

LAKE VERMILION METAL and ANION ANALYSES in Surface Water

METAL/ANION →			Al	As*	B	Ca	Chloride	Cd*	Co	Cu*	Fe	Hg*	K	Mg	Mn	Na	Ni*	Nitrates	P (TP)	Pb*	Sulphate	Zn*	Alkalinity
			ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	ng/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Ideal			<200	<340	< 0.5	< 20	<120	< 0.72	<1.8	< 1.3	< 1.0	< 144	< 164	< 1,000	< 0.05	< 250	< 52	< 10	< 0.0305	<0.065	< 600	< 0.12	> 5
			<10 drink						drink								continous	drink		<0.015 drink	< 10 rice		(20-200 typical)
LOCATION	Date	Collector																					
Lake-wide	1943	DNR																	0.048				
Lake-wide	1976-1993	EPA/MPCA																	0.038				
Lake-wide	1984-2000	DNR																	0.03				
Lake-wide, via Lake Assessment Program	summer 2000	MPCA																	0.024				
Pike Bay, sw Hoodoo Pt	8.18.1983	MPCA																<0.01	0.05				
Pike Bay, sw Hoodoo Pt	8.17.1993	MPCA																	0.059				
Pike Bay	summer 2000	MPCA					8.5												0.029		15.2		35
Big Bay							7.3												0.022		16		37
Wakemup Bay							3.0												0.023		<5.0		27
Lake Outlet (Vermilion River Dam?)							5.4												0.234		10.6		31
Lake -Wide average							6												0.027		11.7		32
Big Bay, near Spider Island	2008	CLMP+																	0.02		14.8		33
Trout Lake portage																					9.6		
Frazer Bay, near 36 island																					12.7		
Niles Bay, near Zups point																					12.5		
Pike Bay							8.8												0.028		10.6		21
Wakemup Bay, near Comet island																					6.8		
unknown, by Gary Whitenack	5.30.14	VLA																			3.2 - 58.9		
Big Bay, between Spider & Stonich	summer 2015	?																< 0.05	0.012		10.45 ave		
Big Bay, between Spider & Stonich	5.08 - 9.15	?																			13.21 ave		
Pike Bay, sw Hoodoo Pt	7.7.15	MPCA																	0.023				
Armstrong Bay	8.7.16	VLA ?					13.3																
Mud Creek Bay							13.0																
East Two Rivers/Tower harbor	7.31.17	VLA ?					26.9																
East Two Rivers/Tower harbor	8.16-10.16	NRR1					27.5 ave																
Hoodoo Pt							13.8																
West Two Rivers							19.0																
Head of the Lakes Bay	8.19.16	1854																					
DO at 5 meters/~15 feet depth		DNR																					
Head of the Lakes Bay	2018-2020	1854																					
Temp at 5 meters depth, July ave.		DNR																					

LAKE VERMILION METAL and ANION ANALYSES in Surface Water

METAL/ANION →		Chl-a	Coliform	DO	pH	Secchi	TDS	TSS	PFOS	Temp	GPS Location	
		µg/L	cfu	mg/L	pH	feet	mg/L	mg/L	ng/L	°F	DMS	
Ideal		< 20	0	> 5.5	6.5 - 8.5	varies	< 500	< 1,200	≤ 4			
		>10 bloom	drink	fish				drink	drink			
LOCATION	Date											
Lake-wide	1943											
Lake-wide	1976-1993	6.7										
Lake-wide	1984-2000	13.0										
Lake-wide, via Lake Assessment Program	summer 2000	6.9										
Pike Bay, sw Hoodoo Pt	8.18.1983	16.0		7.5	7.3	2.1						
Pike Bay, sw Hoodoo Pt	8.17.1993	2.6			7.36	1.3						
Pike Bay	summer 2000	9.5			7.5	3.2		5.6				
Big Bay		5.3			7.5	7.8		2.4				
Wakemup Bay		8.1			7.5	9.5		3.1				
Lake Outlet (Vermilion River Dam?)		4.6			7.3			2.5				
Lake -Wide average		6.3			7.5	8.2		3.4				
Big Bay, near Spider Island	2008	6.8			7.2	6.6		3.0				
Trout Lake portage												
Frazer Bay, near 36 island												
Niles Bay, near Zups point												
Pike Bay		3.2			6.8	1.1		3.1				
Wakemup Bay, near Comet island												
unknown, by Gary Whitenack	5.30.14											
Big Bay, between Spider & Stonich	summer 2015	9.52		0.59 ?				1.2				
Big Bay, between Spider & Stonich	5.08 - 9.15											
Pike Bay, sw Hoodoo Pt	7.7.15			7.57	8.02	4						
Armstrong Bay	8.7.16				7.8							
Mud Creek Bay					7.7							
East Two Rivers/Tower harbor	7.31.17											
East Two Rivers/Tower harbor	8.16-10.16											
Hoodoo Pt												
West Two Rivers												
Head of the Lakes Bay	8.19.16			7.08						72.1°		
DO at 5 meters/~15 feet depth												
Head of the Lakes Bay	2018-2020									71°		
Temp at 5 meters depth, July ave.												

