Black Dog Watershed Management Commission

Agenda

Wednesday, April 15, 2020
5:00 P.M.

Burnsville Maintenance Facility – Conference Room
13713 Frontier Court, Burnsville MN 55337

COMMISSIONERS:

Roger Baldwin, Chairman
Greg Helms, Vice Chairman
Scott Thureen, Secretary/Treasurer
Tom Harmening
Mike Hughes
Curt Enestvedt, Alternate
Rollie Greeno, Alternate

I. Approval of Agenda

II. Approval of Minutes – February 19, 2020

III. Approval of Accounts Payable

IV. Review Budget Performance Reports

V. Review Lac Lavon Habitat Monitoring and Water Quality Reports

VI. Review Draft 2019 Watershed Annual Report

VII. Miscellaneous

VIII. Adjournment

To obtain this information in alternative forms such as braille, large print, audiotape or qualified readers, please contact the City of Burnsville. Telephone (952) 895-4400, TDD (952) 895-4567.

Black Dog Watershed Management Commission

Agenda Background
April 15, 2020

I. Approval of Agenda

Agenda enclosed.

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

II. Approval of Minutes from the February 19, 2020 Meeting

Minutes enclosed.

Action Requested: A motion be considered to approve the Minutes from the February 19, 2020 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 Lac Lavon Habitat and Water Quality Monitoring Reports

In 2019 Barr Engineering performed increased water quality and habitat monitoring on Lac Lavon. Staff from Barr Engineering will go over the monitoring performed, and the results of the monitoring at the meeting. Enclosed in your packet is a copy of the reports. The technical memo provides information that most people will find beneficial and the technical reference document provides more detailed information and data.

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

VI. Review Draft 2019 Annual Newsletter

A draft of the 2019 Watershed Annual Newsletter is enclosed with this background.

Action requested: The Commission review the report and provide feedback to staff about any changes that might be needed. Also, a motion be considered approving the annual newsletter for distribution contingent upon any revisions noted at the meeting being made to the report.

VII. Miscellaneous

VIII. Adjournment

Black Dog Watershed Management Commission

DRAFT
Meeting Minutes
February 19, 2020

MEMBERS PRESENT
Greg Helms, Vice-Chairman
Scott Thureen, Secretary/Treasurer (arrived at 5:03)
Mike Hughes
Tom Harmening
Rollie Greeno, Alternate

MEMBERS ABSENT
Roger Baldwin, Chairman
Curt Enestvedt, Alternate

OTHERS PRESENT
Karen Chandler – Barr Engineering
Joel Jamnik – Campbell Knutson
Samantha Berger – City of Apple Valley
Lindsey Albright – Dakota County Soil and Water Conservation District
Daryl Jacobson – BDWMO Administrator
Tammi Carté – BDWMO Secretary

Greg Helms, Vice-Chairman, called the February 19, 2020, meeting to order at 5:00pm at the Burnsville Maintenance Facility.

I. Approval of Agenda

Motion by Hughes, second by Harmening, to approve the February 19, 2020 Agenda as presented.

Ayes – Helms, Harmening, Hughes
Nays – None

Motion Carried Unanimously

II. Approval of Minutes from the November 20, 2019 Meeting

Motion by Harmening, second by Hughes, to approve the November 20, 2019 Minutes as presented.

Ayes – Helms, Harmening, Hughes
Nays – None

Motion Carried Unanimously

III. Approval of Accounts Payable

Motion by Hughes, second by Harmening, to approve payments to Barr Engineering in the amount of $8,012.38 for services from December 28, 2019 through January 31, 2020; and, to Campbell Knutson in the amount of $666.40 for January 2020 general services; and, to Dakota County Soil & Water in the amount of $1,815.00 for services October – December 2019.

Ayes – Helms, Harmening, Hughes
Nays – None

Motion Carried Unanimously

IV. Review Budget Performance Reports

Daryl Jacobson, BDWMO Administrator, reports that as required every five years, the Black Dog WMO audit process is starting.

No Formal Action Required

V. Approve Engineering Services for Two Years

The Black Dog WMO JPA requires that the Commission solicit for engineering services every two years. A notice was placed in the newspaper for engineering services and one letter of interest was received from Barr Engineering. A copy of the letter of interest was provided to the Commission for review prior to tonight's meeting.

Motion by Hughes, second by Harmening, to approve Barr Engineering to provide engineering serves for 2020 and 2021.

Ayes – Helms, Harmening, Hughes, Thureen
Nays – None

Motion Carried Unanimously

VI. Approve Legal Services for Two Years

The Black Dog WMO JPA requires that the Commission solicit for legal services for every two years. A notice was placed in the newspaper for legal services and one letter of interest was received from Campbell Knutson. A copy of the letter of interest was provided to the Commission for review prior to tonight's meeting.

Motion by Harmening, second by Hughes, to approve Campbell Knutson to provide legal services for 2020 and 2021.

Ayes – Helms, Harmening, Hughes, Thureen
Nays – None

Motion Carried Unanimously

VII. Approve Lakes to Enroll in the 2019 Met Council Citizen Assisted Monitoring Program

Staff proposes that the BDWMO sponsor monitoring at the five strategic water bodies identified in the Watershed Plan. This approach is consistent with what has occurred in past years, as well as, the 2020 Annual Work Plan and Budget. Staff recommends the Commission approve enrolling Crystal Lake, Keller Lake, Kingsley Lake, Orchard Lake, and Lac Lavon in the 2020 CAMP.

Motion by Thureen, second by Hughes, to approve enrolling Crystal Lake, Keller Lake, Kingsley Lake, Orchard Lake, and Lac Lavon in the 2020 CAMP.

Ayes – Helms, Harmening, Hughes, Thureen

Nays – None

Motion Carried Unanimously

VIII. Miscellaneous

1. Karen Chandler – Barr Engineering – CAMP data is needed before the annual monitoring report for 2019 and the newsletter can be completed. There were various issues with water samples which caused a backlog for processing data.
2. Roger Knutson will be retiring from Campbell Knutson the end of October 2020. Joel Jamnik will take over providing legal services for the Black Dog WMO after Roger retires.
3. The next Black Dog WMO meeting is scheduled for March 18, 2020.

IX. Adjournment

Motion by Harmening, second by Hughes, to adjourn at 5:09pm.

Ayes – Helms, Harmening, Hughes, Thureen
Nays – None

Motion Carried Unanimously

BLACK DOG WATERSHED MANAGEMENT COMMISSION
100 Civic Center Parkway
Burnsville, MN 55337

Accounts Payable - April 15, 2020 Meeting

Barr Engineering - Services from February 1, 2020 through February 28, 2020

Engineering	$	2,380.00
Special Projects General Fund - Lac Lavon Mgmt Level Monitoring	$	1,016.00
Special Projects Capital Improvement Fund - Keller Lake Alum Treatment	$	629.00
Water Quality Monitoring - 2019 Habitat Monitoring (Lac Lavon)	$	1,008.00
Water Quality Monitoring - Update Trent Analyses	$	900.00
Public Education - Watershed Annual Report	$	765.00
	$	**6,698.00**

Barr Engineering - Services from February 29, 2020 through April 3, 2020

Engineering	$	1,782.50
Special Projects General Fund - Orchard Lake Water Quality Monitoring	$	164.00
Special Projects General Fund - Lac Lavon Mgmt Level Monitoring	$	2,102.00
Special Projects Capital Improvement Fund - Keller Lake Alum Treatment	$	85.00
Water Quality Monitoring - 2019 Habitat Monitoring (Lac Lavon)	$	135.00
Water Quality Monitoring - Update Trent Analyses	$	300.00
Public Education - Watershed Annual Report	$	1,781.50
	$	**6,350.00**

Campbell Knutson

February 2020 - General Services	$	273.00
	$	**273.00**

Campbell Knutson

March 2020 - General Services	$	95.00
	$	**95.00**

Accounts Payable Total $ 13,416.00

resourceful. naturally.
engineering and environmental consultants

BARR

March 04, 2020

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 February 01, 2020 through February 28, 2020

TOTAL PAYABLE THIS INVOICE:	**$ 6,698.00**
Allocation:	
Engineering	
Special Projects General Fund	**$ 2,380.00**
• **Lac Lavon Mgmt Level Monitoring**	**$ 1,016.00**
Special Projects Capital Improvement Fund	
• **Keller Lake Alum Treatment**	**$ 629.00**
Water Quality Monitoring	
• **2019 Habitat Monitoring (Lac Lavon)**	**$ 1,008.00**
• **Update Trend Analyses**	**$ 900.00**
Public Education	
• **Watershed Annual Report**	**$ 765.00**

OK
3-11-20

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

BLACK DOG WATERSHED MANAGEMENT COMMISSION
100 Civic Center Parkway
Burnsville, MN 55337

Accounts Payable - March 18, 2020 Meeting

Barr Engineering - Services from February 1, 2020 through February 28, 2020

Engineering	$	2,380.00
Special Projects General Fund - Lac Lavon Mgmt Level Monitoring	$	1,016.00
Special Projects Capital Improvement Fund - Keller Lake Alum Treatment	$	629.00
Water Quality Monitoring - 2019 Habitat Monitoring (Lac Lavon)	$	1,008.00
Water Quality Monitoring - Update Trent Analyses	$	900.00
Public Education - Watershed Annual Report	$	765.00
	$	6,698.00

Campbell Knutson

February 2020 - General Services	$	273.00
	$	273.00

Accounts Payable Total $ 6,971.00

BUDGET SUMMARY - 2020 FY
Black Dog Watershed Management Commission
through February 28, 2020

Work Description	Pre-2020 Costs	Barr Budget			Current Invoice	Spent This Year	Balance
		Brought Forward	Current Year	Total Barr Budget			
Engineering	—	0.00	31,000.00	31,000.00	2,380.00	3,985.38	27,014.62
Special Projects: General Fund							
Orchard Lk Water Quality Monitoring (2020)	—	0.00	23,000.00	23,000.00	0.00	0.00	23,000.00
Lac Lavon Mgmt Level Monitoring (2019)	17,449.62	8,250.38	0.00	8,250.38	1,016.00	1,465.50	6,784.88
Subtotal -- Special Projects: General Fund	—	8,250.38	23,000.00	31,250.38	1,016.00	1,465.50	29,784.88
Special Projects: Capital Improvement Fund							
Keller Lake Alum Treatment Feas Study & Impl Planning			7,000.00	7,000.00	629.00	629.00	6,371.00
Subtotal -- Special Projects: Capital Improvement Fund	—	0.00	7,000.00	7,000.00	629.00	629.00	6,371.00
Special Projects: General Fund Reserve							
Watershed Management Plan Update			10,000.00	10,000.00	0.00	0.00	10,000.00
Subtotal -- Special Projects: General Fund Reserve	—	0.00	10,000.00	10,000.00	0.00	0.00	10,000.00
Water Quality Monitoring							
2020 Habitat Monitoring (Keller Lake)	—	0.00	9,600.00	9,600.00	0.00	0.00	9,600.00
2019 Habitat Monitoring (Lac Lavon)	2,023.40	6,476.60	0.00	6,476.60	1,008.00	5,827.50	649.10
Update Trend Analyses	—	0.00	2,000.00	2,000.00	900.00	900.00	1,100.00
Subtotal -- W.Q. Monitoring	—	6,476.60	11,600.00	18,076.60	1,908.00	6,727.50	11,349.10
Public Education							
Watershed Annual Report	—	0.00	4,000.00	4,000.00	765.00	1,903.00	2,097.00
Annual Activity Report	—	0.00	2,000.00	2,000.00	0.00	0.00	2,000.00
Subtotal -- Public Education	—	0.00	6,000.00	6,000.00	765.00	1,903.00	4,097.00
Total Services	—	14,726.98	88,600.00	103,326.98	6,698.00	14,710.38	88,616.60

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

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

March 4, 2020
Invoice No: 23190374.20 - 2

Total this Invoice $3,145.00

Regarding: BDWMO 2020 Engineering Services
Professional Services from February 1, 2020 to February 28, 2020

Job: 2020 2020 Engineering Services

Task: 001 Attend BDWMO Meetings
Labor Charges

	Hours	Rate	Amount
Principal			
Chandler, Karen	1.70	180.00	306.00
Subtotal Labor	1.70		306.00
Task Subtotal			**306.00**
			$306.00

Task: 002 Miscellaneous Consulting
Labor Charges

	Hours	Rate	Amount
Principal			
Chandler, Karen	10.00	180.00	1,800.00
Engineer / Scientist / Specialist III			
Rattei, Margaret	.60	140.00	84.00
Support Personnel II			
Nypan, Nyssa	2.00	95.00	190.00
Subtotal Labor	12.60		2,074.00
Task Subtotal			**2,074.00**
			$2,074.00

Task: 004 Newsletter/Watershed Report
Labor Charges

	Hours	Rate	Amount
Support Personnel I			
Kaul (Contracted), Karen	9.00	85.00	765.00
Subtotal Labor	9.00		765.00
Task Subtotal			**765.00**
			$765.00
Job Subtotal			**$3,145.00**
Total this Invoice			**$3,145.00**

Invoiced to Date	Current	Prior	Total	Received	A/R Balance
	3,145.00	2,743.38	5,888.38	2,743.38	3,145.00

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

March 4, 2020
Invoice No: 23190375.19 - 7

Total this Invoice $1,016.00

Regarding: Lac Lavon 2019 Water Quality Monitoring

Professional Services from February 1, 2020 to February 28, 2020

Job: LAC Lac Lavon 2019 Monitoring

Task: 100 Monitoring, Data Mgmt and Proj Mgmt

Labor Charges

	Hours	Rate	Amount	
Technician I				
Hankard, Madeline	.70	80.00	56.00	
	.70		56.00	
Subtotal Labor				56.00
			Task Subtotal	**$56.00**

Task: 300 Letter Report

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist II				
Menken, Kevin	8.00	120.00	960.00	
	8.00		960.00	
Subtotal Labor				960.00
			Task Subtotal	**$960.00**
			Job Subtotal	**$1,016.00**
			Total this Invoice	**$1,016.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**1,016.00**	**17,899.12**	**18,915.12**	**17,899.12**	**1,016.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

March 4, 2020
Invoice No: 23190375.98 - 14

Total this invoice $629.00

Regarding: Keller Lake Alum Treatment

Professional Services from February 1, 2020 to February 28, 2020

Job: 003 BWSR Contract Administration

Task: 001 BWSR Contract Administration

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist IV				
Wilson, Gregory	3.70	170.00	629.00	
Subtotal Labor	3.70		629.00	
				629.00
		Task Subtotal		$629.00
		Job Subtotal		$629.00
		Total this Invoice		$629.00

Invoiced to Date	Current	Prior	Total	Received	A/R Balance
	629.00	36,969.47	37,598.47	36,969.47	629.00

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

March 4, 2020
Invoice No: 23190457.19 - 4

Total this Invoice $1,008.00

Regarding: BDWMO 2019 Lac Lavon Habitat Monitoring

Professional Services from February 1, 2020 to February 28, 2020

Job: LAC Lac Lavon Habitat Monitoring

Task: 003 Analysis and Report

Labor Charges

	Hours	Rate	Amount
Principal			
Chandler, Karen	2.00	180.00	360.00
Engineer / Scientist / Specialist III			
Wold, Karen	4.80	135.00	648.00
Subtotal Labor	6.80		1,008.00
			1,008.00
		Task Subtotal	**$1,008.00**
		Job Subtotal	**$1,008.00**
		Total this Invoice	**$1,008.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**1,008.00**	**6,842.90**	**7,850.90**	**6,842.90**	**1,008.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

March 4, 2020
Invoice No: 23190375.99 - 1

Total this Invoice $900.00

Regarding: Trend Analysis

Professional Services from February 1, 2020 to February 28, 2020

Job: 2020 2019 Data
Task: 100 Trend Analysis 2019 Data

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist II				
Menken, Kevin	7.50	120.00	900.00	
	7.50		900.00	
Subtotal Labor				**900.00**
		Task Subtotal		**$900.00**
		Job Subtotal		**$900.00**
		Total this Invoice		**$900.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**900.00**	**0.00**	**900.00**	**0.00**	**900.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

resourceful. naturally.
engineering and environmental consultants

BARR

April 07, 2020

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 February 29, 2020 through April 03, 2020

TOTAL PAYABLE THIS INVOICE:	**$ 6,350.00**
Allocation:	
Engineering	**$ 1,782.50**
Special Projects General Fund	
• **Orchard Lk Water Quality Monitoring**	**$ 164.00**
• **Lac Lavon Mgmt Level Monitoring**	**$ 2,102.00**
Special Projects Capital Improvement Fund	
• **Keller Lake Alum Treatment**	**$ 85.00**
Water Quality Monitoring	
• **2019 Habitat Monitoring (Lac Lavon)**	**$ 135.00**
• **Update Trend Analyses**	**$ 300.00**
Public Education	
• **Watershed Annual Report**	**$ 1,781.50**

OK
4-8-20

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 - 2020 FY
Black Dog Watershed Management Commission
through April 3, 2020

Work Description	Pre-2020 Costs	Barr Budget			Current Invoice	Spent This Year	Balance
		Brought Forward	Current Year	Total Barr Budget			
Engineering	-----	0.00	31,000.00	31,000.00	1,782.50	5,767.88	25,232.12
Special Projects: General Fund							
Orchard Lk Water Quality Monitoring (2020)	-----	0.00	23,000.00	23,000.00	164.00	164.00	22,836.00 #
Lac Lavon Mgmt Level Monitoring (2019)	17,449.62	8,250.38	0.00	8,250.38	2,102.00	3,567.50	4,682.88 #
Subtotal -- Special Projects: General Fund	-----	8,250.38	23,000.00	31,250.38	2,266.00	3,567.50	27,682.88
Special Projects: Capital Improvement Fund							
Keller Lake Alum Treatment Feas Study & Impl Planning			7,000.00	7,000.00	85.00	714.00	6,286.00 #
Subtotal -- Special Projects: Capital Improvement Fund	-----	0.00	7,000.00	7,000.00	85.00	714.00	6,286.00
Special Projects: General Fund Reserve							
Watershed Management Plan Update			10,000.00	10,000.00	0.00	0.00	10,000.00
Subtotal -- Special Projects: General Fund Reserve	-----	0.00	10,000.00	10,000.00	0.00	0.00	10,000.00
Water Quality Monitoring							
2020 Habitat Monitoring (Keller Lake)	-----	0.00	9,600.00	9,600.00	0.00	0.00	9,600.00
2019 Habitat Monitoring (Lac Lavon)	2,023.40	6,476.60	0.00	6,476.60	135.00	5,962.50	514.10
Update Trend Analyses	-----	0.00	2,000.00	2,000.00	300.00	1,200.00	800.00
Subtotal -- W.Q. Monitoring	-----	6,476.60	11,600.00	18,076.60	435.00	7,162.50	10,914.10
Public Education							
Watershed Annual Report	-----	0.00	4,000.00	4,000.00	1,781.50	3,684.50	315.50
Annual Activity Report	-----	0.00	2,000.00	2,000.00	0.00	0.00	2,000.00
Subtotal -- Public Education	-----	0.00	6,000.00	6,000.00	1,781.50	3,684.50	2,315.50
Total Services	-----	14,726.98	88,600.00	103,326.98	6,350.00	20,896.38	82,430.60

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

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

April 7, 2020
Invoice No: 23190374.20 - 3

Total this Invoice $3,564.00

Regarding: BDWMO 2020 Engineering Services
Professional Services from February 29, 2020 to April 3, 2020

Job: 2020 2020 Engineering Services

Task: 002 Miscellaneous Consulting
Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	9.00	180.00	1,620.00	
Support Personnel II				
Burt, Deborah	.20	100.00	20.00	
Nypan, Nyssa	1.50	95.00	142.50	
	10.70		1,782.50	
Subtotal Labor				**1,782.50**
		Task Subtotal		**$1,782.50**

Task: 004 Newsletter/Watershed Report
Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	3.90	180.00	702.00	
Engineer / Scientist / Specialist IV				
Wilson, Gregory	1.50	170.00	255.00	
Support Personnel I				
Kaul (Contracted), Karen	9.70	85.00	824.50	
	15.10		1,781.50	
Subtotal Labor				**1,781.50**
		Task Subtotal		**$1,781.50**
		Job Subtotal		**$3,564.00**
		Total this Invoice		**$3,564.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**3,564.00**	**5,888.38**	**9,452.38**	**2,743.38**	**6,709.00**

Outstanding Invoices

Invoice	Date	Balance
2	3/10/2020	3,145.00
Total		**3,145.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

April 7, 2020
Invoice No: 23190375.19 - 8

Total this Invoice $2,102.00

Regarding: Lac Lavon 2019 Water Quality Monitoring

Professional Services from February 29, 2020 to April 3, 2020

Job: LAC Lac Lavon 2019 Monitoring

Task: 200 Aquatic Plant Survey
Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Rattei, Margaret	.10	140.00	14.00	
	.10		14.00	
Subtotal Labor				**14.00**
			Task Subtotal	**$14.00**

Task: 300 Letter Report
Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	3.70	180.00	666.00	
Engineer / Scientist / Specialist III				
Rattei, Margaret	.30	140.00	42.00	
Engineer / Scientist / Specialist II				
Menken, Kevin	11.50	120.00	1,380.00	
	15.50		2,088.00	
Subtotal Labor				**2,088.00**
			Task Subtotal	**$2,088.00**
			Job Subtotal	**$2,102.00**
			Total this Invoice	**$2,102.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**2,102.00**	**18,915.12**	**21,017.12**	**17,899.12**	**3,118.00**

Outstanding Invoices

Invoice	Date	Balance
7	3/6/2020	1,016.00
Total		**1,016.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

April 7, 2020
Invoice No: 23190375.20 - 1

Total this Invoice $164.00

Regarding: Orchard Lake 2020 Water Quality Monitoring

Professional Services from February 29, 2020 to April 3, 2020

Job: ORCH Orchard Lk 2020 Monitoring

Task: 100 Monitoring, Data Mgmt and Proj Mgmt

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Olson, Terri	.20	145.00	29.00	
Technician I				
Melmer, David	1.50	90.00	135.00	
	1.70		164.00	
Subtotal Labor				**164.00**
			Task Subtotal	**$164.00**
			Job Subtotal	**$164.00**
			Total this Invoice	**$164.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**164.00**	**0.00**	**164.00**	**0.00**	**164.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

April 7, 2020
Invoice No: 23190375.98 - 15

Total this Invoice $85.00

Regarding: Keller Lake Alum Treatment

Professional Services from February 29, 2020 to April 3, 2020

Job: 003 BWSR Contract Administration

Task: 001 BWSR Contract Administration

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist IV				
Wilson, Gregory	.50	170.00	85.00	
	.50		85.00	
Subtotal Labor				**85.00**
			Task Subtotal	**$85.00**
			Job Subtotal	**$85.00**
			Total this Invoice	**$85.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**85.00**	**37,598.47**	**37,683.47**	**36,969.47**	**714.00**

Outstanding Invoices

Invoice	Date	Balance
14	3/6/2020	629.00
Total		**629.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

April 7, 2020
Invoice No: 23190375.99 - 2

Total this Invoice $300.00

Regarding: Trend Analysis

Professional Services from February 29, 2020 to April 3, 2020

Job: 2020 2019 Data

Task: 100 Trend Analysis 2019 Data

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist II				
Menken, Kevin	2.50	120.00	300.00	
	2.50		300.00	
Subtotal Labor				**300.00**
			Task Subtotal	**$300.00**
			Job Subtotal	**$300.00**
			Total this Invoice	**$300.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**300.00**	**900.00**	**1,200.00**	**0.00**	**1,200.00**

Outstanding Invoices

Invoice	Date	Balance
1	3/6/2020	900.00
Total		**900.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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

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

April 7, 2020
Invoice No: 23190457.19 - 5

Total this Invoice $135.00

Regarding: BDWMO 2019 Lac Lavon Habitat Monitoring

Professional Services from February 29, 2020 to April 3, 2020

Job: LAC Lac Lavon Habitat Monitoring

Task: 003 Analysis and Report

Labor Charges

	Hours	Rate	Amount
Engineer / Scientist / Specialist III			
Wold, Karen	1.00	135.00	135.00
	1.00		135.00
Subtotal Labor			**135.00**
		Task Subtotal	**$135.00**
		Job Subtotal	**$135.00**
		Total this Invoice	**$135.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**135.00**	**7,850.90**	**7,985.90**	**6,842.90**	**1,143.00**

Outstanding Invoices

Invoice	Date	Balance
4	3/6/2020	1,008.00
Total		**1,008.00**

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.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
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 29, 2020
Account # 602-0000G
349

RE: GENERAL SERVICES
RENDERED TO DATE:

			HOURS	
02/11/2020	SLC	Correspondence to Daryl Jacobson enclosing Affidavit of Publication.	0.20	18.00
02/12/2020	RNK	Review agenda material.	0.30	51.00
02/13/2020	RNK	Review Board agenda material.	0.40	68.00
02/19/2020	JJJ	Review agenda packet.	0.30	51.00
	JJJ	Attend Board meeting.	0.50	85.00
		AMOUNT DUE	1.70	273.00
		TOTAL CURRENT WORK		273.00
		PREVIOUS BALANCE		$666.40
02/21/2020		Payment - thank you		-666.40
		TOTAL AMOUNT DUE		$273.00

OK
Dag
3-11-20

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.

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

March 31, 2020
Account # 602-0000G
350

RE: GENERAL SERVICES
RENDERED TO DATE:

			HOURS	
03/09/2020	SLC	Draft audit letter; finalize and mail same.	0.30	27.00
03/13/2020	RNK	Review Board agenda material.	0.40	68.00
		AMOUNT DUE	0.70	95.00
		TOTAL CURRENT WORK		95.00
		PREVIOUS BALANCE		$273.00
		TOTAL AMOUNT DUE		$368.00

OK
DBJ
4-3-20

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.

