APPENDIX 5.2.7A:
AREA 2

The following abbreviations were used for waterbodies

ASSN = Assean Lake
BURNT = Burntwood River near the inlet to Split Lake
HAYES = Hayes River
LMFB = Limestone GS forebay
LNR = lower Nelson River downstream of the Limestone GS
LSFB = Long Spruce forebay
SPLIT = Split Lake
STL-S = Stephens Lake South
STL-N = Stephens Lake North

Appendix Tables and Figures Page

Tables

Table 5.2.7A-1: Inventory of water quality data collated for the lower Nelson River downstream of Stephens Lake.. ..... 5.2.7A-1
Table 5.2.7A-2: Means of water quality indicators measured in the Limestone forebay and the lower Nelson River upstream of the Angling River under CAMP: 2008–2013. ..... 5.2.7A-2

Figures

Figure 5.2.7A-1: Total phosphorus concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to trophic categories. 5.2.7A-4
Figure 5.2.7A-2: Total nitrogen concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to trophic categories. 5.2.7A-5
Figure 5.2.7A-3: Chlorophyll *a* concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to trophic categories. 5.2.7A-6
Figure 5.2.7A-4: Total phosphorus concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to the Manitoba narrative nutrient guidelines. 5.2.7A-7
Figure 5.2.7A-5: Total phosphorus concentrations measured by MCWS/EC in Split Lake, the Nelson River above the Weir and in the Hayes River (an off-system reference site) from 1979–1982. ..... 5.2.7A-8
Figure 5.2.7A-6: Mean±SE concentrations of chlorophyll *a* measured in the Limestone forebay and the lower Nelson River downstream of Limestone under CAMP (2008-2013). 5.2.7A-9
Figure 5.2.7A-7: Total suspended solids in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-10
Figure 5.2.7A-8: Total suspended solids at sites along the lower Nelson River, 2002–2013... 5.2.7A-11

Figure 5.2.7A-9: Mean±SE Secchi disk depths measured in the Limestone forebay under CAMP 5.2.7A-11
Figure 5.2.7A-10: Surface dissolved oxygen in the lower Nelson River downstream of Stephens Lake from 1972–2013. No data were available for the Kettle forebay. 5.2.7A-12
Figure 5.2.7A-11: Laboratory measured pH in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-13
Figure 5.2.7A-12: Hardness measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-14
Figure 5.2.7A-13: Alkalinity measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-15
Figure 5.2.7A-14: Laboratory measured conductivity measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-16
Figure 5.2.7A-15: Magnesium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-17
Figure 5.2.7A-16: Potassium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-18
Figure 5.2.7A-17: Sodium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-19
Figure 5.2.7A-18: Chloride concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-20
Figure 5.2.7A-19: Sulphate concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-21
Figure 5.2.7A-20: Calcium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013. ..... 5.2.7A-22
Figure 5.2.7A-21: Mean±SE concentrations of mercury measured in waterbodies along the lower Nelson River system under CAMP (2008–2013) and comparison to the Manitoba PAL guideline 5.2.7A-23
Figure 5.2.7A-22: Mean±SE concentrations of aluminum measured in waterbodies along the lower Nelson River system under CAMP (2008–2013) and comparison to the Manitoba PAL guideline 5.2.7A-23
Figure 5.2.7A-23: Mean±SE concentrations of iron measured in waterbodies along the lower Nelson River system under CAMP (2008–2013) and comparison to the Manitoba PAL guideline 5.2.7A-24
Figure 5.2.7A-24: Selenium concentrations measured in the lower Nelson River upstream of the Angling River during CAMP: 2008–2013 ..... 5.2.7A-24

Table 5.2.7A-1: Inventory of water quality data collated for the lower Nelson River downstream of Stephens Lake. Sites are illustrated in Map 5.2.7-1.

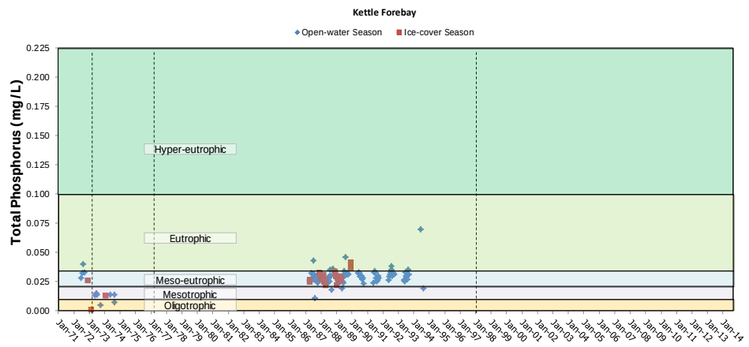
Waterbody	Map Site IDs	Period of Record	Data Source	Study Program
Kettle forebay				
At Kettle Rapids	Station 9	1972–1974	Morelli (1974)	LWCNRSB
At Kettle GS	Kettle GS	1986–1989	Green (1990)	MEMP
At Kettle forebay	Kettle FB	1990–1994	Manitoba Hydro	LAMP
Long Spruce forebay	Site 5	1972–1973	Cleugh (1974)/DFO (2015)	LWCNRSB/DFO
	Long Spruce FB	1990–1994, 1996, 1999	Manitoba Hydro	LAMP
	NR3	2002–2003	Manitoba Hydro	Keeyask
	NR3	2004, 2006, 2009	Manitoba Hydro	Conawapa
Limestone forebay	Limestone FB	1989–1994, 1996, 1999	Manitoba Hydro	LAMP
	NR4	2002–2003	Manitoba Hydro	Keeyask
	NR4	2004, 2006, 2009	Manitoba Hydro	Conawapa
	UHS004	2009–2013 (2009 and 2011-2012 winter only)	Manitoba/Manitoba Hydro	CAMP
Lower Nelson River Downstream of Limestone GS				
Above the Weir River	UHS001	1979–1983	MCWS (2014)	MCWS
Above the Angling River	NR6	2002–2003	Manitoba Hydro	Keeyask
Between the Angling and Weir rivers	C-Tu-08	2009 (winter only)	Manitoba Hydro	Conawapa
Above the Angling River	NR6	2004, 2009	Manitoba Hydro	Conawapa
	UHS002	2008–2013	Manitoba/Manitoba Hydro	CAMP
Lower Nelson River at the estuary	Site 5’	1972	Cleugh (1974)	LWCNRSB
	Site 2	1988	Manitoba Hydro	NR estuary
	NR8	2002–2003	Manitoba Hydro	Keeyask
	NR8	2004, 2009	Manitoba Hydro	Conawapa

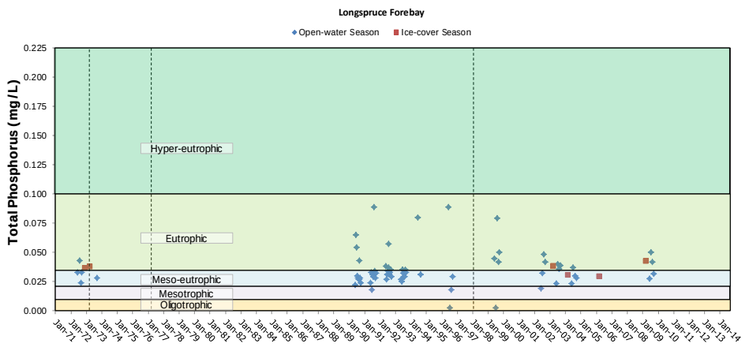
Table 5.2.7A-2: Means of water quality indicators measured in the Limestone forebay and the lower Nelson River upstream of the Angling River under CAMP: 2008–2013.

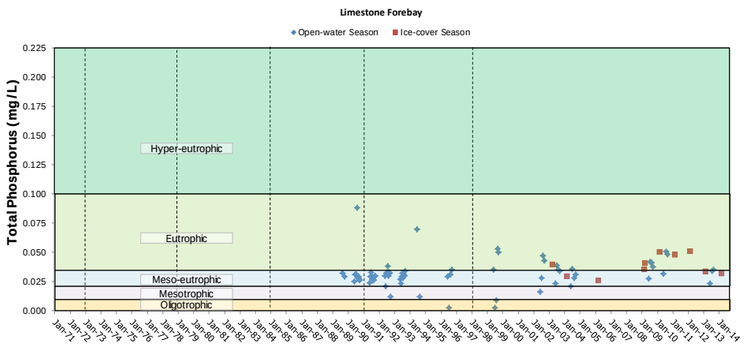
Metric	Units	Waterbody	
		LMFB	LNR
Years Sampled	-	2010/2011, 2013/2014	2008/2009–2013/2014
TP	(mg/L)	0.0378	0.0393
TP Trophic Status	-	Eutrophic	Eutrophic
TN	(mg/L)	0.41	0.51
TN Trophic Status	-	Mesotrophic	Oligotrophic
TKN	(mg/L)	0.37	0.46
Chlorophyll *a*	(µg/L)	2.90	3.57
Chlorophyll *a* Trophic Status	-	Mesotrophic	Oligotrophic
TN:TP		24	30
DOC	(mg/L)	8.5	8.2
Nitrate/nitrite	(mg N/L)	0.0432	0.0501
Ammonia	(mg N/L)	0.026	0.013
Dissolved Phosphorus	(mg/L)	0.020	0.020
DO Lower than MWQSOGs for PAL	(Y/N)	N	N
DO – open water season (surface)	(mg/L)	10.55	10.66
DO – open water season (bottom)	(mg/L)	10.33	10.66
DO – ice cover season (surface)	(mg/L)	16.44	17.03
DO – ice cover season (bottom)	(mg/L)	16.74	15.73
Thermal Stratification	(Y/N)	No	No
Secchi Disk Depth	(m)	0.99	0.35
Secchi Disk Depth – open water only	(m)	0.99	-
TSS	(mg/L)	10.2	14.3
Turbidity	(NTU)	15.8	21.0
True Colour	(TCU)	15.1	23.6
Conductivity	(µmhos/cm)	312	294