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METAL/ANION →			Al	As*	B	Ca	Chloride	Cd*	Co	Cu*	Fe	Hg*	K	Mg	Mn	Na	Ni*	Nitrates	P (TP)	Pb*	Sulphate	Zn*	Alkalinity
			ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	ng/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Ideal			<200	<340	< 0.5	< 20	<120	< 0.72	<1.8	< 1.3	< 1.0	< 144	< 164	< 1,000	< 0.05	< 250	< 52	< 10	< 0.0305	<0.065	< 600	< 0.12	> 5
				<10 drink					drink								continous	drink		<0.015 drink	< 10 rice		(20-200 typical)
LOCATION	Date	Collector																					
Cable Bay, east end	9.15.18	VLA				11.0																	
East Two Rivers, Iron Ore bar bridge						28.5																	
Pike River, above dam						15.9																	
Pike River, below dam, under bridge						15.0																	
Pike River, entering Pike Bay						15.9																	
Stuntz Bay, north end						11.5																	
Stuntz Bay, south end						11.1																	
Trout River, as it empties into Vermilion						4.9																	
West Two Rivers, south side of bridge						10.8																	
Pike Bay, near Hoodoo, west of marked sunken island	7.1.19	MPCA																	0.023		10.9 ave		
Pike Bay, east of Whiskey island	6.19 - 7.19	MPCA																	0.026		10.9 ave		
Big Bay, nnnw of Storich & sw of Spider	6.19 - 7.19	MPCA																	0.017		9.5 ave		
Wakemup Bay, ese Center island	6.19 - 7.19	MPCA																			3.85 ave		
Big Bay, west Birch Is/east Potato Is	end July,2020	VLA																					
water temp at surface	end July,2021																						
	end July,2022																						
	end July,2023																						
Big Bay, Spider Island,sw edge,WQ1	8.3.20	DNR				11.6								5.68					0.023		12.1		43
Trout Lake portage, sw side, WQ2						9.6								4.33					0.020		7.9		35
Frazer Bay, nw of Breezy Pt, WQ3						10.4								4.75					0.020		9.2		38
Niles Bay, mid-bay, WQ4						9.0								4.01					0.040		7.2		35
Wakemup Bay, nw Center Island,WQ5																			0.027		4.6		26
East Two Rivers, Tower harbor, southside dock	9.25.20	VLA				49.2																	
East Two Rivers, Iron Ore bar bridge, west						49.5																	
East Two Rivers, snowmobile bridge south of Mesabi trail						46.2																	
Pike River, east Hwy 169 & Wahsten bridge	9.29.20	MPCA																					
Pike Bay, sw Hoodoo Pt	10.8.20	MPCA																					
East Two Rivers, Tower harbor, southside dock	10.19.20	VLA				32.8																	
East Two Rivers, Iron Ore bar bridge, west side						31.7																	
East Two Rivers, snowmobile bridge south of Mesabi trail						31.9																	
East Two Rivers, snowmobile bridge Mesabi Tr/Junction Rd						31.2																	
Soudan monument culvert,draining Soudan mine & local storm run-off						127.0																	
Tower waste water pond #3 (dry, but snowing)						57.9																	

