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Hydrogeology Baseline Steepbank Oil Sands Mine

May, 1996

Prepared for:

Prepared by:



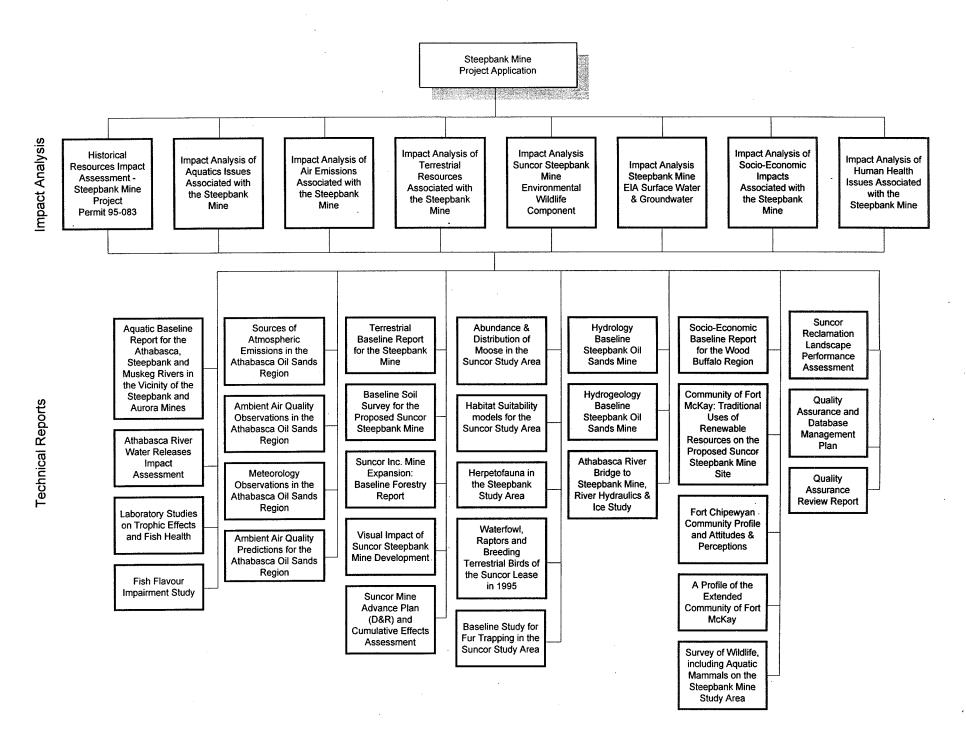




This report is one of a series of reports prepared for Suncor Inc. Oil Sands Group for the Environmental Impact Assessment for the development and operation of the Steepbank Mine, north of Fort McMurray, Alberta. These reports provided information and analysis in support of Suncor's application to the Alberta Energy Utilities Board and Alberta Environmental Protection to develop and operate the Steepbank Mine, and associated reclamation of the current mine (Lease 86/17) with Consolidated Tailings technology.

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EXECUTIVE SUMMARY

This report is one of a series that addresses the potential impacts of the Suncor Steepbank Mine project. It describes the current (or baseline) conditions of the groundwater system in the Study Area, and identifies the changes that are expected to result from the proposed development of the mine. The impact analysis has assessed the four main stages of the mine development:

- · Baseline (1995)
- · Construction Phase (1997 to 2001)
- · Operational Phase (2001 to 2020)
 - Post Reclamation

KEY FACTORS USED TO ASSESS IMPACT

The impacts on groundwater have been evaluated on the basis of changes in:

- direction of groundwater flow;
- · rate of groundwater discharge to surface water bodies; and
- groundwater quality.

The three main surface water bodies in the Study Area are the Athabasca River, the Steepbank River, and Shipyard Lake. Shipyard Lake is a large wetlands located in the Athabasca River valley.

The degree of significance of various impacts was assessed by a qualitative evaluation of severity, duration and anticipated areal extent of each impact. Severity was assessed as either high, medium or low, based on the impacts to either flow or water quality. Duration was short term if the impact occurred through the life of the mine and long term if beyond the life of the mine. Areal extent was considered local if the effect was in the immediate mine area and regional if beyond the immediate mine area. A final assessment of the degree of concern was made based on the expected impact on the receiving water body (either the Athabasca or Steepbank Rivers).

RESOURCE INVENTORY

The baseline study included both a review of regional geologic and hydrogeologic information, and a detailed investigation of the study area. The baseline conditions in the Study Area are summarized below.

Geology

The site's landforms are divided into uplands, valley slopes and floodplain. The uplands slopes gently toward the Athabasca River. It is poorly drained, and covered with muskeg. The uplands is cut by the steep valley slopes of the Steepbank and Athabasca Rivers. The Athabasca floodplain is moderately to poorly drained, and overlain in places with muskeg. The stratigraphy of the Study Area is:

- Surficial Deposits
- · Clearwater Formation
- McMurray Oil Sands
- Basal Aquifer
- Upper Devonian limestone

Major Aquifers

Three major aquifers have been identified. In the uplands, there is an extensive but discontinuous sand deposit, which ranges in thickness from 1 m to 10 m. In the Athabasca River valley, there is a thick (up to 40 m) sand and gravel deposit, that is in contact with the Athabasca River. In the bedrock, the Basal Aquifer and Upper Devonian limestone appear to behave as a single aquifer. The Basal Aquifer is a discontinuous zone of lean oil sands in the McMurray Formation, that generally rests upon the Upper Devonian surface. The Upper Devonian rock is limestone of the Waterways Formation. Its surface is highly irregular, consisting of depressions in the Upper Devonian surface.

Direction of Groundwater Flow-

The direction of groundwater flow in all aquifers is principally horizontal, toward the Athabasca River. As Shipyard Lake is located in the Athabasca River valley, a portion of groundwater flowing toward the river discharges into the wetlands. There is also a small component of groundwater flow toward the Steepbank River.

Groundwater Discharge to Surface Waters

The total rate of groundwater discharge from all aquifers to the Athabasca River, Steepbank River and Shipyard Lake has been calculated to be 2.52 L/s. In comparison to groundwater, the minimum monthly flows recorded in the Athabasca and Steepbank Rivers are:

- Athabasca River 101,000 L/s
- Steepbank River 168 L/s

The average inflow to the Shipyard Lake wetlands is estimated as:

Shipyard Lake 111 L/s

The groundwater discharge from the mine area is therefore less than 1% of the minimum recorded surface water flow in the Athabasca and Steepbank Rivers, and the average flow in Shipyard Lake.

Groundwater as a Resource

There are no groundwater users in the Study Area. The sand and gravel aquifer in the Athabasca River valley has the potential to be used for water supply purposes. Due to its proximity to the river, wells completed in the aquifer are expected to induce recharge from the Athabasca River.

The sand aquifer in the surficial deposits in the uplands is not a viable resource for water supply. This is bacause it has a low hydraulic conductivity, it is relatively thin, and it is quite shallow. The bedrock aquifers are also not usable for water supply purposes. Although they are more productive than the surficial sand aquifer, the water quality in the bedrock is poor. The bedrock groundwater is brackish, and contains organic compounds, including PAHs and napthenic acids.

IMPACT DESCRIPTION

Construction Phase

The only effect that the construction phase is expected to have on the hydrogeologic system is associated with the water supply wells for the new facility. It is planned that two or three water wells will be constructed in the sand and gravel, between the Athabasca River and the proposed facilities area. None of the other aquifers are affected by mine activity in this time frame. The proposed water demand from the wells is approximately 7.6 L/s (650 m3/day). The change in the water level in the aquifer is expected to be small, because of recharge from the

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river. There will be very little effect on the aquifer to the east of the water wells. The flow direction, discharge rate and quality of groundwater in the upland surficial aquifer and bedrock aquifers will not be affected by these wells.

Operational Phase

There are three major impacts that will occur as a result of the operation of the mine in the Study Area. These are:

There will be a change in the direction of groundwater flow in the surficial aquifer, as a result of dewatering of the surficial deposits;

There will be temporary changes in the rate of discharge and direction of flow of groundwater in the bedrock aquifers, while the mine is in operation; and

Pore water from consolidated tailings (CT) placed in the mine pits will seep into the bedrock aquifers and discharge into surface waters.

These three impacts are discussed below:

As a component of the stripping of overburden during the development of Pit 1, the surficial deposits in the area will be dewatered. The surficial aquifer will be intercepted with a diversion system on the east side of the mine, and the groundwater will be diverted to Shipyard Lake through the surface water premine drainage system. The total volume of groundwater discharging from the aquifer to the surface water environment will not change. However, the nature of groundwater discharge from the aquifer to surface water will change. Currently, the discharge occurs as seepage to the Athabasca River, Steepbank River and Shipyard Lake, along the reach of these water bodies adjacent to the Study Area. The broad discharge will be replaced by discharge from point sources into Shipyard Lake and Wood Creek. From there, it will ultimately discharge into the Athabasca River. The groundwater discharge to the Steepbank River will reduce to near zero as the surficial aquifer will have been mined out. Because the groundwater contribution to the surface waters is such a minor component of their flow (less than 1%), the severity of these changes in direction and rate of flow will be very low. The areal extent of this effect will be limited to within approximately 300 m of the diversion system. The change in the direction of flow and rate of discharge from the surficial aquifer will be long term. The diversion of groundwater from the surficial aquifer is expected to continue after the closure of the mine.

In the bedrock aquifers, the groundwater flow in the Basal Aquifer and Upper Devonian will become directed toward the mine pits. The result will be reduced rates of discharge to the Athabasca and Steepbank Rivers and Shipyard Lake. While the pit is being mined, the discharge to these water bodies from the mining area will reduce to near zero. Because the groundwater contribution to the rivers and Shipyard Lake is such a minor component of their flow (less than 1%), the severity of this impact will be very low. The areal extent of this effect will be limited to within 2 km of the mine. The duration of this change in discharge will be relatively short term. Once the pits have been completed, they will be filled with CT. Groundwater from the bedrock aquifers will once again discharge to the surface waters at pre-mine rates.

The CT will interact with the groundwater in the bedrock aquifers once the pits are filled with the tailings. Pore water from the CT is expected to seep from the base of both Ponds 7 and 8. The total rate of seepage of the pore water is estimated to peak at 10.12 L/s in 2020. The duration of any impact associated with seepage of CT water will be long term. The seepage from the ponds will flow through the bedrock aquifers toward the Athabasca and Steepbank Rivers. The result is expected to be increased discharge to these water bodies. The rate of seepage represents less than 1% of the flow in any of these water bodies. The impact of this increased flow on the flow rates in the surface water will be negligible.

