-2	--	--	--	--	3.1	1.7	3.1	9
7/19/2022	0	9.4	9.00	545	27.0		--	--	--
7/19/2022	1	9.4	8.90	546	27.0		--	--	--
7/19/2022	2	9.4	8.90	546	27.0		--	--	--
7/19/2022	3	8.5	8.60	555	26.2		--	--	9
7/19/2022	4	8.2	8.40	568	24.5		--	--	8
7/19/2022	5	11.9	8.20	580	18.2		--	--	9
7/19/2022	6	10.7	8.20	592	12.8		--	--	14
7/19/2022	7	3.4	7.60	607	10.7		--	--	16
7/19/2022	8	0.7	7.30	632	9.3		--	--	36
8/03/2022	0-2	--	--	--	--	3.0	2.7	3.0	12
8/03/2022	0	9.1	8.80	581	25.5		--	--	--
8/03/2022	1	9.2	8.80	580	25.5		--	--	--
8/03/2022	2	9.2	8.80	580	25.5		--	--	--
8/03/2022	3	9.2	8.80	580	25.5		--	--	11
8/03/2022	4	8.9	8.80	585	24.8		--	--	15
8/03/2022	5	11.1	8.40	620	21.7		--	--	9
8/03/2022	6	10.0	8.10	633	14.7		--	--	14
8/03/2022	7	4.3	7.80	654	11.4		--	--	20
8/03/2022	8	0.9	7.30	730	9.4		--	--	48

Table 2
Lac Lavon 2022 Water Quality Measured by Barr Engineering
BDWMO

Date	Sample Depth (m)	Field Measurements						Laboratory Analyses	
		Dissolved oxygen [mg/L]	pH	Specific conduct-ance @ 25ºC [µS/cm]	Water temperature [ºC]	Secchi disc trans-parency [m]	Turbidity [NTU]	Chloro-phyll a, pheophytin adjusted [µg/L]	Total phosphorus [µg/L]
8/18/2022	0-2	--	--	--	--	3.7	1.8	5.3	15
8/18/2022	0	9.5	8.80	562	24.3		--	--	--
8/18/2022	1	9.6	8.80	562	24.3		--	--	--
8/18/2022	2	9.6	8.80	562	24.3		--	--	--
8/18/2022	3	9.2	8.80	563	24.1		--	--	9
8/18/2022	4	8.4	8.70	565	23.3		--	--	8
8/18/2022	5	6.3	8.10	601	22.6		--	--	11
8/18/2022	6	8.1	8.00	633	16.5		--	--	11
8/18/2022	7	1.3	7.70	651	12.4		--	--	14
8/18/2022	8	0.8	7.20	683	10.1		--	--	52
8/31/2022	0-2	--	--	--	--	3.5	1.8	3.7	12
8/31/2022	0	8.6	8.70	548	23.5		--	--	--
8/31/2022	1	8.6	8.80	548	23.5		--	--	--
8/31/2022	2	8.5	8.80	548	23.5		--	--	--
8/31/2022	3	8.5	8.80	548	23.5		--	--	14
8/31/2022	4	8.5	8.80	548	23.5		--	--	11
8/31/2022	5	7.1	8.50	561	22.9		--	--	14
8/31/2022	6	6.4	7.90	618	18.2		--	--	9
8/31/2022	7	1.0	7.50	643	13.4		--	--	17
8/31/2022	8	0.7	7.10	677	10.5		--	--	28
9/13/2022	0-2	--	--	--	--	3.3	1.6	3	9
9/13/2022	0	8.8	8.80	530	22.1		--	--	--
9/13/2022	1	8.7	8.80	531	22.2		--	--	--
9/13/2022	2	8.6	8.80	531	22.2		--	--	--
9/13/2022	3	8.6	8.80	531	22.2		--	--	9
9/13/2022	4	8.6	8.80	531	22.2		--	--	10
9/13/2022	5	8.2	8.80	532	22.2		--	--	8
9/13/2022	6	3.2	7.70	600	18.7		--	--	10
9/13/2022	7	0.8	7.60	617	14.2		--	--	28
9/13/2022	8	0.7	7.20	660	10.8		--	--	164
9/13/2022	9	0.2	7.40	813	9.4		--	--	94

Table 3: Lac Lavon Water Quality Measured by CAMP Volunteer

Sample Date	Sample Depth [m]	Secchi Disc Transparency [m]	Water Temperature [°C]	Chlorophyll-a, Pheophytin Corrected [µg/L]	Nitrogen, Total Kjeldahl [mg/L]	Total Phosphorus [ug/L]
5/3/2022	0	3.0	12.6	3.6	0.66	18
5/30/2022	0	4.9	21.1	1.1	0.58	11
6/26/2022	0	4.8	25.4	1.6	0.48	15
8/9/2022	0	4.4	25.4	2.7	0.48	10

Technical Reference

Black Dog Watershed Management Organization Habitat Monitoring Background Summary

In 2002, the Black Dog Watershed Management Organization (BDWMO) created a program for monitoring the habitat quality of strategic water resources in the watershed. 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. The BDWMO began implementing the habitat monitoring program in 2003 and continued the program through 2009. In 2004, based on feedback from the participating cities and to better define the vegetative quality, several improvements were made to the rating system. The BDWMO used this system for the annual habitat monitoring of each strategic water body through 2009. From 2003-2009 Barr staff annually evaluated the habitat quality of each of the following strategic water bodies:

- Crystal Lake (Burnsville)
- Keller Lake (Burnsville)
- Kingsley Lake (Lakeville)
- Lac Lavon (Apple Valley and Burnsville)
- Orchard Lake (Lakeville)
- Sunset Pond (Burnsville)

In 2010, the BDWMO suspended the habitat monitoring program and re-evaluated the program for its effectiveness. Based on feedback obtained from city staff, the BDWMO revised the habitat monitoring program to provide more effective monitoring, more useful and holistic results, and to reduce the monitoring costs. The BDWMO began implementing the revised habitat monitoring program in 2011. Also in 2011, the BDWMO removed Sunset Pond from its list of strategic water bodies.

The revised program includes monitoring 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—Kingsley Lake (2011), Orchard Lake (2012), Crystal Lake (2013), Lac Lavon (2014), and Keller Lake (2015). This report provides the results of the Orchard Lake 2022 habitat monitoring.

The 2022 Orchard Lake monitoring included plot and meandering surveys. Supplemental photographs were taken to document conditions. 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. Table 1 of the Technical Memo summarizes the 2022 Orchard Lake monitoring results.

Habitat Quality

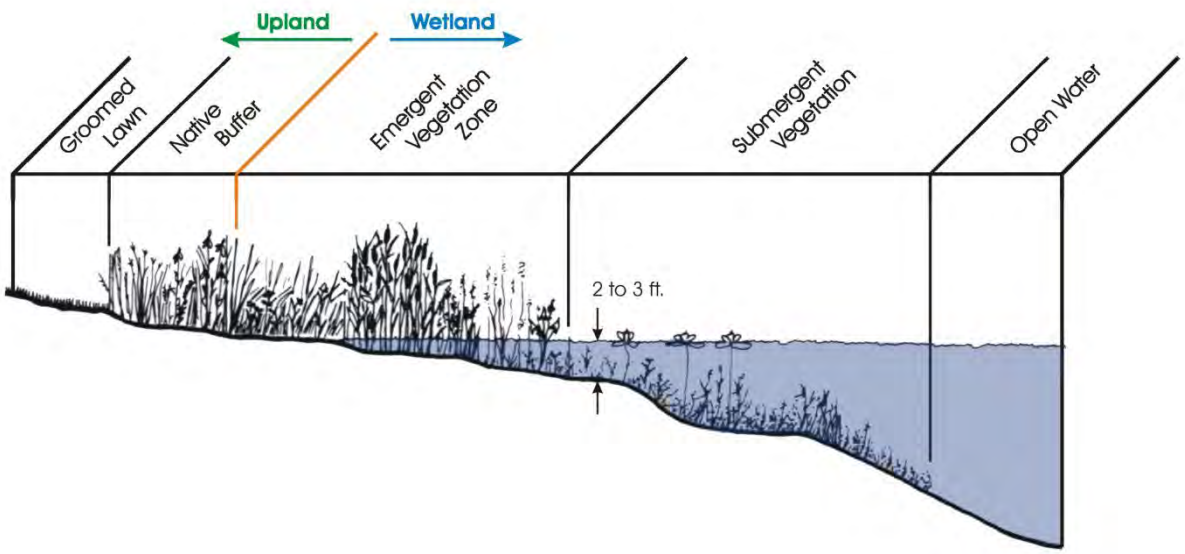
The BDWMO's assessment of the BDWMO strategic water bodies provides baseline and ongoing information regarding the habitat quality of the water bodies and a method for detecting change. Habitat quality was evaluated within the following four general zones:

1. **Submergent vegetation zone—**The submergent zone refers to the areas of the water body where water depths are typically 2 to 20 feet (normal maximum rooting depth) and the vegetation is typically submerged or has floating leaves. The vegetation quality within the submergent zone is normally rated as "excellent" when there are: (a) a diverse assemblage of native plant species (more than 14), (b) a moderate plant density or plant occurrence rating, and (c) no exotic species present.

2. **Emergent vegetation zone—**The 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. The vegetation quality within the emergent zone is typically rated as "excellent" when there are more than 15 species of native and non-invasive plants present, with few exotic plants present.

3. **Condition of the upland buffer area—**The upland buffer is characterized as the upland area immediately surrounding the water body. An excellent quality buffer should extend upslope at least 25 feet from the wetland edge, consist of native vegetation that is not routinely mowed, and be present continuously around the perimeter of the water body.

4. **Sedimentation and shoreline erosion problems—**The presence of sedimentation may come from erosion on slopes, from storm sewer outfalls, or from other sources. The presence of a regular sediment load to the water body can cause a significant reduction in water quality. Shoreline erosion can be caused by natural forces such as ice and wave action, but can also be human induced (e.g., vegetation removal, grading, runoff, structures, etc.). Identifying and correcting these problems early can prevent habitat degradation.



Vegetation Zones

Appendix C summarizes the overall ratings from 2003 through 2021. **Appendix D** includes the previous management recommendations for water bodies assessed from 2003 through 2021. **Table 2 of the Technical Memo** provides the 2022 management recommendations for Orchard Lake.

Wildlife Habitat Characteristics

The strategic water bodies within the BDWMO range from shallow wetland systems to deeper lake systems. Some of them support sustainable fisheries, while others may only periodically support fish. All of the water bodies have some potential for supporting waterfowl and shorebirds. To evaluate the wildlife value of these water bodies, it is important to understand the characteristics that will benefit wildlife.

In general, a more diverse assemblage of native plant species will provide a source of food and protective cover for a wider range of wildlife species. Typically, although not always, native plant species do not become established as monocultures to the detriment of other species, as is often the case with many exotic species. As vegetation diversity increases, so does the likelihood that the water body will support a more diverse assemblage of wildlife.

A diverse interspersion of various plant communities also leads to the potential for attracting a wider range of wildlife. For instance, some waterfowl prefer deeper, open water areas while others tend to inhabit the shallow emergent zones. Some furbearers rely heavily on the shallow, emergent zone and upland areas around the water body while others spend most of their time in the deep marsh areas. Amphibians will typically need a permanently inundated water body but rely on diverse vegetative structure in the upland areas surrounding the water body for critical components of their life cycle. Fish also require permanent inundation to a depth that will not result in freeze-out and where oxygen will not become depleted. A diverse habitat structure is also important for fish.

The upland buffer surrounding these water bodies is important for several reasons. A high-quality upland buffer will have a diverse vegetative structure dominated by self-sustaining native vegetation. A high-quality upland buffer is used by wildlife for shelter, feeding, resting, nesting, and reproduction. In contrast, adjacent upland areas that are maintained in turf grass or paved trails provide little value to wildlife or water quality improvement. Turf grass and trails typically provide feeding and resting grounds only for geese and some species of ducks. Wide and contiguous natural buffers are important as they provide feeding, nesting and safe travel corridors. Upland buffers also help protect the water quality of the water body. Diverse native vegetation helps maintain an open soil structure that promotes infiltration, reduces surface runoff, and increases nutrient uptake.

Wetland Functions and Values Assessment—MNRAM

In addition to the specific habitat parameters described above, the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM) Version 3.0 was used to evaluate the hydrologic system and ecosystem making up each water resource, first in 2003 and then again in 2006. The results of the 2003 and 2006 MNRAM 3.0 assessments were provided in previous year's reports. Orchard Lake was re-assessed in 2012, Crystal Lake was re-assessed in 2013, Lac Lavon was re-assessed in 2014, Keller Lake was re-assessed in 2015, and Kinsley was re-assessed in 2016 with the more updated MNRAM version 3.4. The results of the 2012 Orchard Lake MNRAM are provided in **Appendix E**. Evaluating each ecosystem with MNRAM is a way to get a detailed picture of the overall health of the watershed and the water resource itself. Instead of just looking at specific parameters that are direct indicators of habitat quality, the MNRAM evaluates many different parameters of the water body and its watershed that contribute to sustaining the wetland functions, which are described in **Appendix F**. In general, the MNRAM assessments compare favorably with the BDWMO habitat vegetation assessment results. This method identifies land use or ecological changes, which might affect the water body in the long term. In addition, the MNRAM assessment provides an independent evaluation of the overall wildlife habitat of the water body.

Appendices

- Orchard Lake aquatic plant survey results (**Appendix A**),
- Orchard Lake 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**).

Appendix A

Orchard Lake Aquatic Plant Survey Results

Illinois Pondweed in Orchard Lake, June 2022

Aquatic Plant Surveys for Orchard Lake, Lakeville, Minnesota, 2022

Curlyleaf Pondweed (CLP) Delineation: April 28, 2022
Treatment of CLP: May 19, 2022 (3.29 acres)
CLP Post-Treatment Assessment: June 6, 2022
Eurasian Watermilfoil (EWM) Delineation: June 6, 2022
Treatment of EWM: 14.5 ac
EWM Assessment: July 20, 2022

Prepared for:
City of Lakeville
Lakeville, Minnesota

Prepared by:
Steve McComas
Jo Stuckert
Blue Water Science

December 30, 2022

Aquatic Plant Surveys for Orchard Lake, Lakeville, Minnesota, 2022

A curlyleaf pondweed delineation (conducted on April 28, 2022) and two aquatic plant surveys were conducted by Blue Water Science on Orchard Lake (234 acres) in 2022. After the curlyleaf delineation on April 28, 2021, an early season stratified line transect survey was conducted to evaluate curlyleaf pondweed as well as to delineate Eurasian watermilfoil (EWM) on June 6, 2022. The late summer survey on July 20 (also a stratified line transect survey conducted by Blue Water Science) characterized changes in the plant community and checked for Eurasian watermilfoil.

Curlyleaf Pondweed

Curlyleaf Pondweed Delineation and Treatment: On April 28, 2022, a curlyleaf delineation was conducted to determine where curlyleaf pondweed growth could be a problem in 2022. There were 2 areas where curlyleaf could have produced moderate to heavy growth. A total of 3.29 acres were treated with a diquat herbicide on May 19, 2022 (Figure 1).

Curlyleaf Pondweed Assessment on the June 6, 2022 Survey: The area that was treated for curlyleaf pondweed in May 2022 had good control although light growth of curlyleaf was observed at a number of scattered locations around the lake (Figure 1).

Eurasian Watermilfoil

EWM Delineation: On June 6, 2022, a meander survey was conducted in addition to the line transect survey to delineate EWM. Mostly light growth of EWM was found at a total of 49 locations with 21 sites in the line transect survey and 28 sites in the meandered survey. EWM treatment of 14.5 acres occurred in 2022 (Figure 2).

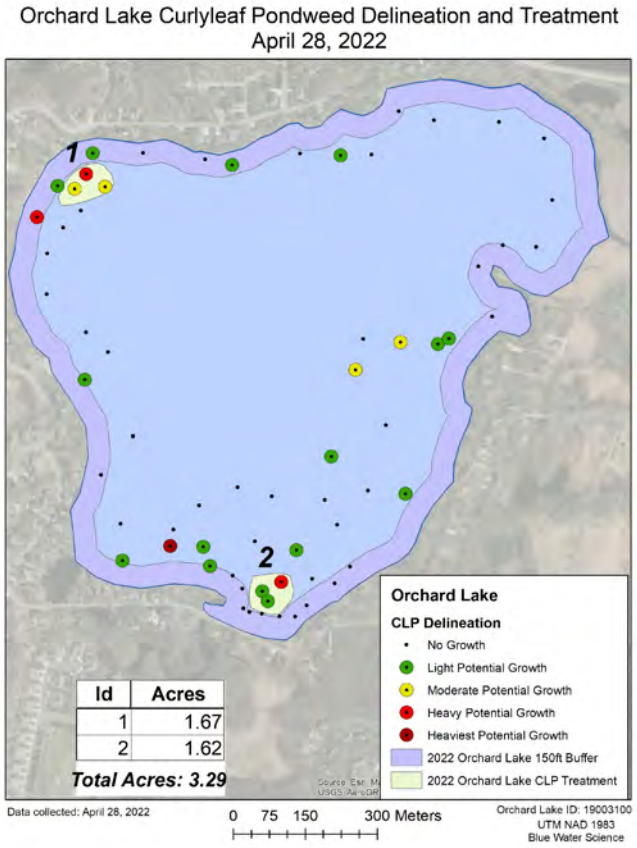
EWM Assessment on the July 20, 2022 Survey: Eurasian watermilfoil was found at a total of 88 locations with 26 sites in the line transect survey and 62 sites in the meandered survey in late summer. Some EWM growth was moderate to heavy (Figure 2). Overall, aquatic plants grew out to a depth of about 12 feet around much of the lake.

Aquatic Plant Distribution and Abundance in 2022

Early Season Plant Survey: On the June 6, 2022 transect survey, the most abundant native submerged plant in Orchard Lake was coontail and was found at 41% of the stations (16 out of 39 sites). Growth was mostly light with some moderate densities (Table 1).

Late Summer Plant Survey: The dominant plant on the July 20, 2022 transect survey in Orchard Lake were EWM and coontail, EWM was found at 67% of the sites (26 out of 39 sites) and coontail was found at 62% of the sites (24 out of 39 sites)(Figure 4 and Table 1).

Curlyleaf Pondweed in Orchard Lake in 2022



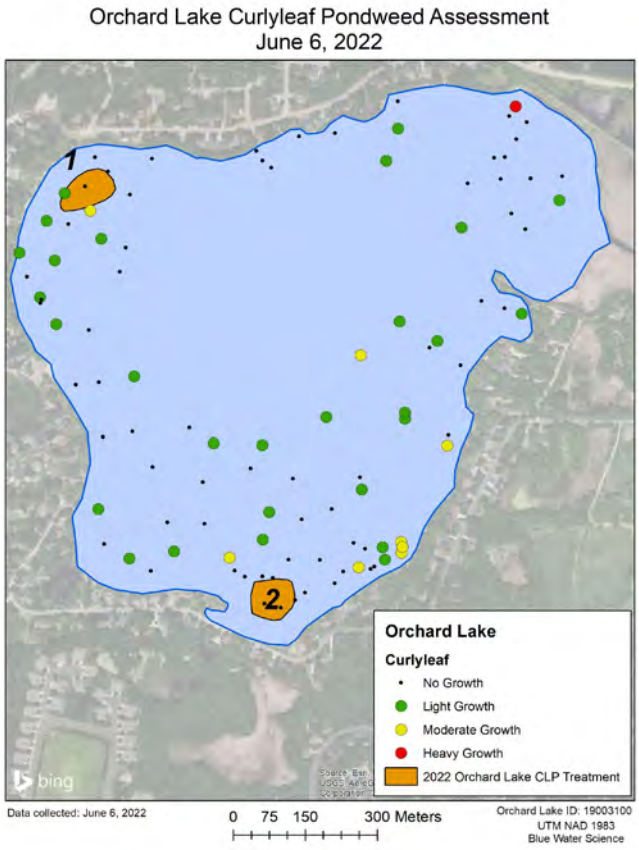
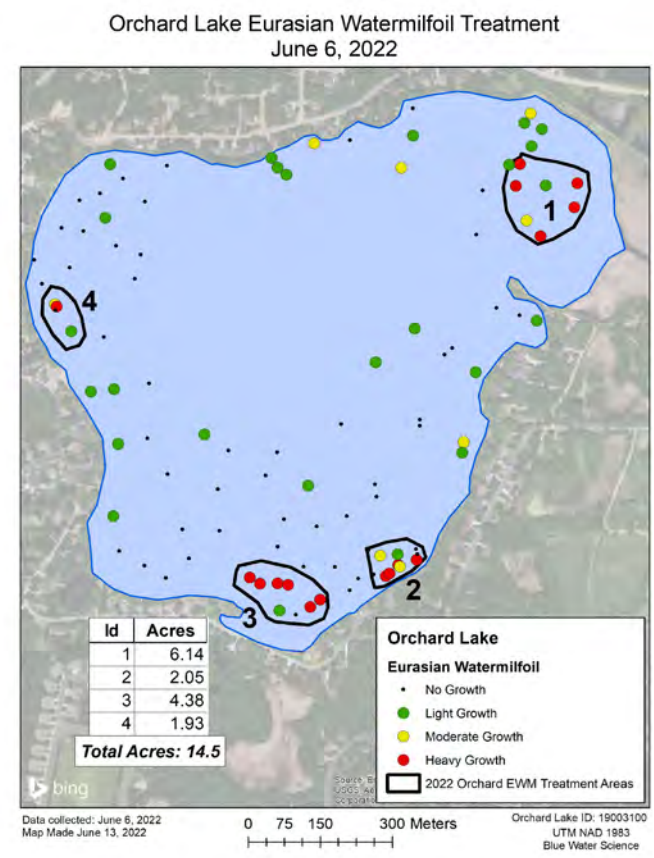


Figure 1. [top] Curlyleaf delineation on April 28, 2022.

A total of 3.29 acres were treated on May 19, 2022.

[bottom] Curlyleaf distribution and density on June 6, 2022. Treatment location for curlyleaf is also shown.

Eurasian Watermilfoil in Orchard Lake in 2022



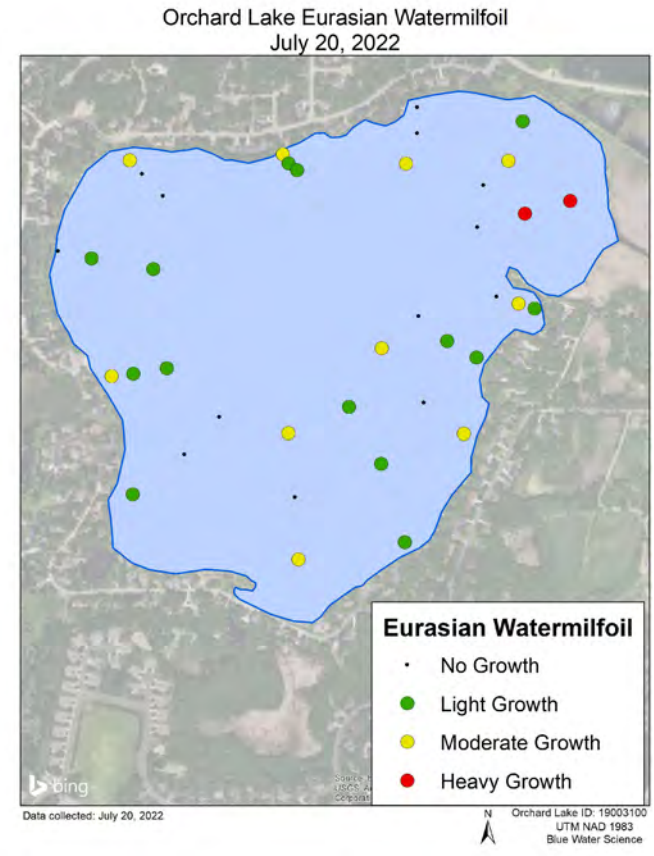


Figure 2. [top-left] EWM presence on June 6, 2022.

Four areas were delineated for EWM treatment in 2022.

[bottom] EWM distribution and density on July 20, 2022.

Key: black dot = no growth, green dot = light growth, yellow dot = moderate growth, red dot = heavy growth.

Comparing Aquatic Plants in June and July, 2022: Two stratified line transect aquatic plant surveys were conducted on June 6 and July 20, 2022. In June, coontail was the dominant native plant. In July, coontail again was the most common plants in the lake (Table 1). Aquatic plant growth was denser in July then in June (Table 1).

Table 1. Summary of early summer aquatic plants surveys for Orchard Lake in 2022. Percent frequency of occurrence is calculated based on the number of times a plant species occurs at a sampling station on transects divided into the number of total stations for the survey. For example, if coontail was found in 25 out of 50 stations, its percent occurrence would be 50%. Density ratings for plants range from 1 to 3 with 3 being the most dense.

	June 6, 2022		July 20, 2022	
	Line Transect with depth ranges (% frequency of occurrence) (39 points)	Density	Line Transect with depth ranges (% frequency of occurrence) (39 points)	Density
Coontail (*Ceratophyllum demersum*)	41% (16)	1.1	62% (24)	1.2
Chara (*Chara sp.*)	28% (11)	1.6	21% (8)	1.8
Moss (*Drepanocladus sp*)	3% (1)	1.0		
Star duckweed (*Lemna trisulca*)			5% (2)	1.0
Northern watermilfoil (*Myriophyllum sibiricum*)	8% (3)	1.0	8% (3)	1.0
Eurasian watermilfoil (*M. spicatum*)	54% (21)	1.3	67% (26)	1.5
Cabbage (*Potamogeton amplifolius*)	15% (6)	1.2	21% (8)	1.4
Curlyleaf pondweed (*P. crispus*)	44% (17)	1.1		
Fries pondweed (*P. Friesii*)			3% (1)	1.0
Illinois pondweed (*P. illinoensis*)			5% (2)	1.0
Whitestem pondweed (*P. praelongus*)	3% (1)	2.0		
Claspingleaf pondweed (*P. Richardsonii*)	15% (6)	1.2	8% (3)	1.3
Stringy pondweed (*P. sp*)	10% (4)	1.0		
Flatstem pondweed (*P. zosteriformis*)	31% (12)	1.3	44% (17)	1.3
Water celery (*Vallisneria americana*)	8% (3)	1.0		
Water stargrass (*Zosterella dubia*)	3% (1)	1.0		
Filamentous algae	21% (8)	1.6	21% (8)	1.8
Number of Submerged Species	13		10	

Details of the June 6, 2022 Aquatic Plant Transect Survey: On the June 6, 2022 transect survey, the most abundant native submerged plant in Orchard Lake was coontail and was found at 41% of the stations (16 out of 39 sites). Overall, aquatic plant growth was mostly light with some moderate densities (Figure 3 and Table 1).

Additional aquatic plant maps are shown in Figure 4.

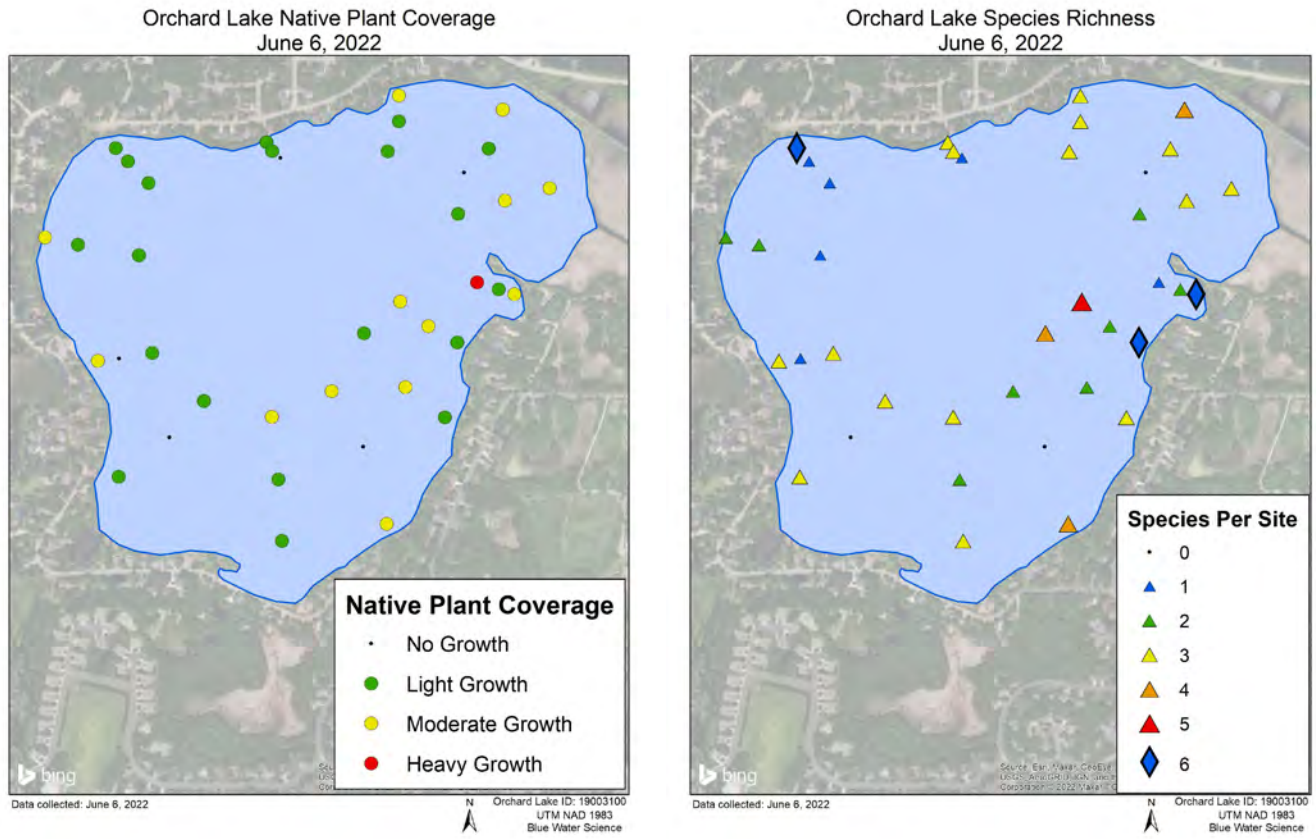


Figure 3. [left] Native Plant distribution and abundance on June 6, 2022. [right] Species Richness on June 6, 2022. Key: Green = light growth, yellow = moderate growth, red = heavy growth, and black = no growth.

June 6, 2022 Aquatic Plant Maps

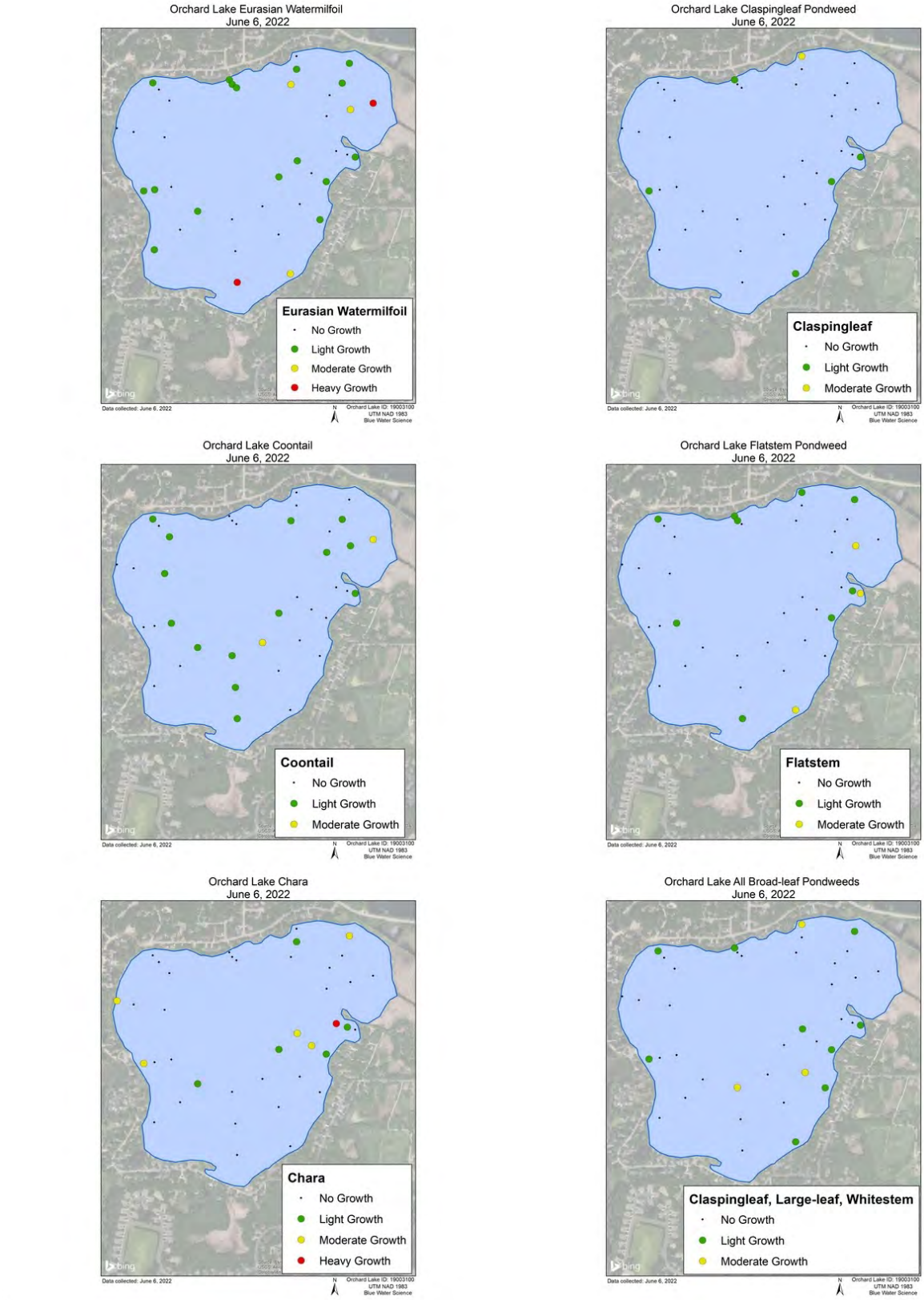


Figure 4. Aquatic plant distribution and abundance on June 6, 2022.
Key: Green = light growth, yellow = moderate growth, red = heavy growth, and black = no growth.

Details of the July 20, 2022 Aquatic Plant Transect Survey: Native plants were well distributed on Orchard Lake on July 20, 2022 (Figure 5). The dominant plant on the July 20, 2022 transect survey in Orchard Lake was coontail and was found at 62% of the sites (24 out of 39 sites) (Figure 6 and Table 1).

Additional aquatic plant maps are shown in Figure 6.