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METAL/ANION →		Chl-a	Coliform	DO	pH	Secchi	TDS	TSS	PFOS	Temp	GPS Location	
		µg/L	cfu	mg/L	pH	feet	mg/L	mg/L	ng/L	°F	DMS	
Ideal		< 20	0	> 5.5	6.5 - 8.5	varies	< 500	< 1,200	≤ 4			
		>10 bloom	drink	fish				drink	drink			
LOCATION	Date											
Cable Bay, east end	9.15.18				7.8							
East Two Rivers, Iron Ore bar bridge					7.5							
Pike River, above dam					8.0							
Pike River, below dam, under bridge					7.9							
Pike River, entering Pike Bay					7.9							
Stuntz Bay, north end					7.7							
Stuntz Bay, south end					7.7							
Trout River, as it empties into Vermilion					7.4							
West Two Rivers, south side of bridge					7.1							
Pike Bay, near Hoodoo, west of marked sunken island	7.1.19			8.63		5						
Pike Bay, east of Whiskey island	6.19 - 7.19			7.26								
Big Bay, nwn of Storich & sw of Spider	6.19 - 7.19	3.6				7.5						
Wakemup Bay, ese Center island	6.19 - 7.19											
Big Bay, west Birch Is/east Potato Is water temp at surface	end July,2020				6.8	5				79°?	47.51.301N, 92.17.219W	
	end July,2021					6				74°	47.50.922N, 92.17.606W	
	end July,2022					6					47.51.061N, 92.17.551W	
	end July,2023					5.5				73°	47.51.070N, 92.17.641W	
Big Bay, Spider Island,sw edge,WQ1	8.3.20	11.7			7.45	7.0	100				47.52.0044N, 92.17.2649W	
Trout Lake portage, sw side, WQ2		13.1			7.39	6.0	82				47.54.3737N, 92.19.5235W	
Frazer Bay, nw of Breezy Pt, WQ3		11.9			7.69	7.0	104				47.52.4282N, 92.27.2309W	
Niles Bay, mid-bay, WQ4		19.6			7.77	6.0	76				47.55.0162N, 92.30.0763W	
Wakemup Bay, nw Center Island,WQ5		22.4				5.0	68				47.55.2726N, 92.36.2038W	
East Two Rivers, Tower harbor, southside dock	9.25.20				7.7							
East Two Rivers, Iron Ore bar bridge, west					7.7							
East Two Rivers, snowmobile bridge south of Mesabi trail					7.7							
Pike River, east Hwy 169 & Wahsten bridge	9.29.20			7.37	7.62							
Pike Bay, sw Hoodoo Pt	10.8.20					5.0						
East Two Rivers, Tower harbor, southside dock	10.19.20				7.24							
East Two Rivers, Iron Ore bar bridge, west side					7.24							
East Two Rivers, snowmobile bridge south of Mesabi trail					7.34							
East Two Rivers, snowmobile bridge Mesabi Tr/Junction Rd					7.35							
Soudan monument culvert,draining Soudan mine & local storm run-					7.31							
Tower waste water pond #3 (dry, but snowing)					8.34							

