

ADDENDA TO THE RAMP TECHNICAL DESIGN AND RATIONALE DOCUMENT



Climate and Hydrology



Water Quality



Sediment Quality



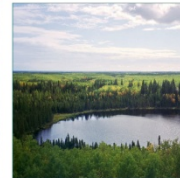
Benthic Invertebrates



Fish Populations



Acid-Sensitive Lakes



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TABLE OF CONTENTS

LIST OF TABLES	ii
1.0 INTRODUCTION.....	1
2.0 ANALYTICAL METHODS FOR WATER AND SEDIMENT QUALITY ANALYTES.....	1
2.1 TRACE METAL ANALYSIS OF POTABLE AND SURFACE WATERS BY ELAN DRC-II INDUCTIVELY COUPLED PLASMA SPECTROMETRY	7
2.1.1 Introduction.....	7
2.1.2 Summary of Methods	8
2.1.3 Scope and Application	8
2.1.4 Apparatus & Equipment.....	9
2.1.5 Mercury Determination – Analytical Methodology.....	10
2.1.6 References	10
2.2 AXYS METHOD MLA021 FOR SEDIMENT PAHS	10
3.0 NEAR REAL TIME STATION ACCESS FOR RAMP CLIMATE AND HYDROMETRIC STATIONS	11
3.1 TECHNOLOGICAL CAPACITY	11
3.2 STATION DEVELOPMENT PROCEDURES.....	12
4.0 WATER YEAR TIMEFRAME FOR HYDROCLIMATE ANALYSIS	14
5.0 RAMP SAMPLING STATION INFORMATION	16

LIST OF TABLES

Table 1	Analytical methods for water quality analytes measured by RAMP.....	1
Table 2	Analytical methods for sediment quality analytes measured by RAMP.	4
Table 3	Telemetry stations operated by RAMP, as of spring 2010.	12
Table 4	Mean winter discharge (m ³ /s) calculated for a water year period (e.g., November 1, 2008 to March 31, 2009) and calendar year period (January 1 to March 31, 2009 and November 1 to December 31, 2009), for stations with complete annual data since November 2008.	15
Table 5	Summary of RAMP data and station information available for the climate component.....	17
Table 6	Summary of RAMP data and station information available for the hydrology component.	18
Table 7	Summary of RAMP data and station information available for the snowcourse survey.	20
Table 8	Summary of RAMP data and station information available for the water quality component.....	22
Table 9	Summary of RAMP data and station information available for the sediment quality component.	23
Table 10	Summary of RAMP data and reach information available for the benthic invertebrates communities component.	25
Table 11	Summary of RAMP data and site information available for the Muskeg River fish fence.	26
Table 12	Summary of RAMP data and reach information available for the fish inventory program.	27
Table 13	Summary of RAMP data and reach information available for the fish tissue program.	28
Table 14	Summary of RAMP data and reach information available for the sentinel species program.....	29
Table 15	Summary of RAMP data and reach information available for the fish assemblage monitoring program.....	30
Table 16	Summary of RAMP data and lake information available for the acid-sensitive lakes component.....	31

1.0 INTRODUCTION

The RAMP Technical Design and Rationale Document was updated in December 2009. Since 2009, additional developments to the program have been completed to provide further clarification of current methodologies or improve on the analyses and availability of the data collected. The Design and Rationale Document will be updated in the future; however, until then, the following addenda have been provided:

- A list of analytical methods of water and sediment quality analytes;
- A description of the near real time station access for RAMP Climate and Hydrology stations;
- A description of the water year timeframe approach for hydrologic analyses; and
- A description of data available for each sampling station.

2.0 ANALYTICAL METHODS FOR WATER AND SEDIMENT QUALITY ANALYTES

Laboratory analytical methods for analytes analyzed by RAMP in water and sediment samples are provided in Table 1 and Table 2, respectively. A more detailed description of the laboratory analyses for total and dissolved metals and ultra-trace mercury in water and PAHs in sediment is also provided.

Table 1 Analytical methods for water quality analytes measured by RAMP.

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab ²
Conventional variables	Alkalinity, Total (as CaCO ₃)	mg/L	5	APHA 4500-H, 2510, 2320	10165	ALS
Conventional variables	Conductivity	µS/cm	0.2	APHA 4500-H, 2510, 2320	2041	ALS
Conventional variables	Dissolved Organic Carbon	mg/L	1	APHA 5310 B-Instrumental	6101	ALS
Conventional variables	Hardness (as CaCO ₃)	mg/L		APHA 1030E	10602	ALS
Conventional variables	pH	pH	0.1	APHA 4500-H, 2510, 2320	10301	ALS
Conventional variables	Total Dissolved Solids	mg/L	5 to 10	APHA 2540 C	10451	ALS
Conventional variables	Total Organic Carbon	mg/L	1	APHA 5310 B-Instrumental	6001	ALS
Conventional variables	Total Suspended Solids	mg/L	3	APHA 2540 D-Gravimetric	102455	ALS
Conventional variables	True Colour	T.C.U.	2	APHA 2120	2021	ALS
General Organics	Total Phenolics	mg/L	0.001	AB ENV.06537-COLORIMETRIC	6537	ALS
General Organics	Total Recoverable Hydrocarbons	mg/L	1	APHA 5520 C-Tetra CI Ext Infrared		ALS
Major ions	Bicarbonate (HCO ₃)	mg/L	5	APHA 4500-H, 2510, 2320	6201	ALS
Major ions	Calcium (Ca)	mg/L	0.5	APHA 3120 B-ICP-OES	104394	ALS
Major ions	Carbonate (CO ₃)	mg/L	5	APHA 4500-H, 2510, 2320	6301	ALS

¹ See Section 1.1 Trace Metal Analysis of Waters by DRC-II (AITF).

² ALS – ALS Laboratory Group; AITF – Alberta Innovates Technology Futures; Hydroqual Laboratories Ltd.

Table 1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab ²
Major ions	Chloride (Cl)	mg/L	0.5	APHA 4110 B-ION CHROMATOGRAPHY	99494	ALS
Major ions	Hydroxide (OH)	mg/L	5	APHA 4500-H, 2510, 2320	8501	ALS
Major ions	Magnesium (Mg)	mg/L	0.1	APHA 3120 B-ICP-OES	104407	ALS
Major ions	Potassium (K)	mg/L	0.5	APHA 3120 B-ICP-OES	104416	ALS
Major ions	Sodium (Na)	mg/L	1	APHA 3120 B-ICP-OES	104423	ALS
Major ions	Sulfate (SO ₄)	mg/L	0.5	APHA 4110 B-ION CHROMATOGRAPHY	98228	ALS
Major ions	Sulphide	mg/L	0.002	APHA 4500 -S E-Auto-Colorimetry	16003	ALS
Nutrients and BOD	Ammonia-N	mg/L	0.05	APHA4500NH3F Colorimetry	102626	ALS
Nutrients and BOD	Biochemical Oxygen Demand	mg/L	2	APHA 5210 B-5 day Incub.-O2 electrode	8202	ALS
Nutrients and BOD	Chlorophyll <i>a</i>	µg/L	0.1	EPA 445.0		ALS
Nutrients and BOD	Nitrate	mg/L	0.05	APHA 4110 B-ION CHROMATOGRAPHY		ALS
Nutrients and BOD	Nitrate+Nitrite	mg/L	0.071	CALCULATION		ALS
Nutrients and BOD	Nitrite	mg/L	0.05	APHA 4110 B-ION CHROMATOGRAPHY	102962	ALS
Nutrients and BOD	Phosphorus, dissolved	mg/L	0.001	APHA 4500 P B,E - AUTO-COLORIMETRY	15113	ALS
Nutrients and BOD	Phosphorus, total	mg/L	0.001	APHA 4500 P B,E-Auto-Colorimetry	15406	ALS
Nutrients and BOD	Total Kjeldahl Nitrogen	mg/L	0.2	APHA 4500N-C -Dig.-Auto-Colorimetry	7012	ALS
Total metals	Aluminum	mg/L	0.002	ICPMS by DRC-II ¹	103999	AITF
Total metals	Antimony	mg/L	0.000001	ICPMS by DRC-II ¹	80043	AITF
Total metals	Arsenic	mg/L	0.000006	ICPMS by DRC-II ¹	80020	AITF
Total metals	Barium	mg/L	0.0001	ICPMS by DRC-II ¹	80022	AITF
Total metals	Beryllium	mg/L	0.00001	ICPMS by DRC-II ¹	80023	AITF
Total metals	Bismuth	mg/L	0.00001	ICPMS by DRC-II ¹	80024	AITF
Total metals	Boron	mg/L	0.0008	ICPMS by DRC-II ¹	80021	AITF
Total metals	Cadmium	mg/L	0.000006	ICPMS by DRC-II ¹	80026	AITF
Total metals	Calcium	mg/L	0.1	ICPMS by DRC-II ¹	80025	AITF
Total metals	Chlorine	mg/L	0.3	ICPMS by DRC-II ¹	80027	AITF
Total metals	Chromium	mg/L	0.0003	ICPMS by DRC-II ¹	80029	AITF
Total metals	Cobalt	mg/L	0.00001	ICPMS by DRC-II ¹	80028	AITF
Total metals	Copper	mg/L	0.0001	ICPMS by DRC-II ¹	80030	AITF
Total metals	Iron	mg/L	0.004	ICPMS by DRC-II ¹	80031	AITF
Total metals	Lead	mg/L	0.000006	ICPMS by DRC-II ¹	80041	AITF
Total metals	Lithium	mg/L	0.0002	ICPMS by DRC-II ¹	80034	AITF
Total metals	Manganese	mg/L	0.00003	ICPMS by DRC-II ¹	80036	AITF
Total metals	Mercury	mg/L	0.00005	ICPMS by DRC-II ¹	80032	AITF
Total metals	Molybdenum	mg/L	0.000008	ICPMS by DRC-II ¹	80037	AITF
Total metals	Nickel	mg/L	0.000006	ICPMS by DRC-II ¹	80039	AITF
Total metals	Selenium	mg/L	0.0002	ICPMS by DRC-II ¹	80044	AITF
Total metals	Silver	mg/L	0.000005	ICPMS by DRC-II ¹	103998	AITF
Total metals	Strontium	mg/L	0.000008	ICPMS by DRC-II ¹	80047	AITF
Total metals	Sulphur	mg/L	0.6	ICPMS by DRC-II ¹	80042	AITF
Total metals	Thallium	mg/L	0.000003	ICPMS by DRC-II ¹	80053	AITF
Total metals	Thorium	mg/L	0.00003	ICPMS by DRC-II ¹	80048	AITF
Total metals	Tin	mg/L	0.00007	ICPMS by DRC-II ¹	80046	AITF
Total metals	Titanium	mg/L	0.00007	ICPMS by DRC-II ¹	80049	AITF
Total metals	Uranium	mg/L	0.000003	ICPMS by DRC-II ¹	80054	AITF
Total metals	Vanadium	mg/L	0.0002	ICPMS by DRC-II ¹	80055	AITF
Total metals	Zinc	mg/L	0.0002	ICPMS by DRC-II ¹	80056	AITF
Total metals	Mercury (Hg), ultra-trace	ng/L	1.2	ICPMS by DRC-II ¹	101979	AITF
Dissolved metals	Aluminum	mg/L	0.001	ICPMS by DRC-II ¹	103927	AITF
Dissolved metals	Antimony	mg/L	0.000001	ICPMS by DRC-II ¹	103951	AITF
Dissolved metals	Arsenic	mg/L	0.000006	ICPMS by DRC-II ¹	103928	AITF
Dissolved metals	Barium	mg/L	0.0001	ICPMS by DRC-II ¹	103930	AITF
Dissolved metals	Beryllium	mg/L	0.00001	ICPMS by DRC-II ¹	103931	AITF
Dissolved metals	Bismuth	mg/L	0.00001	ICPMS by DRC-II ¹	103932	AITF

¹ See Section 1.1 Trace Metal Analysis of Waters by DRC-II (AITF).