Comparison of the chemical composition of the CT water to groundwater chemistry in the bedrock aquifers indicates that although CT has a higher pH, and contains higher levels of organic compounds than the bedrock groundwater, the chemistry is similar. The concentration of naphthenic acids in the CT water ranges from 62 mg/L to 94 mg/L, compared to 8 mg/L to 57 mg/L in the bedrock aquifers. However, the types and concentrations of organic compounds found in the CT are similar to the naturally occurring organic composition of the bedrock

groundwater. Therefore, the severity of the impact of introducing CT water to the bedrock groundwater system is low. With respect to its effect on the future use of groundwater, the expected change in the groundwater chemistry will be negligible.

Post Reclamation

There will be no additional impacts to the hydrogeologic system as a result of closure and reclamation of the mine. The two long-term impacts that are expected to occur are:

- Changes in the direction of groundwater flow in the surficial aquifer to discharge points into Shipyard Lake and Wood Creek; and
- Small changes in flow rate and water quality in the bedrock aquifers, as seepage of pore water from the CT in Ponds 7 and 8, flows through the aquifers, to the Athabasca River, Steepbank River, and Shipyard Lake.

The level of concern associated with these impacts is low.

TABLE OF CONTENTS

	, 10 15 16 1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	NY INSTRUMENTAL PROPERTY.	PAGE
			SUMMARY	
	PART	r I - BAC	KGROUND	
1. 2.		Key Gr	DN FERENCE oundwater Flow Issues oundwater Quality Issues	
	PAR	Г II - BAS	ELINE STUDY	
1.	METI	HODOLOG	GY	
2.			O INFORMATION	
	2.1		Area	
	2.2	•	ge	
	2.3	Climate	3 3	6
3.	REGI	ONAL GE	OLOGY AND HYDROGEOLOGY	.
	3.1		al Geology	6
		3.1.1	Uplands	
		3.1.2	Valley Slopes	
		3.1.3	Floodplain	
		3.1.4	Drift Thickness	
	3.2		al Bedrock Geology	
		3.2.1	Regional Bedrock Topography	
	2.2	3.2.2	Regional Bedrock Stratigraphy	
	3.3		al Hydrogeology	
		3.3.1 3.3.2	Regional Hydraulic Conductivity Data	
_		3.3.2	Regional Groundwater Flow Directions	
4.	CEOI		THE STEEPBANK MINE AREA	
4.	4.1		al Geology	
	7.1	4.1.1	Uplands	
		4.1.2	Valley Slopes	
		4.1.3	Floodplain	
		4.1.4	Thickness of Surficial Deposits	
	4.2		k Geology	
		4.2.1	Local Bedrock Topography	
		4.2.2	Clearwater Formation	
		4.2.3	McMurray Formation Oil Sands	23
		4.2.4	Basal Aquifer	23
		4.2.5	Upper Devonian	
5.	HYDI		OGY OF THE STEEPBANK MINE AREA	
	5.1		al Materials	
		5.1.1	Uplands	
		5.1.2	Valley Slopes	
		5.1.3	Floodplain	
	5.2		k Materials	
		5.2.1	Clearwater Formation	33

6

TABLE OF CONTENTS (continued)

		5.2.2 Oil Sands	4
		5.2.3 Basal Aquifer 3	5
		5.2.4 Upper Devonian 3.	7
	5.3	Potential for Groundwater Use as a Resource	
	5.4	Groundwater/Surface Water Interaction 4	0
		5.4.1 Methodology	0
		5.4.2 Athabasca River	2
		5.4.3 Steepbank River	
		5.4.4 Shipyard Lake	
		5.4.5 Leggett Creek, Wood Creek and unnamed creek	
		5.4.6 Summary of Groundwater/Surface Water Interaction 4	
5.	CONG	CLUSIONS 4	
	6.1	Geology 4	
	6.2	Hydrogeology	5
	PART	III - IMPACT ASSESSMENT - MINING AND POST RECLAMATION	
1	TATTO	ODUCTION4	7
· .		FACTORS	
 ≀		DEVELOPMENT 4	
٠.	3.1	Design Philosophy	
	3.1	Chronology of Mine Development 4	
1.		HODOLOGY	
٠.	4.1	Spatial and Temporal Boundaries	
	4.2	Changes in Groundwater Flow Rates	
5.		CTS OF MINING ON GROUNDWATER	
•	5.1	Construction Phase	
	5.2	Mine Operations 2001 - 2009	
		Surficial Deposits	
		Padroak Aguifara	
	5.3	Mine Operations 2009 - 2020	5
		Surficial Deposits	
		Bedrock Aquifers	
		Consolidated Tailings	
	5.4	Post Reclamation	8
5 .	REQU	JIREMENT FOR ENVIRONMENTAL MONITORING	2
7.	CON	CLUSIONS 6	2
	PART	Γ IV - REFERENCES 6	4
	D. 1 70.0	EV. CLOGGADY OF TERMS	. ,
	PAK	ΓV - GLOSSARY OF TERMS 6	O

TABLE OF CONTENTS (continued)

TABLES

TABLE 1	Drainage Basins in Study Area 5
TABLE 2	Succession of Surficial Geologic Deposits in the
·	Oil Sands Region, (after McPherson and Kathol, 1977)
TABLE 3	Subsurface Stratigraphy of the Northern Part of the
	Athabasca Oil Sands Area (after Carrigy, 1973)
TABLE 4	Summary of Regional Hydraulic Conductivity Data
	from Surficial Deposits
TABLE 5	Summary of Regional Hydraulic Conductivity Data
	from Bedrock
TABLE 6	Regional Chemistry of Groundwater in Surficial Deposits
TABLE 7	Regional Bedrock Groundwater Chemistry
TABLE 8	Hydraulic Conductivity of Surficial Deposits in the Study Area
TABLE 9	Major Ion Chemistry and Field Measured Parameters of
	Groundwater in the Study Area
TABLE 10	Concentrations of Dissolved Metal and Cyanide in
	Groundwater in the Study Area
TABLE 11	Concentrations of Organic Compounds in Groundwater
	in the Study Area
TABLE 12	Naphthenic Acid and Microtox Test Results in Groundwater
	In the Study Area
TABLE 13	Summary of Transmissivity and Hydraulic Conductivity
•	Measured in Bedrock in the Study Area
TABLE 14	Groundwater Quality Parameters Which Exceed CCME Guidelines 39
TABLE 15	Baseline Flow Rates of Groundwater Discharge to
	Surface Water Bodies in the Study Area
TABLE 16	Estimated Groundwater Discharge Rates to Surface Water
	Bodies in the Study Area During Mining and Post Reclamation
TABLE 17	Consolidated Tailings (CT) - Major Ions in Pore Water 58
TABLE 18	Consolidated Tailings (CT) - Dissolved Metals and Cyanide
	In Pore Water
TABLE 19	Consolidated Tailings (CT) - Organic Compounds (including Naphthenic Acids) in
	Pore Water
TABLE 20	Comparison of Organic Compounds Detected in Consolidated
	Tailings (CT) and Groundwater Samples (µg/L) 61

TABLE OF CONTENTS

(continued)

DRAWINGS

	\cdot
DRAWING A-2779-02-01	Baseline (1995) Site Map
DRAWING B-2779-02-02	Location of Piezometers, Geophysical Lines and Wetlands in Study
, ,	Area
DRAWING A-2779-02-03	Surficial Geology Map, (after McPherson and Kathol, 1977)
DRAWING A-2779-02-04	Drift Thickness Map, (after McPherson and Kathol, 1977)
DRAWING B-2779-02-05	Conceptualized Regional Hydrogeologic Setting, (after Carrigy,
	1973)
DRAWING B-2779-02-06	Map showing Cross Sections In Surficial Deposits
DRAWING B-2779-02-07	Surficial Geology Cross Sections A & B, Baseline Conditions
DRAWING B-2779-02-08	Isopach Map of Surficial Deposits
DRAWING B-2779-02-09	Isopach of Surficial Sand Deposit
DRAWING B-2779-02-10	Bedrock Topography Map, showing Zero Edges of Bedrock
	Deposits
DRAWING B-2779-02-11	Map showing Cross Sections In Bedrock
DRAWING B-2779-02-12	Bedrock Cross Section C, Baseline Conditions
DRAWING B-2779-02-13	Bedrock Cross Section D, Baseline Conditions
DRAWING B-2779-02-14	Bedrock Cross Section E, Baseline Conditions
DRAWING B-2779-02-15	Bedrock Cross Section F, Baseline Conditions
DRAWING B-2779-02-16	Bedrock Cross Section G, Baseline Conditions
DRAWING B-2779-02-17	Bedrock Cross Section H, Baseline Conditions
DRAWING B-2779-02-18	Isopach Map of the Basal Aquifer
DRAWING B-2779-02-19	Structure Map of the Basal Aquifer
DRAWING B-2779-02-20	Structure Map of the Upper Devonian
DRAWING B-2779-02-21	Direction of Groundwater Flow in Surficial Materials
DRAWING B-2779-02-22	Piper Plots, Groundwater Samples -1995
DRAWING A-2779-02-23	Stable Isotope Analysis
DRAWING B-2779-02-24	Groundwater Flow Directions in Basal Aquifer and Upper
	Devonian
DRAWING A-2779-02-25	Year 2001 Steepbank Mine Development
DRAWING A-2779-02-26	Year 2009 Steepbank Mine Development
DRAWING A-2779-02-27	Year 2020 Steepbank Mine Development
DRAWING A-2779-02-28	Post Reclamation
DRAWING B-2779-02-29	Cross Sections C and D, before and after mining
DRAWING B-2779-02-30	Cross Sections F and G, before and after mining
DRAWING B-2779-02-31	Cross Section H, before and after mining

APPENDICES

APPENDIX I	Borehole Logs and Well Completion Details
APPENDIX II	Results of Laboratory Analysis of Groundwater Samples

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PART I - BACKGROUND

1. INTRODUCTION

Suncor has evaluated the feasibility and environmental impact of its proposed Steepbank Mine Project. The proposed mine is located on the east side of the Athabasca River, directly across from Suncor's existing Oil Sands operation. The mine is scheduled to begin operation by the year 2000. The planned production rate for the new mine is 90,000 barrels of oil per day.

The hydrogeologic component of the Environmental Impact Assessment (EIA) has evaluated the groundwater environment during three phases of development.

- Baseline Conditions;
- Construction Conditions;
- Mining Conditions; and
- Post-Closure Conditions.

Part II of this report presents the results of the assessment of baseline conditions of the hydrogeologic setting of the Study Area, shown in Drawing A-2779-02-01. Part III of the report presents the assessment of the impacts that are expected to occur as a result of construction of the mine, mining activity, and closure of the mine.