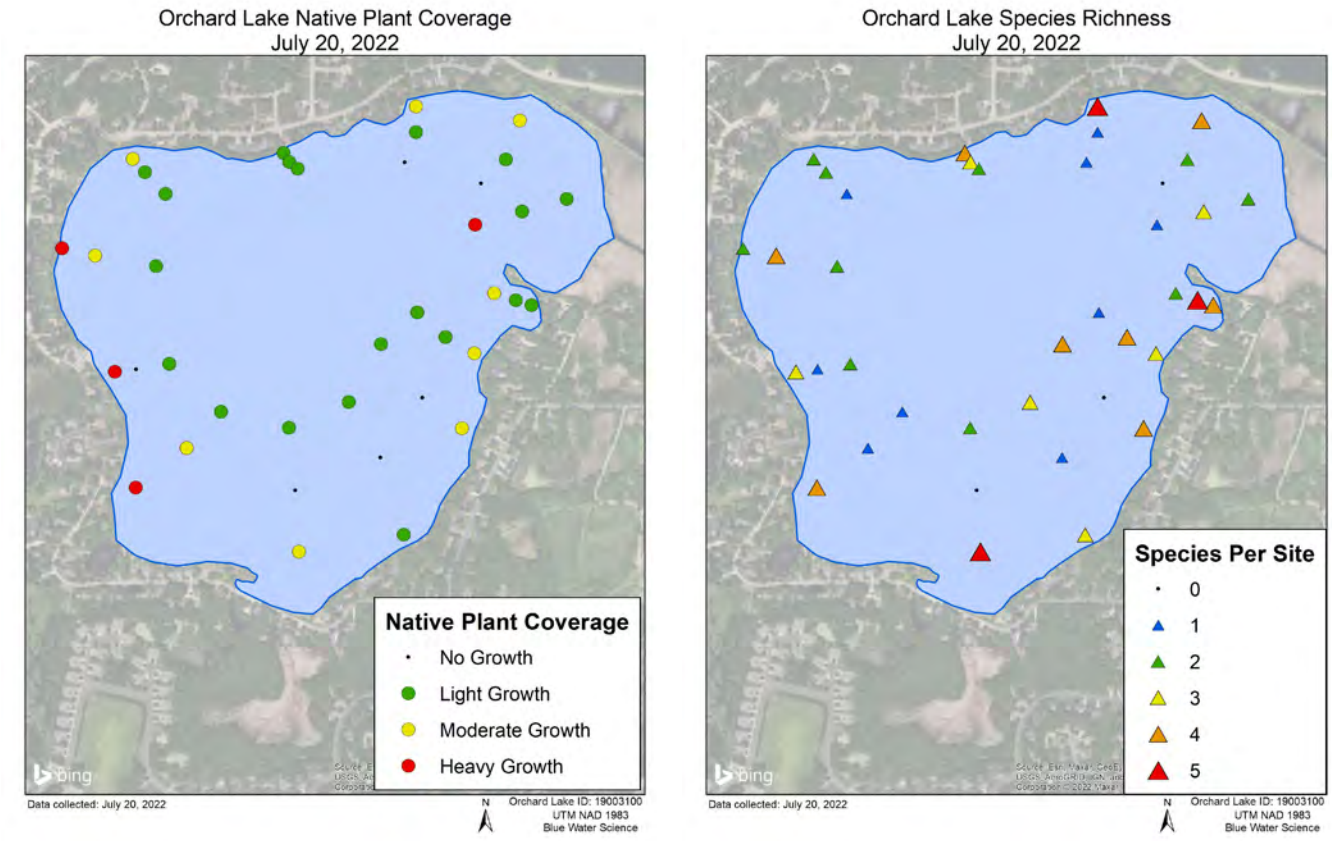
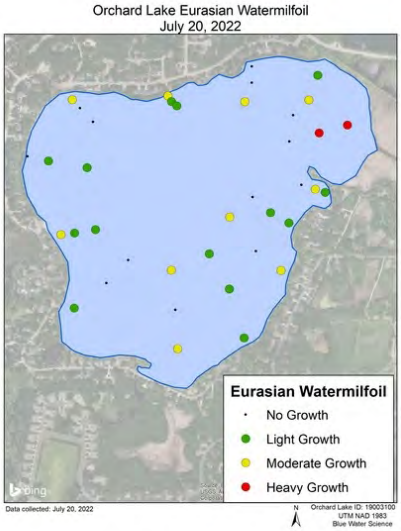
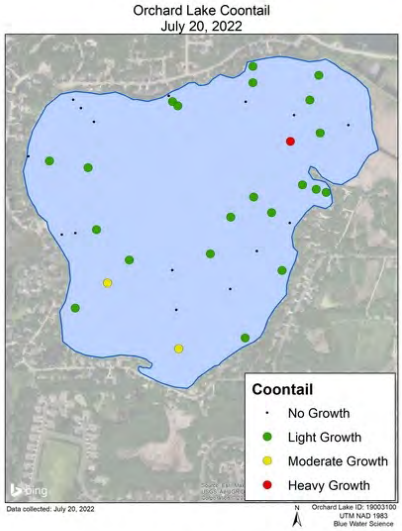
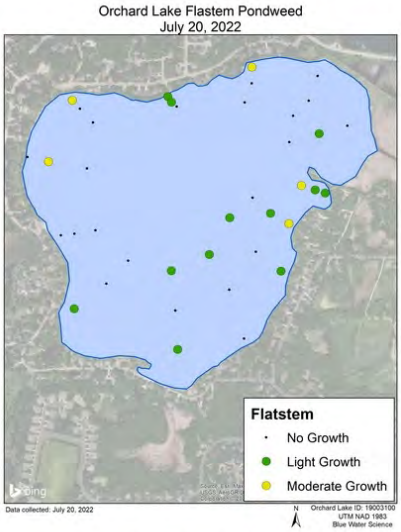


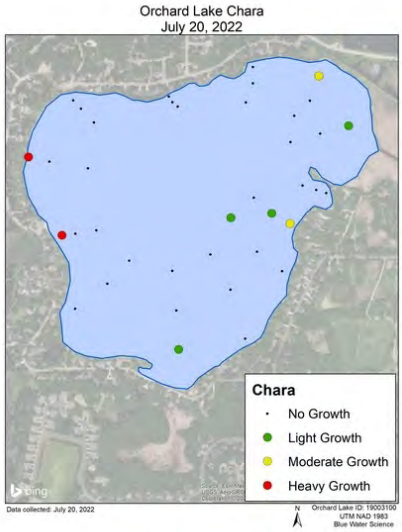
Figure 5. [left] Native Plant distribution and abundance on July 20, 2022. [right] Species Richness on July 20, 2022. Key: Green = light growth, yellow = moderate growth, red = heavy growth, and black = no growth.

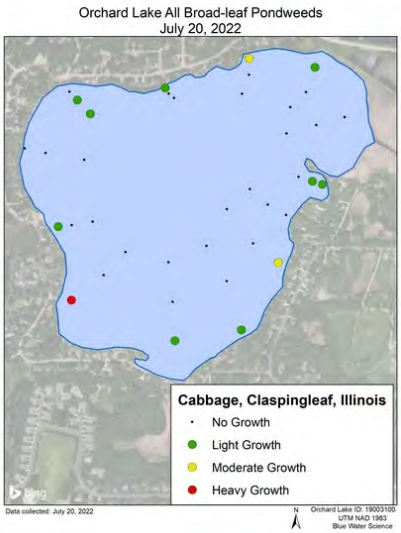
July 20, 2022 Aquatic Plant Maps











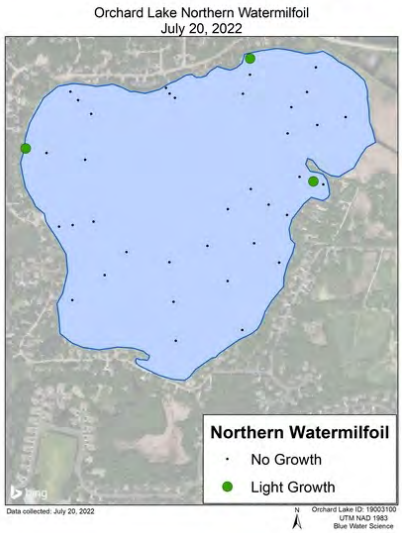


Figure 6. Aquatic plant distribution and abundance on July 20, 2022.
Key: Green = light growth, yellow = moderate growth, red = heavy growth, and black = no growth.

Details of the September 23, 2021 Aquatic Plant Meander Survey: By the end of the summer milfoil had produced heavy growth in several areas around Orchard Lake.

Figure 7. [left] Eurasian watermilfoil was topping out in some areas in September 2021. [right] Eurasian watermilfoil stems on September 23, 2021.

Appendix B

Orchard Lake Floristic Quality Assessment Data

2004 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton richardsonii	clasping-leaf pondweed	5
Potamogeton zosteriformis	flatstem pondweed	6
Ranunculus sp. **	crowfoot	5.5
Stuckenia pectinatus	sago pondweed	3
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.1
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		14
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		19.11

2005 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna minor	common duckweed	5
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Najas flexilis	flexuous naiad	5
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton zosteriformis	flatstem pondweed	6
Ranunculus sp. **	crowfoot	5.5
Stuckenia pectinatus	sago pondweed	3
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.1
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		15
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		19.75

2006 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna minor	common duckweed	5
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Najas flexilis	flexuous naiad	5
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton richardsonii	clasping-leaf pondweed	5
Potamogeton zosteriformis	flatstem pondweed	6
Ranunculus sp. **	crowfoot	5.5
Stuckenia pectinatus	sago pondweed	3
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.1
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		16
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		20.38

2007 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton richardsonii	clasping-leaf pondweed	5
Ranunculus sp. **	crowfoot	5.5
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.2
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		12
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		18.04

2008 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

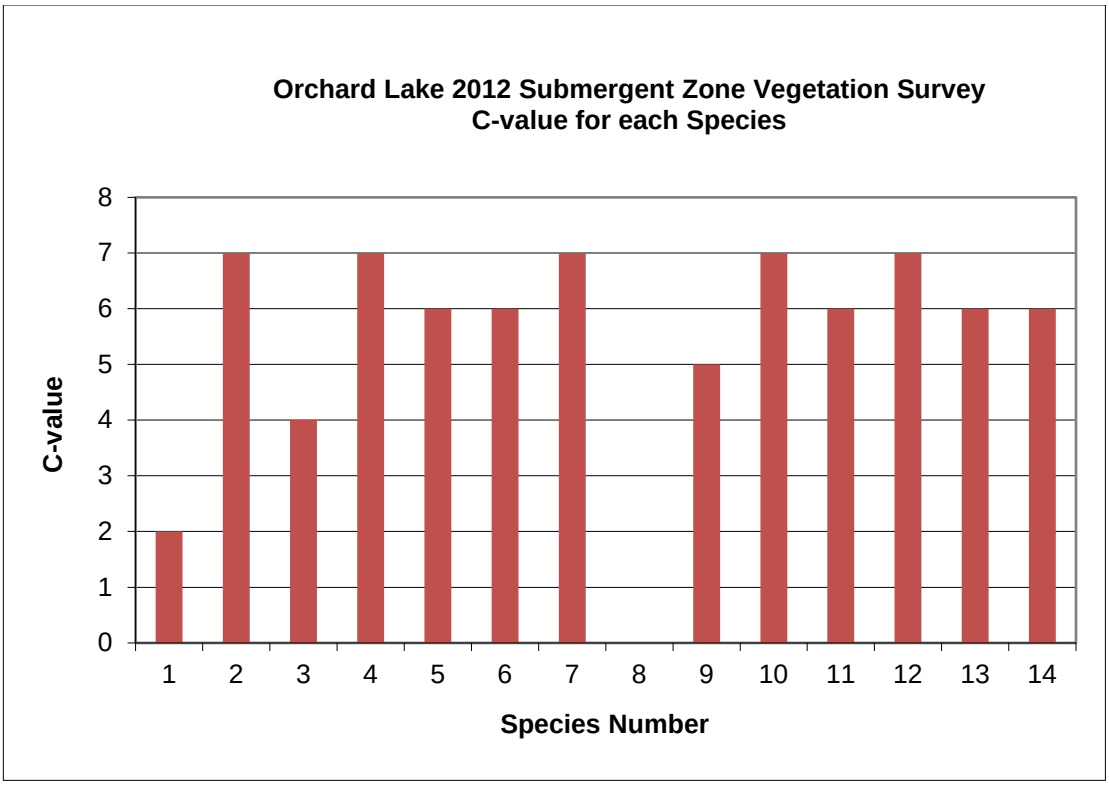
Species	Common Name	Coefficient of Conservatism Value (C-value)
Bidens beckii	Beck's water marigold	8
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna sp. **	duckweed	5
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Najas flexilis	flexuous naiad	5
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton pusillus	leafy pondweed	7
Potamogeton richardsonii	clasping-leaf pondweed	5
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.5
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		15
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		21.17

2009 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna sp.	duckweed	5
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton pusillus	leafy pondweed	7
Ranunculus sp.	crowfoot	5
Zosterella dubia	water stargrass	6
Mean C-value		5.3
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		12
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		18.19

2012 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

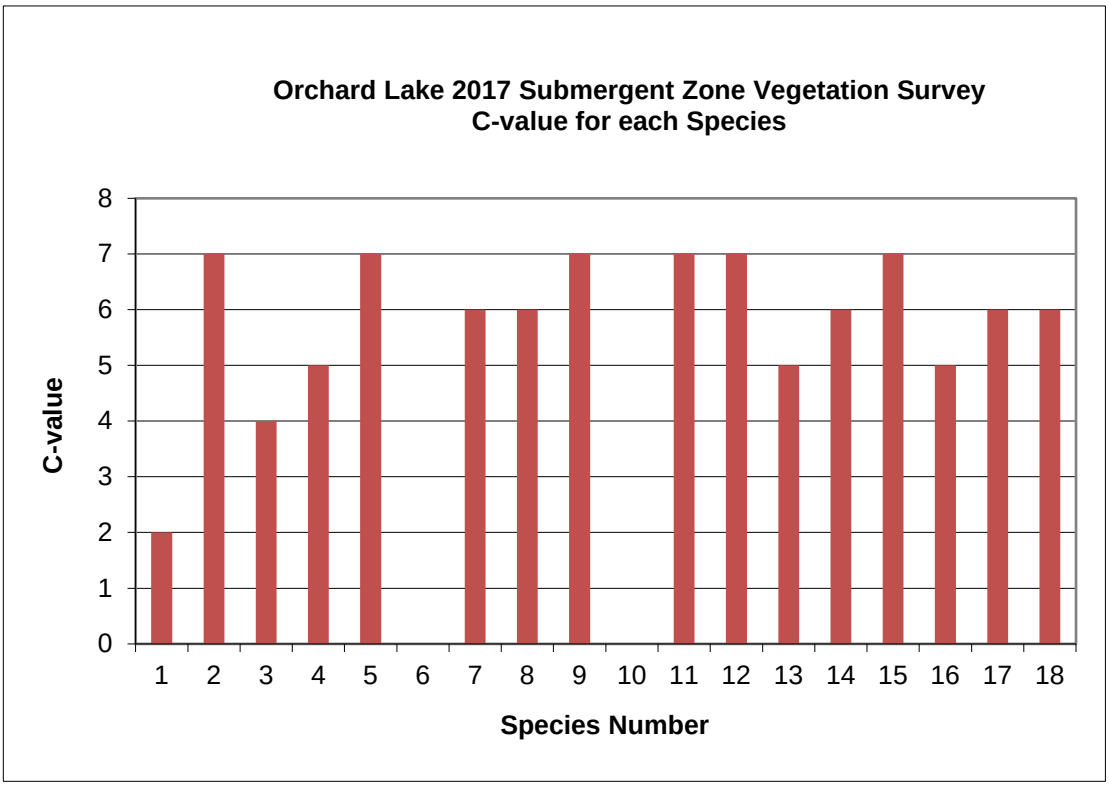
Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Elodea canadensis	elodea	4
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton pusillus	leafy pondweed	7
Potamogeton richardsonii	clasping-leaf pondweed	5
Potamogeton zosteriformis	flatstem pondweed	6
Ranunculus longirostris	white water crowfoot	7
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.4
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		14
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		20.31



Species Number	Scientific Name	Common Name	C-value
1	*Ceratophyllum demersum*	coontail	2
2	*Chara sp.*	muskgrass	7
3	*Elodea canadensis*	elodea	4
4	*Myriophyllum sibiricum*	Siberian Water-Milfoil	7
5	*Nuphar lutea*	yellow pond-lily	6
6	*Nymphaea odorata*	white waterlily	6
7	*Potamogeton amplifolius*	largeleaf pondweed	7
8	*Potamogeton crispus*	curlyleaf pondweed	0
9	*Potamogeton richardsonii*	clasping-leaf pondweed	5
10	*Potamogeton pusillus*	leafy pondweed	7
11	*Potamogeton zosteriformis*	flatstem pondweed	6
12	*Ranunculus longirostris*	white water crowfoot	7
13	*Vallisneria americana*	wild celery	6
14	*Zosterella dubia*	water stargrass	6

2017 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

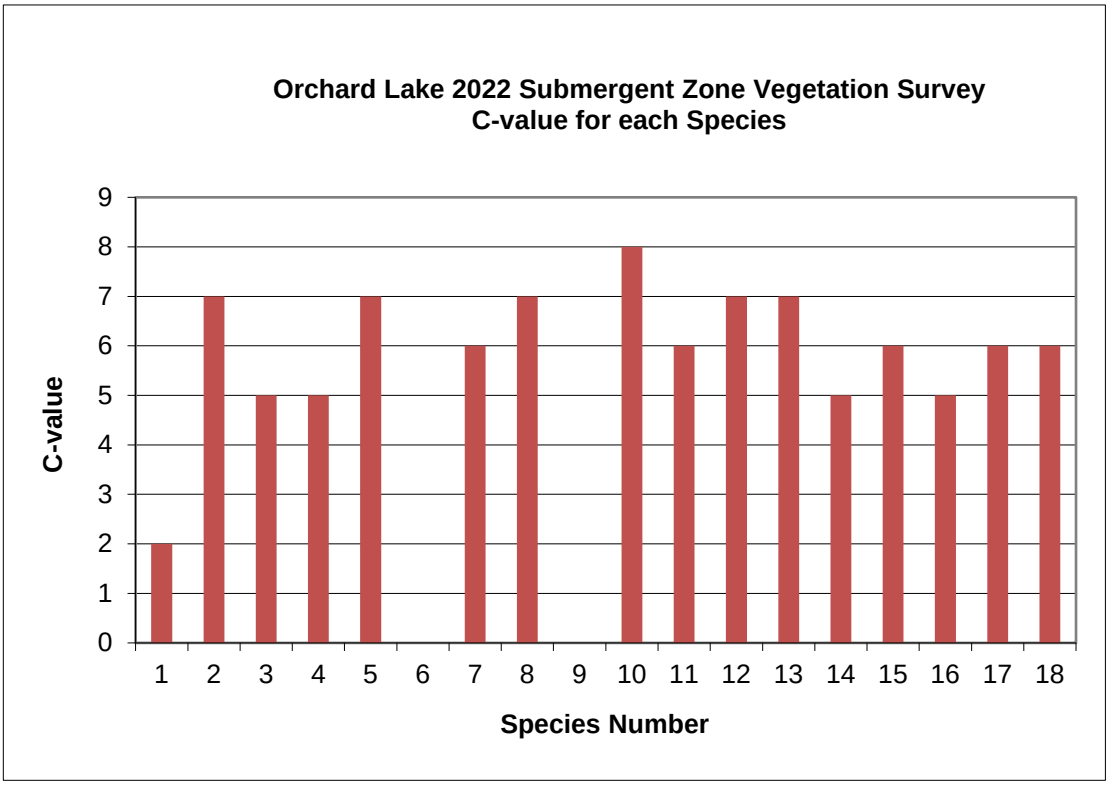
Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Elodea canadensis	elodea	4
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Myriophyllum spicatum	Eurasian watermilfoil	0
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton praelongus	white stemmed pondweed	7
Potamogeton pusillus	leafy pondweed	7
Potamogeton richardsonii	clasping-leaf pondweed	5
Potamogeton zosteriformis	flatstem pondweed	6
Ranunculus longirostris	white water crowfoot	7
Utricularia macrorhiza	common bladderwort	5
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.2
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		18
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		21.92



Species Number	Scientific Name	Common Name	C-value
1	*Ceratophyllum demersum*	coontail	2
2	*Chara sp.*	muskgrass	7
3	*Elodea canadensis*	elodea	4
4	*Lemna trisulca*	star duckweed	5
5	*Myriophyllum sibiricum*	Siberian Water-Milfoil	7
6	*Myriophyllum spicatum*	Eurasian watermilfoil	0
7	*Nuphar lutea*	yellow pond-lily	6
8	*Nymphaea odorata*	white waterlily	6
9	*Potamogeton amplifolius*	largeleaf pondweed	7
10	*Potamogeton crispus*	curlyleaf pondweed	0
11	*Potamogeton praelongus*	white stemmed pondweed	7
12	*Potamogeton pusillus*	leafy pondweed	7
13	*Potamogeton richardsonii*	clasping-leaf pondweed	5
14	*Potamogeton zosteriformis*	flatstem pondweed	6
15	*Ranunculus longirostris*	white water crowfoot	7
16	*Utricularia macrorhiza*	common bladderwort	5
17	*Vallisneria americana*	wild celery	6
18	*Zosterella dubia*	water stargrass	6

2022 Orchard Lake Submergent Zone Vegetation Floristic Quality Index

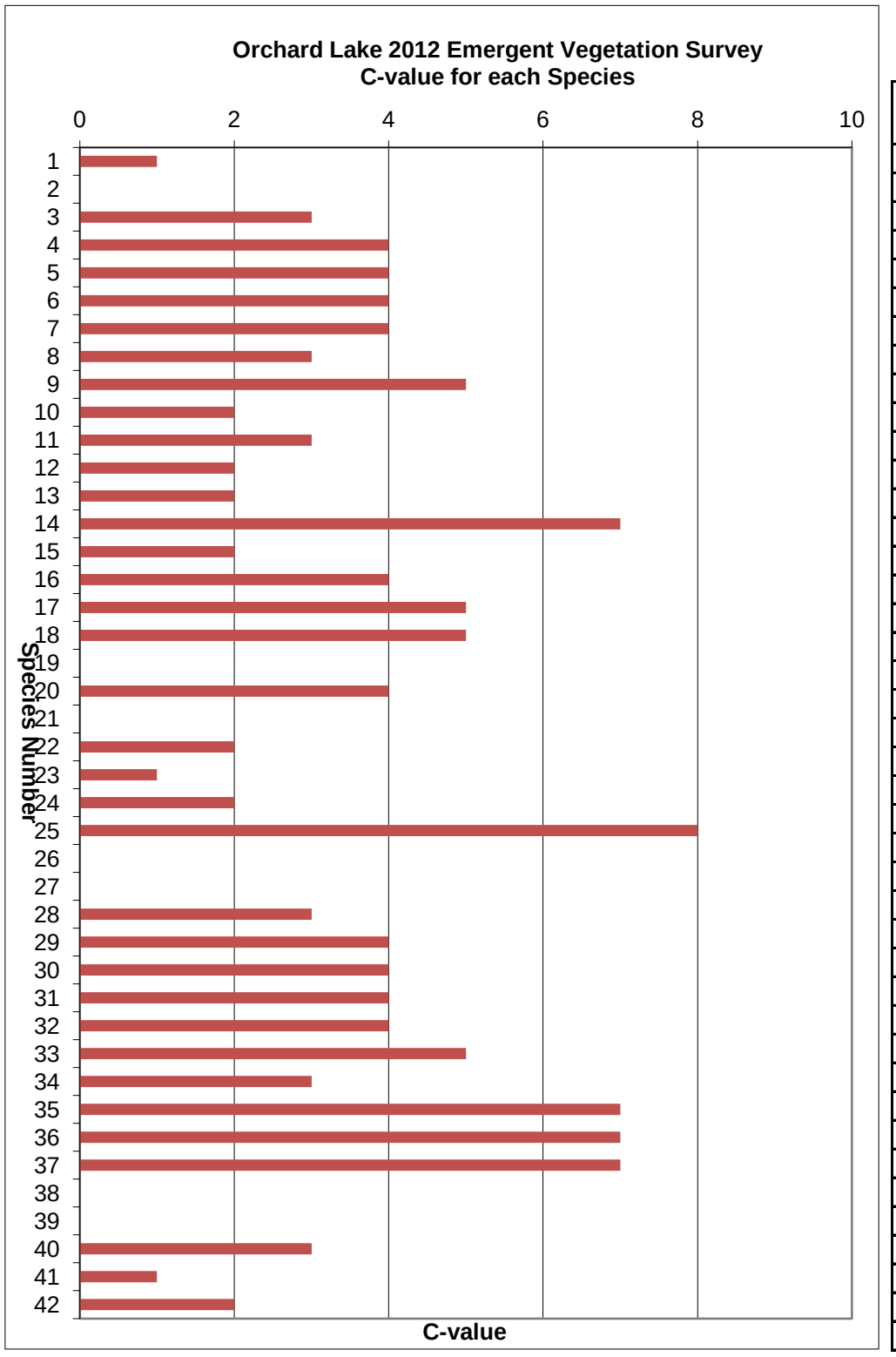
Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Lemna minor	common duckweed	5
Lemna trisulca	star duckweed	5
Myriophyllum sibiricum	Siberian Water-Milfoil	7
Myriophyllum spicatum	Eurasian watermilfoil	0
Nymphaea odorata	white waterlily	6
Potamogeton amplifolius	largeleaf pondweed	7
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton friesii	Fries pondweed	8
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton praelongus	white stemmed pondweed	7
Potamogeton pusillus	leafy pondweed	7
Potamogeton richardsonii	clasping-leaf pondweed	5
Potamogeton zosteriformis	flatstem pondweed	6
Utricularia macrorhiza	common bladderwort	5
Vallisneria americana	wild celery	6
Zosterella dubia	water stargrass	6
Mean C-value		5.3
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		18
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		22.39



Species Number	Scientific Name	Common Name	C-value
1	*Ceratophyllum demersum*	coontail	2
2	*Chara sp.*	muskgrass	7
3	*Lemna minor*	common duckweed	5
4	*Lemna trisulca*	star duckweed	5
5	*Myriophyllum sibiricum*	Siberian Water-Milfoil	7
6	*Myriophyllum spicatum*	Eurasian watermilfoil	0
7	*Nymphaea odorata*	white waterlily	6
8	*Potamogeton amplifolius*	largeleaf pondweed	7
9	*Potamogeton crispus*	curlyleaf pondweed	0
10	*Potamogeton friesii*	Fries pondweed	8
11	*Potamogeton illinoensis*	Illinois pondweed	6
12	*Potamogeton praelongus*	white stemmed pondweed	7
13	*Potamogeton pusillus*	leafy pondweed	7
14	*Potamogeton richardsonii*	clasping-leaf pondweed	5
15	*Potamogeton zosteriformis*	flatstem pondweed	6
16	*Utricularia macrorhiza*	common bladderwort	5
17	*Vallisneria americana*	wild celery	6
18	*Zosterella dubia*	water stargrass	6

2012 Orchard Lake Emergent Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Acer negundo	boxelder	1
Ambrosia trifida	great ragweed	0
Anemone canadensis	Canadian anemone	3
Asclepias incarnata	swamp milkweed	4
Calamagrostis canadensis	Bluejoint	4
Carex comosa	Bearded Sedge	4
Carex scoparia	broom sedge	4
Carex stipata	Stalk-Grain Sedge	3
Carex stricta	Uptight Sedge	5
Cornus racemosa	gray dogwood	2
Eleocharis obtusa	blunt spikerush	3
Equisetum hyemale	scouringrush horsetail	2
Fraxinus pennsylvanica	green ash	2
Glyceria canadensis	Rattlesnake Manna Grass	7
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Lemna minor	common duckweed	5
Lycopus uniflorus	northern bugleweed	5
Lythrum salicaria	purple loosestrife	0
Persicaria sagittata	Arrow-Leaf Tearthumb	4
Phalaris arundinacea	reed canarygrass	0
Polygonum lapathifolium	curlytop knotweed	2
Populus deltoides	eastern cottonwood	1
Populus tremuloides	quaking aspen	2
Quercus bicolor	Swamp White Oak	8
Rhamnus cathartica	common buckthorn	0
Rumex crispus ssp. Crispus	curly dock	0
Sagittaria latifolia	Duck-Potato	3
Salix nigra	black willow	4
Schoenoplectus fluviatilis	river bulrush	4
Schoenoplectus tabernaemontani	softstem bulrush	4
Scirpus atrovirens	green bulrush	4
Sium suave	hemlock waterparsnip	5
Solidago gigantea	Late Goldenrod	3
Streptopus lanceoloatus	Rose Twistedstalk	7
Thelypteris palustris	marsh fern	7
Toxicodendron radicans	eastern poison ivy	7
Typha angustifolia	narrowleaf cattail	0
Typha X glauca	hybrid cattail	0
Ulmus americana	American elm	3
Urtica dioica	Stinging Nettle	1
Vitis riparia	riverbank grape	2
Mean C-value		3.1
S (Number of Species of Emergent Plants in the Lake)		42
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		20.21



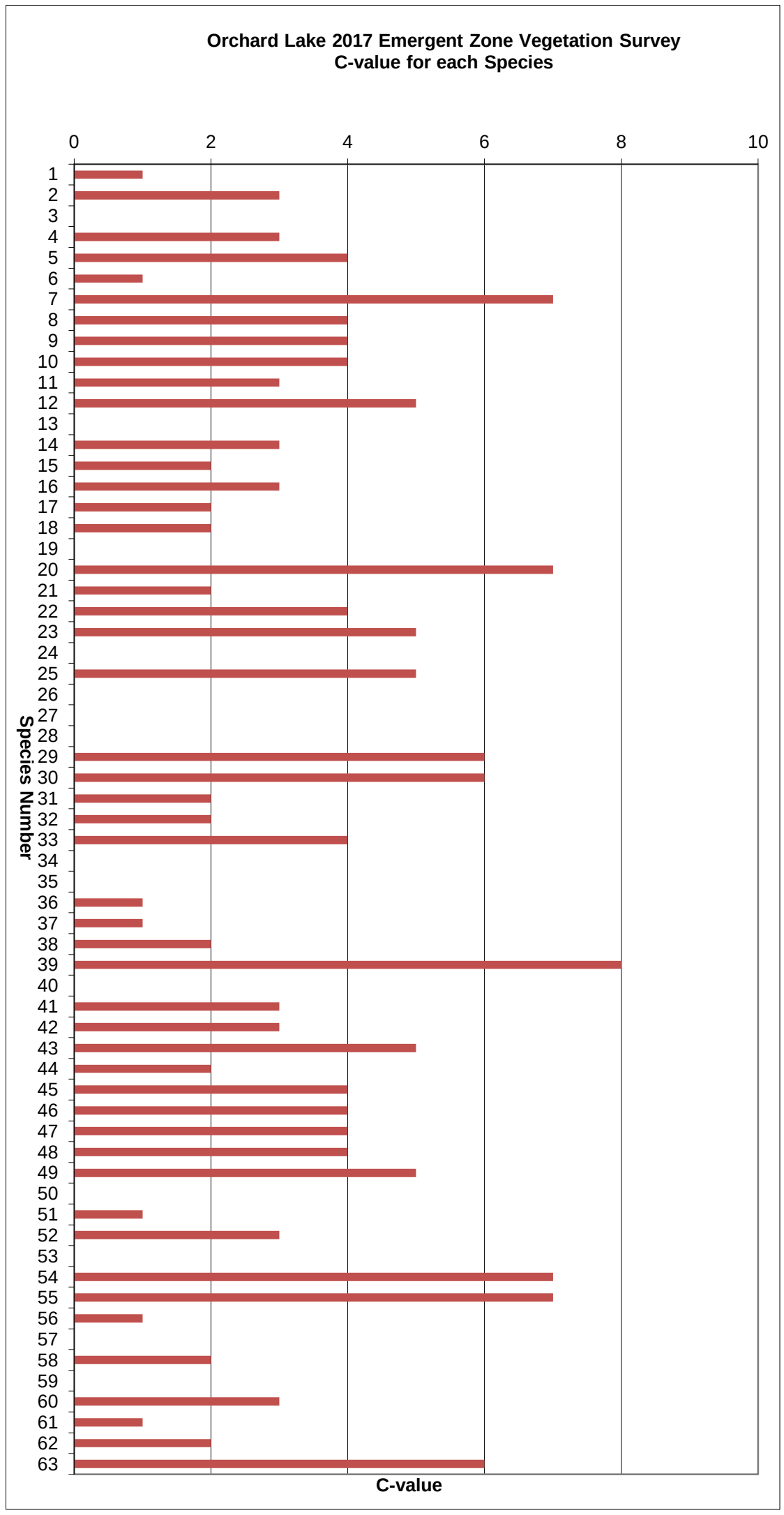
Orchard Lake 2012 Emergent Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Ambrosia trifida var. trifida*	great ragweed	0
3	*Anemone canadensis*	Canadian anemone	3
4	*Asclepias incarnata ssp. Incarnata*	swamp milkweed	4
5	*Calamagrostis canadensis*	Bluejoint	4
6	*Carex comosa*	Bearded Sedge	4
7	*Carex scoparia var. scoparia*	broom sedge	4
8	*Carex stipata*	Stalk-Grain Sedge	3
9	*Carex stricta*	Uptight Sedge	5
10	*Cornus racemosa*	gray dogwood	2
11	*Eleocharis obtusa*	blunt spikerush	3
12	*Equisetum hyemale var. affine*	scouringrush horsetail	2
13	*Fraxinus pennsylvanica*	green ash	2
14	*Glyceria canadensis*	Rattlesnake Manna Grass	7
15	*Impatiens capensis*	jewelweed	2
16	*Iris versicolor*	harlequin blueflag	4
17	*Lemna minor*	common duckweed	5
18	*Lycopus uniflorus*	northern bugleweed	5
19	*Lythrum salicaria*	purple loosestrife	0
20	*Persicaria sagittata*	Arrow-Leaf Tearthumb	4
21	*Phalaris arundinacea*	reed canarygrass	0
22	*Polygonum lapathifolium*	curlytop knotweed	2
23	*Populus deltoides ssp. Monilifera*	eastern cottonwood	1
24	*Populus tremuloides*	quaking aspen	2
25	*Quercus bicolor*	Swamp White Oak	8
26	*Rhamnus cathartica*	common buckthorn	0
27	*Rumex crispus ssp. Crispus*	curly dock	0
28	*Sagittaria latifolia*	Duck-Potato	3
29	*Salix nigra*	black willow	4
30	*Schoenoplectus fluviatilis*	river bulrush	4
31	*Schoenoplectus tabernaemontani*	softstem bulrush	4
32	*Scirpus atrovirens*	green bulrush	4
33	*Sium suave*	hemlock waterparsnip	5
34	*Solidago gigantea*	Late Goldenrod	3
35	*Streptopus lanceoloatus*	Rose Twistedstalk	7
36	*Thelypteris palustris var. pubescens*	marsh fern	7
37	*Toxicodendron radicans*	eastern poison ivy	7
38	*Typha angustifolia*	narrowleaf cattail	0
39	*Typha X glauca*	hybrid cattail	0
40	*Ulmus americana*	American elm	3
41	*Urtica dioica*	Stinging Nettle	1
42	*Vitis riparia*	riverbank grape	2

2017 Orchard Lake Emergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Acer negundo	boxelder	1
Alnus incana	speckled alder	3
Ambrosia trifida	great ragweed	0
Anemone canadensis	Canadian anemone	3
Asclepias incarnata	swamp milkweed	4
Asclepias syriaca *	common milkweed	1
Brasenia schreberi	watershield	7
Calamagrostis canadensis	Bluejoint	4
Carex comosa	Bearded Sedge	4
Carex scoparia	broom sedge	4
Carex stipata	Stalk-Grain Sedge	3
Carex stricta	Uptight Sedge	5
Cirsium arvense	Canada thistle	0
Cornus alba	red-osier dogwood	3
Cornus racemosa	gray dogwood	2
Eleocharis obtusa	blunt spikerush	3
Equisetum hyemale	scouringrush horsetail	2
Fraxinus pennsylvanica	green ash	2
Gleditsia triacanthos	Honey-Locust	0
Glyceria canadensis	Rattlesnake Manna Grass	7
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Lemna minor	common duckweed	5
Lotus corniculatus	bird's-foot trefoil	0
Lycopus uniflorus	northern bugleweed	5
Lythrum salicaria	purple loosestrife	0
Melilotus officinalis	yellow sweetclover	0
Miscanthus sacchariflorus	amur silver grass	0
Nuphar lutea	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Parthenocissus vitacea	woodbine	2
Persicaria lapathifolium	curlytop knotweed	2
Persicaria sagittata	Arrow-Leaf Tearthumb	4
Phalaris arundinacea	reed canarygrass	0
Phleum pratense	Common Timothy	0
Phragmites australis	common reed grass	1
Populus deltoides	eastern cottonwood	1
Populus tremuloides	quaking aspen	2
Quercus bicolor	Swamp White Oak	8
Rhamnus cathartica	common buckthorn	0
Rubus idaeus	Common Red Raspberry	3
Sagittaria latifolia	Duck-Potato	3
Salix amygdaloides	peach leaved willow	5
Salix interior	sandbar willow	2
Salix nigra	black willow	4