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METAL/ANION →			Al	As*	B	Ca	Chloride	Cd*	Co	Cu*	Fe	Hg*	K	Mg	Mn	Na	Ni*	Nitrates	P (TP)	Pb*	Sulphate	Zn*	Alkalinity
Ideal			<200	<340	< 0.5	< 20	<120	< 0.72	<1.8	< 1.3	< 1.0	< 144	< 164	< 1,000	< 0.05	< 250	< 52	< 10	< 0.0305	<0.065	< 600	< 0.12	> 5
LOCATION	Date	Collector	<10 drink						drink								continuous	drink		<0.015 drink	< 10 rice		(20-200 typical)
East Two Rivers, Tower harbor, southside dock	4.12.21	VLA				13.7																	
East Two Rivers, snowmobile bridge south of Mesabi trail						13.2																	
East Two Rivers, snowmobile bridge Mesabi Tr/Junction Rd						13.5																	
Soudan monument culvert,draining Soudan mine & local storm run-off						23.6																	
Tower waste water pond #3 (after sevral days rain & melting snow)						55.2																	
East Two Rivers, Tower harbor, southside dock	6.18.21	VLA				39.1																	
East Two Rivers, snowmobile bridge south of Mesabi trail						42.9																	
East Two Rivers, snowmobile bridge Mesabi Tr/Junction Rd						37.3																	
Soudan monument culvert,draining Soudan mine & local storm run-off						242.0																	
Tower waste water pond #3						57.8																	
Pike River, entrance to Pike Bay						18.7																	
East Two Rivers, Tower harbor, by culvert	8.4.21	VLA				38.2							0.88	4.68	0.540	11.6							
East Two Rivers, Your Boat Club dock						35.5																	
East Two Rivers, midway betweenYBC & Pike Bay ent						22.7																	
East Two Rivers, at Pike Bay entrance						16.9																	
Big Bay, between Potato & Birch islands						11.4							1.36	5.48	0.041	4.73							
Wakemup Bay, Camp Vermilion dock (drought conditions)						6.6							0.93	2.64	0.037	2.83							
Soudan Mine, required by MPCA (high values)	1999	Mine	3680						9.7	308	2100					300							
	2021		8						0.094	0.095	19					0.33							
	2022		34			124	(9.4.22)		0.291	<1.3	43					0.64							
(thru Sept)	2023		1580						0.15	6.3	1640												
Big Bay, near Spider Island	8.10.21	DNR				12.4									6.08						11.3		42
Trout Lake portage		(Sta. 1-5)				10.8									4.94						9.14		37
Frazer Bay, near 36 island						11.3									5.14						9.46		38
Niles Bay, near Zups point						9.7									4.26						7.45		33
Wakemup Bay, near Comet island						6.9									2.78						4.93		24
Lake Riley, Eden Prairie/Chanhassen for reference - one of worst AIS lakes in Twin Cities	8.9.21 - 10.25.21	MPCA					102 - 110																
E2 Rivers, east Tower harbor by culverts	10.25.21	VLA				43.4					0.705	< 2.0	0.882	5.60	0.264	9.39			< 0.20	< 1.0		13.8	
E2 Rivers by YourBoatClub (YBC) dock						41.7	30.9				0.662	< 2.0	1.15	5.31	0.302	8.8			< 0.20	< 1.0		12.9	
Soudan Monument culvert						369.0	27.3				1.33	< 2.0	8.81	63.5	0.453	191			< 0.20	< 1.0		121.0	
Pike River dam, under Hwy 77 bridge (water level up 8" from drought)						18.4	890				0.616	< 2.0	2.52	17.1	0.276	8.81			< 0.20	< 1.0		44.8	
							18.5																

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METAL/ANION →		Chl-a	Coliform	DO	pH	Secchi	TDS	TSS	PFOS	Temp	GPS Location	
		µg/L	cfu	mg/L	pH	feet	mg/L	mg/L	ng/L	°F	DMS	
Ideal		< 20	0	> 5.5	6.5 - 8.5	varies	< 500	< 1,200	≤ 4			
		>10 bloom	drink	fish				drink	drink			
LOCATION	Date											
East Two Rivers, Tower harbor, southside dock	4.12.21				6.98							
East Two Rivers, snowmobile bridge south of Mesabi trail					7.06							
East Two Rivers, snowmobile bridge Mesabi Tr/Junction Rd					7.23							
Soudan monument culvert,draining Soudan mine & local storm run-					8.17							
Tower waste water pond #3 (after sevral days rain & melting snow)					7.62							
East Two Rivers, Tower harbor, southside dock	6.18.21				7.9							
East Two Rivers, snowmobile bridge south of Mesabi trail					8.0							
East Two Rivers, snowmobile bridge Mesabi Tr/Junction Rd					7.7							
Soudan monument culvert,draining Soudan mine & local storm run-					7.8							
Tower waste water pond #3					8.2							
Pike River, entrance to Pike Bay					7.9							
East Two Rivers, Tower harbor, by culvert	8.4.21				?							
East Two Rivers, Your Boat Club dock					6.8							
East Two Rivers, midway betweenYBC & Pike Bay ent					7.0							
East Two Rivers, at Pike Bay entrance					6.9							
Big Bay, between Potato & Birch islands												
Wakemup Bay, Camp Vermilion dock (drought conditions)												
Soudan Mine, required by MPCA	1999				7.73			9.3			47.81.09N, 92.73.67W	?
(high values)	2021				7.5			<1				
	2022				7.4			9.8				
(thru Sept)	2023				7.4			6.9				
Big Bay, near Spider Island	8.10.21	19.9			8.00		132					
Trout Lake portage		12.7			8.25		90					
Frazer Bay, near 36 island		15.6			8.14		88					
Niles Bay, near Zups point		17.6			7.83		76					
Wakemup Bay, near Comet island		13.4			7.64		56					
Lake Riley, Eden Prairie/Chanhassen	8.9.21 -			0.62	7.1 - 8.03	4.9	391					
for reference - one of worst AIS	10.25.21											
lakes in Twin Cities												
E2 Rivers, east Tower harbor by culverts	10.25.21				6.6							
E2 Rivers by YourBoatClub (YBC) dock					6.7							
Soudan Monument culvert					7.1							
Pike River dam, under Hwy 77 bridge (water level up 8" from drought)					6.8							