2. TERMS OF REFERENCE

The terms of reference drafted for the hydrogeologic component of the Steepbank Mine EIA are as follows:

- Describe the groundwater regime of the hydrogeology Study Area by summarizing the existing regional databases. Develop and install a site specific monitoring program in the areas in which no program exists and where developments are anticipated to occur. The new monitoring program should be developed such that groundwater quality and quantity can be determined.
- Describe the effects of the proposed Steepbank Mine Project on the existing groundwater regime of the Study Area. Impacts on water quality, quantity, and discharge to the Athabasca River will be evaluated. Discuss the inter-relationship of the groundwater to the surface water in the Study Area. Outline the mitigation procedures that will be implemented to mitigate any issues that are identified.

A number of key issues related to groundwater flow patterns and groundwater quality have been identified.

2.1 Key Groundwater Flow Issues

The groundwater flow regime, under natural conditions and under mining conditions must be determined.

Dewatering of the overburden, particularly permeable sand and gravel deposits, could locally reduce baseflow to the Steepbank River, and possibly wetlands.

Depressurizing the Basal Aquifer may also have an effect on baseflow in the Steepbank River and wetlands.

2.2 Key Groundwater Quality Issues

Groundwater quality could potentially be impacted as a result of contaminant migration from facilities, including tailings and plant maintenance.

There is also the potential impact that degradation in groundwater quality may have on water quality in the Athabasca River, Steepbank River and associated wetlands.

PART II - BASELINE STUDY

1. METHODOLOGY

The hydrogeologic baseline study has been conducted in two stages:

- a literature review of regional data; and
- · a detailed investigation of the Suncor Study Area.

Regional geologic and hydrogeologic information was compiled from sources such as Suncor's Lease 86, Alsands, OSLO, and Alberta Research Council. This information was used to characterize the regional setting of the mine area. A summary of the regional information is provided in Section 3.

The detailed hydrogeologic investigation of the Study Area comprised the following, which are discussed in the proceeding paragraphs:

- Geophysical surveys (electromagnetic and ground penetrating radar);
- · Interpretation of geologic logs from over 300 boreholes;
- · Installation of standpipe and pneumatic piezometers; and
- · Aerial reconnaissance by helicopter;
- Ground truthing;

- Analysis of groundwater samples for major ions, dissolved metals, organic compounds, toxicity, and stable isotopes; and
- Calculations to determine aquifer productivity and groundwater discharge rates to surface water bodies.

Site specific bedrock geology data was compiled from 316 borehole logs located in Leases 19, 25 and 97, Fee Lots 1 and 3. Of these, 57 boreholes were drilled and cored in the 1995 winter field season. The surficial material was logged in 46 of the boreholes. The borehole logs of holes completed with piezometers are presented in Appendix 1. The geologic information was used to create geologic cross sections, and structure and isopach maps of geologic units that are important to the EIA. The results of the geologic interpretation are discussed in Section 6.

Two surface geophysical surveys were conducted on the site in 1995. Drawing B-2779-02-02 shows the locations of the two surveys. A ground penetrating radar survey (GPR) was run along the east bank of the Athabasca River, as an extension of site investigation work for the proposed bridge across the river. The GPR survey was used to provide information about the bedrock topography, (AGI, 1995). A fixed frequency electromagnetic survey was run along cut lines, roads and on the uplands, (Associated Mining, 1995).

Piezometers, either standpipe or pneumatic, were installed at 20 locations in the Suncor Study Area, as shown in Drawing B-2779-02-02. Twelve 2 inch diameter standpipes were constructed, with response intervals in the following zones:

- 1 limestone piezometer
- 3 Basal Aquifer piezometers
- 6 piezometers in surficial deposits.

Pneumatic piezometers were installed at 10 locations, in the following units:

- 6 nested pairs of pneumatic piezometers in limestone
- · 3 single pneumatic piezometers in limestone
- · 1 single pneumatic piezometers in Oil Sands

The completion details for all the piezometers constructed in 1995 are presented in Appendix I. With the exception of piezometer FL1-BRDG-#4, the piezometers installed in surficial material were constructed in holes drilled with a small auger rig. The piezometers are all installed in the uppermost sand deposit. All piezometers completed in

bedrock were installed in holes originally cored for bitumen exploration. Following coring, the holes were reamed, using a mud rotary drill rig, to permit the construction of 2 inch piezometers.

All standpipe piezometers were tested to determine hydraulic conductivity or transmissivity. Three sampling programs were conducted in March, July and September, of 1995. During each sampling event, water levels were measured in all standpipe and pneumatic piezometers. Water samples were collected from all standpipie piezometers for analysis of major ions, dissolved metals, organic compounds, toxicity (by Microtox), naphthenic acids and stable isotopes. The analyses of inorganics were conducted by Chemex Labs in Calgary. The analyses of organic compounds were performed by Envirotest Labs in Edmonton. The toxicity and naphthenic acids analyses were performed by Syncrude staff, in their Edmonton laboratory. Analyses of samples for the stable isotopes oxygen-18 and deuterium were conducted at the University of Calgary. The results of all field measurements and laboratory analyses are presented in Section 5 of this report.

Two field reconnaissance trips were made to the Study Area by Klohn-Crippen staff, in the spring and fall of 1995. The objectives of the trip were to familiarize the EIA team with the general conditions at the site, and to groundtruth interpretations of the site geology and hydrogeology made from desktop studies. Observations made during the trips have been incorporated in the discussions of results presented in Sections 4 and 5.

Calculations were made to determine aquifer productivity, and the rates of groundwater discharge to surface water. The productivity of the aquifers in surficial deposits and bedrock was assessed using calculations to determine their 20-year yield. The rates of groundwater discharge to the Athabsca River, Steepbank River, Shipyard Lake, Leggett Creek, Wood Creek and an unnamed creek in the Study Area were estimated, using values hydraulic gradients and hydraulic conductivity determined on-site. The results of these calculations are presented in Sections 5.3 and 5.4.

2. BACKGROUND INFORMATION

2.1 Study Area

The Study Area consists of approximately 175 km², located on the east side of the Athabasca River, in Townships 91 and 92, Range 9 W4M. The areas that Suncor is evaluating for mining are Leases 97, 25 and 19, and Fee Lots 1 and 3. The Study Area is shown in Drawing A-2779-02-01.

The physiography of the site is divided into uplands, valley slopes and floodplain, as shown in Drawing A-2779-02-01. The uplands slope gently toward the Athabasca River, from an elevation of 425 masl in the east, to 315 masl above the Athabasca River valley. The uplands are poorly drained, and covered with muskeg.

The upland, which includes most of the Study Area, is cut by the valleys of the Steepbank and Athabasca Rivers. The valley walls are 80 m high at the confluence of the two rivers. The slopes of the valleys are commonly steeper than 50°.

The Athabasca flood plain is at an elevation of approximately 235 masl. The floodplain is moderately to poorly drained, and locally covered with extensive muskeg-wetland (Schwartz, 1980). The river has irregular meanders, with occasional islands and bars.

2.2 Drainage

The Athabasca River, which forms the western boundary of the Study Area, flows northward and discharges into Lake Athabasca. There are seven drainage basins in the Study Area, which all drain into the Athabasca River. The size of each of these basins is listed in Table 1. Approximately 40% of the Study Area is drained by the Steepbank River, which discharges into the Athabasca River opposite the existing Suncor mine, as shown in Drawing B-2779-02-02. Twenty percent of the Study Area is drained by three small water courses to the south of the Steepbank River. These are Leggett Creek, Wood Creek, McLean Creek and an unnamed watercourse which drains to a large wetland (Shipyard Lake) in the Athabasca River valley. More information about the hydrology of the Study Area is presented in a separate hydrology baseline report (Klohn-Crippen, 1996).

Table 1
Major Drainage Basins in the Suncor Sutdy Area

Basins	Leases and Lots Affected	Total Drainage Area (km²)
Steepbank River	Leases 19, 25 and 97: Fee Lot #1	1 320
An unnamed creek (Shipyard Lake)	Leases 19, 25 and 97: Fee Lots # 1 and #3	44.1
Leggett Creek	Lease 19	35.0
Wood Creek	Lease 19: Fee Lot #4	36.8
McLean Creek	Lease 19: Fee Lot #4	53.4
Athabasca 1	Lease 97: Fee Lot #1	4.0
Athabasca 2	Leases 19 and 97: Fee Lot #3	1.0
Athabasca 3	Lease 19	7.2

Note: Drainage areas measured to gauging station or, where ungauged, to the outlet.

2.3 Climate

The climate in the Athabasca Oil Sands area is characterized by long cold winters and short cool summers. Mean daily temperatures at Fort McMurray in January, average about -20°C while July temperatures average 17°C. The mean annual temperature at this location is 0.2°C. There are usually less than 120 frost-free days per year (Atmospheric Environment Service, 1993).

The average annual precipitation in the Study Area has been estimated to be 398 mm, of which almost three-quarters is rainfall (Klohn-Crippen 1996).

3. REGIONAL GEOLOGY AND HYDROGEOLOGY

3.1 Surficial Geology

The surficial geology of the Oil Sands region has been mapped by Bayrock (1971), Bayrock and Reimchen (1973) and McPherson and Kathol (1977). The work by McPherson and Kathol, because it is the most recent, is accepted here as the most accurate. An excerpt of the surficial geology map from McPherson and Kathol is shown in Drawing A-2779-02-03. This map shows the type of surficial material that is expected to occur in the shallow subsurface. A summary of the stratigraphic succession of surficial deposits in the region is provided in Table 2. The distribution of surficial sediments in the region can be characterized into three physiographic settings; uplands, valley slopes and floodplain.

3.1.1 Uplands

The majority of the region on the east side of the Athabasca River is an upland plain, with an elevation of 315 masl or greater. On the east side of the Athabasca River, the topography of the uplands is gently sloped toward the river. Much of the ground in the region is covered with muskeg. Thin, discontinuous deposits of aeolian sand are also common in the region, particularly where glaciofluvial sand is near the ground surface. The aeolian deposits may be too small and discontinuous to appear on the surficial geology map in Drawing A-2779-02-03. As indicated in Table 2, the surficial stratigraphy is the result of the advance and retreat of at least three glaciations. With each glacial advance, till was deposited. The till is an assorted mix of clay, silt, sand and cobbles. The three tills that have been identified in the region from the oldest to youngest are known as the unnamed till, the Firebag and the Fort Hills. The unnamed and Firebag tills are present in most of the region. The Fort Hills till is not believed to extend south of the Muskeg River (McPherson and Kathol, 1977).

As the glaciers retreated, stratified fluvial and lacustrine sediments were deposited. These deposits included glaciofluvial sands and gravels, and glaciolacustrine sands, silts and clays, which overly the till.