Schoenoplectus fluviatilis	river bulrush	4
Schoenoplectus tabernaemontani	softstem bulrush	4
Scirpus atrovirens	green bulrush	4
Sium suave	hemlock waterparsnip	5
Solanum dulcamara	nightshade	0
Solidago canadensis	Canada goldenrod	1
Solidago gigantea	Late Goldenrod	3
Sonchus arvensis	sow thistle	0
Streptopus lanceoloatus	Rose Twistedstalk	7
Thelypteris palustris	marsh fern	7
Toxicodendron rydbergii	western poison ivy	1
Typha angustifolia	narrowleaf cattail	0
Typha latifolia	broad leaf cattail	2
Typha X glauca	hybrid cattail	0
Ulmus americana	American elm	3
Urtica dioica	Stinging Nettle	1
Vitis riparia	riverbank grape	2
Zizia aurea	golden alexanders	6
Mean C-value		2.7
S (Number of Species of Emergent Plants in the Lake)		63
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		21.80



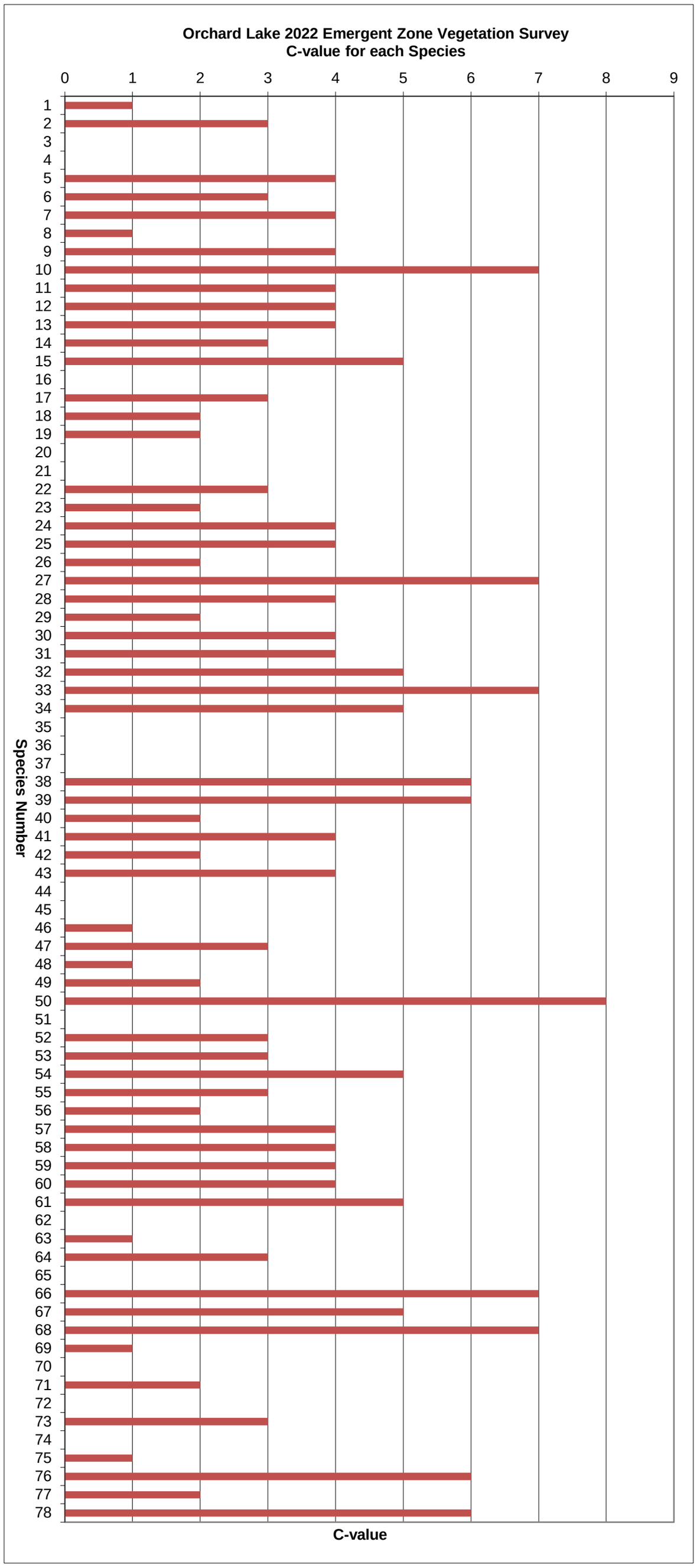
Orchard Lake 2017 Emergent Zone Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Alnus incana*	speckled alder	3
3	*Ambrosia trifida*	great ragweed	0
4	*Anemone canadensis*	Canadian anemone	3
5	*Asclepias incarnata*	swamp milkweed	4
6	*Asclepias syriaca* *	common milkweed	1
7	*Brasenia schreberi*	watershield	7
8	*Calamagrostis canadensis*	Bluejoint	4
9	*Carex comosa*	Bearded Sedge	4
10	*Carex scoparia*	broom sedge	4
11	*Carex stipata*	Stalk-Grain Sedge	3
12	*Carex stricta*	Uptight Sedge	5
13	*Cirsium arvense*	Canada thistle	0
14	*Cornus alba*	red-osier dogwood	3
15	*Cornus racemosa*	gray dogwood	2
16	*Eleocharis obtusa*	blunt spikerush	3
17	*Equisetum hyemale*	scouringrush horsetail	2
18	*Fraxinus pennsylvanica*	green ash	2
19	*Gleditsia triacanthos*	Honey-Locust	0
20	*Glyceria canadensis*	Rattlesnake Manna Grass	7
21	*Impatiens capensis*	jewelweed	2
22	*Iris versicolor*	harlequin blueflag	4
23	*Lemna minor*	common duckweed	5
24	*Lotus corniculatus*	bird's-foot trefoil	0
25	*Lycopus uniflorus*	northern bugleweed	5
26	*Lythrum salicaria*	purple loosestrife	0
27	*Melilotus officinalis*	yellow sweetclover	0
28	*Miscanthus sacchariflorus*	amur silver grass	0
29	*Nuphar lutea*	yellow pond-lily	6
30	*Nymphaea odorata*	white waterlily	6
31	*Parthenocissus vitacea*	woodbine	2
32	*Persicaria lapathifolium*	curlytop knotweed	2
33	*Persicaria sagittata*	Arrow-Leaf Tearthumb	4
34	*Phalaris arundinacea*	reed canarygrass	0
35	*Phleum pratense*	Common Timothy	0
36	*Phragmites australis*	common reed grass	1
37	*Populus deltoides*	eastern cottonwood	1
38	*Populus tremuloides*	quaking aspen	2
39	*Quercus bicolor*	Swamp White Oak	8
40	*Rhamnus cathartica*	common buckthorn	0
41	*Rubus idaeus*	Common Red Raspberry	3
42	*Sagittaria latifolia*	Duck-Potato	3
43	*Salix amygdaloides*	peach leaved willow	5
44	*Salix interior*	sandbar willow	2
45	*Salix nigra*	black willow	4
46	*Schoenoplectus fluviatilis*	river bulrush	4
47	*Schoenoplectus tabernaemontani*	softstem bulrush	4
48	*Scirpus atrovirens*	green bulrush	4
49	*Sium suave*	hemlock waterparsnip	5
50	*Solanum dulcamara*	nightshade	0
51	*Solidago canadensis*	Canada goldenrod	1
52	*Solidago gigantea*	Late Goldenrod	3
53	*Sonchus arvensis*	sow thistle	0
54	*Streptopus lanceoloatus*	Rose Twistedstalk	7
55	*Thelypteris palustris*	marsh fern	7
56	*Toxicodendron rydbergii*	western poison ivy	1
57	*Typha angustifolia*	narrowleaf cattail	0
58	*Typha latifolia*	broad leaf cattail	2
59	*Typha X glauca*	hybrid cattail	0
60	*Ulmus americana*	American elm	3
61	*Urtica dioica*	Stinging Nettle	1
62	*Vitis riparia*	riverbank grape	2
63	*Zizia aurea*	golden alexanders	6

2022 Orchard Lake Emergent Zone Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Acer negundo	boxelder	1
Alnus incana	speckled alder	3
Ambrosia artemisiifolia	common ragweed	0
Ambrosia trifida	great ragweed	0
Amorpha fruticosa	false indigo	4
Anemone canadensis	Canadian anemone	3
Asclepias incarnata	swamp milkweed	4
Asclepias syriaca *	common milkweed	1
Bidens tripartita	three-lobed beggarticks	4
Brasenia schreberi	watershield	7
Calamagrostis canadensis	bluejoint	4
Carex comosa	bearded sedge	4
Carex scoparia	broom sedge	4
Carex stipata	stalk-grain sedge	3
Carex stricta	uptight sedge	5
Cirsium arvense	Canada thistle	0
Cornus alba	red-osier dogwood	3
Cornus racemosa	gray dogwood	2
Cyperus erythrorhizos	red rooted cyperus	2
Dactylis glomerata	orchard grass	0
Echinochloa crus-galli	barnyard grass	0
Eleocharis obtusa	blunt spikerush	3
Equisetum hyemale	scouringrush horsetail	2
Eupatorium perfoliatum	boneset	4
Eutrochium maculatum	Joe-pye weed	4
Fraxinus pennsylvanica	green ash	2
Glyceria canadensis	rattlesnake manna grass	7
Helenium autumnale	sneezeweed	4
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Juncus effusus	soft rush	4
Lemna minor	common duckweed	5
Lobelia cardinalis	cardinal flower	7
Lycopus uniflorus	northern bugleweed	5
Lythrum salicaria	purple loosestrife	0
Melilotus officinalis	yellow sweetclover	0
Miscanthus sacchariflorus	amur silver grass	0
Nuphar variegata	yellow pond-lily	6
Nymphaea odorata	white waterlily	6
Parthenocissus inserta	woodbine	2
Persicaria amphibia	water smartweed	4
Persicaria lapathifolium	curlytop knotweed	2
Persicaria sagittata	arrow-leaf tearthumb	4
Phalaris arundinacea	reed canarygrass	0
Phleum pratense	common timothy	0

Phragmites australis	common reed grass	1
Pilea pumila	clearweed	3
Populus deltoides	eastern cottonwood	1
Populus tremuloides	quaking aspen	2
Quercus bicolor	swamp white oak	8
Rhamnus cathartica	common buckthorn	0
Rubus idaeus	common red raspberry	3
Sagittaria latifolia	duck-potato	3
Salix amygdaloides	peach leaved willow	5
Salix discolor	pussy willow	3
Salix interior	sandbar willow	2
Salix nigra	black willow	4
Schoenoplectus fluviatilis	river bulrush	4
Schoenoplectus tabernaemontani	softstem bulrush	4
Scirpus atrovirens	green bulrush	4
Sium suave	hemlock waterparsnip	5
Solanum dulcamara	nightshade	0
Solidago canadensis	Canada goldenrod	1
Solidago gigantea	late goldenrod	3
Sonchus arvensis	sow thistle	0
Sparganium emersum	unbranched bur-reed	7
Sparganium eurycarpum	giant bur-reed	5
Thelypteris palustris	marsh fern	7
Toxicodendron rydbergii	western poison ivy	1
Typha angustifolia	narrowleaf cattail	0
Typha latifolia	broad leaf cattail	2
Typha X glauca	hybrid cattail	0
Ulmus americana	American elm	3
Ulmus pumila	Siberian elm	0
Urtica dioica	stinging nettle	1
Verbena hastata	blue vervain	6
Vitis riparia	riverbank grape	2
Zizia aurea	golden alexanders	6
Mean C-value		2.9
S (Number of Species of Emergent Plants in the Lake)		78
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		25.70



Orchard Lake 2022 Emergent Zone Vegetation Survey

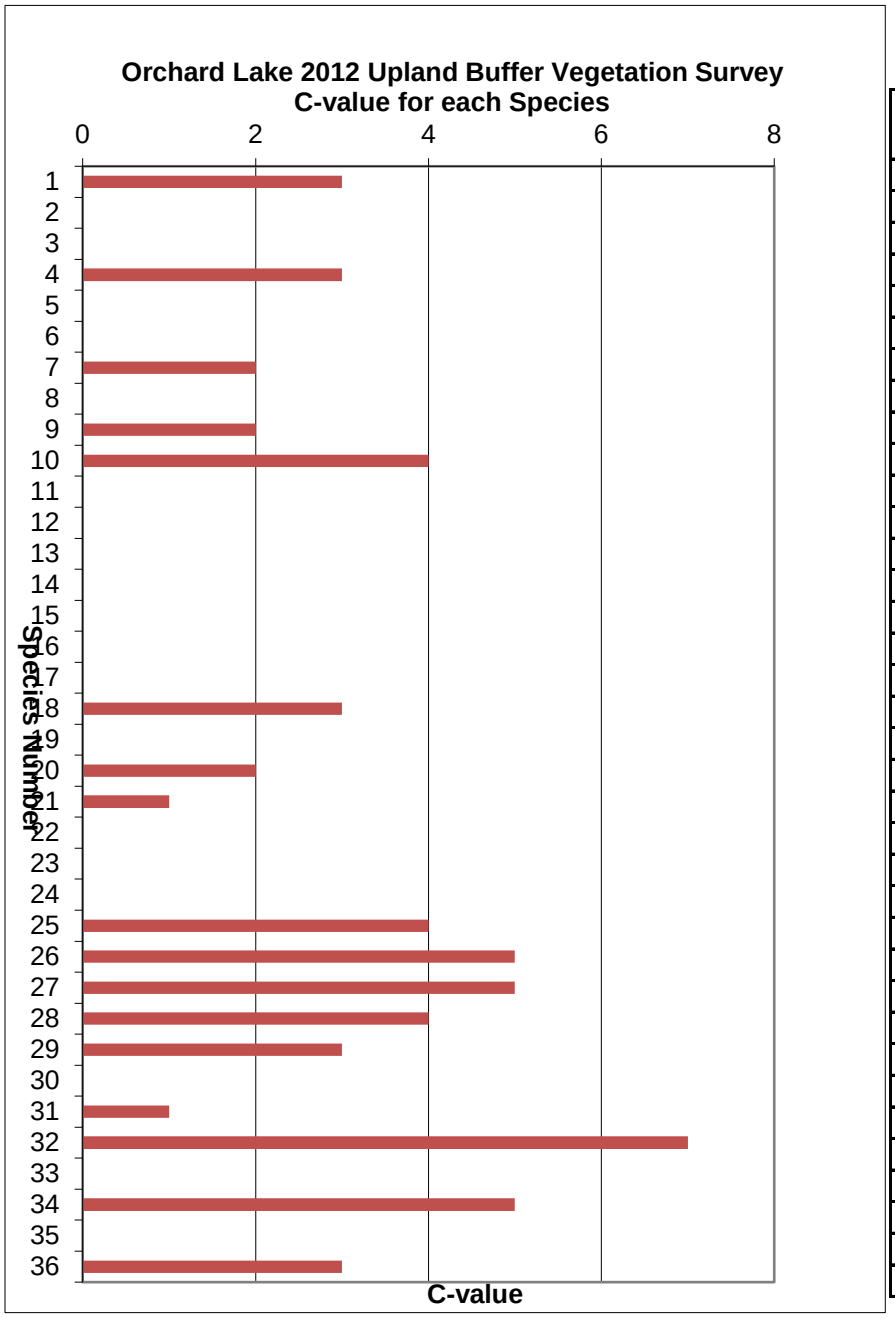
Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Alnus incana*	speckled alder	3
3	*Ambrosia artemisiifolia*	common ragweed	0
4	*Ambrosia trifida*	great ragweed	0
5	*Amorpha fruticosa*	false indigo	4
6	*Anemone canadensis*	Canadian anemone	3
7	*Asclepias incarnata*	swamp milkweed	4
8	*Asclepias syriaca* *	common milkweed	1
9	*Bidens tripartita*	three-lobed beggarticks	4
10	*Brasenia schreberi*	watershield	7
11	*Calamagrostis canadensis*	bluejoint	4
12	*Carex comosa*	bearded sedge	4
13	*Carex scoparia*	broom sedge	4
14	*Carex stipata*	stalk-grain sedge	3
15	*Carex stricta*	uptight sedge	5
16	*Cirsium arvense*	Canada thistle	0
17	*Cornus alba*	red-osier dogwood	3
18	*Cornus racemosa*	gray dogwood	2
19	*Cyperus erythrorhizos*	red rooted cyperus	2
20	*Dactylis glomerata*	orchard grass	0
21	*Echinochloa crus-galli*	barnyard grass	0
22	*Eleocharis obtusa*	blunt spikerush	3
23	*Equisetum hyemale*	scouringrush horsetail	2
24	*Eupatorium perfoliatum*	boneset	4
25	*Eutrochium maculatum*	Joe-pye weed	4
26	*Fraxinus pennsylvanica*	green ash	2
27	*Glyceria canadensis*	rattlesnake manna grass	7
28	*Helenium autumnale*	sneezeweed	4
29	*Impatiens capensis*	jewelweed	2
30	*Iris versicolor*	harlequin blueflag	4
31	*Juncus effusus*	soft rush	4
32	*Lemna minor*	common duckweed	5
33	*Lobelia cardinalis*	cardinal flower	7
34	*Lycopus uniflorus*	northern bugleweed	5
35	*Lythrum salicaria*	purple loosestrife	0
36	*Melilotus officinalis*	yellow sweetclover	0
37	*Miscanthus sacchariflorus*	amur silver grass	0
38	*Nuphar variegata*	yellow pond-lily	6
39	*Nymphaea odorata*	white waterlily	6
40	*Parthenocissus inserta*	woodbine	2
41	*Persicaria amphibia*	water smartweed	4
42	*Persicaria lapathifolium*	curlytop knotweed	2
43	*Persicaria sagittata*	arrow-leaf tearthumb	4
44	*Phalaris arundinacea*	reed canarygrass	0
45	*Phleum pratense*	common timothy	0
46	*Phragmites australis*	common reed grass	1
47	*Pilea pumila*	clearweed	3
48	*Populus deltoides*	eastern cottonwood	1
49	*Populus tremuloides*	quaking aspen	2
50	*Quercus bicolor*	swamp white oak	8
51	*Rhamnus cathartica*	common buckthorn	0
52	*Rubus idaeus*	common red raspberry	3
53	*Sagittaria latifolia*	duck-potato	3
54	*Salix amygdaloides*	peach leaved willow	5
55	*Salix discolor*	pussy willow	3
56	*Salix interior*	sandbar willow	2
57	*Salix nigra*	black willow	4
58	*Schoenoplectus fluviatilis*	river bulrush	4
59	*Schoenoplectus tabernaemontani*	softstem bulrush	4
60	*Scirpus atrovirens*	green bulrush	4
61	*Sium suave*	hemlock waterparsnip	5
62	*Solanum dulcamara*	nightshade	0
63	*Solidago canadensis*	Canada goldenrod	1
64	*Solidago gigantea*	late goldenrod	3
65	*Sonchus arvensis*	sow thistle	0
66	*Sparganium emersum*	unbranched bur-reed	7
67	*Sparganium eurycarpum*	giant bur-reed	5
68	*Thelypteris palustris*	marsh fern	7
69	*Toxicodendron rydbergii*	western poison ivy	1
70	*Typha angustifolia*	narrowleaf cattail	0
71	*Typha latifolia*	broad leaf cattail	2
72	*Typha X glauca*	hybrid cattail	0
73	*Ulmus americana*	American elm	3
74	*Ulmus pumila*	Siberian elm	0
75	*Urtica dioica*	stinging nettle	1
76	*Verbena hastata*	blue vervain	6
77	*Vitis riparia*	riverbank grape	2
78	*Zizia aurea*	golden alexanders	6

2012 Orchard Lake Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer saccharinum	Silver Maple	3
Arctium minus	burrdock	0
Asclepias syriaca *	common milkweed	1
Carex pensylvanica *	Pennsylvania sedge	3
Centaurea biebersteinii	Spotted Knapweed	0
Cirsium arvense	Canada thistle	0
Cornus racemosa	gray dogwood	2
Dactylis glomerata	Orchard Grass	0
Erigeron strigosus	Prairie Fleabane	2
Geranium maculatum	Spotted Crane's-Bill	4
Gleditsia triacanthos	Honey-Locust	0
Hemerocallis fulva	orange day lily	0
Lactuca serriola	prickly lettuce	0
Lonicera tatarica	Tatarian honeysuckle	0
Lotus corniculatus	bird's-foot trefoil	0
Medicago lupulina	black medick	0
Melilotus officinalis	yellow sweetclover	0
Monarda fistulosa	Oswego-Tea	3
Oxalis stricta	Upright Yellow Wood-Sorrel	0
Parthenocissus vitacea	woodbine	2
Persicaria pensylvanica	Pinkweed	1
Phleum pratense	Common Timothy	0
Plantago major	common plantain	0
Poa pratensis	Kentucky bluegrass	0
Polygonatum biflorum	Solomon's seal	4
Quercus ellipsoidalis *	pin oak	5
Quercus rubra	northern red oak	5
Rhus spp. * **	sumac	4
Rubus idaeus	Common Red Raspberry	3
Sedum sp.	stonecrop	0
Solidago canadensis	Canada goldenrod	1
Streptopus lanceolatus	Lance-Leaf Twistedstalk	7
Taraxacum officinale	common dandelion	0
Tilia americana	American basswood	5
Trifolium pratense	red clover	0
Ulmus americana	American elm	3
Mean C-value		1.6
S (Number of Species of Upland Buffer Plants)		36
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		9.67

* A C-value for this species has not been determined in Minnesota.
The C-value used is from the Wisconsin Floristic Quality Assessment.

** An average C-value was used for this genus, since the species were not verified.



Orchard Lake 2012 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer saccharinum*	Silver Maple	3
2	*Arctium minus*	burrdock	0
3	*Asclepias syriaca*	common milkweed	0
4	*Carex pensylvanica* *	Pennsylvania sedge	3
5	*Centaurea biebersteinii*	Spotted Knapweed	0
6	*Cirsium arvense*	Canada thistle	0
7	*Cornus racemosa*	gray dogwood	2
8	*Dactylis glomerata*	Orchard Grass	0
9	*Erigeron strigosus*	Prairie Fleabane	2
10	*Geranium maculatum*	Spotted Crane's-Bill	4
11	*Gleditsia triacanthos*	Honey-Locust	0
12	*Hemerocallis fulva*	orange day lily	0
13	*Lactuca serriola*	prickly lettuce	0
14	*Lonicera tatarica*	Tatarian honeysuckle	0
15	*Lotus corniculatus*	bird's-foot trefoil	0
16	*Medicago lupulina*	black medick	0
17	*Melilotus officinalis*	yellow sweetclover	0
18	*Monarda fistulosa*	Oswego-Tea	3
19	*Oxalis stricta*	Upright Yellow Wood-Sorrel	0
20	*Parthenocissus vitacea*	woodbine	2
21	*Persicaria pensylvanica*	Pinkweed	1
22	*Phleum pratense*	Common Timothy	0
23	*Plantago major*	common plantain	0
24	*Poa pratensis*	Kentucky bluegrass	0
25	*Polygonatum biflorum*	Solomon's seal	4
26	*Quercus ellipsoidalis* *	pin oak	5
27	*Quercus rubra*	northern red oak	5
28	*Rhus spp.* * **	sumac	4
29	*Rubus idaeus*	Common Red Raspberry	3
30	*Sedum sp.*	stonecrop	0
31	*Solidago canadensis*	Canada goldenrod	1
32	*Streptopus lanceolatus*	Lance-Leaf Twistedstalk	7
33	*Taraxacum officinale*	common dandelion	0
34	*Tilia americana*	American basswood	5
35	*Trifolium pratense*	red clover	0
36	*Ulmus americana*	American elm	3

2017 Orchard Lake Upland Buffer Vegetation Floristic Quality Index

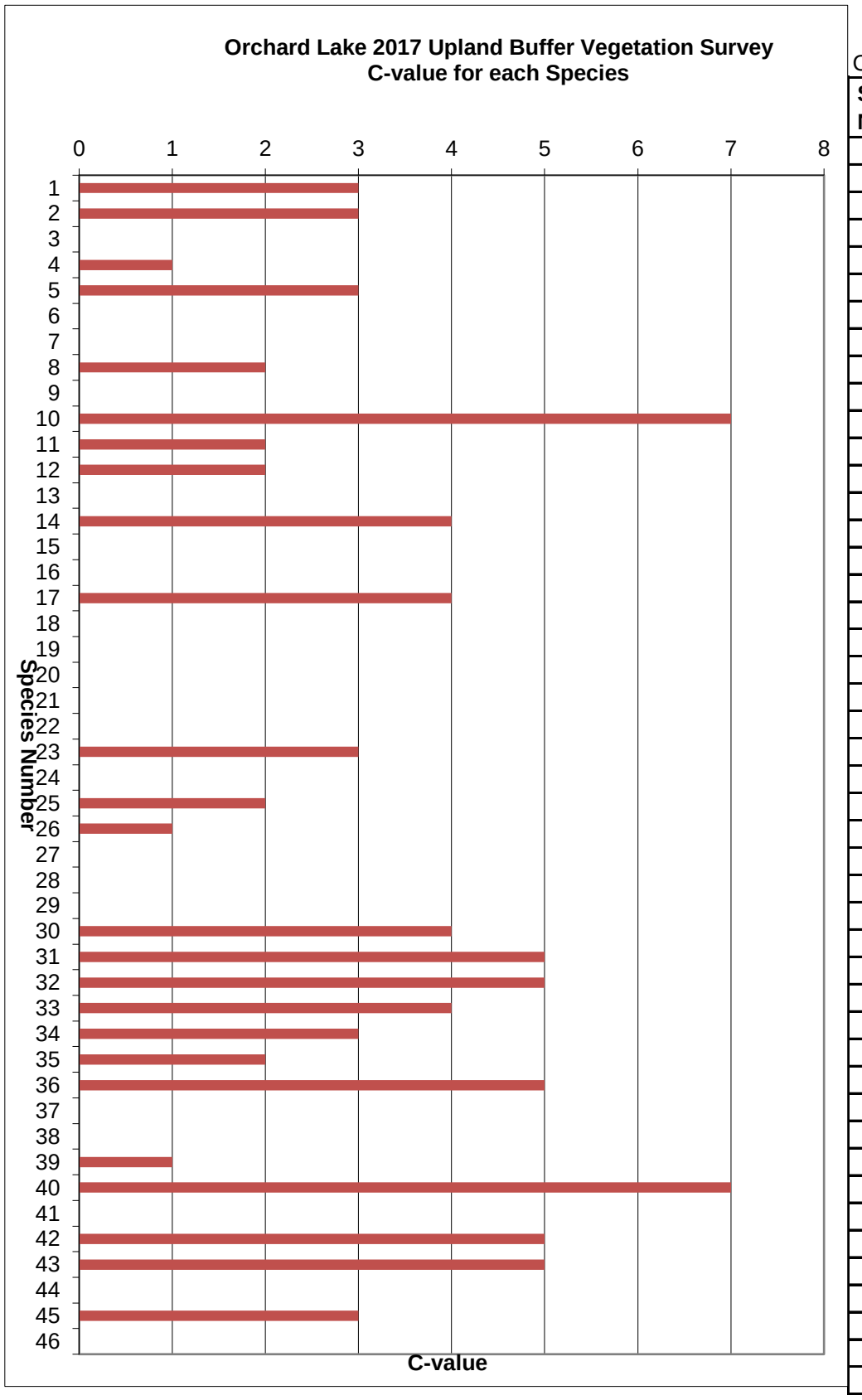
Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer saccharinum	Silver Maple	3
Apocynum cannabinum	dogbane	3
Arctium minus	burrdock	0
Asclepias syriaca *	common milkweed	1
Carex pensylvanica *	Pennsylvania sedge	3
Centaurea biebersteinii	Spotted Knapweed	0
Cirsium arvense	Canada thistle	0
Cornus racemosa	gray dogwood	2
Dactylis glomerata	Orchard Grass	0
Dalea purpurea *	purple prairie clover	7
Equisetum hyemale	scouringrush horsetail	2
Erigeron strigosus	Prairie Fleabane	2
Euphorbia esula	leafy spurge	0
Geranium maculatum	Spotted Crane's-Bill	4
Gleditsia triacanthos	Honey-Locust	0
Hemerocallis fulva	orange day lily	0
Juglans nigra	black walnut	4
Lactuca serriola	prickly lettuce	0
Lonicera tatarica	Tatarian honeysuckle	0
Lotus corniculatus	bird's-foot trefoil	0
Medicago lupulina	black medick	0
Melilotus officinalis	yellow sweetclover	0
Monarda fistulosa	Oswego-Tea	3
Oxalis stricta	Upright Yellow Wood-Sorrel	0
Parthenocissus vitacea	woodbine	2
Persicaria pensylvanica	Pinkweed	1
Phleum pratense	Common Timothy	0
Plantago major	common plantain	0
Poa pratensis	Kentucky bluegrass	0
Polygonatum biflorum	Solomon's seal	4
Quercus ellipsoidalis *	pin oak	5
Quercus rubra	northern red oak	5
Rhus spp. * **	sumac	4
Rubus idaeus	Common Red Raspberry	3
Rubus occidentalis *	black raspberry	2
Sambucus racemosa	red-berried elder	5
Securigera varia	crown vetch	0
Sedum sp.	stonecrop	0
Solidago canadensis	Canada goldenrod	1
Streptopus lanceolatus	Lance-Leaf Twistedstalk	7
Taraxacum officinale	common dandelion	0
Thalictrum dioicum	early meadow-rue	5
Tilia americana	American basswood	5
Trifolium pratense	red clover	0

2017 Orchard Lake Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ulmus americana	American elm	3
Verbascum thapsus	common mullein	0
Mean C-value		1.9
S (Number of Species of Upland Buffer Plants)		46
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		12.68

* A C-value for this species has not been determined in Minnesota.
The C-value used is from the Wisconsin Floristic Quality Assessment.

** An average C-value was used for this genus, since the species were not verified.



Orchard Lake 2017 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer saccharinum*	Silver Maple	3
2	*Apocynum cannabinum*	dogbane	3
3	*Arctium minus*	burrdock	0
4	*Asclepias syriaca* *	common milkweed	1
5	*Carex pensylvanica* *	Pennsylvania sedge	3
6	*Centaurea biebersteinii*	Spotted Knapweed	0
7	*Cirsium arvense*	Canada thistle	0
8	*Cornus racemosa*	gray dogwood	2
9	*Dactylis glomerata*	Orchard Grass	0
10	*Dalea purpurea* *	purple prairie clover	7
11	*Equisetum hyemale*	scouringrush horsetail	2
12	*Erigeron strigosus*	Prairie Fleabane	2
13	*Euphorbia esula*	leafy spurge	0
14	*Geranium maculatum*	Spotted Crane's-Bill	4
15	*Gleditsia triacanthos*	Honey-Locust	0
16	*Hemerocallis fulva*	orange day lily	0
17	*Juglans nigra*	black walnut	4
18	*Lactuca serriola*	prickly lettuce	0
19	*Lonicera tatarica*	Tatarian honeysuckle	0
20	*Lotus corniculatus*	bird's-foot trefoil	0
21	*Medicago lupulina*	black medick	0
22	*Melilotus officinalis*	yellow sweetclover	0
23	*Monarda fistulosa*	Oswego-Tea	3
24	*Oxalis stricta*	Upright Yellow Wood-Sorrel	0
25	*Parthenocissus vitacea*	woodbine	2
26	*Persicaria pensylvanica*	Pinkweed	1
27	*Phleum pratense*	Common Timothy	0
28	*Plantago major*	common plantain	0
29	*Poa pratensis*	Kentucky bluegrass	0
30	*Polygonatum biflorum*	Solomon's seal	4
31	*Quercus ellipsoidalis* *	pin oak	5
32	*Quercus rubra*	northern red oak	5
33	*Rhus spp.* * **	sumac	4
34	*Rubus idaeus*	Common Red Raspberry	3
35	*Rubus occidentalis* *	black raspberry	2
36	*Sambucus racemosa*	red-berried elder	5
37	*Securigera varia*	crown vetch	0
38	*Sedum sp.*	stonecrop	0
39	*Solidago canadensis*	Canada goldenrod	1
40	*Streptopus lanceolatus*	Lance-Leaf Twistedstalk	7
41	*Taraxacum officinale*	common dandelion	0
42	*Thalictrum dioicum*	early meadow-rue	5
43	*Tilia americana*	American basswood	5
44	*Trifolium pratense*	red clover	0
45	*Ulmus americana*	American elm	3
46	*Verbascum thapsus*	common mullein	0

2022 Orchard Lake Upland Buffer Vegetation Floristic Quality Index

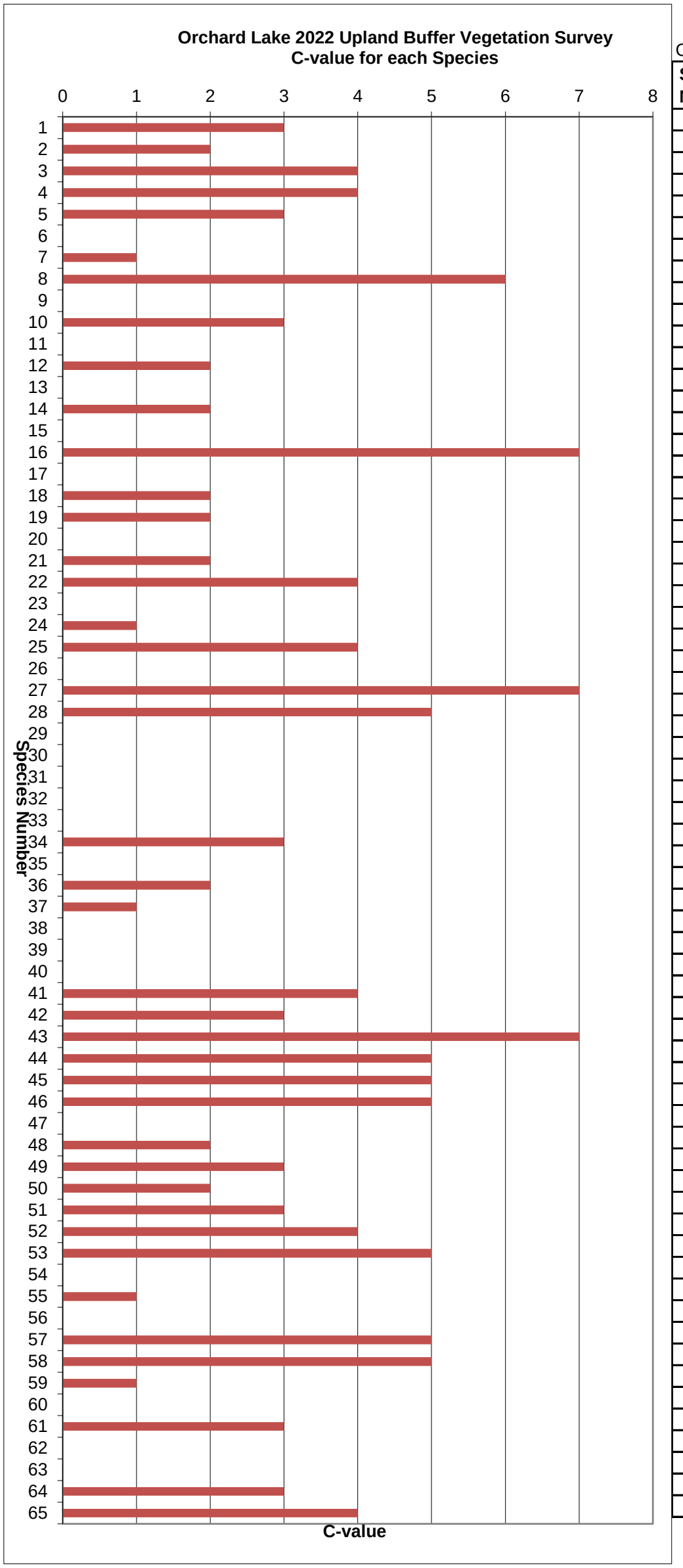
Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer saccharinum	silver maple	3
Ageratina altissima	white snakeroot	2
Amorpha fruticosa	false indigo	4
Andropogon gerardii	big bluestem	4
Apocynum cannabinum	dogbane	3
Arctium minus	burrdock	0
Asclepias syriaca *	common milkweed	1
Asclepias tuberosa *	butterfly weed	6
Bromus inermis	smooth brome	0
Carex pensylvanica *	Pennsylvania sedge	3
Centaurea biebersteinii	spotted knapweed	0
Circaea lutetiana	broadleaf nightshade	2
Cirsium arvense	Canada thistle	0
Cornus racemosa	gray dogwood	2
Dactylis glomerata	orchard grass	0
Dalea purpurea *	purple prairie clover	7
Daucus carota	Queen Anne's lace	0
Equisetum hyemale	scouringrush horsetail	2
Erigeron strigosus	prairie fleabane	2
Euphorbia esula	leafy spurge	0
Fraxinus pennsylvanica	green ash	2
Geranium maculatum	wild geranium	4
Glechoma hederacea	ground ivy	0
Hackelia virginiana	sticktight	1
Juglans nigra	black walnut	4
Lactuca serriola	prickly lettuce	0
Liatris ligulistylis *	meadow blazing star	7
Lobelia siphilitica	blue lobelia	5
Lonicera tatarica	tatarian honeysuckle	0
Lotus corniculatus	bird's-foot trefoil	0
Medicago lupulina	black medick	0
Melilotus officinalis	yellow sweetclover	0
Miscanthus sinensis	Chinese silvergrass	0
Monarda fistulosa	oswego-tea	3
Oxalis stricta	upright yellow wood-sorrel	0
Parthenocissus inserta	woodbine	2
Persicaria pensylvanica	pinkweed	1
Phleum pratense	common Timothy	0
Plantago major	common plantain	0
Poa pratensis	Kentucky bluegrass	0
Polygonatum biflorum	Solomon's seal	4
Prunus virginiana	chokecherry	3
Quercus alba	white oak	7
Quercus ellipsoidalis *	pin oak	5

2022 Orchard Lake Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Quercus macrocarpa	bur oak	5
Quercus rubra	northern red oak	5
Rhamnus cathartica	common buckthorn	0
Rhus typhina *	staghorn sumac	2
Rubus idaeus	common red raspberry	3
Rubus occidentalis *	black raspberry	2
Rudbeckia hirta	black-eyed Susan	3
Rudbeckia laciniata	tall coneflower	4
Sambucus racemosa	red-berried elder	5
Securigera varia	crown vetch	0
Solidago canadensis	Canada goldenrod	1
Taraxacum officinale	common dandelion	0
Thalictrum dioicum	early meadow-rue	5
Tilia americana	American basswood	5
Toxicodendron rydbergii	western poison ivy	1
Trifolium pratense	red clover	0
Ulmus americana	American elm	3
Ulmus pumila	Siberian elm	0
Verbascum thapsus	common mullein	0
Verbena stricta *	hoary vervain	3
Vicia americana *	purple vetch	4
Mean C-value		2.2
S (Number of Species of Upland Buffer Plants)		65
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		17.36

* A C-value for this species has not been determined in Minnesota.
The C-value used is from the Wisconsin Floristic Quality Assessment.