BLACK DOG WMO
CASH ACTIVITY REPORT 2020

Date	Description	Deposits		Check #	Check Amount	Monthly Cash Balance	Expenditures: General Engineering Support	Special Projects (General)	Special Projects (Capital)	Insurance	Legal & Audit	Admin Support	Public Education	Water Quality Monitoring	Conf Public	Contin-gency
	Balance as of 12/31/19					**538,405.58**										
15-Jan	Barr Engineering Co (2019)			1713	2,283.50		1,875.00	408.50	-					-		
15-Jan	Campbell Knutson (2019)			1714	224.00						224.00					
15-Jan	City of Burnsville (2019)			1715	19,296.23							19,296.23				
31-Jan	Interest Income	625.10														
	01/31/20 Balance	625.10			21,803.73	**517,226.95**	1,875.00	408.50	-	-	224.00	19,296.23	-	-	-	-
19-Feb	Barr Engineering Co			1716	8,012.38		1,605.38	449.50	-				1,138.00	4,819.50		
19-Feb	Campbell Knutson			1717	666.40						666.40					
19-Feb	Dakota County Soil & Water (2019)			1718	1,815.00			1,500.00	-				315.00			
29-Feb	Interest Income	532.69														
	02/28/20 Balance	532.69			10,493.78	**507,265.86**	1,605.38	1,949.50	-	-	666.40	-	1,453.00	4,819.50	-	-
31-Mar	Interest Income	494.67														
	03/31/20 Balance	494.67			-	**507,760.53**	-	-	-	-	-	-	-	-	-	-
	Total Revenue	1,652.46	**Total Expense**		32,297.51		3,480.38	2,358.00	-	-	890.40	19,296.23	1,453.00	4,819.50	-	-
	Less: 2019 A/R	-	**Less: 2019 A/P**		(23,618.73)		(1,875.00)	(1,908.50)	-	-	(224.00)	(19,296.23)	(315.00)	-	-	-
	December LMC insurance reclass	-			-											
	Total YTD 2020 Revenue	1,652.46	**Total YTD 2020 Exp**		8,678.78		1,605.38	449.50	-	-	666.40	-	1,138.00	4,819.50	-	-
			2020 Budget		145,700.00		31,000.00	46,500.00	-	3,000.00	8,400.00	18,000.00	17,900.00	15,400.00	500.00	5,000.00
			Budget Remaining		137,021.00		29,395.00	46,050.50	-	3,000.00	7,733.60	18,000.00	16,762.00	10,580.50	500.00	5,000.00

BLACK DOG WATER MANAGEMENT COMMISSION

Budget Performance Report
March 31, 2020

	CURRENT MONTH	YEAR TO DATE			
	ACTUAL	GENERAL FUND BUDGET	CAPITAL IMPROVEMENT FUND BUDGET	ACTUAL	VARIANCE FAVORABLE (UNFAVORABLE)
Opening Fund Balance		$ 415,753	$ 100,849	$ 514,787	
REVENUES :					
Member Contributions:					
City of Apple Valley	$ -	$ 10,376	$ 1,734	$ -	$ (12,110)
City of Burnsville	-	94,293	16,256	-	(110,549)
City of Eagan	-	568	-	-	(568)
City of Lakeville	-	25,763	4,010	-	(29,773)
Total Member Contributions	-	131,000	22,000	-	(153,000)
Other Revenues:					
Interest	$ 495	$ 40	$ -	$ 1,652	$ 1,612
Grant (State of MN BWSR)	-	-	-	-	-
Total Other Revenue	495	40	-	1,652	1,612
Total Revenues	$ 495	$ 131,040	$ 22,000	$ 1,652	$ (151,388)
EXPENDITURES :					
General Engineering Support	$ -	$ 31,000	$ -	$ 1,605	$ 29,395
Special Projects - General Fund	-	46,500	-	450	46,051
Special Projects - Capital Improvement Fund	-	-	-	-	-
Insurance	-	3,000	-	-	3,000
Legal and Audit	-	8,400	-	666	7,734
Administrative Support	-	18,000	-	-	18,000
Public Education	-	17,900	-	1,138	16,762
Water Quality Monitoring	-	15,400	-	4,820	10,581
Conference/Publications	-	500	-	-	500
Contingency	-	5,000	-	-	5,000
Total Expenditures	-	145,700	-	8,679	137,021
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	495	(14,660)	22,000	(7,026)	
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES PLUS OPENING FUND BALANCE				507,761	

TOTAL CASH AVAILABLE 3/31/2020	507,761
Fund Balance 3/31/2020	$507,761

BLACK DOG WATER MANAGEMENT COMMISSION

Budget Performance Report
December 31, 2019
as of 02/19/2020

	CURRENT MONTH	YEAR TO DATE			
	ACTUAL	GENERAL FUND BUDGET	CAPITAL IMPROVEMENT FUND BUDGET	ACTUAL	VARIANCE FAVORABLE (UNFAVORABLE)
Opening Fund Balance				443,330	$ 443,330
REVENUES :					
Member Contributions:					
City of Apple Valley	$ -	$ 10,336	$ 1,721	$ 12,057	$ -
City of Burnsville	-	94,480	16,318	110,798	-
City of Eagan	-	568	-	568	-
City of Lakeville	-	25,616	3,961	29,577	-
Total Member Contributions	-	131,000	22,000	153,000	-
Other Revenues:					
Interest	$ -	$ 40	$ -	$ 10,465.34	$ 10,425
Grant (State of MN BWSR)	-	-	-	115,000	115,000
Total Other Revenue	-	40	-	125,465	125,425
Total Revenues	$ -	$ 131,040	$ 22,000	$ 278,465.34	$ 125,425
EXPENDITURES :					
General Engineering Support	$ -	$ 31,000	$ -	$ 15,850	$ 15,150
Special Projects - General Fund	1,500	39,200	-	34,065	5,135
Special Projects - Capital Improvement Fund	-	-	96,700	100,939	(4,239)
Insurance	-	3,000	-	2,557	443
Legal and Audit	-	4,400	-	2,256	2,144
Administrative Support	-	18,000	-	19,296	(1,296)
Public Education	315	17,900	-	17,136	765
Water Quality Monitoring	-	14,900	-	14,616	284
Conference/Publications	-	500	-	295	205
Contingency	-	5,000	-	-	5,000
Total Expenditures	1,815	133,900	96,700	207,009	23,591
TRANSFERS :					
Transfers In	$ -	$ -	$ 20,000	$ -	$ 20,000
Transfers Out	-	(20,000)	-	-	(20,000)
Total Transfers	-	(20,000)	20,000	-	-
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	(1,815)	(22,860)	(54,700)	71,456	
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES PLUS OPENING FUND BALANCE				514,787	

TOTAL CASH AVAILABLE 12/31/2019	538,406
Fund Balance 12/31/2019	$514,787

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engineering and environmental consultants

BARR

Technical Memorandum

To: Commissioners, Black Dog Watershed Management Organization (BDWMO)
From: Barr Engineering Co.
Subject: 2019 Lac Lavon Habitat Monitoring
Date: March 10, 2020
Project: 23190457

This memorandum presents the results of the BDWMO's 2019 habitat monitoring of Lac Lavon.

1.0 Introduction and Background to the BDWMO Habitat Monitoring Program

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 and 2016
2. Orchard Lake: 2012 and 2017
3. Crystal Lake: 2013 and 2018
4. **Lac Lavon: 2014 and 2019**
5. Keller Lake: 2015

This report provides the results of the Lac Lavon 2019 habitat monitoring.

Habitat quality was evaluated within the submergent, emergent, and upland buffer vegetation zones, and the lake was evaluated for sedimentation and shoreline erosion problems. 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. Additional detail describing the habitat assessment is provided in the technical reference section following this memorandum, which includes

- Lac Lavon aquatic plant survey results (**Appendix A**),
- floristic quality assessment data and methods (**Appendix B**),
- previous habitat assessment monitoring results from 2003 through 2018 (**Appendix C**),
- previous recommended and completed management actions from 2003 through 2018 (**Appendix D**),
- 2014 Lac Lavon 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**), and
- buckthorn management guidelines (**Appendix H**).
- location of the prairie restoration area as provided by the City of Burnsville (**Appendix I**).

2.0 Lac Lavon Habitat Monitoring

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 Minnesota Department of Natural Resources (MNDNR) Public Waters Inventory. The lake's primary water source is groundwater. Lac Lavon's water 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 32 feet (9.8 meters).

Existing 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 with a path to a fishing pier on the northeast shore.

Lac Lavon is used for a variety of recreational purposes, including fishing, swimming, aesthetic viewing, and wildlife habitat. The City of Burnsville Park, with ballpark, tennis courts, paved trails, picnic shelter, play equipment and boat access, and the City of Apple Valley Park, with a fishing pier, canoe rack and access, picnic shelter, paved trails, and children's play equipment provide for most of the lake's recreational use.

Figure 2 shows the 2017 aerial imagery of Lac Lavon.

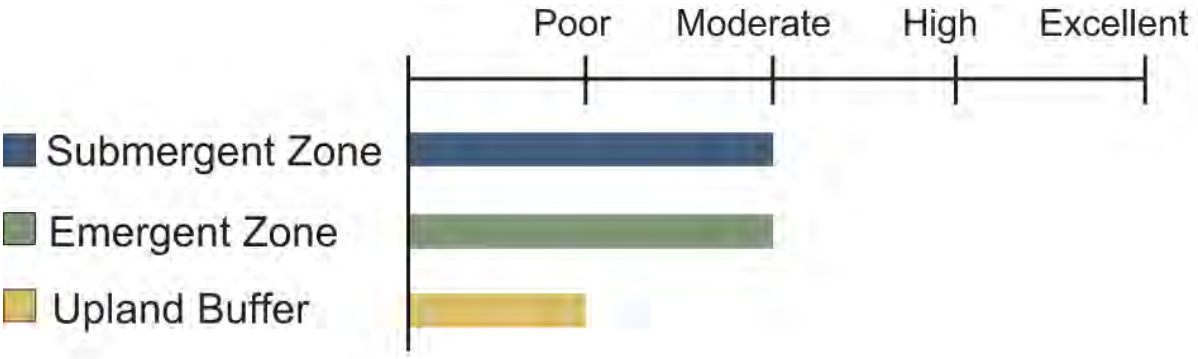
2.1 Lac Lavon 2019 Habitat Monitoring Results

Habitat monitoring for Lac Lavon was conducted from 2003 through 2009, in 2014, and in 2019. The 2019 field monitoring of Lac Lavon was conducted on June 30 and August 23, 2019. Vegetation data were collected in, within, and along the fringe of Lac Lavon's three vegetation zones: (1) submergent, (2) emergent, and (3) upland.

The 2019 Lac Lavon monitoring included transect, plot, and meandering surveys. 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.

On June 30 and August 23, 2019, Endangered Resource Services, LLC staff conducted aquatic vegetation surveys within the submergent zone (**Appendix A**). On August 23, 2019, Barr staff conducted emergent vegetation and upland buffer zone surveys by walking along the shoreline. In addition, the discrete plots were monitored in the emergent zone and upland buffer, as done in 2003-2009 and 2014. **Figure 3** shows the plot locations and the shoreline parcels identifying private versus public ownership. Previous monitoring reports provide the sampling methodology for monitoring conducted before 2011. An overall quality rating for each vegetation zone was computed using the field variables evaluated in each zone. **Table 1** shows the 2014 and 2019 habitat quality ratings for Lac Lavon and **Table 2** shows the recommended management action items.

The following schematic diagram shows the overall ratings in 2019 for each vegetation zone within and adjacent to Lac Lavon:



2.1.1 Lac Lavon Overall Vegetation Zone Ratings

Table 1 shows the 2014 and 2019 Lac Lavon habitat monitoring results. Appendix C provides habitat ratings for the Lac Lavon monitoring conducted prior to 2011.

Submergent Zone

The total number of native species in the submergent zone is **high** (12), the average native plant density rating is **moderate** (1.5), the average exotic species density is rated **moderate** (1.7) and the Mean Coefficient of Conservatism Value (C-Value) Rating is **moderate** (4.5). Averaging these four criteria results in a **moderate** rating overall for the submergent zone of Lac Lavon. This is consistent with the overall rating in 2014.

Curly-leaf pondweed (*Potamogeton crispus*) is a dominant species found every year within Lac Lavon. In June, curly-leaf pondweed was present at 29 percent of sample points shallower than the maximum depth of plant growth. In August, which was after the seasonal die-off of curly-leaf pondweed, only a handful of curly-leaf pondweed plants were observed near the west landing. 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 (*Myriophyllum spicatum*) was also found in Lac Lavon in 2019 and in previous years. In both June and August of 2019, Eurasian watermilfoil was present at more than half of sites shallower than the maximum depth of plant growth – at 54 percent of sample sites in June and 56 percent of sites in August. The densest growth of Eurasian watermilfoil was in the west bay. 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. During August, the Eurasian watermilfoil in the west bay was so dense that it was not possible to motor through it with an electric motor. The MNDNR has identified low-dose fluridone (2-4 ppb maintained for at least 60 days) herbicide as an effective Eurasian watermilfoil control.

In addition, moderate densities of brittle naiad, a non-native, invasive plant species have been found in Lac Lavon during previous monitoring years

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 curlyleaf 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, leafy pondweed (*Potamogeton pusillus*) and white water crowfoot (*Ranunculus longirostris*) have C-values of 7. The mean C-value for vegetation found in the submergent zone of Lac Lavon in 2019 was 4.5. 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, https://www.pca.state.mn.us/water/floristic-quality-assessment-evaluating-wetland-vegetation).

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 FQA method also uses the C-value, and 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 Lac Lavon in 2019; the results are provided in **Appendix B.**

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

Another method for assessing vegetation quality is the Floristic Quality Index (FQI). The MNDNR uses the FQI, along with the number of plant species to calculate the plant eutrophication index of biological integrity (IBI). Currently, the MPCA uses this IBI as supporting information in assessing the lake fish IBI. However, it is expected that the MPCA will use this IBI in the future to evaluate whether a lake is impaired. The number of plant species must be at least 11 and the FQI must be at least 17.8 to meet the IBI standard. The FQI is calculated by multiplying the mean C-value by the square root of the number of species; the FQI for Lac Lavon is shown in **Appendix B**.

Emergent Zone

The overall emergent vegetation zone quality is rated **moderate** for Lac Lavon; this is the same as the overall 2014 rating. The emergent zone includes 38 native wetland plant species resulting in an **excellent** rating and percent cover of exotic species (26-50%), which is a **high** rating. The approximate percent cover of vegetation (0-25%) is a **poor** rating. The emergent zone represents less than five percent total areal coverage, due primarily to owner-maintained sand beaches and riprap walls. The mean C-value rating is **poor** (2.4) and the Rapid Floristic Quality assessment calculations are rated as **fair** for the shrub-carr and fresh meadow communities resulting in an overall **good** condition (**Appendix B**).

Narrowleaf cattail (*Typha angustifolia*) is a dominant non-native invasive species within the vegetated emergent zone. Purple loosestrife (*Lythrum salicaria*), another non-native invasive plant species, is present in shallow open water and along the shoreline (**Appendix B**). Purple loosestrife has been managed for years through the release of beetles, which eat the purple loosestrife plants. This management strategy has been relatively successful within the Twin Cities metropolitan area. The MNDNR's monitoring of the purple loosestrife beetles indicates that populations are sufficient within the Twin Cities metropolitan area to keep purple loosestrife from becoming a significant problem. The cities of Apple Valley and Burnsville also removed purple loosestrife on shallow island areas in 2011.

At the southwest portion of the lake, the emergent shoreline adjacent to the City of Burnsville prairie restoration project was seeded with native emergent vegetation and includes native sedge species (*Carex comosa, Carex stricta, Carex vulpinoidea*), rushes (*Eleocharis erythropoda, Schoenoplectus tabernaemontani, Juncus effuses, Juncus tenuis, and Juncus torreyi*), rice cut grass (*Leersia oryzoides*),

switchgrass (*Panicum virgatum*), and fowl bluegrass (*Poa palustris*), providing desirable diverse habitat. Several forb species present in the emergent zone, including swamp milkweed (*Asclepias incarnata*), boneset (*Eupatorium perfoliatum*), blueflag iris (*Iris versicolor*), golden alexanders (*Zizia aurea*), and blue vervain (*Verbena hastata*) also provide important pollinator habitat. Due to flooded conditions in 2019, several areas within the lakeshore emergent zone were flooded with drowned out vegetation.

Upland Buffer

The overall upland buffer quality is rated **poor** for Lac Lavon. A total of 56 native species and 41 exotic plant species were observed in the upland buffer area in 2019. Exotic plants make up greater than 40 percent of the vegetative cover. The mean C-value rating (2.0) in the upland buffer is poor (**Appendix B**). The naturalized upland buffer within the city-owned property along the western and northeastern portions of the shoreline is wide, providing wildlife habitat and shoreline protection. However, the majority of residential properties are dominated by maintained lawn grasses and sand beaches with little to no naturalized vegetation.

The City of Burnsville has actively managed non-native invasive Canada thistle and spotted knapweed within publicly owned upland buffer areas. The City of Apple Valley released spotted knapweed seedhead boring weevils in Lac Lavon Park in 2010. In 2013, the City of Burnsville installed a native prairie planting, converting a sand beach and turf grass to prairie and wetland vegetation. This planting project has been well managed to control non-native invasive species and is dominated by diverse native plant species. One well-designed residential shoreline restoration project installed on Highview Drive provides an aesthetically pleasing atmosphere to enjoy the lake shoreline, practical erosion protection on a steep slope, and excellent habitat for pollinators and other species.

These restoration projects allow for the growth of desirable native species present in the upland buffer areas, including big bluestem (*Andropogon gerardii*), side-oats grama (*Bouteloua curtipendula*), Pennsylvania sedge (*Carex pensylvanica*), globular coneflower (*Ratbida pinnata*), black eyed Susan (*Rudbeckia hirta*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), common milkweed (*Asclepias syriaca*), butterfly weed (*Asclepias tuberosa*), white wild indigo (*Baptisia alba*), partridge pea (*Chamecrista fasciculata*), purple coneflower (*Echinacea purpurea*), joe pye weed (*Eutrochium maculatum*), prairie smoke (*Geum triflorum*), sawtooth sunflower (*Helianthus grosseserratus*), wild bergamot (*Monarda fistulosa*), stiff goldenrod (*Oligoneuron rigidum*), cup plant (*Silphium perfoliatum*), zigzag goldenrod (*Solidago flexicaulis*), and showy goldenrod (*Solidago speciosa*).

No significant erosion or sedimentation problems were noted within the lake or on the shoreline, but some areas with direct stormwater drainage from impervious surfaces into the lake 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 Lac Lavon 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 Lac Lavon is about 80% residential and 20% city ownership.

For Lac Lavon residential shoreline properties:

- The average buffer width is less than 10 feet.
- Approximately 2% have an adequate buffer width to protect water quality and prevent erosion (≥50 feet).
- Approximately 10% 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 Lac Lavon has a naturalized buffer width adequate for wildlife protection (≥100 feet).

The majority of the residential shoreline properties on Lac Lavon have the potential to provide a 50-foot naturalized buffer without altering any structures. Of the 105 residential properties, only ten do not have the potential to provide at least a 25-foot naturalized buffer.

For Lac Lavon city-owned public properties:

- The average buffer width is approximately 230 feet.
- The buffers on the portion of the city-owned property on the west side of the lake owned by the City of Burnsville average 300 feet wide.
- The buffers on the portion of the city-owned property on the northeast side of the lake owned by the City of Apple Valley average 120 feet wide.

Minnesota Routine Assessment Method (MNRAM) for Wetlands

In 2014, based on the MNRAM, Lac Lavon rated **moderate** for overall vegetative diversity and wildlife habitat. The Lac Lavon shoreline wetland community rated **moderate** for shoreline protection. Maintenance of characteristic amphibian habitat was rated **low**. Maintenance of fish habitat was rated as **high**. Shoreline restoration projects would have the potential to protect the shoreline from erosion and provide spawning and nursery habitat for fish and wildlife. 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 hydrologic regime, and wetland sensitivity to stormwater and urban development. The 2014 Lac Lavon MNRAM summary is provided in **Appendix E**. The MNRAM assessment was not repeated in 2019, as it would likely not result in significant changes from the 2014 assessment.

3.0 Lac Lavon Management Recommendations

3.1 Past and Current Actions

In 2006, the cities of Burnsville and Apple Valley and lakeshore homeowners partnered to fund a fluridone treatment for control of Eurasian watermilfoil. The one-time treatment was expected to provide control of Eurasian watermilfoil for three years, while allowing native plant species to grow. Although Eurasian watermilfoil was not documented within the lake during the May 30, 2007 habitat assessment, City of Apple Valley staff noted the presence of Eurasian watermilfoil later in the 2007 growing season. In 2008, it was documented primarily in the west portion of the lake. Eurasian watermilfoil has since rebounded in the lake. The MNDNR studied the effects of whole-lake fluridone treatments. The MNDNR's current recommendation is to treat Eurasian watermilfoil with low-dose fluridone herbicide (2-4 ppb maintained for 60 days).

Aquatic plant surveys were conducted in 2013, 2014, and 2019.

In 2010, the city of Apple Valley released about 150 spotted knapweed seedhead boring weevils in Lac Lavon Park in Apple Valley. Purple loosestrife removal on shallow island areas was completed by the cities of Apple Valley and Burnsville in 2011.

In 2013, the city of Burnsville installed a native prairie planting, converting a sand beach and turf grass to prairie and wetland vegetation. The layout of the planting is shown in **Appendix I**. The prairie restoration area is approximately 0.4 acre. Some invasive species control for Canada thistle and knapweed was conducted on this new native planting area in 2014.

The cities of Burnsville and Apple Valley 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. The City of Apple Valley also encourages its residents to take advantage of the city's cost-share grant program (now called Rainwater Rewards) for private property shoreline, rain garden and native garden projects. Many residents receive funding from the city and Dakota SWCD programs. The cities of Burnsville and Apple Valley have 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.

One shoreline restoration project was installed in the backyard of a shoreline property owner on Highview Drive in Apple Valley received technical assistance from the Dakota County Soil and Water Conservation District (SWCD). Additional/more numerous 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. Property owners have also created rain gardens on their properties through the Dakota County SWCD Landscaping for Clean Water program. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation.

3.2 Recommendations

The 2019 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, control, and manage curly-leaf pondweed and Eurasian watermilfoil. See **Appendix A** for the 2019 aquatic plant survey charts; more detailed information is available upon request.

2. Continue to control and manage non-native invasive vegetation including purple loosestrife, buckthorn, Siberian elm, leafy spurge, and spotted knapweed. The prairie restoration area in the southwest portion of the lakeshore could be extended to the east along a hillside in an area that does not appear to be used for any activities. This area is currently dominated by non-native knapweed. This project could potentially receive funding assistance from the Dakota SWCD Landscaping for Clean Water program. (**Potential Restoration Areas #1, 2, and 4, as shown in Figure 4 and photos**)

3. 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 in the Apple Valley Park near the fishing pier. This project could potentially receive funding assistance from the Dakota SWCD

Landscaping for Clean Water program. (**Potential Restoration Area #3, as shown in Figure 4 and photos**)

4. Improve the residential shorelines with a wider naturalized emergent zone and upland buffer. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A wider buffer of native vegetation could help protect water quality, prevent erosion, and improve wildlife habitat, vegetative diversity, and aesthetics. Lakeshore residents and cities could receive assistance to create shoreline restoration projects through the Dakota County SWCD Landscaping for Clean Water program. One lakeshore owner in Apple Valley has completed a shoreline restoration project and received technical assistance from the Dakota County SWCD (See **Appendix G** for examples of shoreline restorations). As more lakeshore residents restore their shoreline to naturalized vegetation, the benefits of improved wildlife habitat, vegetation diversity, water quality, aesthetics, and recreation will be realized (**Potential Restoration Area #5, as shown in Figure 4 and photos).**

Tables

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.

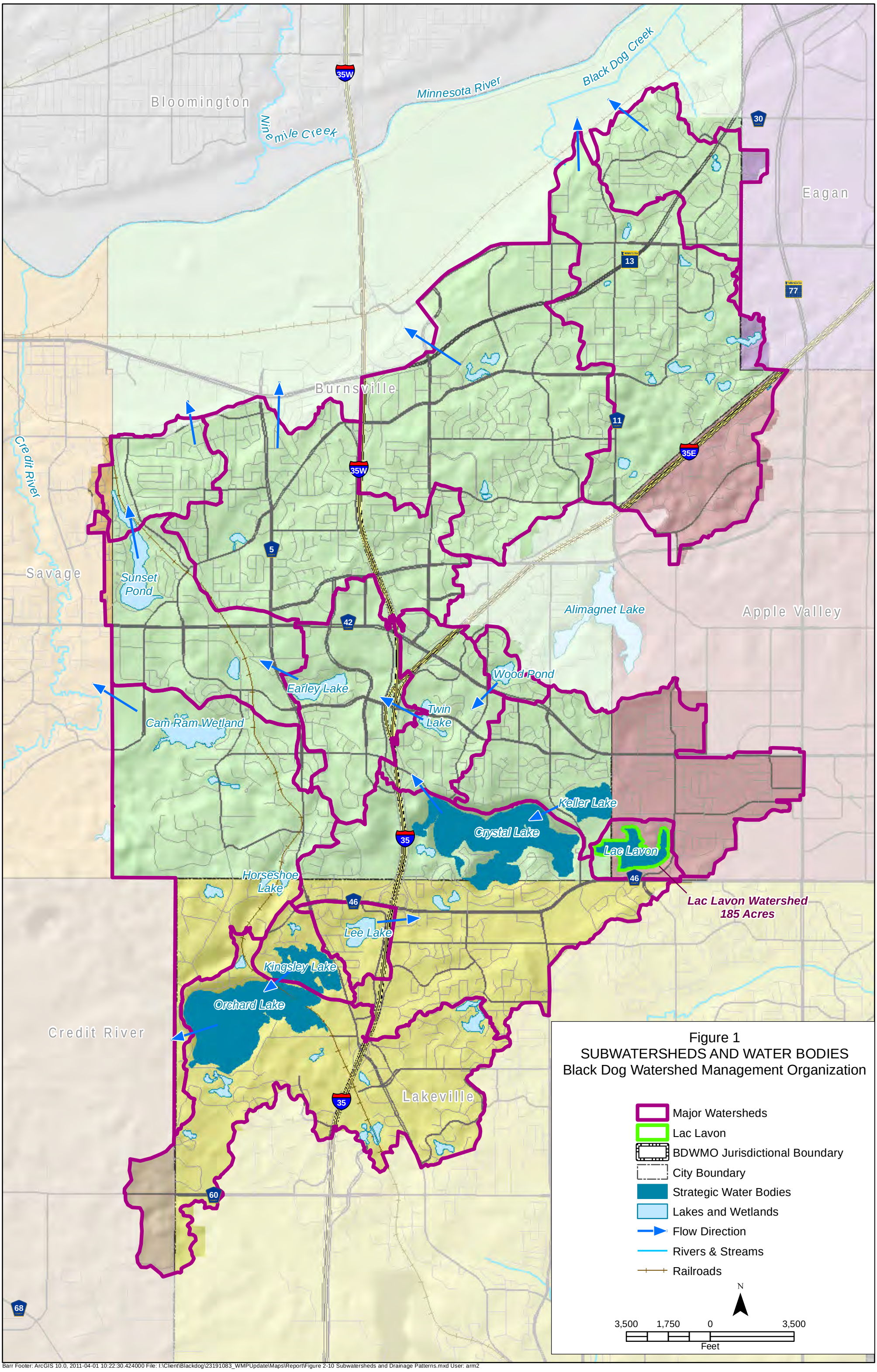
Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating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

Figures



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2017 Aerial Imagery

Sample Plot Locations

Lac Lavon

Municipal Boundary

N

Feet

400 200 0 400

Figure 2

LAC LAVON
SAMPLE PLOT LOCATIONS
Black Dog WMO
Burnsville and Apple Valley, MN

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2017 Aerial Imagery

Sample Plot Locations

Municipal Boundary

Lac Lavon

Shoreline Parcel Ownership

Public

Residential

N

Feet

400 200 0 400

Figure 3

LAC LAVON
SHORELINE PARCEL OWNERSHIP
Black Dog WMO
Burnsville and Apple Valley, MN

2017 Aerial Imagery

Potential Restoration Areas

N

Feet

400 200 0 400

Figure 4

LAC LAVON
Potential Restoration Areas
Black Dog WMO
Burnsville and Apple Valley, MN

Photos

Lac Lavon and Shoreline August 23, 2019

Submergent Zone –west portion of Lac Lavon

Plot 1B Emergent Zone

Plot 1C Upland Buffer

Submergent Zone – north portion of Lac Lavon

Plot 2B Emergent Zone

Plot 2C Upland Buffer

Submergent Zone – northeast portion of Lac Lavon

Plot 3B – Emergent Zone

Plot 3C – Upland Buffer

City of Burnsville prairie restoration area

The City of Burnsville prairie restoration area provides habitat for pollinators

Emergent shoreline adjacent to City prairie restoration was also seeded with native vegetation.

Potential restoration area #1 - The City of Burnsville prairie restoration area could be extended to include this area currently dominated by knapweed. Remove knapweed and restore with tall grass prairie.


Flooded conditions in 2019 prevented access to fishing dock in City of Apple Valley Park

Typical shoreline along City owned property with wide naturalized buffer helps prevent shoreline erosion and provides wildlife habitat.

Potential Restoration Areas #2 and #4 – Continue to control non-native invasive vegetation with the naturalized upland buffer areas in the city parks, including control of buckthorn, Siberian elm, leafy spurge, and spotted knapweed.

Potential Restoration Area #3 – Stormwater flows directly to the lake along impervious surfaces and turf grass where it can collect pollutants and decrease water quality. Create buffer strips of naturalized vegetation adjacent to the bituminous lake access pathway to slow down and pretreat stormwater prior to entering the lake.

Typical residential shoreline – mowed turf grass or sand beach to edge of water, lacking protective vegetation.

Potential Restoration Area #5 - Sturdy native vegetation in the emergent zone and upland buffer of residential properties could provide more shoreline stability.

A successful existing residential shoreline restoration

Lac Lavon provides natural habitat for recreational activities including biking and kayaking.

Technical Reference

(Provided in separate report)

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 Lac Lavon 2019 habitat monitoring.

The 2019 Lac Lavon monitoring includes transect, 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 2019 Lac Lavon monitoring results.