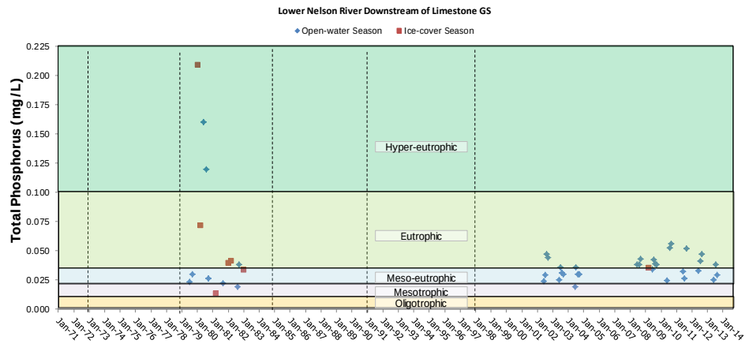
Table 5.2.7A-2: Means of water quality indicators measured in the Limestone forebay and the lower Nelson River upstream of the Angling River under CAMP: 2008–2013.

Metric	Units	Waterbody	
		LMFB	LNR
TDS	(mg/L)	189	185
Hardness	(mg/L)	121	124
Hardness Category	-	Hard	Hard
pH	-	8.21	8.24
Total Alkalinity		101	100
Metals > MWQSOGs for PAL	-	Al, Fe	Al, Fe, Se
Aluminum	(mg/L)	0.785	0.719
Iron	(mg/L)	0.612	0.599
Mercury (<0.000026 mg/L DL only)	(mg/L)	0.0000019	<0.000020
Mercury (0.000001 mg/L DL only)	(mg/L)	0.0000019	<0.0000010
Calcium	(mg/L)	29.0	30.2
Magnesium	(mg/L)	11.9	11.8
Potassium	(mg/L)	2.89	2.82
Sodium	(mg/L)	16.7	16.2
Chloride	(mg/L)	18.9	18.4
Sulphate	(mg/L)	28.4	25.6









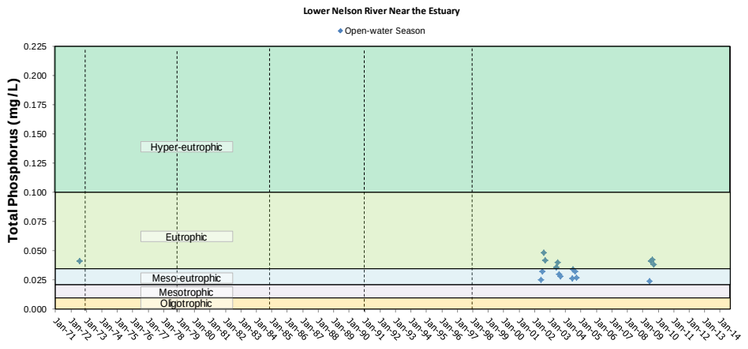


Figure 5.2.7A-1: Total phosphorus concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to trophic categories.

Figure 5.2.7A-2: Total nitrogen concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to trophic categories.

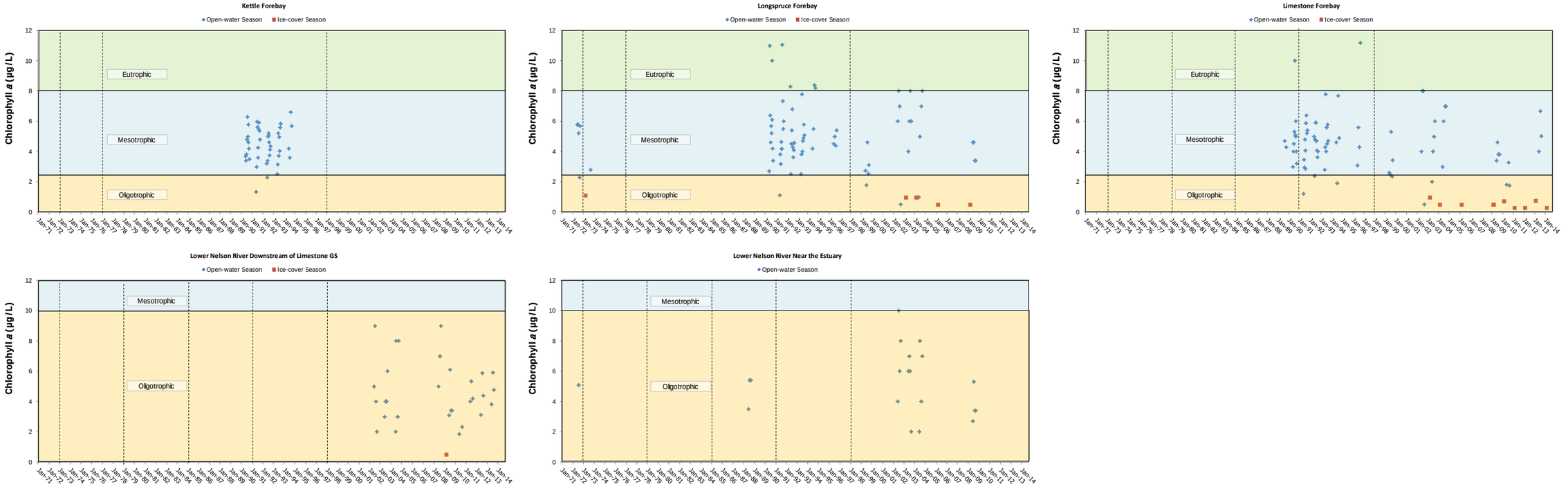


Figure 5.2.7A-3: Chlorophyll *a* concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to trophic categories.

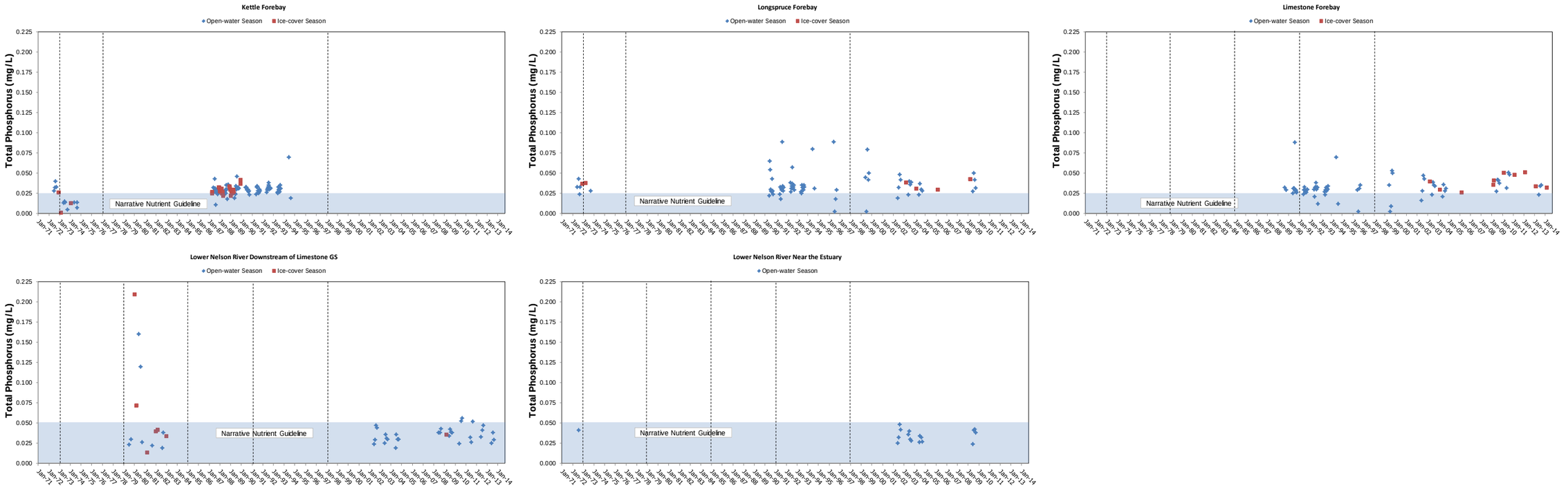


Figure 5.2.7A-4: Total phosphorus concentrations in the lower Nelson River downstream of Stephens Lake from 1972–2013 and comparison to the Manitoba narrative nutrient guidelines.