** An average C-value was used for this genus, since the species were not verified.



Orchard Lake 2022 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer saccharinum*	silver maple	3
2	*Ageratina altissima*	white snakeroot	2
3	*Amorpha fruticosa*	false indigo	4
4	*Andropogon gerardii*	big bluestem	4
5	*Apocynum cannabinum*	dogbane	3
6	*Arctium minus*	burrdock	0
7	*Asclepias syriaca* *	common milkweed	1
8	*Asclepias tuberosa* *	butterfly weed	6
9	*Bromus inermis*	smooth brome	0
10	*Carex pensylvanica* *	Pennsylvania sedge	3
11	*Centaurea biebersteinii*	spotted knapweed	0
12	*Circaea lutetiana*	broadleaf nightshade	2
13	*Cirsium arvense*	Canada thistle	0
14	*Cornus racemosa*	gray dogwood	2
15	*Dactylis glomerata*	orchard grass	0
16	*Dalea purpurea* *	purple prairie clover	7
17	*Daucus carota*	Queen Anne's lace	0
18	*Equisetum hyemale*	scouringrush horsetail	2
19	*Erigeron strigosus*	prairie fleabane	2
20	*Euphorbia esula*	leafy spurge	0
21	*Fraxinus pennsylvanica*	green ash	2
22	*Geranium maculatum*	wild geranium	4
23	*Glechoma hederacea*	ground ivy	0
24	*Hackelia virginiana*	sticktight	1
25	*Juglans nigra*	black walnut	4
26	*Lactuca serriola*	prickly lettuce	0
27	*Liatris ligulistylis* *	meadow blazing star	7
28	*Lobelia siphilitica*	blue lobelia	5
29	*Lonicera tatarica*	tatarian honeysuckle	0
30	*Lotus corniculatus*	bird's-foot trefoil	0
31	*Medicago lupulina*	black medick	0
32	*Melilotus officinalis*	yellow sweetclover	0
33	*Miscanthus sinensis*	Chinese silvergrass	0
34	*Monarda fistulosa*	oswego-tea	3
35	*Oxalis stricta*	upright yellow wood-sorrel	0
36	*Parthenocissus inserta*	woodbine	2
37	*Persicaria pensylvanica*	pinkweed	1
38	*Phleum pratense*	common Timothy	0
39	*Plantago major*	common plantain	0
40	*Poa pratensis*	Kentucky bluegrass	0
41	*Polygonatum biflorum*	Solomon's seal	4
42	*Prunus virginiana*	chokecherry	3
43	*Quercus alba*	white oak	7
44	*Quercus ellipsoidalis* *	pin oak	5
45	*Quercus macrocarpa*	bur oak	5
46	*Quercus rubra*	northern red oak	5
47	*Rhamnus cathartica*	common buckthorn	0
48	*Rhus typhina* *	staghorn sumac	2
49	*Rubus idaeus*	common red raspberry	3
50	*Rubus occidentalis* *	black raspberry	2
51	*Rudbeckia hirta*	black-eyed Susan	3
52	*Rudbeckia laciniata*	tall coneflower	4
53	*Sambucus racemosa*	red-berried elder	5
54	*Securigera varia*	crown vetch	0
55	*Solidago canadensis*	Canada goldenrod	1
56	*Taraxacum officinale*	common dandelion	0
57	*Thalictrum dioicum*	early meadow-rue	5
58	*Tilia americana*	American basswood	5
59	*Toxicodendron rydbergii*	western poison ivy	1
60	*Trifolium pratense*	red clover	0
61	*Ulmus americana*	American elm	3
62	*Ulmus pumila*	Siberian elm	0
63	*Verbascum thapsus*	common mullein	0
64	*Verbena stricta* *	hoary vervain	3
65	*Vicia americana* *	purple vetch	4

Community #1

Eggers & Reed Plant Community Type: Shallow Open Water

Percent of AA Occupied by Type: 75

Spp. #	Scientific Name	Common Name	Cover Class	CC Range	Midpoint CC	Native Status	Rapid FQA Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	p	pC
1	Ceratophyllum demersum	Coon's-Tail	5	> 50 - 75%	62.5	Native	Aquatic	OBL	OBL	OBL	2	0.5787	1.1574
2	Lemna minor	Common Duckweed	3	> 5 - 25%	15	Native	Aquatic	OBL	OBL	OBL	5	0.1389	0.6944
3	Lemna trisulca	Ivy-Leaf Duckweed	3	> 5 - 25%	15	Native	Aquatic	OBL	OBL	OBL	5	0.1389	0.6944
4	Nymphaea odorata	American White Water-Lily	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	6	0.0278	0.1667
5	Potamogeton amplifolius	Large-Leaf Pondweed	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	7	0.0278	0.1944
6	Potamogeton crispus	Curly Pondweed	2	> 1 - 5%	3	Introduced	Aquatic	OBL	OBL	OBL	0	0.0278	0
7	Potamogeton zosteriformis	Flat-Stem Pondweed	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	6	0.0278	0.1667
8	Utricularia macrorhiza	Greater Bladderwort	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	5	0.0278	0.1389
9	Vallisneria americana	American Eel-Grass	1	> 0 - 1%	0.5	Native	Aquatic	OBL	OBL	OBL	6	0.0046	0.0278
10		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
11		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
13		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
14		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
15		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
16		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
17		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
18		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
19		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
20		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
21		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
22		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
23		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
24		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
26		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
27		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
28		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
29		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
30		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
31		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
32		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
33		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
34		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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39		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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41		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
42		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
43		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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46		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
47		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
48		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
49		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
50		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
51		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
52		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
53		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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55		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
56		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
57		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
58		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
59		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
60		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Community #2

Eggers & Reed Plant Community Type: Deep Marsh

Percent of AA Occupied by Type: 15

Spp. #	Scientific Name	Common Name	Cover Class	CC Range	Midpoint CC	Native Status	Rapid FQA Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	p	pC
1	Asclepias incarnata	Swamp Milkweed	2	> 1 - 5%	3	Native	Herb	FACW	OBL	OBL	4	0.0248	0.0992
2	Calamagrostis canadensis	Bluejoint	1	> 0 - 1%	0.5	Native	Herb	FACW	OBL	OBL	4	0.0041	0.0165
3	Carex comosa	Bearded Sedge	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0041	0.0165
4	Carex stipata	Stalk-Grain Sedge	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	3	0.0041	0.0124
5	Carex stricta	Uptight Sedge	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0041	0.0207
6	Alnus incana	Speckled Alder	1	> 0 - 1%	0.5	Native	Shrub	FACW	FACW	FACW	3	0.0041	0.0124
7	Brasenia schreberi	Watershield	3	> 5 - 25%	15	Native	Aquatic	OBL	OBL	OBL	7	0.124	0.8678
8	Eleocharis obtusa	Blunt Spike-Rush	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	3	0.0248	0.0744
9	Glyceria canadensis	Rattlesnake Manna Grass	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	7	0.0041	0.0289
10	Impatiens capensis	Spotted Touch-Me-Not	2	> 1 - 5%	3	Native	Herb	FACW	FACW	FACW	2	0.0248	0.0496
11	Iris versicolor	Harlequin Blueflag	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	4	0.0248	0.0992
12	Lemna minor	Common Duckweed	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	5	0.0248	0.124
13	Lycopus uniflorus	Northern Water-Horehound	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0041	0.0207
14	Lythrum salicaria	Purple Loosestrife	2	> 1 - 5%	3	Introduced	Herb	OBL	OBL	OBL	0	0.0248	0
15	Nuphar variegata	0	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	6	0.0248	0.1488
16	Nymphaea odorata	American White Water-Lily	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	6	0.0248	0.1488
17	Phragmites australis	Common Reed	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	1	0.0041	0.0041
18	Sagittaria latifolia	Duck-Potato	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	3	0.0041	0.0124
19	Schoenoplectus fluviatilis	River Club-Rush	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0041	0.0165
20	Schoenoplectus tabernaemontani	Soft-Stem Club-Rush	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0041	0.0165
21	Sium suave	Hemlock Water-Parsnip	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0041	0.0207
22	Thelypteris palustris	Eastern Marsh Fern	2	> 1 - 5%	3	Native	Herb	OBL	OBL	FACW	7	0.0248	0.1736
23	Typha angustifolia	Narrow-Leaf Cat-Tail	5	> 50 - 75%	62.5	Introduced	Herb	OBL	OBL	OBL	0	0.5165	0
24	Typha latifolia	Broad-Leaf Cat-Tail	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	2	0.0248	0.0496
25	Typha X glauca	0	2	> 1 - 5%	3	Introduced	Herb	OBL	OBL	OBL	0	0.0248	0
26	Persicaria amphibia	Water Smartweed	1	> 0 - 1%	0.5	Native	Aquatic, Herb	OBL	OBL	OBL	4	0.0041	0.0165
27	Pilea pumila	Canadian Clearweed	1	> 0 - 1%	0.5	Native	Herb	FAC	FACW	FACW	3	0.0041	0.0124
28	Sium suave	Hemlock Water-Parsnip	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0041	0.0207
29	Sparganium eurycarpum	Broad-Fruit Burr-Reed	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	5	0.0248	0.124
30		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
31		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
32		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
33		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
34		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
37		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
38		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
39		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
40		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
41		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
42		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
43		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
44		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
45		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
46		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
47		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
48		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
49		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
50		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
51		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
52		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
53		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
54		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
56		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
57		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
58		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
59		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
60		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Community #3

Eggers & Reed Plant Community Type: Floodplain Forest

Percent of AA Occupied by Type: 10

Spp. #	Scientific Name	Common Name	Cover Class	CC Range	Midpoint CC	Native Status	Rapid FQA Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	p	pC
1	Acer negundo	Ash-Leaf Maple	2	> 1 - 5%	3	Native	Tree	FAC	FAC	FAC	1	0.0168	0.0168
2	Ambrosia trifida	Great Ragweed	1	> 0 - 1%	0.5	Native	Herb	FAC	FAC	FAC	0	0.0028	0
3	Anemone canadensis	Round-Leaf Thimbleweed	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	3	0.0028	0.0084
4	Cirsium arvense	Canadian Thistle	1	> 0 - 1%	0.5	Introduced	Herb	FACU	FACU	FACU	0	0.0028	0
5	Cornus alba	Red Osier	2	> 1 - 5%	3	Native	Shrub	FACW	FACW	FACW	3	0.0168	0.0504
6	Cornus racemosa	Gray Dogwood	1	> 0 - 1%	0.5	Native	Shrub	FAC	FAC	FAC	2	0.0028	0.0056
7	Fraxinus pennsylvanica	Green Ash	3	> 5 - 25%	15	Native	Tree	FAC	FACW	FACW	2	0.084	0.1681
8	Parthenocissus inserta	Thicket-Creeper	2	> 1 - 5%	3	Native	Woody Vine	FAC	FACU	FACU	2	0.0168	0.0336
9	Persicaria lapathifolia	Dock-Leaf Smartweed	1	> 0 - 1%	0.5	Native	Herb	OBL	FACW	FACW	2	0.0028	0.0056
10	Persicaria sagittata	Arrow-Leaf Tearthumb	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0028	0.0112
11	Phalaris arundinacea	Reed Canary Grass	4	> 25 - 50%	37.5	Introduced	Herb	FACW	FACW	FACW	0	0.2101	0
12	Populus deltoides	Eastern Cottonwood	3	> 5 - 25%	15	Native	Tree	FAC	FAC	FAC	1	0.084	0.084
13	Populus tremuloides	Quaking Aspen	2	> 1 - 5%	3	Native	Tree	FAC	FAC	FAC*	2	0.0168	0.0336
14	Rhamnus cathartica	European Buckthorn	3	> 5 - 25%	15	Introduced	Shrub	FACU	FAC	FAC	0	0.084	0
15	Rubus idaeus	Common Red Raspberry	2	> 1 - 5%	3	Native	Shrub	FACU	FACU	FAC*	3	0.0168	0.0504
16	Salix amygdaloides	Peach-Leaf Willow	2	> 1 - 5%	3	Native	Tree	FACW	FACW	FACW	5	0.0168	0.084
17	Salix interior	Sandbar Willow	2	> 1 - 5%	3	Native	Shrub	FACW	FACW	FACW	2	0.0168	0.0336
18	Salix nigra	Black Willow	2	> 1 - 5%	3	Native	Tree	FACW	OBL	OBL	4	0.0168	0.0672
19	Solanum dulcamara	Climbing Nightshade	2	> 1 - 5%	3	Introduced	Woody Vine	FACU	FAC	FAC	0	0.0168	0
20	Solidago canadensis	Canadian Goldenrod	3	> 5 - 25%	15	Native	Herb	FACU	FACU	FACU	1	0.084	0.084
21	Solidago gigantea	Late Goldenrod	3	> 5 - 25%	15	Native	Herb	FAC	FACW	FACW	3	0.084	0.2521
22	Sonchus arvensis	Field Sow-Thistle	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FACU	FACU	0	0.0028	0
23	Streptopus lanceolatus	Lance-Leaf Twistedstalk	1	> 0 - 1%	0.5	Native	Herb	FAC	FAC	FACU	7	0.0028	0.0196
24	Toxicodendron rydbergii	Western Poison Ivy	2	> 1 - 5%	3	Native	Herb	FACU	FAC	FAC	1	0.0168	0.0168
25	Ulmus americana	American Elm	2	> 1 - 5%	3	Native	Tree	FAC	FACW	FACW	3	0.0168	0.0504
26	Urtica dioica	Stinging Nettle	2	> 1 - 5%	3	Native	Herb	FAC	FACW	FAC	1	0.0168	0.0168
27	Vitis riparia	River-Bank Grape	3	> 5 - 25%	15	Native	Woody Vine	FAC	FACW	FAC	2	0.084	0.1681
28	Zizia aurea	Golden Alexanders	1	> 0 - 1%	0.5	Native	Herb	FAC	FAC	FAC	6	0.0028	0.0168
29	Alnus incana	Speckled Alder	1	> 0 - 1%	0.5	Native	Shrub	FACW	FACW	FACW	3	0.0028	0.0084
30	Ambrosia artemisiifolia	Annual Ragweed	1	> 0 - 1%	0.5	Native	Herb	FACU	FACU	FACU	0	0.0028	0
31	Amorpha fruticosa	False Indigo-Bush	2	> 1 - 5%	3	Native	Shrub	FACW	FACW	FACW	4	0.0168	0.0672
32	Echinochloa crus-galli	Large Barnyard Grass	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FACW	FAC	0	0.0028	0
33	Eupatorium perfoliatum	Common Boneset	1	> 0 - 1%	0.5	Native	Herb	FACW	OBL	FACW	4	0.0028	0.0112
34	Eutrochium maculatum	Spotted Trumpetweed	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0028	0.0112
35	Glyceria canadensis	Rattlesnake Manna Grass	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	7	0.0028	0.0196
36	Helenium autumnale	Fall Sneezeweed	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	4	0.0028	0.0112
37	Lycopus uniflorus	Northern Water-Horehound	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0028	0.014
38	Salix discolor	Pussy Willow	2	> 1 - 5%	3	Native	Shrub	FACW	FACW	FACW	3	0.0168	0.0504
39	Verbena hastata	Simpler's-Joy	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	6	0.0028	0.0168
40		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
41		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
42		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
43		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
44		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
45		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
46		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
47		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
48		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
49		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
50		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
51		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
52		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
53		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
54		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
56		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
57		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
58		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
59		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
60		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Metric Summary & Community Assessments

	Community #1	Community #2	Community #3
Community Type	Shallow Open Water	Deep Marsh	Floodplain Forest
wC	3.2	2.2	1.5
Numerical Condition Category	3	3	4
Condition Category	Fair	Fair	Poor

Additional Metrics			
Native Species Richness	8	26	33
Introduced Species Richness	1	3	6
Mean C	4.7	3.8	2.6
FQI	13.2	19.5	14.7
Total Midpoint % Cover	108	121	178.5
Total Introduced Spp. Cover	3	68.5	57
Proportion of Introduced Cover	0.03	0.57	0.32

Overall Assessment

Community #	Community Type	*wC*	Condition Category	Numerical Category	Proportion of AA	Proportion x Numerical Category
1	Shallow Open Water	3.2	Fair	3	0.75	2.25
2	Deep Marsh	2.2	Fair	3	0.15	0.45
3	Floodplain Forest	1.5	Poor	4	0.1	0.4

Weighted Average Numerical Category for AA **3**

Overall AA Condition **Fair**

Appendix C

2003-2021 Habitat Assessment Monitoring Results

Appendix C: 2003-2009 Habitat Assessment Monitoring Results
Black Dog Watershed Management Organization

Water Body	Monitoring Year	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Vegetation Quality - Wet Areas													Vegetation Quality - Upland							Erosion/Sedimentation	
			Submergent Zone Sampling							Vegetated Emergent Zone Sampling						Upland Buffer Sampling								
			Overall Submergent Vegetative Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Occurrence or Density Rating[2,3]	Total Number of Native Species[5]	Exotic Species			Emergent Zone Vegetative 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]	Exotic Species		Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Total Number of Species	Average Exotic Plant Occurrence Rating or Average Density Rating[2, 3]	Maximum Exotic Plant Occurrence Rating or Maximum Density Rating[4]					Number of Species	Total Exotic Emergent Percent Coverage[9]						Number of Species	Percent of Total Coverage[15]		
Crystal	2003	15%	Moderate	80%	1.5	15	2	1.1	1.1	Moderate	5%	26-50%	18	4	26-50%	Moderate	<10 ft.	>95%	16	26-50%	2	15-40%	0-10%	No
	2004		Excellent		1.2	14	2	1.1	2.9	Excellent		26-50%	16	6	26-50%	Moderate	<10 ft.	>95%	16	26-50%	4	15-40%	0-10%	No
	2005		Moderate		1.2	13	2	1.1	2.7	Excellent		26-50%	16	6	26-50%	Moderate	<10 ft.	>95%	17	26-50%	3	15-40%	0-10%	No
	2006		Excellent		1.0	17	2	1.5	3.2	Excellent		26-50%	18	8	26-50%	Moderate	<10 ft.	>95%	17	26-50%	3	15-40%	0-10%	No
	2007		Excellent		1.5	16	2	1.6	3.4	Excellent		26-50%	22	10	26-50%	Moderate	<10 ft.	>95%	15	26-50%	5	15-40%	0-10%	No
	2008		Moderate		1.3	15	2	1.6	2.5	Excellent		26-50%	21	12	26-50%	Moderate	<10 ft.	>95%	15	26-50%	5	15-40%	0-10%	No
	2009		Moderate		1.3	14	2	1.6	2.8	Excellent		26-50%	20	11	26-50%	Moderate	<10 ft.	>95%	15	26-50%	7	15-40%	0-10%	No
Keller	2003	0%	Moderate	90%	1.9	4	1	3.2	3.2	Poor	10%	51-75%	5	2	51-75%	Moderate	<10 ft.	>95%	7	76-100%	6	>40%	0-10%	No
	2004		Moderate		1.7	5	1	1.8	2.5	Moderate		51-75%	6	2	51-75%	Moderate	<10 ft.	>95%	7	76-100%	6	>40%	0-10%	No
	2005		Moderate		1.3	5	2	1.0	1.1	Moderate		51-75%	7	2	26-50%	Moderate	<10 ft.	>95%	8	76-100%	7	>40%	0-10%	No
	2006		Moderate		2.0	5	2	1.8	2.5	Moderate		51-75%	8	2	26-50%	Moderate	<10 ft.	>95%	8	76-100%	8	>40%	0-10%	No
	2007		Moderate		2.1	3	2	2.4	3.8	Moderate		51-75%	9	3	26-50%	Moderate	<10 ft.	>95%	5	76-100%	9	>40%	0-10%	No
	2008		Moderate		2.2	3	2	2.2	2.9	Moderate		51-75%	9	3	26-50%	Moderate	<10 ft.	>95%	6	76-100%	12	>40%	0-10%	No
	2009		Poor		3.0	2	2	2.7	3.3	Moderate		51-75%	9	4	26-50%	Moderate	<10 ft.	>95%	4	76-100%	11	>40%	0-10%	No
Kingsley	2003	0%	Moderate	95%	2.7	7	0	0.0	0.0	Excellent	5%	51-75%	11	2	0-25%	Excellent	25-50 ft.	>95%	15	51-75%	4	15-40%	0-10%	No
	2004		Moderate		2.7	7	0	0.0	0.0	Excellent		51-75%	11	2	0-25%	Excellent	25-50 ft.	>95%	15	51-75%	4	15-40%	0-10%	No
	2005		Moderate		2.6	7	1	1.0	1.0	Excellent		51-75%	15	6	0-25%	Excellent	25-50 ft.	>95%	19	76-100%	2	15-40%	0-10%	No
	2006		Excellent		1.8[17]	13[18]	1	1.0	1.0	Excellent		51-75%	15	6	0-25%	Excellent	25-50 ft.	>95%	19	76-100%	3	15-40%	0-10%	No
	2007		Excellent		1.6	13	1	1.0	1.0	Excellent		51-75%	19	6	0-25%	Excellent	25-50 ft.	>95%	21	76-100%	4	15-40%	0-10%	No
	2008		Moderate		2.9	5	0	0.0	0.0	Excellent		51-75%	18	5	0-25%	Excellent	25-50 ft.	>95%	25	76-100%	4	15-40%	0-10%	No
	2009		Excellent		2.0	11	1	1.0	1.0	Excellent		51-75%	16	5	0-25%	Excellent	25-50 ft.	>95%	23	76-100%	5	15-40%	0-10%	No
Lac Lavon	2003	25%	Poor	70%	2.0	7	1	1.0	1.0	Poor	5%	0-25%	14	5	0-25%	Poor	<10 ft.	<75%	12	0-25%	17	>40%	0-10%	No
	2004		Moderate		0.9	9	2	1.6	1.9	Moderate		0-25%	15	5	0-25%	Poor	<10 ft.	<75%	12	0-25%	17	>40%	0-10%	No
	2005		Moderate		2.3	5	1	2.0	2.0	Excellent		0-25%	20	10	0-25%	Poor	<10 ft.	<75%	12	0-25%	16	>40%	0-10%	No
	2006		Moderate		1.6	10[19]	2	2.5	4.0	Excellent		0-25%	16	13	0-25%	Poor	<10 ft.	<75%	11	0-25%	19	>40%	0-10%	No
	2007		Excellent		1.8	10[20]	3	1.8	4.0	Excellent		0-25%	16	12	0-25%	Poor	<10 ft.	<75%	12	0-25%	18	>40%	0-10%	No
	2008		Poor		1.0	5	2	1.0	1.0	Moderate		0-25%	14	9	0-25%	Poor	<10 ft.	<75%	9	0-25%	13	>40%	0-10%	No
	2009		Moderate		1.6	10	2	2.5	4.0	Moderate		0-25%	13	8	0-25%	Poor	<10 ft.	<75%	9	0-25%	11	>40%	0-10%	No
Orchard	2003	20%	Poor	75%	1.2	13	1	2.3	3.4	Moderate	5%	26-50%	16	5	26-50%	Moderate	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2004		Moderate		1.2	13	1	2.3	2.3	Excellent		26-50%	17	5	26-50%	Moderate	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2005		Moderate		1.3	14	1	1.8	2.6	Moderate		26-50%	14	6	26-50%	Moderate	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2006		Moderate		1.2	13	1	1.7	3.4	Excellent		26-50%	18	9	26-50%	Moderate	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2007		Moderate		1.3	11	1	1.9	3.3	Excellent		26-50%	18	9	26-50%	Moderate	<10 ft.	>95%	3	26-50%	5	>40%	0-10%	No
	2008		Moderate		1.3	14	1	1.6	2.8	Excellent		26-50%	16	8	26-50%	Moderate	<10 ft.	>95%	3	26-50%	7	>40%	0-10%	No
	2009		Moderate		1.6	11	1	1.7	2.5	Excellent		26-50%	16	8	26-50%	Moderate	<10 ft.	>95%	3	26-50%	6	>40%	0-10%	No
Sunset Pond	2003	0%	Moderate	75%	3.0	11	1	1.0	1.0	Poor	25%	76 - 100%	5	5	76-100%	Moderate	10-25 ft.	75-95%	10	51-75%	15	15-40%	0-10%	Yes
	2004		Excellent		2.2	11	0	0.0	0.0	Poor		76 - 100%	4	3	76-100%	Moderate	10-25 ft.	75-95%	10	51-75%	18	15-40%	0-10%	Yes
	2005		Excellent		2.1	10	1	1.0	1.0	Poor		76 - 100%	6	4	76-100%	Moderate	10-25 ft.	75-95%	9	76-100%	20	>40%	0-10%	Yes
	2006		Moderate		2.6	11	1	1.0	1.0	Poor		76 - 100%	7	4	76-100%	Moderate	10-25 ft.	75-95%	9	76-100%	19	>40%	0-10%	No
	2007		Excellent		1.9	12	1	1.0	1.0	Moderate		76-100%	11	6	76-100%	Moderate	10-25 ft.	75-95%	8	76-100%	19	>40%	0-10%	No
	2008		Excellent		1.8	10	1	2.0	3.0	Poor		76-100%	10	5	76-100%	Moderate	10-25 ft.	75-95%	5	76-100%	15	>40%	0-10%	No
	2009		Moderate		2.2	11	1	3.0	3.0	Poor		76-100%	10	5	76-100%	Moderate	10-25 ft.	75-95%	6	76-100%	17	>40%	0-10%	Yes

Appendix C: 2003-2009 Habitat Assessment Monitoring Results
Black Dog Watershed Management Organization

The following footnotes pertain to 2003-2009 data.

[1]Overall Submergent Vegetative Quality rating is the average of the exotic species density, macrophyte density, and total number of native: >0.66 = Excellent, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Vegetative Quality	Avg. Exotic Species Density	Exotic Species Density/ Occurrence Rating Score	Avg. Macrophyte Density	Avg. Macrophyte Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating	Total Overall Diversity Score
Poor	>2.0	0.1	0.0 - 1.0 and >3.0	0.1	<9	0.1	< 0.33
Moderate	>0 - 2.0	0.5	1.0 - 1.5 and > 2.5 to 3.0	0.5	9-14	.25-.75	0.33 - 0.66
Excellent	0	1.0	1.5 to 2.5	1.0	>14	1.0	> 0.66

[2]Plant occurrence ratings are a relative measure of the amount of native submergent vegetation with a scale from 1 to 5; 1 = lowest density (present on only 1 of 4 casts), 5 = highest density (hook full of vegetation on 4 of 4 casts).

[3]Density data for Crystal, Keller, and Orchard Lakes were collected by Blue Water Science. Numerous sample plots were conducted over the entire water body. A density scale of 1 to 4 was utilized (max = 4) by estimating the amount of vegetation obtained by rake casts and also transforming visual observations.

[4]Maximum exotic plant occurrence 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.

[5]The Total Number of Native Species within the submergent zone for Crystal, Keller and Orchard Lakes is based on a detailed survey conducted by Blue Water Science; and for Kingsley Lake, Lac Lavon, and Sunset Pond, based on a survey by Barr Engineering and volunteers. The survey of the 3 water bodies conducted by Blue Water Science involved the sampling of numerous sample plots or stations. The survey for Lac Lavon, Kingsley, and Sunset Pond is based on 3 sampling locations and a visual survey during travels on the water body: <7 = Poor, 7-14 = Moderate, >14 = Excellent.

[6]Emergent Zone Vegetative Quality is the average of the following parameters within the emergent zone: the approximate total percent coverage, the total number of native wetland species, and the percent coverage of exotic species: >0.66 = Excellent, 0.33-0.66 = Moderate, <0.33 = Poor.

Emergent Zone Vegetative Quality	Percent Cover	Percent Cover Rating Score		Total Number of Native Wetland Plants	Number of Native Wetland Plants Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Overall Emergent Zone Quality Score
Poor	0-25%	0.1		<or= 5	0.1	76-100%	0.1	< 0.33
Moderate	76-100% or 26-50%	0.5		>5 - 15	0.66 - 0.33	26-75%	.33-.66	0.33 - 0.66
Excellent	51-75%	1.0		> 15	1.0	0-25%	1.0	> 0.66

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

[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations and a visual survey during travels on the water body: 0-5 = Poor, 6-15 = Moderate, >15 = Excellent.

[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into four categories: 0-25%=Excellen(1.0), 26-50%=Moderate(0.5), 51-75%=Poor(0.0), 76-100%=Poor(0.1)

[10]Overall Upland Buffer Quality is determined based on the average of the four upland buffer quality parameters, with the exception of the number of exotic species present and the number of native plant species: >0.66 = Excellent, 0.33-0.66 = Moderate, <0.66 = 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	Overall Upland Buffer QualityScore
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-50 ft.	0.4 - 0.7	25-75%	.4-.7	0.33 - 0.66
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	> 0.66

[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: 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 3 sampling locations and a visual survey.

[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: 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%.

[17]The 2006 plant occurrence rating is lower (has improved), when compared to past assessment years primarily due to the low occurrence of additional plants found during a more detailed survey of the lake. The more detailed plant survey was conducted to better understand the extent of curlyleaf pondweed.

[18]The number of plant species documented in 2006, when compared to past assessment years, increased primarily due to additional plants found during a more detailed survey of the lake. The more detailed plant survey was conducted to better understand the extent of curlyleaf pondweed.

[19]The number of native submergent plant species documented in 2006, was incorrectly represented as 11 in the 2006 annual report. The actual number of native submergent plant species documented in 2006 was 10.

[20]Native plant species were noted by the Minnesota Department of Natural Resouces during an October 25, 2007 macropyte survey and used in the 2007 annual report.

Rating Code: **Poor** **Moderate** **Excellent**

Table 1: Orchard Lake 2012 and 2017 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)

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)

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

Table 1: Orchard Lake 2017 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2017 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 - Conduct a meandering survey of submergent, emergent, and upland buffer zones rather than monitoring of plot locations. Orchard Lake in 2012, Crystal Lake in 2013, Lac Lavon in 2014, Keller Lake in 2015, Kingsley Lake in 2016, Orchard Lake in 2017 - 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 2017 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 2017 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 4 according to MN DNR methodology. The rating system is based on a 1 to 3 scale. Therefore the density results were converted to match the rating system.

[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.