² ALS – ALS Laboratory Group; AITF – Alberta Innovates Technology Futures; Hydroqual Laboratories Ltd.

Table 1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab ²
Dissolved metals	Boron	mg/L	0.0008	ICPMS by DRC-II ¹	103929	AITF
Dissolved metals	Cadmium	mg/L	0.000006	ICPMS by DRC-II ¹	103934	AITF
Dissolved metals	Calcium	mg/L	0.1	ICPMS by DRC-II ¹	103933	AITF
Dissolved metals	Chlorine	mg/L	0.3	ICPMS by DRC-II ¹	103935	AITF
Dissolved metals	Chromium	mg/L	0.0003	ICPMS by DRC-II ¹	103937	AITF
Dissolved metals	Cobalt	mg/L	0.00001	ICPMS by DRC-II ¹	103936	AITF
Dissolved metals	Copper	mg/L	0.0001	ICPMS by DRC-II ¹	103938	AITF
Dissolved metals	Iron	mg/L	0.004	ICPMS by DRC-II ¹	103939	AITF
Dissolved metals	Lead	mg/L	0.000006	ICPMS by DRC-II ¹	103949	AITF
Dissolved metals	Lithium	mg/L	0.0002	ICPMS by DRC-II ¹	103942	AITF
Dissolved metals	Manganese	mg/L	0.00003	ICPMS by DRC-II ¹	103944	AITF
Dissolved metals	Mercury	mg/L	0.00005	ICPMS by DRC-II ¹	103940	AITF
Dissolved metals	Molybdenum	mg/L	0.000008	ICPMS by DRC-II ¹	103945	AITF
Dissolved metals	Nickel	mg/L	0.00006	ICPMS by DRC-II ¹	103947	AITF
Dissolved metals	Selenium	mg/L	0.0002	ICPMS by DRC-II ¹	103952	AITF
Dissolved metals	Silver	mg/L	0.000005	ICPMS by DRC-II ¹	103926	AITF
Dissolved metals	Strontium	mg/L	0.000008	ICPMS by DRC-II ¹	103955	AITF
Dissolved metals	Sulphur	mg/L	0.6	ICPMS by DRC-II ¹	103950	AITF
Dissolved metals	Thallium	mg/L	0.00003	ICPMS by DRC-II ¹	103958	AITF
Dissolved metals	Thorium	mg/L	0.00003	ICPMS by DRC-II ¹	103956	AITF
Dissolved metals	Tin	mg/L	0.00007	ICPMS by DRC-II ¹	103954	AITF
Dissolved metals	Titanium	mg/L	0.00007	ICPMS by DRC-II ¹	103957	AITF
Dissolved metals	Uranium	mg/L	0.000003	ICPMS by DRC-II ¹	103959	AITF
Dissolved metals	Vanadium	mg/L	0.0002	ICPMS by DRC-II ¹	103960	AITF
Dissolved metals	Zinc	mg/L	0.0002	ICPMS by DRC-II ¹	103961	AITF
General Organics	Naphthenic Acids	mg/L	0.02	electron-trap GC/MS		AITF
Toxicity	Algal Growth Inhibition Test (72 h)	%		Biological test method: Growth Inhibition test using a freshwater alga <i>Pseudokirchneriella subcapitata</i> (formerly <i>Selenastrum capricornutum</i>). Environment Canada, EPS 1/RM/25, 2nd Edition, March 2007		HydroQual
Toxicity	Ceriodaphnia 6-day survival test	%		Biological test method: Test of reproduction and survival using the cladoceran <i>Ceriodaphnia dubia</i> , 2007. Environment Canada, EPS 1/RM/21		HydroQual
Toxicity	Ceriodaphnia 6-day reproduction test	%		Biological test method: Test of reproduction and survival using the cladoceran <i>Ceriodaphnia dubia</i> , 2007. Environment Canada, EPS 1/RM/21		HydroQual
Toxicity	Fathead minnow 7-d survival test	%		Biological test method: Test of larval growth and survival using fathead minnows, 1992. Environment Canada, EPS 1/RM/22. (amended September 2008).		HydroQual
Toxicity	Fathead minnow 7-d growth test	%		Biological test method: Test of larval growth and survival using fathead minnows, 1992. Environment Canada, EPS 1/RM/22. (amended September 2008).		HydroQual

¹ See Section 1.1 Trace Metal Analysis of Waters by DRC-II (AITF).

² ALS – ALS Laboratory Group; AITF – Alberta Innovates Technology Futures; HydroQual Laboratories Ltd.

Table 2 Analytical methods for sediment quality analytes measured by RAMP.

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	Lab ²
Hydrocarbons and Organic Compounds	2-Bromobenzotrifluoride	%	1	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	Benzene	mg/kg	0.005	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 1 (BTEX)	mg/kg	10	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 1 (C6-C10)	mg/kg	10*	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 2 (C10-C16)	mg/kg	20*	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 3 (C16-C34)	mg/kg	20*	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 4 (C34-C50)	mg/kg	20	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	Ethylbenzene	mg/kg	0.015	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	F4G-SG (GHH-Silica)	mg/kg	500	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	m+p-Xylene	mg/kg	0.05	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	o-Xylene	mg/kg	0.05	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	Toluene	mg/kg	0.05	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	Total Hydrocarbons (C6-C50)	mg/kg	20	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Hydrocarbons and Organic Compounds	Xylenes	mg/kg	0.1	CCME CWS-PHC Dec-2000 - Pub# 1310	ALS
Physical properties	% Clay	%	1	CSSS 47.3 - Hydrometer	ALS
Physical properties	% Moisture	%	0.1	Oven dry 105C-Gravimetric	ALS
Physical properties	% Sand	%	1	CSSS 47.3 - Hydrometer	ALS
Physical properties	% Silt	%	1	CSSS 47.3 - Hydrometer	ALS
Physical properties	CaCO3 Equivalent	%	0.8	SSSA (1996) P455-456	ALS
Physical properties	Inorganic Carbon	%	0.1	SSSA (1996) P455-456	ALS
Physical properties	Texture			CSSS 47.3 - Hydrometer	ALS
Physical properties	Total Carbon by Combustion	%	0.1	SSSA (1996) P. 973-974	ALS
Physical properties	Total organic carbon	%	0.1	SSSA (1996) P455-456	ALS
Total metals	Aluminum (Al)	mg/kg	50	EPA 200.2/6020A	ALS
Total metals	Antimony (Sb)	mg/kg	0.1	EPA 200.2/6020A	ALS
Total metals	Arsenic (As)	mg/kg	0.1	EPA 200.2/6020A	ALS
Total metals	Barium (Ba)	mg/kg	0.5	EPA 200.2/6020A	ALS
Total metals	Beryllium (Be)	mg/kg	0.2	EPA 200.2/6020A	ALS
Total metals	Bismuth (Bi)	mg/kg	0.2	EPA 200.2/6020A	ALS
Total metals	Cadmium (Cd)	mg/kg	0.1	EPA 200.2/6020A	ALS
Total metals	Calcium (Ca)	mg/kg	100	EPA 200.2/6020A	ALS
Total metals	Chromium (Cr)	mg/kg	0.5	EPA 200.2/6020A	ALS
Total metals	Cobalt (Co)	mg/kg	0.1	EPA 200.2/6020A	ALS
Total metals	Copper (Cu)	mg/kg	0.5	EPA 200.2/6020A	ALS
Total metals	Iron (Fe)	mg/kg	200	EPA 200.2/6020A	ALS
Total metals	Lead (Pb)	mg/kg	0.5	EPA 200.2/6020A	ALS
Total metals	Lithium (Li)	mg/kg	0.5	EPA 200.2/6020A	ALS
Total metals	Magnesium (Mg)	mg/kg	20	EPA 200.2/6020A	ALS
Total metals	Manganese (Mn)	mg/kg	1	EPA 200.2/6020A	ALS
Total metals	Mercury (Hg)	mg/kg	0.05	EPA 200.2/245.1	ALS

¹ See Section 1.2 AXYS Method MLA021 (PAHs).

² ALS - ALS Laboratory Group; AXYS - AXYS Analytical Services; Hydroqual Laboratories Ltd.

Table 2 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	Lab ²
Total metals	Nickel (Ni)	mg/kg	0.5	EPA 200.2/6020A	ALS
Total metals	Phosphorus (P)	mg/kg	100	EPA 200.2/6020A	ALS
Total metals	Potassium (K)	mg/kg	100	EPA 200.2/6020A	ALS
Total metals	Selenium (Se)	mg/kg	0.2	EPA 200.2/6020A	ALS
Total metals	Silver (Ag)	mg/kg	0.2	EPA 200.2/6020A	ALS
Total metals	Sodium (Na)	mg/kg	100	EPA 200.2/6020A	ALS
Total metals	Strontium (Sr)	mg/kg	1	EPA 200.2/6020A	ALS
Total metals	Thallium (Tl)	mg/kg	0.05	EPA 200.2/6020A	ALS
Total metals	Tin (Sn)	mg/kg	2	EPA 200.2/6020A	ALS
Total metals	Titanium (Ti)	mg/kg	1	EPA 200.2/6020A	ALS
Total metals	Uranium (U)	mg/kg	0.05	EPA 200.2/6020A	ALS
Total metals	Vanadium (V)	mg/kg	0.2	EPA 200.2/6020A	ALS
Total metals	Zinc (Zn)	mg/kg	5	EPA 200.2/6020A	ALS
PAHs	Acenaphthene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Acenaphthylene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Anthracene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Benz[a]anthracene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Benzo[a]pyrene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Benzo[b,j,k]fluoranthene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Benzo[g,h,i]perylene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Biphenyl	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Benzo[a]anthracenes/ Chrysenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Benzofluoranthenes/ Pyrenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Dibenzothiophenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Fluoranthenes/Pyrenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Fluorenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Naphthalenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C1-Phenanthrenes/ Anthracenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C2-Benzo[a]anthracenes/ Chrysenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C2-Benzofluoranthenes/ Pyrenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C2-Dibenzothiophenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C2-Fluoranthenes/Pyrenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C2-Fluorenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C2-Naphthalenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS

¹ See Section 1.2 AXYS Method MLA021 (PAHs).

² ALS - ALS Laboratory Group; AXYS - AXYS Analytical Services; Hydroqual Laboratories Ltd.

Table 2 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	Lab ²
PAHs	C2-Phenanthrenes/ Anthracenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C3-Dibenzothiophenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C3-Fluoranthenes/Pyrenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C3-Fluorenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C3-Naphthalenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C3-Phenanthrenes/ Anthracenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C4-Dibenzothiophenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C4-Naphthalenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	C4-Phenanthrenes/ Anthracenes	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Chrysene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Dibenz[a,h]anthracene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Dibenzothiophene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Dimethyl-Biphenyl	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Fluoranthene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Fluorene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Indeno[1,2,3-c,d]-pyrene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Methyl Acenaphthene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Methyl-Biphenyl	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Naphthalene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Phenanthrene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Pyrene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
PAHs	Retene	mg/kg		MLA021, based on USEPA methods 1625 and 8270 ¹	AXYS
Toxicity	<i>Chironomus dilutus</i> - 10d growth	mg/ organism		Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	HydroQual
Toxicity	<i>Chironomus dilutus</i> - 10d growth - % of Control	%		Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	HydroQual

¹ See Section 1.2 AXYS Method MLA021 (PAHs).