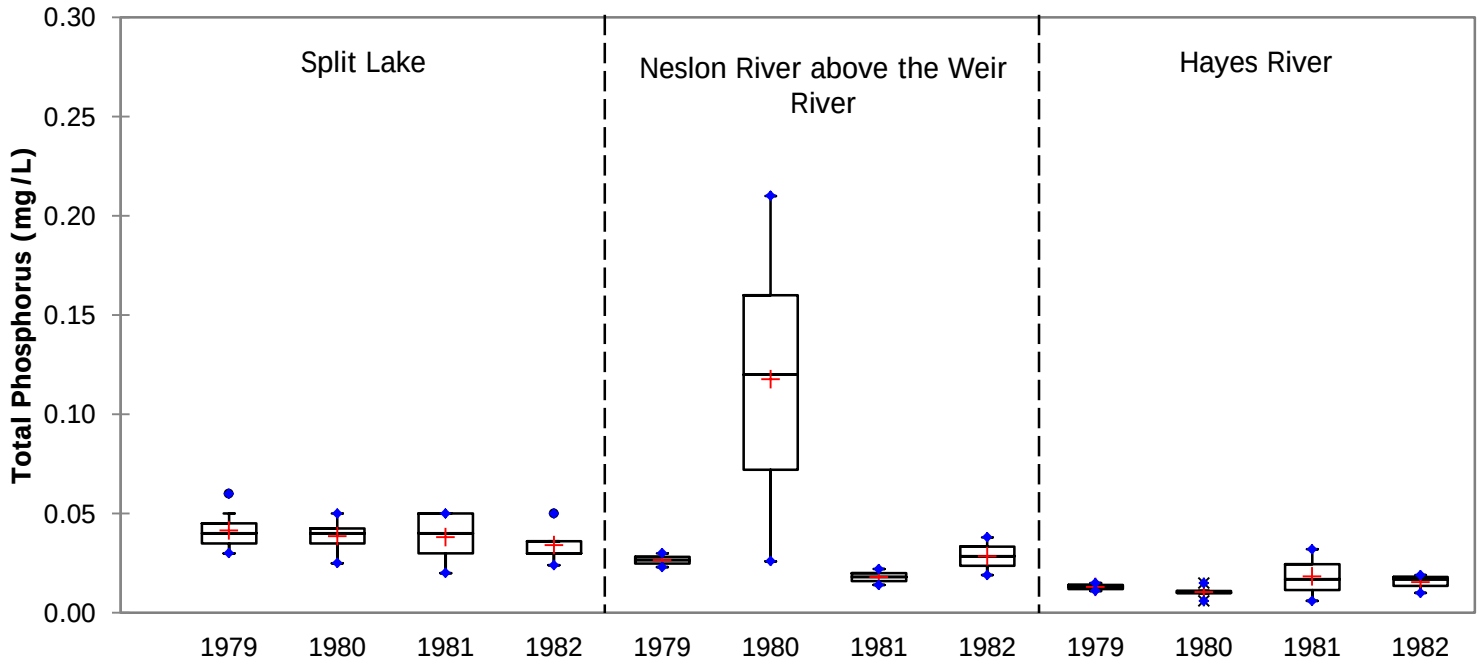


Figure 5.2.7A-5: Total phosphorus concentrations measured by MCWS/EC in Split Lake, the Nelson River above the Weir and in the Hayes River (an off-system reference site) from 1979–1982.

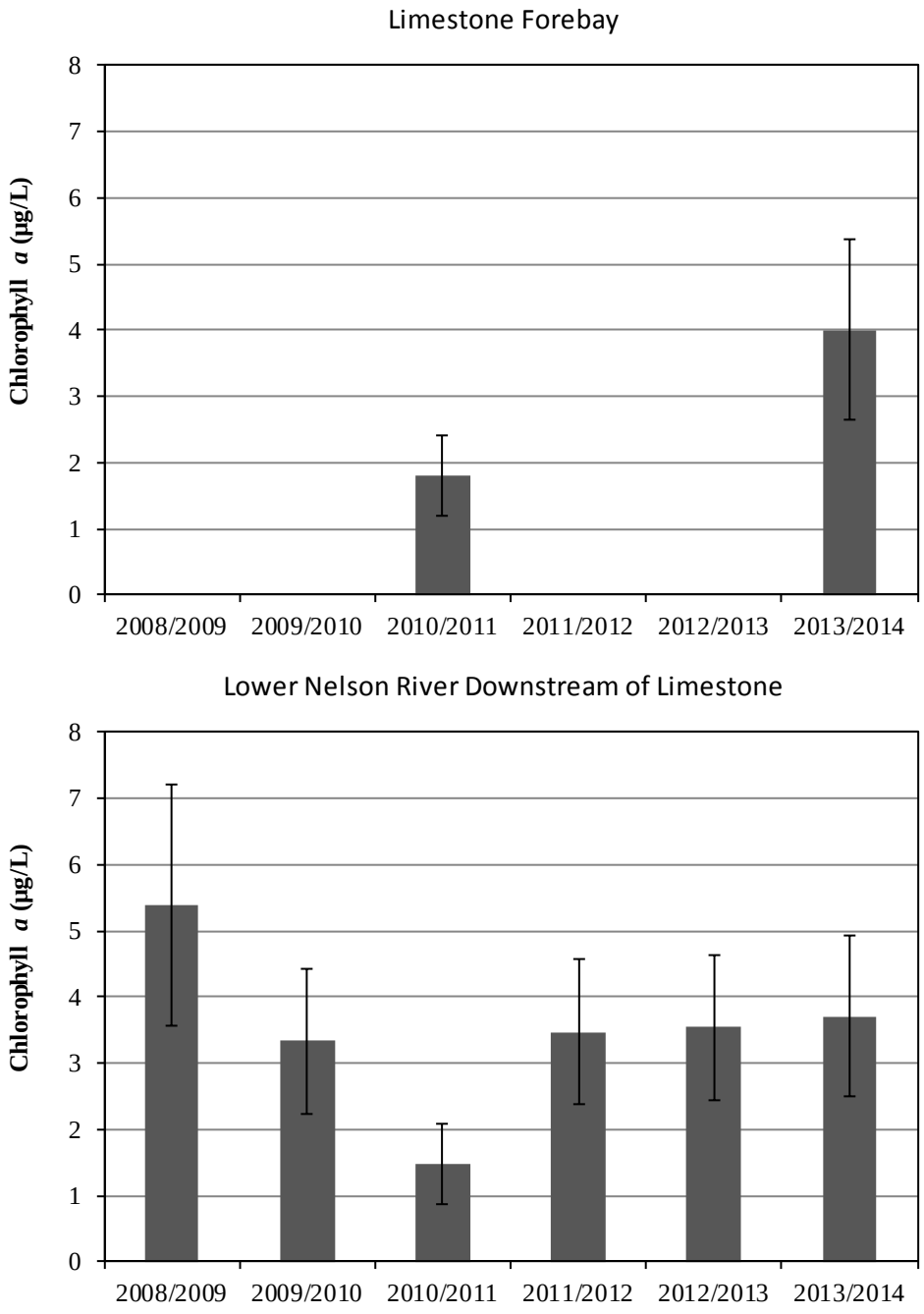


Figure 5.2.7A-6: Mean±SE concentrations of chlorophyll *a* measured in the Limestone forebay and the lower Nelson River downstream of Limestone under CAMP (2008-2013).

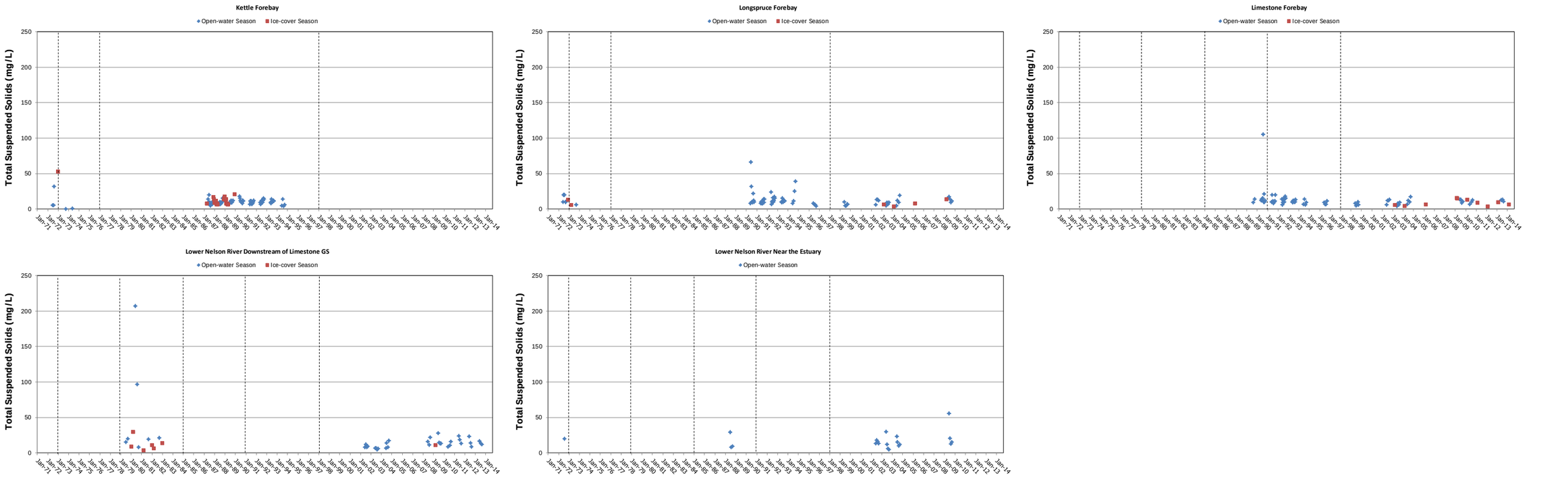


Figure 5.2.7A-7: Total suspended solids in the lower Nelson River downstream of Stephens Lake from 1972–2013.