[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. The additional category of "High" was added in 2011 through 2017 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 2017 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 sampling locations and a visual survey during travels 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 sampling locations, a meandering visual survey during travels on the water body, and 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 two plot locations, a meandering visual survey during travels on the water body, and 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 two 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 1: Crystal Lake 2013 and 2018 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone Sampling								
	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]
2013	15%	**High**	80%	1.2 (Excellent)	18 (Excellent)	4.9 (Moderate)	2	1.8 (Moderate)	2.2 (Poor)
2018	15%	**High**	80%	1.2 (Excellent)	15 (Excellent)	5.0 (Moderate)	2	1.2 (Moderate)	1.4 (Moderate)

Monitoring Year	Vegetated Emergent Zone Sampling						
	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]
2013	**High**	5%	26-50% (Moderate)	36 (Excellent)	3.0 (Moderate)	10	26-50% (High)
2018	**High**	5%	26-50% (Moderate)	50 (Excellent)	3.3 (Moderate)	9	26-50% (High)

Monitoring Year	Upland Buffer Sampling								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]		
2013	**Moderate**	<10 ft. (Poor)	>95% (High)	39 (Excellent)	2.6 (Poor)	26-50% (Moderate)	16	15-40% (Moderate)	0-10%	No
2018	**Moderate**	<10 ft. (Poor)	>95% (High)	54 (Excellent)	2.7 (Poor)	26-50% (Moderate)	20	15-40% (Moderate)	0-10%	No

Table 1: Crystal Lake 2018 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2018 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 and 2016, Orchard Lake in 2012 and 2017, Crystal Lake in 2013 and 2018, Lac Lavon in 2014, Keller Lake in 2015 - 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 2018 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 2018 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.
[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. The additional category of "High" was added in 2011 through 2018 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: Crystal Lake 2018 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 sampling locations and a visual survey during travels 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 sampling locations, a meandering visual survey during travels on the water body, and 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 two plot locations, a meandering visual survey during travels on the water body, and 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 two 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 1: Lac Lavon 2014 and 2019 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone Sampling								
	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]
2014	25%	**Moderate**	70%	1.4 (Moderate)	12 (HIgh)	4.6 (Moderate)	2	2.0 (Moderate)	3.0 (Poor)
2019	25%	**Moderate**	70%	1.5 (Moderate)	12 (HIgh)	4.5 (Moderate)	2	1.7 (Moderate)	3.0 (Poor)

Monitoring Year	Vegetated Emergent Zone Sampling						
	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]
2014	**Moderate**	5%	0-25% (Poor)	32 (Excellent)	2.3 (Poor)	15	26-50% (High)
2019	**Moderate**	5%	0-25% (Poor)	38 (Excellent)	2.4 (Poor)	17	26-50% (High)

Monitoring Year	Upland Buffer Sampling								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]		
2014	**Poor**	<10 ft. (Poor)	>95% (High)	32 (Excellent)	1.3 (Poor)	0-25% (Poor)	31	>40% (Poor)	0-10%	No
2019	**Poor**	<10 ft. (Poor)	75-95% (Moderate)	56 (Excellent)	2.0 (Poor)	0-25% (Poor)	41	>40% (Poor)	0-10%	No

Table 1: Lac Lavon 2019 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2019 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 and 2016, Orchard Lake in 2012 and 2017, Crystal Lake in 2013 and 2018, Lac Lavon in 2014 and 2019, Keller Lake in 2015 - 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 2019 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 2019 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 Lac Lavon were collected by Matt Berg using a point intercept 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.
[5]The Total Number of Native Species within the submergent zone for Lac Lavon was collected by Matt Berg using a point intercept survey.
The additional category of "High" was added in 2011 through 2019 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: Lac Lavon 2019 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 sampling locations and a visual survey during travels 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 sampling locations, a meandering visual survey during travels on the water body, and 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 two plot locations, a meandering visual survey during travels on the water body, and 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 two 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 1: Keller Lake 2015 and 2020 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]
2015	0%	**Poor**	90%	1.3 (Moderate)	2 (Poor)	1.5 (Poor)	2	1.8 (Moderate)	2.2 (Poor)
2020	0%	**Moderate**	90%	1.2 (Excellent)	2 (Poor)	1.5 (Poor)	2	1.8 (Moderate)	2.3 (Poor)

Monitoring Year	Vegetated 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]
2015	**High**	10%	51-75% (High)	28 (Excellent)	2.3 (Poor)	8	26-50% (High)
2020	**High**	10%	51-75% (High)	36 (Excellent)	2.4 (Poor)	10	26-50% (High)

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]		
2015	**Moderate**	25-50 ft. (High)	>95% (High)	20 (Moderate)	1.6 (Poor)	76-100% (Excellent)	10	>40% (Poor)	0-10%	No
2020	**Moderate**	25-50 ft. (High)	>95% (High)	42 (Excellent)	1.8 (Poor)	51-75% (High)	29	>40% (Poor)	0-10%	No

Table 1: Keller Lake 2020 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2020 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 and 2016, Orchard Lake in 2012 and 2017, 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 2020 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 2020 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 Keller Lake were collected by Blue Water Science using a point intercept 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.
[5]The Total Number of Native Species within the submergent zone for Keller Lake was collected by Blue Water Science using a point intercept survey. The additional category of "High" was added in 2011 through 2020 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: Keller Lake 2020 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 two plot locations and a visual survey walking along the shoreline. 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 2 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 two plot locations, 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 two 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 1: Kingsley Lake 2011 - 2021 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]
2011	0%	**High**	70%	1.4 (Moderate)	18 (Excellent)	5.8 (Moderate)	0	0.0 (Excellent)	0.0 (Excellent)
2016	0%	**High**	70%	1.4 (Moderate)	20 (Excellent)	5.7 (Moderate)	1	<1.0 (High)	<1.0 (High)
2021	0%	**Moderate**	70%	1.7 (Moderate)	19 (Excellent)	5.5 (Moderate)	1	1.5 (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]
2011	**High**	30%	51-75% (High)	22 (Excellent)	3.3 (Moderate)	4	26-50% (High)
2016	**High**	30%	51-75% (High)	31 (Excellent)	3.8 (Moderate)	4	26-50% (High)
2021	**High**	30%	51-75% (High)	45 (Excellent)	4.0 (Moderate)	6	26-50% (High)

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]		
2011	**High**	25-50 ft. (High)	>95% (High)	45 (Excellent)	2.2 (Poor)	76-100% (Excellent)	25	15-40% (Moderate)	0-10%	No
2016	**High**	25-50 ft. (High)	>95% (High)	59 (Excellent)	2.2 (Poor)	76-100% (Excellent)	26	15-40% (Moderate)	0-10%	No
2021	**High**	25-50 ft. (High)	>95% (High)	67 (Excellent)	2.1 (Poor)	76-100% (Excellent)	28	15-40% (Moderate)	0-10%	No

Table 1: Kingsley Lake 2021 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2021 monitoring and analysis:

- Monitor one water body per year. Kingsley Lake in 2011, 2016, and 2021, Orchard Lake in 2012 and 2017, 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 2021 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 2021 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 Kingsley Lake were collected by Barr using a meander 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.
[5]The Total Number of Native Species within the submergent zone for Kingsley Lake was collected by Barr using a meander survey.
The additional category of "High" was added in 2011 through 2021 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: Kingsley Lake 2021 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 two plot locations and a visual survey walking and kayaking along the shoreline. 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 2 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 two plot locations, 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 two 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%.

Appendix D

2003–2021 Recommended and Completed Management Actions

Table D-1: 2009 Recommended and Completed Management Actions
Black Dog Watershed Management Organization Habitat Monitoring

Strategic Water Body	Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed 2004-2009 Actions Which May Improve Wildlife Habitat and/or Water Quality
Crystal	Unmanicured, native vegetation in adjacent upland and emergent zone is narrow and not continuous, limiting wildlife benefits.	1. Increase width and continuity of native upland buffer and emergent zone.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding and obtaining any needed MnDNR permits for potential upland buffer and emergent zone enhancements.	Inform/show lakeshore property owners how a native upland buffer and native emergent zone can improve functions and values of the lake and improve aesthetics.	Spring - Fall	2009: Operation of the ferric chloride treatment system halted due to low water levels. The City of Burnsville harvested curlyleaf pondweed. In late 2009, the City of Burnsville treated 14 acres of buckthorn within Crystal West Park. In 2009 and 2008, garlic mustard within the upland buffer was removed/pulled. 2004-2008: The BDWMO resumed and continued operation of the ferric chloride treatment system. The City of Burnsville: 1) excavated/enhanced four stormwater treatment ponds (including West Buck Hill Park), which reduced the phosphorus loading into the lake, and 2) conducted annual harvesting of Eurasian watermilfoil and curlyleaf pondweed. The City of Lakeville excavated/enhanced the Bluebill stormwater treatment pond.
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Purple loosestrife is present.	2. Continue to control and manage purple loosestrife.	Control and manage. For large stands of purple loosestrife, contact the MnDNR to request a release of purple loosestrife-controlling beetles. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase/maintain wildlife habitat.	Spring - Fall	
	Curlyleaf pondweed is present.	3. Control curlyleaf pondweed	Control by harvesting or chemical treatment.	Maintain wildlife habitat.	Late Spring	
	Eurasian watermilfoil is present.	4. Control Eurasian watermilfoil.	Control by chemical treatment.	Maintain wildlife habitat.	Summer	
Keller Lake	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife benefits.	1. Increase width and continuity of native upland buffer.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding of potential upland buffer enhancements.	Inform/show lakeshore property owners how a native upland buffer can improve functions and values of the lake and improve aesthetics.	Spring - Fall	In 2010 the City of Apple Valley may construct Whitney Pond for stormwater treatment within the Keller Lake watershed. 2009: Due to low water levels, operation of the ferric chloride treatment system halted and no harvesting of curlyleaf pondweed was conducted. The City of Burnsville stabilized approximately one hundred feet of shoreline on the southeast edge of the lake. Logs were interlaced and secured along the shoreline and red-osier dogwood live stakes were installed along the eroding banks. 2004 - 2008: The Cities of Apple Valley and Burnsville partnered to conduct annual harvesting of curlyleaf pondweed. 2005: The City of Apple Valley excavated and enhanced Redwood Pond, which will decrease phosphorus loading into Keller Lake. Also, In 2010 the City of Apple Valley may construct Whitney Pond for stormwater treatment within the Keller Lake watershed.
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Purple loosestrife is present.	2. Continue to control and manage purple loosestrife.	Control and manage. For large stands of purple loosestrife, contact the MnDNR to request a release of purple loosestrife-controlling beetles. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase/maintain wildlife habitat.	Spring - Fall	
	Curlyleaf pondweed dominates the lake in late spring-early summer.	3. Continue control of curlyleaf pondweed.	Control as recommended by the MnDNR. Since the MnDNR designates Keller Lake as a "Natural Environment", a special permit is needed to chemically treat the lake.	Maintain wildlife habitat.	Summer	
	Eurasian watermilfoil is present.	4. Control Eurasian watermilfoil.	Control as recommended by the MnDNR. Since the MnDNR designates Keller Lake as a "Natural Environment", a special permit is needed to chemically treat the lake.	Maintain wildlife habitat.	Summer	
Kingsley Lake	Curlyleaf pondweed is present.	1. Conduct a detailed late spring macrophyte survey to ascertain densities and extent of coverage.	Consider control measures, dependent on results of an detailed early growing season survey.	Maintain wildlife habitat.	Late Spring	2005 - 2008: Annually, the City of Lakeville and members of the Kingsley Lake Homeowner's Association removed purple loosestrife plants and common buckthorn from portions of the lake and the upland buffer surrounding the lake. On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curlyleaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake." However, since curlyleaf pondweed may typically die-off prior to the early-June habitat assessment, the peak density and percent total coverage of curlyleaf pondweed is uncertain. To date, it is unclear if curlyleaf pondweed densities and percent coverage have been relatively consistent or increasing within the lake over the last few years. In 2008, a Kingsley lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
	Common buckthorn dominates portions of the upland buffer.	2. Conduct an evaluation of common buckthorn, followed by removal.	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide.	Increase wildlife habitat.	Open	
	Purple loosestrife is present.	3. Continue to control and manage purple loosestrife.	Control and manage. For large stands of purple loosestrife, contact the MnDNR to request a release of purple loosestrife-controlling beetles. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase/maintain wildlife habitat.	Spring - Fall	
	Hybrid cattail and reed canary grass are present.	4. Control hybrid cattail and reed canary grass.	Control hybrid cattail and reed canary grass now before colonies become more abundant. The herbicide Rodeo ™ can be used to effectively control both invasive emergent species.	Increase/maintain wildlife habitat.	Spring-Summer	
Lac Lavon	Eurasian watermilfoil dominates portions of the lake.	1. Continue to manage Eurasian watermilfoil.	Control by chemical treatment as recommended by MnDNR.	Increase/maintain wildlife habitat and water quality	Spring-Summer	2006: The Cities of Burnsville and Apple Valley and the lake homeowners partnered to fund a fluridone treatment for control of Eurasian watermilfoil. The treatment is expected to provide control of Eurasian watermilfoil for three years, while allowing native plant species to rebound. The cities have continued to inform the MnDNR of the ongoing treatments and the MnDNR proposes to continue aquatic plant surveys to study the effects of whole-lake fluridone treatments. However, no MnDNR macrophyte survey was conducted in 2008.
	Curlyleaf pondweed is present.	2. Monitor presence of curlyleaf pondweed.	Control if increased occurrence and subsequent midsummer die off threatens water quality)	Identify the problem before it becomes difficult to treat.	Spring	
	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife benefits.	3. Increase width/creation of native upland buffer.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding of potential upland buffer enhancements.	Inform/show lakeshore property owners of how a native upland buffer can improve functions and values of the lake and improve aesthetics.	Spring - Fall	
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
Orchard Lake	Curlyleaf pondweed dominates the lake in late spring-early summer.	1. Continue curlyleaf pondweed control measures.	Control and manage	Increase/maintain wildlife habitat and water quality.	Late Spring - Early summer	2009: The City of Lakeville conducted herbicide treatment for curlyleaf pondweed within the northeast bay (~20 acres). The herbicide treatment resulted in lake-wide control of curlyleaf pondweed. 2004-2008: The City of Lakeville provided lakeshore owners with shoreline restoration information. However, to date, no plans have been made for potential future shoreline restoration projects. Annually, the City of Lakeville harvested approximately 70 acres of curlyleaf pondweed. 2007: A small area of lakeshore, near the boat launch, was restored using native plants.
	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife benefits.	2. Increase width and continuity of native upland buffer.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding of potential upland buffer enhancements.	Inform/show lakeshore property owners how a native upland buffer can improve functions and values of the lake and improve aesthetics.	Spring - Fall	
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Purple loosestrife is present.	3. Conduct a detailed evaluation of purple loosestrife, followed by removal/control.	Control and manage by hand-pulling if only a few plants are present or introduce beetles if numerous plants are present.	Increase/maintain wildlife habitat.	Spring - Summer	
Sunset Pond	Extensive algal bloom	1. Reduce phosphorus loading into the pond.	Construct/install: catch basin sumps, prefabricated treatment devices (e.g. Stormceptor), infiltration facilities within the watershed, or other more conventional methods. Conduct more frequent street sweepings.	Improve wildlife habitat, fishery habitat, and aesthetics/recreation.	Open	In 2009, as in past years, the City of Burnsville actively managed the restored native buffer adjacent to the pond, the surrounding prairie restoration area, and portions of the emergent zone. Specifically, in 2007 through 2009 the City of Burnsville conducted spot spraying of invasive vegetation, such as reed canary grass, thistle, and purple loosestrife. A prescription burn, inter-seeding of prairie species, and buckthorn removal were conducted in 2008 to increase the plant diversity in the upland area.
	Maintained turf grass remains within portions of the upland buffer.	2. Enhance/maintain upland buffer.	Continue restoring sustainable native communities	Improve wildlife habitat and water quality.	Spring - Fall	
	Exotic species are dominant in emergent zone, and include narrow-leaf cattail, hybrid cattail, and reed canary grass.	3. Manage exotic species within emergent zone.	Selective herbicide treatments to reduce presence of exotic species	Allow for the establishment of more diverse native species that provide better wildlife values.	Spring - Fall	
	Presence of curlyleaf pondweed observed in 2003 and 2005 through 2008.	4. Conduct a late spring macrophyte survey to ascertain densities and extent of coverage.	consider control measures dependent on the results of an early growing season survey.	Maintain wildlife habitat. Reduce down-stream phosphorus loading.	Late Spring	
	The southern portion of the pond is shallow (1 to 3 feet deep).	5. Create a "navigation channel".	Excavate and remove sediment.	Improve wildlife habitat, fishery habitat, and aesthetics/recreation.	Winter	

Table 2: 2011 Recommended and Completed Management Actions for Kingsley Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed 2004-2009 Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed is present in some years.	Conduct a detailed late spring macrophyte survey to ascertain densities and extent of coverage.	Consider control measures, dependent on results of a detailed early growing season survey.	Maintain wildlife habitat.	Late Spring	2005 - 2008: Annually, the City of Lakeville and members of the Kingsley Lake Homeowner's Association removed purple loosestrife plants and common buckthorn from portions of the lake and the upland buffer surrounding the lake. Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control. On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curlyleaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake." However, since curlyleaf pondweed may typically die-off prior to the early-June habitat assessment, the peak density and percent total coverage of curlyleaf pondweed is uncertain. To date, it is unclear if curlyleaf pondweed densities and percent coverage have been relatively consistent or increasing within the lake over the last few years. In 2008, a Kingsley Lake lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
Common buckthorn dominates portions of the upland buffer.	Conduct an evaluation of common buckthorn, followed by removal.	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide.	Increase wildlife habitat.	Open	
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. Continue to request monitoring from the MnDNR to assure beetles are present and at appropriate populations for biological control.	Increase/maintain wildlife habitat.	Spring - Fall	
Hybrid cattail and reed canary grass are present.	Control hybrid cattail and reed canary grass.	Control hybrid cattail and reed canary grass now before colonies become more abundant. The herbicide Rodeo ^{TM} can be used to effectively control both invasive emergent species.	Increase/maintain wildlife habitat.	Spring-Summer	
Stormwater drainage from impervious surfaces is directed into the lake.	Redirect stormwater for infiltration prior to discharge.	Install a rainwater garden or other suitable method for infiltration.	Improve water quality	Open	
Bare soil on steep slope could cause erosion and sedimentation into lake.	Vegetate hillslope.	Plant vegetation suited for steep slopes along hillside to prevent erosion.	Improve water quality	Open	
Upland buffer areas lacking naturalized vegetation.	Improve the shoreline with a naturalized upland buffer.	Rather than manicured turf grass, gravel, and managed plantings with bare soil, the shoreline could be vegetated with native grasses and wildflowers. A landscape architect could create inviting spaces and views for restaurant customers to enjoy.	Increase wildlife habitat and Improve water quality	Open	
Emergent and upland buffer areas contain non-native invasive vegetation.	Replace non-native invasive vegetation with native vegetation.	Treat non-native invasive vegeation and then seed with an appropriate BWSR seed mix.	Increase/maintain wildlife habitat.	Spring-Summer	

Table 2: 2012 Recommended and Completed Management Actions for Orchard Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed 2004-2012 Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. See Figure 3 for locations of curlyleaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	**1999 through 2012:** The City of Lakeville conducts aquatic vegetation monitoring twice/year. **2009 through 2012**: The City of Lakeville conducted annual herbicide treatment for curlyleaf pondweed. **2004 through 2008:** Annually, the City of Lakeville harvested approximately 70 acres of curlyleaf pondweed. **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. **2004 through 2012**: The City of Lakeville annually provides lakeshore owners with shoreline restoration information and encourages homeowners to take advantage of the Blue Thumb restoration program. One shoreline resident started a restoration project in **2012**. **2007**: A small area of lakeshore, near the boat launch, was restored using native plants. **2002**: Purple loosestrife beetles were released by the MNDNR. Follow up monitoring indicates that beetles are present at a popoulation that the MNDNR feels is appropriate for biological control of purple loosestrife plants.
Upland buffer areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	To expand on the shoreline restoration that was done near the boat launch in 2007, the adjacent upland buffer could also be restored to naturalized native vegetation and not mowed (Potential Restoration Area #1 as shown in Appendix A and Figure 5). In the Wayside Park Area, non-native invasive vegetation including common buckthorn, vetch, spotted knapweed, and cattails could be removed and replaced with native vegetation. The naturalized upland buffer could be widened (Potential Restoration Area #2 as shown in Appendix A and Figure 5). At the beach area, there is a timber wall which is currently being used for fishing. A shoreline restoration could be done in this area (Potential Resotration Area #3 as shown in Appendix A and Figure 5). On the northwest side of the lake, one property owned by the City of Lakeville (adjacent to residential shoreline properties) could be restored to naturalized vegetation and provide an example for adjacent residential landowners for shoreline and upland buffer restoration (Potential Restoration Area #4 as shown in Appendix A and Figure 5).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass up the the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics (Potential Restoration Area #5 as shown in Appendix A and Figure 5).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. Continue to request monitoring from the MNDNR to assure beetles are present and at appropriate populations for biological control (See Figures 3 and 5 for location of purple loosestrife).	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	

Table 2: 2013 Recommended and Completed Management Actions for Crystal 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
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. See Blue Water Science report for locations of curlyleaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	**1999 through 2013:** The City of Burnsville conducts aquatic vegetation monitoring twice/year. **2003 through 2013**: The City of Burnsville conducted annual harvesting of curlyleaf pondweed. **2004-2008**: -The BDWMO operated the ferric chloride treatment system. -The City of Burnsville: 1) excavated/enhanced four stormwater treatment ponds (including West Buck Hill Park), which reduced the phosphorus loading into the lake, and 2) conducted annual harvesting of Eurasian watermilfoil and curlyleaf pondweed. -The City of Lakeville excavated/enhanced the Bluebill stormwater treatment pond. In **2009 and 2008**, garlic mustard within the upland buffer was removed/pulled. In late **2009**, the City of Burnsville treated 14 acres of buckthorn within Crystal West Park.
Upland buffer areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	The width and density of naturalized shoreline buffer at the location of Emergent Plot #1 near the swimming area has improved significantly since 2009. The adjacent upland buffer could also be restored to naturalized native vegetation and not mowed (Potential Restoration Areas #1 through 4 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass up the the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics (Potential Restoration Area #5 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Continue to control. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment.	Maintain wildlife habitat.	Summer	

Table 2: 2014 Recommended and Completed Management Actions for Lac Lavon
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
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. **See Macrophyte Survey Results for locations of curlyleaf pondweed**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys were conducted by Barr in 2013 and 2014.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment. **See Macrophyte Survey Results for locations of Eurasian watermilfoil**	Maintain wildlife habitat.	Summer	In 2006, the cities of Burnsville and Apple Valley and the lake homeowners partnered to fund a fluridone treatment for control of Eurasian watermilfoil. Aquatic plant surveys were conducted by Barr in 2013 and 2014.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Continue to control. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. **See Macrophyte Survey Results for locations of purple loosestrife**	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	Purple loosestrife removal on shallow island areas was completed by the cities of Apple Valley and Burnsville in 2011.
Upland buffer areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	Expand native prairie planting to include area to the east, which is dominated by knapweed. This could become a tall grass prairie. **Potential Restoration Area #1**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2013, the city of Burnsville installed a native prairie planting converting a sand beach and turf grass to prairie and wetland vegetation.
Upland buffer areas in city parks contain non-native invasive vegetation such as buckthorn, Siberian elm, leafy spurge, and spotted kanpweed.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation **Potential Restoration Area #2**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Some invasive species control for Canada thistle and knapweed was conducted on the new native planting area in 2014. In 2010, the city of Apple Valley released about 150 spotted knapweed seedhead boring weevils in Lac Lavon Park in Apple Valley. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation
Impervious surfaces and turf grass in the Apple Valley park near the fishing pier can collect pollutants in stormwater and flow directly into the lake, decreasing water quality.	Increase areas of naturalized vegetation to slow down and pretreat stormwater prior to entering the lake.	Strategically create buffer strips with naturalized vegetation adjacent to impervious surfaces to slow down and pretreat stormwater prior to entering the lake. **Potential Restoration Area #3**	Improve water quality	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass or sand up to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. **Potential Restoration Area #4**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	One raingarden was installed in the backyard of a shoreline property owner on Highview Drive in Apple Valley through the Blue Thumb program. The establishment of shoreline restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city owned property and residential property.

Table 2: 2015 Recommended and Completed Management Actions for Keller 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
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. **See Appendix A Aquatic Plant Survey for locations of curlyleaf pondweed**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys have been conducted by Blue Water Science 1998-2015. Iron dosing occurred from 1999 through 2008. Mechanical harvesting is conducted each year since 2004.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Continue to monitor. Control as recommended by the MnDNR. Since the MnDNR designates Keller Lake as a "Natural Environment Lake", chemical treatment is not allowed.	Maintain wildlife habitat.	Summer	Aquatic plant surveys have been conducted by Blue Water Science 1998-2015.
The inlet coming from the stormwater pond at the south end of Keller Lake is surrounded by bare soil or sparse vegetation.	Re-vegetated bare areas to prevent soil erosion into Keller Lake.	Seed or plant bare areas with native vegetation. **Potential Restoration Area #1**	Improve water quality and vegetative diversity.	Spring or Fall	
Shoreline fishing traffic is causing bare soil areas along the shoreline.	Re-vegetated bare areas to prevent soil erosion into Keller Lake.	Create designated stone walkways for fishing access. **Potential Restoration Area #2**	Improve water quality, vegetative diversity, and aesthetics.	Spring - Fall	
The southern public park is littered with trash and other dumped items especially near the shoreline.	Clean up the litter.	Organize a neighborhood clean-up project to pick up trash and other dumped items along the south shoreline of the lake. **Potential Restoration Area #3**	Improve aesthetics. Potentially prevent harm to wildlife. Prevent migration of trash into lake.	Spring - Fall	
Upland buffer areas in city parks contain non-native invasive vegetation such as buckthorn and garlic mustard.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation. Pull garlic mustard within the City of Burnsville property at the north end of the lake. Continue to remove and treat new growth of buckthorn in city parks. **Potential Restoration Area #4**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Buckthorn appears to have been previously removed in the park along the southern shoreline.
Upland buffer areas lacking naturalized vegetation. Some of the residential properties have narrow buffers with turf grass close to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Manicured turf grass near the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. **Potential Restoration Area #5**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	Most residential properties allow a narrow width of naturalized vegetation to prevent soil erosion, however a wider buffer of native vegetation could help improve wildlife habitat, vegetative diversity, and aesthetics.

Table 2: 2016 Recommended and Completed Management Actions for Kingsley 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
Curlyleaf pondweed is present in some years.	Continue to monitor	Consider control measures, if densities and locations increase to an extent of concern.**See Appendix A Aquatic Plant Survey for locations of curlyleaf pondweed**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curlyleaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake."
Common buckthorn dominates portions of the upland buffer.	Conduct an evaluation of common buckthorn, followed by removal.	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide. **See Figure 4, Potential Restoration Area #1**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	From 2005-2008, the City of Lakeville and members of the Kingsley Lake Association removed common buckthorn from portions of the lake and the upland buffer surrounding the lake.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. **See Figure 4 for purple loosestrife locations.**	Increase/maintain wildlife habitat.	Spring - Fall	From 2005-2008, the City of Lakeville and members of the Kingsley Lake Association removed purple loosestrife plants from portions of the lake and the upland buffer surrounding the lake. Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Stormwater drainage from impervious surfaces is directed into the lake.	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 #2.**	Improve water quality	Open	
Bare soil on steep slope could cause erosion and sedimentation into lake.	Re-vegetate bare areas to prevent soil erosion into Kingsley Lake.	Plant vegetation suited for steep slopes along hillside to prevent erosion. **See Figure 4, Potential Restoration Area #3**	Improve water quality	Spring - Fall	
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. **See Figure 4, Potential Restoration Areas #4 through 7**. See **Appendix G** for examples of improvements. See also island shoreline areas becoming bare from YMCA camper overuse (**Figure 4, Potential Restoration Areas 10 and 11)**.	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2008, a Kingsley Lake lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
Emergent zone and upland buffer areas contain non-native invasive vegetation.	Continue to control and manage non-native invasive vegetation, including, but not limited to reed canary grass, hybrid cattail, and yellow iris.	Treat non-native invasive vegeation and then seed with an appropriate BWSR seed mix. **See Figure 4, Potential Restoration Areas #8 and 9.** Remove yellow iris **(See Appendix A for locations of yellow iris).** The MN DNR may require a permit for cattail treatment and yellow iris removal if below the OHW. Dense reed canary grass is located at **Plot 2b as shown of Figure 3**. Dense hybrid cattail is located at **Plot 1b as shown on Figure 3**.	Increase/maintain wildlife habitat.	Spring-Summer	

Table 2: 2017 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
Curlyleaf pondweed is common in early spring	Continue to monitor, control, and manage.	Continue to treat curlyleaf pondweed 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 1999-2017, the City of Lakeville contracts Blue Water Science to conduct aquatic plant surveys twice per year. Curlyleaf pondweed was harvested annually from 2004-2009. Herbicide treatments were conducted annually from 2009-2012 and 2015-2017.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. **See Figure 4 for purple loosestrife locations.**	Increase/maintain wildlife habitat.	Spring - Fall	Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Stormwater drainage from impervious surfaces is directed into the lake.	Redirect stormwater for infiltration prior to discharge.	Install a rainwater garden, pervious pavement, or other suitable method for infiltration and establish a naturalized upland buffer. **See Figure 4 and Site Photos, 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.
Bare soil along shoreline could cause erosion and sedimentation into lake.	Re-vegetate bare areas to prevent soil erosion 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 Area #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.
Upland buffer areas lacking naturalized vegetation.	Increase width and continuity of native upland buffer.	Rather than manicured turf grass the shoreline could be vegetated with native grasses and wildflowers. **See Figure 4 and Site Photos, Potential Restoration Areas #1-3, 7 and 8**. See **Appendix G** for examples of improvements.	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring - Fall	2004 through 2012: The City of Lakeville annually provides lakeshore owners with shoreline restoration information and encourages homeowners to take advantage of the Blue Thumb 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. 2007: A small area of lakeshore, near the boat launch, was restored using native plants.

Table 2: 2018 Recommended and Completed Management Actions for Crystal 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
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. See Appendix A Blue Water Science report for locations of curlyleaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	1999 through 2018: The City of Burnsville conducts aquatic vegetation monitoring twice/year. 2003 through 2018: The City of Burnsville conducted annual harvesting of curlyleaf pondweed.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment. See Appdendix A Blue Water Science report for locations of Eurasian watermilfoil.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	
Common and glossy buckthorn are present	Control common and glossy buckthorn	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide. See Appendix H for buckthorn management guidelines. See Appendix I for locations of buckthorn.	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Fall	In 2009, the City of Burnsville treated 14 acres of buckthorn within Crystal Lake West Park (Appendix I).
Garlic mustard is present	Control garlic mustard	Organize a volunteer neighborhood group to pull garlic mustard. See Appendix I for locations of garlic mustard.	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring	In 2008 and 2009, the City of Burnsville removed garlic mustard within the upland buffer (Appendix I)
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. See Appendix I for locations of purple loosestrife.	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Bare soil areas are present along shoreline in Crystal Lake West Park area.	Re-vegetate bare soil areas to prevent soil erosion into Crystal Lake and create designated stone walkways for fishing access.	Exposed soil along the shoreline of Crystal Lake West Park Area could be re-vegetated to prevent shoreline erosion. Strategically located stones could provide fishing access to prevent disturbance of vegetation after it is established. (Potential Restoration Area #1 as shown in Figure 4 and photos)	Improve water quality and prevent erosion.	Spring - Fall	
Timber retaining wall in Tyecke Park area is in poor condition.	Repair timber retaining wall to prevent soil erosion into Crystal Lake.	Steep slopes in the Tyecke Park area are well protected with mature naturalized vegetation, however a timber retaining wall along the shoreline may need to be repaired or replaced to prevent slope destabilization and erosion. (Potential Restoration Area #2 as shown in Figure 4 and photos)	Prevent erosion	Winter	
Shoreline areas lacking naturalized vegetation within publicly owned beach area. Some areas have mowed turf grass close to the lakeshore edge.	Increase width and continuity of native upland buffer.	The upland buffer near the location of Plot #1C and shoreline to the south, and north of the beach area could be restored to naturalized native vegetation and not mowed (Potential Restoration Areas #3 and 4 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	The width and density of naturalized shoreline buffer at the location of Emergent Plot #1B near the beach area has improved significantly since 2009.
Shoreline areas lacking naturalized vegetation within residential properties. Most of the residential properties have turf grass up the the lakeshore edge.	Increase width and continuity of native upland buffer.	Rather than manicured turf grass, the shoreline could be vegetated with native grasses and wildflowers. (Potential Restoration Area #5 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	Six residential property owners have completed shoreline restortion projects using either City of Burnsville or Dakota Soil and Water Conservation District grants.

Table 2 2019 Recommended and Completed Management Actions for Lac Lavon – 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
Curly-leaf pondweed dominates the lake in late spring-early summer.	Continue curly-leaf pondweed control measures.	Continue to control and manage. Detailed results are available upon request.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys were conducted in 2013, 2014, and 2019.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment. Detailed results are available upon request.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	In 2006, the cities of Burnsville and Apple Valley and the lake homeowners partnered to fund a one-time fluridone treatment for control of Eurasian watermilfoil. Aquatic plant surveys were conducted in 2013, 2014, and 2019.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Continue to control. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	Purple loosestrife removal on shallow island areas was completed by the cities of Apple Valley and Burnsville in 2011. Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Shoreline areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	Expand native prairie planting to include area to the east, which is dominated by knapweed. This could become a tall grass prairie. Potential Restoration Area #1	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2013, the city of Burnsville installed a native prairie planting converting a sand beach and turf grass to prairie and wetland vegetation.
Shoreline areas in city parks contain non-native invasive vegetation such as buckthorn, Siberian elm, leafy spurge, and spotted knapweed.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation Potential Restoration Area #2	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Some invasive species control for Canada thistle and knapweed was conducted on the new native planting area in 2014. In 2010, the city of Apple Valley released about 150 spotted knapweed seedhead boring weevils in Lac Lavon Park in Apple Valley. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation
Impervious surfaces and turf grass in the Apple Valley park near the fishing pier can collect pollutants in stormwater and flow directly into the lake, decreasing water quality.	Increase areas of naturalized vegetation adjacent to impervious surfaces to slow down and pretreat stormwater prior to entering the lake.	Strategically create buffer strips of naturalized vegetation adjacent to the bituminous lake access pathway to slow down and pretreat stormwater prior to entering the lake. Potential Restoration Area #3	Improve water quality	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass or sand up to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. Potential Restoration Area #4	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	One native prairie restoration project was installed in the backyard of a shoreline property owner on Highview Drive in Apple Valley through the Dakota Soil and Water Conservation District program. The establishment of shoreline restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city owned property and residential property.