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METAL/ANION →			Al	As*	B	Ca	Chloride	Cd*	Co	Cu*	Fe	Hg*	K	Mg	Mn	Na	Ni*	Nitrates	P (TP)	Pb*	Sulphate	Zn*	Alkalinity
			ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	ng/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Ideal			<200	<340	< 0.5	< 20	<120	< 0.72	<1.8	< 1.3	< 1.0	< 144	< 164	< 1,000	< 0.05	< 250	< 52	< 10	< 0.0305	<0.065	< 600	< 0.12	> 5
			<10 drink						drink								continuous	drink		<0.015 drink	< 10 rice		(20-200 typical)
LOCATION	Date	Collector																					
Soudan monument culvert,draining Soudan mine &	5.11.22	VLA				61.7				0.43					0.14								
E2 River, Mesabi Tr west of Junction Rd		record high				14.7				<0.01					0.04								
E2 River, Tower harbor		water				15.7				<0.01					0.05								
E2 River, YBC dock		1359.66'				14.8				<0.01					0.05								
Pike River dam, under Hwy 77 bridge		(5.23.22)				6.5	5.3			<0.01					0.05						13.4		
Big Bay, near Spider Island, WQ1	6.14.22	DNR				11.6								5.69				0.026			12.7		36
Trout Lake portage, WQ2		(Sta. 1-5)				8.4								3.72				0.022			8.0		28
Frazer Bay, near 36 island, WQ3						10.5								4.86				0.029			10.0		34
Niles Bay, near Zups point, WQ4						9.8								4.39				0.041			8.5		33
Wakemup Bay, near Comet island, WQ5						6.5								2.29				0.032			6.6		24
Tower waste water pond #3	6.29.22	VLA	50	< 2.0	0.115	58.8	87.8	<0.0001	< 0.50	<0.0050	0.319	1.03	6.13	8.44	0.208	53.6	< 5.0	0.26	1.53	<0.0005	9.9	<0.0200	167
Soudan monument culvert,draining Soudan mine & local storm run		water level	599	< 2.0	<0.100	159.0	368.00	<0.0001	15.6	0.4660	1.64	57.2	5.52	31.7	0.284	72.4	36.6	0.650	0.012	0.000917	94.8	0.0433	74
E2 River, Mesabi Tr west of Junction Rd		1358.35'	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
E2 River, Tower Harbor			50	< 2.0	<0.100	24.8	7.38	<0.0001	< 0.50	<0.0050	0.541	1.17	<0.50	2.82	0.11	4.34	< 5.0	< 0.03	0.214	<0.0005	1.9	<0.0200	81
E2 River, YBC dock			50	< 2.0	<0.100	24.5	7.67	<0.0001	< 0.50	<0.0050	0.565	0.99	<0.50	2.79	0.137	4.00	< 5.0	< 0.03	0.029	<0.0005	1.9	<0.0200	10
E2 River, entrance to Pike Bay			82	< 2.0	<0.100	23.2	8.35	<0.0001	< 0.50	<0.0050	0.727	1.67	<0.50	3.49	0.139	4.61	< 5.0	< 0.03	0.033	<0.0005	3.2	<0.0200	68
W2 River, near Hwy 169 bridge			103	< 2.0	<0.100	19.8	6.74	<0.0001	< 0.50	<0.0050	1.90	3.71	3.21	2.05	0.133	3.21	< 5.0	0.04	0.035	<0.0005	3.0	<0.0200	56