² ALS - ALS Laboratory Group; AXYS - AXYS Analytical Services; Hydroqual Laboratories Ltd.

Table 2 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	Lab ²
Toxicity	<i>Chironomus dilutus</i> - 10d survival	# surviving		Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	HydroQual
Toxicity	<i>Chironomus dilutus</i> - 10d survival - % of Control	%		Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	HydroQual
Toxicity	<i>Hyalella azteca</i> - 14d growth	mg/organism		Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	HydroQual
Toxicity	<i>Hyalella azteca</i> - 14d survival	# surviving		Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	HydroQual
Toxicity	<i>Hyallela azteca</i> - 14d growth - % of Control	%		Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	HydroQual
Toxicity	<i>Hyallela azteca</i> - 14d survival - % of Control	%		Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	HydroQual

¹ See Section 1.2 AXYS Method MLA021 (PAHs).

² ALS - ALS Laboratory Group; AXYS - AXYS Analytical Services; Hydroqual Laboratories Ltd.

2.1 TRACE METAL ANALYSIS OF POTABLE AND SURFACE WATERS BY ELAN DRC-II INDUCTIVELY COUPLED PLASMA SPECTROMETRY

2.1.1 Introduction

The elan DRC-II inductively coupled plasma spectrometry method (ICPMS) is used for the analysis of trace metals in potable and surface waters. This technique is especially applicable to the analysis of dissolved, acid extractable, and total recoverable trace metals in water samples containing low level total dissolved solids (TDS). It is therefore highly suitable for provincial water quality surveys and monitoring studies.

2.1.2 Summary of Methods

The ICPMS method is used for the analysis of up to 36 trace metals and major ions in low TDS (<0.2%) and/or low conductivity (<2000 $\mu\text{mho/cm}$) water samples. Aqueous samples are collected, preserved, sub-sampled and/or digested under ultra-clean conditions and processed using the ICPMS.

2.1.3 Scope and Application

For the determination of dissolved elements, samples are filtered either in the field or the lab and then preserved with 1% concentrated high purity HNO_3 . For the determination of extractable or total recoverable elements, samples are preserved either in the field or the lab with 1% concentrated high purity HNO_3 and must be allowed to stabilize for a minimum of 16 hours before digestion or analysis. For total recoverable metals, samples are digested in 1% concentrated HNO_3 in closed vessels by microwave heating, as per ARC microwave digestion method for total recoverable metals in potable and surface waters or as per modified Environmental Protection Agency (EPA), Method 3015.

This method is applicable for the quantitative analysis of the following metals:

- Aluminum (Al);
- Antimony (Sb);
- Arsenic (As);
- Barium (Ba);
- Beryllium (Be);
- Bismuth (Bi);
- Boron (B);
- Cadmium (Cd);
- Chromium (Cr);
- Cobalt (Co);
- Copper (Cu);
- Iron (Fe);
- Lead (Pb);
- Lithium (Li);
- Magnesium (Mg);
- Manganese (Mn);
- Sodium (Na);
- Potassium (K);
- Molybdenum (Mo);

- Nickel (Ni);
- Selenium (Se);
- Silver (Ag);
- Strontium (Sr);
- Thallium (Tl);
- Thorium (Th);
- Tin (Sn);
- Titanium (Ti);
- Uranium (U);
- Vanadium (V);
- Zinc (Zn);
- Silicon (Si); and
- Phosphorus (P).

It is also applicable for the semi-quantitative analysis of the following four elements:

- Calcium (Ca);
- Chlorine (Cl);
- Mercury (Hg); and
- Sulphur (S).

Standard solutions of these elements are prepared and analyzed before and after sample sets to calibrate the instrument and to obtain and to check the correction coefficients used for correcting interferences. Traceable standard reference materials are included as part of the QA/QC protocol. The laboratory is accredited and participates in twice yearly performance samples of similar matrix with Canadian Association for Laboratory Accreditation (CALA).

2.1.4 Apparatus & Equipment

ICPMS Analytical System consists of the following:

- Perkin Elmer Elan DRC-II ICPMS with the mass resolution in the mass range 6-238 amu;
- ESI SCFAST auto-sampler; and
- Perkin Elmer Multiwave 3000 microwave digestion system.

2.1.5 Mercury Determination – Analytical Methodology

Water samples are digested with bromine chloride at room temperature for at least 12 hours prior to sample analysis. This digestion converts any organic mercury species to inorganic mercury. The bromine chloride also acts as a preservative. After sample digestion, a hydroxylamine reagent is added to the sample in order to reduce halogens which may damage the gold trap. The sample solution reduced with stannous chloride and the resulting elemental mercury vapour is swept to a gold gauze where it is pre-concentrated. The gauze is then heated and the liberated mercury is swept to an atomic absorption cell. The mercury signal is automatically collected by the computer, sample absorbance compared to the absorbances of a series of mercury standards and converted to mercury concentration in the water sample.

2.1.6 References

Trace Metal Analysis of Potable and Surface Waters by Elan DRC-II Inductively Coupled Plasma Spectrometry. AITF file 2054-EC/INO/61/09.

2.2 AXYS METHOD MLA021 FOR SEDIMENT PAHS

AXYS Method MLA021 was used for the determination of concentrations of PAHs, and alkylated PAHs in solid (sediment, soil) and equipment rinsate (aqueous) matrices (AITF file 2054-EC/INO/61/09). All samples were spiked with a solution of fifteen deuterated surrogate standards prior to analysis. Solid samples were extracted by soxhlet extraction. Aqueous samples were solvent extracted. The sample extracts were fractionated on a silica gel chromatographic column and analyzed using capillary column gas chromatography with detection by low resolution mass spectrophotometry (GC/MS) for PAHs and alkylated PAHs. The GC/MS was operated at unit mass resolution. Concentrations are reported in ng/g on a dry weight basis for solids and ng/L for aqueous samples. This method is based upon USEPA Methods 1625 and 8270, with modifications. AXYS Analytical is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) (Lab ID A2637) in Canada for the analysis of PAHs in solids.

3.0 NEAR REAL TIME STATION ACCESS FOR RAMP CLIMATE AND HYDROMETRIC STATIONS

As of November 2010 the RAMP Climate and Hydrology program operates seven stations that have remote access via the Bell Cellular network. These stations and the dates of telemetry operation are listed in Table 3. The telemetry capability of these stations has been installed at the request of the client to support monthly reporting of data.

There are two primary benefits to using the cellular network to transmit data from the data loggers, including:

- Cost effectiveness compared to satellite systems; and
- Two-way communication with select data loggers.

3.1 TECHNOLOGICAL CAPACITY

The technological capacity for near-real-time data capture, transmission, and reporting has been successfully demonstrated for RAMP using cell-modem technology for stations that are within range of the Bell/Telus Cellular network. The range of coverage offered by the cellular network continues to improve with significant enhancements for cellular data transfer implemented by Bell and Telus in September 2009. While these network enhancements have improved data transmission for existing near-real-time RAMP locations, there are still other areas of the RAMP Focus Study Area that remain outside of the cellular range; areas that contain existing and proposed RAMP stations that may be considered as potential future candidates for near-real-time reporting. RAMP now has the capability to test if cellular telemetry is potentially possible at specific stations prior to installing permanent station telemetry equipment.

If cellular telemetry communication is not possible at a station, a satellite system must be used to communicate with the data logger. The GOES system is the preferred option; however, this would require that data be transmitted via Alberta Environment, which may be considered as a future option for remote locations.

Table 3 Telemetry stations operated by RAMP, as of spring 2010.

Station ID	Station Name	Station Sensors/Parameters	Data Logger	Telemetry Start Date/Status	Near Real Time data ¹
C1	Aurora Climate	Air Temperature, Relative Humidity, Precipitation, Wind Speed, Wind Direction, Solar Radiation, Snow Depth	CR10	Prior to 2008	
C2	Horizon Climate	Air Temperature, Relative Humidity, Precipitation Wind Speed, Wind Direction, Solar Radiation, Snow Depth, Barometric Pressure	CR1000	February 2009	All Parameters (daily, 15 min data)
C3	Steepbank Climate	Air Temperature, Relative Humidity, Precipitation, Wind Speed and Direction, Snow Depth, Solar Radiation, Barometric Pressure	CR1000	November 2010	
L2	Kearl Lake	Air Temperature, Relative Humidity, Precipitation, Water Level, Water Temperature	CR1000	October 2009	Water Level (daily, 15 min data)
S5A	Muskeg R. above Muskeg Ck.	Water Level, Water Temperature, Barometric Pressure	CR800	2008	
S15A	Tar R. near the Mouth	Water Level, Water Temperature	CR800	April 2010	Water Level and Water Temp (daily, 15 min data)
S33	Muskeg R. at Aurora Albian Boundary	Water Level, Water Temperature	CR800	2008	
S34	Tar R. above CNRL Lake	Water Level, Water Temperature	CR800	October 2009 - March 2010	

Note: CR series of data loggers are built by Campbell Scientific.

¹ Stations with near-real time data are currently outputting data for use.

3.2 STATION DEVELOPMENT PROCEDURES

Procedures for developing a station for near-real-time reporting depend on the station location and reporting needs. The general procedure is outlined below and would be adjusted depending on the specific nature of the station, existing infrastructure, and reporting requirements:

- Identify reporting needs including variables, frequency, and period of data required;
- Conduct a telemetry station assessment. This assessment involves addressing a number of questions about the proposed location. Will a new station be developed (or is this an existing RAMP station) and is the

proposed location within the range of cellular transmission? Is the station topography conducive to signal transfer? Is this a temporary or permanent station? If this is for an existing location; what monitoring equipment was previously installed? A telemetry transmission test kit has been prepared that can be used to provide a preliminary assessment regarding station signal transfer capability related to cellular transmission. A set of criteria has also been developed for assessing GOES satellite transmission potential for stations located outside the cellular range;

- Design and prepare reporting protocols. Currently there are three approaches to reporting provisional data collected through the telemetry systems. Stations L2 (Kearl Lake), C2 (Horizon Climate), and S15A (Tar River near the Mouth) have been set-up to direct-report provisional data to the Member's area of the RAMP website thereby providing near-real-time access for all members. The other stations report to RAMP; the data is reviewed and compiled; and posted to the RAMP Member's area on a monthly basis to support Member's monthly reporting objectives; and the C1 climate station reports provisional near-real-time data to AENV and also to RAMP. The development of the public RAMP website to provide provisional real-time data will be developed in the future;
- Determine equipment needs for the location that will be used to capture data and transfer data using a telemetry system. If a GOES satellite system is required, communications, coordination, and approval from AENV would be required to utilize this system of data transfer. Once approved for development, installation and system testing would occur; and
- Undertake ongoing monitoring, reporting, and system maintenance. All telemetry stations require on-going monitoring and maintenance. Data reporting reliability has increased with improved cellular networks and improved equipment options. Data gaps and data signal interruptions do occur and are a characteristic of these systems; however, recent improvements particularly to the cellular network have improved near-real-time data transmission in the RAMP Focus Study Area considerably.