Table 2 2020 Recommended and Completed Management Actions for Keller 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
Curly-leaf pondweed dominates the lake in late spring-early summer.	Continue curly-leaf pondweed control measures.	Continue to control and manage. See Appendix A for details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys have been conducted by Blue Water Science since 1998. A curly-leaf pondweed turion survey was also conducted in 2020. Iron dosing occurred during 1996 - 2008. Mechanical harvesting was conducted from 2004 - 2015. Herbicide treatments were conducted from 2017 – 2020.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Continue to control and manage. See Appendix A for details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	Aquatic plant surveys have been conducted by Blue Water Science since 1998.
Low native aquatic vegetative diversity in the submergent zone.	Continue to increase native aquatic plant diversity.	Continue to monitor and assess. See Appendix A for details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	A seedbank assessment was conducted in 2020. Native aquatic plant re-introduction began in 2020.
The inlet coming from the stormwater pond at the south end of Keller Lake is surrounded by bare soil or sparse vegetation.	Re-vegetate bare areas to prevent soil erosion into Keller Lake.	Seed or plant bare areas with native vegetation. **Potential Restoration Area #1**	Improve water quality and vegetative diversity.	Spring or Fall	
Shoreline pedestrian observation and fishing traffic is causing bare soil areas along the shoreline.	Re-vegetate bare areas to prevent soil erosion into Keller Lake.	Create designated stone walkways for observation and fishing access. **Potential Restoration Area #2**	Improve water quality, vegetative diversity, and aesthetics.	Spring-Fall	
The southern public park is littered with trash and other dumped items, especially near the shoreline.	Clean up the litter.	Organize a neighborhood clean-up project to pick up trash and other dumped items along the south shoreline of the lake. **Potential Restoration Area #3**	Improve aesthetics. Potentially prevent harm to wildlife. Prevent migration of trash into lake.	Spring - Fall	
Shoreline areas in city parks contain non-native invasive vegetation such as buckthorn, spotted knapweed, and garlic mustard.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation. Pull garlic mustard within the City of Burnsville property at the north end of the lake. Continue to remove and treat new growth of buckthorn in city parks. **Potential Restoration Area #4**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Buckthorn appears to have been previously removed in the park along the southern shoreline, however new seedlings are emerging. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation
Upland buffer areas lacking naturalized vegetation. Many of the residential properties have narrow buffers with lawns mowed to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. **Potential Restoration Area #5**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	The Dakota Soil and Water Conservation District program assists homeowners with establishment of shoreline restoration projects. Additional restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city owned property and residential property.
Shoreline areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	Adjust mowing distance away from shoreline in Apple Valley's Keller Park. **Potential Restoration Area #6**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
A portion of Lac Lavon Park in Burnsville south of Keller Lake includes a large area of mowed turf grass with no apparent use.	Consider using this area for a native prairie restoration with meandering trails and educational signs.	Recruit volunteers through neighborhood or organizations to transform the lawn into a prairie. **Potential Restoration Area #7**	Improve vegetative diversity and aesthetics. Increase wildlife habitat and provide pollinator habitat. Provide recreational and educational opportunities.	Spring - Fall	
Sediment from the Lac Lavon Park parking lot is directed into the floodplain forest along the south shoreline of Keller Lake.	Prevent sediment from entering the floodplain forest area.	Install a pre-treatment system such as a rain garden or sediment trap to collect sediment from the parking lot. Follow up with routine maintenance of sediment clean-out. **Potential Restoration Area #8**	Protect floodplain forest from further degradation and prevent sediment from reaching Keller Lake, thereby improving water quality.	Winter	
Japanese hedge parsley is located along the edge of the path near the storm pond north of Keller Lake. This is a new non-native invasive species in Minnesota. Early detection and control will prevent infestations.	Eradicate- Pull, cut or mow before flowering. Monitor area for new seedlings. Spray rosettes or bolting plants in spring with 1-2% glyphosate or 1-2% triclopyr. In fall, use herbicides on rosettes.	A report of this species at this location was submitted through the Great Lakes Early Detection Network online application. Follow up with the Dakota County Cooperative Weed Management contact to verify action will be taken for eradication. **Potential Restoration Area #9**	Prevent spread and infestation.	Spring - Fall	

Table 2 2021 Recommended and Completed Management Actions for Kingsley 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
Curly-leaf pondweed is present in in some years at one location of the lake.	Continue to monitor the extent and density of curly-leaf pondweed.	Consider control measures if densities and locations increase to an extent of concern. See **Appendix A** for location of curly-leaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curly-leaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake.".
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, hybrid cattail, yellow iris, common buckthorn, Russian olive, 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 Area #1**. Small colonies of purple loosestrife can be hand pulled or dug before plants go to seed. **See Figure 4 and Appendix A for purple loosestrife locations**. Remove yellow iris (**See Appendix A for locations of yellow iris)**. The MN DNR may require a permit for cattail treatment, purple loosestrife, and yellow iris removal if below the OHW. Dense reed canary grass is located **Potential Restoration Area #5**. Dense invasive cattail is located at **Potential Restoration Area #8**. Treat or remove non-native invasive vegetation and then seed with an appropriate native seed mix. **See Figure 4, Potential Restoration Areas #8 and 9.**	Increase wildlife habitat, improve vegetative diversity and aesthetics.	Spring-Fall	From 2005-2008, the City of Lakeville and members of the Kingsley Lake Association removed common buckthorn from portions of the lake and the upland buffer surrounding the lake. From 2005-2008, the City of Lakeville and members of the Kingsley Lake Association removed purple loosestrife plants from portions of the lake and the upland buffer surrounding the lake. 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 #2.**	Improve water quality	Open	
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. **See Figure 4, Potential Restoration Areas #4, 6, and 7**. Adjust mowing distance further away from shoreline on City properties (**See Figure 4, Potential Restoration Areas #8 and 9** and photos). See Appendix G for examples of improvements.	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring – Fall	In 2008, a Kingsley Lake lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
Bare soil on steep slope could cause erosion and sedimentation into lake.	Re-vegetate bare areas to prevent soil erosion and sedimentation into Kingsley Lake.	Plant vegetation suited for steep slopes along hillside to prevent erosion. **See Figure 4, Potential Restoration Area #3** on restaurant property**.** See also island and shoreline areas becoming bare from YMCA camper overuse (**Figure 4, Potential Restoration Areas 10, 11, and 12**).	Improve water quality	Spring - Fall	

Appendix E

2012 Orchard Lake MNRAM Wetland Functional Assessment Results

Wetland Functional Assessment Summary

Wetland Name	Hydrogeomorphology	Maintenance of Hydrologic Regime	Flood/ Stormwater/ Attenuation	Downstream Water Quality	Maintenance of Wetland Water Quality	Shoreline Protection
Orchard Lake	Depressional/Flow-through (apparent inlet and outlet), Depressional/Flow-through (apparent inlet and outlet)	0.75	0.53	0.58	0.37	0.46
		High	Moderate	Moderate	Moderate	Moderate

Wetland Name	Maintenance of Characteristic Wildlife Habitat Structure	Maintenance of Characteristic Fish Habitat	Maintenance of Characteristic Amphibian Habitat	Aesthetics/ Recreation/ Education/ Cultural	Commercial Uses	Ground-Water Interaction	Additional Information: Wetland Restoration Potential	Additional Information: Wetland Sensitivity to Stormwater and Urban Development	Additional Information: Additional Stormwater Treatment Needs
Orchard Lake	0.37	0.49	0.05	0.76	0.00	Combination Discharge, Recharge	0.00	0.50	0.37
	Moderate	Moderate	Low	High	Not Applicable		Not Applicable	Moderate	Moderate

Wetland Community Summary

Wetland Name	Location	Vegetative Diversity/Integrity: Community: Cowardin Classification	Community: Circular 39	Community: Plant Community	Wetland Proportion	Individual Community Rating	Highest Wetland Rating	Average Wetland Rating	Weighted Average Wetland Rating	
Orchard Lake	19-114-21-11-001	L2UBGh	Type 5	Shallow, Open Water Communities	95	0.1	0.50	0.30	0.12	
							Moderate	Low	Low	
		PEM1C	Type 3	Shallow Marsh	5	0.5	0.50	0.30	0.12	
							Moderate	Low	Low	
					100		0.50	0.30	0.12	☐

☑ *Denotes incomplete calculation data.*

Appendix F

Descriptions of MNRAM Wetland Functions

6.0 Functional Rating Formulas

GENERAL NOTE: Some questions are not applicable to particular wetlands and will be scored N/A. In these cases, rather than count N/A as zero, an alternate equation is provided that eliminates the question from the formula altogether. Because not every question has N/A as an option, formulas that do not include N/A-option questions have only one configuration.

Formulas with a "reverse rating" (marked as "R") take the actual response and "flip" its value for the calculation, so that a question response of "A" high (value of 1.0) will be calculated as low (value of 0.1). In such a formula, medium ratings stay medium.

6.1 VEGETATIVE DIVERSITY/INTEGRITY

Table 3: Vegetative Diversity/Integrity Summary

The functional rating is based primarily on the diversity of vegetation within the wetland in comparison to an undisturbed condition for that wetland type. An exceptional rating results from one of the following conditions: 1) highly diverse wetlands with virtually no non-native species, 2) rare or critically impaired wetland communities in the watershed, or 3) the presence or previous siting of rare, threatened, or endangered plant species. A high rating indicates the presence of diverse, native wetland species and a lack of non-native or invasive species. Wetlands that rate low are primarily dominated by non-native and/or invasive species.

This table may be used when calculating Vegetative Diversity/Integrity Functional Index manually. It shows four options for calculating and presenting floristic data. If you are entering data directly into the MnRAM 3.0 database, this table does not apply.

	3A Proportion of Wetland	3B Individual Community Scores	3C Highest Quality	3D Non-Weighted Average	3E Weighted Average
Community #1	**T**	**A**		**A**	**A**
Community #2	**U**	**B**		**B**	**B**
Community #3	**V**	**C**		**C**	**C**
Community #4	**W**	**D**		**D**	**D**
Community #5	**X**	**E**		**E**	**E**
Community #6	**Y**	**F**		**F**	**F**
Community #7	**Z**	**G**		**G**	**G**
Wetland Rating Value	**1.0**		**Highest Value**	**(A+B+C+D+E+F+G)/7 = Ave.**	**(A*T)+(B*U)+(C*V)+(D*W)+(E*X)+(F*Y)+(G*Z) = Wt. Ave.**

If any questions #4-6 are answered yes and/or if any of the Special Features b, d, or i have been selected, enter Exceptional for the functional index. If not, compute the contribution to vegetative diversity and integrity by each plant community by doing the following: multiply the ranking for each community (Question #3b) by its total proportion in Question 3a (percent of total). Then, the functional index for the entire wetland can be calculated four ways (as follows) and should be utilized according to the scope of the project:

3b) Individual Community Scores: maintain raw data as recorded.

3c) Highest Quality Community: report the highest-functioning community.

3d) Non-Weighted Average Quality of all Communities: straight average

3e) Weighted Average Quality Based on Percentage of Each Community: multiply each community rating by its percentage, then add all together.

Vegetative Diversity/ Integrity					
	3a. Proportion of Wetland	**3b. Individual Community Scores**	**3c. Highest Rated Community Quality**	**3d. Non-Weighted Average**	**3e. Weighted Average**
Community #1	**T**	**A**	**If Spec. Features b, d or i are checked then rate Exceptional (2); if either question 4, 5, or 6 are Yes, then rate Exceptional (2); else:**		
Community #2	**U**	**B**			
Community #3	**V**	**C**			
Community #4	**W**	**D**			
Community #5	**X**	**E**			
Community #6	**Y**	**F**			
Community #7	**Z**	**G**			
Overall Wetland Value Rating	**1.0**		**: Highest Value of A-G**	**: (A+B+C+ D+E+F+G)/7 = Ave.**	**:(A*T)+(B* U)+(C*V)+ (D*W)+(E* X)+(F*Y)+(G*Z) = Wt. Ave.**

6.2 MAINTENANCE OF CHARACTERISTIC HYDROLOGIC REGIME

A wetland's hydrologic regime or hydroperiod is the seasonal pattern of the wetland water level that is like a hydrologic signature of each wetland type. It defines the rise and fall of a wetland's surface and subsurface water. The constancy of the seasonal patterns from year to year ensures a reasonable stability for the wetland[23]. The ability of the wetland to maintain a hydrologic regime characteristic of the wetland type is evaluated based upon wetland soil and vegetation characteristics, land use within the wetland, land use within the upland watershed contributing to the wetland, and wetland outlet configuration. Maintenance of the hydrologic regime is important for maintaining a characteristic vegetative community, and is closely associated with other functions including flood attenuation, water quality and groundwater interaction.

Measures the degree of human alteration of the wetland hydrology, either by outlet control or by altering immediate watershed conditions. Each parameter is weighted equally.

MnRAM #	Excel #	Variable Description	Type of Interaction
13	E17	Outlet—natural hydrologic regime	Controlling
14	E18	Dominant upland land use	Compensatory
15	E19	Soil condition/wetland	Compensatory
20	F24	Stormwater runoff/pretreatment-Reverse	Compensatory

Hydrologic Regime Index = (13+14+15+20)/4

6.3 FLOOD AND STORMWATER STORAGE/ATTENUATION

A wetland's ability to provide flood storage and/or flood wave attenuation is dependent on many characteristics of the wetland and contributing watershed. Characteristics of the subwatershed that affect the wetlands ability to provide flood storage and attenuation include: soil types, land use and resulting stormwater runoff volume, sediment delivery from the subwatershed, and the abundance of wetlands and waterbodies in the subwatershed. Wetland characteristics which affect the wetland's ability to store and or attenuate stormwater include: condition of wetland soils; presence, extent, and type of wetland vegetation; presence and connectivity of channels; and most importantly outlet configuration. Higher rated wetlands will have an unaltered or restricted outlet, undisturbed wetland soils, dense emergent vegetation without channels, a high proportion of impervious surfaces in the subwatershed, large runoff volumes, clayey upland soils, and few wetlands present within the subwatershed.

This formula is based on the Surface Water Storage Functional Capacity Index scoring concept and equation[24]. The formula was altered with the addition of three surface flow characteristics and two stormwater runoff parameters (Stormwater Runoff Quality/Quantity and Subwatershed Wetland Density) along with the removal of two parameters (Soil Porosity and Subsurface Outlet,

[23] Mitsch and Gosselink, 2000
[24] Lee et al., 1997

which is already characterized in another parameter). This index is comprised of 5 primary processes, which are weighted equally; included in each major process are one to three characteristics that equally contribute to that process.

1. **Outlet Characteristics**: Outlet characteristics
2. **Upland Watershed**: Upland land use, Upland soils,
3. **Wetland Condition/Land Use**: Wetland land use, sediment delivery
4. **Runoff Characteristics:** Stormwater runoff quality/quantity, subwatershed wetland density
5. **Surface Flow Characteristics**: Flow-through emergent vegetation density, surface flow characteristics

Flood and Stormwater Storage Index Computation:

Entire Formula: Outlet for flood retention{12} + (Dominant upland use-RR{14}+ Upland soils{19})/2 + (Soil condition{15} + Sediment delivery{18})/2 + Stormwater runoff pretreat&det{20} + Subwatershed wetland density{21})/2 + (Percent emergent vegetative cover{16} + Flow-through emergent vegetative roughness{17} + Channels/sheet flow{22})/3)/5.

1. If 12=0, then: ((14+19)/2+(15+18)/2+(20+21)/2+(16+17+22)/3)/4

2. If 12>0, then: (12+(14+19)/2+(15+18)/2+(20+21)/2+(16+17+22)/3)/5

No changes to the formula are necessary if 16=0.

Flood and Stormwater Storage/Attenuation Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
12	E16	Outlet—flood attenuation	Controlling—optional
14	F18	Dominant upland land use-RR	Compensatory
19	E23	Upland soils	Compensatory
15	E19	Soil condition	Compensatory
18	E22	Sediment delivery	Compensatory
20	E24	Stormwater pretreatment &detention	Compensatory
21	E25	Subwatershed wetland density	Compensatory
16	F20	Emergent vegetation % cover	Comp.—optional
17	E21	Emergent vegetation flood resistance	Comp.—optional
22	E26	Channels/sheet flow	Compensatory

6.4 DOWNSTREAM WATER QUALITY PROTECTION

This rates the wetland's ability and opportunity to protect valuable downstream resources. Valuable downstream resources include recreational waters (i.e. lakes, streams, rivers, creeks, etc) and potable water supplies. The level of functioning is determined based on runoff characteristics, sedimentation processes, nutrient cycling, and the presence and location of significant downstream water resources. Runoff characteristics that are evaluated include: land use and soils in the upstream watershed, the stormwater delivery system to the wetland, and sediment delivery characteristics. The ability of the wetland to remove sediment from stormwater is determined by emergent vegetation and overland flow characteristics. A high nutrient removal rating indicates dense vegetation and sheet flow to maximize nutrient uptake and residence time within the wetland. The opportunity for a wetland to protect a valuable water resource diminishes with distance from the wetland so wetlands with valuable waters within 0.5 miles downstream have the greatest opportunity to provide protection.

Compute Functional Index for Downstream Water Quality Protection
This functional index computation was derived from a combination of Nutrient Cycling and Retention of Particulates functions in the HGM Prairie Pothole draft guidebook[54] with the downstream sensitivity concept from *The Minnesota Wetland Evaluation Methodology.* Three major processes make up equal portions of the Downstream Water Quality Protection function[25] with a measure of opportunity to protect downstream resources; each process is comprised of two to four observable parameters.

1. **Rate, Quantity, and Quality of Runoff to the Wetland**: this is characterized by the conditions in the upstream watershed; both land use and soils, that affect the sediment and nutrient loads to the wetland, and by the existing storm water delivery system to the wetland (Upland watershed conditions, storm water runoff, evidence of sediment delivery, and upland buffer each comprise 1/16 of the entire downstream water quality functional index based on their contribution to sediment removal).
2. **Sedimentation**: this is characterized by the presence of flow-through emergent vegetation density and by the overland flow characteristics within the wetland. A wetland with primarily sheet flow through the wetland and dense emergent vegetation density will allow sediment to drop out more effectively than a wetland with channel flow and no vegetation (When all parameters are applicable; emergent vegetative density and overland flow characteristics each make up 1/8 of the total downstream water quality functional index based on their contribution to sediment removal).
3. **Nutrient Uptake**: this is characterized by the outlet configuration and vegetative characteristics. A wetland with long water retention times has more capacity to remove nutrients from the water column via physical and biological processes. Vegetation slows floodwaters by creating frictional drag in proportion to stem density which allows sediment particles to settle out, thereby improving the water quality for downstream uses (Outlet characteristics and vegetative density each make up 1/8 of the total downstream water quality functional index based on their contribution to nutrient uptake).

[25] Derived from a combination of Nutrient Cycling and Retention of Particulates functions in the HGM Prairie Pothole draft guidebook (Lee et al., 1997) with the downstream sensitivity concept from *The Minnesota Wetland Evaluation Methodology.*

4. **Downstream Sensitivity**: if the wetland contributes to the maintenance of water quality within one-half mile of a recreational water body or potable water supply source downstream, it operates at a higher functioning level than a similar wetland farther from or without significant downstream water resources (This factor accounts for ¼ of the total downstream water quality functional index).

Downstream Water Quality Functional Index Computations:

1. If 12=0, then: $(14+20_{reversed}+18+(\mathbf{23+24+26})/3+(\mathbf{16}+17)/2+27)/6$

2. If 12>0, then: $(14+20_{reversed}+18+(\mathbf{23+24+26})/3+(\mathbf{16}+17)/2+27+12)/7$

No changes to the formula are necessary if 16=0.

Entire Formula:
(Dominant upland land use{14} + Stormwater runoff pretreatment & detention{$20_{reversed}$ } + Sediment delivery {18} + (Upland buffer width{23}WQ + Upland buffer vegetative cover{24} + Upland buffer slope {26})/3 + (Flow-through %emergent vegetative cover{16} + Flow-through emergent vegetative roughness{17})/2 + Downstream sensitivity{27}+ Outlet for flood{12})/7

Downstream Water Quality Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
14	E18	Dominant upland land use	Controlling
20	E24	Stormwater runoff pretreatment &detention	Controlling
18	E22	Sediment delivery	Controlling
23	G27	Upland buffer width	Comp.
24	G28	Upland area management	Comp.
26	G34	Upland area slope	Comp.
16	F20	Emergent vegetation (% cover)	Comp.—optional
17	E21	Emergent vegetation (roughness coefficient)	Comp.—optional
27	E39	Downstream sensitivity	Comp.
12	E16	Outlet for flood	Controlling--optional

6.5 MAINTENANCE OF WETLAND WATER QUALITY

The sustainability of a wetland is partially driven by the quality and quantity of stormwater runoff entering the wetland. The ability of the wetland to sustain its characteristics is evaluated based on characteristics of the contributing subwatershed and indicators within the wetland. Subwatershed conditions which affect the wetland's sustainability in relation to water quality impacts include: upland land use; sediment delivery characteristics to the wetland; stormwater runoff volumes and rates; and the extent, condition, and width of upland buffer. Indicators of nutrient loading to the wetland indicate that a diverse wetland may not be sustainable. Indicators that a wetland has been affected by nutrient loading include the presence of monotypic vegetation and/or algal blooms.

This functional index was derived from a combination of sources including MNRAM, HGM, WEM, WET, and experiences of the project team. The sustainability of a wetland

is partially driven by the quality and quantity of stormwater runoff entering the wetland. The ability of the wetland to sustain its characteristics is evaluated based on characteristics of the contributing subwatershed and indicators within the wetland. Subwatershed conditions which affect the wetland's sustainability in relation to water quality impacts include: upland land use; sediment delivery characteristics to the wetland; stormwater runoff volumes and rates; and the extent, condition, and width of upland buffer. Indicators of nutrient loading to the wetland indicate that a diverse wetland may not be sustainable. Indicators that a wetland has been affected by nutrient loading include the presence of monotypic vegetation and/or algal blooms.

Wetland Water Quality Functional Index Computation:

(3e*2+14+$20_{reversed}$ +**(23**+**24**+**26)**/3+18+28)/7

Entire Formula:
(Vegetative Diversity/Integrity{3e*2} + Dominant upland land use{14} + Stormwater runoff pretreatment & detention{$20_{reversed}$ } + (Upland buffer width{23}WQ + Upland buffer vegetative cover {24} + Upland buffer slope {26})/3 + Sediment delivery {18})/2 + Nutrient loading {28})/7

Wetland Water Quality Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
3e	D6*2	Vegetative Diversity/Integrity	Contributing
14	E18	Dominant upland land use	Contributing
20	F24	Stormwater runoff pretreatment and detention—RR	Contributing
23	G27	Upland buffer width	Contributing
24	G28	Upland area management	Contributing
26	G34	Upland area slope	Contributing
18	E22	Sediment delivery	Contributing
28	E40	Nutrient loading	Contributing

This functional index was derived from a combination of sources including MNRAM, HGM, WEM, WET, and experiences of the project team. The sustainability of a wetland is partially driven by the quality and quantity of stormwater runoff entering the wetland. The ability of the wetland to sustain its characteristics is evaluated based on characteristics of the contributing subwatershed and indicators within the wetland. Subwatershed conditions which affect the wetland's sustainability in relation to water quality impacts include: upland land use; sediment delivery characteristics to the wetland; stormwater runoff volumes and rates; and the extent, condition, and width of upland buffer. Indicators of nutrient loading to the wetland indicate that a diverse wetland may not be sustainable. Indicators that a wetland has been affected by nutrient loading include the presence of monotypic vegetation and/or algal blooms.

6.6 SHORELINE PROTECTION

Shoreline protection is evaluated only for those wetlands adjacent to lakes, streams, or deepwater habitats. The function is rated based on the wetlands opportunity to protect the shoreline; i.e. wetlands located in areas frequently experiencing large waves and high

currents have the best opportunity to protect the shore. In addition, shore areas composed of sands and loams with little vegetation or shallow-rooted vegetation will benefit the most from shoreline wetlands. The wetland width, vegetative cover, and resistance of the vegetation to erosive forces determine the wetland's ability to protect the shoreline.

Each of the five parameters contributes equally[26]: based primarily on the characteristics presented in WEM with a simple, straightforward computation of the index assuming all characteristics contribute equally.

MnRAM #	Excel #	Variable Description	Type of Interaction
29	E41	Shoreline?	Controlling
30	E42	Rooted shoreline vegetation (% cover)	Contributing
31	E43	Wetland width (average)	Contributing
32	E44	Emergent vegetation erosion resistance	Contributing
33	E45	Shoreline erosion potential	Contributing
34	E46	Bank protection ability	Contributing

Shoreline Protection Functional Index Computation:

If 29=1, then:
Shoreline Protection Index = (30+31+32+33+34)/5

Entire Formula:
(Rooted shoreline vegetation {30} + Average shoreline wetland width {31} + Emergent vegetation erosion resistance {32} + (Shoreline erosion potential {33} + Bank protection ability {34})/5

6.7 MAINTENANCE OF CHARACTERISTIC WILDLIFE HABITAT STRUCTURE

The ability of a wetland to support various wildlife species is difficult to determine due to the specific requirements of the many wildlife species that utilize wetlands. This function determines the value of a wetland for wildlife in a more general sense, and not based on any specific species. The characteristics evaluated to determine the wildlife habitat function include: vegetative quality, outlet characteristics (which control hydrologic regime), upland land use, wetland soil type and conditions, water quality of storm water runoff entering the wetland, upland buffer extent, condition, and diversity; the interspersion of wetlands in the area; barriers to wildlife movement; wetland size; vegetative and community interspersion within the wetland; and amphibian breeding potential and overwintering habitat.

Thirteen parameters are weighed equally as described below; vegetative quality weighted double the other factors. The questions are borrowed or modified from MNRAM, WET, WEM, and HGM methodologies, combined to provide a measure of wildlife habitat in general, not focusing on any particular species.

If Rare Wildlife (35) or Rare Natural Community (36) are true, then this Index is Exceptional.

[26] Based primarily on the characteristics presented in WEM.

If Special Features d, g, or j are checked, then this Index is Exceptional, otherwise, follow conditions below:

If 37=0 and 38=0 and 39=0, then:
(3e*2+40+41+(**23**+**24**+**25)**/3+13+ 20)/7

If 38=0 and 39=0, then:
(3e*2+37+40+41+(**23**+**24**+**25)**/3+ 13+20)/8

If 37=0 and 39=0, then:
(3e*2+38+40+41+(**23**+**24**+**25)**/3+ 13+20)/8

If 37=0 and 38=0, then:
(3e*2+39+40+41+(**23**+**24**+**25)**/3+ 13+20)/8

If 39=0, then:
(3e*2+37+38+40+41+(**23**+**24**+**25)**/3+13+20)/9

If 38=0, then:
(3e*2+39+37+40+41+(**23**+**24**+**25)**/3+13+20)/9

If 37=0, then:
(3e*2+39+38+40+41+(**23**+**24**+**25)**/3+13+20)/9

If 37>0 and 38>0 and 39>0, then:
(3e*2+39+37+38+40+41+(**23+24+25**)/3+13+20)/10

Entire Equation:
(Vegetative Diversity/Integrity{3e*2} + Wetland Detritus {39} + Vegetation Interspersion {37} + Community Interspersion {38} + Wetland Interspersion {40} + Wildlife Barriers {41} + (Upland buffer width {23}WQ + Upland Area Management{24} + Upland area diversity {25})/3 + Outlet natural hydrologic regime {13}+ Stormwater runoff pretreatment and detention 20)/11

MnRAM #	Excel #	Variable Description	Type of Interaction
41	E53	Wildlife barriers	Controlling
3e	D6	Vegetative Ranking (communities' weighted average)	Compensatory
39	E51	Wetland detritus (n/a)	
23	I27	Upland buffer average width	
24	G28	Upland area management	
25	G31	Upland area diversity	
13	E17	Outlet natural hydrologic regime	
20	F24	Stormwater runoff pretreatment & detention—RR	
37	F49	Vegetation interspersion (n/a)	
38	F50	Community interspersion (n/a)	
40	E52	Wetland interspersion	

6.8 MAINTENANCE OF CHARACTERISTIC FISH HABITAT

The ability of the wetland to support native fish populations is determined by structural factors within the wetland as well as water quality contributions from upland factors. Wetlands rated High are lacustrine or riverine and provide spawning/nursery habitat, or

refuge for native species (included but not limited to game fish). Wetlands rated Low for fish habitat do not have a direct hydrologic connection to a waterbody with a native fishery or have poor water quality.

MnRAM #	Excel #	Variable Description	Type of Interaction
46	E58*2	Fish habitat quality	Controlling
29	D41	Fringe wetland?	Contributing
24	G28	Adjacent area management	Compensatory
18	E22	Sediment delivery	Compensatory
20 (R)	F24	Storm water runoff	Compensatory
28	E40	Nutrient load	Compensatory
30	E42	Percent cover	Compensatory
31	E43	Wetland shoreline width	Compensatory
33 (R)	F45	Shoreline erosion potential	Compensatory

Fish Habitat Functional Index Computation:

If Special Features a or g are checked, then Fishery Habitat Index = Exceptional.

If 46=0, then Fishery Habitat = N/A

If 29=0, Fishery Habitat Index = [(46*2)+24+18+20(R) +28]/6

If 29>0, Fishery Habitat Index = [(46*2)+24+18+20(R) +28+**30**+**31**+**33(R)**]/9

6.9 MAINTENANCE OF CHARACT. AMPHIBIAN HABITAT FOR BREEDING/OVERWINTERING

The ability of a wetland to support various amphibian species is difficult to determine due to the specific requirements of the many amphibian species that depend on wetlands. This function determines the value of a wetland for amphibians in general, not based on specific species. An adequate wetland hydroperiod and the presence or absence of predatory fish are considered to be limiting variables for this function. In general, wetlands must remain inundated until early to mid-June to allow the larval stages to metamorphose into adults. Because many amphibians are partly terrestrial, the characteristics evaluated to determine the amphibian habitat function include numerous hydrology and terrestrial measures. The characteristics evaluated include: upland land use, upland buffer width, water quality of storm water runoff entering the wetland, barriers to wildlife movement, and amphibian breeding potential and overwintering habitat.

An adequate wetland hydroperiod (Question 42) is considered to be the primary limiting variable for this functional index. If the hydroperiod is insufficient for breeding, the wetland rating for amphibian use will be Not Sufficient. The status of predatory fish in the wetland (Q.43) is a secondary limiting factor to the final rating; the lowest rating for this variable, however, is 0.1 (Low), rather than zero (Not Sufficient).

Amphibians' ability to use a particular wetland for over wintering is a contributing factor in rating the wetland's functional index (Q.44). Because most amphibians are partly terrestrial, the extent of upland buffer habitat surrounding the wetland (Q.23) is an

important habitat component[27] and is weighted by a factor of two. Question 14 (Upland Land Use) is also included as an indicator of the quality of the surrounding upland habitat[56]. Unnatural fluctuations in water depth in wetlands from conducted storm water runoff can impair reproductive success in amphibians, which often attach their eggs to stems of wetland vegetation, e.g., salamanders, tree frogs, green frogs, and wood frogs[28]. Extreme water level fluctuations during winter may also cause mortality in overwintering reptiles and amphibians[29]. Thus, Question 20 is included in the formula, with a reverse rating. Question 41 (Barriers) is included because access to and from the wetland by amphibians is an important factor in habitat quality[30].

Amphibian Habitat Functional Index Computation:

If 42=0, then N/A

Otherwise: Amphibian Habitat Index = (43) * [(44 + 2*$23_{wildlife}$ + 14 + 41 + $20_{reversed}$)/6]

Entire Formula:

If Amphibian Breeding Potential-Hydroperiod {42} is applicable, then: (Amphibian Breeding Potential-Predator Fish {43}) * {[(Amphibian Overwintering Habitat {44}+ 2*Upland Buffer Width $(23)_{Wildlife}$ + Dominant Upland Land Use {14} + Barriers {41} + Stormwater Input $\{20_{reverse}\}$]/6}

Amphibian Habitat Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
42	D54	Amphibian breeding potential—hydroperiod	Controlling
43	D55	Amphibian breeding potential—fish presence	Controlling
44	E56	Amphibian overwintering habitat	Compensatory
23	I27	Upland buffer width	Compensatory
41	E53	Wildlife barriers	Compensatory
14	E18	Dominant upland land use	Compensatory
20	F24	Stormwater runoff pretreatment & detention—RR	Compensatory

6.10 AESTHETICS/RECREATION/EDUCATION/CULTURAL/SCIENCE

The aesthetics/recreation/education/cultural and science function and value of each wetland is evaluated based on the wetland's visibility, accessibility, evidence of recreational uses, evidence of human influences (e.g. noise and air pollution) and any known educational or cultural purposes. Accessibility of the wetland is key to its aesthetic or educational appreciation. While dependent on accessibility, a wetland's functional level could be evaluated by the view it provides observers. Distinct contrast

[27] Knutson et al., 2000
[28] Richter and Azous, 1995
[29] Hall and Cuthbert, 2000
[30] Knutson, et al., 1999; Findlay and Bourdages, 2000; Semlitsch, 2000.

between the wetland and surrounding upland may increase its perceived importance. Also, diversity of wetland types or vegetation communities may increase its functional level as compared to monotypic open water or vegetation. Excess negative human influence on the wetland is counted double in the formula.

All questions contribute equally to the overall index.

MnRAM #	Excel #	Variable Description	Type of Interaction
48	E60	Rare educational opportunity	Controlling
49	E61	Wetland visibility	Compensatory
50	E62	Proximity to population	Compensatory
51	E63	Public ownership	Compensatory
52	E64	Public access	Compensatory
53	E65	Human influence—wetland	Compensatory
54	E66	Human influence—viewshed	Compensatory
55	E67	Spatial buffer	Compensatory
56	E68	Recreational activities in wetland	Compensatory

Aesthetics/Recreation/Education/Cultural/Science Functional Index Computations:

If Special Features c, h, or u is checked[31], or

If 48=1, then Index = Exceptional;

If 53=0.1 (Low), then = (50+51+52+2*53+54+55+56)/8

If 53>0.1, then = (49+50+51+52+53+54+55+56)/8

Entire Formula

(Wetland Visibility {49} + Proximity to Population {50} + Public Ownership {51} + Public Access {52} + Human Influence - Wetland {53} + Human Influence - Viewshed {54} + Spatial Buffer {55} + Recreational Activities in Wetland {56})/8

6.11 COMMERCIAL USES

This question considers the nature of any commercially-valuable use of the wetland and requires the assessor to consider how such use may be a detriment to the sustainability of the wetland. Some row crops can be planted in Type 1 wetlands after spring flooding has ceased and still have adequate time to grow to maturity. This non-wetland-dependent agricultural use of wetlands may include hay, pasture/grazing, or row crops such as soybeans or corn. Wetland-dependent crops include wild rice and cranberries, which rely on the wetland hydrology for part of their life cycle.

[31] c = Designated scientific and natural area; h = Archeologic or historic site designated by the State Historic Preservation Office; u = State or Federal designated wilderness area.

Sustainable uses of the wetland would not require modifying a natural wetland. Products in this category would include collection of botanical products, wet native grass seed, floral decorations, wild rice, black spruce, white cedar, and tamarack. Sustainable uses may require modification of the natural hydrology, such as for wetland-dependent crops (rice, cranberries). Haying and grazing can be less intrusive agricultural activities utilized more or less casually when hydrologic conditions permit; light pasture and occasional haying would be considered more or less sustainable. Like peat-mining, cropping is an unsustainable use of the wetland as it is results in severe alterations of wetland characteristics (soil, vegetation, hydrology).

MnRAM #	Excel #	Variable Description	Type of Interaction
57	E69	Commercial crop—hydrologic impact	Controlling

Commercial Uses Functional Index = 57

6.12 GROUND-WATER INTERACTION

The ground water interaction function is the most difficult to assess. Here the most likely type of ground water interaction is determined, i.e. recharge or discharge, or a combination. In many cases, a wetland will exhibit both recharge and discharge characteristics, however one is usually more dominant. Several wetland and watershed characteristics are evaluated to determine the likely interaction including: wetland soil type, upland land use, upland soil types and wetland size, wetland hydroperiod, wetland outlet characteristics, and topographic relief.

The purpose of this function is strictly to determine the likelihood of the appropriate ground-water interaction based on observable characteristics of the wetland and watershed. The significance of ground water as a component of the wetland water budget is the most difficult functional characteristic to determine without large quantities of detailed hydrologic and geologic information. The following methodology takes the most easily observable and distinct measures of recharge/discharge relationships from the *Wetland Evaluation Technique*[32] and the *Hydrogeomorphic Assessment Methodology*[33]. In many wetlands, surface water and ground water both make significant contributions to the water budget, but occasionally recharge or discharge is dominant. The goal here is to identify the dominant ground-water interaction (if there is one) to help guide future management and provide an indication when additional information may be warranted.

[32] Adamus, et al., 1987
[33] Magee and Hollands, 1998

- If 5 or 6 of questions 58-63 are answered the same, this indicates a strong likelihood that the most frequently stated interaction exerts the primary influence on the wetland.
- If 3-4 questions are answered the same, then the wetland is likely influenced by a combination of both recharge and discharge interactions (i.e. both types of ground water interaction are likely to be present at some point during most years).

58. Wetland Soils – from HGM system functional assessments and Novitzki
59. Subwatershed Land Use/Imperviousness – taken from WET Volume I
60. Wetland Size and Upland Soils – taken from WET Volume I and HGM
61. Wetland Hydrologic Regime– taken from WET Volume I and HGM
62. Inlet/Outlet Configuration – taken from WET Volume I and HGM
63. Upland Topographic Relief – taken from WET Volume I

Special Concerns for Recharge Wetlands

Wherever ground water recharge is indicated as the **primary** interaction and the wetland lies within a sensitive ground water area (**Special Feature Question q**), a contribution area to a public water supply, or a wellhead protection area (**Special Feature Question r**), it should be recorded as Exceptional for the ground water/wetland function.

6.13 WETLAND RESTORATION POTENTIAL

The potential for wetland restoration is determined based on the ease with which the wetland could be restored, the number of landowners within the historic wetland basin, the size of the potential restoration area, the potential for establishing buffer areas or water quality ponding, and the extent and type of hydrologic alteration. Each variable uses the High, Medium, Low rating rather than raw numbers—see MnRAM for individual ranges.

MnRAM #	Excel #	Variable Description	Type of Interaction
64	D79	Wetland Restoration Potential	Controlling
65	F80	Number of Landowners Affected	Contributing
21	E25	Subwatershed Wetland Density	Contributing
66b	F82	Total Wetland Restored Size (Potential)	Contributing
66c	F83	Calculated potential new wetland area	Contributing
67	F84	Potential Buffer Width	Contributing
68	F85	Likelihood of Restoration Success	Contributing

If 64="Yes", then Wetland Restoration Potential = (65+21+66b+66c+67+68)/6,

Otherwise, if 64="No" then "N/A"

Entire Formula

(Landowners Affected by Restoration (65)+Subwatershed Wetland Density (21)+ Wetland Restoration Size (66b)+Proportion of Wetland Drained (66c)+Potential Buffer Width (67)+Likelihood of Restoration Success (68))/6

6.14 WETLAND SENSITIVITY TO STORMWATER INPUT AND URBAN DEVELOPMENT

The sensitivity of the wetland to stormwater and urban development is determined based on guidance within the *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands,* State of Minnesota Storm-Water Advisory Group, June, 1997.