Table 2
Succession of Surficial Geologic Deposits in the Oil Sands Region

PERIOD	PHYSIOGRAPHIC SETTINGS	DESCRIPTION OF UNITS					
Quaternary	Uplands	Recent Sediments	Muskeg; generally less than 3 m thick acolian deposits; fine to medium grained sand, in discontinuous thin sheets and dunes outwash deposits; commonly very fine to fine grained sand, with minor coarse sand.				
		Upper Sediments	Stratified sand and gravel layers, till fragments, pebbles and boulders; mixed glacio-lacustrine deposits; stratified clay, silt and sand, with pebbles and till-like layers.				
		Fort Hills Till	Low relief till; composed of sand silt and clay (68% silt), commonly with thin lenses of lacustrine clay and/or glaciofluvial sand.				
		Lower Sediments (?)	Stratified glacio-lacustrine deposits; stratified clay, silt and sand.				
			Outwash deposits; commonly very fine to fine grained sand, with minor coarse sand and gravel layers, till fragments, pebbles and boulders.				
	:		Kames and kame moraine; composed primarily of stratified sand and silt, with minor gravel, clay and till lenses.				
		Firebag Till	Low relief till, composed of sand, silt and clay, with gravel and boulders, usually in contact with bedrock.				
		Unnamed Till					
		Undifferentiated till and stratified sediments	The existence of these deposits is inferred, based on the presence of vert thick drift sequences, and complex geophysical responses in boreholes in areas of thick drift.				
	Valley Slopes	Recent Sediments	Eroded slope and gulley; discontinuous colluvial cover on slopes.				
	Floodplains	Recent Sediments	Stream valley; discontinuous alluvial gravel, sand, silt and clay along streams.				
			Alluvial sand; with minor silt and clay, confined mainly to the floodplain of the Athabasca River.				
			Alluvial silt and clay; with minor sand and gravel, common along most streams usually discontinuous and less than 3 m thick.				
		stratified Sediments	Meltwater channel sediment; fine to coarse- grained sand, with minor silt and clay, overlying thin sand and gravel and lag gravel with boulders, possibly early Athabasea river alluvium.				
Cretaceous		Sandstone, silt- stone and shale					

3.1.2 Valley Slopes

The valley slopes of the Athabasca and Steepbank Rivers are covered by a discontinuous layer of colluvium, chiefly composed of sandy and silty material, with some bituminous sand. Where the slopes are particularly steep, bedrock is exposed.

3.1.3 Floodplain

The Athabasca River valley has been incised into the Upper Devonian. The Athabasca floodplain is covered with an alluvial deposit of fine sand. Meltwater channel sediments, composed primarily of fine to coarse grained sand, are found below the alluvial deposits. The meltwater sediments are more or less continuous throughout the Athabasca River valley. The meltwater channel sediments are in contact with the Upper Devonian limestone.

The floodplains of smaller streams in the Oil Sands area are filled with thin, discontinuous alluvial deposits of silt and clay. The occurrence of these deposits in the Steepbank River valley is shown in Drawing A-2779-02-03.

3.1.4 Drift Thickness

An excerpt of McPherson and Kathol's (1977) map of the thickness of surficial deposits is shown in Drawing A-2779-02-04. In the uplands, the surficial deposits are commonly 7.5 m to 30 m thick. McPherson and Kathol identified an area south of the Steepbank River, near the middle of Lease 19, (Drawing A-2779-02-04) where the surficial deposits are up to 45 m thick.

In the Athabasca River valley, the surficial materials are generally less than 6 m thick (McPherson and Kathol, 1977). Outcrops of Upper Devonian and Cretaceous rock are visible in numerous places along the river valley. However, near Suncor's Tar Island Dike, over 40 m of surficial sand and gravel has been logged beneath the floodplain:

3.2 Regional Bedrock Geology

3.2.1 Regional Bedrock Topography

The bedrock surface in the region has been shaped by three main processes:

- glaciation
- fluvial erosion
- collapse of karst features

Beneath the uplands, the bedrock surface slopes gently toward the Athabasca River. On the east side of the Athabasca River, the elevation of the bedrock beneath the uplands ranges from approximately 460 masl 20 km

from the river, to 315 masl at the edge of the escarpment. This surface has been incised by both preglacial and postglacial fluvial processes. The most obvious of these incisions are the courses of present-day rivers, including the Athabasca and Steepbank Rivers. In other investigations (McPherson and Kathol, 1977), channels in the bedrock surface commonly contain aquifer material. The elevation of the bedrock surface beneath the Athabasca River is approximately 220 masl.

-9-

Throughout the region, (McPherson and Kathol, 1977; Carrigy, 1973), depressions in the bedrock surface have been observed, that have been interpreted to be collapse structures in the underlying Upper Devonian surface.

The present-day surface topography masks all but the most pronounced structural features of the bedrock surface. The bedrock outcrops only in river valleys, where slopes are very steep.

3.2.2 Regional Bedrock Stratigraphy

The Cretaceous and Devonian geology in the Oil Sands region has been described by Cotterill and Hamilton (1995), Crickmay (1957), Carrigy (1959, 1973) and Norris (1963). The stratigraphy of the northern part of the Oil Sands region is presented in Table 3. A simplified geologic cross section of the regional bedrock stratigraphy is shown in Drawing B-2779-02-05. The thickness of the Cretaceous and Devonian section decreases toward the east. The depth to the underlying Precambrian surface also decreases to the east.

The Cretaceous deposits in the Oil Sands area consist of a succession of sandstones and shales that rest upon the eroded surface of the Devonian. Over most of the region, the Cretaceous strata are comprised of the Grand Rapids, Clearwater and McMurray Formations. The Grand Rapids Formation is an uncemented feldspathic sandstone. It is present only in areas where the bedrock elevation exceeds approximately 410 m (Carrigy, 1973). The Clearwater Formation is a glauconitic shale of marine origin. A glauconitic sandstone deposit at the base of the shale is known as the Wabiskaw Member. Commonly, the Wabiskaw sandstone contains heavy oil. It is therefore frequently considered part of the Oil Sands. In the Athabasca River valley, the bottom of the Clearwater Formation occurs at approximately 305 masl elevation.

The McMurray Formation, commonly referred to as the Oil Sands, is a series of quartz sandstone units, impregnated with heavy oil. As shown in the cross section in Drawing B-2779-02-05, the McMurray Formation is thickest where it has been deposited in depressions and channels in the surface of the underlying Devonian. In Suncor's active lease area, the McMurray Formation typically ranges in thickness from 45 m to 80 m. To the north, in the former Alsands area, the Oil Sands deposit is as great as 100 m thick.

In the lower portion of the McMurray Formation is a widespread, relatively continuous occurrence of sandstone which contains little or no heavy oil. This is known as the basal water sand, or commonly, the Basal Aquifer.

The Devonian strata form a wedge of westward dipping rock that sits directly on the Precambrian. The Upper Devonian strata consist of the Waterways, Slave Point and Fort Vermillion Formations. The Waterways Formation is also referred to as the Beaverhill Lake Group by some authors (Carrigy, 1963; Hackbarth and Nastasa, 1979). As shown in Table 3, the Waterways Formation has been subdivided into five limestone members. In the Athabasca River valley, the upper-most unit is the Moberly Member, which is a clastic limestone with beds of clastic lime mudstone, skeletal wackestone and shale (Cotterill and Hamilton, 1995). The rock outcrops along the Athabasca River and major tributaries between the Clearwater River and Fort MacKay. Exposures of the rock are described as rubbly and weathered (Carrigy, 1973). The subcrop of the Upper Devonian strata has been eroded, and exhibits a highly irregular surface. Relief on the Upper Devonian is as great as 100 m over distances as short as 1000 m (Hackbarth and Nastasa, 1979). The highly irregular surface is believed to be partly the result of karstification.

Below the Waterways Formation is the Slave Point Formation, which consists of wackestone and argillaceous lime mudstone. The Fort Vermillion Formation is made up of anhydrite, dolostone, and mudstone. Below this, the Middle Devonian deposits are present. As shown in Table 3, the Middle Devonian in the Oil Sands area is the Elk Point Group, which is comprised of the Watt Mountain, Prairie Evaporite, Methy and Contact Rapids Formations. The Watt Mountain Formation is a thin (10 m) layer of dolomitic shale. The Prairie Evaporite Formation is predominantly an anhydrite deposit. As shown in Drawing B-2779-02-05, it is believed to be discontinuous or absent on the east side of the Athabasca River. The Methy Formation is a reefal dolomite. The Contact Rapids Formation consists of dolomite, dolomitic siltstone, shale, anhydride and gypsum.

3.3 Regional Hydrogeology

3.3.1 Regional Hydraulic Conductivity Data

Hydraulic conductivity is a measure of a material's permeability to water. Materials with hydraulic conductivity values as high as 1×10^{-2} m/s are extremely permeable. Very coarse gravel is an example of such a material. Low values, in the order of 1×10^{-10} m/s are typical of low permeability material such as clay or unfractured shale. Transmissivity is another term used in this report in discussing permeability of aquifers. The transmissivity is the product of the hydraulic conductivity and the thickness of an aquifer. It is commonly determined from pumping tests, and is more indicative of the ability of an aquifer to produce water than hydraulic conductivity.

Table 3
Subsurface Stratigraphy of the Northern Part of the Athabasca Oil Sands Area,
After Carrigy (1973), McPherson and Kathol (1975) and Cotterill and Hamilton (1995)

[-			
System or Series	Formation	Member	Lithology
Pleistocene and Recent			Clay, silt, sand, silt and gravel
Cretaceous	Smoky Group LaBiche Dunvegan Shaftesbury Manville Group Grand Rapids Clearwater	Wabiskaw	Shale Shale Sandstone, siltstone and shale Shale, with sandstone and siltstone Sandstone Shale Glauconitic Sandstone
	McMurray	Upper Middle Lower	Sand, very fine, silt Sand, medium cross-bedded Sand, coarse, gravel, silt
	Erosional Unconformity		
Upper Devonian	Beaverhill Lake Group	1	
	Waterways	Mildred Mobertly Christina Calumet Firebag	Argillaceous Limestone Limestone Calcareous Shale Clastic Limestone Argillaceous Limestone
	Disconformity		
	Slave Point		Wackestone, mudstone and shale
	Fort Vermillion		Anhydrite, dolostone, minor mudstone
Middle Devonian	Elk Point Group Watt Mountain Prairie Evaporite Winnipegosis (Methy) Contact Rapids		Dolomitic shale Salt, anhydride, gypsum, silty shale Dolomite, in part reefal Dolomite, dolomitic siltstone, shale
Lower Devonian	Granite Wash (La Loche)		with minor anhydride and gypsum Arkosic Sandstone
	Erosional Unconformity)	Access to a conference of the
Precambrian	Metasedimentary Rock		
		Klohn Uringen	

Hydraulic conductivity data from the Oil Sands region has been collected from published sources such as Hackbarth and Nastasa (1979), as well as from Alsands (1978b) and OSLO projects and Suncor's Lease 86. This information will provide an important basis with which to compare hydraulic conductivity measurements made at the Steepbank Mine site, presented in Section 5.