Pike River, below dam under Hwy 77 bridge			182	< 2.0	<0.100	15.3	16	<0.0001	0.70	<0.0050	3.25	5.19	2.03	14.9	0.360	9.80	< 5.0	0.08	0.047	<0.0005	18.9	<0.0200	74
Stuntz Bay			< 50	< 2.0	<0.100	11.2	8.85	<0.0001	< 0.50	<0.0050	0.138	1.42	1.15	5.26	0.042	5.35	< 5.0	< 0.03	0.023	<0.0005	13.3	<0.0200	43
Cable Bay			< 50	< 2.0	<0.100	12.7	8.89	<0.0001	< 0.50	<0.0050	0.134	1.37	1.25	5.81	0.028	5.76	< 5.0	< 0.03	0.027	<0.0005	13.5	<0.0200	43
Big Bay, near Spider Island "hole"			< 50	< 2.0	<0.100	9.5	8.87	<0.0001	< 0.50	<0.0050	<0.100	1.23	1.25	4.08	0.013	5.76	< 5.0	< 0.03	0.027	<0.0005	13.5	<0.0200	37
Trout River, as it empties into Ver.			< 50	< 2.0	<0.100	3.9	3.85	<0.0001	< 0.50	<0.0050	<0.100	1.06	0.82	2.99	<0.010	3.22	< 5.0	< 0.03	0.013	<0.0005	6.4	<0.0200	31
Frazer Bay, nw Breezy Pt			< 50	< 2.0	<0.100	9.7	7.54	<0.0001	< 0.50	<0.0050	<0.100	0.74	0.98	3.1	<0.010	3.29	< 5.0	< 0.03	0.015	<0.0005	10.8	<0.0200	56
Niles Bay, mid bay			< 50	< 2.0	<0.100	11.5	6.91	<0.0001	< 0.50	<0.0050	<0.100	0.66	0.99	5.41	0.011	4.39	< 5.0	< 0.03	0.015	<0.0005	8.5	<0.0200	43
Wakemup Bay, nw of Center Island			< 50	< 2.0	<0.100	6.5	4.53	<0.0001	< 0.50	<0.0050	<0.100	0.63	0.91	2.59	<0.010	3.30	< 5.0	< 0.03	0.014	<0.0005	4.0	<0.0200	31
Black Bay, mid bay			234	< 2.0	<0.100	3.5	2.34	<0.0001	< 0.50	<0.0050	0.765	4.48	0.85	1.27	0.045	2.20	< 5.0	< 0.03	0.082	<0.0005	1.4	<0.0200	25
Wolf Bay, near Vermilion dam			< 50	< 2.0	<0.100	9.8	7.03	<0.0001	< 0.50	<0.0050	<0.100	0.58	1.01	4.28	0.017	4.55	< 5.0	< 0.03	0.017	<0.0005	8.9	<0.0200	37
Soudan Monument culvert	9.13.2022	VLA				327.0	860.0			0.4	4.52										105.0		86.8
E2 River, Tower Harbor		water level				32.1	19.9			< 0.01	0.50										1.8		105.0
E2 River, YBC dock		1357.31'				32.0	15.1			< 0.01	0.43										1.9		105.0
E2 River, entrance to Pike Bay						19.0	12.9			< 0.01	0.93										9.2		86.8
Pike River, below dam under Hwy 77 bridge											3.14										17.1		x
Pike River, entrance to Pike Bay											2.50										15.4		
Stuntz Bay						12.0																	
Cable Bay						12.0																	
Soudan Monument culvert	5.8.2023	VLA	0.50			80.4	126.0			0.66	1.79										70.7		
Junction Rd power substation culvert		water level				48.4	35.2				0.17											14.2	
E2 River, Tower Harbor		1359.04'				16.8	8.7				0.35											2.8	
E2 River, YBC dock			0.08			16.6	5.2				0.32											2.7	
W2 River, near Hwy 169 bridge						9.0	2.0				0.63											1.8	
Pike River, below dam under Hwy 77 bridge						8.2	8.4				0.77											16.1	