Habitat Quality

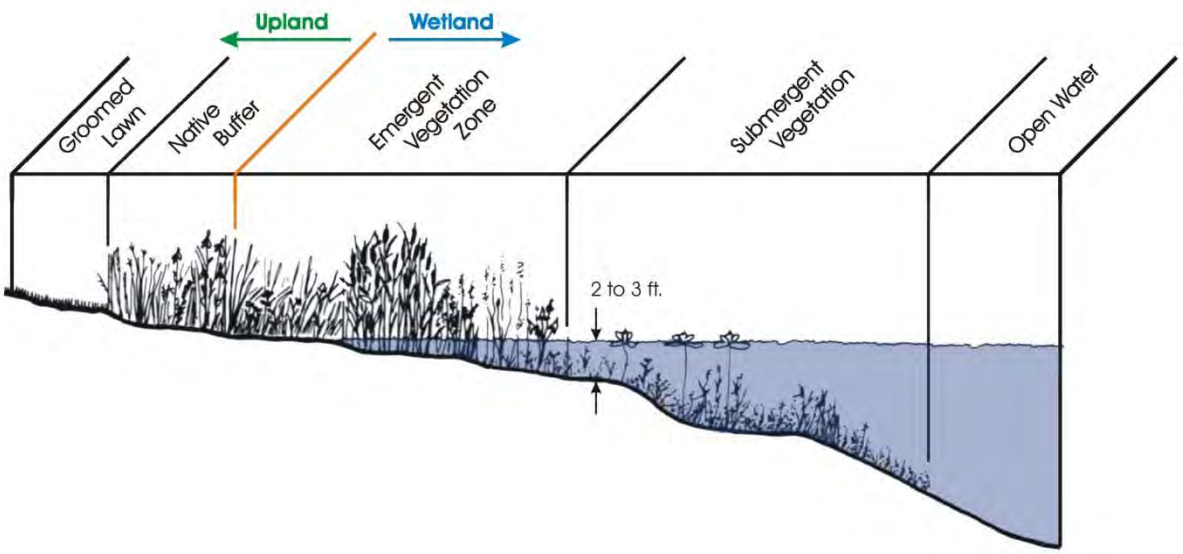
The BDWMO's assessment of the BDWMO strategic water bodies provides baseline and ongoing information regarding the habitat quality of the water bodies and a method for detecting change. Habitat quality was evaluated within the following four general zones:

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 2018. **Appendix D** includes the previous management recommendations for water bodies assessed from 2009 through 2018. **Table 2 of the Technical Memo** provides the 2019 management recommendations for Lac Lavon.

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 appear to 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 a number of 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

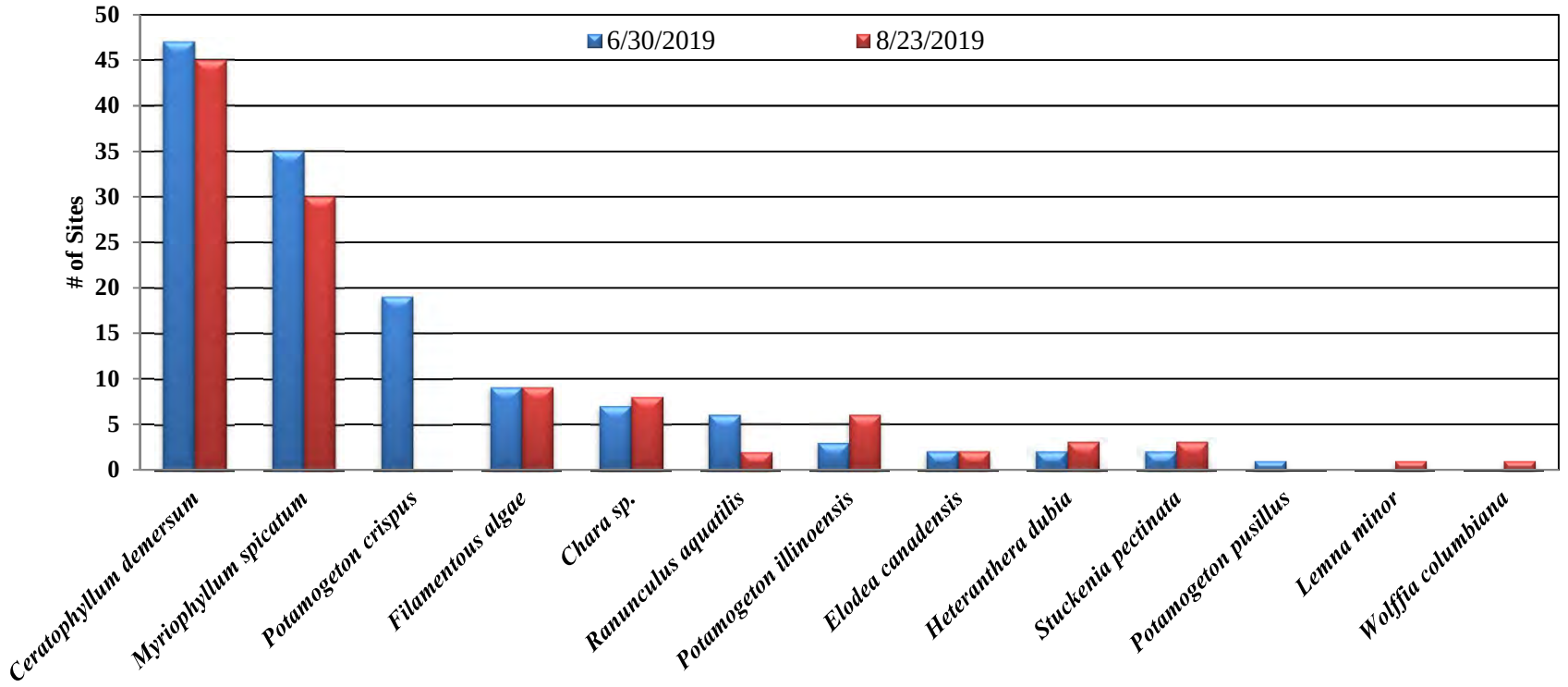
In addition to the specific habitat parameters described above, the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM) Version 3.0 was used to evaluate the hydrologic system and ecosystem making up each water resource, first in 2003 and then again in 2006. The results of the 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 2014 Lac Lavon 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

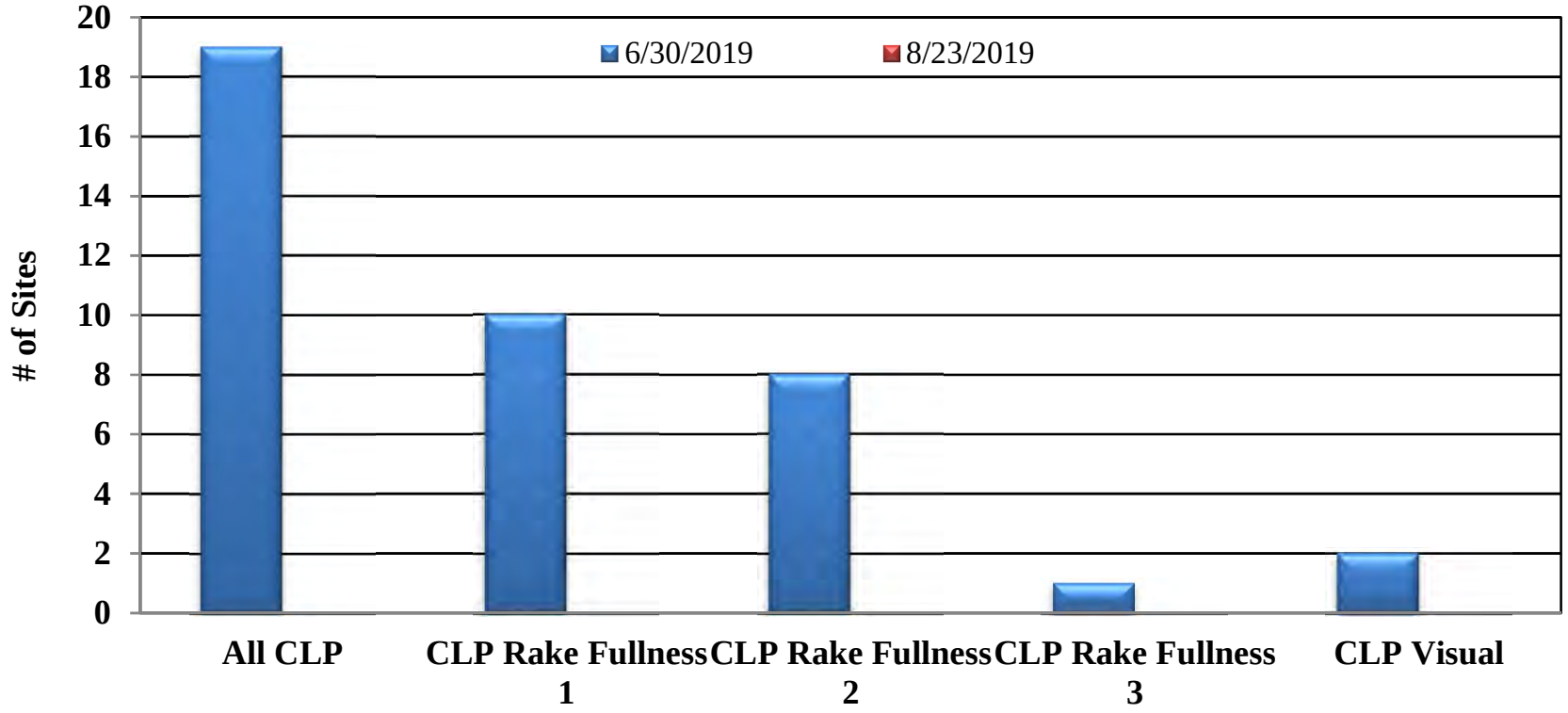
Appendix A

Lac Lavon Aquatic Plant Survey Results

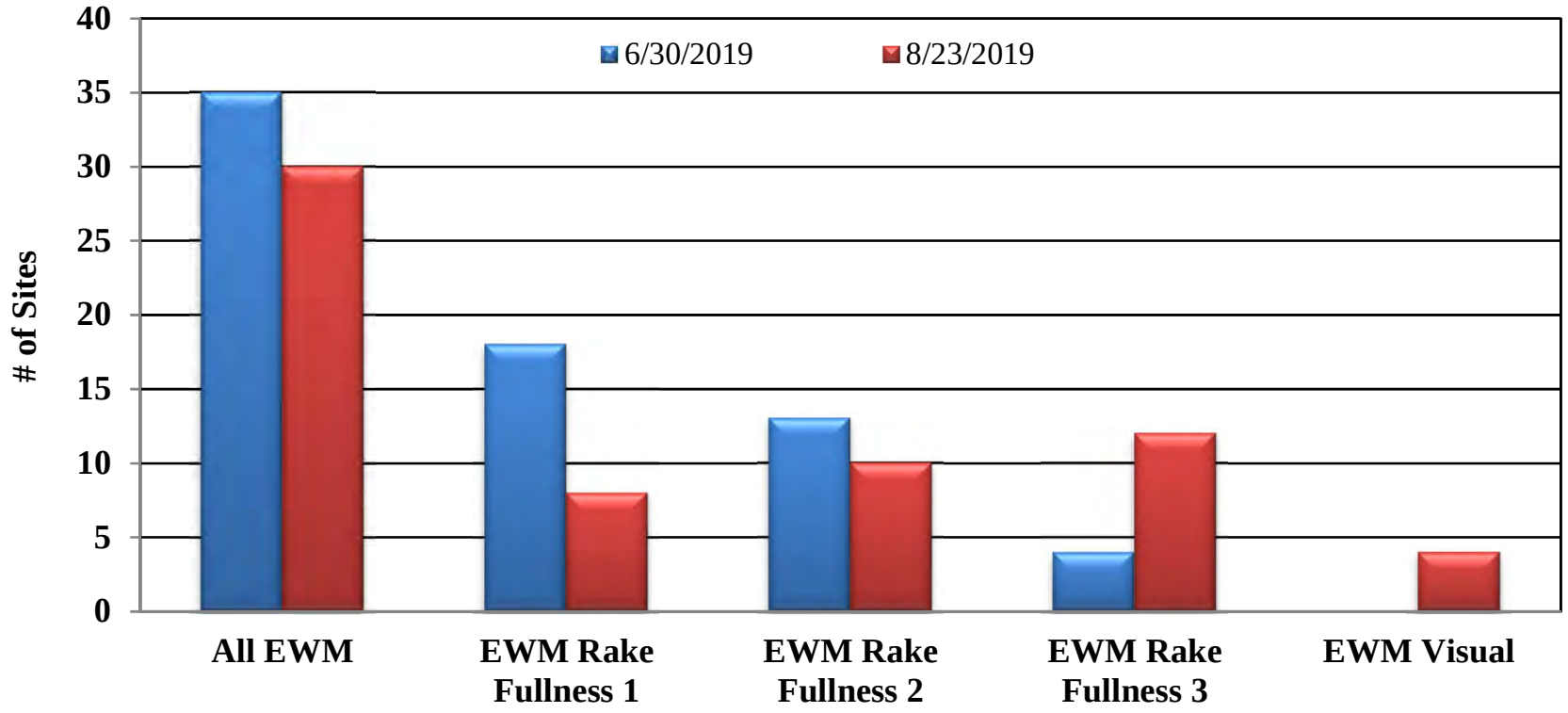
June - August Differences for All Species
Lac Lavon - Dakota County, MN

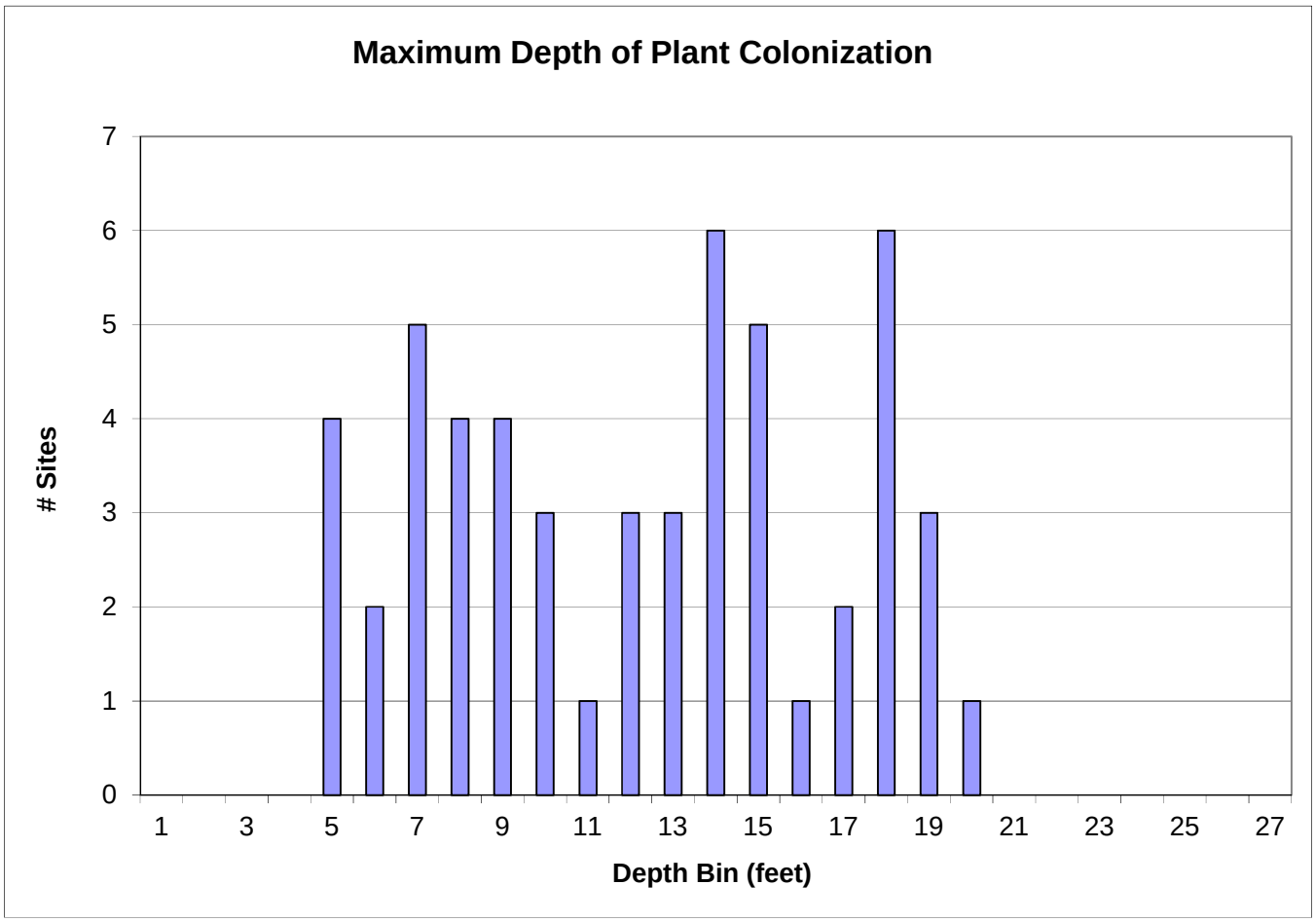


June - August CLP Differences
Lac Lavon - Dakota County, MN



June - August EWM Differences
Lac Lavon - Dakota County, MN



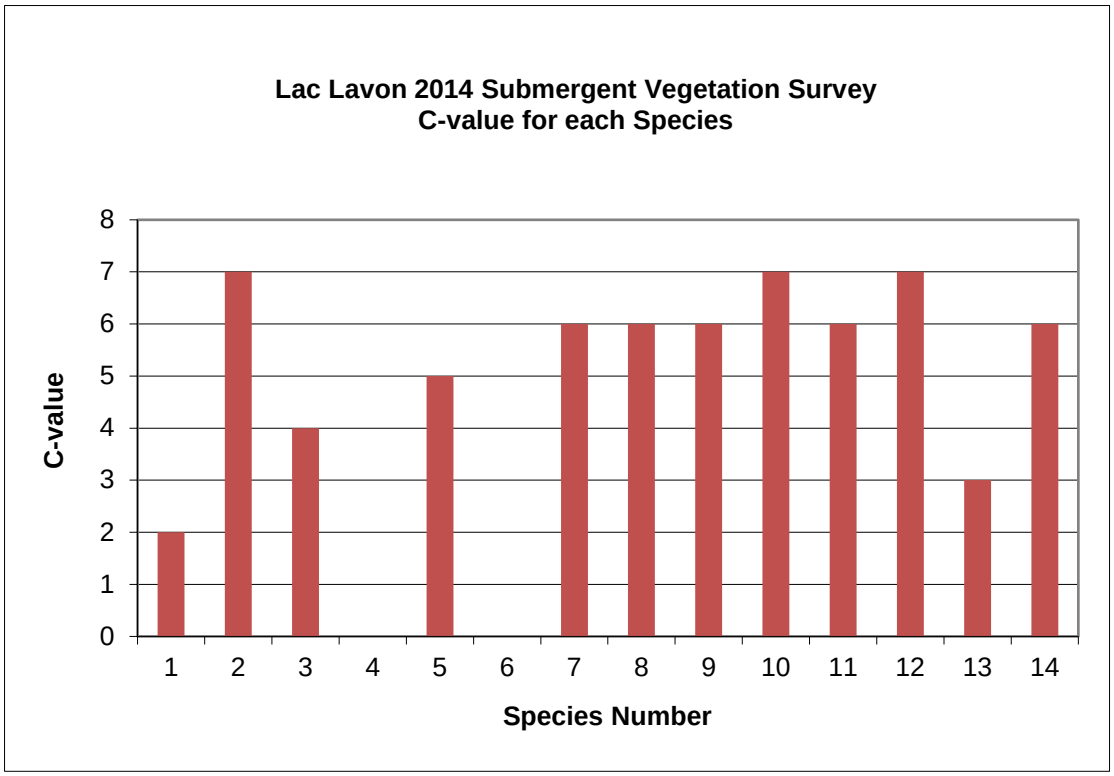

Maximum Depth of Plant Colonization
Sites
0
1
2
3
4
5
6
7
1
3
5
7
9
11
13
15
17
19
21
23
25
27
Depth Bin (feet)

Appendix B

Lac Lavon Floristic Quality Assessment Data

2014 Lac Lavon Submergent Vegetation Floristic Quality Index

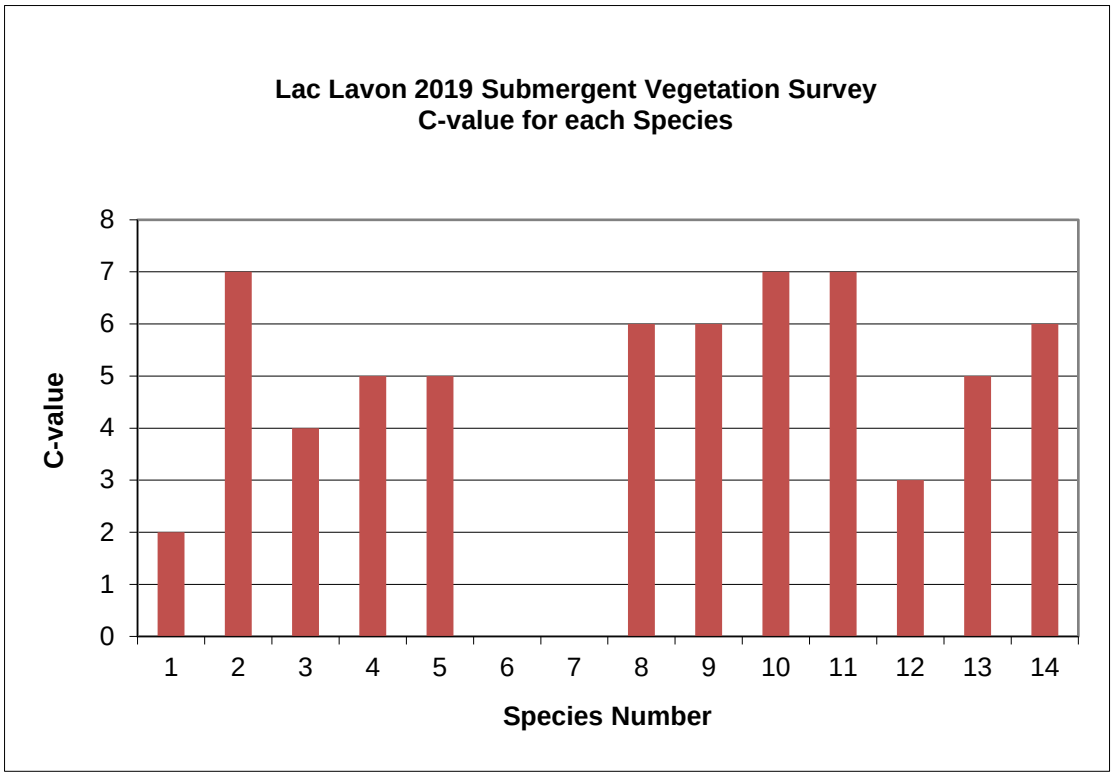
Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Elodea canadensis	elodea	4
Myriophyllum spicatum	Eurasian watermilfoil	0
Najas flexilis	flexuous naiad	5
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton foliosus	narrowleaf pondweed	6
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton nodosus	longleaf pondweed	6
Potamogeton pusillus	leafy pondweed	7
Potamogeton zosteriformis	flatstem pondweed	6
Ranunculus longirostris	white water crowfoot	7
Stuckenia pectinatus	sago pondweed	3
Zosterella dubia	water stargrass	6
Mean C-value		4.6
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		14
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		17.37



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 spicatum*	Eurasian watermilfoil	0
5	*Najas flexilis*	flexuous naiad	5
6	*Potamogeton crispus*	curlyleaf pondweed	0
7	*Potamogeton foliosus*	narrowleaf pondweed	6
8	*Potamogeton illinoensis*	Illinois pondweed	6
9	*Potamogeton nodosus*	longleaf pondweed	6
10	*Potamogeton pusillus*	leafy pondweed	7
11	*Potamogeton zosteriformis*	flatstem pondweed	6
12	*Ranunculus longirostris*	white water crowfoot	7
13	*Stuckenia pectinatus*	sago pondweed	3
14	*Zosterella dubia*	water stargrass	6

2019 Lac Lavon Submergent Vegetation Floristic Quality Index

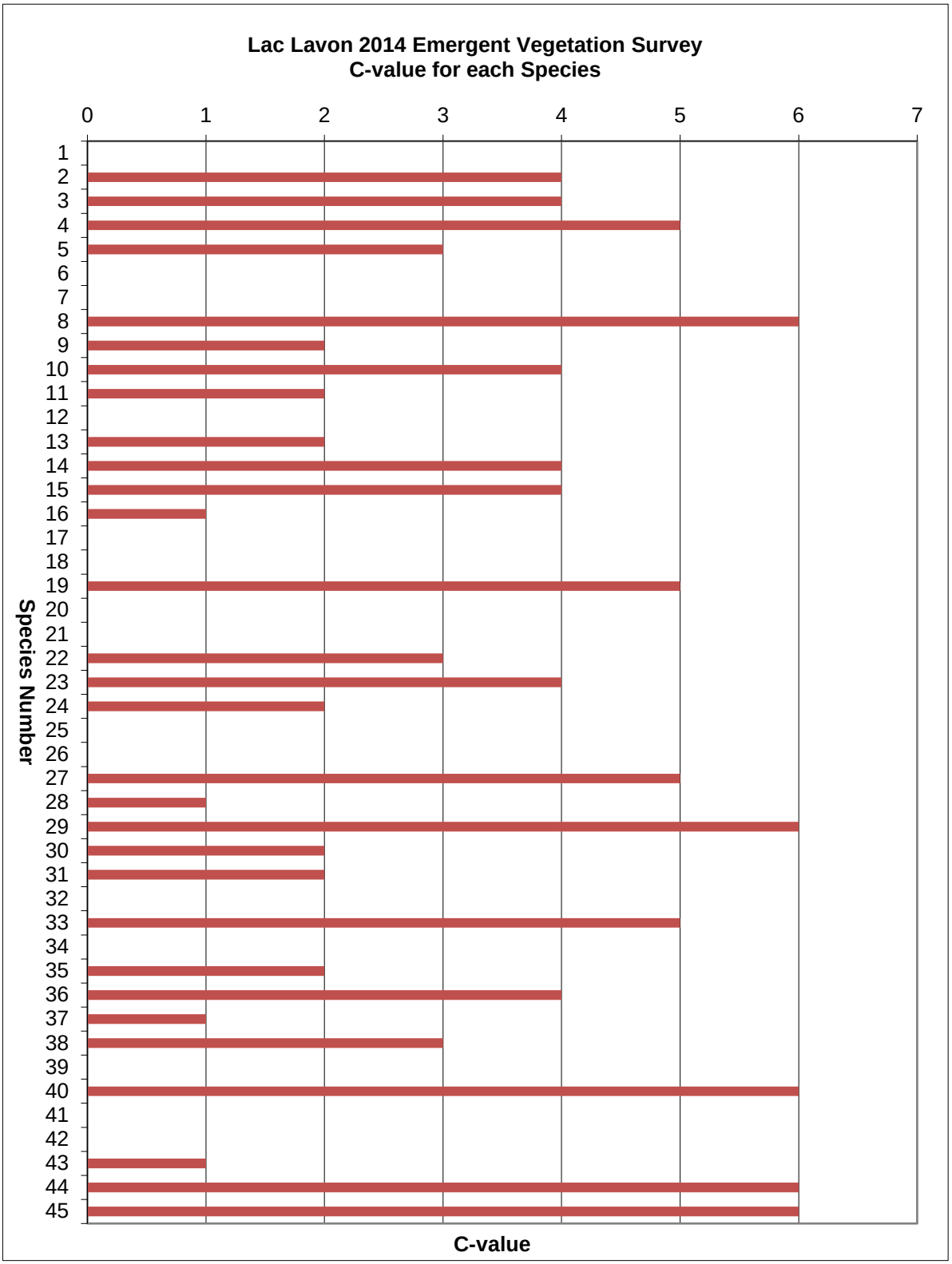
Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Chara sp.	muskgrass	7
Elodea canadensis	elodea	4
Lemna minor	small duckweed	5
Spirodela polyrhiza	large duckweed	5
Myriophyllum spicatum	Eurasian watermilfoil	0
Potamogeton crispus	curlyleaf pondweed	0
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton nodosus	longleaf pondweed	6
Potamogeton pusillus	leafy pondweed	7
Ranunculus longirostris	white water crowfoot	7
Stuckenia pectinatus	sago pondweed	3
Wolffia columbiana	common watrmeal	5
Zosterella dubia	water stargrass	6
Mean C-value		4.5
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		14
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		16.84



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 minor*	small duckweed	5
5	*Spirodela polyrhiza*	large duckweed	5
6	*Myriophyllum spicatum*	Eurasian watermilfoil	0
7	*Potamogeton crispus*	curlyleaf pondweed	0
8	*Potamogeton illinoensis*	Illinois pondweed	6
9	*Potamogeton nodosus*	longleaf pondweed	6
10	*Potamogeton pusillus*	leafy pondweed	7
11	*Ranunculus longirostris*	white water crowfoot	7
12	*Stuckenia pectinatus*	sago pondweed	3
13	*Wolffia columbiana*	common watrmeal	5
14	*Zosterella dubia*	water stargrass	6