3.3.1.1 Surficial Materials

Table 4 provides a summary of hydraulic conductivity values measured in surficial materials in the region. The hydraulic conductivity of till, measured at the OSLO site, ranges from 5.3×10^{-8} m/s to 6.8×10^{-7} m/s, with a mean of 1.4×10^{-7} m/s.

The hydraulic conductivity of sand deposits tested at OSLO and Suncor ranges from 1.1×10^{-8} m/s to 9.2×10^{-5} m/s, with a mean of 1.1×10^{-5} m/s.

The hydraulic conductivity of sand and gravel deposits, measured in the floodplain at Suncor, ranges from 7.0×10^{-6} m/s to 1.0×10^{-3} m/s, with a mean of 3.8×10^{-4} m/s.

3.3.1.2 Bedrock Materials

The hydraulic conductivity of bedrock units measured in the Oil Sands region is summarized in Table 5. Hackbarth and Nastasa (1979) determined the hydraulic conductivity of the Clearwater Formation ranges from 1×10^{-9} m/s to 1×10^{-6} m/s, with a mean of approximately 1.5×10^{-7} m/s.

Tests conducted in the Oil Sands indicate that the hydraulic conductivity ranges between 3.5×10^{-9} m/s and 3.2×10^{-7} m/s, with a mean of 1.5×10^{-7} .

Extensive pumping tests have been conducted in the Basal Aquifer by Alberta Research Council (Hackbarth 1977) and others at the Alsands site, north of the Steepbank Mine area. The results of these tests are listed in Table 5. The hydraulic conductivity of the Basal Aquifer ranges from 1.5×10^{-7} m/s to 2.4×10^{-2} m/s, with a mean of 4.2×10^{-5} m/s.

The hydraulic conductivity of the Upper Devonian limestone ranges from 4.0×10^{-11} m/s to 3.0×10^{-5} m/s, with a mean of 5.1×10^{-7} m/s. Such a wide range of hydraulic conductivity in a limestone indicates that the rock is probably fractured. Descriptions of the Upper Devonian Strata in Carrigy (1973) and Cotterill and Hamilton (1995) support this interpretation. In some areas of the region, the Upper Devonian limestone may therefore be nearly as permeable an aquifer as the Basal Aquifer.

Below the Upper Devonian strata, the hydraulic conductivity of the underlying formations is generally very low. The hydraulic conductivity of the salt in the Prairie Evaporite Formation is in the order of 3.0×10^{-9} m/s. The hydraulic conductivity of the Methy Formation has been found to range from 2.6×10^{-10} m/s to 1.6×10^{-7} m/s, with a mean of 1.8×10^{-8} m/s.

3.3.2 Regional Groundwater Flow Directions

The groundwater flow systems conform to the classic principles of regional groundwater flow. Groundwater is recharged in uplands, and discharges in lowlands. All groundwater flow is directed to the Athabasca and Clearwater Rivers, as well as smaller rivers that have incised into the Upper Devonian strata, such as the Steepbank, Muskeg and MacKay Rivers.

In the surficial deposits in the uplands, the direction of groundwater flow is controlled by the hydraulic conductivity and bedrock topography. A shallow flow system exists in the surficial material, in which groundwater flows more or less horizontally toward the major surface water bodies. The topographic highs in the bedrock act as groundwater divides. Groundwater discharges from the surficial deposits through the colluvium to the river valleys.

In the floodplain of the Athabasca River, the groundwater flow in the surficial deposits is horizontal. The groundwater flows toward the river, with a slight downstream component to its direction.

In the Clearwater Formation and Oil Sands, the direction of groundwater flow is predominantly downward (Hackbarth and Nastasa, 1979). The cause of these gradients is probably due to the fact that these deposits have very low hydraulic conductivity, in comparison to the underlying Basal Aquifer...

The direction of groundwater flow in the Basal Aquifer is toward the Athabasca River, and into any stream valleys and depressions where the aquifer outcrops.

In the upper-most portion of the Upper Devonian rock, the flow is more or less horizontal toward the Athabasca River and deeply incised valleys. This is because the Upper Devonian limestone has a relatively high hydraulic conductivity in comparison to the Oil Sands above it, and the deeper limestone below it.

There is some evidence that the Upper Devonian Limestone and Basal Aquifer may act as a hydraulically connected unit. During pumping tests conducted by Alberta Research Council, the hydraulic head in the Upper Devonian Strata responded to pumping from the Basal Aquifer (Hackbarth and Nastasa, 1979). This implies that there may be some degree of groundwater flow between the two units.

Table 4
Summary of Regional Hydraulic Conductivity Data from Surficial Deposits

Hydrogeologic Unit	Minimum Hydraulic Conductivity (m/s)	Maximum Hydraulic Conductivity (m/s)	Mean Hydraulic Conductivity (m/s)
TILL	5.3 x 10 ⁻⁸	6.8 x 10 ⁻⁷	1.4 x 10 ⁻⁷
SAND	1.1 x 10 ⁻⁸	9.2 x 10⁻⁵	1.1 x 10 ⁻⁵
SAND AND	7.0 x 10 ⁻⁶	1.0 x 10 ⁻³	3.8 x 10 ⁻⁴

Table 5
Summary of Regional Hydraulic Conductivity Data from Bedrock

Hydrogeologic Unit	Minimum Hydraulic Conductivity (m/s)	Maximum Hydraulic Conductivity (m/s)	Mean Hydraulic Conductivity (m/s)
Clearwater Formation	1 x 10 ⁻⁹	1 x 10 ⁻⁵	1 x 10 ⁻⁷
Oil Sands	3.5 x 10 ⁻⁹	3.2 x 10 ⁻⁷	1.5 x 10 ⁻⁷
Basal Aquifer	1.5 x 10 ⁻⁷	2.4 x 10 ⁻⁴	4.2 x 10 ⁻⁵
Upper Devonian (Waterways Formation)	4.0 x 10 ⁻¹¹	3.0 x 10 ⁻⁵	5.1 x 10 ⁻⁷
Prairie Evaporite Formation	**	*	3.0 x 10 ⁻⁹
Methy Formation	2.6 x 10 ⁻¹⁰	1.6 x 10 ⁻⁷	1.8 x 10 ⁻⁸

3.3.3 Regional Groundwater Chemistry

Regional groundwater chemistry has been published by Schwartz (1979, 1980) and Hackbarth (1977). In addition, Suncor collects groundwater samples from its network of monitoring piezometers at its active mine. Table 6 shows a summary of groundwater chemistry data from muskeg and surficial deposits. Table7 summarizes groundwater chemistry from bedrock units. The descriptions of the water quality include the terms fresh, brackish and saline. These descriptions are based on the concentration of total dissolved solids (TDS) found in the water. The descriptions are based on the following ranges of TDS:

<u>TDS</u>	(mg	L)

Fresh 0 - 1000 Brackish 1000 - 20 000 Saline 20 000 - 35 000

The chemistry data presented in Table 6 was collected by Schwartz (1979) from the Muskeg River basin, which is several miles north of the Steepbank Mine Study Area. The table shows that the chemistry of water found in muskeg is generally very fresh, with an electric conductivity (EC) ranging from 50 μ mhos/cm to over 800 μ mhos/cm. The mean EC was found to be 137 μ mhos/cm. The major ions in the muskeg water tend to be calcium, magnesium and bicarbonate. Muskeg water that has high levels of EC or sodium concentration probably has been influenced by groundwater discharge from bedrock (Schwartz, 1980).

The groundwater chemistry data has been collected from a variety of surficial deposits, including sand units, and till. The groundwater in the surficial units tends to be fresh. The total dissolved solids (TDS) ranges from 144 mg/L to 754 mg/L, with a mean of 520 mg/L. The major ions are predominantly calcium, magnesium and bicarbonate. Areas in which the groundwater in muskeg and surficial deposits has high levels of sodium and chloride are probably receiving water from bedrock units.

Data from chemical analyses of bedrock groundwater is shown in Table 7. Water in the Clearwater Formation is slightly brackish. The concentration of TDS reported in Schwartz (1979) ranged from 971 mg/L to 2762 mg/L, with a mean of 1794 mg/L. The major cations are sodium and potassium. Bicarbonate is the major anion. The sulphate and chloride concentrations in the Clearwater Formation appear to be higher than in the overlying surficial material.

