

Table 1. Maximum, minimum, and range of water levels (m) for Lac la Croix, Rainy and Namakan for each of the years that aquatic vegetation was sampled.

	Water Body			
Maximum/year	Lac la Croix	Rainy	Namakan	
Max 1987	361.89	337.73	340.96	
Max 2002	361.38	338.57	341.20	
Max 2003	361.00	337.39	340.63	
Max 2004	361.79	337.66	340.86	
Max 2005	362.08	337.94	340.99	
Max 2010	361.33	337.72	340.89	
Minimum/year				
Min 1987	360.47	336.65	338.52	
Min 2002	360.38	336.84	339.37	
Min 2003	360.27	336.58	339.38	
Min 2004	360.50	336.86	339.35	
Min 2005	360.40	336.85	339.33	
Min 2010	360.45	336.89	339.39	
Range/ year				
Range 1987	1.41	1.07	2.44	
Range 2002	1.00	1.73	1.83	
Range 2003	0.73	0.82	1.25	
Range 2004	1.28	0.81	1.52	
Range 2005	1.68	1.10	1.66	
Range 2010	0.88	0.83	1.50	
Mean Range	1.16	1.06	1.70	

Table 2 . Variability in select enviromental metrics among water bodies and years. Deep elevations were sampled 2.0m below mean high water (MHW), mid-deep sites were 1.25m below MHW. See text for more detailed description of metric development.

	# yrs. since last drawdown	# drawdowns since 1927	Ice out , Julian day	GDDs, yr. of sampling	water level fluctuations (m), yr. of sampling
LLC Deep, 2002, 05	75, 78	0	120	980, 855	1.00, 1.68
LLC Deep, 2010	83	0	94	836	0.88
LLC Mid-deep, 2002, 05	2, 5	6, 7	120	980, 855	1.00, 1.68
LLC Mid-deep, 2010	0	9	94	836	0.88
Namakan deep, 2002	15	6	120	980	1.83
Namakan deep, 2010	23	6	94	836	1.50
Namakan mid-deep, 2002	4	23	120	980	1.83
Namakan mid-deep, 2010	12	23	94	836	1.50
Rainy deep, 2003,04,05	76, 77, 78	0	125, 121, 113	893, 602, 855	0.82, 0.81, 1.10
Rainy deep, 2010	83	0	100	836	0.83
Rainy mid-deep, 2003,04,05	76, 77, 78	1	125, 121, 113	893, 602, 855	0.82, 0.81, 1.10
Rainy mid-deep, 2010	80	1	100	836	0.83

Table 3. Comparison of overall 20 most abundant taxa (by Imp. Value) between elevations (1.25m and 2.00m) in **Lac la Croix** across both sampling times. "x" to the left of values indicates taxa are 4x or more abundant at 1.25m, "x" to the right indicates taxa are 4x or more abundant at 2.0m.

	Taxa		1.25m	2.00m	
1	<i>Najas flexilis</i>		347.56	296.46	
2	<i>Nymphaea odorata</i>		201.87	182.63	
3	<i>Isoetes sp.</i>		60.67	272.42	x
4	<i>Sagittaria rosette</i>		193.36	95.41	
5	<i>Vallisneria americana</i>		28.26	195.56	x
6	<i>Potamogeton narrowleaved</i>		128.14	90.85	
7	<i>Chara sp.</i>		27.99	166.61	x
8	<i>Scirpus subterminalis</i>		119.05	71.89	
9	<i>Myriophyllum sp.</i>		102.33	77.57	
10	<i>Utricularia vulgaris</i>		65.92	95.35	
11	<i>Sparganium fluctuans</i>		88.06	61.23	
12	<i>Potamogeton gramineus</i>		88.37	46.32	
13	<i>Bidens beckii</i>		38.69	95.99	
14	<i>Eleocharis palustris</i>	x	115.12	0.00	
15	<i>Glyceria borealis</i>	x	58.24	0.00	
16	<i>Utricularia minor</i>		17.10	40.17	
17	<i>Eriocaulon aquaticum</i>	x	57.17	0.00	
18	<i>Potamogeton richardsonii</i>		16.32	38.53	
19	<i>Eleocharis acicularis</i>	x	53.48	0.00	
20	<i>Ranunculus longirostris</i>		8.24	29.54	

Table 4. Comparison of overall 20 most abundant taxa (by Imp. Value) between elevations (1.25m and 2.00m) in **Rainy Lake** across both sampling times. "x" to the left of values indicates taxa are 4x or more abundant at 1.25m, "x" to the right indicates taxa are 4x or more abundant at 2.0m.