2014 Lac Lavon Emergent Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Ambrosia artemisiifolia	common ragweed	0
Asclepias incarnata	swamp milkweed	4
Beckmannia syzigachne	slough grass	4
Carex stricta	Uptight Sedge	5
Carex vulpinoidea	fox sedge	3
Centaurium sp.	knapweed	0
Cirsium arvense	Canada thistle	0
Equisetum pratense	meadow horsetail	6
Erigeron philadelphicus	Philadelphia fleabane	2
Eupatorium perfoliatum	boneset	4
Fraxinus pennsylvanica	green ash	2
Glechoma hederacea	ground ivy	0
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Juncus effusus	soft rush	4
Juncus tenuis	path rush	1
Lactuca serriola	prickly lettuce	0
Lotus corniculatus	bird's-foot trefoil	0
Lycopus uniflorus	northern bugleweed	5
Lythrum salicaria	purple loosestrife	0
Melilotus officinalis	sweet clover	0
Mentha arvensis	wild mint	3
Onoclea sensibilis	sensitive fern	4
Parthenocissus vitacea	woodbine	2
Phalaris arundinacea	reed canarygrass	0
Plantago major	common plantain	0
Poa palustris	fowl bluegrass	5
Populus deltoides	eastern cottonwood	1
Potamogeton nodosus	longleaf pondweed	6
Potentilla simplex	cinquefoil	2
Rhus hirta	smooth sumac	2
Rumex crispus	curly dock	0
Salix amygdaloides	peach leaf willow	5
Salix babilonica	weeping willow	0
Salix interior	sandbar willow	2
Schoenoplectus tabernaemontani	softstem bulrush	4
Solidago canadensis	Canada goldenrod	1
Solidago gigantea	Late Goldenrod	3
Taraxacum officinale	common dandelion	0
Tradescantia sp.	spiderwort	6
Trifolium repens	white clover	0
Typha angustifolia	narrowleaf cattail	0
Urtica dioica	Stinging Nettle	1
Verbena hastata	blue vervain	6
Zizia aurea	golden alexanders	6
Mean C-value		2.3
S (Number of Species of Emergent Plants in the Lake)		45
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		15.65


Lac Lavon 2014 Emergent Vegetation Survey
C-value for each Species
0
1
2
3
4
5
6
7
Species Number
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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37
38
39
40
41
42
43
44
45
C-value

Lac Lavon 2014 Emergent Vegetation Survey

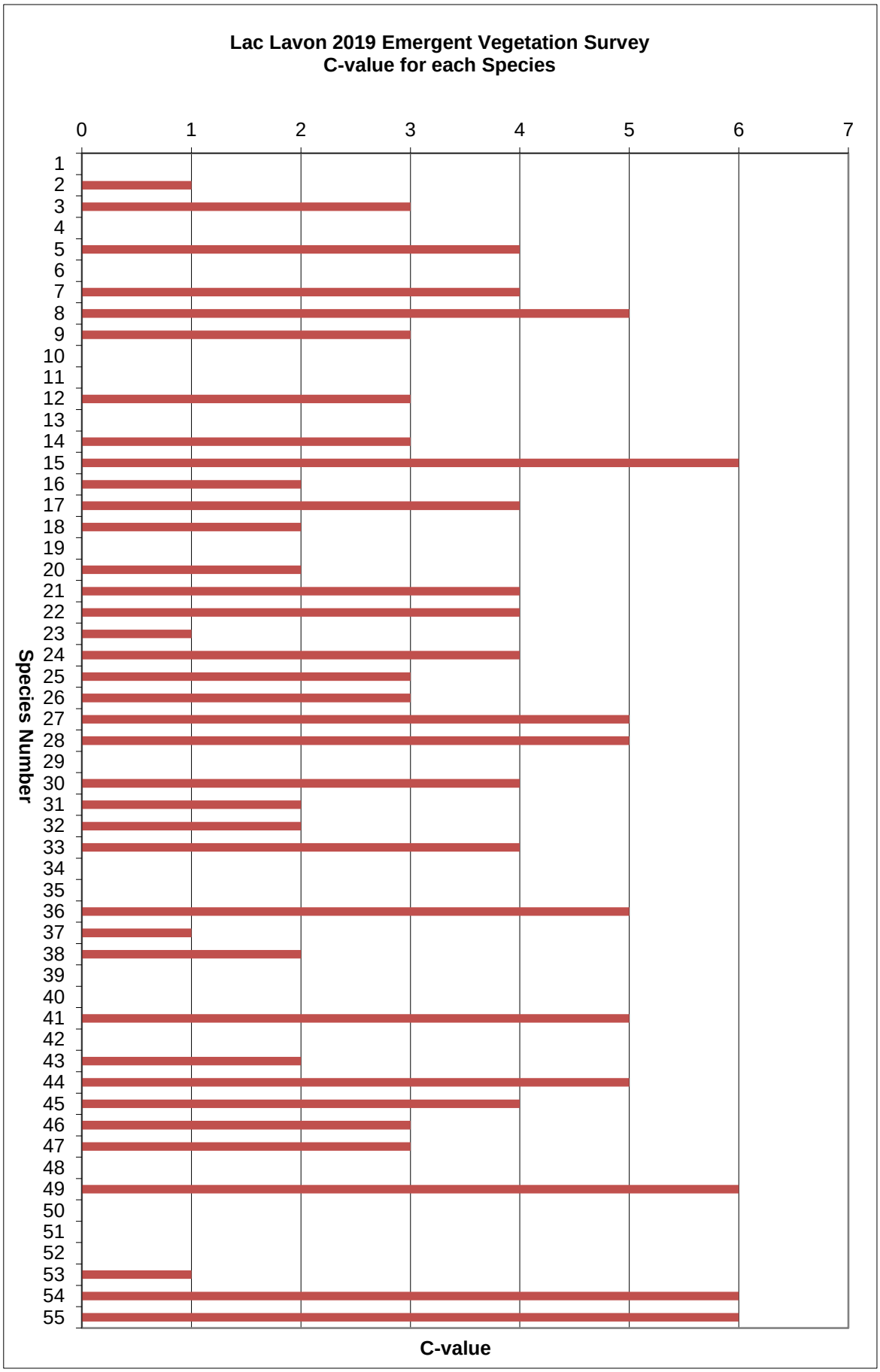
Species Number	Scientific Name	Common Name	C-value
1	*Ambrosia artemisiifolia*	common ragweed	0
2	*Asclepias incarnata*	swamp milkweed	4
3	*Beckmannia syzigachne*	slough grass	4
4	*Carex stricta*	Uptight Sedge	5
5	*Carex vulpinoidea*	fox sedge	3
6	*Centaurium sp.*	knapweed	0
7	*Cirsium arvense*	Canada thistle	0
8	*Equisetum pratense*	meadow horsetail	6
9	*Erigeron philadelphicus*	Philadelphia fleabane	2
10	*Eupatorium perfoliatum*	boneset	4
11	*Fraxinus pennsylvanica*	green ash	2
12	*Glechoma hederacea*	ground ivy	0
13	*Impatiens capensis*	jewelweed	2
14	*Iris versicolor*	harlequin blueflag	4
15	*Juncus effusus*	soft rush	4
16	*Juncus tenuis*	path rush	1
17	*Lactuca serriola*	prickly lettuce	0
18	*Lotus corniculatus*	bird's-foot trefoil	0
19	*Lycopus uniflorus*	northern bugleweed	5
20	*Lythrum salicaria*	purple loosestrife	0
21	*Melilotus officinalis*	sweet clover	0
22	*Mentha arvensis*	wild mint	3
23	*Onoclea sensibilis*	sensitive fern	4
24	*Parthenocissus vitacea*	woodbine	2
25	*Phalaris arundinacea*	reed canarygrass	0
26	*Plantago major*	common plantain	0
27	*Poa palustris*	fowl bluegrass	5
28	*Populus deltoides*	eastern cottonwood	1
29	*Potamogeton nodosus*	longleaf pondweed	6
30	*Potentilla simplex*	cinquefoil	2
31	*Rhus hirta*	smooth sumac	2
32	*Rumex crispus*	curly dock	0
33	*Salix amygdaloides*	peach leaf willow	5
34	*Salix babilonica*	weeping willow	0
35	*Salix interior*	sandbar willow	2
36	*Schoenoplectus tabernaemontani*	softstem bulrush	4
37	*Solidago canadensis*	Canada goldenrod	1
38	*Solidago gigantea*	Late Goldenrod	3
39	*Taraxacum officinale*	common dandelion	0
40	*Tradescantia sp.*	spiderwort	6
41	*Trifolium repens*	white clover	0
42	*Typha angustifolia*	narrowleaf cattail	0
43	*Urtica dioica*	Stinging Nettle	1
44	*Verbena hastata*	blue vervain	6
45	*Zizia aurea*	golden alexanders	6

2019 Lac Lavon Emergent Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Acer ginnala	amur maple	0
Acer negundo	boxelder	1
Acer saccharinum	silver maple	3
Ambrosia artemisiifolia	common ragweed	0
Asclepias incarnata	swamp milkweed	4
Asclepias syriaca	common milkweed	0
Carex comosa	bristly sedge	4
Carex stricta	Uptight Sedge	5
Carex vulpinoidea	fox sedge	3
Centaurium sp.	knapweed	0
Cirsium arvense	Canada thistle	0
Cyperus sp.	flat sedge	3
Echinochloa crus-galli	barnyard grass	0
Eleocharis erythropoda	red rooted spikerush	3
Equisetum pratense	meadow horsetail	6
Erigeron philadelphicus	Philadelphia fleabane	2
Eupatorium perfoliatum	boneset	4
Fraxinus pennsylvanica	green ash	2
Glechoma hederacea	ground ivy	0
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Juncus effusus	soft rush	4
Juncus tenuis	path rush	1
Juncus torreyi	Torrey's rush	4
Laportea canadensis	wood nettle	3
Leersia oryzoides	rice cut grass	3
Lemna minor	small duckweed	5
Lycopus uniflorus	northern bugleweed	5
Lythrum salicaria	purple loosestrife	0
Onoclea sensibilis	sensitive fern	4
Panicum virgatum	switchgrass	2
Parthenocissus vitacea	woodbine	2
Persicaria amphibia	water smartweed	4
Phalaris arundinacea	reed canarygrass	0
Plantago major	common plantain	0
Poa palustris	fowl bluegrass	5
Populus deltoides	eastern cottonwood	1
Potentilla simplex	cinquefoil	2
Rhamnus cathartica	common buckthorn	0
Rumex crispus	curly dock	0
Salix amygdaloides	peach leaf willow	5
Salix babilonica	weeping willow	0
Salix interior	sandbar willow	2
Salix petiolaris	slender willow	5
Schoenoplectus tabernaemontani	softstem bulrush	4
Scirpus cyperinus	woolgrass	3
Solidago gigantea	Late Goldenrod	3
Taraxacum officinale	common dandelion	0
Tradescantia sp.	spiderwort	6

2019 Lac Lavon Emergent Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Trifolium repens	white clover	0
Typha angustifolia	narrowleaf cattail	0
Ulmus pumila	Siberian elm	0
Urtica dioica	Stinging Nettle	1
Verbena hastata	blue vervain	6
Zizia aurea	golden alexanders	6
Mean C-value		2.4
S (Number of Species of Emergent Plants in the Lake)		55
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		17.80


Lac Lavon 2019 Emergent Vegetation Survey
C-value for each Species
0
1
2
3
4
5
6
7
Species Number
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
C-value

Lac Lavon 2019 Emergent Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer ginnala*	amur maple	0
2	*Acer negundo*	boxelder	1
3	*Acer saccharinum*	silver maple	3
4	*Ambrosia artemisiifolia*	common ragweed	0
5	*Asclepias incarnata*	swamp milkweed	4
6	*Asclepias syriaca*	common milkweed	0
7	*Carex comosa*	bristly sedge	4
8	*Carex stricta*	Uptight Sedge	5
9	*Carex vulpinoidea*	fox sedge	3
10	*Centaurium sp.*	knapweed	0
11	*Cirsium arvense*	Canada thistle	0
12	*Cyperus sp.*	flat sedge	3
13	*Echinochloa crus-galli*	barnyard grass	0
14	*Eleocharis erythropoda*	red rooted spikerush	3
15	*Equisetum pratense*	meadow horsetail	6
16	*Erigeron philadelphicus*	Philadelphia fleabane	2
17	*Eupatorium perfoliatum*	boneset	4
18	*Fraxinus pennsylvanica*	green ash	2
19	*Glechoma hederacea*	ground ivy	0
20	*Impatiens capensis*	jewelweed	2
21	*Iris versicolor*	harlequin blueflag	4
22	*Juncus effusus*	soft rush	4
23	*Juncus tenuis*	path rush	1
24	*Juncus torreyi*	Torrey's rush	4
25	*Laportea canadensis*	wood nettle	3
26	*Leersia oryzoides*	rice cut grass	3
27	*Lemna minor*	small duckweed	5
28	*Lycopus uniflorus*	northern bugleweed	5
29	*Lythrum salicaria*	purple loosestrife	0
30	*Onoclea sensibilis*	sensitive fern	4
31	*Panicum virgatum*	switchgrass	2
32	*Parthenocissus vitacea*	woodbine	2
33	*Persicaria amphibia*	water smartweed	4
34	*Phalaris arundinacea*	reed canarygrass	0
35	*Plantago major*	common plantain	0
36	*Poa palustris*	fowl bluegrass	5
37	*Populus deltoides*	eastern cottonwood	1
38	*Potentilla simplex*	cinquefoil	2
39	*Rhamnus cathartica*	common buckthorn	0
40	*Rumex crispus*	curly dock	0
41	*Salix amygdaloides*	peach leaf willow	5
42	*Salix babilonica*	weeping willow	0
43	*Salix interior*	sandbar willow	2
44	*Salix petiolaris*	slender willow	5
45	*Schoenoplectus tabernaemontani*	softstem bulrush	4
46	*Scirpus cyperinus*	woolgrass	3
47	*Solidago gigantea*	Late Goldenrod	3
48	*Taraxacum officinale*	common dandelion	0
49	*Tradescantia sp.*	spiderwort	6
50	*Trifolium repens*	white clover	0
51	*Typha angustifolia*	narrowleaf cattail	0
52	*Ulmus pumila*	Siberian elm	0
53	*Urtica dioica*	Stinging Nettle	1
54	*Verbena hastata*	blue vervain	6
55	*Zizia aurea*	golden alexanders	6

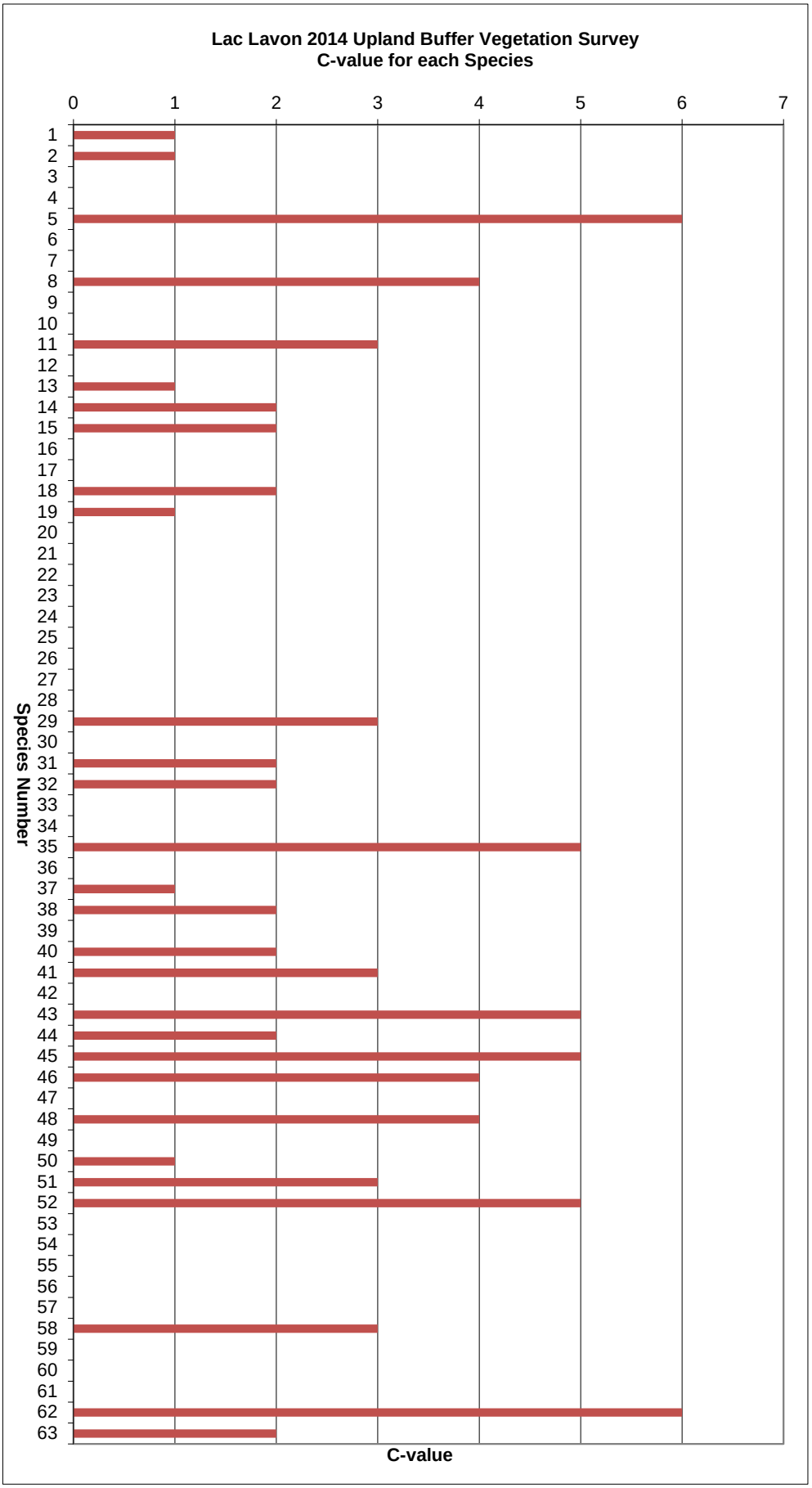
2014 Lac Lavon Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer negundo	boxelder	1
Achillea millefolium	yarrow	1
Arctium minus	burrdock	0
Asclepias syriaca	common milkweed	0
Asclepias tuberosa	butterfly weed	6
Berteroa incana	hoary allysum	0
Bromus inermis	smooth brome	0
Carex comosa	bristly sedge	4
Centaurea biebersteinii	spotted knapweed	0
Cirsium vulgare	bull thistle	0
Cornus alba	red osier dogwood	3
Dactylis glomerata	Orchard Grass	0
Equisetum arvense	field horsetail	1
Erigeron philadelphicus	Philadelphia fleabane	2
Erigeron strigosus	daisy fleabane	2
Euphorbia esula	leafy spurge	0
Frangula alnus	glossy buckthorn	0
Fraxinus pennsylvanica	green ash	2
Galium aparine	cleavers	1
Gleditsia triacanthos	honey locust	0
Lactuca serriola	prickly lettuce	0
Leonorus cardiaca	motherwort	0
Leucanthemum vulgare	daisy	0
Lonicera tatarica	Tatarian honeysuckle	0
Lotus corniculatus	bird's-foot trefoil	0
Lythrum salicaria	purple loosestrife	0
Medicago lupulina	black medic	0
Melilotus officinalis	sweetclover	0
Mentha arvensis	wild mint	3
Nepeta cataria	catnip	0
Panicum virgatum	switchgrass	2
Parthenocissus vitacea	woodbine	2
Phalaris arundinacea	reed canarygrass	0
Phleum pratense	timothy	0
Pinus resinosa	red pine	5
Poa pratensis	Kentucky bluegrass	0
Populus deltoides	cottonwood	1
Potentilla simplex	cinquefoil	2
Rhamnus cathartica	common buckthorn	0
Rhus hirta	smooth sumac	2
Rudbeckia hirta	black eyed Susan	3
Rumex crispus	curly dock	0
Salix amygdaloides	peach leaf willow	5
Salix interior	sandbar willow	2

2014 Lac Lavon Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Salix lucida	shinging willow	5
Salix nigra	black willow	4
Silene latifolia	bladder campion	0
Silphium perfoliatum	cup plant	4
Solanum dulcamara	climbing nightshade	0
Solidago canadensis	Canada goldenrod	1
Solidago gigantea	Late Goldenrod	3
Sorghastrum nutans	Indian grass	5
Taraxacum officinale	common dandelion	0
Trifolium hybridum	alsike clover	0
Trifolium pratense	red clover	0
Trifolium procumbens	hop clover	0
Trifolium repens	white clover	0
Ulmus americana	American elm	3
Ulmus pumila	Siberian elm	0
Verbascum thapsus	mullein	0
Vicia sativa	vetch	0
*Viola sp. **	violet	6
Vitis riparia	wild grape	2
Mean C-value		1.3
S (Number of Species of Upland Buffer Plants)		63
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		10.46

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


Lac Lavon 2014 Upland Buffer Vegetation Survey
C-value for each Species
0
1
2
3
4
5
6
7
Species Number
1
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62
63
C-value

Lac Lavon 2014 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Achillea millefolium*	yarrow	1
3	*Arctium minus*	burrdock	0
4	*Asclepias syriaca*	common milkweed	0
5	*Asclepias tuberosa*	butterfly weed	6
6	*Berteroa incana*	hoary allysum	0
7	*Bromus inermis*	smooth brome	0
8	*Carex comosa*	bristly sedge	4
9	*Centaurea biebersteinii*	spotted knapweed	0
10	*Cirsium vulgare*	bull thistle	0
11	*Cornus alba*	red osier dogwood	3
12	*Dactylis glomerata*	Orchard Grass	0
13	*Equisetum arvense*	field horsetail	1
14	*Erigeron philadelphicus*	Philadelphia fleabane	2
15	*Erigeron strigosus*	daisy fleabane	2
16	*Euphorbia esula*	leafy spurge	0
17	*Frangula alnus*	glossy buckthorn	0
18	*Fraxinus pennsylvanica*	green ash	2
19	*Galium aparine*	cleavers	1
20	*Gleditsia triacanthos*	honey locust	0
21	*Lactuca serriola*	prickly lettuce	0
22	*Leonorus cardiaca*	motherwort	0
23	*Leucanthemum vulgare*	daisy	0
24	*Lonicera tatarica*	Tatarian honeysuckle	0
25	*Lotus corniculatus*	bird's-foot trefoil	0
26	*Lythrum salicaria*	purple loosestrife	0
27	*Medicago lupulina*	black medic	0
28	*Melilotus officinalis*	sweetclover	0
29	*Mentha arvensis*	wild mint	3
30	*Nepeta cataria*	catnip	0
31	*Panicum virgatum*	switchgrass	2
32	*Parthenocissus vitacea*	woodbine	2
33	*Phalaris arundinacea*	reed canarygrass	0
34	*Phleum pratense*	timothy	0
35	*Pinus resinosa*	red pine	5
36	*Poa pratensis*	Kentucky bluegrass	0
37	*Populus deltoides*	cottonwood	1
38	*Potentilla simplex*	cinquefoil	2
39	*Rhamnus cathartica*	common buckthorn	0
40	*Rhus hirta*	smooth sumac	2
41	*Rudbeckia hirta*	black eyed Susan	3
42	*Rumex crispus*	curly dock	0
43	*Salix amygdaloides*	peach leaf willow	5
44	*Salix interior*	sandbar willow	2
45	*Salix lucida*	shinging willow	5
46	*Salix nigra*	black willow	4
47	*Silene latifolia*	bladder campion	0
48	*Silphium perfoliatum*	cup plant	4
49	*Solanum dulcamara*	climbing nightshade	0
50	*Solidago canadensis*	Canada goldenrod	1
51	*Solidago gigantea*	Late Goldenrod	3
52	*Sorghastrum nutans*	Indian grass	5
53	*Taraxacum officinale*	common dandelion	0
54	*Trifolium hybridum*	alsike clover	0
55	*Trifolium pratense*	red clover	0
56	*Trifolium procumbens*	hop clover	0
57	*Trifolium repens*	white clover	0
58	*Ulmus americana*	American elm	3
59	*Ulmus pumila*	Siberian elm	0
60	*Verbascum thapsus*	mullein	0
61	*Vicia sativa*	vetch	0
62	*Viola sp. **	violet	6
63	*Vitis riparia*	wild grape	2

2019 Lac Lavon Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer negundo	boxelder	1
Acer rubrum	red maple	3
Achillea millefolium	yarrow	1
Ageratina altissima	white snakeroot	2
Ambrosia artemisiifolia	common ragweed	0
Ambrosia trifida	great ragweed	0
Andropogon gerardii	big bluestem	4
Apocynum cannabinum	dogbane	3
Arctium minus	burrdock	0
Aronia melanocarpa ***	black chokeberry	7
Asclepias incarnata	swamp milkweed	4
Asclepias syriaca	common milkweed	0
Asclepias tuberosa	butterfly weed	6
Baptisia alba	white wild indigo	8
Berteroa incana	hoary allysum	0
Bouteloua curtipendula	side oats grama	6
Bromus inermis	smooth brome	0
Carex comosa	bristly sedge	4
Carex pensylvanica ***	Pennsylvania sedge	3
Centaurea biebersteinii	spotted knapweed	0
Chamecrista fasciculata	partridge pea	2
Cirsium vulgare	bull thistle	0
Cornus alba	red osier dogwood	3
Cornus racemosa	gray dogwood	2
Dactylis glomerata	Orchard Grass	0
Daucus carota	Queen Anne's lace	0
Echnacea purpurea **	purple coneflower	10
Equisetum arvense	field horsetail	1
Erigeron strigosus	daisy fleabane	2
Euphorbia esula	leafy spurge	0
Eutrochium maculatum	joe pye weed	4
Frangula alnus	glossy buckthorn	0
Fraxinus pennsylvanica	green ash	2
Galium aparine	cleavers	1
Geum triflorum	prairie smoke	7
Glechoma hederacea	ground ivy	0
Gleditsia triacanthos	honey locust	0
Hackelia virginiana	Virginia stickseed	1
Helianthus grosseserratus	sawtooth sunflower	3
Hemerocallis sp.	day lily	0
Hosta sp.	hosta	0
Impatiens capensis	jewelweed	2
Juglans nigra	black walnut	4
Laportea canadensis	wood nettle	3