4.0 WATER YEAR TIMEFRAME FOR HYDROCLIMATE ANALYSIS

The water year period (November 1 to October 31) will be used as the basis for hydrology-climate analysis in future RAMP reporting. This approach has become the standard base period for hydrometric analysis for interior northern river systems that typically have a well defined winter period with several months of precipitation received in the form of snow. Winter flows for these systems are typically low followed by higher flows (and sometimes annual maximum flows) resulting from snowmelt contributions to the system. The winter flow conditions for these northern river systems straddles two calendar years with the onset of winter conditions beginning typically around the start of November and ending with the spring freshet in the following calendar year. When considering the RAMP Focus Study Area (FSA), a water year analytical timeframe (relative to a calendar year timeframe):

- provides a basis for analysis and reporting that allows for seasonal connectivity of flow data as representative of the hydrologic regime;
- aligns RAMP hydrologic analyses with analysis protocols for river systems with similar seasonal attributes; and
- provides for statistical independence between winter measurement endpoints by including a single, full winter flow period within the annual analytical time period rather than two partial winter seasons as formerly applied using the calendar year approach.

In 2009, 11 out of 35 hydrometric stations in the RAMP program operated year-round and; therefore, the analysis from only these stations were potentially affected by this change in timeframe. These stations are listed in Table 4 and potential changes to calculated measurement endpoints for these stations using water-year versus calendar year conventions are described below:

- The annual runoff volume for a watershed is calculated based on flows recorded from November 1 to October 31 of the following calendar year. The natural flow regime for these river systems (described above) includes a low-flow winter period when precipitation is stored as snow in the watershed area. As a result the winter flows (regardless of a calendar-year or water-year basis for calculation), represent a small portion of the annual runoff volume; it is this period of low flows that is accounted differently with the change to water-year analysis. Changes to a water-year convention has little effect on this measurement endpoint given it is typically dominated by open-season flow conditions;
- The reported annual maximum daily flow statistic is not affected by the change to water-year convention as maximum flows generally occur during spring freshet or summer rainfall events which are reported consistently with both water-year and calendar-year conventions;

- Open-water season minimum daily discharge values are not affected by a change to water-year convention as the open-water period (defined as May 1 to October 31) is consistent regardless of a water-year or calendar-year convention;
- Minimum annual and minimum winter discharges, together with their corresponding dates, are not currently reported as measurement endpoints, however, it is expected that these endpoints will potentially be included in future RAMP reporting. This information will especially be useful as part of any future Instream Flow Needs (IFN) analysis. Using a water-year convention is more appropriate for these measurement endpoints as seasonal connectivity achieved through a water-year approach allows for statistical independence between annual values and a more meaningful assessment of these endpoints as a representation of the flow regime. Since these values were not previously reported, transition between the two conventions is not an issue; and
- Mean winter flow values calculated using a water-year convention is more representative of the flow regime due to the reporting of mean flow conditions for a connected winter season that straddles two calendar years. The previous calendar-year convention provided mean winter flows calculated from portions of two different winter flow seasons; January to March combined with November to December of the same calendar year. The mean winter discharge for the water-year convention for the 2009 water-year is compared with the values calculated using the calendar-year convention for 2009 in Table 4. The measurement endpoint values of mean winter flow are different for the two approaches.

Table 4 Mean winter discharge (m³/s) calculated for a water year period (e.g., November 1, 2008 to March 31, 2009) and calendar year period (January 1 to March 31, 2009 and November 1 to December 31, 2009), for stations with complete annual data since November 2008.

Station (Watershed)	2009 Water Year	2009 Calendar Year
S5 (Muskeg)	0.34	0.35
S6 (Mills)	0.013	0.010
S7 (Muskeg)	1.2	1.1
S10 (Muskeg)	0.1	0.0
S14A (Ells)	1.8	1.7
S24 (Athabasca)	193	209
S26 (MacKay)	2.7	1.2
S27 (Firebag)	12.0	16.9
S29 (Christina)	8.0	6.4
S38 (Steepbank)	-	1.5
S40 (MacKay)	2.5	0.8
07DA001 (Athabasca below Fort McMurray).	161.7	145.9

5.0 RAMP SAMPLING STATION INFORMATION

Sampling station information including station ID, UTM coordinates, variables collected, timing and frequency of sampling, and the years when sampling was conducted is provided in Table 5 to Table 16 for each of the RAMP monitoring components.

Table 5 Summary of RAMP data and station information available for the climate component.

Waterbody	Station ID	Easting	Northing	UTM Zone	NAD	Daily Maximum Temperature (deg. C)	Daily Minimum Temperature (deg. C)	Daily Mean Temperature (deg. C)	Daily Maximum Relative Humidity (%)	Daily Minimum Relative Humidity (%)	Total Rainfall (mm)	Total Snowfall (cm)	Total Precipitation (mm)	Snow on the Ground (cm)	Speed of Extreme Gust (km/h)	Global Solar Radiation (RF1) (kWh/m2)	Station pressure (kPa)	Relative humidity (%)	Peak wind speed (km/h)	Global Solar Radiation (KW/m2)	Maximum 2-minute Wind Speed (km/h)	Maximum 10-Minute Wind Speed (km/h)	Water Temperature (deg. C)
Aurora Climate Station	C1	475230	6344049	12	83	10 May 1995 - 31-Dec-09 (4949 days of data)	10 May 1995 - 31-Dec-09 (4875 days of data)	11 Mar 1988 - 31-Dec-09 (5538 days of data)	01 Jan 2007 - 31-Dec-07 (365 days of data)	01 Jan 2007 - 31-Dec-07 (365 days of data)	10 May 1995 - 31-Dec-08 (4169 days of data)	01 Jan 1996 - 31-Dec-08 (3991 days of data)	10 Mar 1988 - 31-Dec-09 (5388 days of data)	26 Oct 1995 - 31-Dec-09 (2000 days of data)	10 May 1995 - 31-Dec-08 (4602 days of data)	11 Mar 1988 - 31-Dec-08 (5164 days of data)	21 Apr 2001 - 10-Jun-01 (51 days of data)	10 May 1995 - 31-Dec-09 (4917 days of data)	01 Jan 2003 - 31-Dec-09 (1349 days of data)	01 Jan 2009 - 31-Dec-09 (319 days of data)	10 May 1995 - 31-Dec-09 (4924 days of data)	10 May 1995 - 31-Dec-09 (4924 days of data)	
Calumet River near the Mouth	S16	458087	6361908	12	83	11 Jun 2001 - 11-Oct-05 (1533 days of data)	11 Jun 2001 - 11-Oct-05 (1533 days of data)	11 Jun 2001 - 11-Oct-05 (1533 days of data)			11 Jun 2001 - 2-May-05 (770 days of data)	11 Jun 2001 - 23-Mar-05 (713 days of data)	11 Jun 2001 - 2-May-05 (1279 days of data)										27 May 2003 - 31-Oct-04 (201 days of data)
Christina River near Chard (07CE002)	S29	508350	6188157	12	83						08 Jul 2002 - 10-Oct-03 (270 days of data)												
Ells River above Joslyn Creek Diversion	S45	441222	6342629	12	83																		13 Jun 2009 - 31-Dec-09 (143 days of data)
Ells River at the CNRL Bridge	S14A	455748	6344947	12	83																		14 Jul 2005 - 31-Dec-09 (1361 days of data)
Horizon Climate Station	C2	442885	6360457	12	83	16 Oct 2008 - 31-Dec-09 (372 days of data)	16 Oct 2008 - 31-Dec-09 (372 days of data)	16 Oct 2008 - 31-Dec-09 (372 days of data)					01 Jan 2009 - 31-Dec-09 (204 days of data)	01 Jan 2009 - 30-Dec-09 (296 days of data)	16 Oct 2008 - 31-Dec-08 (65 days of data)	16 Oct 2008 - 31-Dec-08 (69 days of data)	16 Oct 2008 - 31-Dec-09 (426 days of data)	16 Oct 2008 - 31-Dec-09 (372 days of data)	01 Jan 2009 - 31-Dec-09 (357 days of data)	01 Jan 2009 - 31-Dec-09 (220 days of data)	16 Oct 2008 - 31-Dec-09 (422 days of data)	16 Oct 2008 - 31-Dec-09 (422 days of data)	
Iyininim Creek above Kearl Lake	S03	489491	6345029	12	83						30 Apr 1999 - 20-Oct-08 (1159 days of data)												
Jackpine Creek at Canterra Road	S02	475132	6343680	12	83																		20 Oct 2007 - 31-Dec-09 (676 days of data)
Kearl Lake	L2	484856	6351061	12	83	01 Jan 2008 - 31-Dec-09 (731 days of data)	01 Jan 2008 - 31-Dec-09 (731 days of data)	25 Sep 2007 - 31-Dec-09 (829 days of data)					01 Jan 2008 - 31-Dec-09 (670 days of data)						25 Sep 2007 - 31-Dec-09 (722 days of data)				25 Sep 2007 - 31-Dec-09 (829 days of data)
Kearl Lake Outlet	S09	483980	6346750	12	83												07 Apr 1999 - 20-Apr-01 (709 days of data)						
MacKay River at Petro-Canada Bridge	S40	445023	6314256	12	83																		19 Sep 2008 - 31-Dec-09 (382 days of data)
McClelland Lake	L1	483430	6371950	12	83	29 Mar 2007 - 31-Dec-09 (776 days of data)	29 Mar 2007 - 31-Dec-09 (776 days of data)	09 Feb 2007 - 31-Dec-09 (824 days of data)			09 Aug 2002 - 8-Oct-05 (398 days of data)		15 Apr 2006 - 31-Dec-09 (1088 days of data)						06 Sep 2006 - 31-Dec-09 (885 days of data)				14 Mar 2008 - 31-Dec-09 (387 days of data)
Muskeg River above Muskeg Creek	S05A	476100	6351600	12	83												16 Mar 2002 - 31-Dec-09 (2752 days of data)						01 Sep 2004 - 31-Dec-09 (1250 days of data)
Poplar Creek at Highway 63 (WSC 07DA007)	S11	471998	6307667	12	83																		14 May 2008 - 20-Oct-09 (280 days of data)
Steepbank Climate Station	C3	473947	6320511	12	83									13 Aug 2009 - 31-Dec-09 (141 days of data)									
Surmont Creek at Highway 881	S32	490310	6254473	12	83																		24 Jun 2008 - 24-Oct-09 (283 days of data)
Tar River above CNRL Lake	S34	440729	6361689	12	83																		08 Apr 2008 - 31-Dec-09 (420 days of data)
Tar River Lowland Tributary near the Mouth	S19	457502	6352663	12	83						13 Jun 2002 - 31-Dec-05 (731 days of data)		01 Jan 2006 - 22-Oct-09 (1133 days of data)										
Tar River near the Mouth	S15A	458395	6353391	12	83																		21 Sep 2007 - 22-Oct-09 (290 days of data)
Wapasu Creek at Canterra Road	S10	490272	6355942	12	83																		01 Jan 2008 - 31-Dec-09 (577 days of data)

Table 6 Summary of RAMP data and station information available for the hydrology component.