LAKE VERMILION METAL and ANION ANALYSES in Surface Water

METAL/ANION →		Chl-a	Coliform	DO	pH	Secchi	TDS	TSS	PFOS	Temp	GPS Location	
		µg/L	cfu	mg/L	pH	feet	mg/L	mg/L	ng/L	°F	DMS	
Ideal		< 20	0	> 5.5	6.5 - 8.5	varies	< 500	< 1,200	≤ 4			
		>10 bloom	drink	fish				drink	drink			
LOCATION	Date											
Soudan monument culvert,draining Soudan mine & E2 River, Mesabi Tr west of Junction Rd	5.11.22				8.9							
E2 River, Tower harbor					8.1							
E2 River, YBC dock					7.7							
Pike River dam, under Hwy 77 bridge					7.7							
Big Bay, near Spider Island, WQ1	6.14.22	6.69			7.65		112				47.52.0044N, 92.17.2649W	
Trout Lake portage, WQ2		18.60			7.58		108				47.54.3737N, 92.19.5235W	
Frazer Bay, near 36 island, WQ3		8.61			7.68		112				47.52.4282N, 92.27.2309W	
Niles Bay, near Zups point, WQ4		20.80			8.22		112				47.55.0162N, 92.30.0763W	
Wakemup Bay, near Comet island, WQ5		19.30			7.73		64				47.55.2726N, 92.36.2038W	
Tower waste water pond #3	6.29.22	NA			7.6	x	344	< 2.0			47.48.50N, 92.15.25W	
Soudan monument culvert,draining Soudan mine & local storm run		NA			7.6	NA	1110	12.2			47.48.49N, 92.14.26W	
E2 River, Mesabi Tr west of Junction Rd		x	x	x	x	x	x	x			x	
E2 River, Tower Harbor		< 1.67			7.5	7.5	118	< 1.4			47.48.14 N, 92.16.52W	
E2 River, YBC dock		< 1.25			7.4	B	120	< 1.4			47.48.19 N, 92.17.18W	
E2 River, entrance to Pike Bay		6.01			6.6	4.5	108	2.6			47.48.28 N, 92.17.42W	
W2 River, near Hwy 169 bridge		NA			6.4	NA	132	2.2			47.47.30 N, 92.22.05W	
Pike River, below dam under Hwy 77 bridge		NA			7.5	NA	210	2.8			47.47.30N, 92.22.06W	
Stuntz Bay		10.7			7.5	5.0	96	2.8			47.49.51N, 92.14.32W	
Cable Bay		7.68			7.4	6.0	98	1.9			47.50.45N, 92.12.03W	
Big Bay, near Spider Island "hole"		6.69			7.4	7.5	94	< 1.4			47.52.00N, 92.17.28W	
Trout River, as it empties into Ver.		7.34			6.8	13.0	50	< 2.0			47.54.51N, 92.19.34W	
Frazer Bay, nw Breezy Pt		8.01			7.6	9.0	82	< 2.0			? N, 92.27.24W	
Niles Bay, mid bay		7.48			7.4	8.5	66	< 2.0			47.53.32N, 92.30.32W	
Wakemup Bay, nw of Center Island		3.34			6.8	12.0	50	< 1.4			47.55.23N, 92.36.49W	
Black Bay, mid bay		6.94			6.2	2.0	68	< 1.4			47.57.30N, 92.28.28W	
Wolf Bay, near Vermilion dam		7.48			7.2	8.0	76	2.0			47.57.23N, 92.28.28W	
Soudan Monument culvert	9.13.2022				7.9		1820				47.48.49N, 92.14.26W	
E2 River, Tower Harbor					7.7		164				47.48.14 N, 92.16.52W	
E2 River, YBC dock					7.6		162				47.48.18N, 92.17.16W	
E2 River, entrance to Pike Bay					7.5		166				47.48.47N, 92.17.69W	
Pike River, below dam under Hwy 77 bridge					7.5						47.47.30N, 92.22.06W	
Pike River, entrance to Pike Bay					7.5						47.48.28 N, 92.17.42W	
Stuntz Bay					x						47.49.77N, 92.14.35W	
Cable Bay					x						47.50.72N, 97.12.01W	
Soudan Monument culvert	5.8.2023				8.1						47.48.49N, 92.14.26W	
Junction Rd power substation culvert					7.9							
E2 River, Tower Harbor					7.9						47.48.14 N, 92.16.52W	
E2 River, YBC dock					7.7						47.48.18N, 92.17.16W	
W2 River, near Hwy 169 bridge					7.4						47.47.30 N, 92.22.05W	
Pike River, below dam under Hwy 77 bridge					7.5						47.47.30N, 92.22.06W	