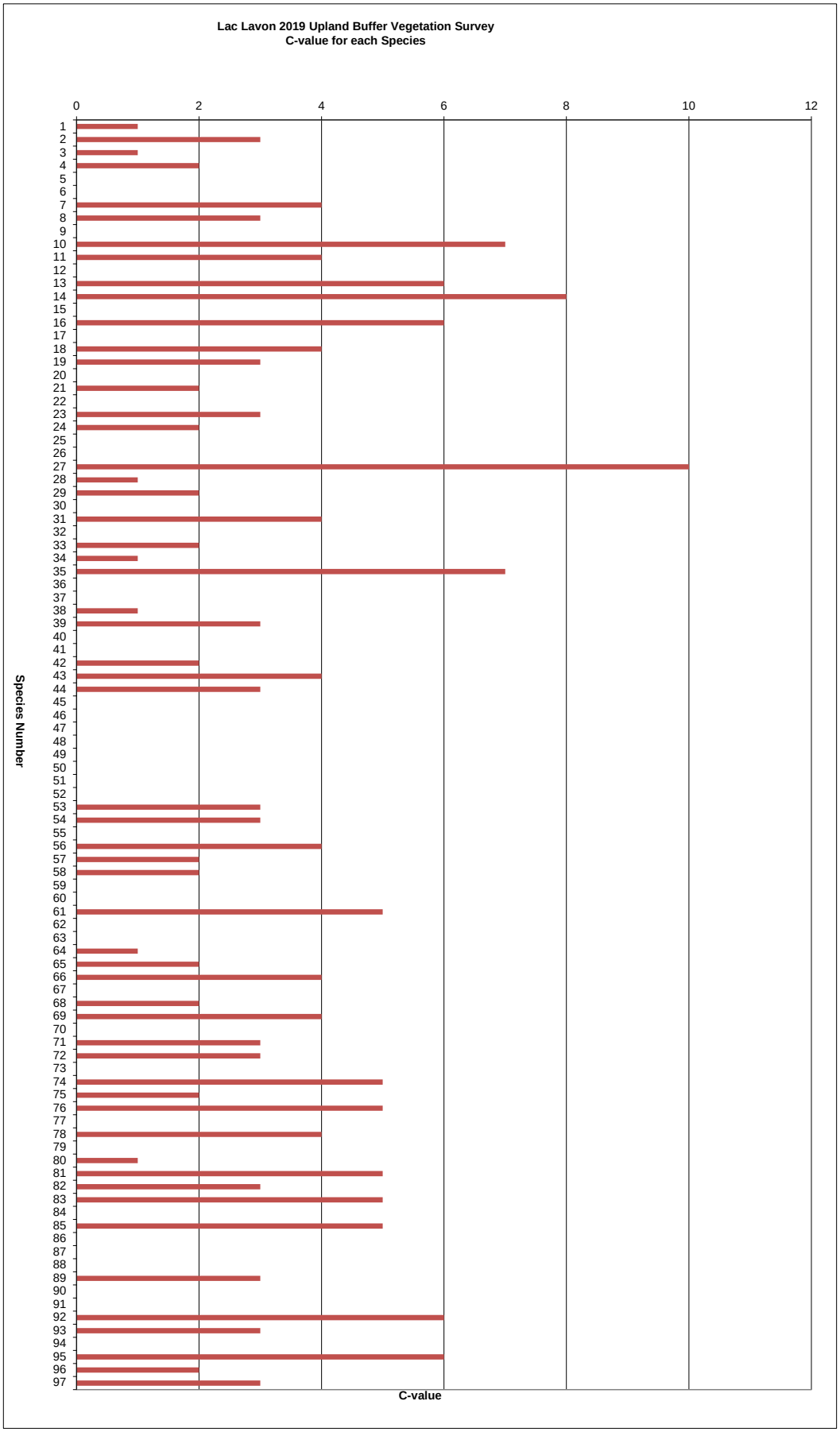
2019 Lac Lavon Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Leonorus cardiaca	motherwort	0
Leucanthemum vulgare	daisy	0
Lonicera tatarica	Tatarian honeysuckle	0
Lotus corniculatus	bird's-foot trefoil	0
Lythrum salicaria	purple loosestrife	0
Malus sp.	apple	0
Medicago lupulina	black medic	0
Melilotus officinalis	sweetclover	0
Mentha arvensis	wild mint	3
Monarda fistulosa	wild bergamot	3
Nepeta cataria	catnip	0
Oligoneuron rigidum	stiff goldenrod	4
Panicum virgatum	switchgrass	2
Parthenocissus vitacea	woodbine	2
Phalaris arundinacea	reed canarygrass	0
Phleum pratense	timothy	0
Pinus resinosa	red pine	5
Plantago major	common plantain	0
Poa pratensis	Kentucky bluegrass	0
Populus deltoides	cottonwood	1
Potentilla simplex	cinquefoil	2
Ratbida pinnata ***	globular coneflower	4
Rhamnus cathartica	common buckthorn	0
Rhus hirta	smooth sumac	2
Ribes americanum	wild black currant	4
Rosa sp.	rose	0
Rubus idaeus	red raspberry	3
Rudbeckia hirta	black eyed Susan	3
Rumex crispus	curly dock	0
Salix amygdaloides	peach leaf willow	5
Salix interior	sandbar willow	2
Schizachyrium scoparium	little bluestem	5
Silene latifolia	bladder campion	0
Silphium perfoliatum	cup plant	4
Solanum dulcamara	climbing nightshade	0
Solidago canadensis	Canada goldenrod	1
Solidago flexicaulis	zigzag goldenrod	5
Solidago gigantea	Late Goldenrod	3
Solidago speciosa	showy goldenrod	5
Sonchus arvensis	sow thistle	0
Sorghastrum nutans	Indian grass	5
Taraxacum officinale	common dandelion	0
Trifolium hybridum	alsike clover	0
Trifolium pratense	red clover	0

2019 Lac Lavon Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ulmus americana	American elm	3
Ulmus pumila	Siberian elm	0
Verbascum thapsus	mullein	0
Verbena hastata	blue vervain	6
Verbena stricta ***	hoary vervain	3
Vicia sativa	vetch	0
Viola sp. *	violet	6
Vitis riparia	wild grape	2
Zanthoxylum americanum	common prickly ash	3
Mean C-value		2.0
S (Number of Species of Upland Buffer Plants)		97
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		19.80

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


Lac Lavon 2019 Upland Buffer Vegetation Survey
C-value for each Species
0
2
4
6
8
10
12
Species Number
C-value

Lac Lavon 2019 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Acer rubrum*	red maple	3
3	*Achillea millefolium*	yarrow	1
4	*Ageratina altissima*	white snakeroot	2
5	*Ambrosia artemisiifolia*	common ragweed	0
6	*Ambrosia trifida*	great ragweed	0
7	*Andropogon gerardii*	big bluestem	4
8	*Apocynum cannabinum*	dogbane	3
9	*Arctium minus*	burrdock	0
10	Aronia melanocarpa ***	black chokeberry	7
11	*Asclepias incarnata*	swamp milkweed	4
12	*Asclepias syriaca*	common milkweed	0
13	*Asclepias tuberosa*	butterfly weed	6
14	*Baptisia alba*	white wild indigo	8
15	*Berteroa incana*	hoary allysum	0
16	*Bouteloua curtipendula*	side oats grama	6
17	*Bromus inermis*	smooth brome	0
18	*Carex comosa*	bristly sedge	4
19	*Carex pensylvanica* ***	Pennsylvania sedge	3
20	*Centaurea biebersteinii*	spotted knapweed	0
21	*Chamecrista fasciculata*	partridge pea	2
22	*Cirsium vulgare*	bull thistle	0
23	*Cornus alba*	red osier dogwood	3
24	*Cornus racemosa*	gray dogwood	2
25	*Dactylis glomerata*	Orchard Grass	0
26	*Daucus carota*	Queen Anne's lace	0
27	*Echnacea purpurea* **	purple coneflower	10
28	*Equisetum arvense*	field horsetail	1
29	*Erigeron strigosus*	daisy fleabane	2
30	*Euphorbia esula*	leafy spurge	0
31	*Eutrochium maculatum*	joe pye weed	4
32	*Frangula alnus*	glossy buckthorn	0
33	*Fraxinus pennsylvanica*	green ash	2
34	*Galium aparine*	cleavers	1
35	*Geum triflorum*	prairie smoke	7
36	*Glechoma hederacea*	ground ivy	0
37	*Gleditsia triacanthos*	honey locust	0
38	*Hackelia virginiana*	Virginia stickseed	1
39	*Helianthus grosseserratus*	sawtooth sunflower	3
40	*Hemerocallis sp.*	day lily	0
41	*Hosta sp.*	hosta	0
42	*Impatiens capensis*	jewelweed	2
43	*Juglans nigra*	black walnut	4
44	*Laportea canadensis*	wood nettle	3
45	*Leonorus cardiaca*	motherwort	0
46	*Leucanthemum vulgare*	daisy	0
47	*Lonicera tatarica*	Tatarian honeysuckle	0
48	*Lotus corniculatus*	bird's-foot trefoil	0
49	*Lythrum salicaria*	purple loosestrife	0
50	*Malus sp.*	apple	0
51	*Medicago lupulina*	black medic	0
52	*Melilotus officinalis*	sweetclover	0
53	*Mentha arvensis*	wild mint	3
54	*Monarda fistulosa*	wild bergamot	3
55	*Nepeta cataria*	catnip	0
56	*Oligoneuron rigidum*	stiff goldenrod	4
57	*Panicum virgatum*	switchgrass	2
58	*Parthenocissus vitacea*	woodbine	2
59	*Phalaris arundinacea*	reed canarygrass	0
60	*Phleum pratense*	timothy	0
61	*Pinus resinosa*	red pine	5
62	*Plantago major*	common plantain	0
63	*Poa pratensis*	Kentucky bluegrass	0
64	*Populus deltoides*	cottonwood	1
65	*Potentilla simplex*	cinquefoil	2
66	*Ratbida pinnata* ***	globular coneflower	4
67	*Rhamnus cathartica*	common buckthorn	0
68	*Rhus hirta*	smooth sumac	2
69	*Ribes americanum*	wild black currant	4
70	*Rosa sp.*	rose	0
71	*Rubus idaeus*	red raspberry	3
72	*Rudbeckia hirta*	black eyed Susan	3
73	*Rumex crispus*	curly dock	0
74	*Salix amygdaloides*	peach leaf willow	5
75	*Salix interior*	sandbar willow	2
76	*Schizachyrium scoparium*	little bluestem	5
77	*Silene latifolia*	bladder campion	0
78	*Silphium perfoliatum*	cup plant	4
79	*Solanum dulcamara*	climbing nightshade	0
80	*Solidago canadensis*	Canada goldenrod	1
81	*Solidago flexicaulis*	zigzag goldenrod	5
82	*Solidago gigantea*	Late Goldenrod	3
83	*Solidago speciosa*	showy goldenrod	5
84	*Sonchus arvensis*	sow thistle	0
85	*Sorghastrum nutans*	Indian grass	5
86	*Taraxacum officinale*	common dandelion	0
87	*Trifolium hybridum*	alsike clover	0
88	*Trifolium pratense*	red clover	0
89	*Ulmus americana*	American elm	3
90	*Ulmus pumila*	Siberian elm	0
91	*Verbascum thapsus*	mullein	0
92	*Verbena hastata*	blue vervain	6
93	*Verbena stricta* ***	hoary vervain	3
94	*Vicia sativa*	vetch	0
95	*Viola sp.* *	violet	6
96	*Vitis riparia*	wild grape	2
97	*Zanthoxylum americanum*	common prickly ash	3

Community #1

Eggers & Reed Plant Community Type: Shallow Open Water

Percent of AA Occupied by Type: 70

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	4	> 25 - 50%	37.5	Native	Aquatic	OBL	OBL	OBL	2	0.6	1.2
2	Elodea canadensis	Canadian Waterweed	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	4	0.048	0.192
3	Spirodela polyrhiza	Common Duckmeat	1	> 0 - 1%	0.5	Native	Aquatic	OBL	OBL	OBL	5	0.008	0.04
4	Potamogeton crispus	Curly Pondweed	3	> 5 - 25%	15	Introduced	Aquatic	OBL	OBL	OBL	0	0.24	0
5	Wolffia columbiana	Columbian Watermeal	1	> 0 - 1%	0.5	Native	Aquatic	OBL	OBL	OBL	5	0.008	0.04
6	Ranunculus longirostris	Long-Beak Water-Crowfoot	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	7	0.048	0.336
7	Stuckenia pectinata	Sago False Pondweed	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	3	0.048	0.144
8		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
9		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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
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 #2

Eggers & Reed Plant Community Type: Shrub Carr

Percent of AA Occupied by Type: 5

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	0.0179	0.0179
2	Acer saccharinum	Silver Maple	2	> 1 - 5%	3	Native	Tree	FAC	FACW	FACW	3	0.0179	0.0537
3	Fraxinus pennsylvanica	Green Ash	2	> 1 - 5%	3	Native	Tree	FAC	FACW	FACW	2	0.0179	0.0358
4	Laportea canadensis	Canadian Wood-Nettle	2	> 1 - 5%	3	Native	Herb	FAC	FACW	FACW	3	0.0179	0.0537
5	Lactuca serriola	Prickly Lettuce	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FACU	FACU	0	0.003	0
6	Parthenocissus inserta	Thicket-Creeper	1	> 0 - 1%	0.5	Native	Woody Vine	FAC	FACU	FACU	2	0.003	0.006
7	Populus deltoides	Eastern Cottonwood	2	> 1 - 5%	3	Native	Tree	FAC	FAC	FAC	1	0.0179	0.0179
8	Rhamnus cathartica	European Buckthorn	3	> 5 - 25%	15	Introduced	Shrub	FACU	FAC	FAC	0	0.0896	0
9	Onoclea sensibilis	Sensitive Fern	2	> 1 - 5%	3	Native	Herb	FACW	FACW	FACW	4	0.0179	0.0716
10	Urtica dioica	Stinging Nettle	2	> 1 - 5%	3	Native	Herb	FAC	FACW	FAC	1	0.0179	0.0179
11	Salix amygdaloides	Peach-Leaf Willow	4	> 25 - 50%	37.5	Native	Tree	FACW	FACW	FACW	5	0.2239	1.1194
12	Salix interior	Sandbar Willow	4	> 25 - 50%	37.5	Native	Shrub	FACW	FACW	FACW	2	0.2239	0.4478
13	Salix petiolaris	Meadow Willow	4	> 25 - 50%	37.5	Native	Shrub	OBL	OBL	FACW	5	0.2239	1.1194
14	Verbena hastata	Simpler's-Joy	2	> 1 - 5%	3	Native	Herb	FACW	FACW	FACW	6	0.0179	0.1075
15	Schoenoplectus tabernaemontani	Soft-Stem Club-Rush	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	4	0.0179	0.0716
16	Carex vulpinoidea	Common Fox Sedge	2	> 1 - 5%	3	Native	Herb	FACW	FACW	OBL	3	0.0179	0.0537
17	Lycopus uniflorus	Northern Water-Horehound	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	5	0.0179	0.0896
18	Rumex crispus	Curly Dock	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FAC	FAC	0	0.003	0
19	Taraxacum officinale	Common Dandelion	1	> 0 - 1%	0.5	Introduced	Herb	FACU	FACU	FACU	0	0.003	0
20		#N/A	1	> 0 - 1%	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.003	#N/A
21		#N/A	1	> 0 - 1%	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.003	#N/A
22		#N/A	1	> 0 - 1%	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.003	#N/A
23		#N/A	2	> 1 - 5%	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.0179	#N/A
24		#N/A	1	> 0 - 1%	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.003	#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
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: Fresh Meadow

Percent of AA Occupied by Type: 5

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	Ambrosia artemisiifolia	Annual Ragweed	2	> 1 - 5%	3	Native	Herb	FACU	FACU	FACU	0	0.0216	0
2	Asclepias incarnata	Swamp Milkweed	2	> 1 - 5%	3	Native	Herb	FACW	OBL	OBL	4	0.0216	0.0863
3	Carex comosa	Bearded Sedge	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	4	0.0216	0.0863
4	Carex stricta	Uptight Sedge	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	5	0.0216	0.1079
5	Carex vulpinoidea	Common Fox Sedge	2	> 1 - 5%	3	Native	Herb	FACW	FACW	OBL	3	0.0216	0.0647
6	Cirsium arvense	Canadian Thistle	2	> 1 - 5%	3	Introduced	Herb	FACU	FACU	FACU	0	0.0216	0
7	Cyperus esculentus	Chufa	1	> 0 - 1%	0.5	Introduced	Herb	FACW	FACW	FACW	0	0.0036	0
8	Echinochloa crus-galli	Large Barnyard Grass	2	> 1 - 5%	3	Introduced	Herb	FAC	FACW	FAC	0	0.0216	0
9	Eupatorium perfoliatum	Common Boneset	2	> 1 - 5%	3	Native	Herb	FACW	OBL	FACW	4	0.0216	0.0863
10	Impatiens capensis	Spotted Touch-Me-Not	2	> 1 - 5%	3	Native	Herb	FACW	FACW	FACW	2	0.0216	0.0432
11	Iris versicolor	Harlequin Blueflag	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0036	0.0144
12	Leersia oryzoides	Rice Cut Grass	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	3	0.0216	0.0647
13	Lycopus uniflorus	Northern Water-Horehound	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0036	0.018
14	Lythrum salicaria	Purple Loosestrife	3	> 5 - 25%	15	Introduced	Herb	OBL	OBL	OBL	0	0.1079	0
15	Onoclea sensibilis	Sensitive Fern	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	4	0.0036	0.0144
16	Panicum virgatum	Wand Panic Grass	2	> 1 - 5%	3	Native	Herb	FAC	FAC	FAC	2	0.0216	0.0432
17	Persicaria amphibia	Water Smartweed	2	> 1 - 5%	3	Native	Aquatic, Herb	OBL	OBL	OBL	4	0.0216	0.0863
18	Phalaris arundinacea	Reed Canary Grass	3	> 5 - 25%	15	Introduced	Herb	FACW	FACW	FACW	0	0.1079	0
19	Poa palustris	Fowl Blue Grass	2	> 1 - 5%	3	Native	Herb	FACW	FACW	FACW	5	0.0216	0.1079
20	Rumex crispus	Curly Dock	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FAC	FAC	0	0.0036	0
21	Schoenoplectus tabernaemontani	Soft-Stem Club-Rush	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	4	0.0216	0.0863
22	Scirpus cyperinus	Cottongrass Bulrush	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	3	0.0216	0.0647
23	Solidago gigantea	Late Goldenrod	3	> 5 - 25%	15	Native	Herb	FAC	FACW	FACW	3	0.1079	0.3237
24	Taraxacum officinale	Common Dandelion	2	> 1 - 5%	3	Introduced	Herb	FACU	FACU	FACU	0	0.0216	0
25	Typha angustifolia	Narrow-Leaf Cat-Tail	4	> 25 - 50%	37.5	Introduced	Herb	OBL	OBL	OBL	0	0.2698	0
26	Verbena hastata	Simpler's-Joy	2	> 1 - 5%	3	Native	Herb	FACW	FACW	FACW	6	0.0216	0.1295
27	Zizia aurea	Golden Alexanders	2	> 1 - 5%	3	Native	Herb	FAC	FAC	FAC	6	0.0216	0.1295
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
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

Metric Summary & Community Assessments

	Community #1	Community #2	Community #3
Community Type	Shallow Open Water	Shrub Carr	Fresh Meadow
wC	2.0	3.3	1.6
Numerical Condition Category	3	3	3
Condition Category	Fair	Fair	Fair
Additional Metrics			
Native Species Richness	6	15	19
Introduced Species Richness	1	4	8
Mean C	3.7	2.5	2.6
FQI	9.1	9.6	11.5
Total Midpoint % Cover	62.5	167.5	139
Total Introduced Spp. Cover	15	16.5	77.5
Proportion of Introduced Cover	0.24	0.10	0.56

Overall Assessment

Community #	Community Type	*wC*	Condition Category	Numerical Category	Proportion of AA	Proportion x Numerical Category
1	Shallow Open Water	2.0	Fair	3	0.7	2.1
2	Shrub Carr	3.3	Fair	3	0.05	0.15
3	Fresh Meadow	1.6	Fair	3	0.05	0.15

Weighted Average Numerical Category for AA **2**

Overall AA Condition **Good**

Appendix C

2003-2018 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: Keller Lake 2015 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

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]
0%	**Poor**	90%	1.3 (Moderate)	2 (Poor)	1.5 (Poor)	2	1.8 (Moderate)	2.2

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]
High	10%	51-75% (High)	28 (Excellent)	2.3 (Poor)	8	26-50% (High)

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]		
Moderate	25-50 ft. (High)	>95% (High)	20 (Moderate)	1.6 (Poor)	76-100% (Excellent)	10	>40% (Poor)	0-10%	No

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Table 1: Keller Lake 2015 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2015 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake only in 2011 - Conduct a meandering survey of submergent, emergent, and upland buffer zones rather than monitoring of plot locations. Orchard Lake only in 2012, Crystal Lake only in 2013, Lac Lavon only in 2014, Keller Lake only 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 2015 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 2015 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 utilizing a 6-tined hook; 1 = light density (plant species found on only 1 tine), 2 = moderate density (plant species found on 2 to 4 tines), 3 = heavy density (plant species found on 5 or 6 tines).

[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 2015 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 2015 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: Kingsley Lake 2011 and 2016 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)

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)

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

Table 1: Kingsley Lake 2016 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2016 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 - 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 2016 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 2016 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 utilizing a 6-tined hook; 1 = light density (plant species found on only 1 tine), 2 = moderate density (plant species found on 2 to 4 tines), 3 = heavy density (plant species found on 5 or 6 tines).

[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 2016 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 2016 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%.

Appendix D

2003–2018 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.

Appendix E

2014 Lac Lavon MNRAM 3.4 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
Lac Lavon	Depressional/Isolated (no discernable inlets or outlets), Lacustrine Fringe (edge of deepwater areas)/Shoreland	0.65	0.52	0.63	0.69	0.36
		Moderate	Moderate	Moderate	High	Moderate

						Additional Information			
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	Wetland Restoration Potential	Wetland Sensitivity to Stormwater and Urban Development	Additional Stormwater Treatment Needs
Lac Lavon	0.50	0.68	0.05	0.76	0.00	Combination Discharge, Recharge	0.00	0.50	0.69
	Moderate	High	Low	High	Not Applicable		Not Applicable	Moderate	High

Wetland Community Summary

		Vegetative Diversity/Integrity							
		Community							
Wetland Name	Location	Cowardin Classification	Circular 39	Plant Community	Wetland Proportion	Individual Community Rating	Highest Wetland Rating	Average Wetland Rating	Weighted Average Wetland Rating
Lac Lavon	19-114-21-11-001	L2UBGh	Type 5	Shallow, Open Water Communities	95	0.5	0.50	0.50	0.50
							Moderate	Moderate	Moderate
		PSS1B	Type 6	Shrub Carr	5	0.5	0.50	0.50	0.50
							Moderate	Moderate	Moderate
					100		0.50	0.50	0.50

☑ *Denotes incomplete calculation data.*

Management Classification Report for Lac Lavon **DWMO Strategic Waterbodies**

ID: 4

DAKOTA County
Minnesota (Shakopee) Watershed, #33
Corps Bank Service Area 9

Based on the MnRAM data input from field and office review and using the classification settings as shown below, this wetland is classified as Manage 1

Functional rank of this wetland based on MnRAM data	Functional Category	Self-defined classification value settings for this management level
Moderate	Vegetative Diversity/Integrity	High
Moderate	Habitat Structure (wildlife)	High
Low	Amphibian Habitat	Moderate
High	Fish Habitat	High
Moderate	Shoreline Protection	Moderate
High	Aesthetic/Cultural/Rec/Ed and Habitat	High / Moderate
Moderate	Stormwater/Urban Sensitivity and Vegetative Diversity	High / Moderate
High	Wetland Water Quality and Vegetative Diversity	High / Moderate
Moderate	Characteristic Hydrology and Vegetative Diversity	High / Moderate
Moderate	Flood/Stormwater Attenuation*	-
Not Applicable	Commericial use*	High
Moderate	Downstream Water Quality*	-

The critical function that caused this wetland to rank as **Manage 1** was
Maintenance of Characteristic Fish Habitat

Details of the formula for this action are shown below:

Maintenance of Characteristic Fish Habitat **[Q46*2)+Q24+Q18+Q20R+Q28+Q30+Q31+Q33R]/9**

Question	*Value*	*Description*
18	1	Sediment delivery
20	1	Stormwater runoff
24	0.425	Adjacent area Management
28	1	Nutrient loading
30	0.1	Shoreline rooted vegetation (%cover)
31	0.1	Shoreline wetland in-water width
33	0.5	Shoreline erosion potential
46	1	Fish habitat quality

* The classification value settings for these functions are not adjustable

Management Classification Report for Lac Lavon

ID: 4

DWMO Strategic Waterbodies

DAKOTA County
Minnesota (Shakopee) Watershed, # 33
Corps Bank Service Area 9

This report was printed on: Thursday, November 20, 2014

* The classification value settings for these functions are not adjustable

MnRAM Site Assessment Report

Thursday, November 20, 2014

Wetland: Lac Lavon **Project: BDWMO Strategic Waterbodies**

Wetland ID: 4, Township 114, Section 11, Range 21, , ,

DAKOTA County, Minnesota (Shakopee) Watershed, Corps Bank Service Area #9

Assessment Purpose: Inventory

A site visit was made to this wetland on 7/2/2014 by KSW. Site conditions were Normal. This wetland is estimated to cover 60 acres.

This report reflects conditions on the ground at the date of the assessment and, unless noted or implicit in the standard questions, does not reflect speculation on the future or past conditions.

This wetland is located in or near the city of Lakeville

General Features

Hydrogeomorphology

The maximum water depth at this site is 120 inches, with 95 percent inundated. With an immedidate drainage area of 185 acres, it is doubtful that this wetland is sustainable given its small catchment area.

As a Depressional/Isolated wetland, this site has no discernable inlets or outlets. As such, t is valued for its ability to store water, especially if located lower in the watershed. If it does not already have invasive species in the plant community, its lack of connection to upstream sites with such species may protect it.

As a Lacustrine Fringe wetland, this site located at the edge of deepwater areas and may be considered shoreland. As such, it protects from possible erosive wave effects and may be used as a spawning area for fish.

This wetland has been drained or altered 0% from its original size of 60 acres.

Soils

The soils in the immediate wetland area are primarily Pits, gravel. The adjacent upland, to about 500 feet, is Wadena loam, 2 to 6 percent slopes.

Vegetation and Upland Buffer

The extent of vegetation in this wetland is about 50 percent and the naturalized buffer width averages 5 feet. Vegetated buffers around wetlands provide multiple benefits including wildlife habitat, erosion protection, and a reduction in surface water runoff.

This buffer provides very little, if any, protection of water quality or habitat for wildlife.

As a shoreline wetland, this site has the potential to protect from erosion and provide spawning and nursery habitat for fish and wildlife. Wetlands located in areas with strong currents and wave action have the greatest potential for protecting shoreline. Shorelines composed of sandy or erodible soils will benefit the most from shoreline wetland protection.

Special Features

F Public park, forest, trail or recreation area.

K Local Shoreland Management Plan area.

M Shoreland area identified in a zoning ordinance.

Vegetative Communities

The following plant communities were observed:

(See Appendix A for details on the Dominant Species per plant community)

Shallow, Ow Communities Type 5, L2UBGh. This community had a vegetative index of moderate and comprised 95 percent of the entire area.

Shrub-carr Type 6, PSS1B. This community had a vegetative index of moderate and comprised 5 percent of the entire area.

The highest rated community was the Shallow Marsh community rated at 0.5. Averaging all the communities together, the Vegetative Diversity and Integrity of this wetland is Moderate. A more accurate look uses a weighted average; using this method, this site shows a Moderate Vegetative Diversity and Integrity.

The weighted average provides the best measure for an entire wetland. Plant communities at this site are, overall, of average quality. Individual community ratings should be examined to provide a complete picture of possible high-value communities or smaller-but-poor-quality segments that might degrade the site over time.

Functional Ratings

Function	*Rating*	*Comment*
Vegetative Diversity	Moderate	Moderate-functioning vegetative communities indicate a presence of native wetland species with substantial non-native or invasive species.
Additional stormwater treatment needs	High	Because the maintenance of wetland water quality index is high, no additional treatment is called for.
Maintenance of Hydrologic Regime	Moderate	There has been some degree of human alteration of the wetland hydrology, either by outlet control or by altering immediate watershed conditions. However, the wetland retains some of the hydrologic regime similar to the original wetland type, either in part of the wetland or overall to some extent. Because of the interference (whether active or inadvertant), some characteristic vegetative communities have likely been affected, as also have the functions of flood attenuation, water quality and groundwater interaction.
Flood/Stormwater/Attenuation	Moderate	The wetland provides some flood storage and/or flood wave attenuation. It may have either an altered or unrestricted outlet, disturbed wetland soils, thin or little emergent vegetation (with channels) or it may be situated high in a watershed with a low proportion of impervious surfaces, moderate runoff volumes, loamy upland soils, and one or more other wetlands present within the subwatershed.

Downstream Water Quality	Moderate	This wetland has some ability and opportunity to protect downstream resources. 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, as do those that receive more (and less-treated) runoff.
Maintenance of Wetland Water Quality	High	Wetland water quality is high, indicating little need for additional treatment. As long as upland land use and existing buffer conditions do not change, this wetland can be expected to sustain current characteristics.
Shoreline Protection	Moderate	This fringe site provides some protection against erosive action. Reducing the amount of buffer that is manicured would further protect the adjacent water resource, as would increasing the buffer width.
Maintenance of Characteristic Wildlife Habitat Structure	Moderate	The site provides good habitat and is relatively accessible to wildlife, although it may be somewhat isolated on the landscape and lack the rich vegetative community and complex structure that would support a wider range of wildlife.
Maintenance of Characteristic Fish Habitat	High	The site has a direct connection to spawning or nursery habitat, or may provide refuge or shade for native species of fish. Low amounts of sediment mean that eggs are not smothered; good water quality supports fish health.
Maintenance of Characteristic Amphibian Habitat	Low	Predatory fish are always present and winter habitat unsuitable as site often freezes to the bottom. High inputs of untreated stormwater or unfiltered runoff contribute to poor water quality and reproductive conditions.
Aesthetics/Recreation /Education/Cultural	High	Regardless of actual integrity, the site is accessible and valued by significant populations of people. Its value is enhanced by not being visibly altered by human influences such as trash or roads. There is a high evidence it is used for mulitple recreational activities.
Wetland restoration potential	Not Applicable	Because restoration would affect permanent structures or infrastructure (houses, roads, septic systems), this site is not suitable for restoration.
Wetland Sensitivity to Stormwater and Urban Development	Moderate	This wetland is moderately sensitive to stormwater; 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.