Waterbody	Station ID	Easting	Northing	UTM Zone	NAD	Water Level (m)	Discharge (m ³ /s)
Calumet River	CR1	458087	6361908	12	83		04 May 2005 - 18-Oct-09 (718 days of data)
McClelland Lake	L1	483430	6371950	12	83	22 Jun 1997 - 31-Dec-09 (2617 days of data)	22 Jun 1997 - 2-Sep-06 (1761 days of data)
Kearl Lake	L2	484856	6351061	12	83	19 Jan 1989 - 31-Dec-09 (3209 days of data)	26 Apr 2007 - 17-Oct-07 (175 days of data)
Isadore's Lake	L3	463297	6342987	12	83	22 Feb 2000 - 31-Dec-09 (2923 days of data)	
Alsands Drain	S01	470006	6345534	12	83	16 Apr 1997 - 30-Dec-02 (1564 days of data)	10 Aug 1995 - 30-Dec-02 (1891 days of data)
Jackpine Creek at Canterra Road	S02	475132	6343680	12	83	17 Apr 1997 - 27-Nov-09 (2934 days of data)	06 May 1995 - 27-Nov-09 (3268 days of data)
Iyininim Creek above Kearl Lake	S03	489491	6345029	12	83	20 Apr 1989 - 24-Oct-09 (2052 days of data)	18 Jan 1989 - 24-Oct-09 (2173 days of data)
Blackfly Creek near the Mouth	S04	484469	6340172	12	83	15 Feb 1989 - 27-Oct-98 (425 days of data)	15 Feb 1989 - 27-Oct-98 (761 days of data)
Blackfly Creek near the Mouth	S04A	485905	6338825	12	83	25 Apr 2007 - 25-Oct-07 (140 days of data)	25 Apr 2007 - 25-Oct-07 (140 days of data)
Muskeg River above Stanley Creek	S05	479820	6356551	12	83	12 Feb 2003 - 31-Dec-09 (2405 days of data)	04 May 2003 - 31-Dec-09 (2434 days of data)
Muskeg River above Muskeg Creek	S05A	476100	6351600	12	83	17 Apr 1997 - 31-Dec-09 (4394 days of data)	11 Aug 1995 - 31-Dec-09 (4637 days of data)
Mills Creek at Highway 63	S06	463829	6344743	12	83	16 Apr 1997 - 31-Dec-09 (3249 days of data)	16 Apr 1997 - 31-Dec-09 (3233 days of data)
Muskeg River near Fort MacKay (WSC 07DA008)	S07	465408	6338944	12	83	01 Jan 2000 - 31-Dec-09 (3058 days of data)	01 Mar 1998 - 31-Dec-09 (4323 days of data)
Stanley Creek near the Mouth	S08	477401	6356595	12	83	14 Sep 1999 - 14-Oct-03 (634 days of data)	
Kearl Lake Outlet	S09	483980	6346750	12	83	18 Jan 1989 - 27-Nov-09 (2253 days of data)	18 Jan 1989 - 27-Nov-09 (2239 days of data)
Wapasu Creek at Canterra Road	S10	490272	6355942	12	83	08 May 1997 - 31-Dec-09 (2790 days of data)	08 May 1997 - 31-Dec-09 (2774 days of data)
Poplar Creek at Highway 63 (WSC 07DA007)	S11	471998	6307667	12	83	05 May 1995 - 30-Nov-09 (2387 days of data)	20 Apr 1996 - 30-Nov-09 (2325 days of data)
Fort Creek at Highway 63	S12	462600	6363400	12	83	02 Apr 2000 - 21-Oct-09 (1210 days of data)	02 Apr 2000 - 21-Oct-09 (1204 days of data)
Albian Pond 3 Outlet	S13	468854	6344688	12	83	02 Mar 2000 - 7-Dec-02 (714 days of data)	02 Mar 2000 - 7-Dec-02 (714 days of data)
Ells River above Joslyn Creek	S14	457310	6349466	12	83	13 May 2001 - 24-Oct-07 (1165 days of data)	15 Mar 2001 - 24-Oct-07 (1150 days of data)
Ells River at the CNRL Bridge	S14A	455748	6344947	12	83	30 Oct 2004 - 31-Dec-09 (1591 days of data)	30 Oct 2004 - 31-Dec-09 (1615 days of data)
Tar River near the Mouth (WSC 07DA015)	S15	454390	6357209	12	83	09 May 2001 - 28-Oct-06 (1060 days of data)	14 Mar 2001 - 28-Oct-06 (1049 days of data)
Tar River near the Mouth	S15A	458395	6353391	12	83	01 May 2007 - 22-Oct-09 (501 days of data)	01 May 2007 - 22-Oct-09 (501 days of data)
Calumet River near the Mouth	S16	458087	6361908	12	83	12 May 2001 - 31-Oct-04 (570 days of data)	12 May 2001 - 31-Oct-04 (537 days of data)
Tar River Upland Tributary	S17	444331	6358256	12	83	12 May 2001 - 31-Oct-04 (659 days of data)	12 May 2001 - 13-Oct-03 (376 days of data)
Calumet River Upland	S18	452702	6367295	12	83	12 May 2001 - 31-Oct-01 (173 days of data)	12 May 2001 - 28-Jun-01 (48 days of data)
Calumet River Upland Tributary	S18A	451129	6363087	12	83	10 Jun 2002 - 25-Oct-09 (1005 days of data)	10 Jun 2002 - 25-Oct-09 (874 days of data)

Table 6 (Cont'd.)

Waterbody	Station ID	Easting	Northing	UTM Zone	NAD	Water Level (m)	Discharge (m ³ /s)
Tar River Lowland Tributary near the Mouth	S19	457502	6352663	12	83	09 May 2001 - 22-Oct-09 (1353 days of data)	09 May 2001 - 22-Oct-09 (1353 days of data)
Muskeg River Upland	S20	492106	6355709	12	83	08 May 2001 - 21-Oct-09 (1554 days of data)	08 May 2001 - 21-Oct-09 (1341 days of data)
Shelley Creek near the Mouth	S21	476419	6347933	12	83	14 May 2001 - 14-Oct-03 (492 days of data)	
Muskeg Creek near the Mouth	S22	480970	6349071	12	83	17 Jan 1989 - 27-Oct-09 (1625 days of data)	17 Jan 1989 - 27-Oct-09 (1567 days of data)
Aurora Boundary Weir	S23	470315	6349946	12	83	01 Jan 2001 - 31-Dec-02 (730 days of data)	01 Jan 2001 - 31-Dec-02 (730 days of data)
Athabasca River below Eymundson Creek	S24	466313	6372760	12	83	20 Jun 2001 - 31-Dec-09 (2993 days of data)	21 Jun 2001 - 31-Dec-09 (3115 days of data)
Susan Lake Outlet	S25	464491	6368503	12	83	11 Jun 2002 - 23-Oct-09 (632 days of data)	11 Jun 2002 - 23-Oct-09 (622 days of data)
MacKay River near Fort McKay (WSC 07DB001)	S26	458031	6341078	12	83	31 Oct 2001 - 20-Dec-08 (1670 days of data)	01 Mar 2001 - 31-Dec-09 (3163 days of data)
Firebag River near the Mouth (WSC 07DC001)	S27	489529	6388843	12	83	01 Jan 2002 - 31-Dec-09 (2718 days of data)	01 Jan 2002 - 31-Dec-09 (2863 days of data)
Khahago Creek below Black Fly Creek	S28	480489	6342185	12	83	19 Jan 1989 - 25-Oct-07 (1179 days of data)	19 Jan 1989 - 25-Oct-07 (1178 days of data)
Christina River near Chard (07CE002)	S29	508195	6187926	12	83	13 Jan 2002 - 31-Dec-08 (1925 days of data)	13 Jan 2002 - 31-Dec-09 (2869 days of data)
Hangingstone River at Highway 63	S30	476889	6252656	12	83	22 Apr 2002 - 22-Oct-02 (110 days of data)	13 May 2002 - 21-Oct-02 (107 days of data)
Hangingstone Creek at North Star Road	S31	469784	6236095	12	83	10 Apr 2002 - 24-Oct-09 (1168 days of data)	10 Apr 2002 - 24-Oct-09 (1162 days of data)
Surmont Creek at Highway 881	S32	490310	6254473	12	83	14 Jan 2002 - 24-Oct-09 (1122 days of data)	18 May 2002 - 24-Oct-09 (1114 days of data)
Muskeg River at the Aurora / Albion Boundary	S33	474876	6350204	12	83	30 Apr 2003 - 31-Dec-09 (2407 days of data)	29 Jan 2003 - 31-Dec-09 (2410 days of data)
Tar River above CNRL Lake	S34	440729	6361689	12	83	26 Apr 2005 - 31-Dec-09 (1075 days of data)	26 Apr 2005 - 31-Dec-09 (1053 days of data)
McClelland Lake Outlet below McClelland Lake	S35	483856	6373577	12	83	29 Jun 2008 - 8-Oct-08 (102 days of data)	
McClelland Lake Outlet above Firebag River	S36	490480	6384065	12	83	14 May 2008 - 25-Oct-09 (297 days of data)	14 May 2008 - 25-Oct-09 (297 days of data)
East Jackpine Creek near the 1300 m Contour	S37	487840	6325424	12	83	22 Sep 2007 - 24-Oct-09 (336 days of data)	22 Sep 2007 - 24-Oct-09 (336 days of data)
Steepbank River near Fort McMurray (WSC 07DA006)	S38	474809	6317895	12	83		01 Jan 2009 - 31-Dec-09 (365 days of data)
Beaver River above Syncrude (WSC 07DA018)	S39	465475	6310820	12	83		03 Jan 2008 - 31-Dec-09 (701 days of data)
MacKay River at Petro-Canada Bridge	S40	445023	6314256	12	83	01 Jan 2008 - 31-Dec-09 (696 days of data)	01 Jan 2008 - 31-Dec-09 (696 days of data)
Clearwater River above Christina River (WSC 07CD005)	S42	504427	6279666	12	83		01 Jan 2009 - 31-Dec-09 (365 days of data)
Firebag River above Suncor Firebag	S43	531715	6354765	12	83	01 May 2009 - 29-Oct-09 (182 days of data)	01 May 2009 - 29-Oct-09 (182 days of data)
Pierre River near for MacKay WSC 07DA013)	S44	460775	6369300	12	83	01 May 2009 - 25-Oct-09 (143 days of data)	01 May 2009 - 25-Oct-09 (143 days of data)
Ells River above Joslyn Creek Diversion	S45	441222	6342629	12	83	13 Jun 2009 - 31-Dec-09 (142 days of data)	13 Jun 2009 - 25-Oct-09 (4 days of data)

Table 7 Summary of RAMP data and station information available for the snowcourse survey.