	Taxa		1.25m	2.00m				
1	Vallisneria americana		425.16	774.94				
2	Najas flexilis		234.70	102.20				
3	Potamogeton robbinsii		31.05	292.76	x			
4	Isoetes sp.	x	202.40	29.49				
5	Potamogeton narrowleaved		129.02	49.61				
6	Potamogeton richardsonii		28.95	132.03	x			
7	Potamogeton gramineus	x	140.11	12.07				
8	Sparganium fluctuans	x	129.26	19.34				
9	Bidens beckii		16.40	120.43	x			
10	Myriophyllum sp.		27.63	105.13				
11	Sagittaria rosette	x	103.88	10.36				
12	Ranunculus longirostris		19.47	90.33	x			
13	Elodea canadensis		39.74	56.18				
14	Eleocharis acicularis	x	80.21	2.17				
15	Chara sp.		21.90	46.67				
16	Nymphaea odorata	x	55.50	7.01				
17	Sagittaria sp.	x	62.01	0.00				
18	Zosterella dubia		1.68	58.86	x			
19	Eleocharis palustris	x	51.50	0.00				
20	Elatine minima		33.02	11.00				

Table 5. Comparison of overall 20 most abundant taxa (by Imp. Value) between elevations (1.25m and 2.00m) in **Namakan** across both sampling times. "x" to the left of values indicates taxa are 4x or more abundant at 1.25m, "x" to the right indicates taxa are 4x or more abundant at 2.0m.

	Taxa		1.25 m	2.00 m		
1	Vallisneria americana		380.44	610.41		
2	Najas flexilis		436.00	284.25		
3	Potamogeton narrowleaved		263.73	152.55		
4	Chara sp.		58.81	280.89	x	
5	Potamogeton gramineus	x	228.73	56.27		
6	Lemna trisulca		44.35	175.42	x	
7	Elodea canadensis		60.07	112.43		
8	Isoetes sp.	x	119.17	21.66		
9	Sagittaria rosette	x	111.85	27.14		
10	Bidens beckii		47.62	87.56		
11	Myriophyllum sp.		30.77	97.32		
12	Nymphaea odorata		62.98	61.27		
13	Potamogeton richardsonii		30.25	86.79		
14	Ceratophyllum demersum		29.42	63.10		
15	Eleocharis acicularis	x	51.02	6.88		
16	Ranunculus longirostris		31.39	17.91		
17	Elatine minima	x	33.73	6.73		
18	Potamogeton zosteriformis		16.24	22.73		
19	Utricularia vulgaris		18.94	8.78		
20	Sparganium fluctuans		12.90	11.94		

Table 6. Multi-response Permutation Procedure (MRPP) comparisons between elevations (1.25m and 2.00m) for cover, frequency and importance value, for each water body independently. "*" indicates differences at p=0.001 level.

Water Body	Metric	Group by :	A	p		
Lac la Croix	Cover	Depth	0.06007	0.00011	*	
		Group by :	A	p		
Lac la Croix	Frequency	Depth	0.05844	0.00000	*	
		Group by :	A	p		
Lac la Croix	Importance Value	Depth	0.05184	0.00002	*	
		Group by :	A	p		
Namakan	Cover	Depth	0.03046	0.00375		
		Group by :	A	p		
Namakan	Frequency	Depth	0.04149	0.00000	*	
		Group by :	A	p		
Namakan	Importance Value	Depth	0.05084	0.00005	*	
		Group by :	A	p		
Rainy	Cover	Depth	0.04561	0.00023	*	
		Group by :	A	p		
Rainy	Frequency	Depth	0.09209	0.00000	*	
		Group by :	A	p		
Rainy	Importance Value	Depth	0.08821	0.00000	*	
		Group by :	A	p		

Table 8. Multi-response Permutation Procedure (MRPP) pairwise comparisons among water bodies for cover, frequency and importance value at both depths (1.25m and 2.00m). "*" on right of p values indicates differences at p=0.001 level.