Appendix A: Dominant Species By Plant Community

	Wetland Type	Plant Community	Dominant Species	Percent Cover
L2UB	**Type 5**	**Shallow, Ow Communities**		
			Sago pondweed	>3-<10%
			American pondweed	0-3%
			Water stargrass	>3-<10%
			Limp white water crowfoot	>3-<10%
			Leafy pondweed	>10-25%
			Illinois pondweed	>3-<10%
			Flat-stemmed pondweed	0-3%
			Eurasian water milfoil	>10-25%
			Curly pondweed	>10-25%
			Canadian elodea	>3-<10%
			Common coontail	>25-50%
			Flexuous naiad	0-3%
PSS1	**Type 6**	**Shrub-carr**		
			Black willow	0-3%
			Common mint	0-3%
			Common dandelion	0-3%
			Common boneset	0-3%
			Canada thistle	0-3%
			American slough grass	0-3%
			Blue vervain	0-3%
			Cottonwood	0-3%
			Curly dock	0-3%
			Bristly sedge	0-3%
			Prickly lettuce	0-3%
			Tussock sedge	0-3%
			Swamp milkweed	0-3%
			Stinging nettle	0-3%
			Spotted touch-me-not	0-3%
			Soft stem bulrush	0-3%
			Sensitive fern	0-3%
			Sandbar willow	>25-50%
			Reed canary grass	>10-25%
			Common ragweed	0-3%
			Purple loosestrife	0-3%
			Yarrow	0-3%
			Peach-leaved willow	>10-25%
			Northern bugleweed	0-3%
			Northern blue flag	0-3%
			Narrow-leaved cattail	0-3%

Green ash	0-3%
Golden alexanders	0-3%
Giant goldenrod	0-3%
Fox sedge	0-3%
Fowl bluegrass	>10-25%
Red maple	0-3%

MnRAM: Site Response Record

For Wetland Lac Lavon

Location: 19-114-21-11-001

BDWMO Strategic Waterbodies

Plant Community: Shallow, Open Water C

Cowardin Classification: L2UBGh — Circular 39: Type 5

Plant Community: Shrub Carr

Cowardin Classification: PSS1B — Circular 39: Type 6

4	*Listed, rare, special species?*	No
5	*Rare community or habitat?*	No
6	*Pre-European-settlement condition?*	No

Hydrogeomorphology / topography:

7		Depressional/Isolated, Lacustrine
8-1	*Maximum water depth*	120 inch
8-2	*% inundated*	95%
9	*Immediate drainage--local WS*	185 acres
10	*Esimated size/existing site:*	*(see #66)*
11-Upland Soil		Wadena loam, 2 to 6 percent slopes
11-Wetland Soil		Pits, gravel

12	*Outlet for flood control*	A
13	*Outlet for hydro regime*	A
14	*Dominant upland land use*	B
15	*Wetland soil condition*	C
16	*Vegetation (% cover)*	50%
17	*Emerg. veg flood resistance*	NA
18	*Sediment delivery*	A
19	*Upland soils (soil group)*	A
20	*Stormwater runoff*	C
21	*Subwatershed wetland density*	C
22	*Channels/sheet flow*	A
23	*Adjacent buffer width*	5 feet

Adjacent area management

24-A	*Full*	25%
24-B	*Manicured*	25%
24-C	*Bare*	50%

Adjacent area diversity/structure

25-A	*Native*	0%
25-B	*Mixed*	40%
25-C	*Sparse*	60%

Adjacent area slope

26-A	*Gentle*	20%
26-B	*Moderate*	20%
26-C	*Steep*	60%

27	*Downstream sens./WQ protect.*	A
28	*Nutrient loading*	A
29	*Shoreline wetland?*	Yes

Shoreline Wetland

30	*Rooted veg., % cover*	5%
31	*Wetland in-water width*	5 feet
32	*Emerg. veg. erosion resistance*	C
33	*Erosion potential of site*	B
34	*Upslope veg./bank protection*	A
35	*Rare wildlife?*	No
36	*Scare/Rare/S1/S2 community*	No
37	*Vegetative cover*	C
38	*Veg. community interspersion*	C
39	*Wetland detritus*	NA
40	*Interspersion on landscape*	B
41	*Wildlife barriers*	B

Amphibian-breeding potential

42	*Hydroperiod adequacy*	Adequate
43	*Fish presence*	C
44	*Overwintering habitat*	A
45	*Wildlife species (list)*	
46	*Fish habitat quality*	A
47	*Fish species (list)*	
48	*Unique/rare opportunity*	No
49	*Wetland visibility*	A
50	*Proximity to population*	Yes
51	*Public ownership*	B
52	*Public access*	A
53	*Human influence on wetland*	B
54	*Human influence on viewshed*	C
55	*Spatial buffer*	A
56	*Recreational activity potential*	A
57	*Commercial crop--hydro impact*	NA

Groundwater-specific questions

58	*Wetland soils*	Recharge
59	*Subwatershed land use*	Discharge
60	*Wetland size/soil group*	Recharge
61	*Wetland hydroperiod*	Discharge
62	*Inlet/Outlet configuration*	Recharge
63	*Upland topo relief*	Discharge

Additional information

64	*Restoration potential*	No
65	*LO affected by restoration*	
66	*Existing size*	60
	Restorable size	0
	Potential new wetland	0
67	*Average width of pot. buffer*	0 feet
68	*Ease of potential restoration*	
69	*Hydrologic alterations*	0
70	*Potential wetland type*	0
71	*Stormwater sensitivity*	
72	*Additional treatment needs*	

Watershed Minnesota (Shakopee)

WS# 33 Service Area: 9

For functional ratings, please run the Summary tab report.

This report printed on: 11/20/2014

Appendix F

Descriptions of MNRAM Wetland Functions

Appendix D

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)

Knutson, M.G., J.R. Sauer, D.A. Olsen, M.J. Mossman, L.M. Hemesath and M.J. Lannoo. 1999. *Effects of landscape composition and wetland fragmentation on frog and toad abundance and species richness in Iowa and Wisconsin, U.S.A.* Conservation Biology 13:1437-1446.

Knutson, M.G., J.R. Sauer, D.A. Olsen, M.J. Mossman, L.M. Hemesath and M.J. Lannoo. 2000. *Landscape associations of frog and toad species in Iowa and Wisconsin, U.S.A.* Jour. Iowa Acad. Sci. 107(3):134-145.

Knutson, P. L., J. C. Ford, and M. R. Inskeep. 1981. *National Survey of Planted Salt Marshes (vegetative stabilization and wave stress).* Wetlands 3:129-153.

Kuchler, A.W. 1967. Vegetation Mapping. The Ronald Press, New York, New York.

Lannoo, M.J. 1998. *Amphibian conservation and wetland management in the upper midwest: a catch 22 for the cricket frog. In* Status and Conservation of Midwestern amphibians. M.J. Lanoo, ed. University of Iowa Press, Iowa City, Iowa. Pages 331-339.

Lee, L.C. and Mark M. Brinson, William J. Kleindl, P. Michael Whited, Michael Gilbert, Wade L. Nutter, Dennis F. Whigham, Dave DeWald. 1997. *Revised Operational Draft Guidebook for the Hydrogeomorphic Assessment of Temporary and Seasonal Prairie Pothole Wetlands*. Seattle, WA. pp. 116+app.

Lehtinen, R.M., S.M. Galatowitsch and J.R. Tester. 1999. *Consequences of habitat loss and fragmentation for wetland amphibian assemblages.* Wetlands 19:1-12.

Magee, D.W. and Garrett G. Hollands. 1998. *A Rapid Procedure for Assessing Wetland Functional Capacity.* Association of State Wetland Managers. 190 pp.

Michigan DNR. 1981. *Manual for Wetland Evaluation Techniques.* Michigan Department of Natural Resources, Lansing, MI.

Mitch & Gosselink 2000. Wetlands 3rd Edition.

Ogawa, H. and J. W. Male. 1983. *The Flood Mitigation Potential of Inland Wetlands*. Water Resources Research Center. University of Massachusetts.

Oldfield, B. and J.J. Moriarty. 1994. *Amphibians and reptiles native to Minnesota*. University of Minnesota Press, Minneapolis, Minnesota.

Reed, P.B. 1988 (and 1993 supplement). National List of Plant Species that Occur in Wetlands, U. S. Fish and Wildlife Service National Wetland Inventory, St. Petersburg, FL.

Rheinhardt, R., Mark M. Brinson, N. Eric Fleming, J. Glenn Sandifer, Jr., 1997. *Deciduous Wetland Flats Interim HGM Model*. 50 pp.

Richter, Klaus O. and Amanda L. Azous. 1995. Amphibian occurrence and wetland characteristics in the Puget Sound Basin. Wetlands 15:305-312.

Seaberg, J.K. and Douglas D. Hansen. 2000. *Metropolitan Area Groundwater Model Project Summary: Northwest Province, Layers 1, 2, and 3 Model, Version 1.00*. Minnesota Pollution Control Agency.

Semlitsch, R.D. 2000. Principles for management of aquatic-breeding amphibians. J. Wildlife Mgmt. 64:615-631.

Shaw, S. and C.G. Fredine. 1956. *Wetlands of the United States Circular 39.* U.S. Fish and Wildlife

Service. U.S. Government Printing Office, Washington, D.C.

Smith, S.G. 1986. *The cattails (Typha): Interspecific ecological differences and problems of identification.* Proceedings of the 5th Annual Conference of the NALMS. Geneva, Illinois, 357-362.

Snodgrass, J.W., M.J. Komoroski, A.L.Bryan, Jr., and J. Burger, Jr. 2000. *Relationships among isolated wetland size, hydroperiod, and amphibian species richness: implications for wetland regulations.* Conservation Biology 14:414-419.

State of Minnesota Storm-Water Advisory Group. 1997. *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands.*

Thill, D., and M. Jacobson. 2000. *The Minnehaha Creek Routine Assessment Method,* in conjunction with the Minnehaha Creek Watershed District.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, Final Report.

Verry, E.S. 1988. *The Hydrology of Wetlands and Man's Influence on it.* International Symposium on the Hydrology of Wetlands in Temperate and Cold Regions. Joensuu, Finland.

Wells, J. Mike Mueller, John Parker, Bruce Gerbig, S. Jatnieks-Straumanis, Bruce Wilson, John Kittelson, Paul Richert, Teri Sardinas, Scott LaChance, and Larry Smith, 1988. *The Minnesota Wetland Evaluation Methodology for the North Central United States*. Corps of Engineers in conjunction with the Minnesota Environmental Quality Board Wetland Evaluation Methodology Task Force, John R. Wells, Chairman.

Whited, D., Galatowitsch, S., Tester, J.R., Schik, K., Lehtinen, R., Husveth, J. 2000. Landscape and Urban Planning, 49 (1-2): 49-65.

Williams, R.E. 1968. *Flow of groundwater adjacent to a small, closed basin in glacial till.* Water Resources Research 4:777-783.

BMP References:

Board of Water and Soil Resources, Association of Metropolitan Soil and Water Conservation Districts. 1989. Minnesota Construction Site Erosion and Sediment Control Planning Handbook. St. Paul.

Minnesota Pollution Control Agency. 2000. Protecting Water Quality in Urban Areas: Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban and Developing Areas of Minnesota. Minneapolis, March, 2000.

Barr Engineering Company. 2001. Minnesota Urban Small Sites BMP Manual: Stormwater Best Management Practices for Cold Climates. Metropolitan Council Environmental Services, St. Paul, MN.

Appendix G

Vegetation Shoreline Buffer Brochure Examples

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

Blue Thumb
PLANTING FOR CLEAN WATER™

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

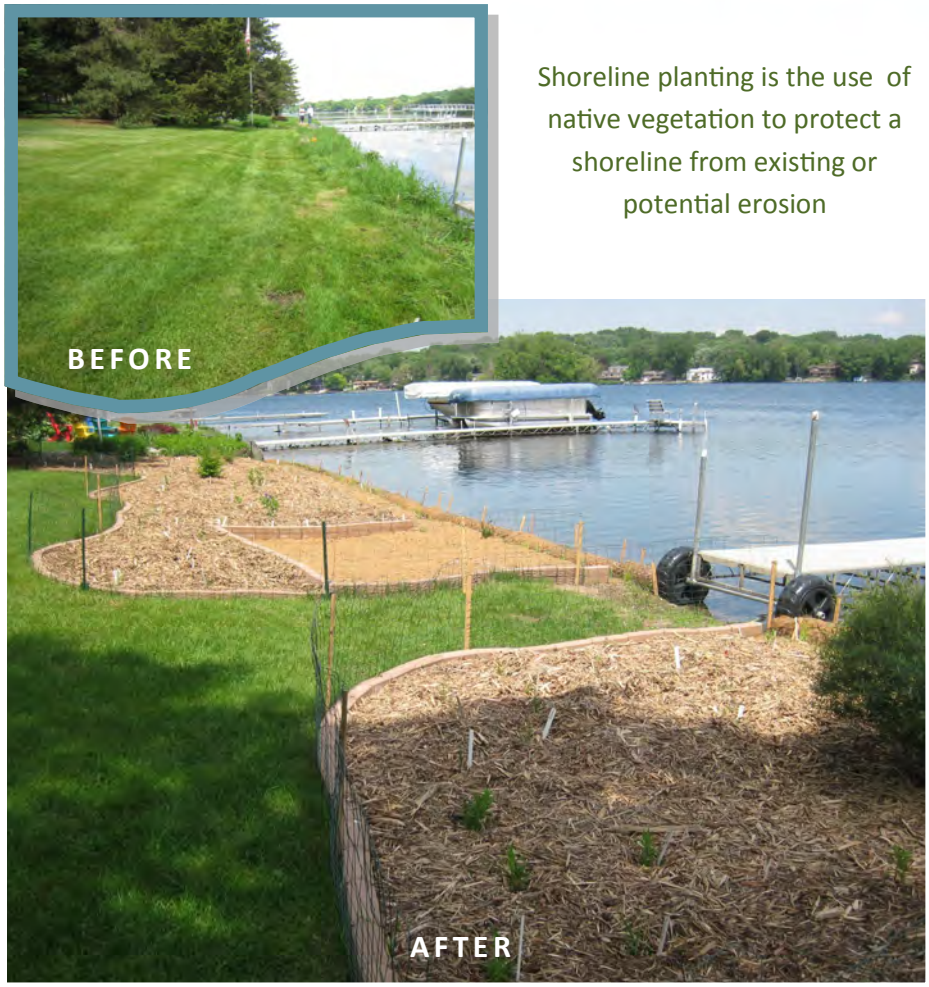
Dakota County Soil and Water Conservation District
4100 220th St. W., Suite 102, Farmington, MN 55024 651-480-7777 www.dakotaswcd.org

Revised 9/18/2013

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

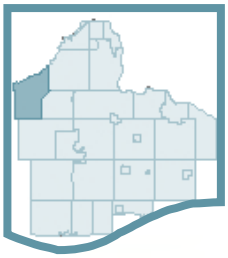
COST: Project materials cost estimated at $3,192

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

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

Lac Lavon Prairie Restoration Area

Provided by the City of Burnsville

Lac Lavon
Prairie Planting

Project:

Date:

Notes:

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: Black Dog Watershed Management Organization (BDWMO)
From: Kevin Menken, Barr Engineering
Subject: Lac Lavon 2019 Water Quality Assessment
Date: March 10, 2020
Project: 23190375

This memorandum presents the results of 2019 management-level water quality monitoring of Lac Lavon, as well as discussion of aquatic macrophyte surveys conducted in June 2019 and August 2019. Management-level water quality monitoring was conducted by Barr Engineering Co. (Barr) on behalf of the BDWMO in 2019. 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.

2019 Water Quality Monitoring Activities

The 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 2019 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 Pace Analytical 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 Pace Analytical for analyses of total phosphorus concentrations.

Also, a citizen volunteer conducted CAMP water quality monitoring in 2019. Tabulated water quality data collected by Barr (Table 2) and the CAMP volunteer (Table 3) are attached at the end of this memorandum.

The 2019 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* results were very similar between Barr and CAMP measurements, while total phosphorus concentrations were generally higher in Barr-collected samples than CAMP samples. Barr measurements of SDT were generally not as deep (worse) than CAMP measurements as well. SDT measurements are somewhat subjective, and can be influenced by time of day of measurements (e.g. wave action and sun angle). Observed differences in Barr and CAMP measurements of total phosphorus concentrations could be due to the manner of sample collection – a composite of top 2 meters of lake water (Barr) versus dipping sample container below the lake surface (CAMP).

Summer Averages of Water Quality Parameters and Associated Goals

The 2019 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 BDWMO 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 2019 is 4.2 meters (13.8 feet). When a statistical trend analysis indicates that water transparency has degraded beyond this level (i.e. SDT less than 4.2 meters), then a diagnostic study of potential causes is recommended according to the BDWMO's Watershed Management Plan. The summer average SDT in 2019 was 4.0 meters (13.1 feet), which is worse than the action level of 4.2 meters. However, there was a statistically significant trend (90% confidence interval) of improving water quality 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, but summer averages of total

Figure 1a: Lac Lavon 2019 Secchi Disc Transparency

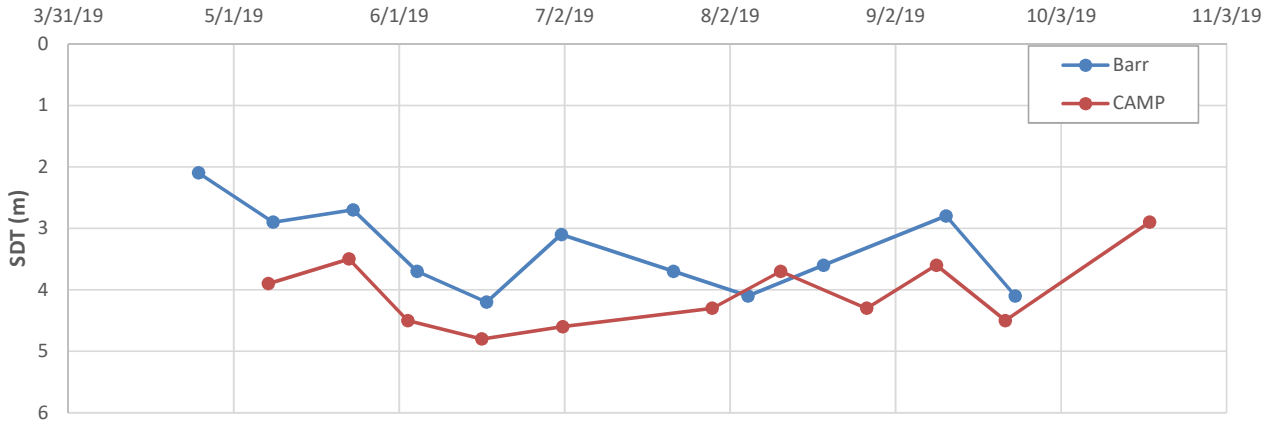


Figure 1b: Lac Lavon 2019 Chlorophyll *a*

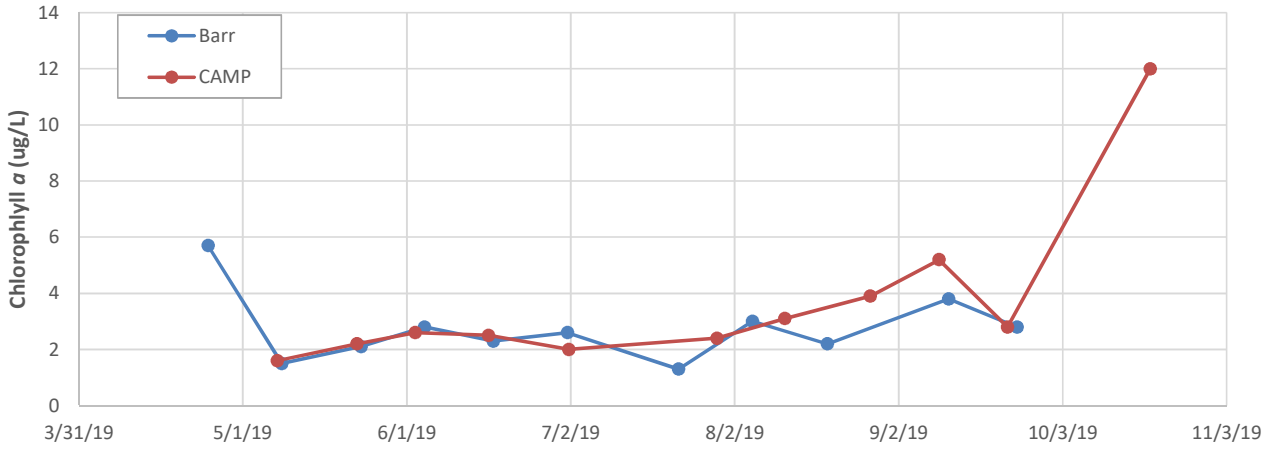


Figure 1c: Lac Lavon 2019 Total Phosphorus

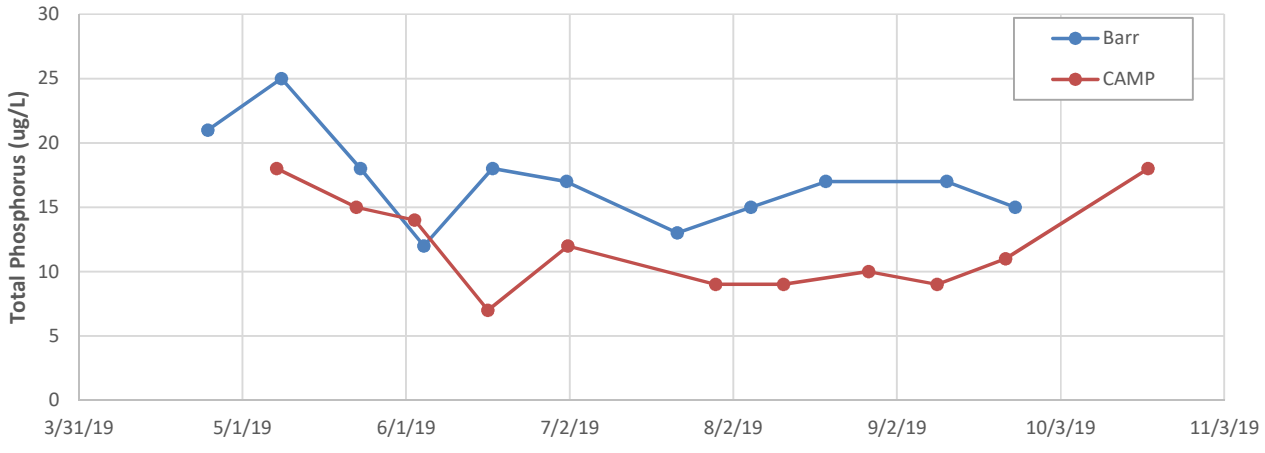


Figure 2a: Lac Lavon June-Sept. Secchi Disc Transparency

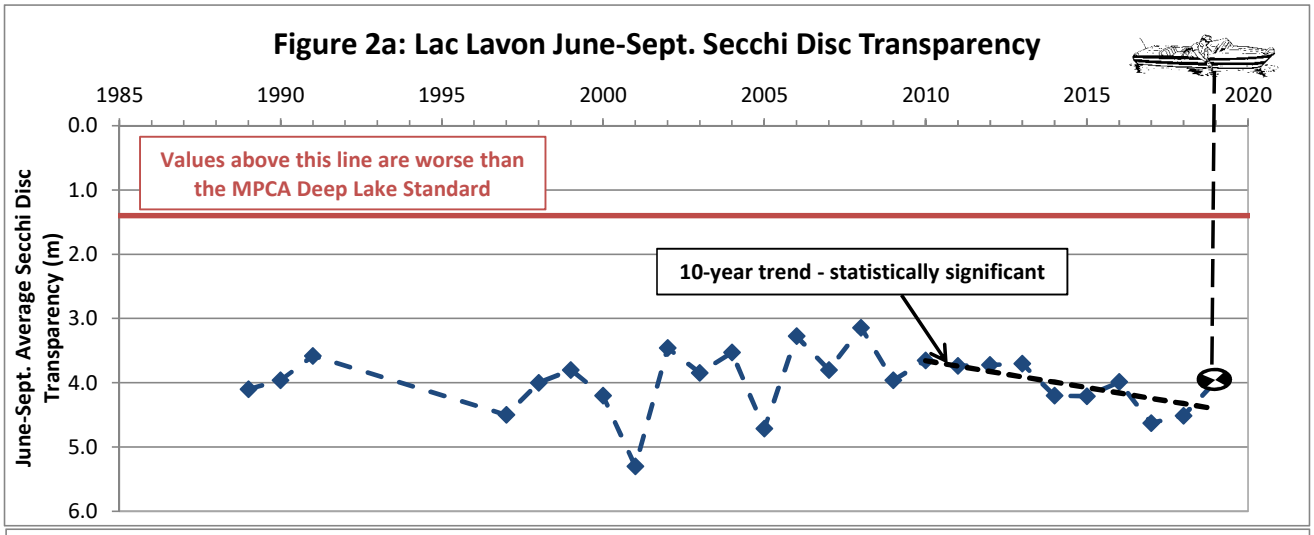


Figure 2b: Lac Lavon June-Sept. Average Chlorophyll *a*

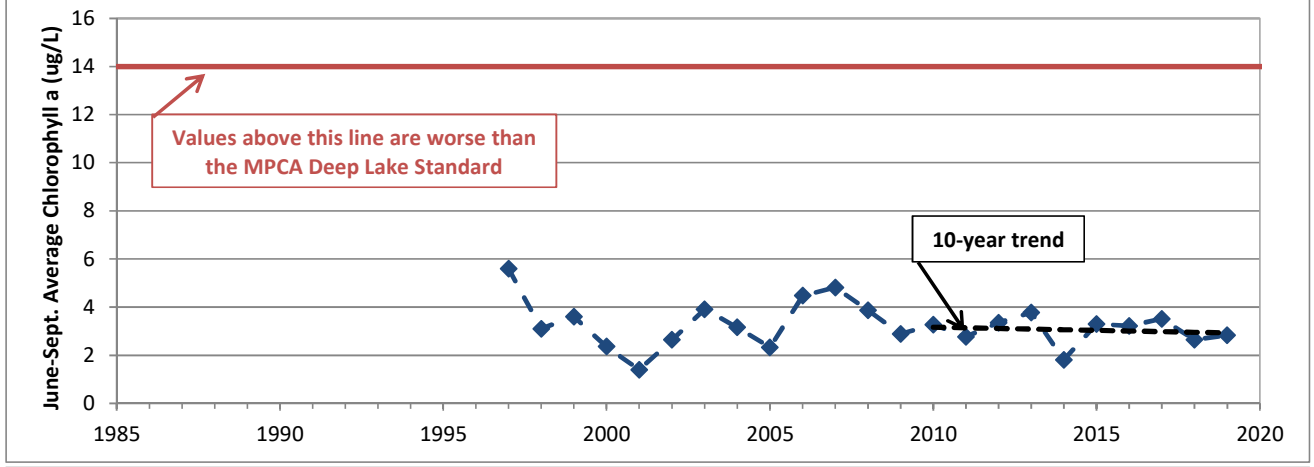
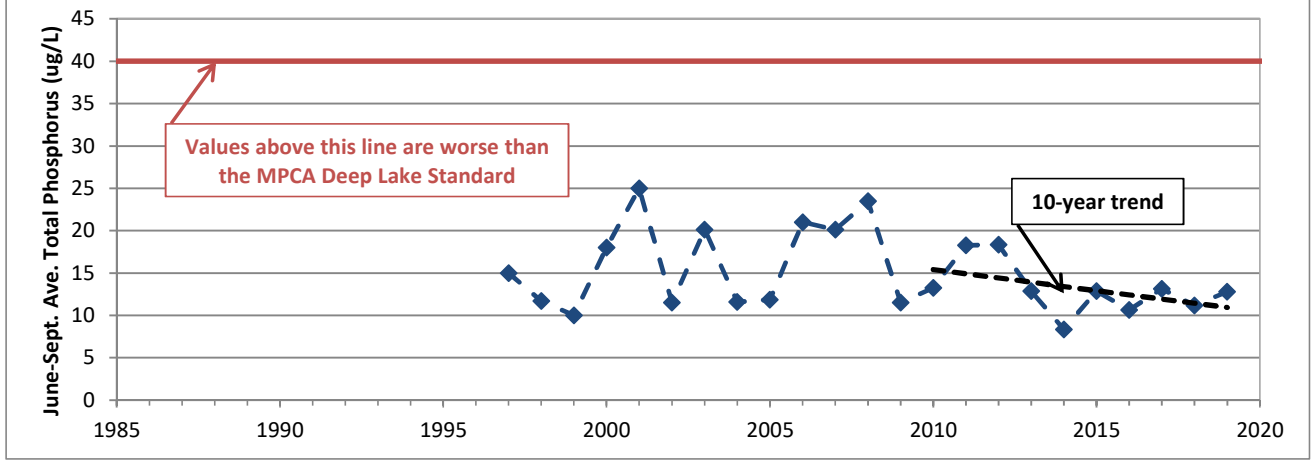


Figure 2c: Lac Lavon June-Sept. Average Total Phosphorus



phosphorus and chlorophyll *a* indicate continued excellent water quality in Lac Lavon. Based on results of 2019 water quality monitoring, a diagnostic study of Lac Lavon is not required or recommended.