Use habitat proportions from Vegetative Integrity section and enter into a formula to compute answer according to the following criteria[34].

Exceptional = Sedge meadows, open and coniferous bogs, calcareous fens, low prairies, wet to wet-mesic prairies, coniferous swamps, lowland hardwood swamps, or seasonally flooded basins.

A = Shrub-carrs, alder thickets, diverse fresh wet meadows dominated by native species, diverse shallow and deep marshes, and diverse shallow, open water communities.

B = Floodplain forests, fresh wet meadows dominated by reed canary grass, shallow and deep marshes dominated by cattail, reed canary grass, giant reed or purple loosestrife, and shallow, open water communities with low to moderate vegetative diversity.

C = Gravel pits, cultivated hydric soils, or dredge/fill disposal sites.

6.15 ADDITIONAL STORMWATER TREATMENT NEEDS

This rates the sustainability of the wetland with regard to stormwater discharges to the wetland. The need for additional stormwater treatment prior to discharge to the wetland is rated based on the overall rating for Maintenance of Wetland Water Quality. If a wetland is severely degraded by stormwater inputs, the rating will be low, since a diverse, high quality wetland will not be sustainable.

Use functional rating for Maintenance of Wetland Water Quality (MWWQ) as follows (this index is rated strictly from the measure of the water quality in the wetland and the sustainability, i.e. if the water quality in the wetland is low, additional stormwater treatment is needed to protect the wetland and the rating is low):

Use Value for Maintenance of Wetland Water Quality Index (D76, Excel spreadsheet) and apply to criteria below.

A = Maintenance of Wetland Water Quality Index >0.66 (no additional treatment needed)

B = 0.33 < Maintenance of Wetland Water Quality Index $\leq$ < 0.66 (sediment removal needed)

[34] Taken directly from State of Minnesota Storm-Water Advisory Group, 1997.

C = Maintenance of Wetland Water Quality Index < 0.33 (sediment and nutrient removal needed)

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Appendix G

Vegetation Shoreline Buffer Brochure Examples

PROJECT FACTSHEET

HENNINGSON RESIDENTIAL NATIVE PLANTING

DAKOTA COUNTY
SOIL & WATER CONSERVATION DISTRICT

A native planting, also called natural landscaping, uses plants, trees and grasses that are suitable for growth in a particular geographical area

PROJECT: Installation of a 500 sq. ft. residential native garden.

COST: Project materials cost estimated at $2,360

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

Black Dog
Watershed Management Organization

LOCATION:

Kenosha Ave
Burnsville

PRACTICE:

- Native Planting

BENEFITS:

- Runoff volume reduction
- Slope stabilization
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

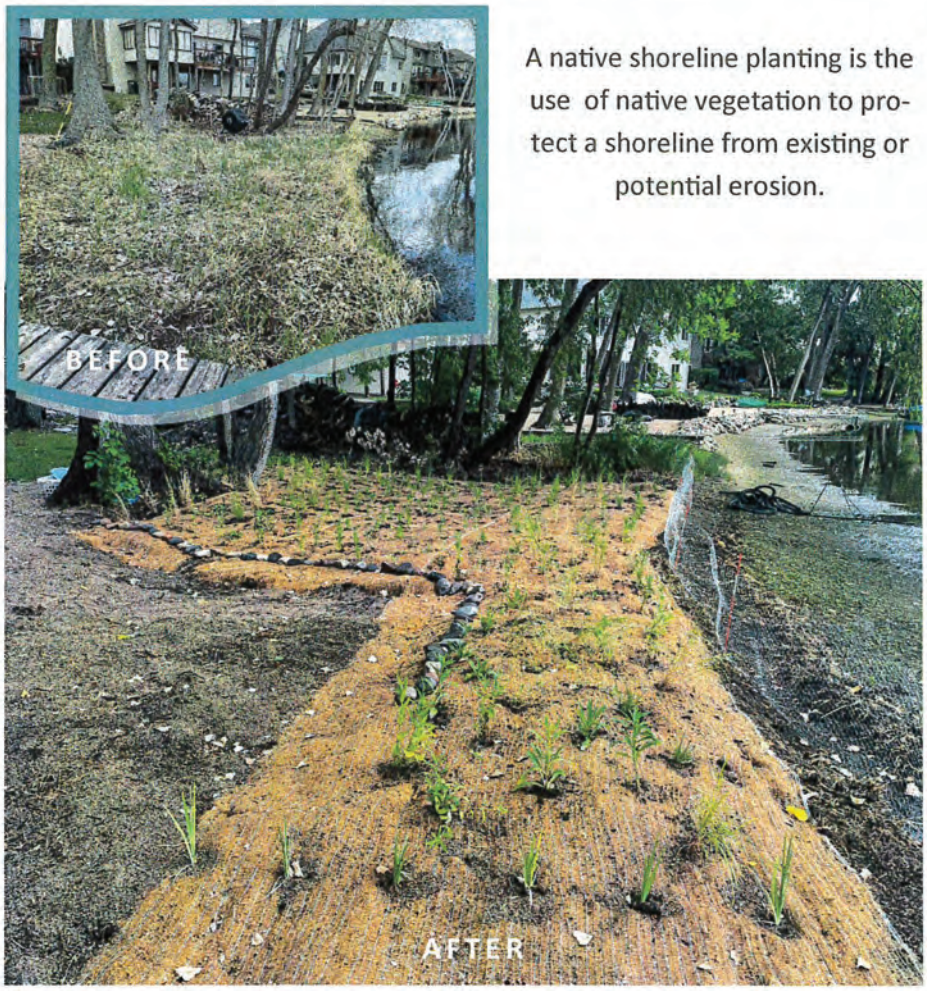
- Summer 2021

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 7/7/2021

PROJECT FACTSHEET

DILLMAN
NATIVE SHORELINE PLANTING

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT



A native shoreline planting is the use of native vegetation to protect a shoreline from existing or potential erosion.

PROJECT: Installation of a 620 square foot Native Shoreline Planting

COST: Project materials cost estimated at $1,096

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

Black Dog
Watershed Management Organization

LOCATION:

Keller Lake Road
Burnsville

PRACTICE:

- Native Shoreline Planting

BENEFITS:

- Shoreline stabilization and erosion reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Black Dog

INSTALLATION:

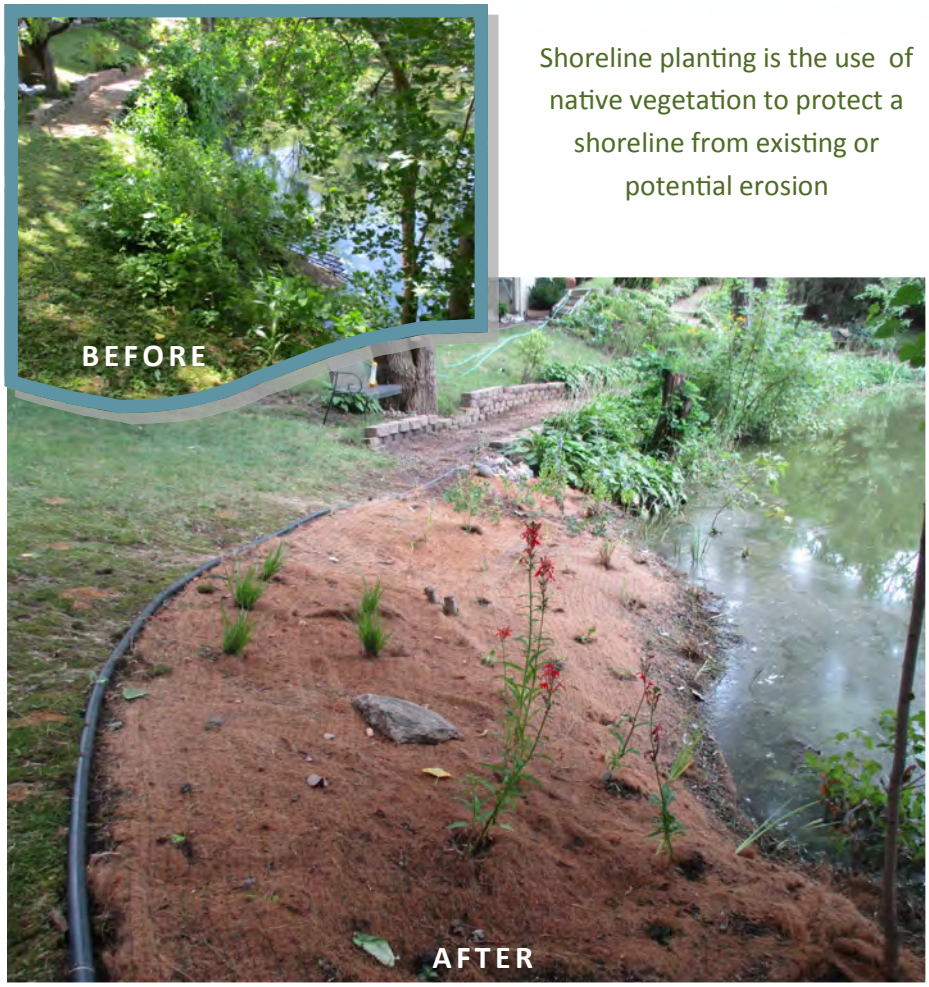
- Summer 2021

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 7/7/2021

PROJECT FACTSHEET

ASHENBRENER RESIDENTIAL SHORELINE PLANTING

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT



Shoreline planting is the use of native vegetation to protect a shoreline from existing or potential erosion

PROJECT: Installation of a 280 square foot residential shoreline planting

COST: Project materials cost estimated at $1,410

FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

Black Dog
Watershed Management Organization

LOCATION:

Burnsville, MN

Baypoint Drive

PRACTICE:

- Residential shoreline planting

BENEFITS:

- Shoreline stabilization and erosion reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Minnesota River

RECEIVING WATERS:

- Unnamed pond

INSTALLATION:

- Summer 2016

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 8/31/2016

PROJECT FACTSHEET

DELONG

RESIDENTIAL SHORELINE

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

A native shoreline planting is the use of native vegetation to protect a shoreline from existing or potential erosion

PROJECT: Installation of a 1,300 square foot native shoreline planting

COST: Project materials cost estimated at $2,300

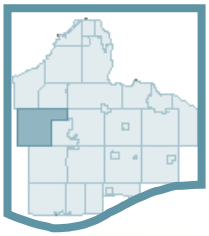
FUNDING: Landowners receive a $250 Blue Thumb grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

Black Dog
Watershed Management Organization

LOCATION:

Lakeville, MN

166th Street W.



PRACTICE:

- Residential Native Shoreline Planting

BENEFITS:

- Shoreline stabilization and erosion reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Minnesota River

RECEIVING WATERS:

- Lee Lake

INSTALLATION:

- Summer 2016

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 8/4/2016

PROJECT FACTSHEET

MCCRUM
RESIDENTIAL SHORELINE PLANTING

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

Shoreline planting is the use of native vegetation to protect a shoreline from existing or potential erosion

PROJECT: Installation of a 1000 square foot residential shoreline planting

COST: Project materials cost estimated at $3,000

FUNDING: Landowners receive a $250 Blue Thumb grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

Black Dog
Watershed Management Organization

LOCATION:

Burnsville, MN

132nd Street East

PRACTICE:

- Residential shoreline planting

BENEFITS:

- Shoreline stabilization and erosion reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Minnesota River

RECEIVING WATERS:

- Minnesota River

INSTALLATION:

- Summer 2015

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 9/10/2015

PROJECT FACTSHEET

GILBERTSON

RESIDENTIAL RAINGARDEN

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

A raingarden is a shallow depression that captures rainwater, removes pollutants, and soaks the water into the ground

PROJECT: Installation of a 275 square foot residential raingarden

COST: Project materials cost estimated at $706

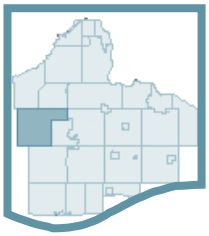
FUNDING: Landowners receive a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County Soil and Water Conservation District

Black Dog
Watershed Management Organization

LOCATION:

Lakeville, MN

170th Street West



PRACTICE:

- Residential raingarden

BENEFITS:

- Runoff volume reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public outreach and education
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERSHED:

- Minnesota River

RECEIVING WATERS:

- Crystal Lake

INSTALLATION:

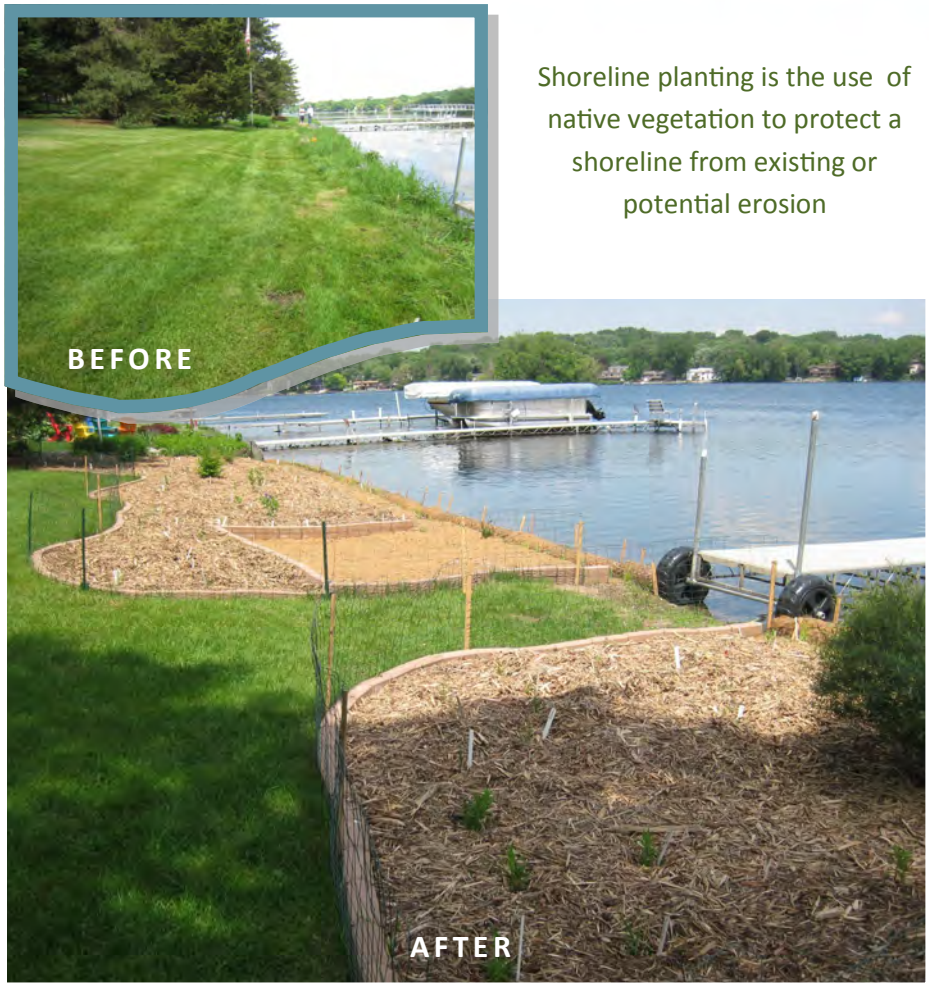
- Summer 2015

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: (651) 480-7777 Fax: (651) 480-7775 www.dakotacountyswcd.org Revised: 6/26/2015

PROJECT FACTSHEET

COADY
SHORELINE PLANTING

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT



Shoreline planting is the use of native vegetation to protect a shoreline from existing or potential erosion

PROJECT: Installation of a 1000 square foot shoreline planting

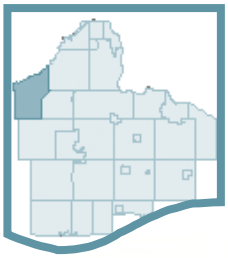
COST: Project materials cost estimated at $3,192

FUNDING: Landowners receive a $250 Blue Thumb grant as well as technical assistance provided by the Dakota County SWCD

Blue Thumb
PLANTING FOR CLEAN WATER®

LOCATION:

Burnsville MN
Bluebill Bay Road



PRACTICE:

- Shoreline Planting

BENEFITS:

- Shoreline stabilization and erosion reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERBODY:

- Crystal Lake

WATERSHED:

- Minnesota River

INSTALLATION:

- Summer 2014

4100 220th Street W, Suite 102, Farmington, MN 55024 Tel: 651.480.7777 Fax: 651.480.7775 www.dakotaswcd.org Revised: 8/1/2014

Sullivan Shoreline Planting

Project: A 375 square foot shoreline planting along Crystal Lake, covering approximately 50 linear feet of shoreline. Erosion control blanket, native shrubs, and deep-rooted native plant plugs were used to stabilize the existing slope.

Costs: Project material costs were estimated at $935.

Funding: Dakota County SWCD provided technical assistance and Blue Thumb Grant in the amount of $100. The City of Burnsville provided Neighborhood Water Resources Enhancement Grant.

Practice:

Shoreline Planting

Shoreline Benefits:

Reduced erosion and sediment into the receiving waterbody

Improved aesthetics

Improved water quality

Slope stabilization

Partners:

Black Dog Watershed Management Organization

City of Burnsville

Watershed:

Minnesota River

Construction:

July 2009

Location:

Burnsville

Minnesota

Dakota County Soil and Water Conservation District
4100 220th St. W., Suite 102, Farmington, MN 55024 651-480-7777 www.dakotaswcd.org

Revised 8/4/09

Fay Shoreline

Project: A 600 square foot shoreline planting.

Costs: Project material costs were estimated at $1,847.

Funding: Dakota County SWCD provided technical assistance and Blue Thumb Grant in the amount of $250.

Practice:

Shoreline planting and Native garden

Benefits:

Runoff volume reduction

Improved aesthetics

Improved water quality

Opportunity for public education and outreach

Wildlife habitat

Slope stabilization

Partner:

Black Dog Watershed Management Organization

Watershed:

Minnesota River

Location:

Burnsville

Minnesota

Construction:

2013

Dakota County Soil and Water Conservation District
4100 220th St. W., Suite 102, Farmington, MN 55024 651-480-7777 www.dakotaswcd.org

Revised 9/18/2013

Appendix H

Buckthorn Management Guidelines

Buckthorn Management Guidelines

Goal: Restore native plant communities in designated natural areas and other park locations by controlling and removing non-native invasive species.

Buckthorn belongs to the *Rhamnaceae* family. It is native to Europe and Asia, first appearing in the U.S. in the late 1700s. Buckthorn quickly naturalized in the woodlands of the northeastern states. Today buckthorn flourishes in the understory of Minnesota woodlands and in brushy thickets along roadsides and fields. It has become a major plant pest in natural woodlands and wetlands.

Buckthorn can grow to 15-20 feet and has dark green elliptical or oval leaves. In the fall its leaves hang on late into the season and without much color change. It starts easily from seed and will tolerate almost any soil condition or location. In partial shade it will outstretch its neighbors toward the light.

Buckthorn removal is recommended for those areas where the native plant community has been displaced by buckthorn species and where there is a high likelihood that the native plant community can be enhanced and restored.

Restoration of the native communities is the overall intent of non-native eradication efforts.

Volunteer Considerations

Volunteers must be trained in species identification, removal techniques and other aspects related to the eradication/restoration efforts.

Identification of buckthorn by volunteers is best performed during the month of October.

Process

Buckthorn removal is a long-term process requiring several steps over a three- to four-year period. Pulling seedlings, cutting and removing mature plants, chemically treating stumps and replanting the site with native species are critical to the long-term success of restoration efforts.

Staff are responsible for cutting mature plants and chemically treating the stumps in areas designated for restoration. A 20%-25% solution of glyphosate (Roundup) with a dye is used to paint, chemically treat, and mark the stumps.

Volunteer procedures

1. Hand pulling allowed by volunteers with training or under the supervision of a "trained" volunteer supervisor.
2. Use of loppers allowed by volunteers.
3. No use of power tools or chemicals by volunteers; chemicals and power tool use only by staff or contractor.
4. Volunteers must sign waiver form.

Recommended chronology of restoration activities with volunteers

Year one

- Seedlings cut or pulled (September-November)
- Mature trees cut by staff and/or volunteers in late fall (October-December)
- Stumps or stems chemically treated by staff immediately after cutting
- Removal of brush to a chipping location (or pile on site for burning)

Year two

- Remove seedlings by hand pulling or cutting and treating (June-November)
- Follow-up cutting by staff and/or volunteers in late fall (October-December) and chemically treat stump and stems.

Year three

- Seedling removal by hand pulling or cutting and treating as necessary
- Plant native understory shrubs, trees, ferns, wildflowers and grasses to approximate prior native plant community.

Year four

- Continued monitoring and buckthorn seedling removal

Other removal techniques

Mechanical

- Prescribed fire for seedlings; prescribed burns in early spring and fall annually or biannually to control buckthorn may have to be continued for several years

Chemical

- Cut-stump and stem treatment with glyphosate; 20%-25% active ingredient cut-stump; or basal bark spray treatment around the stem with 25-50% a.i. triclopyr (Garlon) – consideration of worker safety issues will dictate chemical selection. Glyphosate products registered for wetland/aquatic use should be used on water bodies and wetlands. Sponge applicators can help prevent chemical spill or spread to workers.
- Fosamine, a non-selective bud inhibitor for woody species, can be applied as a basal bark treatment in the fall at 3% a.i. concentration in winter

Another technique is goat rental.

The method of buckthorn control should be selected based on the site, safety concerns, and opportunities for continued vegetation management.

Other Sources for Guidance

University of Minnesota:
http://www.extension.umn.edu/environment/agroforestry/woody-vegetation-control.html

University of Wisconsin:
http://mipncontroldatabase.wisc.edu/search?name=common_buckthorn&habitat=7&season=7

Minnesota Department of Natural Resources:
http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/buckthorn/control.html

U.S. Department of Agriculture Natural Resources Conservation Service:
https://efotg.sc.egov.usda.gov/references/public/MN/797Buckthorn.pdf
See Buckthorn Control Quick Guide for a summary of control techniques.

Appendix I

Pollinators Brochure

How can YOU help pollinators?

A decline in pollinators affects us all. Reversing this trend is important to our ecosystem as well as to human health and well-being. Pollinators have evolved with plants over thousands of years, developing unique and interdependent relationships. We can all do our part to help pollinators rebound from the challenges they face.

1. **Plant a variety of native flowering plants in your home garden, agricultural or natural landscapes (with bloom times from April to October).**

2. **Provide a variety of natural habitats for nesting sites and clean water sources.**

3. **Avoid pesticide use and purchase pollinator plants (and seeds) that have not been treated with systemic pesticides.**

4. **Help increase awareness about the need to protect pollinators**

More resources about pollinators can be found at http://www.bwsr.state.mn.us/practices/pollinator/index.html

Minnesota Board of Water & Soil Resources
www.bwsr.state.mn.us

MINNESOTA BOARD OF WATER & SOIL RESOURCES

PROTECTING
Minnesota's Pollinators

There is increasing evidence that insect pollinators are disappearing at alarming rates. Major factors include loss of forage plants and nesting habitat, disease, pesticide use, and pests.

Pollination causes plants to produce the seeds and fruits that sustain wildlife and humans, and provides important ecosystem services. More than 1/3rd of all plants or plant products consumed by humans are dependent on pollinators.

Many Minnesota-grown crop plants cannot produce seed without the help of insect pollinators. These include:

- -Apples
- -Berries
- -Sunflowers
- -Clovers
- -Beans
- -Squash
- -Cucumbers

Minnesota's Pollinators & Pollinator Plants

When these critters visit a flower to consume nectar and/or pollen, some of the pollen grains stick to their bodies. Pollination occurs when this pollen is transferred from one plant to another.

Bees

With over 4000 species, bees are considered the most important pollinators in North America, around 500 of which are native to Minnesota and Wisconsin. Bee families include honey bees, bumble bees, mason bees, carpenter bees, and sweat bees.

Butterflies & Moths

Butterflies and moths are also important pollinators and many are in trouble. Milkweed is the host plant for monarch butterfly caterpillars, and the loss of this plant is drastically reducing monarch butterfly populations. The Poweshiek skipperling, Dakota skipper, and Karner Blue butterflies are threatened or endangered in Minnesota.

Beetles, Flies, Wasps & Midges

Beetles are considered to be important pollinators because of their large numbers. Beetles play an important role in controlling agricultural pests. Though less effective as pollinators, many flies, wasps, midges, and even mosquitos visit flowers and consume nectar as part of their diet.

Hummingbirds

Of the 20 hummingbirds in North America, only the Ruby-throated is regularly found in Minnesota. This charismatic pollinator is attracted to brightly colored tubular flowers like the columbine.

Goldenrod
Solidago spp.

Joe Pye Weed
Eupatorium spp.

Milkweed
Asclepias spp.

Black-eyed Susan
Rudbeckia spp.

Prairie Blazing Star
Liatris spp.

Columbine
Aquilegia spp.

Minnesota Board of Water & Soil Resources

resourceful. naturally.
engineering and environmental consultants

BARR

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

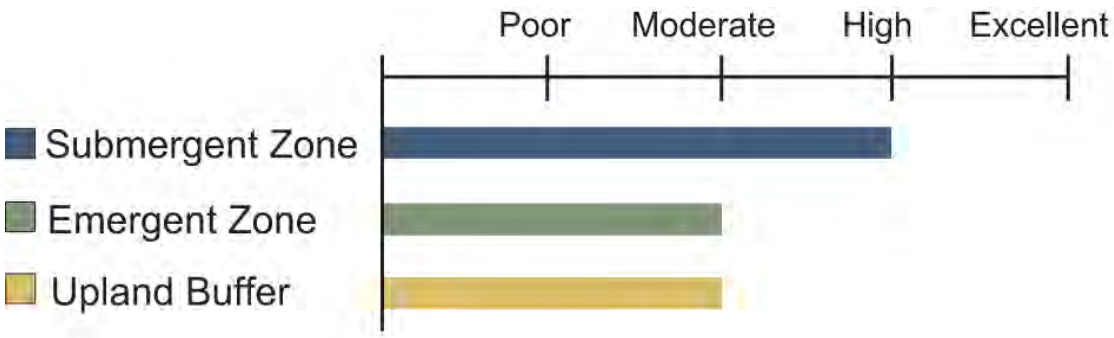
Habitat monitoring for Orchard Lake was conducted from 2003 through 2009, 2012, 2017, and 2022. The 2022 field monitoring of Orchard Lake was performed on June 6, July 20, and August 17, 2022. Vegetation

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.

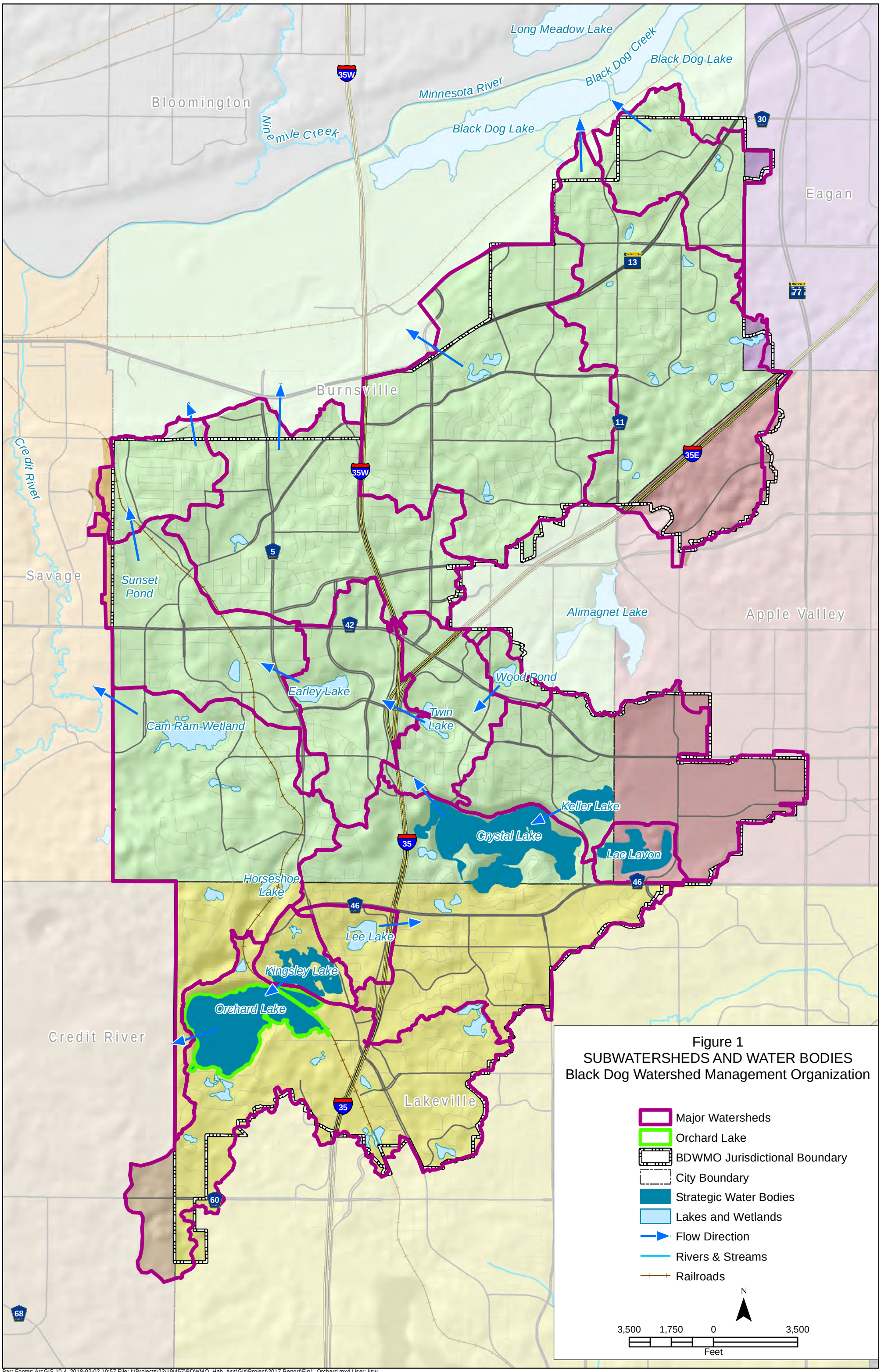
Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (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


Long Meadow Lake
Black Dog Creek
Black Dog Lake
Minnesota River
Black Dog Lake
Bloomington
Nine mile Creek
Eagan
Burnsville
Cr'e dit Rivel
Savage
Sunset Pond
Alimagnet Lake
Apple Valley
Earley Lake
Wood Pond
Twin Lake
Cam Ram Wetland
Keller Lake
Crystal Lake
Lac Lavon
Horseshoe Lake
Lee Lake
Kingsley Lake
Orchard Lake
Credit River
Lakeville
35W
35E
35
30
13
77
11
5
42
46
60
68
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

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2021 Dakota County Aerial Imagery

N

Feet

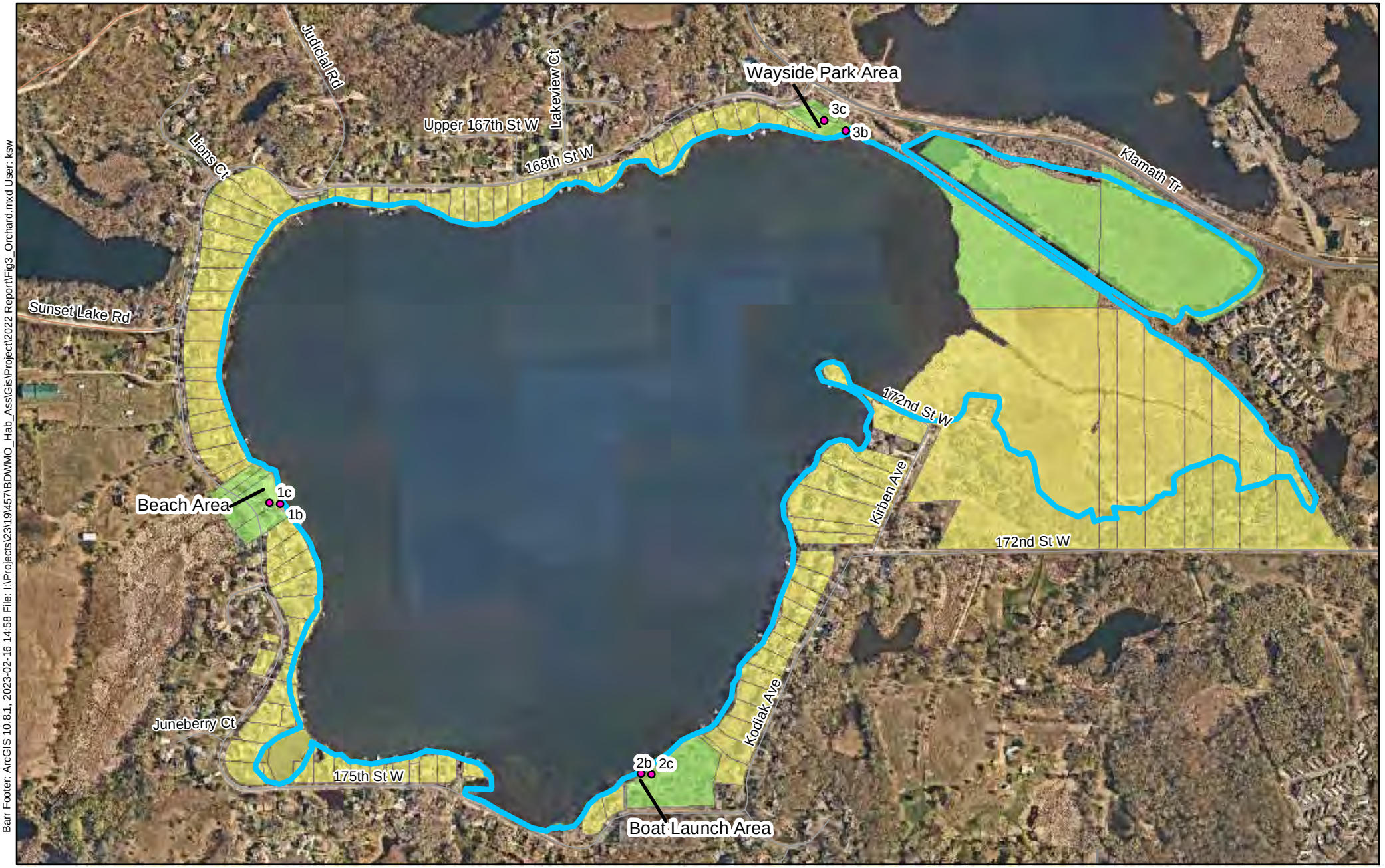
700 350 0 700

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)

BLACK DOG
Watershed Management Organization

2022 WATERSHED ANNUAL REPORT

Published April 2023

Our Vision:

To manage water resources and related ecosystems to sustain their long-term health and public value to contribute to the well-being of the communities within the watershed.

Evaluating our Success

The BDWMO watershed management plan calls for the organization and its member cities to identify outcome-based goals for specific water bodies found within the watershed, and to meet annually to discuss progress toward these goals. The BDWMO uses the following tools to track progress toward goals:

- **Trend Analysis**—The BDWMO collects water quality information to track water quality trends.
- **Performance Analysis**—The BDWMO will evaluate the member cities' implementation of maintenance plans, capital improvement projects, programs, and other items.
- **Habitat Quality Analysis**—The BDWMO collects habitat quality data to detect conditions that would trigger a need for management actions.