Table 6
Regional Chemistry of Groundwater in Surficial Deposits

Well ID	Unit	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3	SO4 mg/L	CI mg/L	TDS ¹	EC μmhos/em	Total ALK	Reference
1 (l	7												g :
Muskeg	Minimum		0.7	0.5	1.3	0	0	3.2	1.3		50	0	Schwartz 1980
•	Maximum		33.6	9.9	212	2.4	566	15.6	9.1		84		
	Mean		17	4.9	4.1	0.6	80.7	5.9	2.4		137.0		
Surficial l	Deposits												
HC1	Clay, sandy	77/08/09	74.0	25.0	6.1	2.5	358.0	21.0	10.0	496.6	437.0	293.6	Schwartz 1979
HC2	Sand, clayey	77/08/08	35.5	10.0	3.9	1.3	156.0	7.7	0.3	214.7	256.0	127.9	Schwartz 1979
HC4	Clay	77/08/07	110.0	15.0	8.9	2.7	437.0	0.5	4.0	578.1	600.0	358.3	Schwartz 1979
HC6	Clay, silty	77/08/07	130.0	29.0	5.6	2.1	583.0	0.5	4.0	754.2	680.0	478.1	Schwartz 1979
HC7	Clay, silty	77/08/07	98.0	22.0	4.2	1.0	371.0	0.5	2.0	498.7	570.0	304.2	Schwartz 1979
HC8	Sand	77/08/07	38.7	22.0	12.4	2.7	250.0	0.5	4.0	330.3	363.0	205.0	Schwartz 1979
HC9	Sand	77/08/07	20.0	7.6	5.2	0.6	98.0	9.2	4.0	144.6	165.0	80.4	Schwartz 1979
HC10	Clay	77/08/07	117.0	25.0	7.3	2.0	484.0	3.5	4.0	642.8	695.0	396.9	Schwartz 1979
HC12	Clay	77/08/07	110.0	25.0	7.0	1.9	503.0	0.5	4.0	649.4	670.0	412.5	Schwartz 1979
HC13	Clay	77/08/08	110.0	30.0	16.0	2.2	534.0	9.5	4.0	705.7	690.0	437.9	Schwartz 1979
HC15	Clay	77/08/08	90.0	28.0	15.1	3.2	500.0	0.5	4.0	640.8	665.0	410.0	Schwartz 1979
HC16	Clay	77/08/08	73.4	21.3	7.6	2.0	368.0	0.5	4.0	476.8	508.0	301.8	Schwartz 1979
HC18	Clay, silty	77/08/08	82.0	33.0	14.6	8.9	499.0	0.5	4.0	642.0	650.0	409.2	Schwartz 1979
HC21	Silt and clay	77/08/06	66.0	35.0	7.0	2.1	428.0	0.5	10.0	548.6	550.0	351.0	Schwartz 1979
HC23	Silt	77/08/06	73.4	18.0	41.0	1.4	350.0	0.5	76.0	560.3	650.0	287.0	Schwartz 1979
HC25	Sand	77/08/11	27.0	11.01	36.0	5.8	236.0	15.8	4.0	335.7	375.0	193.5	Schwartz 1979
HC26	Sand	77/08/11	63.1	10.8	7.9	3.2	280.0	0.5	4.0	369.5	392.0	229.6	Schwartz 1979
HC27	Clay	77/08/07	110.0	26.0	10.4	1.1	430.0	10.0	4.0	591.5	625.0	352.6	Schwartz 1979
HC29	Clay	77/08/11	98.0	20.0	38.0	5.0	550.0	0.5	4.0	715.5	720.0	451.0	Schwartz 1979
eranda and anterprinte annual construction	Minimum		20.0	7.6	3.9	0.6	98.0	0.5	0.3	144.6	165.0	80.4	
	Maximum		130.0	35.0	41.0	8.9	583.0	21.0	76.0	754.2	720.0	478.1	Nacional Control of the Control of t
	Mean		80.3	21.8	13.4	2.7	390.3	4.4	8.0	520.8	539.5	320.0	Septiment of the septim

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Table 7

	Regional Bedrock Groundwater Chemistry												
Well ID	Unit	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3 mg/l	SO4 mg/L	Cl mg/L	TDS ¹ mg/L	EC μmhos/ cm	Total ALK mg/L	Reference
Clearwater Fon	mation	_	_	_		_							
8-114 8-220 8-370	Clay Clay Clay	75/02/22 75/03/06 75/03/23	19.6 34.0 17.9	6.6 3.2 7.0	239.0 700.0 409.0	13.3 117.0 15.4	541.8 1898.0 1054.0	97.0 5.7 117.0	54.0 4.0 27.0	971 2762 1647	1100 1800 1710	444 1556 864	Schwartz 1979 Schwartz 1979 Schwartz 1979
	Minimum Maximum Mean		17.9 34.0 23.8	3.2 7.0 5.6	239.0 700.0 449.3	13.3 117.0 48.6	541.8 1898.0 1164.6	5.7 117.0 73.2	4.0 54.0 28.3	971 2762 1794	1100 1800 1537	444 1556 955	
McMurray Form	nation	•			•		•			•			
6-21 6-220 7-135	Oil Sands Oil Sands Oil Sands Minimum	75/09/11 75/09/11 75/09/10	31.0 6.9 9.6 6.9	5.2 21.1 15.0 5.2	17.5 1400.0 34520.8	1.7 1017.0 768.9	4.6 2165.0 768.9 4.6	2.5 14.0 6.6 2.5	12.0 1600.0 756.7	208 37181 13922 208	280 6500 3390	4 1775 630 4	
	Maximum Mean		31.0 15.8	21.1	34520.8 11979.4	1017.0 381.2	2165.0 768.9	14.0	1600.0 756.7	37171 13922	6500 3389	1665 630	THE CONTRACT OF THE CONTRACT O
BP-2WA BP-4WA Fina 73-6 Fina 73-2 Tenneco Tenneco Tenneco 7-337	Basal Aquifer	80/07/02 80/07/02 80/07/02 80/07/02 79/07/07 74/02/27 74/02/18 75/09/10	74.0 3.2 8.5 11.0 9.0 128.0 42.0 14.7	167.0 2.2 20.0 21.0 0.6 84.0 62.0 28.0	6281.0 331.0 625.0 203.0 118.0 190.0 161.0 575.0	63.0 19.0 15.0 11.3 6.7 - - 22.1	3304.0 401.0 1051.0 647.0 361.0 602.0 431.0 1239.0	4.0 7.5 10.0 6.0 6.7 528.0 344.0 2.7	8550.0 176.0 446.0 49.0 2.0 - - 218.0	16928 1032 1652 643 366 1532 1040 2100	27400 1500 2850 1180 525 - - 3200	2709 329 862 531 296 494 353 1016	Hackbarth 1977 Hackbarth 1977 Hackbarth 1977 Hackbarth 1977 Hackbarth 1977 Schwartz 1979 Schwartz 1979 Schwartz 1979
	Minimum Maximum Mean		3.2 128.0 36.3	0.6 167.0 48.1	118.0 6281.0 1060.5	6.7 63.0 22.9	361.0 304.0 1004.5	2.7 528.0 113.6	2.0 8550.0 1573.5	366 16928 3162	525 27400 6109	353 1016 621	

Klohn-Crippen

Table 7

				Regional Bedrock Groundwater Chemistry				<u>y</u>					
Well ID	Unit	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3 mg/l	SO4 mg/L	CI mg/L	TDS¹ mg/L	EC μmhos/ cm	Total ALK mg/L	Reference
Upper Devonia	1			0	8	8	8		R	a a	ı de la	3	8
BP-1W	Limestone	80/07/01	106.0	451.0	10281.0	101.0	1515.0	1.0	16750.0	29024	45000	1242	Hackbarth 1977
BP-2W	Limestone	80/07/02	39.0	152.0	7312.0	66.0	1659.0	1700.0	10250.0	19684	31300	1360	Hackbarth 1977
BP-3W	Limestone	80/07/02	13.0	12.0	975.0	9.0	464.0	36.0	1290.0	2576	4550	380	Hackbarth 1977
Env91-2A	Limestone	94/10/27	73.0	58.0	3 57 9.0	19.6	2038.0	1.4	4910.0	9660	16013	1672	KCCL 1995
Env91-5	Limestone	94/11/09	21.9	22.5	2555.0	12.1	2607.0	2.1	2540.0	6458	10752	2138	KCCL 1995
Env92-6	Limestone	94/10/26	110.0	150.0	10626.0	52.4	2731.8	7.0	15480.0	27791	42508	2241	KCCL 1995
Env94-10A	Limestone	94/10/31	190.0	35.5	2086.0	7.8	782.6	48.2	3240.0	5999	10340	642	KCCL 1995
Env94-7	Limestone	94/11/03	336.0	105.0	1180.0	12.1	982.5	918.0	1710.0	4753	7670	806	KCCL 1995
Env94-8A	Limestone	94/10/31	171.0	28.0	207.0	6.3	597.3	58.6	338.0	1108	2011	490	KCCL 1995
Env94-9A	Limestone	94/10/31	113.0	25.2	1460.5	2.7	719.0	61.4	1940.0	3962	7183	590	KCCL 1995
	Minimum	TANKS OF THE PARTY	13.0	12.0	207.0	2.7	464.0	1.0	338.0	1108	2011	380	
	Maximum	1200 Million 100 M	336.0	451.0	10626.0	101.0	2731.8	1700.0	16750.0	29024	45000	2241	
	Mean	transcenter the second	117.3	103.9	4026.0	28.9	1409.6	283.4	5844.8	11807	17733	1156	,
Prairie Evapori	te						,						
7-594	gypsum	75/02/19	380	346	1688	67	422	2500	2875	8278	8000÷	346	Schwartz 1979
Precambrian				-		•				•			
7-933	Granite	75/03/11	25.4	1.5	251	76	158	134	300	946	1480	130	Schwartz 1979

¹ Approximate

Groundwater in the Oil Sands ranges from being quite fresh to saline. The value of TDS, as shown in Table 7, ranges from 208 mg/L to 37 181 mg/L. The mean concentration of TDS was 13 922 mg/L. Sodium, chloride and bicarbonate are the major ions in groundwater from the Oil Sands.

The Basal Aquifer yields water that ranges from fresh to very brackish. The TDS reported by Schwartz (1979) and Hackbarth (1977) ranged from 366 mg/L to 16 928 mg/L. The mean concentration of TDS in the Basal Aquifer was 3162 mg/L. The major ions in the aquifer are sodium, bicarbonate and chloride. The sulphate level was also found to be quite high in two wells in the Alsands area (greater than 300 mg/L). In general, the groundwater in the Oil Sands and the Basal Aquifer appear to be quite similar. The concentration of dissolved compounds in both units varies by two orders of magnitude. They both have the same major ion chemistry. In one important characteristic, however, they are quite different; the Oil Sands contains a higher concentration of hydrocarbons.

The chemistry of groundwater in the Upper Devonian formations shown in Table 8 is from sites at Alsands and Suncor's active mine. The groundwater in the Upper Devonian strata is slightly brackish to saline. The concentration of TDS in the limestone ranged from 1108 mg/L to 29 024 mg/L, with a mean of 11 807 mg/L. Sodium, chloride and bicarbonate are the major ions in water in the Upper Devonian strata. In general, the data in Table 7 indicates that the groundwater in the Upper Devonian strata is more brackish than in the Basal Aquifer. Chloride is also more predominant in the Upper Devonian strata than in the Basal Aquifer.

Table 7 also provides chemistry data for groundwater from the Middle Devonian and Precambrian rock. Water from the Prairie Evaporite and Methy Formations is saline, with major ions being sodium, sulphate and chloride.

4. GEOLOGY OF THE STEEPBANK MINE AREA

4.1 Surficial Geology

An examination of the borehole logs for the 1995 drilling program confirms, in general, the interpretation of the surficial geology by McPherson and Kathol (1977). Table 2 presents a summary of the stratigraphic sequence proposed by McPherson and Kathol. The following discussion describes the surficial deposits found in the uplands, valley slopes and floodplain at the Steepbank Mine area.

4.1.1 Uplands

On the uplands, the simplified stratigraphic column is as follows:

Muskeg Stratified Sediments Till Bedrock

Cross sections through the surficial deposits in the uplands have been prepared. A map showing the locations of the sections is provided in Drawing B-2779-02-06. Two cross sections (A and B) are shown in Drawing B-2779-02-07.