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 (2010-2019) 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 (2010-2019)
Total Phosphorus (µg/L)	≤ 40	13
Chlorophyll *a* (µg/L)	≤ 14	3.0
Secchi Disc Transparency (m)	≥ 1.4	4.0

Aquatic Plant (Macrophyte) Surveys

Barr contracted with Endangered Resource Services, LLC to conduct point-intercept surveys in June and August of 2019. Results of the point-intercept surveys, as well as habitat monitoring conducted by Barr in 2019, are detailed in a separate memo (2019 Lac Lavon Habitat Monitoring, February 2019 draft). Barr previously conducted aquatic plant (macrophyte) surveys in 2013, 2014, and 2016. Three aggressive aquatic invasive plants were identified previously 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. Curly-leaf pondweed, Eurasian watermilfoil, and purple loosestrife were all found in Lac Lavon in 2019, but brittle naiad was not reported in the 2019 surveys. Brittle naiad (*Najas minor*) was first reported in Lac Lavon in 2003, and has been observed in the lake in 2013, 2014, and 2016 during the August surveys. Brittle naiad was observed at multiple locations in Lac Lavon during the August 2016 survey. Unlike curly-leaf pondweed and Eurasian watermilfoil, which are widespread in many Minnesota lakes, brittle naiad has only been reported in a handful of Minnesota lakes. Brittle naiad grows much shorter than curly-leaf pondweed and Eurasian watermilfoil, which can create dense surface mats; therefore, brittle naiad is less of a nuisance in Lac Lavon than the other non-native invasive plants.

In June 2019, curly-leaf pondweed was found at 29% of sampling points shallow enough for plant growth. 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. Eurasianwater milfoil may also crowd out native plant species. In August 2019, Eurasian watermilfoil was found at 56% of sampling points where water was shallow enough for plant growth.

The 2019 Lac Lavon Habitat Monitoring memo describes in detail calculations of a Floristic Quality Index (FQI) for the submergent 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. Three species were identified in 2019 that have a C-value of 7 and would therefore be considered indicative of good water quality: long-leaf pondweed, muskgrass, and white water crowfoot. The total number of native species found in the submergent zone of Lac Lavon was reported as high (12). The 2019 average native plant density rating was rated as moderate (1.5), and the average exotic species density was rated as moderate (1.7). The Mean C-Value rating was determined to be moderate (4.5). Averaging these four criteria results in a moderate rating overall for the submergent zone of Lac Lavon.

Lake Levels

Lac Lavon has no regularly flowing outlet, 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 through 2014, 2018, and 2019. During that period, the lake elevation had fluctuated from a low of 927.6 feet on June 2, 2010 to a high of 932.71 feet on September 19, 2019, a difference of 5.11 feet (Figure 3). The high lake levels flooded the path leading to the fishing dock in 2019 (Photograph 1). Many landlocked lakes in the Twin Cities experienced high water levels in 2019 due to record-breaking precipitation in 2019, combined with above-average precipitation in prior recent years.

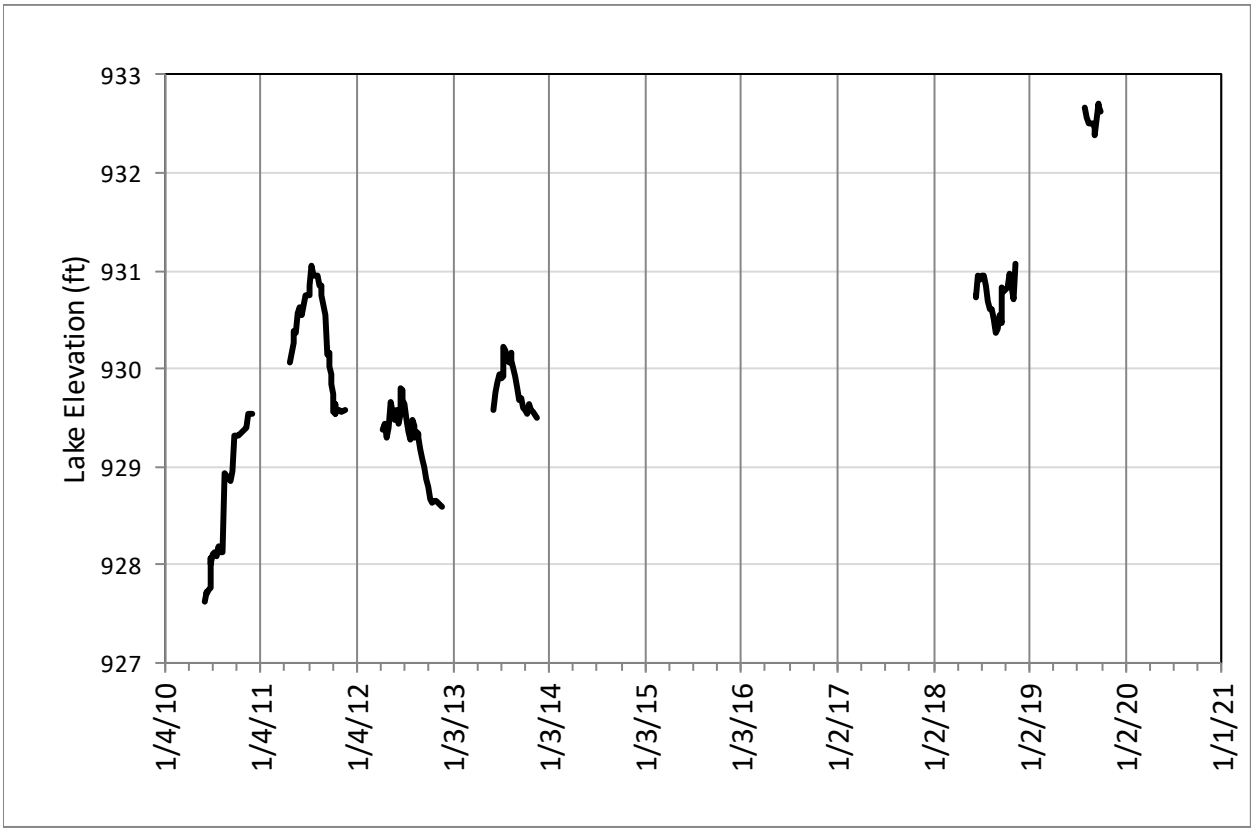


Figure 3: Lac Lavon Water Surface Elevation

Photograph 1: High lake levels in 2019 preventing access to the Lac Lavon fishing dock in city park.

phosphorus and chlorophyll *a* indicate continued excellent water quality in Lac Lavon. Based on results of 2019 water quality monitoring, a diagnostic study of Lac Lavon is not required or recommended.

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 (2010-2019) 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 (2010-2019)
Total Phosphorus (µg/L)	≤ 40	13
Chlorophyll *a* (µg/L)	≤ 14	3.0
Secchi Disc Transparency (m)	≥ 1.4	4.0

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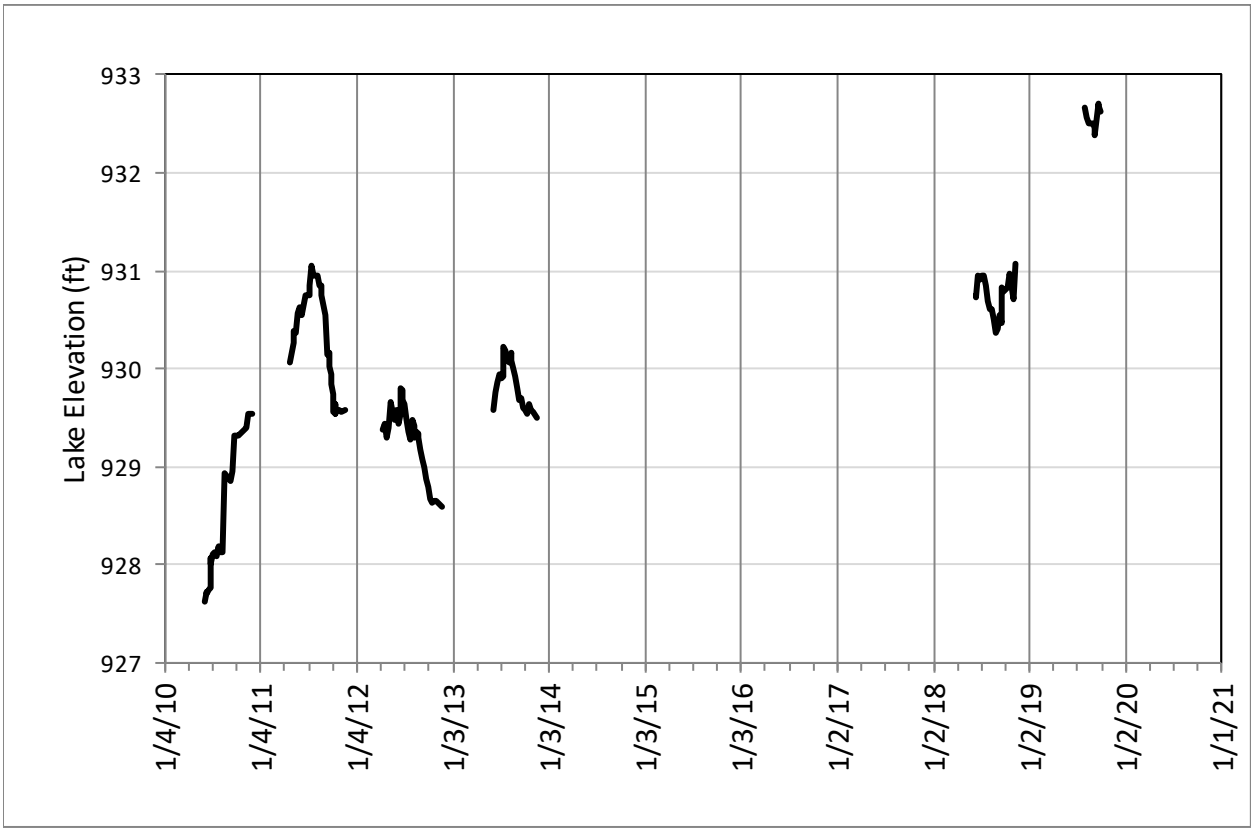

Figure 3: Lac Lavon Water Surface Elevation

Photograph 1: High lake levels in 2019 preventing access to the Lac Lavon fishing dock in city park.

Discussion of 2019 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. A statistical analysis shows an improving trend (90% confidence) of summer averages of Secchi disc transparency for the recent 10-year period of 2010-2019. 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 3 years.

A variety of native and non-native aquatic plants grow in Lac Lavon. Several species of native plants that are indicative of good water quality were identified in 2019. However, dense growths of non-native curly-leaf pondweed and Eurasian watermilfoil are occurring in some areas of the lake. Barr recommends periodic macrophyte surveys to monitor the aquatic plant community of Lac Lavon.

Table 2
Lac Lavon 2019 Water Quality Measured by Barr Engineering
BDWMO

Date	Sample Depth	Field Measurements						Laboratory Analyses	
		Dissolved oxygen [mg/l]	pH	Specific conductance @ 25 ºC [umhos/cm}	Water Temperature [ºC]	Secchi disc [m]	Turbidity [NTU]	Chlorophyll a, pheophytin-adjusted [ug/l]	Phosphorus, total, as P [mg/l]
4/24/2019	0 - 2 m	--	--	--	--	2.1	2.6	5.7	0.021
4/24/2019	0 m	11.8	8.2	572	11.6	--	--	--	--
4/24/2019	1 m	12.0	8.2	573	11.9	--	--	--	--
4/24/2019	2 m	12.2	8.2	573	10.7	--	--	--	--
4/24/2019	3 m	12.3	8.1	572	9.0	--	--	--	0.018
4/24/2019	4 m	11.1	7.9	574	7.5	--	--	--	0.016
4/24/2019	5 m	10.6	7.8	574	6.8	--	--	--	0.020
4/24/2019	6 m	9.0	7.6	574	6.2	--	--	--	0.016
4/24/2019	7 m	8.1	7.5	577	5.9	--	--	--	0.018
4/24/2019	8 m	7.7	7.5	578	5.9	--	--	--	0.020
4/24/2019	9 m	6.9	7.4	580	5.6	--	--	--	0.021
5/08/2019	0 - 2 m	--	--	--	--	2.9	1.7	1.5	0.025
5/08/2019	0 m	11.1	8.2	582	14.3	--	--	--	--
5/08/2019	1 m	11.2	8.2	581	14.3	--	--	--	--
5/08/2019	2 m	11.2	8.3	582	14.3	--	--	--	--
5/08/2019	3 m	11.5	8.3	581	13.8	--	--	--	0.027
5/08/2019	4 m	12.2	8.2	575	10.8	--	--	--	0.019
5/08/2019	5 m	12.3	8.0	571	7.8	--	--	--	0.026
5/08/2019	6 m	9.1	7.7	575	6.7	--	--	--	0.021
5/08/2019	7 m	6.2	7.4	580	6.3	--	--	--	0.030
5/08/2019	8 m	4.4	7.2	580	6.0	--	--	--	0.032
5/08/2019	9 m	0.2	7.1	643	5.9	--	--	--	0.042
5/23/2019	0 - 2 m	--	--	--	--	2.7	2.1	2.1	0.018
5/23/2019	0 m	9.8	8.2	565	13.7	--	--	--	--
5/23/2019	1 m	9.8	8.2	565	13.7	--	--	--	--
5/23/2019	2 m	9.8	8.3	565	13.7	--	--	--	--
5/23/2019	3 m	9.8	8.3	566	13.7	--	--	--	0.025
5/23/2019	4 m	9.8	8.3	566	13.7	--	--	--	0.022
5/23/2019	5 m	9.8	8.3	566	13.6	--	--	--	0.020
5/23/2019	6 m	9.8	8.3	565	13.6	--	--	--	0.030
5/23/2019	7 m	10.6	7.8	580	9.0	--	--	--	0.030
5/23/2019	8 m	1.2	7.5	584	7.1	--	--	--	0.041
5/23/2019	9 m	0.1	7.3	685	6.3	--	--	--	0.038
6/04/2019	0 - 2 m	--	--	--	--	3.7	1.2	2.8	0.012
6/04/2019	0 m	10.7	8.4	560	20.6	--	--	--	--
6/04/2019	1 m	10.7	8.5	560	20.5	--	--	--	--
6/04/2019	2 m	10.7	8.5	560	20.4	--	--	--	--
6/04/2019	3 m	11.5	8.4	556	18.3	--	--	--	0.0092
6/04/2019	4 m	11.4	8.4	566	16.1	--	--	--	0.014
6/04/2019	5 m	9.8	8.1	571	13.7	--	--	--	0.012
6/04/2019	6 m	9.3	7.7	582	9.8	--	--	--	0.011
6/04/2019	7 m	6.2	7.4	584	7.9	--	--	--	0.017
6/04/2019	8 m	0.8	7.2	598	7.1	--	--	--	0.020
6/17/2019	0 - 2 m	--	--	--	--	4.2	1.8	2.3	0.018
6/17/2019	0 m	9.6	8.5	535	21.7	--	--	--	--
6/17/2019	1 m	9.7	8.5	535	21.7	--	--	--	--
6/17/2019	2 m	9.7	8.5	535	21.6	--	--	--	--
6/17/2019	3 m	9.7	8.5	535	21.5	--	--	--	0.0092
6/17/2019	4 m	11.2	8.4	549	19.4	--	--	--	0.016
6/17/2019	5 m	12.6	8.4	557	15.1	--	--	--	0.018
6/17/2019	6 m	10.0	7.9	566	11.0	--	--	--	0.033
6/17/2019	7 m	4.5	7.6	574	8.9	--	--	--	0.024
6/17/2019	8 m	0.2	7.1	610	7.6	--	--	--	0.038
6/17/2019	9 m	0.1	7.1	666	7.2	--	--	--	0.058
7/01/2019	0 - 2 m	--	--	--	--	3.1	1.6	2.6	0.017
7/01/2019	0 m	9.0	8.4	517	24.2	--	--	--	--
7/01/2019	1 m	9.0	8.4	517	24.2	--	--	--	--
7/01/2019	2 m	9.1	8.4	519	24.2	--	--	--	--
7/01/2019	3 m	9.0	8.4	516	24.1	--	--	--	0.015
7/01/2019	4 m	7.1	7.9	555	21.8	--	--	--	0.016
7/01/2019	5 m	10.4	8.1	574	18.2	--	--	--	0.022
7/01/2019	6 m	8.8	7.6	584	11.7	--	--	--	0.029
7/01/2019	7 m	4.5	7.2	602	9.8	--	--	--	0.027

Table 2
Lac Lavon 2019 Water Quality Measured by Barr Engineering
BDWMO

Date	Sample Depth	Field Measurements						Laboratory Analyses	
		Dissolved oxygen [mg/l]	pH	Specific conductance @ 25 ºC [umhos/cm}	Water Temperature [ºC]	Secchi disc [m]	Turbidity [NTU]	Chlorophyll a, pheophytin-adjusted [ug/l]	Phosphorus, total, as P [mg/l]
7/01/2019	8 m	0.08	7.0	638	8.4	--	--	--	0.038
7/01/2019	9 m	0.05	6.9	713	7.7	--	--	--	0.045
7/22/2019	0 - 2 m	--	--	--	--	3.7	1.8	1.3	0.013
7/22/2019	0 m	8.5	8.5	506	26.0	--	--	--	--
7/22/2019	1 m	8.6	8.6	504	26.1	--	--	--	--
7/22/2019	2 m	8.6	8.6	504	26.0	--	--	--	--
7/22/2019	3 m	8.6	8.6	505	26.0	--	--	--	0.012
7/22/2019	4 m	8.6	8.5	507	26.0	--	--	--	0.014
7/22/2019	5 m	8.2	7.8	533	20.5	--	--	--	0.018
7/22/2019	6 m	9.8	7.8	592	15.3	--	--	--	0.024
7/22/2019	7 m	3.1	7.2	605	11.4	--	--	--	0.020
7/22/2019	8 m	0.2	7.0	652	9.2	--	--	--	0.025
7/22/2019	9 m	0.1	7.0	749	8.2	--	--	--	0.058
8/05/2019	0 - 2 m	--	--	--	--	4.1	0.3	3.0	0.015
8/05/2019	0 m	10.1	8.9	513	26.9	--	--	--	--
8/05/2019	1 m	10.0	8.9	512	27.0	--	--	--	--
8/05/2019	2 m	10.1	8.9	513	27.0	--	--	--	--
8/05/2019	3 m	10.0	8.9	514	27.0	--	--	--	0.015
8/05/2019	4 m	6.9	8.8	570	26.5	--	--	--	0.012
8/05/2019	5 m	8.5	8.0	600	22.0	--	--	--	0.020
8/05/2019	6 m	8.6	7.8	607	16.3	--	--	--	0.034
8/05/2019	7 m	1.7	7.3	628	12.4	--	--	--	0.042
8/05/2019	8 m	0.4	7.2	662	9.8	--	--	--	0.076
8/05/2019	9 m	0.1	7.2	789	8.2	--	--	--	0.17
8/19/2019	0 - 2 m	--	--	--	--	3.6	1.4	2.2	0.017
8/19/2019	0 m	8.6	8.7	504	25.0	--	--	--	--
8/19/2019	1 m	8.7	8.7	504	24.6	--	--	--	--
8/19/2019	2 m	8.6	8.7	504	24.5	--	--	--	--
8/19/2019	3 m	8.4	8.7	502	24.4	--	--	--	0.016
8/19/2019	4 m	6.1	7.8	576	22.9	--	--	--	0.013
8/19/2019	5 m	8.1	7.8	596	17.7	--	--	--	0.014
8/19/2019	6 m	1.2	7.2	621	13.2	--	--	--	0.016
8/19/2019	7 m	0.7	7.0	667	10.5	--	--	--	0.015
8/19/2019	8 m	0.6	7.1	788	8.6	--	--	--	0.030
8/19/2019	9 m	0.4	7.1	804	8.5	--	--	--	0.092
9/11/2019	0 - 2 m	--	--	--	--	2.8	1.3	3.8	0.017
9/11/2019	0 m	8.4	8.5	515	20.2	--	--	--	--
9/11/2019	1 m	8.3	8.3	515	20.2	--	--	--	--
9/11/2019	2 m	8.3	8.5	515	20.1	--	--	--	--
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9/11/2019	4 m	8.1	8.5	515	20.1	--	--	--	0.014
9/11/2019	5 m	8.1	8.5	515	20.1	--	--	--	0.015
9/11/2019	6 m	4.6	7.8	545	19.2	--	--	--	0.016
9/11/2019	7 m	0.5	7.4	630	14.6	--	--	--	0.042
9/11/2019	8 m	0.4	7.2	686	11.1	--	--	--	0.036
9/11/2019	9 m	0.4	7.2	814	8.9	--	--	--	0.056
9/24/2019	0 - 2 m	--	--	--	--	4.1	1.6	2.8	0.015
9/24/2019	0 m	9.2	8.6	514	20.9	--	--	--	--
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9/24/2019	5 m	5.8	8.2	518	19.3	--	--	--	0.017
9/24/2019	6 m	2.3	7.7	528	18.5	--	--	--	0.014
9/24/2019	7 m	0.3	7.4	636	15.3	--	--	--	0.032
9/24/2019	8 m	0.2	7.3	684	11.8	--	--	--	0.036
9/24/2019	9 m	0.2	7.4	813	9.4	--	--	--	0.094

-- Not analyzed

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]
5/7/2019	0	3.9	13.1	1.6	0.58	18
5/22/2019	0	3.5	14.3	2.2	0.55	15
6/2/2019	0	4.5	25.5	2.6	0.53	14
6/16/2019	0	4.8	21.8	2.5	0.59	~7
7/1/2019	0	4.6	25.9	2.0	0.41	12
7/29/2019	0	4.3	26.6	2.4	0.40	~9
8/11/2019	0	3.7	25.0	3.1	0.34	~9
8/27/2019	0	4.3	22.3	3.9	0.47	10
9/9/2019	0	3.6	20.7	5.2	0.48	~9
9/22/2019	0	4.5	21.2	2.8	0.44	11
10/19/2019	0	2.9	11.4	12	0.60	18

Notes

~9 - Value is less than the laboratory's method reporting limit, and is therefore an approximate value.

DRAFT

Black Dog Watershed Management Organization

2019 WATERSHED ANNUAL REPORT

Published April 2020

Our mission is . . .

To provide leadership in the management and stewardship of the water resources in northwestern Dakota County, Minnesota, through the cooperation of four cities and the involvement of local stakeholders.

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:

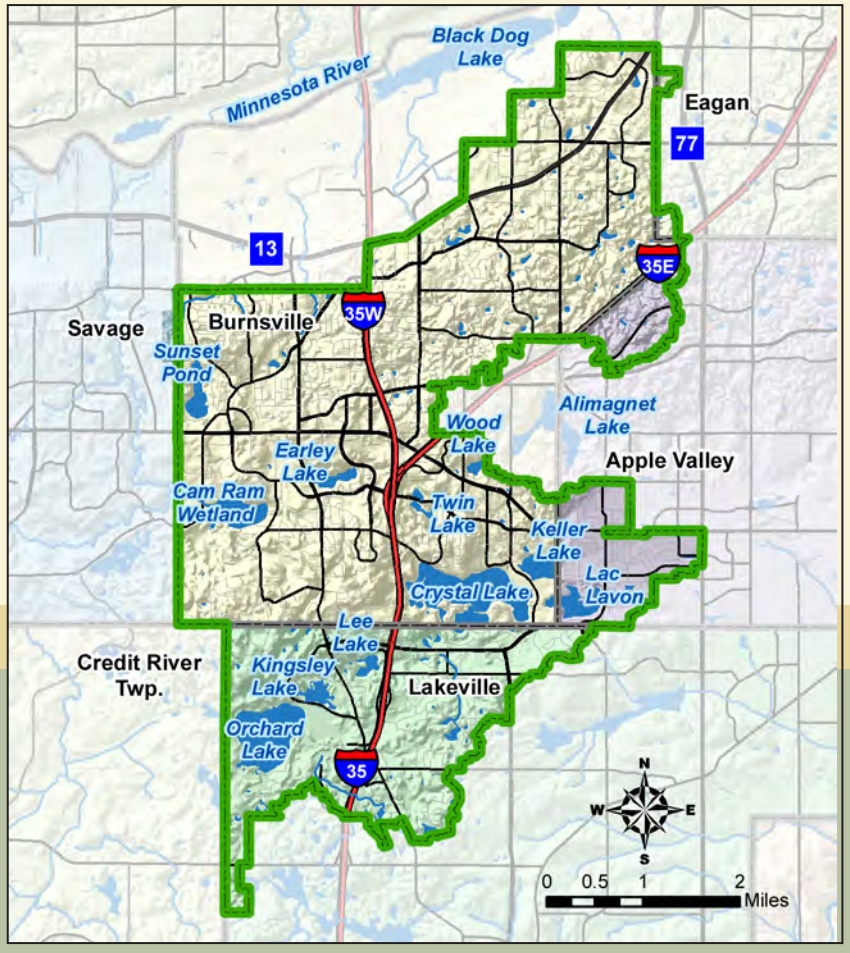
- **Trend Analysis**—The BDWMO collects water quality information to track water quality trends.
- **Performance Analysis**—The BDWMO will evaluate the member cities' implementation of maintenance plans, captial improvement projects, programs, and other items.
- **Habitat Quality Analysis**—The BDWMO 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 2019, and plans for 2020 and beyond.

What is the Black Dog Watershed Management Organization?

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

More Improvements for Keller Lake

Phase I of the Keller Lake Alum Treatment is Complete

In 2019, the BDWMO received a BWSR Clean Water Fund grant for an alum treatment project to improve Keller Lake's water quality. The alum treatment was divided into two phases to increase the long-term effectiveness. Phase I occurred in June, 2019 when 21,109 gallons of chemical precipitant were applied to Keller Lake (see page 5 for story on Keller Lake water quality monitoring). It is expected that, following completion of both phases of the in-lake aluminum treatment, the annual average TP (total phosphorus) load to Keller Lake will be reduced by 80% or 186 lbs/yr. The in-lake aluminum application represents most of the remaining TP load reduction required to ensure that Keller Lake water quality can meet the MPCA's shallow lake standards on a consistent basis.

Secondary benefits of this project include improving water clarity and providing the means for attaining a healthy native plant community in the lake. This project will also improve the water quality of Crystal Lake, which is immediately downstream of Keller Lake. Protecting the water quality of Crystal Lake is also important as it was recently removed from the impaired waters list for eutrophication (see page 6 for story on Crystal Lake water quality monitoring).

Alum treatment in action

How Does Alum Treatment Work?

When aluminum is applied to lake water, it binds with phosphorus in the lake sediment, forming a compound. After it binds with the aluminum, the phosphorus no longer supplies nutrients to lake algae, reducing its growth.