Depth	Metric	Water Body			A	p						
Mid-deep (1.25m)	Cover	Lac la Croix	vs.	Namakan	0.06439	0.00004	*					
		Lac la Croix	vs.	Rainy	0.06003	0.00000	*					
		Namakan	vs.	Rainy	0.01876	0.02328						
Deep (2.00m)	Cover	Lac la Croix	vs.	Namakan	0.04483	0.00029	*					
		Lac la Croix	vs.	Rainy	0.08895	0.00000	*					
		Namakan	vs.	Rainy	0.03069	0.00483						
Depth	Metric	Water Body			A	p						
Mid-deep (1.25m)	Frequency	Lac la Croix	vs.	Namakan	0.07816	0.00000	*					
		Lac la Croix	vs.	Rainy	0.09356	0.00000	*					
		Namakan	vs.	Rainy	0.02636	0.00010	*					
Deep (2.00m)	Frequency	Lac la Croix	vs.	Namakan	0.04662	0.00000	*					
		Lac la Croix	vs.	Rainy	0.09354	0.00000	*					
		Namakan	vs.	Rainy	0.06499	0.00010	*					
Depth	Metric	Water Body										
Mid-deep (1.25m)	Imp. Value	Lac la Croix	vs.	Namakan	0.08357	0.00000	*					
		Lac la Croix	vs.	Rainy	0.09564	0.00000	*					
		Namakan	vs.	Rainy	0.02184	0.00459						
Deep (2.00m)		Lac la Croix	vs.	Namakan	0.06813	0.00000	*					
		Lac la Croix	vs.	Rainy	0.13371	0.00000	*					
		Namakan	vs.	Rainy	0.05390	0.00046	*					

Table 11. Comparison of total cover and total frequency among water bodies and between times. Significant differences resulting from a two-way ANOVA (water body, time) at p=0.01 are indicated. Averages over the two times are also indicated, and ANOVAs were calculated for each elevation separately.

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							Significant Differences		
Lac la Croix		Namakan		Rainy		Main Effects		Interaction Effects	
1.25m	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Water body	Time	
Total Cover	740.7	923.8	1048.5	1173.7	1293.0	612.7	None	None	Rainy T1 > Rainy T2
average		832.3		1111.1		952.9			
Total Frequency	113.4	147.4	101.6	108.7	108.4	81.5	see interaction	None	LLC T2 > Rainy T2, NAM T1
average		130.4		105.1		95.0			
Lac la Croix		Namakan		Rainy					
2.00m	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Water body	Time	
Total Cover	742.5	1783.5	1123.3	1378.1	859.2	746.7	None	None	LLC T2 > LLC T1, Rainy T2
average		1263.0		1250.7		803.0			
Total Frequency	92.7	123.3	81.6	89.4	72.4	64.6	LLC > Rainy	None	None
average		108.0		85.5		68.5			

Table 12. Taxa unique to one or two water bodies as sampled in 1240 quadrats (both time periods) along the **1.25m** elevation transects. Only those taxa present with overall frequency of 3 or more are included.

				Frequency	Frequency
Uniquely absent in Namakan at 1.25m				LLC	Rainy
				121	59
	<i>Eleocharis palustris</i>			12	7
	<i>Nuphar spp.</i>			4	25
	<i>Potamogeton natans</i>			9	25
	<i>Potamogeton robbinsii</i>			12	38
	<i>Zizania palustris</i>			2	4
	<i>Zosterella dubia</i>				
Uniquely absent in Rainy at 1.25m				LLC	Namakan
				34	6
	<i>Callictriche hermaphroditica</i>			19	11
	<i>Ranunculus flammula</i>			121	4
	<i>Scirpus subterminalis</i>			32	3
	<i>Utricularia minor</i>				
Uniquely present in Namakan at 1.25m				Frequency	
				65	
	<i>Lemna trisulca</i>			13	
	<i>Ranunculus sp.</i>			4	
	<i>Scirpus fluviatilis</i>				
Uniquely present in Lac la Croix at 1.25 m				Frequency	
				8	
	<i>Epilobium sp.</i>			3	
	<i>Hippurus vulgaris</i>			3	
	<i>Polygonum amphibium</i>			5	
	<i>Scirpus americana</i>			6	
	<i>Sium sauve</i>				

Table 13. Taxa unique to one or two water bodies as sampled in 1240 quadrats (both time periods) along the **2.0m** elevation transects. Only those taxa present with overall frequency of 3 or more are included.