4.1.1.1 Muskeg

From a helicopter flight over the site, it was confirmed that the majority of the uplands area is covered with muskeg. Borehole logs from the 1995 drilling program show the muskeg is generally less than 1 m thick.

4.1.1.2 Stratified Sediments

Below the muskeg, sand was encountered in over half of the boreholes in which surficial materials were logged. From descriptions on the logs, these sediments are interpreted to be either glaciofluvial outwash or mixed glaciolacustrine sediments. Where they are present, the thickness of the sand units ranges from 1 m to 10 m. As shown in the cross sections in Drawing B-2779-02-07, and the isopach map in Drawing B-2779-02-09, the thickest sand deposits were found in Lease 97.

The stratified sediments form a discontinuous layer of sand over the Steepbank Mine area. The presence of the shallow sand in the area suggests that the outwash and glaciolacustrine sediments referred to by McPherson and Kathol (1977) extend farther south than is shown in the surficial geology map in Drawing A-2779-02-03.

4.1.1.3 Till

Till has been deposited over nearly the entire upland area. The descriptions of till in the logs provided by Suncor resemble the Firebag till, as described by McPherson and Kathol (1977). The till is predominantly a sandy loam, increasing in clay content with depth. The composition of the Firebag till bears a resemblance to the bedrock beneath it. In the centre and east portions of the Study Area, the till overlies shale of the Clearwater Formation. In these locations, the lower till horizons are clayey, and appear to contain rafted or re-worked Clearwater shale. On the west side of the Study Area, where the Clearwater Formation has been eroded, the till is in contact with Oil Sands. Correspondingly, the borehole logs describe the till as being more sandy, with bitumen odour. The total thickness of the till ranges from zero to 28 m in the boreholes that have been logged. The till contains some sand layers and lenses of 1 m or 2 m thick.

The presence of the unnamed till at the Study Area was not confirmed with the 1995 drilling results.

Generally, the distribution of the till found in the 1995 boreholes agrees with the surficial geology map prepared by McPherson and Kathol (1977) shown in Drawing A-2779-02-03, with a few exceptions. As shown in cross section B (Drawing B-2779-02-07), the till was absent in borehole L9795005. In this area, stratified sand sediments rest directly on bedrock.

4.1.1.4 Deep Undifferentiated Till and Stratified Sediments

McPherson and Kathol (1977) suggested that unidentified deposits of till and stratified sediments may exist in areas where surficial deposits are very thick. Their investigation indicates that the drift in portions of Lease 19 may be up to 45 m thick. Unfortunately, the 1995 drilling program did not explore these areas. It is possible that coarse grained sediments may exist in these portions of Lease 19.

4.1.2 Valley Slopes

The valley slopes along the Steepbank River and the east side of the Athabasca River are covered with colluvium. The colluvium consists mainly of sandy and silty material, with some bituminous sand. The thickness of these deposits is not known. However, it probably ranges from zero to several 10's of metres, where the slopes are less steep. The bedrock is exposed on slopes that are particularly steep.

4.1.3 Floodplain

The Athabasca River valley has been eroded into the Upper Devonian limestone. Valley sediments consist of discontinuous alluvial gravel, sand silt and clay that contact the Upper Devonian surface. The floodplain on the east bank of the Athabasca River is comprised of organic material and alluvial sand silt and clay, with some sand and gravel deposits. The results from geotechnical drilling in the fall of 1995 indicate that the sand and gravel is very clean, with no silt or clay sized material.

4.1.4 Thickness of Surficial Deposits

A map showing the thickness of surficial deposits is shown in Drawing B-2779-02-08. Data used to produce the map was taken from borehole logs from Leases 97 and 25, Fee Lots 1 and 3, and the GPR survey (AGI, 1995) in the Athabasca River valley. On the uplands, the thickness of surficial material ranges from 1 m to 45 m. The surficial deposits are thinnest along the edge of the scarp of the river valleys. The thickness surficial deposits are located in the southeast part of Lease 25, and in Lease 19. The drift thickness map by McPherson and Kathol (1977), shown in Drawing A-2779-02-04, is more or less consistent with the map prepared for this study.

However, their map extends farther south. It shows that the thickest surficial deposits (50 m) occur east of Leggett Creek in Lease 19.

On the valley slopes, the surficial deposits are generally less than 1 m thick. Along the Steepbank River, in Lease 97 and Fee Lot 1, the valley walls are very steep, and the bedrock outcrops. In the Athabasca floodplain, the GPR survey indicated the alluvial and channel sediments are up to 25 m thick. Beneath the river near Tar Island Dyke, the surficial material has been found to be over 40 m thick.

4.2 Bedrock Geology

From the results of the compilation of borehole data, the simplified bedrock stratigraphy of the Steepbank Mine area is as follows:

- · Clearwater Formation
- · McMurray Formation Oil Sands
- Basal Aquifer
- Upper Devonian

The bedrock topography in the area is presented in Drawing B-2779-02-10. Six cross sections through the bedrock have been prepared. A map showing the locations of the cross sections is shown in Drawing B-2779-02-11. The cross sections are shown in Drawings B-2779-02-12 to B-2779-02-17. An isopach of the Basal Aquifer is shown in Drawing B-2779-02-18. The structure of the Basal Aquifer is presented in Drawing B-2779-02-19. The structure if the Upper Devonian surface is shown in Drawing B-2779-02-20.

4.2.1 Local Bedrock Topography

The bedrock topography map shown in Drawing B-2779-02-10 illustrates that the bedrock surface generally resembles the ground surface. The topographic contours of the bedrock surface are essentially parallel to the Athabasca River. In the uplands, the bedrock surface generally slopes toward the Athabasca River. The bedrock elevation ranges from 260 masl to greater than 400 masl at the eastern extent of the Study Area. Beneath the Athabasca River, the bedrock elevation is less than 200 masl.

A comparison of the thickness of surficial deposits (Drawing B-2779-02-08) and the bedrock topography (Drawing B-2779-02-10) reveals that depressions in the bedrock surface are filled with thick deposits of surficial material. Therefore, the location of depressions in the bedrock are generally not evident from the ground surface. Depressions in the bedrock surface also tend to correspond with depressions in the Upper Devonian surface (Drawing B-2779-02-20). The presence of these depressions is evidence of collapse features in the Devonian

limestone. They also suggest that the collapse processes were active until the late Cretaceous, after the Clearwater Formation was deposited.

Existing borehole data do not indicate the presence of any channel-like features in the bedrock surface, as are present in the OSLO area. Throughout Alberta, Pleistocene deposits of sand and gravel have been deposited in bedrock channels. Such deposits are important aquifers and sources of aggregate around the province. It appears that no such deposits occur in the Steepbank Mine area.

4.2.2 Clearwater Formation

The Clearwater Formation is present over most of the uplands in the Study Area. It extends to the edge of the river valley, where it subcrops beneath the surficial deposits. The edge of the Clearwater Formation is shown on the bedrock topography map in Drawing B-2779-02-10. As shown in cross sections C to H (Drawings B-2779-02-12 to B-2779-02-17), the deposit forms a wedge of material that thickens from west to east. The thickness of the deposit ranges from zero to 30 m.

4.2.3 McMurray Formation Oil Sands

The Oil Sands deposit in the Study Area ranges in thickness from 50 m to 75 m. As illustrated in the cross sections in Drawings B-2779-02-12 to B-2779-02-17, the Oil Sands subcrops in the Athabasca River valley and the lower reach of the Steepbank River. The edge of the Oil Sands deposit is shown in the bedrock topography map in Drawing B-2779-02-10. Borehole data supplied by Suncor indicate that interburden deposits occur sporadically in the Oil Sands. The composition of the interburden was not noted on the data sheets.

The Oil Sands is underlain by the Basal Aquifer in most of the Study Area. In many depressions in the Devonian surface, there is Oil Sands below the Basal Aquifer. This is shown clearly in cross section D, (Drawing B-2779-02-13), in which there is nearly 20 m of Oil Sands in a depression below the Basal Aquifer.

4.2.4 Basal Aquifer

The distribution and thickness of the Basal Aquifer in the Study Area is shown in the isopach map in Drawing B-2779-02-18. There are large portions of Leases 97 and 25 where the aquifer is absent. From field observations in the Steepbank River valley, it has been interpreted that the aquifer is absent from the northeast corner of the Study Area. However there is only limited borehole information to support this interpretation.

The thickness of the Basal Aquifer ranges from zero to 50 m. The aquifer is thickest on the north side of the Steepbank River, in the north end of Fee Lot 1. There is also a 35 m thick occurrence of the aquifer around the east end of Fee Lot 3.

As shown in cross sections C to H, (Drawings B-2779-02-12 to B-2779-02-17), the Basal Aquifer is thickest where it overlies depressions in the Devonian surface. Furthermore, the places where the Basal Aquifer is absent coincide with topographic highs on the Devonian surface. For example, in the isopach map (Drawing B-2779-02-18), there is a meandering feature in Lease 97 and Fee Lot 1 where the aquifer is absent. This feature may be mistaken for a fluvial element. However, from the structure map of the Devonian surface (Drawing B-2779-02-20), it can be seen that the underlying limestone surface is high, and the Basal Aquifer material has been draped around it.

Drawing B-2779-02-19 is a structure map of the top of the Basal Aquifer. Where the aquifer is present, the elevation of its upper surface ranges from 216 masl to 282 masl. Where the aquifer is thin, (less than 15 m), the structure of the aquifer reflects the structure of the underlying Devonian. However, because depressions in the Devonian surface are filled with thick deposits of Basal Aquifer, the thick occurrences of aquifer mask the underlying limestone surface.

4.2.5 Upper Devonian

A structure contour map of the Upper Devonian surface is presented in Drawing B-2779-02-20. The map illustrates the surface of the Devonian is an undulating erosional unconformity, ranging in elevation from 190 masl to 290 masl. Several closed depressions are present on the Devonian surface, which suggest that some subsidence due to karstification and collapse have taken place. Topographic highs are also apparent, at numerous locations on the surface. As shown in the cross sections in Drawings B-2779-02-13 to B-2779-02-17, the surface of the Upper Devonian strata subcrops along the Athabasca River and the lower portion of the Steepbank River. In places, outcrops of limestone stand up to 10 m above river level.

Observations made on core samples and outcrops revealed that the Upper Devonian limestone is highly fractured and weathered. Some of the fractures contain clay. The cause of the fractures is probably related to weathering processes or karstification.