Site ID	Easting	Northing	UTM Zone	NAD	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
463378,6342927	463378	6342927	12	83	yes												
463885,6332502	463885	6332502	12	83	yes												
464054,6347511	464054	6347511	12	83	yes												
464993,6339613	464993	6339613	12	83	yes												
468016,6343202	468016	6343202	12	83	yes												
468115,6343423	468115	6343423	12	83	yes												
468768,6340622	468768	6340622	12	83	yes												
469085,6340889	469085	6340889	12	83	yes												
469621,6341137	469621	6341137	12	83	yes												
470450,6341953	470450	6341953	12	83	yes												
472068,6343054	472068	6343054	12	83	yes												
473432,6343442	473432	6343442	12	83	yes												
473911,6343295	473911	6343295	12	83	yes												
475141,6344001	475141	6344001	12	83	yes												
476660,6344618	476660	6344618	12	83	yes												
480691,6348324	480691	6348324	12	83	yes												
463824,6340599	463824	6340599	12	83		yes											
463896,6332814	463896	6332814	12	83		yes											
464071,6347847	464071	6347847	12	83		yes											
464098,6339309	464098	6339309	12	83		yes											
467980,6343515	467980	6343515	12	83		yes											
468474,6347005	468474	6347005	12	83		yes											
468527,6347709	468527	6347709	12	83		yes											
468745,6340847	468745	6340847	12	83		yes											
468873,6349399	468873	6349399	12	83		yes											
469812,6346976	469812	6346976	12	83		yes											
470113,6341819	470113	6341819	12	83		yes											
471093,6342784	471093	6342784	12	83		yes											
472707,6343284	472707	6343284	12	83		yes											
473997,6343536	473997	6343536	12	83		yes											
475236,6344151	475236	6344151	12	83		yes											
475975,6344532	475975	6344532	12	83		yes											
463861,6344912	463861	6344912	12	83			yes										
463875,6339360	463875	6339360	12	83			yes										
463915,6332905	463915	6332905	12	83			yes										
464191,6339198	464191	6339198	12	83			yes										
467232,6342273	467232	6342273	12	83			yes										
469948,6345664	469948	6345664	12	83			yes										
470078,6346099	470078	6346099	12	83			yes										
475112,6344064	475112	6344064	12	83			yes										
476015,6351787	476015	6351787	12	83			yes										
477842,6345649	477842	6345649	12	83			yes										
479714,6347482	479714	6347482	12	83			yes										
481427,6349312	481427	6349312	12	83			yes										
483640,6350203	483640	6350203	12	83			yes										
484823,6351076	484823	6351076	12	83			yes										
485708,6352668	485708	6352668	12	83			yes										
489559,6355474	489559	6355474	12	83			yes										
460605,6355986	460605	6355986	12	83				yes									
460912,6357129	460912	6357129	12	83				yes									
461219,6358494	461219	6358494	12	83				yes									
462061,6363534	462061	6363534	12	83				yes									
462615,6360701	462615	6360701	12	83				yes									
462686,6349471	462686	6349471	12	83				yes									
462931,6360918	462931	6360918	12	83				yes									
463241,6365477	463241	6365477	12	83				yes									
463490,6360479	463490	6360479	12	83				yes									
463633,6355102	463633	6355102	12	83				yes									
464026,6332571	464026	6332571	12	83				yes									
464040,6339755	464040	6339755	12	83				yes									
464545,6365007	464545	6365007	12	83				yes									
464654,6355883	464654	6355883	12	83				yes									
464683,6360165	464683	6360165	12	83				yes									
466173,6357254	466173	6357254	12	83				yes									
467389,6359665	467389	6359665	12	83				yes									
469539,6369598	469539	6369598	12	83				yes									
471511,6344638	471511	6344638	12	83				yes									
473105,6343322	473105	6343322	12	83				yes									
474290,6342862	474290	6342862	12	83				yes									
475525,6344085	475525	6344085	12	83				yes									
477936,6345470	477936	6345470	12	83				yes									
478532,6345913	478532	6345913	12	83				yes									
481670,6349196	481670	6349196	12	83				yes									
484827,6350813	484827	6350813	12	83				yes									
484916,6350817	484916	6350817	12	83				yes									
487617,6354569	487617	6354569	12	83				yes									
490343,6355733	490343	6355733	12	83				yes									
490867,6355758	490867	6355758	12	83				yes									
491214,6355611	491214	6355611	12	83				yes									
491807,6354947	491807	6354947	12	83				yes									
449523,6355475	449523	6355475	12	83					yes								
449862,6355845	449862	6355845	12	83						yes							
450705,6359210	450705	6359210	12	83							yes						

Table 7 (Cont'd.)

Site ID	Easting	Northing	UTM Zone	NAD	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
450790,6366752	450790	6366752	12	83					yes								
450795,6364545	450795	6364545	12	83					yes								
453380,6354457	453380	6354457	12	83					yes								
454220,6353287	454220	6353287	12	83					yes								
454245,6354379	454245	6354379	12	83					yes								
454514,6357816	454514	6357816	12	83					yes								
455355,6352488	455355	6352488	12	83					yes								
455449,6359393	455449	6359393	12	83					yes								
455585,6360159	455585	6360159	12	83					yes								
455598,6360676	455598	6360676	12	83					yes								
455610,6362131	455610	6362131	12	83					yes								
455626,6362686	455626	6362686	12	83					yes								
458905,6362244	458905	6362244	12	83					yes								
463790,6346589	463790	6346589	12	83					yes								
464169,6344127	464169	6344127	12	83					yes								
474414,6342341	474414	6342341	12	83					yes								
474442,6339912	474442	6339912	12	83					yes								
475881,6343799	475881	6343799	12	83					yes								
477018,6344966	477018	6344966	12	83					yes								
477884,6345500	477884	6345500	12	83					yes								
478550,6345883	478550	6345883	12	83					yes								
481256,6348977	481256	6348977	12	83					yes								
483835,6345603	483835	6345603	12	83					yes								
483912,6348324	483912	6348324	12	83					yes								
462375,6359769	462375	6359769	12	83					yes		yes						
462622,6362376	462622	6362376	12	83					yes		yes						
463121,6359714	463121	6359714	12	83					yes		yes						
463318,6359809	463318	6359809	12	83					yes		yes						
484935,6349023	484935	6349023	12	83					yes		yes	yes	yes	yes	yes		
450609,6359477	450609	6359477	12	83						yes							
453949,6354992	453949	6354992	12	83						yes							
453996,6356081	453996	6356081	12	83						yes							
454422,6358046	454422	6358046	12	83						yes							
454526,6354544	454526	6354544	12	83						yes							
455016,6356786	455016	6356786	12	83						yes							
455377,6359616	455377	6359616	12	83						yes							
455618,6363764	455618	6363764	12	83						yes							
456679,6358050	456679	6358050	12	83						yes							
456815,6358033	456815	6358033	12	83						yes							
457771,6359600	457771	6359600	12	83						yes							
458077,6362358	458077	6362358	12	83						yes							
458445,6361553	458445	6361553	12	83						yes							
450625,6360330	450625	6360330	12	83						yes			yes				
452239,6358089	452239	6358089	12	83						yes			yes				
452803,6358111	452803	6358111	12	83						yes			yes				
450690,6359216	450690	6359216	12	83							yes						
452143,6357868	452143	6357868	12	83							yes						
452814,6357863	452814	6357863	12	83							yes						
453998,6356100	453998	6356100	12	83							yes						
454443,6354521	454443	6354521	12	83							yes						
454558,6357854	454558	6357854	12	83							yes						
454950,6356616	454950	6356616	12	83							yes						
455449,6354379	455449	6354379	12	83							yes						
455451,6359387	455451	6359387	12	83							yes						
455670,6363551	455670	6363551	12	83							yes						
456606,6357835	456606	6357835	12	83							yes						
456759,6357829	456759	6357829	12	83							yes						
457929,6359643	457929	6359643	12	83							yes						
458044,6362079	458044	6362079	12	83							yes						
458731,6361722	458731	6361722	12	83							yes						
463518,6359959	463518	6359959	12	83							yes						
454096,6355198	454096	6355198	12	83							yes	yes					
454118,6355166	454118	6355166	12	83								yes					
454363,6357197	454363	6357197	12	83								yes					
454430,6354569	454430	6354569	12	83								yes					
458087,6361908	458087	6361908	12	83								yes	yes				
475820,6343952	475820	6343952	12	83								yes	yes				
461193,6348854	461193	6348854	12	83								yes	yes	yes	yes	yes	yes
468889,6340820	468889	6340820	12	83								yes	yes	yes	yes	yes	yes
471456,6343212	471456	6343212	12	83								yes	yes	yes	yes	yes	yes
472020,6343260	472020	6343260	12	83								yes	yes	yes	yes	yes	yes
475132,6343680	475132	6343680	12	83								yes	yes	yes	yes	yes	yes
483430,6372126	483430	6372126	12	83								yes	yes	yes	yes	yes	yes
490272,6355942	490272	6355942	12	83								yes	yes	yes	yes	yes	yes
490735,6355914	490735	6355914	12	83								yes	yes	yes	yes	yes	yes
491872,6354837	491872	6354837	12	83								yes	yes	yes	yes	yes	yes
508195,6187926	508195	6187926	12	83								yes	yes	yes	yes	yes	yes
454252,6363837	454252	6363837	12	83										yes	yes	yes	yes
454355,6363733	454355	6363733	12	83										yes	yes	yes	yes
457325,6352897	457325	6352897	12	83										yes	yes	yes	yes
457616,6352863	457616	6352863	12	83										yes	yes	yes	yes
462681,6362344	462681	6362344	12	83										yes	yes	yes	yes
484839,6351065	484839	6351065	12	83												yes	yes

Table 9 Summary of RAMP data and station information available for the sediment quality component.

Waterbody	Description	Station ID	Easting	Northing	UTM Zone	NAD	Station Status	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Athabasca Delta	Athabasca River Delta composite	ARD-1	511903	6494506	12	83	Test since station inception			yes										
Athabasca Delta	Athabasca River Delta main channel	ARD-2	482595	6477692	12	83	Test since station inception									yes				
Athabasca Delta	at Old Fort	ATR-OF	470205	6474330	12	83	Test since station inception									yes				
Athabasca Delta	Big Eddy Channel	BEC	496433	6479092	12	83	Test since station inception									yes				
Athabasca Delta	Big Point Channel	BPC-1	511903	6494506	12	83	Test since station inception			yes	yes	yes	yes	yes		yes		yes	yes	yes
Athabasca Delta	Upper Big Point Channel	BPC-2	508178	6480236	12	83	Test since station inception									yes				
Athabasca Delta	Cree Creek	CC-1	469032	6482965	12	83	Test since station inception									yes				
Athabasca Delta	Upper Embarras River	EMR-1	467807	6468730	12	83	Test since station inception									yes				
Athabasca Delta	Lower Embarras River	EMR-2	494635	6491898	12	83	Test since station inception									yes				
Athabasca Delta	Flour Bay	FLB-1	504943	6478592	12	83	Test since station inception				yes									
Athabasca Delta	Fletcher Channel	FLC-1	496382	6491567	12	83	Test since station inception					yes	yes	yes		yes		yes	yes	yes
Athabasca Delta	Goose Island Channel	GIC-1	509578	6494200	12	83	Test since station inception					yes	yes	yes		yes		yes	yes	yes
Athabasca Delta	Jackfish Creek	JC-1	502679	6473400	12	83	Test since station inception									yes				
Athabasca River	upstream of Donald Creek- composite	ATR-DC-CC	475020	6298154	12	83	Baseline since station inception	yes												
Athabasca River	upstream of Donald Creek- east bank	ATR-DC-E	475120	6298140	12	83	Baseline since station inception		yes		yes	yes	yes	yes	yes					
Athabasca River	upstream of Donald Creek- west bank	ATR-DC-W	475103	6298152	12	83	Baseline since station inception		yes		yes	yes	yes	yes	yes					
Athabasca River	downstream of development- east bank	ATR-DD-E	463707	6367819	12	83	Test since station inception						yes	yes	yes					
Athabasca River	downstream of development- west bank	ATR-DD-W	463065	6367951	12	83	Test since station inception						yes	yes	yes					
Athabasca River	upstream of the Embarras River	ATR-ER	468288	6468175	12	83	Test since station inception				yes	yes	yes	yes	yes	yes		yes	yes	yes
Athabasca River	upstream of Fort Creek - cross-channel	ATR-FC-CC-D	461227	6363101	12	83	Test since station inception	yes												
Athabasca River	upstream of Fort Creek - east bank	ATR-FC-E	461509	6363018	12	83	Test since station inception				yes	yes	yes	yes						
Athabasca River	downstream of Fort Creek - east bank	ATR-FC-E-D	461521	6363163	12	83	Test since station inception		yes											
Athabasca River	upstream of Fort Creek - west bank	ATR-FC-W	460965	6363164	12	83	Test since station inception				yes	yes	yes	yes						
Athabasca River	downstream of Fort Creek - west bank	ATR-FC-W-D	460959	6363234	12	83	Test since station inception		yes											
Athabasca River	upstream of the Firebag River- east bank	ATR-FR-E	478459	6400329	12	83	Test since station inception						yes	yes	yes					
Athabasca River	upstream of the Firebag River-west bank	ATR-FR-W	478031	6400586	12	83	Test since station inception						yes	yes	yes					
Athabasca River	upstream of the Muskeg River- east bank	ATR-MR-E	463504	6332230	12	83	Test since station inception				yes	yes	yes	yes	yes					
Athabasca River	downstream of the Muskeg River- east bank	ATR-MR-E-D	463373	6332357	12	83	Test since station inception		yes											
Athabasca River	upstream of the Muskeg River- west bank	ATR-MR-W	463203	6332042	12	83	Test since station inception				yes	yes	yes	yes	yes					
Athabasca River	downstream of the Muskeg River- west bank	ATR-MR-W-D	463137	6332278	12	83	Test since station inception		yes											
Athabasca River	upstream of the Steepbank River- east bank	ATR-SR-E	470931	6319632	12	83	Test since station inception				yes	yes	yes	yes	yes					
Athabasca River	upstream of the Steepbank River- west bank	ATR-SR-W	470785	6319199	12	83	Test since station inception				yes	yes	yes	yes	yes					
Athabasca River	upstream of Fort McMurray	ATR-UFM	475330	6286105	12	83	Baseline since station inception						yes	yes	yes					
Beaver River Watershed	Upper Beaver River	BER-D2	465475	6311289	12	83	Baseline since station inception												yes	yes
Calumet River Watershed	Calumet River mouth	CAR-1	460816	6363196	12	83	Test since 2005						yes		yes	yes				
Calumet River Watershed	Upper Calumet River	CAR-2	454108	6366533	12	83	Baseline since station inception									yes				
Calumet River Watershed	Calumet River mouth	CAR-D1	460698	6363156	12	83	Test since station inception													yes
Calumet River Watershed	Upper Calumet River	CAR-D2	453995	6366522	12	83	Baseline since station inception										yes			yes
Christina River Watershed	Christina River upstream of Fort McMurray	CHR-1	496646	6280035	12	83	Test since station inception						yes	yes	yes					
Christina River Watershed	Christina River upstream of Janvier	CHR-2	511698	6192371	12	83	Baseline since station inception						yes	yes	yes					
Christina River Watershed	Christina River upstream of Fort McMurray	CHR-D1	496481	6280190	12	83	Test since station inception										yes	yes		yes
Christina River Watershed	Christina River upstream of Janvier	CHR-D2	511666	6192362	12	83	Baseline since station inception										yes			yes
Clearwater River Watershed	Clearwater River upstream of Fort McMurray	CLR-1	480611	6283924	12	83	Test since 2002					yes	yes	yes						
Clearwater River Watershed	Clearwater River upstream of the Christina River	CLR-2	496294	6280422	12	83	Baseline since station inception					yes	yes	yes						