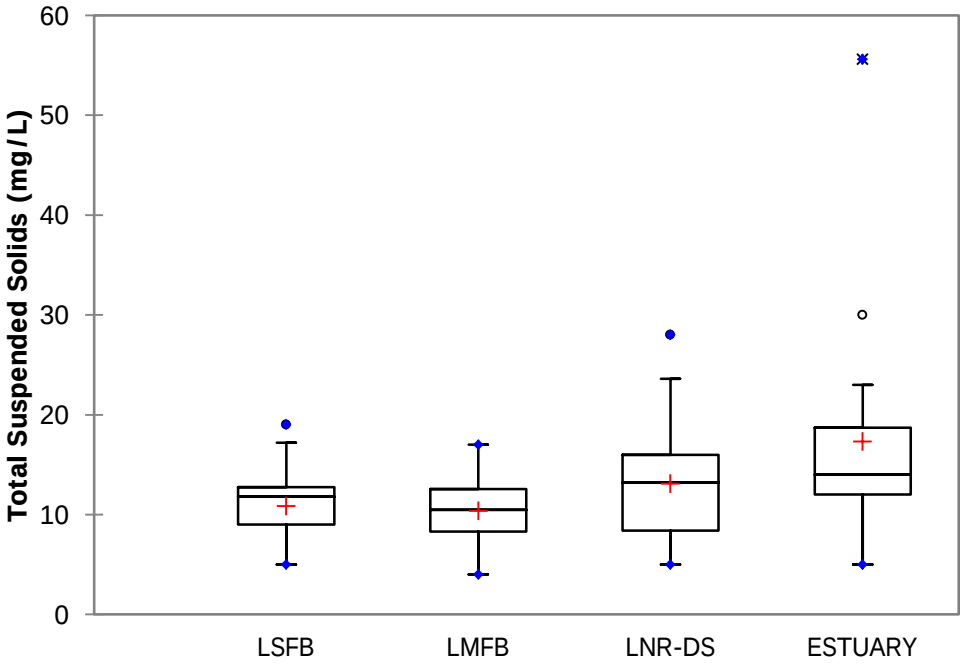


Figure 5.2.7A-8: Total suspended solids at sites along the lower Nelson River, 2002–2013.

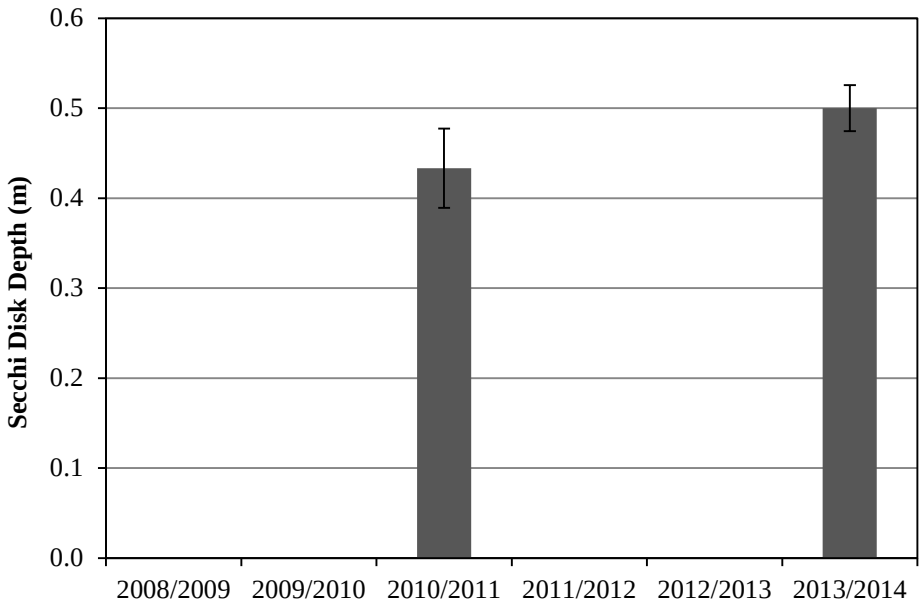


Figure 5.2.7A-9: Mean±SE Secchi disk depths measured in the Limestone forebay under CAMP.

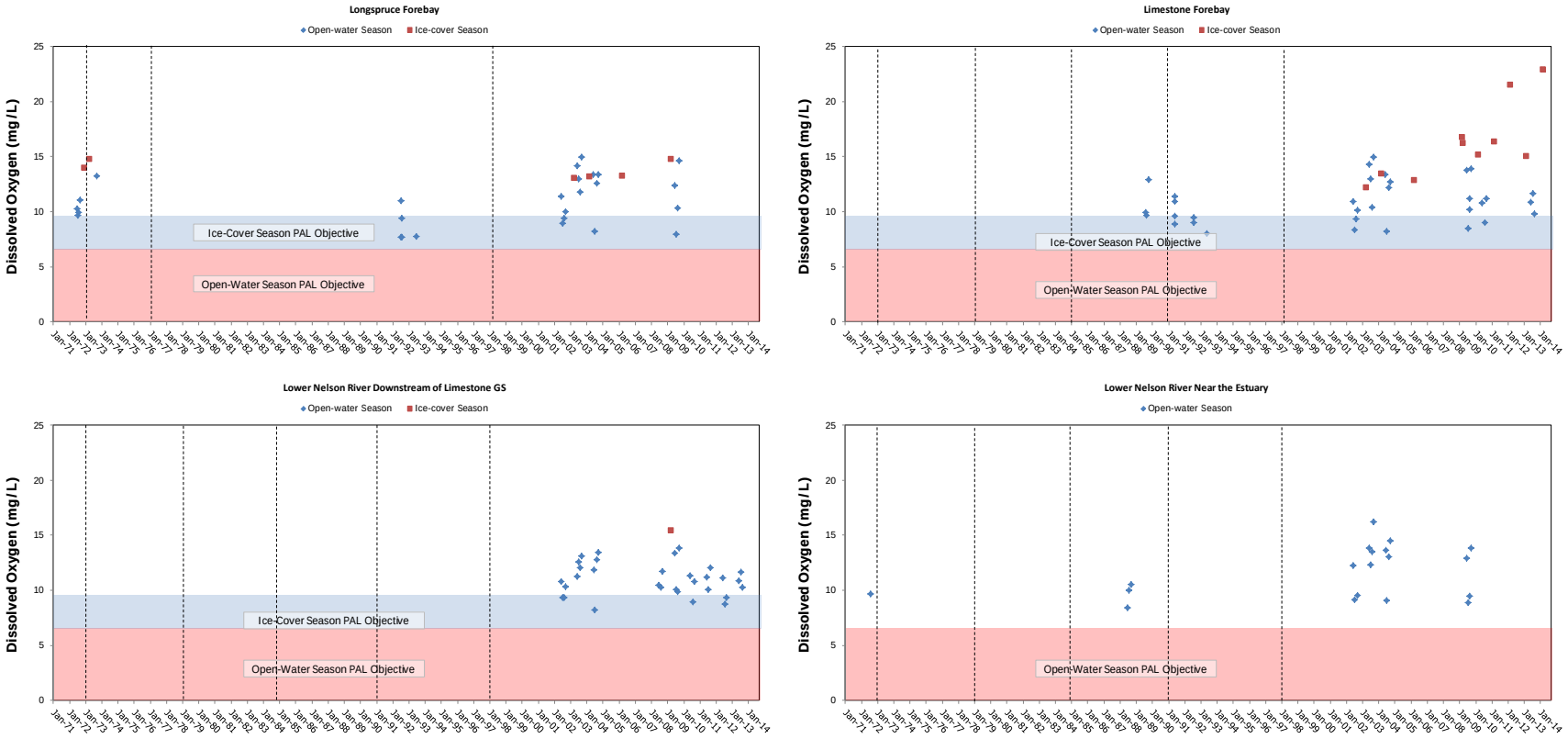
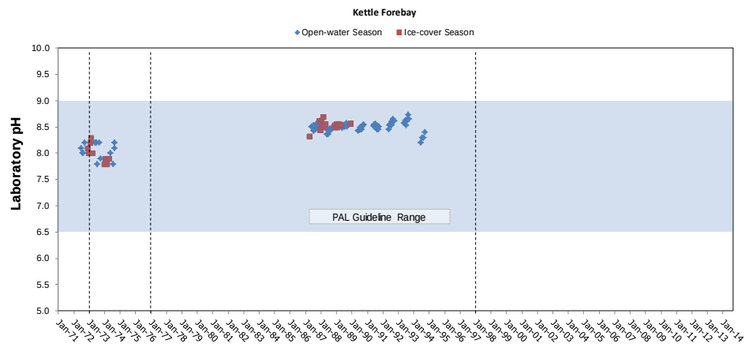
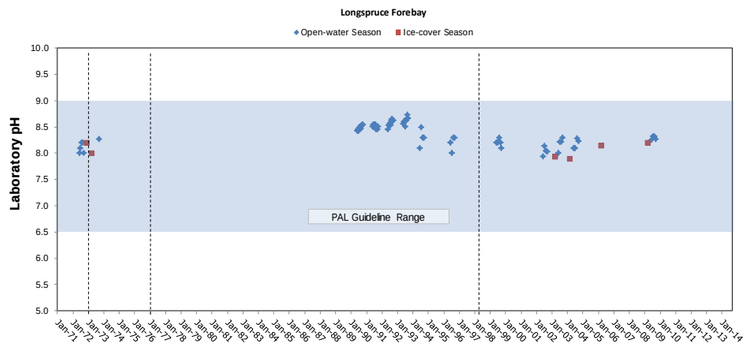
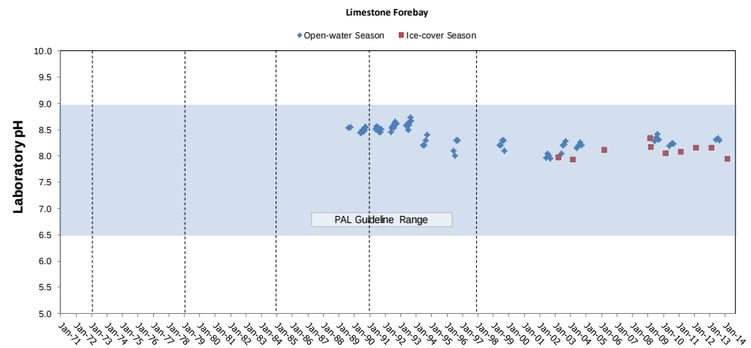
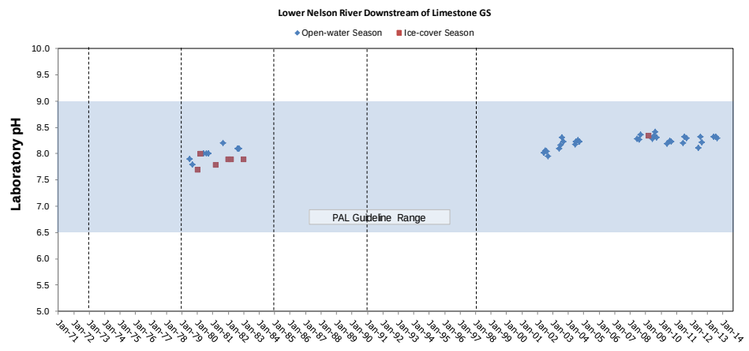