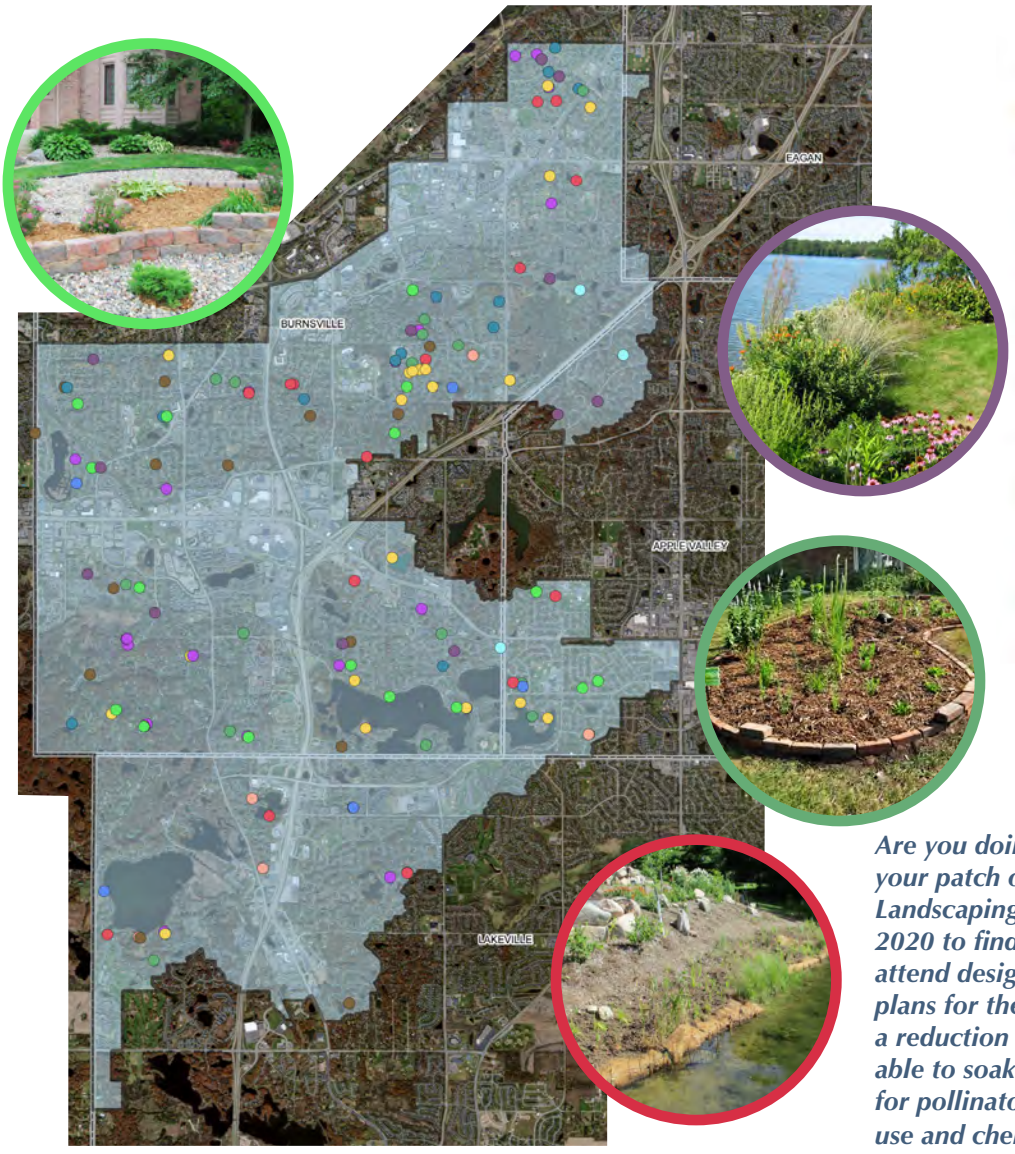
Two forms of aluminum are typically applied to lakes: alum and sodium aluminate. When alum is added to a lake, it will lower the pH (make it more acidic), while sodium aluminate will raise the pH (more basic). Therefore, these two chemicals are often added in combination to neutralize the pH effects during treatment.

City of Burnsville is Developing Use Attainability Analysis for Keller Lake

Based on the updated lake and watershed condition, the City of Burnsville is developing an Use Attainability Analysis (UAA) of Keller Lake. The specific purpose of the UAA is to assess and develop an achievable water clarity goal for Keller Lake using the results of watershed and in-lake water quality modeling. The study approach includes a detailed evaluation of the historical lake water quality dataset for Keller Lake to assess what level of water clarity can be achieved based on what is known about the current lake and watershed conditions. This assessment will require an evaluation of the long-term trends and interrelationships of all of the water quality and ecological variables, including consideration of the applicable state standards and goals from other similar lakes in the region. As a part of the process, stakeholders will learn more about how varying levels of lake water clarity (and associated variables) correspond with the potential lake uses. Knowing what uses are intended for Keller Lake will ultimately inform the decision-making on the recommended lake water quality goals. A public meeting and draft UAA report are planned for summer 2020.

Landscaping for Clean Water—A Look at the Past Decade

As we enter 2020, it's instructive to look back on the progress made over the past decade. From 2009 through 2019, hundreds of people participated in the Dakota SWCD's Landscaping for Clean Water program workshops. Nearly 160 projects were completed within the BDWMO through the support of the BDWMO for the program. The map below shows the project locations, color-coded by year. Projects included the creation of native gardens, raingardens, or native shorelines that stabilize soil. A few past projects are featured in the photos below.



YEAR	NUMBER OF PROJECTS
2019	19
2018	18
2017	17
2016	16
2015	18
2014	16
2013	13
2012	18
2011	6
2010	7
2009	9

Are you doing everything possible on your patch of lawn or lakeshore? Attend a Landscaping for Clean Water workshop in 2020 to find out. Participants in the program attend design workshops to develop landscape plans for their own yards. Project goals include a reduction in stormwater runoff as water is able to soak into the ground, improved habitat for pollinators and birds, and reduced water use and chemical inputs.

Who Can Get a Grant?

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.

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. In 2019, 97 homeowners attended Landscaping for Clean Water Introductory classes hosted by the BDWMO; 54 went on to design projects. The BDWMO provided 19 construciton funding grants—10 grants went to landowners who attended the Burnsville introductory workshops, with the other 9 grants going to landowners who live in the BDWMO, but attended the Introductory Class in another city or previous year. The BDWMO will fund up to 18 Landscaping for Clean Water projects in 2020. Homeowners must attend workshops to apply for grants.

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 www.dakotaswcd.org/costshare.html.

Looking at Lac Lavon

The BDWMO is pleased to report that Lac Lavon continues to have excellent water quality. The summer-average Secchi disc transparency (a measure of water clarity) in 2019 was 4.0 meters (13 feet), which is significantly better than the MPCA deep-lake water quality standard of 1.4 meters. In addition to measuring water clarity with a Secchi disc, concentrations of chlorophyll-*a* (a measure of algal abundance) and total phosphorus (the nutrient that drives algal growth) were also monitored in Lac Lavon. The summer-average concentrations of chlorophyll-a (2.8 µg/L) and total phosphorus (13 µg/L) were both better than the MPCA deep-lake water quality standards of 14 µg/L and 40 µg/L, respectively. Lac Lavon is a flooded former gravel pit with a small watershed, and receives much of its water from groundwater inflow. Therefore, the amount of external phosphorus entering Lac Lavon is relatively small, and the process of eutrophication (i.e. the process by which nutrients build up in a waterbody) in Lac Lavon is expected to be slow.

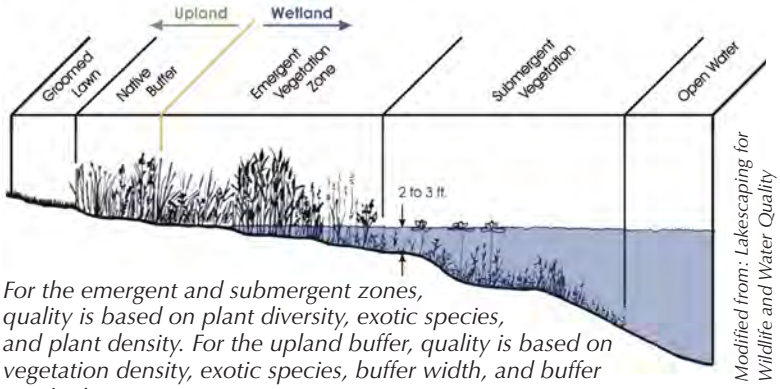
Surveys of Lac Lavon's aquatic vegetation were performed in June and August of 2019. The vegetation surveys found an abundance of both native and non-native aquatic plants. A total of 12 native species were identified in the submergent zone of Lac Lavon. The density of native plants was relatively moderate, including three species that are considered indicative of good water quality: long-leaf pondweed, muskgrass, and white water crowfoot. The non-native aquatic plants that were found in 2019 include curly-leaf pondweed and Eurasian watermilfoil. Curly-leaf pondweed dies off in mid-summer, earlier than native plants, releasing nutrients that can contribute to summer algae blooms. Eurasian watermilfoil was found to

be growing in high densities in a few areas of Lac Lavon, and may be crowding out native plants in these areas. The non-native purple loosestrife, an emergent wetland plant, was also found along the shoreline in several locations. The non-native brittle naiad was found in Lac Lavon in previous years, but was not encountered during the 2019 surveys. Lac Lavon is one of only a handful of Minnesota lakes that are known to be infested with brittle naiad. True to its name, brittle naiad easily breaks into fragments, which can spread and grow into new plants. Invasive non-native aquatic plants can be spread to other lakes by transport of seeds and/or plant fragments, and lake users should take care in removing all plant fragments from boats and other equipment when leaving the water to avoid spreading non-native plants to other waterbodies.

The BDWMO will continue to monitor the water quality of Lac Lavon in 2020. Habitat monitoring is scheduled again for Lac Lavon in 2024.

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.



For the emergent and submergent zones, quality is based on plant diversity, exotic species, and plant density. For the upland buffer, quality is based on vegetation density, exotic species, buffer width, and buffer continuity.

Modified from: Lakescaping for Wildlife and Water Quality

In 2019, the BDWMO monitored the habitat quality of Lac Lavon. 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.

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.)

See page 7 for Lac Lavon habitat monitoring results.
See www.blackdogwmo.org for the full report.

Water Quality Monitoring Program

The BDWMO and member cities continued to monitor several of its lakes during 2019 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.

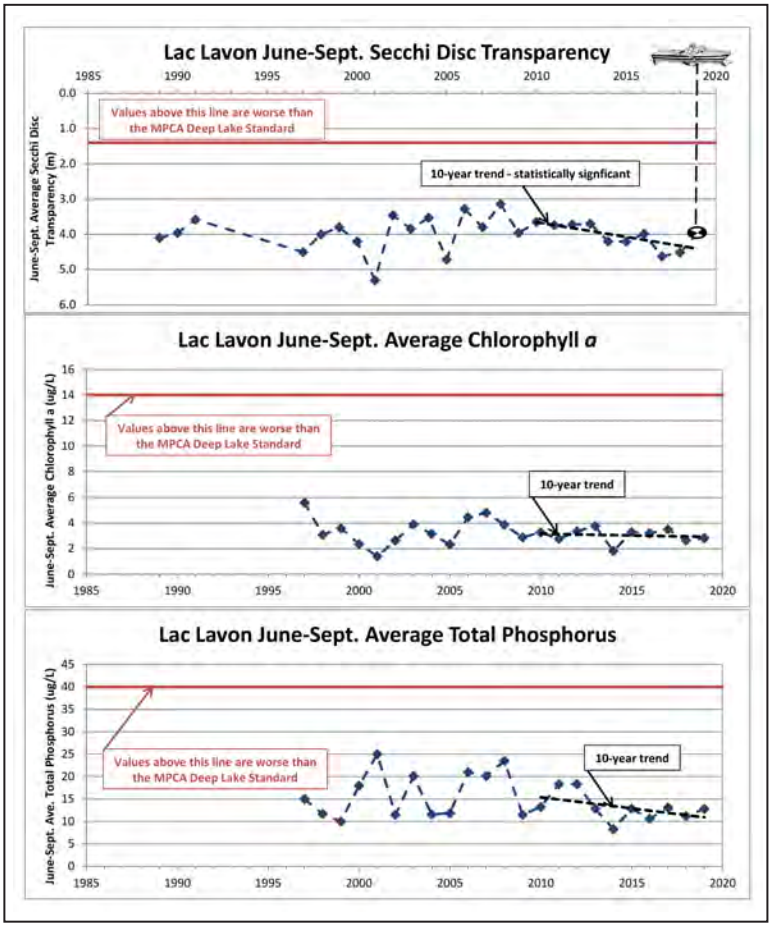
Lac Lavon (Apple Valley & Burnsville)

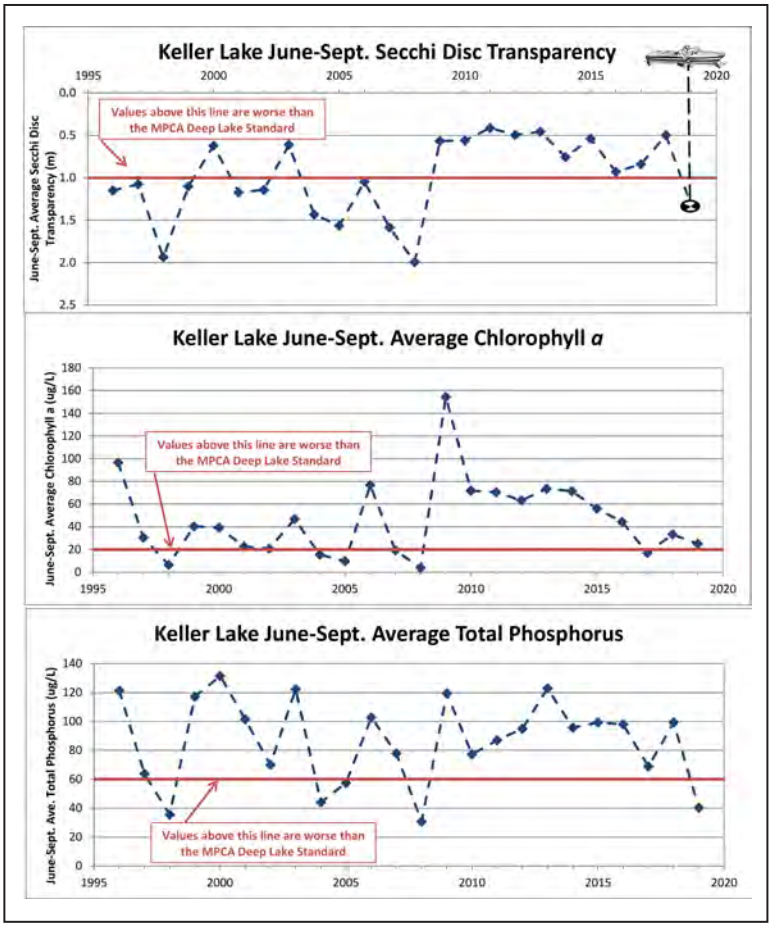
Water Quality Monitoring—In 2019, the BDWMO performed more detailed management level monitoring on the lake (see story on page 4). Habitat monitoring was also performed in 2019 (see page 7 for results).

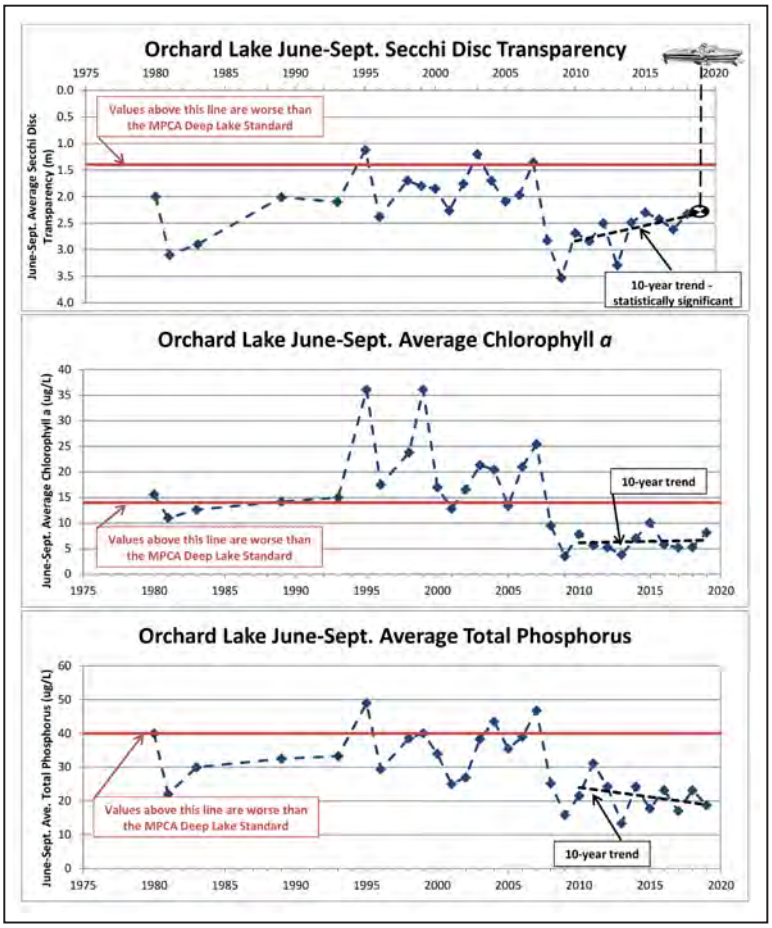
Keller Lake (Burnsville & Apple Valley)

Water Quality Monitoring—An alum treatment was conducted on Keller Lake in spring 2019, resulting in improved water quality. (See story on page 2). The 2019 Secchi disc transparency summer average was 1.3 meters (4.3 feet), which is better than it has been since 2008, and is better than the MPCA's shallow lake standard of 1.0 meter (3.3 feet). The summer-average total phosphorus (40 µg/L) was also better than it has been since 2008, and was better than the MPCA shallow lake standard of 60 µg/L. The 2019 summer-average of chlorophyll-*a* (25 µg/L) was worse than the MPCA's shallow lake standard of 20 µg/L.

Trend analyses were not completed for Keller Lake because of the alum treatment that was conducted in spring 2019. 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 2020. Habitat monitoring is also scheduled for the lake in 2020.

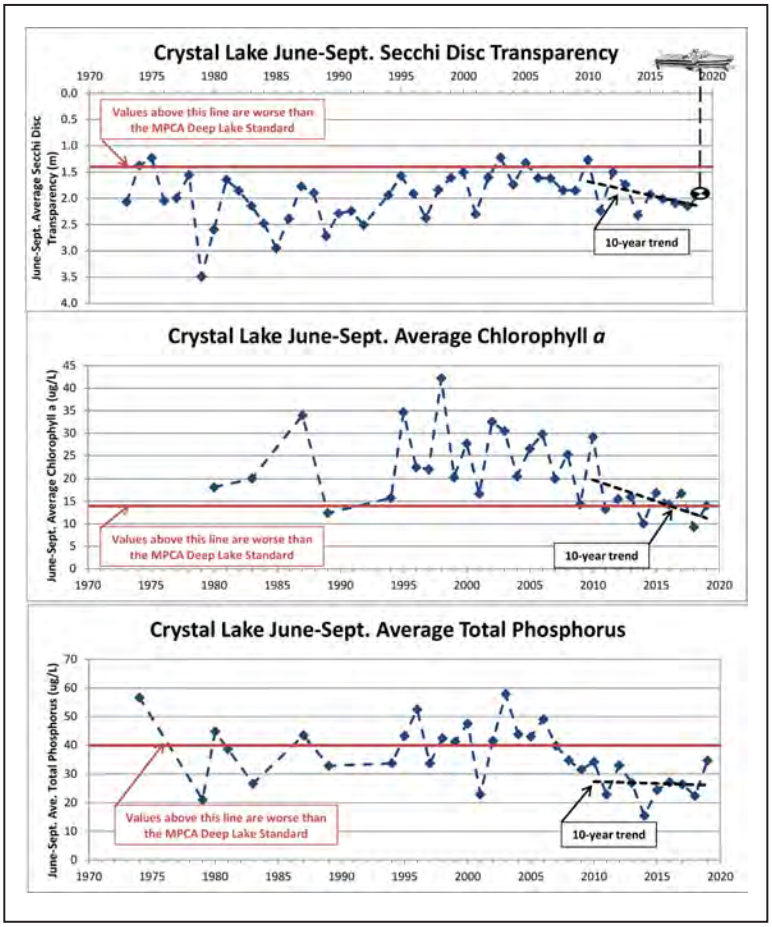






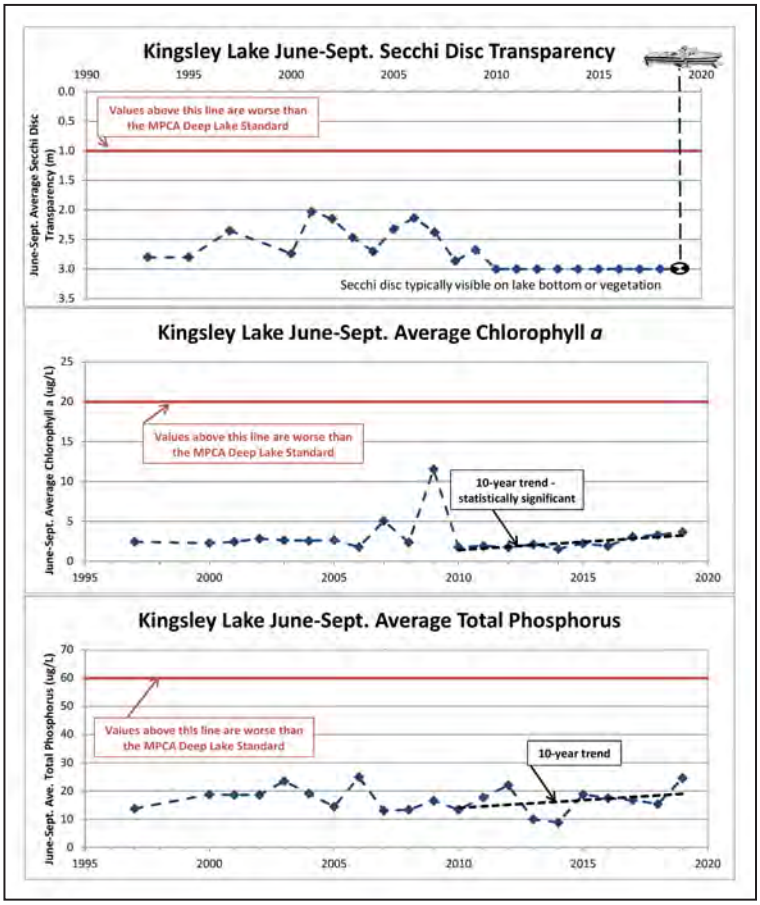
Orchard Lake (Lakeville)

Water Quality Monitoring—The 2019 summer-average Secchi disc transparency was 2.3 meters (7.6 feet), which is the same as the 2018 summer average, and better than the MPCA deep-lake water quality standard of 1.4 meters. The 2019 summer average of total phosphorus (19 µg/L) was better than the 2018 summer average, and is better than the MPCA's deep lake standard (40 µg/L). The summer-average chlorophyll-*a* (8.2 µg/L) was worse than the 2018 summer average, but better than the MPCA's deep lake standard (14 µg/L). The BDWMO will continue to monitor the water quality of Orchard Lake in 2020. Habitat monitoring is scheduled for the lake in 2022.



Crystal Lake (Burnsville & Lakeville)

Water Quality Monitoring—The 2019 summer-average Secchi disc transparency was 1.9 meters (6.2 feet), which is similar to other recent summer averages, and better than the MPCA deep-lake water quality standard of 1.4 meters. The 2019 summer average of total phosphorus (35 µg/L) was worse than the 2018 summer average, but better than the MPCA's deep lake standard (40 µg/L). The summer-average chlorophyll-*a* (14 µg/L) was worse than the 2018 summer average, and is equal to the MPCA's deep lake standard (14 µg/L). The BDWMO will continue to monitor the water quality of Crystal Lake in 2020. The next Crystal Lake habitat monitoring is scheduled for 2023.



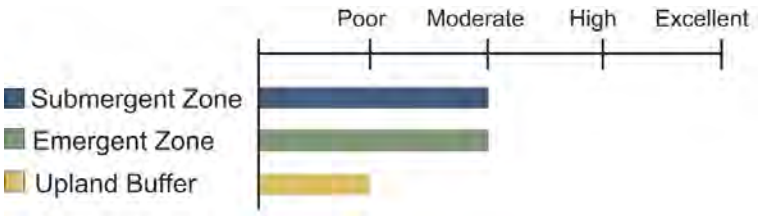
Kingsley Lake (Lakeville)

Water Quality Monitoring—Water quality monitoring data from 2019 show continued excellent water quality in Kingsley Lake. The lake 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 2019 summer averages of total phosphorus (25 µg/L) was the highest it's been since 2006, but still considerably better than the MPCA shallow lake standard (60 µg/L). The 2019 summer average chlorophyll-*a* (3.7 µg/L) was similar to years 2015-2018, and is considerably better than the MPCA's shallow lake standard (20 µg/L). The BDWMO will continue to monitor the water quality of Kingsley Lake in 2020. Habitat monitoring is scheduled for Kingsley Lake in 2021.

** 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 above.*

Lac Lavon Habitat Monitoring Results for 2019

As mentioned in the article on page 4, Lac Lavon habitat monitoring was conducted in 2019. The BDWMO made the following quality ratings, based on the monitoring results:



Submergent zone quality rating = Moderate

Rating based on averaging four criteria:

1. **high total number of native species (12)**
2. **moderate average native plant density (1.5)**
3. **moderate rating for average exotic species density (1.7)**
4. **moderate coefficient of conservatism value (mean C-value) (4.5)**

Curly-leaf pondweed, a dominant species found every year in Lac Lavon, was present at 29 percent of sample points shallower than the maximum depth of plant growth in June. In August, (after seasonal die-off) only a handful of the plants were observed. This die-off 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 also found in Lac Lavon in 2019 and in previous years. 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 BDWMO recommends continued monitoring, control, and management of these invasive species.

Emergent vegetation zone quality rating = Moderate

Rating based on averaging four criteria:

1. **excellent number of native wetland plant species (38)**
2. **high rating for % coverage of exotic species (26-50%)**
3. **a poor mean C-value rating (2.4)**
4. **poor rating for total vegetative cover (0-25%)**

Narrowleaf cattail is a dominant non-native invasive species found in the lake. Purple loosestrife, another non-native invasive plant species, is present in shallow open water and along the shoreline and has been managed for years through the release of beetles, which eat the plants. At the southwest portion of the lake, the emergent shoreline adjacent to the Burnsville prairie restoration project was seeded with native emergent vegetation.

The BDWMO recommends continued control and management of purple loosestrife.

Upland buffer zone quality rating = Poor

- 56 native species and 41 exotic species observed
- Exotic plant species > 40% of upland vegetative cover. The mean C-value rating is 2.0 (poor).
- Upland buffer (within city-owned property) along the western and northeastern portions of the shoreline is wide, providing wildlife habitat and shoreline protection.
- The majority of residential properties are dominated by maintained lawn grasses and sand beaches with little to no naturalized vegetation. The majority of the residential shoreline properties on Lac Lavon have the potential to provide a 50-foot naturalized buffer without altering any structures. One residential property has a naturalized buffer width adequate for wildlife protection (≥100 feet).
- 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:

Roger Baldwin, Chair
(serving since 1996)
Tom Harmening, Commissioner
(serving since 2002)
Mike Hughes, Commissioner
(serving since 2008)
Curtis Enestvedt, Alternate
(serving since 2014)

Representing Apple Valley and Eagan:

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

Representing Lakeville:

Scott Thureen, Secretary/Treasurer
(serving since 2008)
Vacant, Alternate

Engineering Consultant:

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

Legal Consultant:

Roger Knutson, 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.

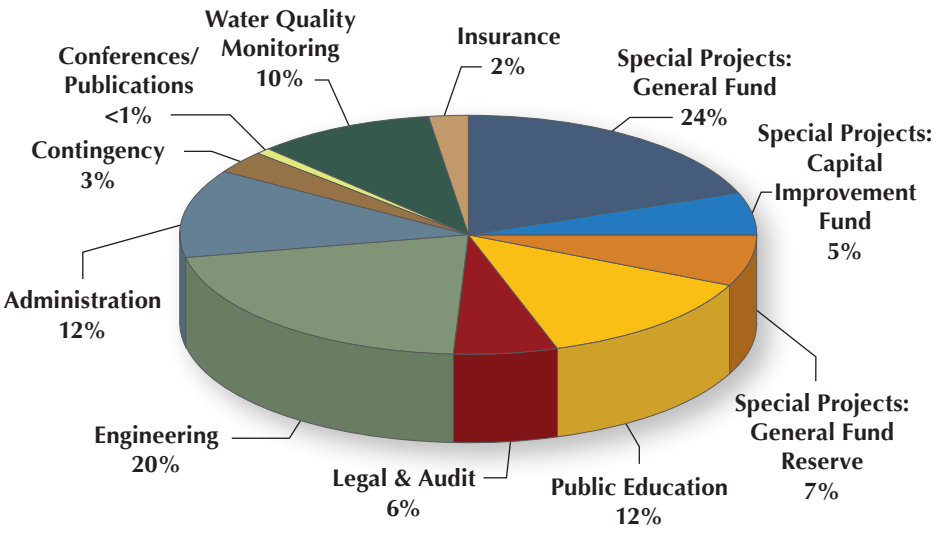
For more information, please contact:

Daryl Jacobson, Administrator
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337
Telephone: 952-895-4574
Fax: 952-895-4531

Website: www.blackdogwmo.org

2020 Expenditures

Engineering	$31,000
Legal and Audit	$8,400
Administrative Services	$18,000
Public Education	$17,900
Insurance	$3,000
Special Projects – General Fund	$36,500
Special Projects – Capital Improvement Fund	$7,000
Special Projects – General Fund Reserve	$10,000
Conference/Publications	$500
Water Quality Monitoring	$15,400
Contingency	$5,000
Total Expenditures	**$152,700**



2020 Income

Member Contributions	$153,000
Interest	$40
Total Income	**$153,040**