LAKE VERMILION METAL and ANION ANALYSES in Surface Water

METAL/ANION →			Al	As*	B	Ca	Chloride	Cd*	Co	Cu*	Fe	Hg*	K	Mg	Mn	Na	Ni*	Nitrates	P (TP)	Pb*	Sulphate	Zn*	Alkalinity
			ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	ng/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Ideal			<200	<340	< 0.5	< 20	<120	< 0.72	<1.8	< 1.3	< 1.0	< 144	< 164	< 1,000	< 0.05	< 250	< 52	< 10	< 0.0305	<0.065	< 600	< 0.12	> 5
			<10 drink						drink								continous	drink		<0.015 drink	< 10 rice		(20-200 typical)
LOCATION	Date	Collector																					
Daisy Bay, sw, reading station		water level																					
highest recorded		1359.66'																					
Daisy Bay, sw, reading station	6.18.2023	water level																					
		1357.86'																					
Daisy Bay, sw, reading station	7.27.2023	water level																					
		1357.46'																					
E2 River, Tower Harbor	7.31.2023	VLA																					
E2 River, YBC dock						33.2																	
W2 River, near Hwy 169 bridge																							
Pike River, below dam under Hwy 77 bridge																					17.8		
Big Bay, nw Birch Is/se Potato Is																							
Big Bay, near Spider Island, WQ1	7.31.2023	DNR				11.5								6.27					0.019		12.9		37
Trout Lake portage, WQ2						9.83								5.00					0.021		9.64		32
Frazer Bay, near 36 island, WQ3						10.9								5.61					0.017		11.6		35
Niles Bay, near Zups point, WQ4						9.63								4.75					0.015		9.32		32
Wakemup Bay, near Comet island, wos						6.82								3.04					0.016		4.54		25
Daisy Bay, sw, reading station	9.1.2023	water level																					
		1357.02'																					
Daisy Bay, sw, reading station	11.8.2023	water level																					
		1357.08'																					
Daisy Bay, sw, reading station	4.15.2024	water level																					
		1357.98'																					

LAKE VERMILION METAL and ANION ANALYSES in Surface Water

METAL/ANION →			Al	As*	B	Ca	Chloride	Cd*	Co	Cu*	Fe	Hg*	K	Mg	Mn	Na	Ni*	Nitrates	P (TP)	Pb*	Sulphate	Zn*	Alkalinity
Ideal			ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	ng/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			<200	<340	< 0.5	< 20	<120	< 0.72	<1.8	< 1.3	< 1.0	< 144	< 164	< 1,000	< 0.05	< 250	< 52	< 10	< 0.0305	<0.065	< 600	< 0.12	> 5
			<10 drink						drink								continuous	drink		<0.015 drink	< 10 rice		(20-200 typical)
LOCATION	Date	Collector																					
4.22.2024																							

LAKE VERMILION METAL and ANION ANALYSES in Surface Water

METAL/ANION →		Chl-a	Coliform	DO	pH	Secchi	TDS	TSS	PFOS	Temp	GPS Location	
		µg/L	cfu	mg/L	pH	feet	mg/L	mg/L	ng/L	°F	DMS	
Ideal		< 20	0	> 5.5	6.5 - 8.5	varies	< 500	< 1,200	≤ 4			
		>10 bloom	drink	fish				drink	drink			
LOCATION	Date											
4.22.2024												