Figure 5.2.7A-10: Surface dissolved oxygen in the lower Nelson River downstream of Stephens Lake from 1972–2013. No data were available for the Kettle forebay.









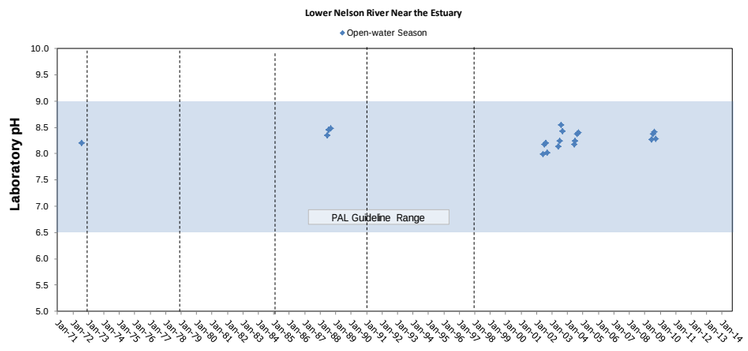
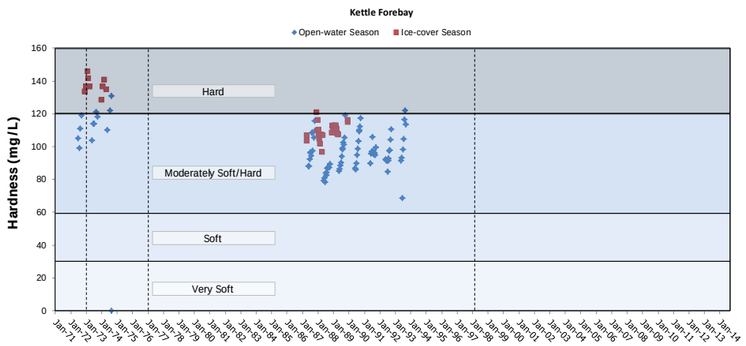
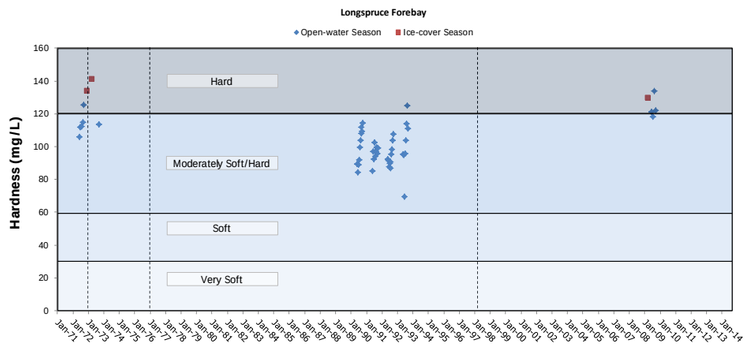


Figure 5.2.7A-11: Laboratory measured pH in the lower Nelson River downstream of Stephens Lake from 1972–2013.





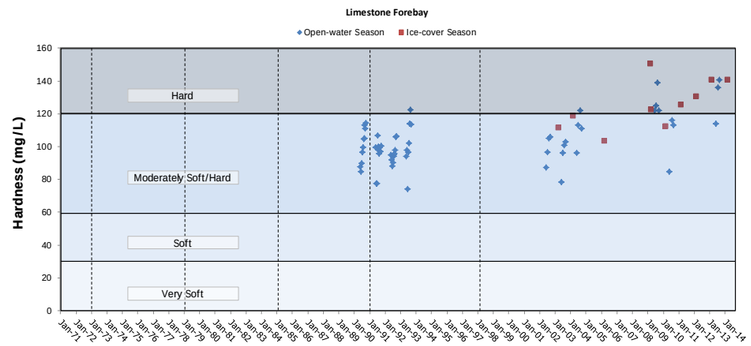


Figure 5.2.7A-12: Hardness measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.

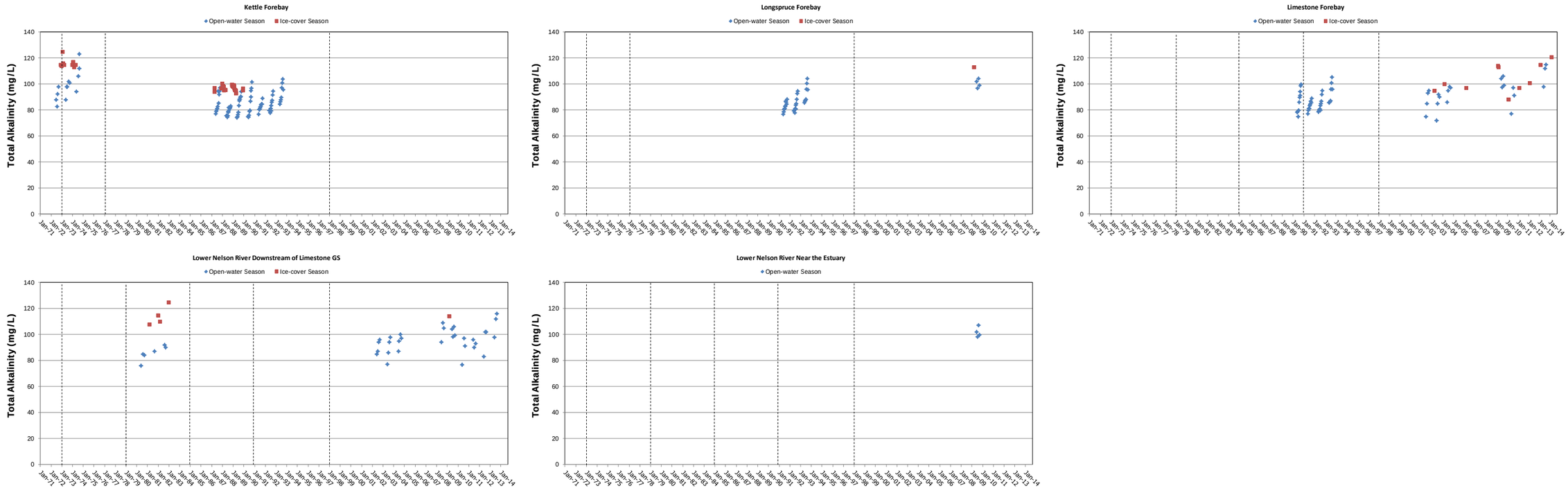


Figure 5.2.7A-13: Alkalinity measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.

Figure 5.2.7A-14: Laboratory measured conductivity measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.