				Frequency	Frequency
Uniquely absent in Namakan at 2.0m				LLC	Rainy
				48	65
	<i>Zosterella dubia</i>			13	10
	<i>Potamogeton epihydrus</i>				
Uniquely absent in Lac la Croix at 2.0m				Namakan	Rainy
				10	3
	<i>Eleocharis acicularis</i>			75	3
	<i>Lemna trisulca</i>				
Uniquely present in Lac la Croix at 2.0m				Frequency	
	<i>Scirpus subterminalis</i>			40	
	<i>Subularia aquatica</i>			8	
	<i>Utricularia intermedia</i>			6	
	<i>Utricularia minor</i>			65	

Table 14. The ten most abundant taxa, by cover, at the mid-deep elevation (1.25m) over two sampling times for Lac la Croix (2002-5 & 2010), Namakan (2002 & 2010, and Rainy (2003-5 & 2010). Additionally the cumulative percent cover is listed for these taxa, e.g., the ten most abundant taxa at Lac la Croix account for 81.0 % of all cover. (Totals also shown).

	Lac la Croix			Namakan			Rainy		
	Cover	Cum. %		Cover	Cum. %		Cover	Cum. %	
1	<i>Najas flexilis</i>	4191.6	25.2	<i>Najas flexilis</i>	6486.6	26.5	<i>Vallisneria americana</i>	3971	20.8
2	<i>Sagittaria rosette</i>	2064.5	37.6	<i>Vallisneria americana</i>	5151.3	47.6	<i>Najas flexilis</i>	2626	34.6
3	<i>Nymphaea odorata</i>	1924.4	49.1	<i>Potamogeton narrowleaf</i>	3907.9	63.6	<i>Isoetes</i> sp.	1954	44.9
4	<i>Scirpus subterminalis</i>	1266.3	56.8	<i>Potamogeton gramineus</i>	2183.1	72.5	<i>Sparganium fluctuans</i>	1788	54.3
5	<i>Eleocharis palustris</i>	881.3	62.0	<i>Sagittaria rosette</i>	1249.8	77.6	<i>Potamogeton gramineus</i>	1618	62.7
6	<i>Potamogeton narrowleaf</i>	805.9	66.9	<i>Chara</i> sp.	987.3	81.7	<i>Sagittaria</i> sp.	1133	68.7
7	<i>Potamogeton gramineus</i>	789.3	71.6	<i>Isoetes</i> sp.	733.6	84.7	<i>Potamogeton natans</i>	980.1	73.8
8	<i>Myriophyllum</i> sp.	559.3	75.0	<i>Elodea canadensis</i>	444	86.5	<i>Sagittaria rosette</i>	940.3	78.8
9	<i>Eleocharis acicularis</i>	505.4	78.0	<i>Bidens beckii</i>	436.6	88.3	<i>Potamogeton narrowleaf</i>	730.8	82.6
10	<i>Sparganium fluctuans</i>	499.5	81.0	<i>Lemna trisulca</i>	383.4	89.9	<i>Eleocharis acicularis</i>	686.1	86.2
	Water Body Totals	16,645			24,444			19,057	

Table 15. The ten most abundant taxa, by cover, at the deep elevation (2.0m) over two sampling times for Lac la Croix (2002-5 & 2010), Namakan (2002 & 2010, and Rainy (2003-5 & 2010). Additionally the cumulative percent cover is listed for these taxa, e.g., the ten most abundant taxa at Lac la Croix account for 89.7 % of all cover. (Totals also shown).

	Lac la Croix			Namakan			Rainy		
	Cover	Cum. %		Cover	Cum. %		Cover	Cum. %	
1	<i>Isoetes sp.</i>	5688	22.5	<i>Vallisneria americana</i>	8956	32.5	<i>Vallisneria americana</i>	7930.7	49.4
2	<i>Najas flexilis</i>	5289	43.5	<i>Chara sp.</i>	6298	55.4	<i>Potamogeton robbinsii</i>	2428.9	64.5
3	<i>Chara sp.</i>	2821	54.6	<i>Najas flexilis</i>	3684	68.8	<i>Myriophyllum sp.</i>	1144.4	71.6
4	<i>Nymphaea odorata</i>	2423	64.2	<i>Potamogeton narrowleaf</i>	1765	75.2	<i>Potamogeton richardsonii</i>	1011.7	77.9
5	<i>Vallisneria americana</i>	2395	73.7	<i>Lemna trisulca</i>	1687	81.4	<i>Zosterella dubia</i>	612.7	81.8
6	<i>Sagittaria rosette</i>	1539	79.8	<i>Myriophyllum sp.</i>	999.9	85.0	<i>Najas flexilis</i>	604.5	85.5
7	<i>Scirpus subterminalis</i>	827.4	83.1	<i>Elodea canadensis</i>	682	87.5	<i>Ranunculus longirostris</i>	590.6	89.2
8	<i>Myriophyllum sp.</i>	733	86.0	<i>Bidens beckii</i>	630.9	89.8	<i>Elodea canadensis</i>	561	92.7
9	<i>Utricularia minor</i>	483.6	87.9	<i>Potamogeton gramineus</i>	587.7	91.9	<i>Bidens beckii</i>	412.2	95.3
10	<i>Bidens beckii</i>	467.1	89.7	<i>Ceratophyllum demersum</i>	548.9	93.9	<i>Chara sp.</i>	154.7	96.2
	Water Body Totals	25,259			27,515			16,058	