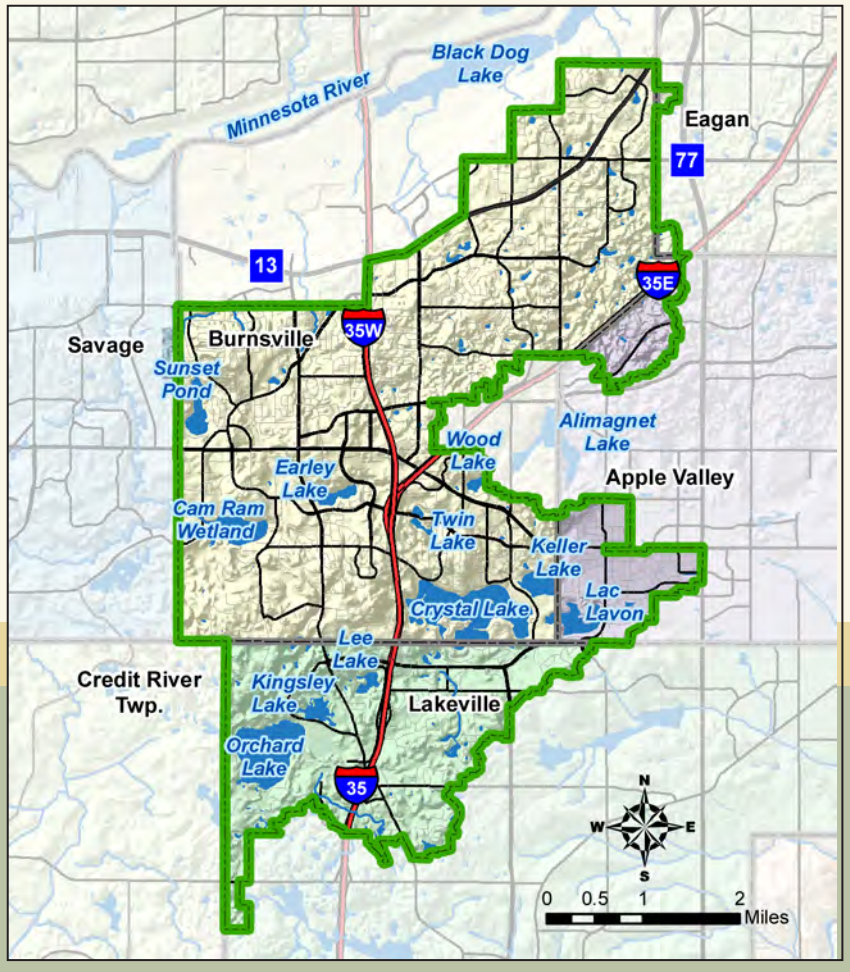
This annual report outlines the BDWMO's goals, progress toward those goals in 2022, and plans for 2023 and beyond.

What is the Black Dog Watershed Management Organization?

DRAFT

The Black Dog Watershed Management Organization (BDWMO) actively manages surface water, such as that found in lakes, streams, and wetlands, located in the Black Dog and Credit River watersheds within Dakota County. To effectively manage surface water, the BDWMO develops and implements plans that address water quality, responds to drainage issues that cross multiple municipal boundaries, and assists cities within the watershed to manage surface water runoff. The BDWMO is represented by commissioners who are appointed by the cities within the watershed, which include Burnsville, Lakeville, Apple Valley, and Eagan.

The total area of the Black Dog watershed is 17,500 acres; 70 percent of the watershed lies within the city of Burnsville, 21 percent of the area is within the city of Lakeville, 8 percent is within the city of Apple Valley, and 1 percent is within the city of Eagan.



In this Issue

BDWMO Approves and Adopts Updated Watershed Management Plan

At the end of 2022, the BDWMO completed the lengthy process of updating its Watershed Management Plan—a plan that establishes the vision, policies, and activities for protecting, restoring, and managing the surface water resources within the boundaries of the BDWMO for the next decade (2022–2032).

The plan provides resource data and background information, identifies and prioritizes watershed-wide and resource-specific issues, establishes measurable goals, sets policies and performance standards for the BDWMO and its cities, and lays out a 10-year implementation schedule including projects and programs.

Land and Water Resources Inventory

The plan includes a land and water resources inventory, covering climate and precipitation; topography and drainage; population, demographics, and land use; soils; geology; groundwater; surface water resources (lakes, ponds, and wetlands); water monitoring and studies; water quality and BDWMO management classifications; water quantity and flooding; natural communities and rare species; fish and wildlife habitat; open space and recreational areas; and pollutant sources.

Priority Issues and Resources

Understanding the condition of water and natural resources present in the BDWMO is key to identifying priority issues, establishing goals, and targeting the actions of the BDWMO, its member cities, and other partners. As part of the plan development, the BDWMO commissioners solicited input on priority issues and concerns from residents, state agencies, member cities, and regional partners through multiple stakeholder engagement activities, including:

- Plan notification letter
- City and Partner staff interviews
- Online survey
- Technical Advisory Committee (TAC) workshop
- Public kickoff meeting (virtual)

Higher Priority Issues	Lower Priority Issues
• **Water quality**, including: - Stormwater runoff quality - In-lake water quality - Impairments (Keller Lake) • **Lake ecology and habitat**, including: - Habitat quality - Invasive species management • **Groundwater management**, including: - Pollution prevention - Conservation and sustainability • **Education and Engagement**	• **Flooding and water levels** • **Wetland management** • **Upland and natural area management**

The BDWMO also classified Crystal Lake, Keller Lake, Kingsley Lake, Lac Lavon, and Orchard Lake as strategic waterbodies to be the focus of BDWMO activities.

Goals and Policies

The plan presents the goals and policies established by the BDWMO to address the priority resources or operational issues. Where possible, BDWMO goals contain measurable targets to evaluate progress.

Key goals include:

- Maintain or improve water quality in BDWMO strategic waterbodies to meet applicable state standards or existing 10-year (2012–2021) summer average water quality, if better than state standards.
- Work with member cities to reduce chloride loading relative to current conditions through practices consistent with the Twin Cities Metropolitan Area Chloride Management Plan and Minnesota Statewide Chloride Management Plan.
- Maintain or improve the ecological and habitat quality of BDWMO strategic waterbodies to achieve applicable standards for floristic quality index (FQI ≥ 17.8) and native species diversity of submerged vegetation (at least 11 species).
- Support member city and partner actions to prevent the increase or reduce the occurrence of aquatic invasive species within BDWMO strategic waterbodies.
- Increase awareness and knowledge of residents, local officials, and city staff regarding water resources and stormwater management through actions coordinated with member cities, Dakota SWCD, and other partners.
- Increase community capacity to implement water and natural resource stewardship action through increased participation in volunteer activities; increased participation in small-scale BMP cost share projects; and providing data through accessible media.

Implementation Program

The plan also presents a 10-year implementation program, including a continuation of ongoing activities as well as new activities to address emerging issues and changing priorities. Notable new or expanded activities include:

- Expanded water chemistry monitoring of Keller Lake and Kingsley Lake
- Algal community monitoring of strategic waterbodies
- Chloride monitoring of strategic waterbodies
- Development of K-12 education outreach
- Targeted outreach to address chloride loading
- Opportunities to use watershed-based implementation funding (WBIF) to support member city projects for stormwater treatment, shoreline improvement, and aquatic plant management for strategic waterbodies.

Landscaping for Clean Water—Clean Water Starts at Home

Since most land is privately owned, it is up to each individual landowner to do the right thing on their property to help keep water clean. The Landscaping for Clean Water program makes it easy for residents to turn their yards into a lush and lovely force for clean water rather than a contributor to water pollution.

Are you doing everything possible on your patch of lawn? Attend a Landscaping for Clean Water workshop to find out. Participants in the program attend design workshops to develop landscape plans for their own yards. These plans include creating native gardens, raingardens, or native shorelines that stabilize soil. These planting practices provide habitat for pollinators and birds, reduce watering and require no chemical inputs. On top of that, these practices help water soak into the ground rather than running off and delivering polluted stormwater into lakes, rivers and wetlands.

Who can get a grant?

Participants in the workshops can submit an application, project plan, and cost estimates to the Dakota County SWCD for grant funds of up to $250.

2022 Classes and Participants

In 2022, all Landscaping for Clean Water programming was held virtually. Three live virtual Introduction classes were held in the spring (March through May) and then recorded so others could participate in the classes at their leisure. A total of 58 residents of the BDWMO participated in the Introduction classes through either a live virtual class or through the recordings.

A total of 41 participants took part in the virtual Design classes which consisted of a series of pre-recorded videos. Project materials for participants were made available online and an "Office Hours" program was used to provide virtual consultations to Design class participants. A total of 15 participants took advantage of these virtual consultations with staff in 2022. Participants were thankful for the additional one-on-one design assistance.

Nine projects were installed in the BDWMO in 2022—five raingardens and four native gardens (see two below).

In 2022, two Maintenance classes were taught in the spring. Each workshop focused on garden maintenance across all seasons. Providing participants with seasonal information on how to maintain and promote the health, performance, and beauty of their garden. A total of 21 people registered for the Maintenance classes.

The 2023 Landscaping for Clean Water program will be held both in-person and virtually for the first time since 2019! For more information and to get signed up, visit https://dakotaswcd.org/services/landscaping-for-clean-water/.

Before and after: Installation of a 250 sq. ft. residential native garden

Before and after: Installation of a 250 sq. ft. residential raingarden

Landscaping for Clean Water is one type of cost-sharing program offered by the Dakota County SWCD. For more information, call 651-480-7777 or go to https://dakotaswcd.org/services/landscaping-for-clean-water/.

"School" of Goldfish

There are two new teachers in the Black Dog WMO, and they are here to remind you not to release unwanted pets into local water bodies. Two new educational goldfish mounts, "Betty" and "Bubbles" are available for use by local public entities to help educate the public on harms of exotic invasive species. Goldfish can wreak havoc in lakes and ponds. Their feeding behavior disrupts shallow rooted plants, muddying the water, and also releasing phosphorous bound in the sediment. Less clear water and additional phosphorous can prevent sunlight from reaching plants and can lead to additional algal blooms. Aquatic plants provide important habitat for native fish and help sustain water clarity by holding sediments in place.

The goldfish mounts were funded through an Aquatic Invasive Species grant offered by Dakota County Environmental Services as learning tools for education and outreach opportunities. Other entities or local government units can borrow the fish for educational events. Contact 952-953-2462 for more information on borrowing one of the mounts.

Lac Lavon Looking Lovely

The BDWMO is pleased to report that Lac Lavon continues to have excellent water quality. The 2022 summer-average Secchi disc transparency in Lac Lavon was 3.5 meters (11.5 feet), and considerably better than the MPCA deep-lake water quality standard of 1.4 meters. The 2022 summer average of total phosphorus (the nutrient that drives algal growth) was 13 µg/L, considerably better than the MPCA's deep lake standard (40 µg/L). The summer-average chlorophyll-*a* (a measure of algal abundance) was 3 µg/L, also considerably better than the MPCA's deep lake standard (14 µg/L).

Aquatic plant surveys were performed in June and August of 2022— the survey found twelve aquatic plant species present in Lac Lavon, nine of which are native to Minnesota. The three non-native aquatic plants identified in 2022 were curly-leaf pondweed, Eurasian watermilfoil, and brittle naiad. Eurasian watermilfoil, and the native plant coontail, were the two most abundant aquatic plants in June and August. The non-native emergent plant purple loosestrife was also identified on shorelines. Brittle naiad was first identified on Lac Lavon in 2003. As of 2022, the Minnesota Department of Natural Resources reports that only six lakes in Minnesota are known to have brittle naiad. Brittle naiad does not grow very tall, and does not appear to be growing at nuisance levels in Lac Lavon—it was not even identified in aquatic plant surveys conducted in 2019.

The BDWMO will continue to monitor the water quality of Lac Lavon in 2023.

Non-native brittle naiad in Lac Lavon, August 10, 2022

Lac Lavon Raingarden Coming in 2023

The City of Apple Valley leveraged $40,000 in local grant dollars to design and construct a raingarden at the parking lot located on the north end of Lac Lavon. Currently, stormwater runoff flows off the parking lot, down a slope, ultimately reaching Lac Lavon. The raingarden, featuring native plants, will serve as a demonstration project for the improvement of water quality within the watershed.

Wanted: Water Quality Warriors

Apple Valley is searching for volunteers willing to grab a paddle and conduct water quality monitoring on area lakes as part of the Metropolitan Council's Citizen Assisted Monitoring Program or CAMP. Volunteers are currently needed on Lac Lavon. Volunteers must have access to a boat, have freezer space to store samples, and be willing to utilize electronic or paper forms for sample reporting. Training and water quality monitoring supplies are provided by the Met Council. For more details, visit www.metrocouncil.org and search for "Lake Monitoring."

Habitat Monitoring Program

Since 2003, the BDWMO has implemented a program for monitoring the wildlife and fish habitat quality of strategic water resources in the watershed, including biological and physical indicators, such as upland and aquatic vegetation, buffer zones, erosion, sedimentation, and the presence of non-native exotic species. The program also recommends management actions based upon monitoring results.

2022 was the final year of the habitat monitoring program.

In 2022, the BDWMO monitored the habitat quality of Orchard Lake. Monitoring included transect, plot, and meandering surveys. Photographs were taken to document conditions. Analysis and reporting of the monitoring data includes a floristic quality assessment and a four-tiered rating system (poor, moderate, high, and excellent). 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.

Habitat monitoring results showed that Orchard Lake's submergent zone was rated high, but both the emergent and upland buffer zones were rated moderate. Curly-leaf pondweed and Eurasian watermilfoil are treated each year in Orchard Lake.

See page 7 for additional Orchard Lake habitat monitoring results. See www.blackdogwmo.org for the full report.

The member cities have provided lakeshore owners with shoreline restoration information since 2004 and continually promote and encourage lakeshore property owners each year to take advantage of the Dakota County SWCD Landscaping for Clean Water shoreline restoration program. (See page 3 for more about this program.)

Water Quality Monitoring Program

The BDWMO and member cities continued to monitor several of its lakes during 2022 through the Metropolitan Council's Citizen-Assisted Monitoring Program (CAMP) to detect any water quality changes that would require management action by the WMO. In addition, the BDWMO conducted more detailed monitoring on Lac Lavon (see page 4). The monitoring focused on three water quality indicators—total phosphorus and chlorophyll-*a* concentrations, plus Secchi disc transparency. All three variables correlate strongly to the open-water nuisance conditions of lakes (i.e., algal blooms).

Long-term monitoring is important because lakes can change from year to year. Only when several years of data are compiled do trends become apparent. Because the MPCA periodically evaluates water quality data from the most recent ten-year period to determine if a lake violates applicable water quality standards, the WMO has adopted the same time convention for conducting its annual trend analyses. Graphs on this page and subsequent pages show historic trends in water quality.

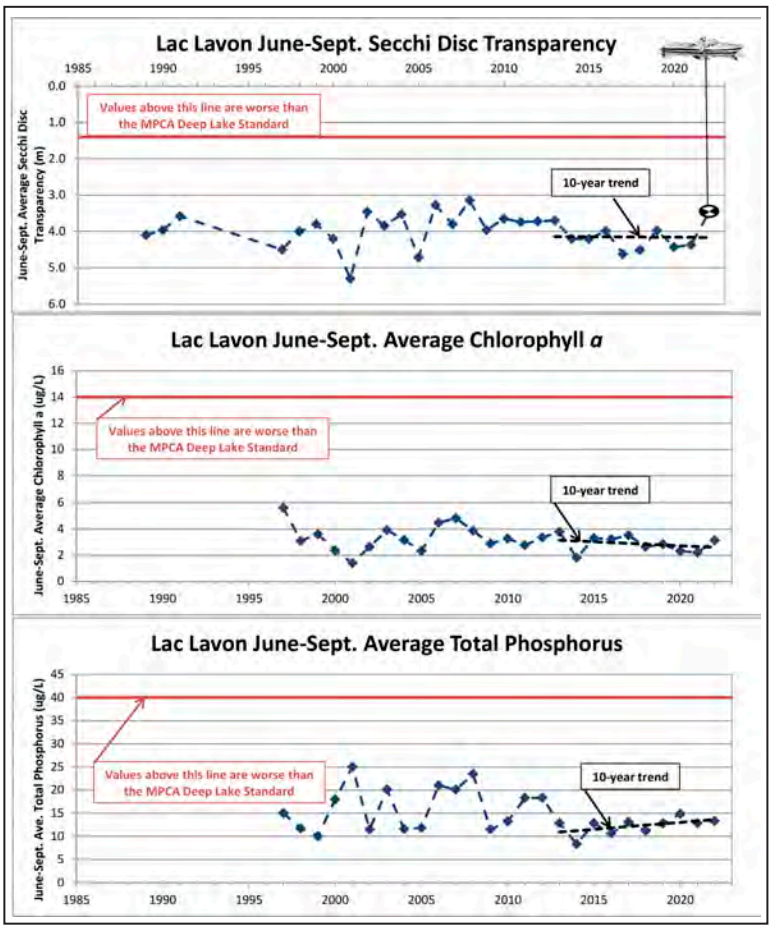
Lac Lavon (Apple Valley & Burnsville)

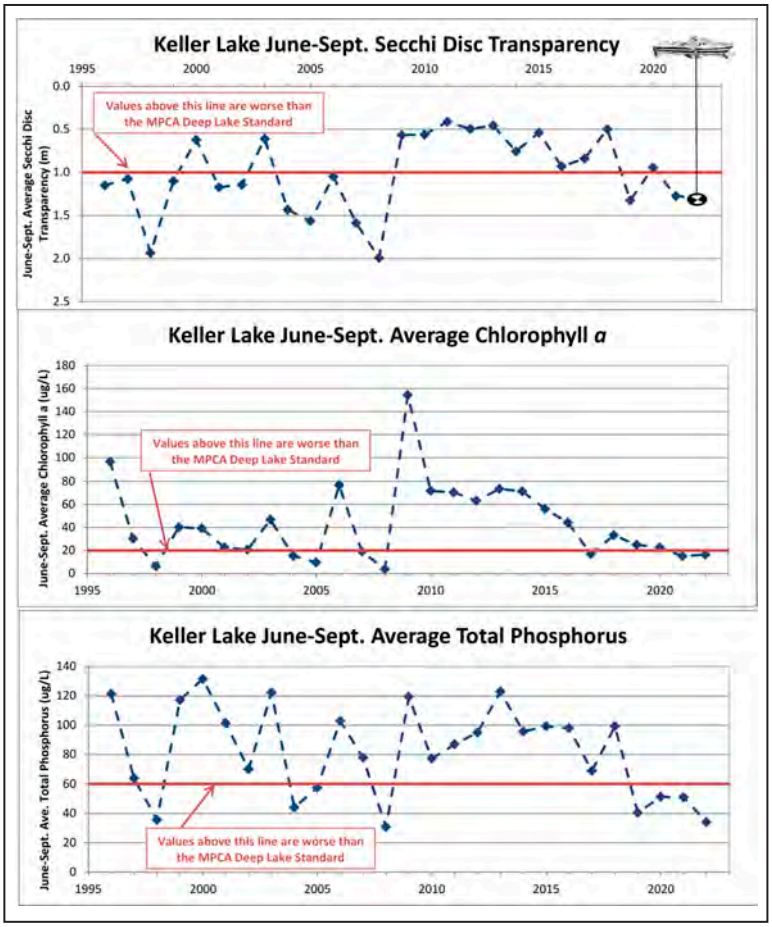
Water Quality Monitoring—In 2022, the BDWMO performed more detailed management level monitoring on the lake (see story on page 4).

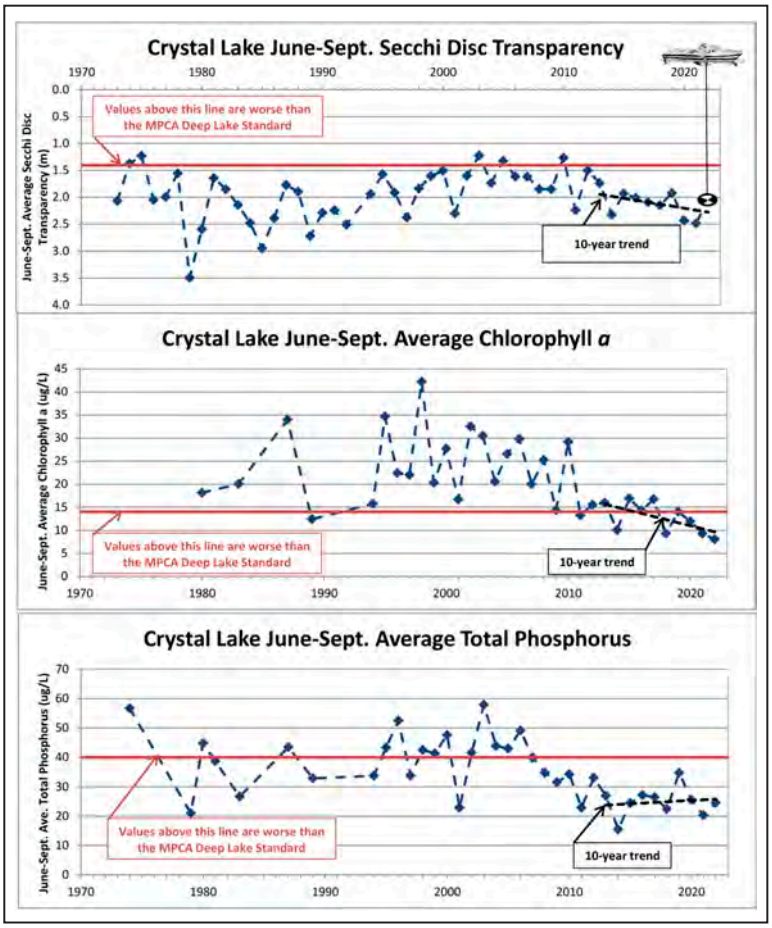
Keller Lake (Burnsville & Apple Valley)

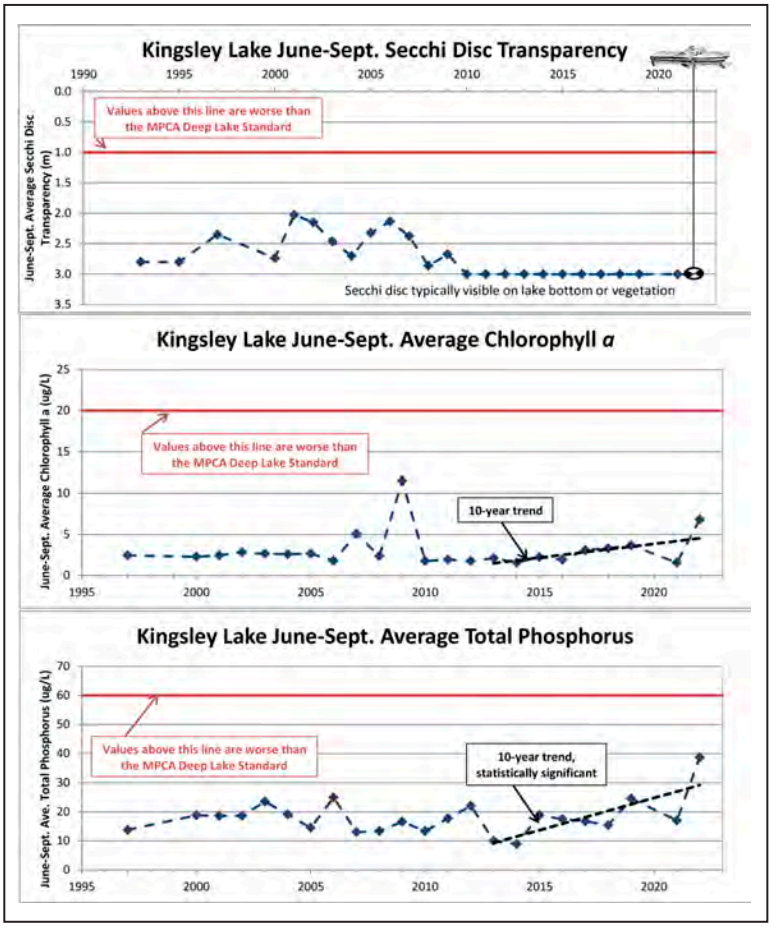
Water Quality Monitoring—An alum and sodium aluminate treatment was conducted on Keller Lake in Spring 2019 and Spring 2021, resulting in improved water quality in recent years. The 2022 Secchi disc transparency summer average was 1.3 meters (4.2 feet), which is better than the MPCA's shallow lake standard of 1.0 meter (3.3 feet). The summer-average total phosphorus (34 µg/L) was also better than the MPCA's shallow lake standard of 60 µg/L. Summer averages of total phosphorus had been consistently worse than the MPCA standard every year for the period 2009-2018, before the alum and sodium aluminate treatment of the lake. The 2022 summer-average of chlorophyll-*a* (16 µg/L) was also better than the MPCA's shallow lake standard of 20 µg/L.

Trend analyses were not completed for Keller Lake because of the alum and sodium aluminate treatments that were conducted in 2019 and 2021. The three-lake TMDL study and implementation plan identifies the water quality improvement measures needed to achieve the BDWMO and MPCA goals for the lake. The BDWMO will continue to monitor the water quality of Keller Lake in 2023, including regularly-scheduled management level monitoring.









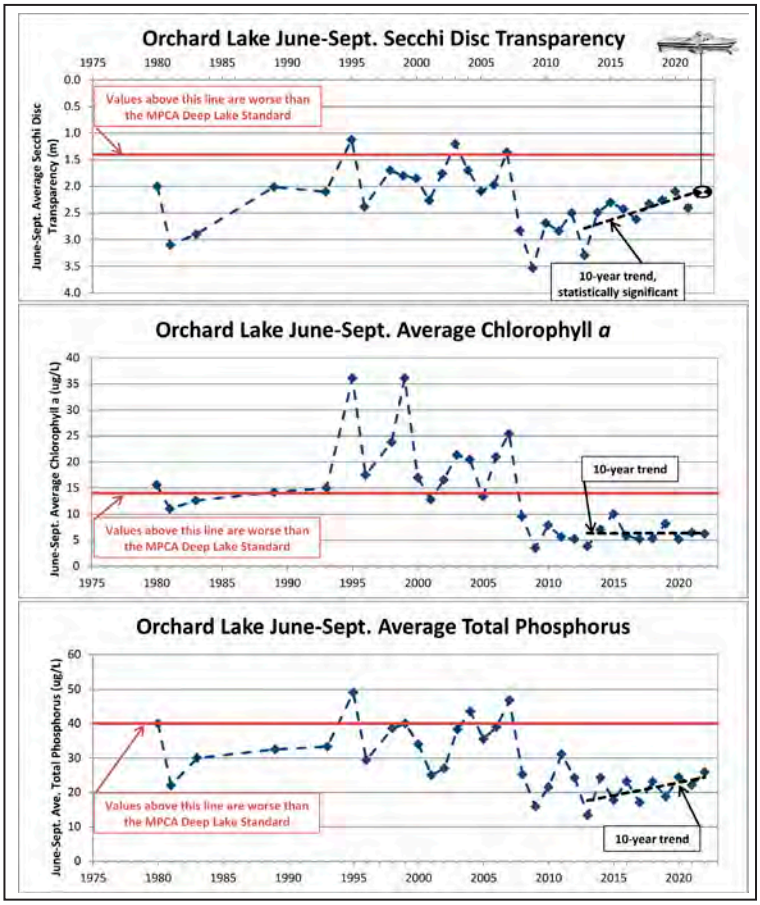
Crystal Lake (Burnsville & Lakeville)

Water Quality Monitoring—Crystal Lake continued to experience good water quality in 2022. The 2022 summer-average Secchi disc transparency was 2.0 meters (6.6 feet), which is better than the MPCA deep-lake water quality standard of 1.4 meters. The 2022 summer average of total phosphorus (25 µg/L) was better than the deep lake standard (40 µg/L). The summer average of chlorophyll-*a* (8 µg/L) was also better than the deep lake standard (14 µg/L), and was the best on record for Crystal Lake. There were no statistically significant trends in summer averages of water quality for the period 2013-2022. The BDWMO will continue to monitor the water quality of Crystal Lake in 2023.

Kingsley Lake

Kingsley Lake (Lakeville)

Water Quality Monitoring—Water quality monitoring data from 2022 show continued good water quality in Kingsley Lake. Water is often clear enough that the Secchi disc used to measure transparency can still be seen when resting on the bottom of the lake.* The 2022 summer average of total phosphorus (39 µg/L) was the worst on record, and double the 2021 summer average, but still much better than the shallow lake standard (60 µg/L). However, there is a statistically significant trend of degrading total phosphorus concentration for the 10-year period of 2013–2022. Chlorophyll-*a* (7 µg/L) concentrations were the worst they have been since 2009, but also still much better than the shallow lake standard (20 µg/L). The 2022 summer averages of total phosphorus and chlorophyll-*a* were better than the MPCA's shallow lake standards, and have consistently been better than the water quality standards since 1997. Water quality was not monitored in Kingsley Lake in 2020. The BDWMO will continue to monitor the water quality of Kingsley Lake in 2024. **Secchi disc readings in Kingsley Lake are difficult because lake vegetation obscures the Secchi disc, giving false measurements; therefore, there is no trend line in the graph at left.*

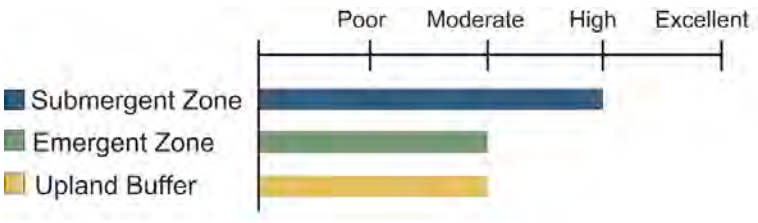


Orchard Lake (Lakeville)

Water Quality Monitoring—Orchard Lake's water quality in 2022 was similar to other recent years, but has generally experienced declining water clarity over the past 13 years. There is a statistically significant trend of degrading water clarity for the 10-year period of 2013-2022. The 2022 summer average Secchi disc transparency was 2.1 meters (6.9 feet), which is better than the MPCA deep-lake water quality standard of 1.4 meters. The 2022 summer-averages of total phosphorus (26 µg/L) and chlorophyll-*a* (6 µg/L) were better than the MPCA's deep-lake water quality standards as well. There were no statistically significant trends in summer averages of total phosphorus and chlorophyll-*a* for the most recent 10-year period. Summer averages of water quality in Orchard Lake have been consistently better than the water quality standards for the last fifteen years (2008-2022). The BDWMO will continue to monitor the water quality of Orchard Lake in 2023.

Orchard Lake Habitat Monitoring Results for 2022

As mentioned in the article on page 4, habitat monitoring was conducted in 2022 on Orchard Lake. The BDWMO made the following quality ratings, based on the monitoring results:



Submergent zone quality rating = High

Rating based on averaging four criteria:

1. excellent total number of native species (16)
2. excellent average native plant density (1.2)
3. moderate rating for average exotic species density (1.3)
4. moderate coefficient of conservatism value (mean C-value) (5.3)

Curly-leaf pondweed and Eurasian watermilfoil are treated each year in Orchard Lake. Curly-leaf pondweed has been documented within Orchard Lake since 2004. Eurasian watermilfoil was first observed in 2017 and has since increased in distribution. Coontail is the dominant native submergent plant species. Moderate and light densities of native plants were well distributed on Orchard Lake in 2022, including flatstem pondweed, muskgrass, and largeleaf pondweed. Filamentous algae was also present on the lake in 2022.

The BDWMO recommends continued monitoring and control of non-native invasive plant species.

Emergent vegetation zone quality rating = Moderate

Rating based on averaging four criteria:

1. excellent number of native wetland plant species (64)
2. moderate rating for % coverage of exotic species (51-75%)
3. a poor mean C-value rating (2.9)
4. high rating for total vegetative cover (51-75%)

Non-native species, including narrowleaf and hybrid cattail, and purple loosestrife are found in the vegetated emergent zone. The deep marsh habitat in the northeastern portion of Orchard Lake contains dense cattails and purple loosestrife along with native vegetation, including sedges, rushes, bulrushes, bur-reeds, ferns, iris, and bluejoint, which provide habitat for frogs, turtles, green herons, wood ducks, and great blue herons. One shoreline restoration is well maintained by the residentail landowner, providing aesthetically pleasing shoreline pollinator habitat and erosion protection with dense coverage of native emergent species.

The BDWMO recommends continued control and management of purple loosestrife and encouragement of additional residential shoreline restoration projects to control erosion and improve habitat.

Upland buffer zone quality rating = Moderate

- 41 native species and 24 exotic species observed.
- Exotic plant species >40% of upland vegetative cover. The mean C-value rating is 2.2 (poor).
- Upland buffer within residential properties is dominated by maintained lawn grasses with little to no naturalized vegetation. These area could be vegetated with native grasses and wildflowers to control erosion and improve habitat. The BDWMO recommends control of non-native common buckthorn, Chinese silver grass, and Siberian elm.
- Additional recommendations are in areas of bare soil to prevent erosion.
- Lakeshore property owners are encouraged to apply for funds (see page 3) to assist with implementation of the BDWMO recommendations.

BLACK DOG
Watershed Management Organization

Board of Commissioners

Representing Burnsville:

Curtis Enestvedt, Chair
(serving since 2014)
Mike Hughes, Vice Chair
(serving since 2008)
Lynette Dunsworth, Commissioner
(serving since 2023)
Alternate — Open position

Representing Apple Valley and Eagan:

Rollie Greeno, Commissioner
(serving since 2018)
Greg Helms, Alternate
(serving since 2011)

Representing Lakeville:

Scott Thureen, Secretary/Treasurer
(serving since 2008)
Natalie Walker, Alternate
(serving since 2020)

Engineering Consultant:

Karen Chandler, P.E., Barr Engineering Co.

Legal Consultant:

Jared Shepherd, Campbell Knutson, P.A.

Regular board meetings...

are held at 5:00 p.m. on the third Wednesday of the month at the Burnsville Maintenance Facility at 13713 Frontier Court.

For more information, please contact:

Daryl Jacobson, Administrator
Black Dog WMO

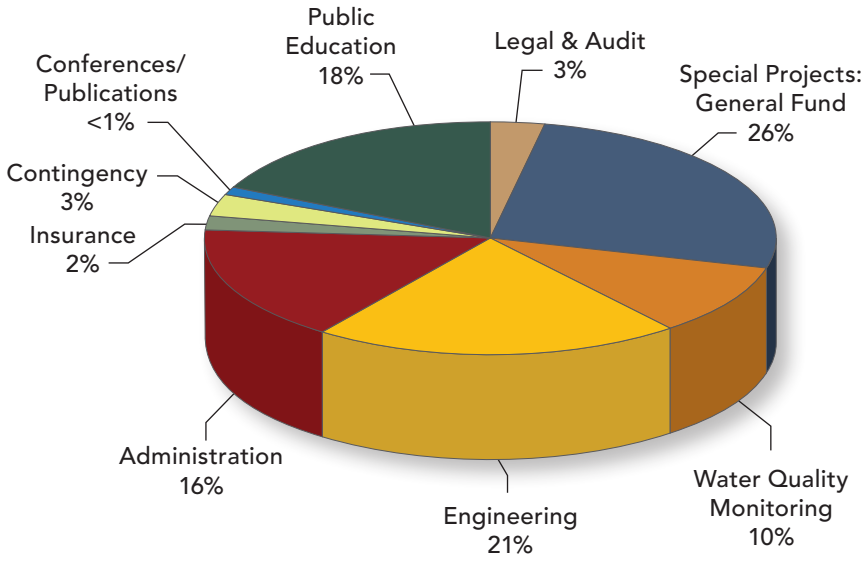
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337

Phone: 952-895-4574
Daryl.Jacobson@burnsvillemn.gov

Website: www.blackdogwmo.org

2023 Budget

Engineering	$31,000
Legal and Audit	$5,000
Administrative Services	$24,000
Public Education	$25,700
Insurance	$2,500
Special Projects – General Fund	$37,300
Conference/Publications	$500
Water Quality Monitoring	$15,200
Contingency	$5,000
Total Expenditures	**$146,200**



2023 Income

Member Contributions	$143,500
Interest	$40
Total Income	**$143,540**