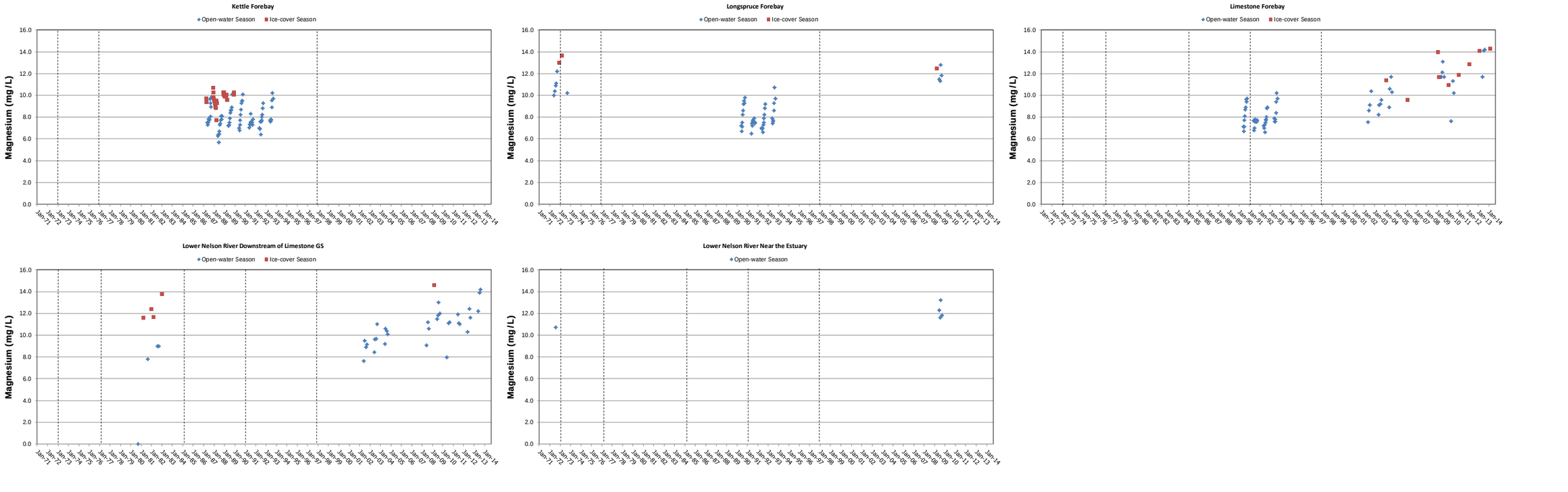


Figure 5.2.7A-15: Magnesium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.

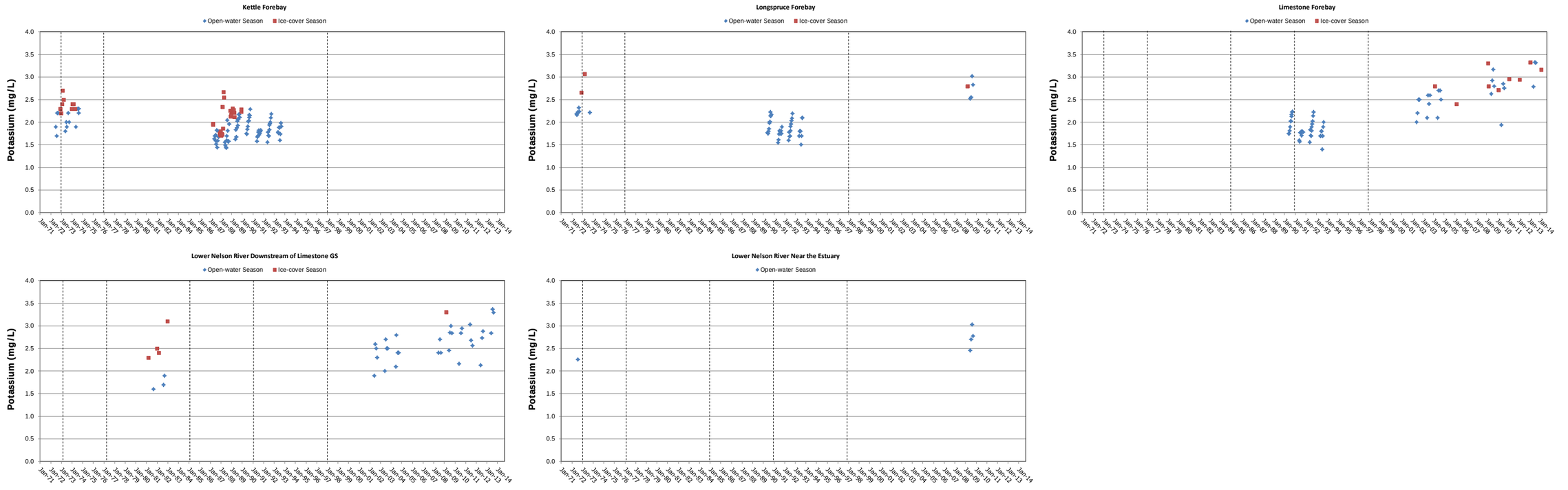
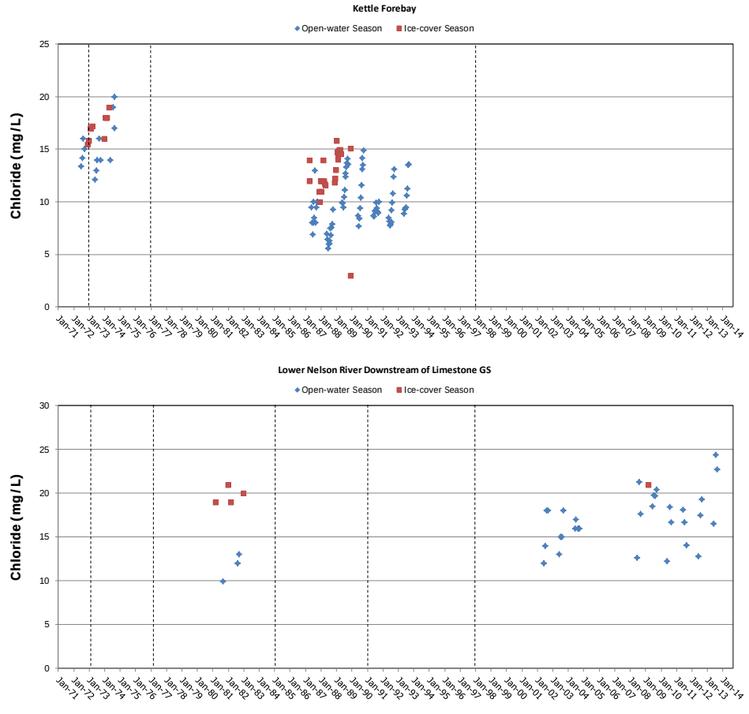
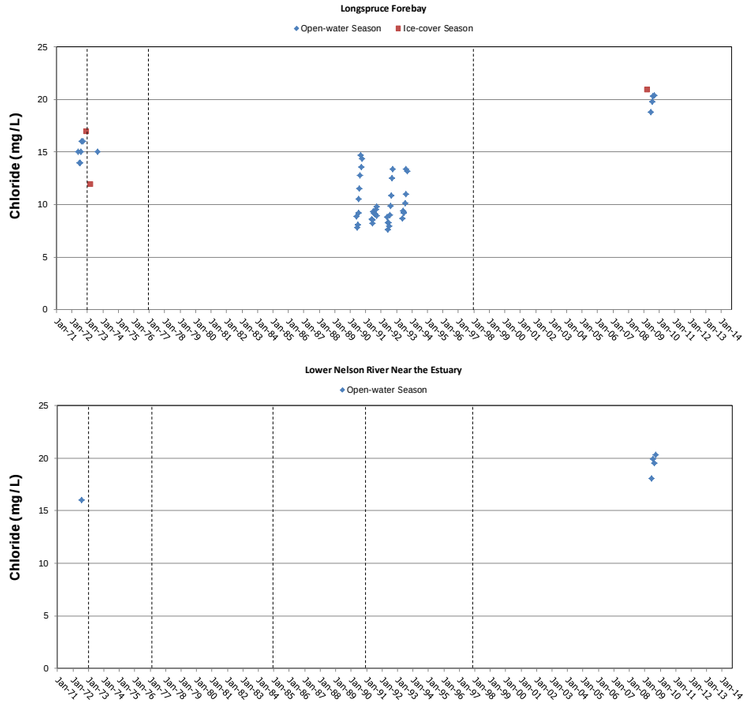


Figure 5.2.7A-16: Potassium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.

Figure 5.2.7A-17: Sodium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.