Table 9 (Cont'd.)

Waterbody	Description	Station ID	Easting	Northing	UTM Zone	NAD	Station Status	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Clearwater River Watershed	Clearwater River upstream of Fort McMurray	CLR-D1	498883	6279869	12	83	Test since 2002													yes
Clearwater River Watershed	Clearwater River upstream of the Christina River	CLR-D2	479431	6284197	12	83	Baseline since station inception													yes
Ells River Watershed	Ells River mouth	ELR-1	459241	6351495	12	83	Test since 2002		yes				yes	yes	yes	yes				
Ells River Watershed	Ells River upstream of the Canadian Natural Lease 7	ELR-2	455753	6344915	12	83	Baseline since station inception								yes	yes				
Ells River Watershed	Ells River mouth	ELR-D1	459318	6351291	12	83	Test since 2002										yes	yes		
Firebag River Watershed	Firebag River mouth	FIR-1	479114	6400215	12	83	Test since station inception						yes	yes	yes					
Firebag River Watershed	Firebag upstream of Suncor Firebag	FIR-2	531543	6354825	12	83	Baseline since station inception							yes	yes					
Firebag River Watershed	Tributary to the Firebag River	FIR-2X	532835	6355957	12	83	Baseline since station inception						yes							
Firebag River Watershed	Firebag River mouth	FIR-D1	479363	6400434	12	83	Test since station inception										yes	yes		
Fort Creek Watershed	Fort Creek mouth	FOC-1	461523	6363121	12	83	Baseline since station inception				yes		yes							
Fort Creek Watershed	Fort Creek mouth	FOC-D1	461527	6363105	12	83	Test since 2005										yes	yes	yes	
Hangingstone River Watershed	Hangingstone River upstream of Fort McMurray	HAR-1	478653	6276265	12	83	Baseline since station inception								yes	yes				
Isadore's Lake	Isadore's Lake	ISL-1	463361	6342764	12	83	Test since station inception					yes					yes	yes	yes	yes
Kearl Lake	Kearl Lake	KEL-1	485425	6349374	12	83	Test since 2009					yes			yes		yes	yes	yes	yes
Mackay River Watershed	Mackay River mouth	MAR-1	461601	6336007	12	83	Test since 2002	yes	yes			yes	yes		yes					
Mackay River Watershed	Mackay River upstream of Suncor MacKay	MAR-2	444682	6314024	12	83	Baseline since station inception					yes			yes					
McClelland Lake	McClelland Lake	MCL-1	479158	6373132	12	83	Baseline since station inception						yes	yes			yes	yes	yes	yes
McLean Creek Watershed	McLean Creek mouth	MCC-1	474637	6306051	12	83	Test since station inception			yes	yes	yes	yes			yes				
Muskeg River Watershed	Jackpine Creek mouth	JAC-1	471935	6346300	12	83	Baseline since station inception	yes							yes					
Muskeg River Watershed	Jackpine Creek mouth	JAC-D1	471862	6346430	12	83	Test since 2006										yes	yes	yes	yes
Muskeg River Watershed	Upper Jackpine Creek	JAC-D2	480036	6324999	12	83	Baseline since station inception										yes	yes	yes	yes
Muskeg River Watershed	Muskeg River mouth	MUR-1	463473	6332409	12	83	Test since station inception	yes	yes	yes	yes	yes	yes	yes	yes	yes				
Muskeg River Watershed	Muskeg River 1 km upstream of mouth	MUR-1b	464188	6332056	12	83	Test since station inception				yes			yes						
Muskeg River Watershed	Muskeg River upstream of Canterra Road	MUR-2	466569	6340506	12	83	Test since station inception				yes			yes	yes	yes				
Muskeg River Watershed	Muskeg River upstream of Jackpine Creek	MUR-4	474379	6349075	12	83	Test since station inception	yes			yes			yes						
Muskeg River Watershed	Muskeg River upstream of Muskeg Creek	MUR-5	476043	6351800	12	83	Test since 2003				yes			yes						
Muskeg River Watershed	Muskeg River upstream of Wapasu Creek	MUR-6	492093	6355679	12	83	Baseline since station inception				yes			yes						
Muskeg River Watershed	Muskeg River upstream of Stanley Creek	MUR-D2	479759	6356751	12	83	Test since station inception										yes	yes	yes	yes
Muskeg River Watershed	Upper reach Muskeg River	MUR-D3	480075	6357945	12	83	Test since 2008							yes	yes	yes	yes	yes	yes	yes
Muskeg River Watershed	Stanley Creek mouth	STC-1	477375	6356665	12	83	Test since station inception							yes						
Poplar Creek Watershed	Poplar Creek mouth	POC-1	473051	6308820	12	83	Test since station inception	yes					yes		yes					
Poplar Creek Watershed	Poplar Creek mouth	POC-D1	473071	6308822	12	83	Test since station inception												yes	yes
Shipyard Lake	Shipyard Lake	SHL-1	473481	6313037	12	83	Test since station inception					yes	yes	yes	yes		yes	yes	yes	yes
Steepbank River Watershed	North Steepbank River upstream of Suncor Lewis	NSR-1	497380	6324549	12	83	Baseline since station inception						yes	yes	yes	yes				
Steepbank River Watershed	Steepbank River mouth	STR-1	470807	6319811	12	83	Test since station inception	yes	yes				yes			yes				
Steepbank River Watershed	Steepbank River upstream of Suncor Millennium	STR-2	485820	6309347	12	83	Baseline since station inception						yes			yes				
Steepbank River Watershed	Steepbank River upstream of the North Steepbank River	STR-3	495022	6300250	12	83	Baseline since station inception									yes				
Tar River Watershed	Tar River mouth	TAR-1	458852	6353527	12	83	Test since 2004		yes				yes	yes	yes	yes				
Tar River Watershed	Tar River upstream of Canadian Natural Horizon	TAR-2	441968	6360675	12	83	Baseline since station inception								yes	yes				
Tar River Watershed	Tar River mouth	TAR-D1	458573	6353573	12	83	Test since station inception										yes			yes

Table 10 Summary of RAMP data and reach information available for the benthic invertebrates communities component.