Table 17. Top 10 taxa by cover at the six sites sampled three times, first in 1987 , then in 2002-5, and again in 2010. Both elevations are shown, total cover is collapsed over time and the 2 sites in each water body.

	1.25m	Total		Total		Total
	Lac la Croix	Cover	Namakan	Cover	Rainy	Cover
1	<i>Najas flexilis</i>	1644.3	<i>Najas flexilis</i>	1387.2	<i>Vallisneria americana</i>	1082.0
2	<i>Nymphaea odorata</i>	917.2	<i>Potamogeton narrowleaf</i>	1318.1	<i>Sparganium fluctuans</i>	1051.0
3	<i>Myriophyllum sp.</i>	469.8	<i>Vallisneria americana</i>	1087.1	<i>Potamogeton gramineus</i>	520.0
4	<i>Scirpus subterminalis</i>	435.1	<i>Eleocharis acicularis</i>	461.8	<i>Najas flexilis</i>	277.5
5	<i>Sagittaria rosette</i>	357.3	<i>Ranunculus flammula</i>	451.0	<i>Sagittaria rosette</i>	184.0
6	<i>Bidens beckii</i>	282.9	<i>Chara sp.</i>	302.4	<i>Potamogeton narrowleaf</i>	155.7
7	<i>Potamogeton gramineus</i>	247.0	<i>Ranunculus longirostris</i>	297.1	<i>Isoetes sp.</i>	140.2
8	<i>Potamogeton narrowleaf</i>	193.9	<i>Nymphaea odorata</i>	194.2	<i>Eleocharis palustris</i>	112.1
9	<i>Chara sp.</i>	119.9	<i>Potamogeton gramineus</i>	171.1	<i>Potamogeton robbinsii</i>	75.0
10	<i>Utricularia vulgaris</i>	113.4	<i>Crassula aquatica</i>	136.5	<i>Sagittaria sp.</i>	67.1
	Total all taxa	5402.5		6394.5		3806.8
	2.00m	Total		Total		Total
	Lac la Croix	Cover	Namakan	Cover	Rainy	Cover
1	<i>Najas flexilis</i>	1792.6	<i>Vallisneria americana</i>	1761.4	<i>Vallisneria americana</i>	2398.1
2	<i>Chara sp.</i>	1182.3	<i>Chara sp.</i>	828.5	<i>Potamogeton richardsonii</i>	104.2
3	<i>Vallisneria americana</i>	541.2	<i>Najas flexilis</i>	729.8	<i>Potamogeton epihydrus</i>	61.0
4	<i>Sagittaria rosette</i>	402.2	<i>Ceratophyllum demersum</i>	332.5	<i>Potamogeton robbinsii</i>	29.5
5	<i>Nymphaea odorata</i>	385.1	<i>Nymphaea odorata</i>	132.3	<i>Najas flexilis</i>	18.6
6	<i>Bidens sp.</i>	301.2	<i>Potamogeton narrowleaf</i>	64.5	<i>Potamogeton amplifolius</i>	10.1
7	<i>Potamogeton gramineus</i>	158.0	<i>Potamogeton richardsonii</i>	50.2	<i>Potamogeton gramineus</i>	9.1
8	<i>Myriophyllum sp.</i>	97.1	<i>Sagittaria rosette</i>	43.2	<i>Potamogeton narrowleaf</i>	8.2
9	<i>Potamogeton epihydrus</i>	90.0	<i>Myriophyllum sp.</i>	34.8	<i>Ranunculus longirostris</i>	5.3
10	<i>Potamogeton richardsonii</i>	81.8	<i>Elodea canadensis</i>	24.2	<i>Myriophyllum sp.</i>	5.1
	Total all taxa	5351.6		4061.8		2668.6