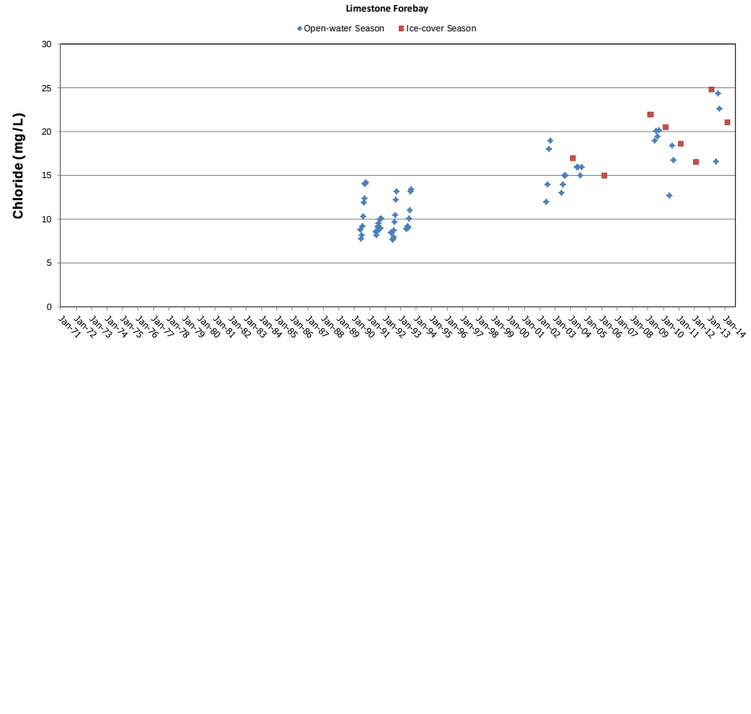
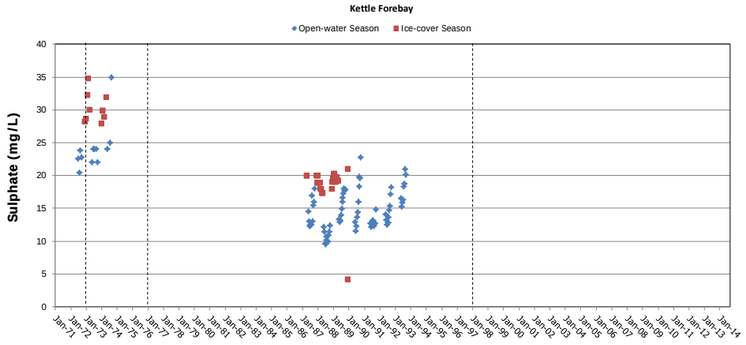
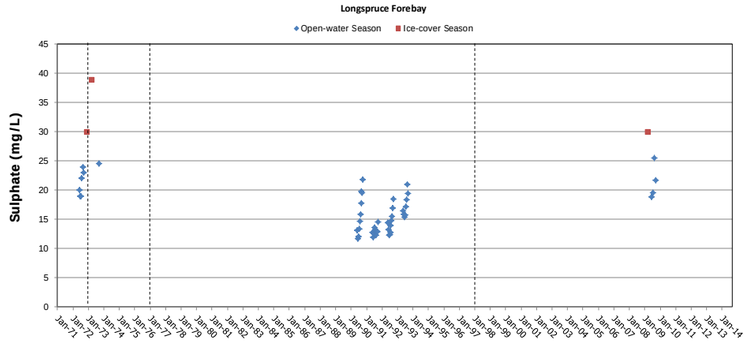
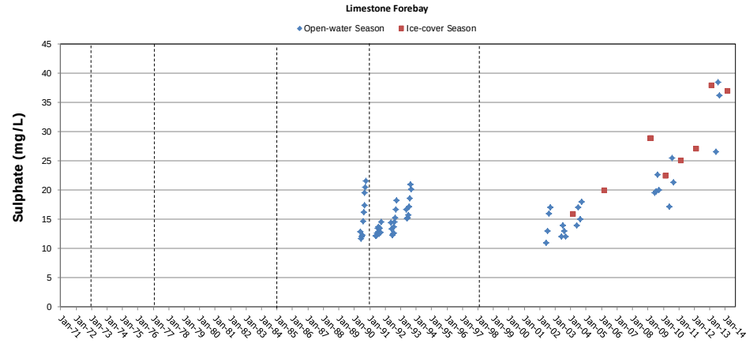
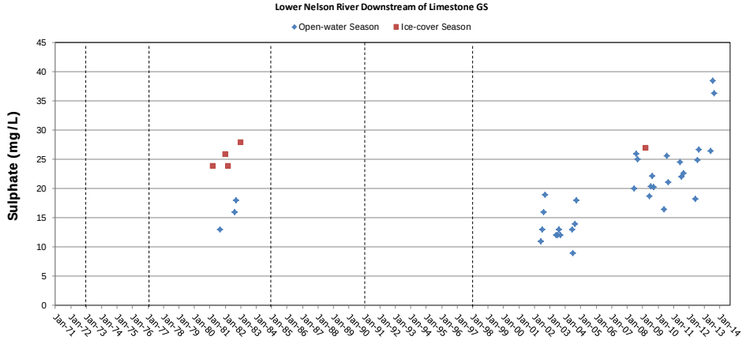


Figure 5.2.7A-18: Chloride concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.









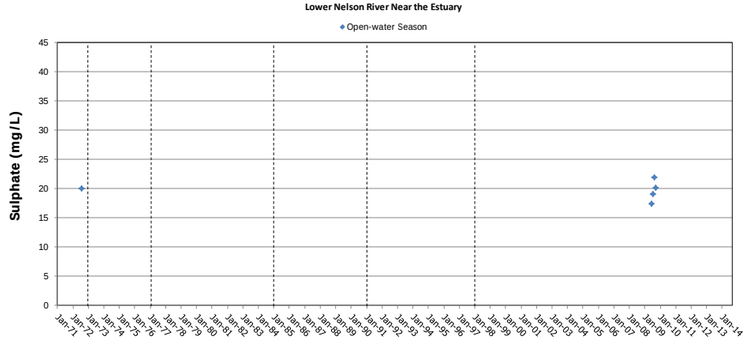
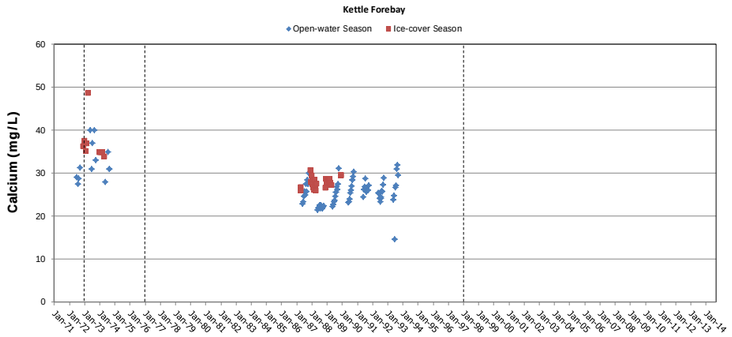
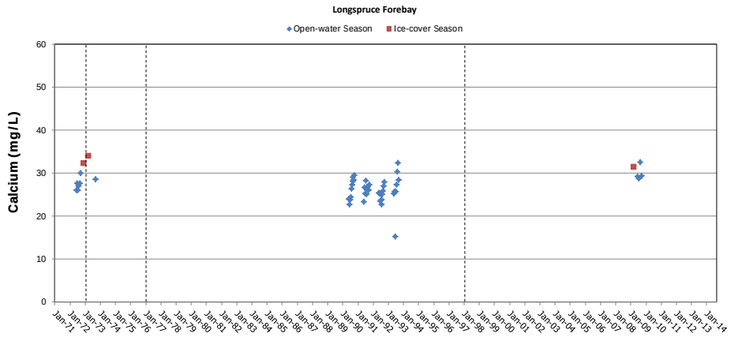
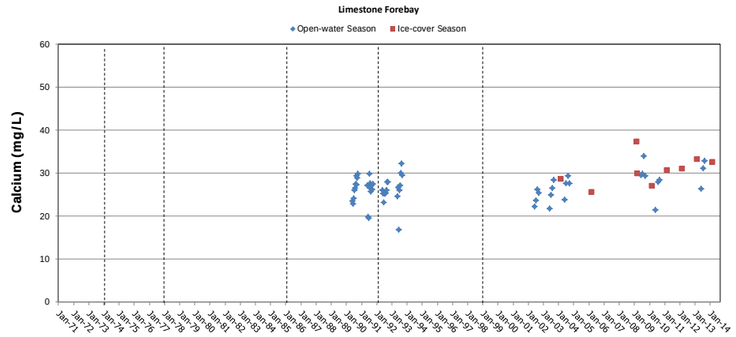
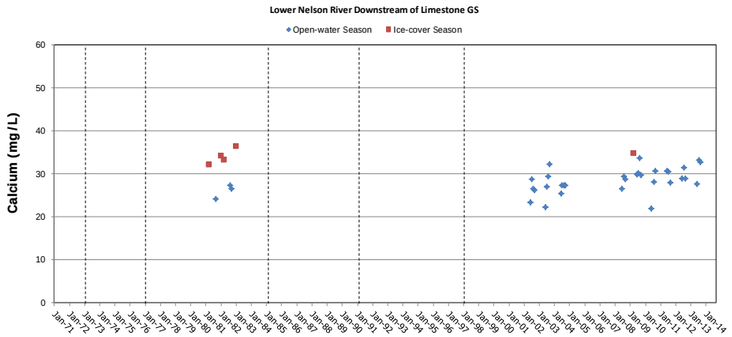


Figure 5.2.7A-19: Sulphate concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.