Waterbody	Reach Description	Reach ID	Easting	Northing	UTM Zone	NAD	Reach Type	Reach Status	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Athabasca Delta	Athabasca Delta	ARD-D1	511903	6494506	12	83	River: Depositional	Test since station inception				1							
Athabasca Delta	Big Point Channel - 8km upstream from the Athabasca Delta	BPC	512036	6494301	12	83	Athabasca Delta	Baseline since station inception					1	1	1		5	5	5
Athabasca Delta	Fletcher Channel - 14km upstream of Athabasca Delta	FLC	496371	6491663	12	83	Athabasca Delta	Baseline since station inception					1	1	1		4	5	5
Athabasca Delta	Goose Island Channel - 8km upstream from the Athabasca Delta	GIC	509557	6494432	12	83	Athabasca Delta	Baseline since station inception					1	1	1		4	5	5
Beaver River	upstream of the Petro-Canada Road	BER-D2	465475	6311289	12	83	River: Depositional	Baseline since station inception										10	10
Calumet River	at mouth	CAR-D1	460698	6363156	12	83	River: Depositional	Test since 2005				15	15	15	10				10
Calumet River	upper portion of the river	CAR-D2	453995	6366522	12	83	River: Depositional	Baseline since station inception					5	5	5	5			10
Christina River	at bridge near Chard west of hwy 881	CHR-D1	496481	6280190	12	83	River: Depositional	Baseline since station inception				15	15	15	10	10			10
Christina River	at mouth	CHR-D2	511666	6192362	12	83	River: Depositional	Test since station inception				15	15	15	10	10	10		
Christina River	downstream of the Cheecham winter road crossing	CHR-E2A	532759	6236195	12	83	River: Erosional	Baseline since station inception										10	
Clearwater River	upstream of Christina River confluence	CLR-D2	479431	6284197	12	83	River: Depositional	Baseline since station inception			15	15	15	15	10				10
Clearwater River	upstream of Fort McMurray	CLR-D1	498883	6279869	12	83	River: Depositional	Test since 2002			15	15	15	15	10				10
Dunkirk River	25km upstream of confluence to MacKay River	DUR-E1	396208	6301643	12	83	River: Erosional	Baseline since station inception											10
Ells River	at mouth	ELR-E2	455479	6344965	12	83	River: Depositional	Test since station inception					15	15	10	10	10		
Ells River	upstream of Joslyn Creek	ELR-D1	459318	6351291	12	83	River: Erosional	Baseline since station inception					15	15	10	10			
Firebag River	at mouth	FIR-D1	479363	6400434	12	83	River: Depositional	Test since station inception					15	15	10	10	9		
Firebag River	upper portion of the river	FIR-E2	531283	6355080	12	83	River: Erosional	Baseline since station inception					15	15	10	10	10		
Fort Creek	at mouth	FOC-D1	461527	6363105	12	83	River: Depositional	Test since 2005			5	5	5		3	5	5	5	
Hangingstone River	near confluence to Clearwater River	HAR-E1	478160	6278143	12	83	River: Erosional	Baseline since station inception						15	10	10	10	10	
Horse River	140km upstream of confluence to Athabasca River	HOR-E1	427377	6246956	12	83	River: Erosional	Baseline since station inception											10
Isadore's Lake	lake on east side of Athabasca River	ISL-1	463571	6343843	12	83	Lake	Test since station inception								10	10	10	10
Jackpine Creek	30km upstream of Muskeg River	JAC-D2	480036	6324999	12	83	River: Depositional	Baseline since station inception					15	15	10	10	10	10	10
Jackpine Creek	at mouth	JAC-D1	471862	6346430	12	83	River: Depositional	Test since 2006				15	15	15	10	10	10	10	9
Kearl Lake	lake in Muskeg watershed	KEL-1	485417	6349805	12	83	Lake	Baseline since station inception			9	10	10	10	10	10	10	10	10
MacKay River	15km downstream of the Petro Canada Road crossing	MAR-E2	449583	6319957	12	83	River: Erosional	Baseline since station inception				15	15	15	10	10	10	10	10
MacKay River	at mouth	MAR-E1	461541	6336018	12	83	River: Erosional	Test since 2002	3	15	13	15	15	15	10	10	10	10	10
McClelland Lake	lake in Firebag watershed	MCL-1	478204	6371304	12	83	Lake	Baseline since station inception				10	10	10	10	10	10	10	10
Muskeg River	at mouth	MUR-E1	463643	6332493	12	83	River: Erosional	Test since station inception	3	15	14	15	15	15	2	10	10	10	10
Muskeg River	middle reach, downstream of Canterra Road	MUR-D2	466295	6339500	12	83	River: Depositional	Test since station inception		15	15	15	15	15	10	10	10	10	10
Muskeg River	Upstream of Stanley Creek	MUR-D3	480075	6357945	12	83	River: Depositional	Test since 2008				15	15	15	10	10	10	10	10
Poplar Creek	at mouth	POC-D1	473047	6308837	12	83	River: Depositional	Test since station inception										7	10
Shipyard Lake	lake on east side of Athabasca River	SHL-1	473552	6313264	12	83	Lake	Test since station inception		10	10	10	10	8	10	10	10	10	10
Steeptank River	at mouth	STR-E1	471390	6320166	12	83	River: Erosional	Baseline since station inception	3	15	14	15		15	10	10	10	10	10
Steeptank River	upstream of North Steeptank River	STR-E2	499961	6297509	12	83	River: Erosional	Baseline since station inception						15	10	10	10	10	10
Tar River	at mouth	TAR-D1	458573	6353573	12	83	River: Depositional	Test since 2004				15	15	15	10	10			10
Tar River	upper portion of the river	TAR-E2	440357	6361662	12	83	River: Erosional	Baseline since station inception					15	15	10	10			10

Table 11 Summary of RAMP data and site information available for the Muskeg River fish fence.

Site ID	Easting	Northing	UTM Zone	NAD	2001	2003	2009	2006
2001	465557	6339249	12	83	yes			
2003	463676	6332356	12	83		yes		
2006	463676	6332356	12	83			yes	
2009	464049	6332081	12	83				yes

Table 12 Summary of RAMP data and reach information available for the fish inventory program.

Waterbody	Reach Description	Reach ID	Easting	Northing	UTM Zone	NAD	Reach Status	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Clearwater River	40km upstream of Christina River confluence, east bank	CR1,CR1A,CR1B	529654	6289294	12	83	Baseline							Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clearwater River	20 km upstream of Christina River confluence, east bank	CR2,CR2A,CR2B,CR2C	511717	6281767	12	83	Baseline							Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clearwater River	downstream of Christina River confluence, east bank	CR3,CR3A,CR3B	493170	6280968	12	83	Test							Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	upstream of Stepbank River, west bank and east bank	04A,04B	472483	6317359	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Stepbank River, west bank and east bank	05A,05B	470720	6319468	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	downstream of Stepbank River, west bank	06A	469020	6321841	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Poplar Creek, west bank	01A	473106	6309477	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Poplar Creek, east bank	00B	474294	6306719	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Muskeg River, east bank	10B	463317	6332841	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	downstream of Muskeg River, west bank	11A	462053	6336415	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Tar River, west bank	17A	459398	6355118	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Fort Creek, west bank and east bank	19A,19B	461311	6363232	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Athabasca River	at Ells River, west bank	16A	459554	6351898	12	83	Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 13 Summary of RAMP data and reach information available for the fish tissue program.

Waterbody	Reach ID	Easting	Northing	UTM Zone	NAD	1998	2001	2002	2003	2004	2005	2006	2007	2008	2009
Athabasca River	04	472483	6317359	12	83										
Athabasca River	05	470720	6319468	12	83										
Athabasca River	06	469020	6321841	12	83										
Athabasca River	01	473106	6309477	12	83	yes	yes	yes	yes		yes			yes	
Athabasca River	00	474294	6306719	12	83										
Athabasca River	10	463317	6332841	12	83										
Athabasca River	11	462053	6336415	12	83										
Big Island Lake	Big Island Lake	410151	6386202	12	83									yes	
Christina Lake	Christina Lake	505639	6164031	12	83				yes						
Clearwater River	CR1	529654	6289294	12	83										
Clearwater River	CR2	511717	6281767	12	83					yes		yes	yes		yes
Clearwater River	CR3	493170	6280968	12	83										
Clearwater River	CR4	503569	6279600	12	83										
Gardiner Lake	Gardiner Lake	408722	6376677	12	83									yes	
Gregoire Lake	Gregoire Lake	491050	6258971	12	83								yes		
Jackson Lake	Jackson Lake	504450	6424146	12	83										yes
Muskeg River	Muskeg River	467025	6341235	12	83		yes	yes		yes					
Namur Lake	Namur Lake	400725	6367280	12	83								yes		
Winefred Lake	Winefred Lake	528023	6149743	12	83					yes					

Table 14 Summary of RAMP data and reach information available for the sentinel species program.

Waterbody	Reach ID	Easting	Northing	UTM Zone	NAD	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Athabasca River	ATR-1	473915	6285974	12	83				yes					yes		
Athabasca River	ATR-2	474127	6303665	12	83	yes			yes					yes		
Athabasca River	ATR-3	469585	6321461	12	83	yes			yes					yes		
Athabasca River	ATR-4	463046	6332775	12	83	yes			yes					yes		
Athabasca River	ATR-5	478503	6406579	12	83				yes					yes		
Dunkirk River	DR-R	395769	6302578	12	83		yes	yes			yes		yes			yes
Ells River	ELR-lower	457310	6349628	12	83							yes		yes		
Ells River	ELR-upper	440285	6342517	12	83		yes					yes		yes		
Hangingstone River	HAR-1	475503	6261000	12	83		yes									
Hangingstone River	HAR-2	476398	6253114	12	83		yes									
Horse River	HR-R	427373	6246861	12	83		yes	yes			yes		yes			yes
Muskeg River	MR-E	463694	6332452	12	83	yes	yes	yes			yes		yes			yes
Muskeg River	MR-upper	463968	6332168	12	83	yes	yes									
Steepbank River	SR-E	471294	6320044	12	83			yes			yes		yes			yes
Steepbank River	SR-MN	472046	6319916	12	83	yes	yes									
Steepbank River	SR-R	479474	6316421	12	83	yes	yes	yes			yes					yes
Steepbank River	SR-R2	484475	6310521	12	83								yes			

Table 15 Summary of RAMP data and reach information available for the fish assemblage monitoring program.

Waterbody	Reach ID	Easting	Northing	UTM Zone	NAD	2009
Beaver River	BER-F2	465509	6311218	12	83	yes
Dunkirk River	DUR-F1	395769	6302578	12	83	yes
Horse River	HOR-F1	427373	6246861	12	83	yes
Jackpine Creek	JAC-F1	471818	6346443	12	83	yes
Jackpine Creek	JAC-F2	480087	6324962	12	83	yes
MacKay River	MAR-F1	461335	6336209	12	83	yes
Muskeg River	MUR-F1	463699	6332445	12	83	yes
Poplar Creek	POC-F1	473042	6308669	12	83	yes
Steepbank River	STR-F1	471300	6320038	12	83	yes
Tar River	TAR-F1	458332	6353477	12	83	yes

Table 16 Summary of RAMP data and lake information available for the acid-sensitive lakes component.

Location	Lake ID	Easting	Northing	UTM Zone	NAD	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Birch Mountains	175 (P13/E177)	416003	6353212	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	199 (P49/E142)	446002	6394961	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	436 (L18/Namur)	402704	6368016	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	442 (L23/Otasan)	417321	6396959	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	444 (L25/Legend)	383849	6364923	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	447 (L28)	382996	6414339	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	448 (L29/Clayton/E136)	424694	6435790	12	83	yes		yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	454 (L46/Bayard)	416941	6404239	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	455 (L47)	396500	6395456	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	457 (L49)	404995	6403111	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Birch Mountains	464 (L60)	403796	6392247	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Canadian Shield	118 (L107/Weekes)	555469	6620456	12	83		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Canadian Shield	473 (A301)	525150	6559733	12	83			yes	yes	yes	yes	yes	yes		yes	yes
Canadian Shield	84 (L109/Fletcher)	510321	6553552	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Canadian Shield	88 (O-10)	518279	6556260	12	83	yes	yes	yes	yes	yes	yes		yes		yes	yes
Canadian Shield	90 (R1)	517889	6562197	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Caribou Mountains	146 (E52/Fleming)	243692	6522556	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Caribou Mountains	152 (E59/Rocky Island)	263546	6562225	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Caribou Mountains	89 (E68/Whitesand)	245596	6570610	12	83		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Caribou Mountains	91 (O-1/E55)	298955	6571856	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Caribou Mountains	97 (O-2/E67)	253582	6582654	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	182 (P23)	509000	6346712	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	185 (P27)	508300	6333712	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	209 (P7)	515399	6343212	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	268 (E15)	506092	6305335	12	83		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	270 (4)	506113	6291421	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	271 (6)	549064	6277789	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	400 (L39/E9/A150)	536495	6424234	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	418 (L35/Kearl)	485939	6349881	12	83					yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	452 (L4)	508990	6334305	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	470 (L7)	461006	6368512	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Northeast of Fort McMurray	471 (L8)	460931	6369481	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	166 (A86)	448014	6170896	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	167 (A29)	466180	6224950	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	168 (A21)	483819	6235130	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	169 (A24)	484387	6230872	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	170 (A26)	489502	6230877	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	287 (25)	487594	6229281	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	289 (27)	477248	6228400	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	290 (28)	487068	6225576	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	342 (82)	448271	6183205	12	83				yes	yes	yes	yes	yes	yes	yes	yes
Stony Mountains	354 (94)	515689	6179208	12	83				yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	165 (A42)	365015	6247322	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	171 (A47)	367321	6235430	12	83	yes	yes		yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	172 (A59)	383467	6197733	12	83	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	223 (P94)	440557	6334112	12	83				yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	225 (P96)	444002	6295513	12	83				yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	226 (P97)	456002	6296463	12	83				yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	227 (P98)	451762	6293513	12	83				yes	yes	yes	yes	yes	yes	yes	yes
West of Fort McMurray	267 (1)	441917	6290884	12	83				yes	yes	yes	yes	yes	yes		yes