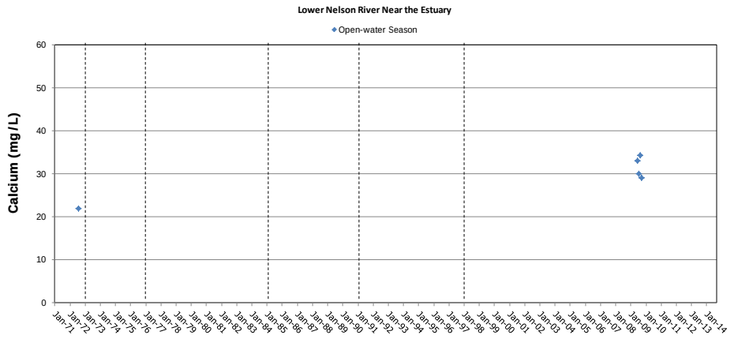


Figure 5.2.7A-20: Calcium concentrations measured in the lower Nelson River downstream of Stephens Lake from 1972–2013.

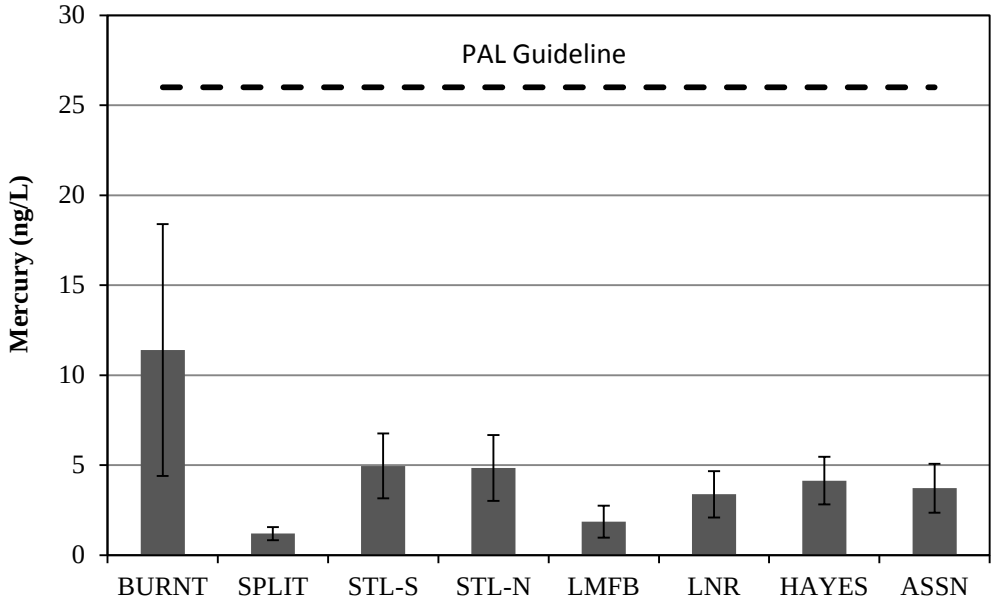


Figure 5.2.7A-21: **Mean±SE concentrations of mercury measured in waterbodies along the lower Nelson River system under CAMP (2008–2013) and comparison to the Manitoba PAL guideline.**

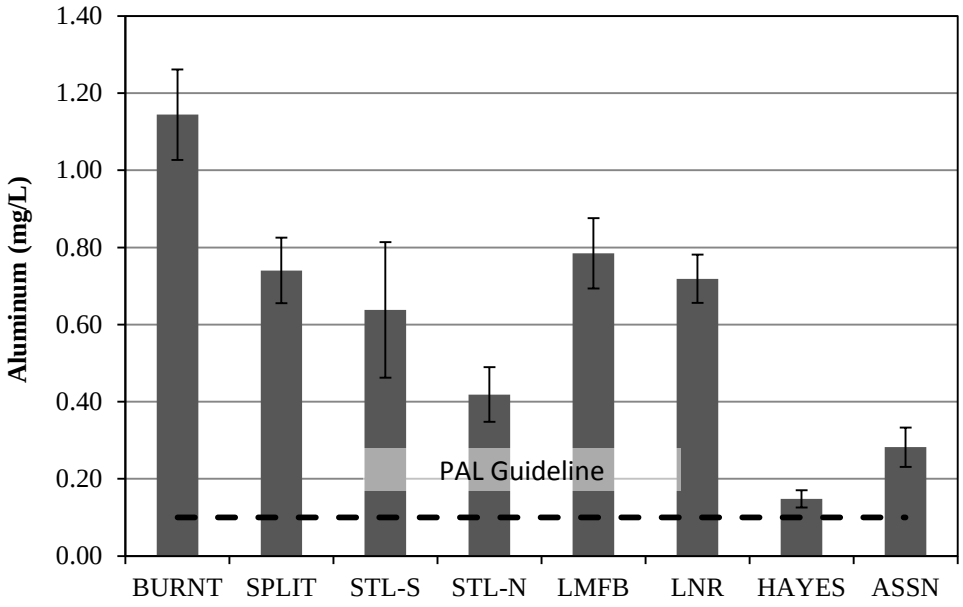


Figure 5.2.7A-22: **Mean±SE concentrations of aluminum measured in waterbodies along the lower Nelson River system under CAMP (2008–2013) and comparison to the Manitoba PAL guideline.**

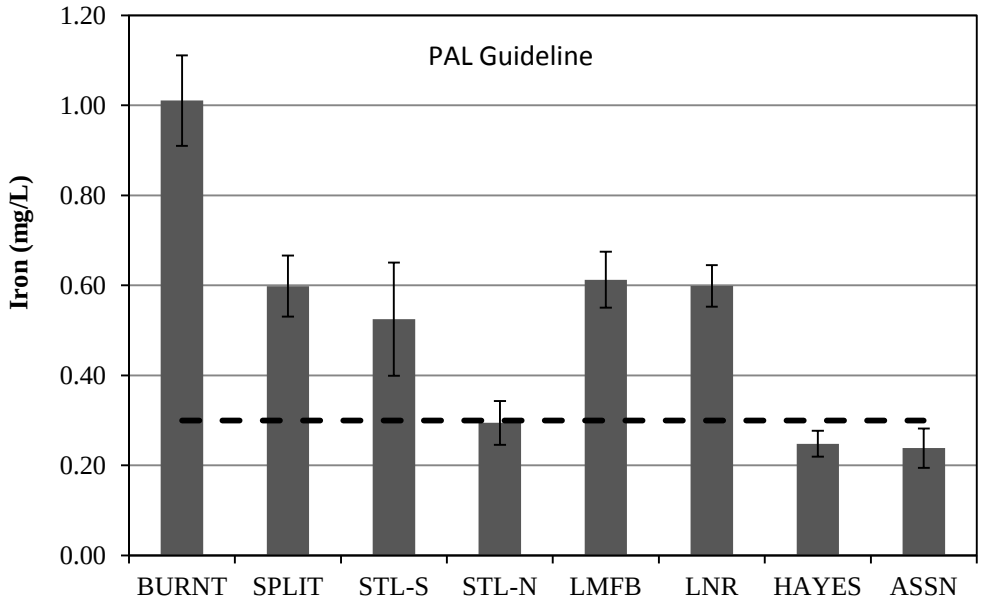


Figure 5.2.7A-23: **Mean±SE concentrations of iron measured in waterbodies along the lower Nelson River system under CAMP (2008–2013) and comparison to the Manitoba PAL guideline.**

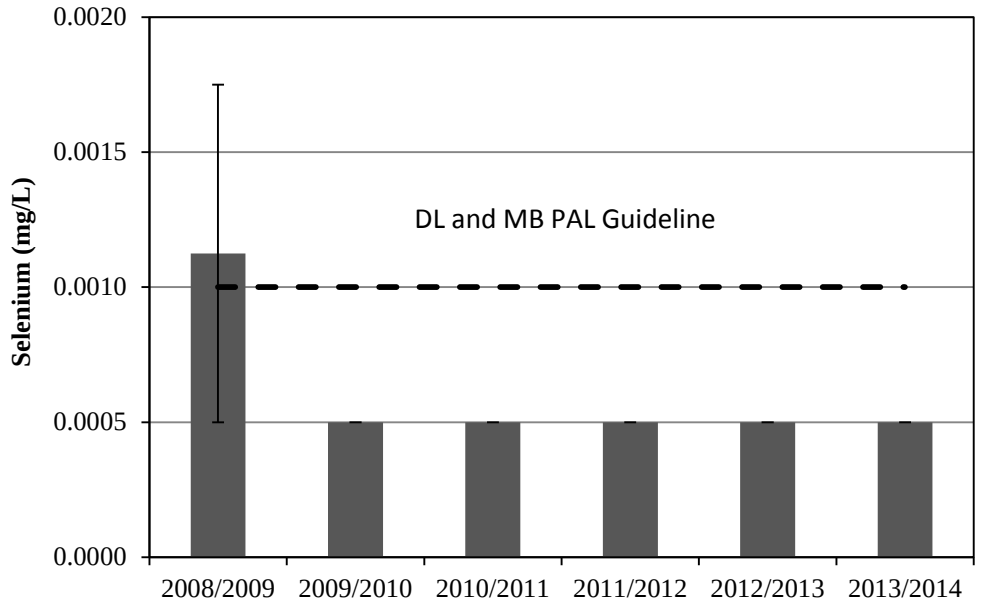


Figure 5.2.7A-24: **Selenium concentrations measured in the lower Nelson River upstream of the Angling River during CAMP: 2008–2013.**