5. HYDROGEOLOGY OF THE STEEPBANK MINE AREA

5.1 Surficial Materials

5.1.1 Uplands

Five piezometers have been constructed in surficial deposits in the uplands of the Steepbank Mine area. The location of the piezometers (L97-P95-OBS#1, -OBS#2, -OBS#3, -OBS#4 and -OBS#5) is shown in Drawing B-2779-02-02. The piezometers are all completed in shallow sand deposits, above the till. Four piezometers were subjected to rising head tests to determine the hydraulic conductivity of the sand. Piezometer L97-P95-OBS#4 was not tested, because the electrical conductivity of its water was too low to activate a depth sounder.

5.1.1.1 Hydraulic Conductivity of Surficial Material in Uplands

The hydraulic conductivity determined from the tests is summarized in Table 8. The hydraulic conductivity of the sand ranges from 4.0×10^{-7} m/s to 2.0×10^{-5} m/s, with a mean of 3.7×10^{-6} m/s. This is within the range calculated from piezometer tests elsewhere in the region (shown in Table 4).

The hydraulic conductivity of the till in the Study Area has not been measured. However, it is reasonable to assume that hydraulic conductivity of the till is similar to what was found elsewhere in the region. As shown in Table 4, the hydraulic conductivity of the till ranges from 5.3×10^{-8} m/s to 6.8×10^{-7} m/s, with a mean of 1.4×10^{-7} m/s. This is the same order of magnitude as the Clearwater Formation, (Table 5).

Table 8

Hydraulic Conductivity of Surficial Deposits in the Study Area

Piezometer	Hydrogeologic Unit	K m/s
L97-P95-OBS#1	Sand	4.0x10 ⁻⁵
L97-P95-0BS#2	Silty Sand	6.0x10 ⁻⁷
L97-P95-OBS#3	Sand	2.0x10 ⁻⁵
L97-P95-0BS#5	Sand	4.0x10 ⁻⁷
	Geometric Mean	3.7x10 ⁻⁶

5.1.1.2 Groundwater Flow in Surficial Material in Uplands

The upland is predominantly covered with permeable sand which overlies less permeable till. The groundwater flow in the surficial materials is controlled by two factors: the hydraulic conductivity of the surficial deposits, and the topography of the ground and underlying geologic units. The groundwater flows horizontally in the more permeable surficial units. Drawing B-2779-02-21 shows an interpretation of the direction of horizontal flow in the surficial materials.

The direction of the horizontal flow is controlled by the site's topography. On the north side of the Steepbank River, the ground surface slopes toward the Steepbank River. Therefore groundwater in the surficial material also flows toward the river.

On the south side the Steepbank River, the majority of the upland area slopes toward the Athabasca River. As shown in Drawing B-2779-02-21, there is a divide in the ground surface very close to the south bank of the Steepbank escarpment. Therefore, the majority of the shallow groundwater flows toward the Athabasca River. A small percentage of the groundwater flows toward the south bank of the Steepbank River. As it reaches the edge of the uplands, the groundwater discharges into the colluvium on the valley slopes, and flows into the river valleys.

In the till, the hydraulic gradient is probably downward except where the till has been incised by stream channels. This is because the hydraulic conductivity of the till is similar to hydraulic conductivity of the underlying Clearwater Formation. The rate of flow through the till is probably much less than the flow through the sandier shallow sediments.

5.1.1.3 Groundwater Chemistry in Surficial Materials in the Uplands

Groundwater samples were collected from five piezometers in the uplands in the Steepbank Mine area in March, July and September 1995. The analytical results from these samples (piezometers L97-P95-OB#1, -OB#2, -OB#3, -OB#4; and -OB#5) are tabulated in Tables 9 and 12. The complete analytical results are included in Appendix 2. A Piper plot, which is a graphical presentation of the major ion chemistry of the water, is shown on Drawing B-2779-02-22 for each sampling event.

The surficial groundwater ranges from extremely fresh (TDS = 24 mg/L) to fresh (TDS = 622 mg/L). The Piper plot in Drawing B-2779-02-22 illustrates that there are two types of water in the surficial sand deposits; low TDS water and high TDS water. The low TDS groundwater is generally a calcium-magnesium bicarbonate type water, while the high TDS groundwater is a sodium-bicarbonate type water. The ratio of sulphate to total dissolved solids is higher in the low TDS water than the high TDS water. There is a higher chloride concentration (although still less than 15 mg/L) in the high TDS water. The pH ranges from 5.9 to 8.1, with an average of 7.1 units.

Trace amounts of organics, including PAH and alkylated PAH's, were found in the surficial groundwater collected from -OB#5 as shown in Table 11. Naphthenic acid values range from <3 to 7 mg/L, and Microtox toxicity testing indicates the water is non-toxic, as shown in Table 12.

Groundwater samples collected in October 1995 were analyzed for the stable isotopes deuterium and oxygen-18. Grab samples were also collected from the Steepbank River, Shipyard Lake, and La Saline Lake, which is north of the Study Area. Stable isotope analyses are used to help understand the source of a water, and the processes that have affected it. A scatter plot of the deuterium and oxygen-18 concentrations in the water samples is shown in Drawing A-2779-02-23. The groundwater from surficial deposits plots along the meteoric water line.

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Table 9

Major Ion Chemistry and Field Measured Parameters of Groundwater in the Study Area

				· · · · · · · · · · · · · · · · · · ·								
Well ID	Date	Ca	Mg	Ns	K	CI CI	SO4	Total Alk	Bicarbonate	TDS	Specific Cond	pH
		mg/L	mg/L	mg/L	mg/L	mgL	mg∕L	mg∕L	mg/L	mg/L	umhos/cm	unite
					SURFIC	IAL DEPOSITS						
L97-P95-OB-1	03/17/95	78	22	10.4	1.93	1.2	23.8	305	372	324	580	7.19
L97-P95-OB-1	07/03/95	79.8	19.9	8.8	2.3	0.7	18.3	262	319	290	514	7.68
L97-P95-OB-1	09/12/95	71.9	18.7	9.8	2.6	0.7	16.5	245	299	270	478	7.49
L97-P95-OB-2	03/17/95	25	7.4	186	4.18	9.6	0.7	491	599	532	873	7.56
L97-P95-OB-2	06/29/95	22.8	6.2	189	3.3	14.2	0.8	485	591	532	883	8.1
L97-P95-OB-2	09/13/95	21.4	6.1	195	3.1	10	0.8	481	586	530	885	7.75
L97-P95-OB-3	03/17/95	5.1	0.89	1.66	0.51	< 0.5	10.2	9.86	12	24	43	5.56
L97-P95-OB-3	07/04/95	3.3	0.9	4.2	0.7	<0.5	9.9	7.14	9	24	35	5.65
L97-P95-OB-3	09/12/95	3.8	1.1	4.6	1.2	9.7	9	8	10	34	39	5.61
L97-P95-OB-4	03/13/95	4.35	1.29	2.3	1.12	<0.5	9.7	14.72	18	28	48	5.62
L97-P95-OB-4	07/03/95	7.7	1.5	3.2	8.0	3.1	11	12.44	15	35	54	5.87
L97-P95-OB-4	09/12/95	4.6	1.4	5.2	1.1	2.2	10.5	8.01	10	30	50.3	5.76
L97-P95-OB-5	03/13/95	64	17.8	159	2.85	7.8	10.2	566	690	607	1010	7.13
L97-P95-OB-5	07/03/95	53.7	14.4	178	2.1	9.3	5.4	576	702	.614	1011	7.45
L97-P95-OB-S	09/14/95	52	14	190	2.4	10.2	5	573	698	623	1048	7.44
FL7-BRDG-4	03/13/95	14.2	3.24	8.9	1.49	4.6	28.8	31.56	38	81	142	6.23
FL7-BRDG-4	07/06/95	17.7	3.4	11.1	1.4	4.2	26.5	51	62	96	174	6.48
FL7-BRDG-4	09/13/95	20.5	3.5	6.2	1.5	4.3	25.5	48	59	92	175	6.6
minimum		3.3	0.89	1.7	0.51	0.7	0.7	7.14	9	24	35	3.56
maximum		79.8	22	195	4.18	14.2	28.8	576	702	623	1048	8.1
mean		30.5	8.0	65.2	1.9	6.1	12.4	231.9	283	265	447	6.73
					BAS	AL AOUIFER						
L97-P95-1-BA	03/13/95	76	105	4880	31.6	6520	ı	2125	2590	12909	21860	6.98
L97-P95-1-BA	06/28/95	87.3	92.6	5040	36.7	6220	0.5	2146	2616	12785	21467	7.44
L97-P95-1-BA	09/12/95	85.4	102	5030	34.8	6685	1	2161	2634	13255	21506	7.19
L97-P95-3-BA	03/13/95	45	57	3290	29.9	3880	1.2	1873	2289	3448	14220	7.2
L97-P95-3-BA	07/04/95	52.3	53.8	3320	25.1	4220	<0.5	1886	2299	3821	14025	7.4
L97-P95-3-BA	09/13/95	47.1	43.3	3140	17.8	4090	30.5	1888	2301	8519	14326	7.33
FL3-P95-6-BA	03/13/95	190	158	6720	82.2	10200	5	1451	1769	18240	30840	7.11
FL3-P95-6-BA	07/10/95	193	209	9140	85.3	12800	11.3	2011	2451	23664	39218	7.15
FL3-P95-6-BA	09/15/95	198	223	10700	62	16850	80	2083	2539	29383	43358	7.12
L97-P95-8-BA	06/28/95	16	8.4	1080	28.6	599	6.9	1445	1761	2620	4238	7.76
L97-P95-8-BA	09/13/95	13.7	7.8	1180	20	678	13	1797	2191	3008	4948	7.45
FL3-P95-13-BA	03/13/95	85	103	3230	26.8	3920	1.3	2045	2493	8613	14010	7.13
FL3-P95-13-BA	07/05/95	89.1	80.5	3150	26.2	3920	0.5	2099	2539	8546	13709	7.19
FL3-P95-13-BA	07/05/95	89.1	81.2	3080	26.4	3883	<0.5	2097	2556	8438	13709	7.22
FL3-P95-13-BA	09/14/95	90.6	82.7	3050	24.1	4090	0.6	2073	2527	8601	14499	7.21
minimum		13.7	7.8	1080	17.8	599	0.5	1445	1761	2620	4238	6.98
meximum		198	223	10700	85.3	16850	80	2161	2634	29383	43358	7.76
mean		90.5	93.8	4402	37.2	5904	11.8	1946	2372	11723	19062	7.26
					UPPE	R DEVONIAN						
L97-P95-2-L	03/13/95	25.8	20.5	1560	25.8	1440	2.4	1602	1953	4051	6967	7.39
L97-P95-2-L	06/29/95	27.7	21.6	1860	24.4	1535	0.3	1826	2226	4582	7860	7.74
L97-P93-2-L	09/14/95	26.3	24.7	1870	24.1	1690	16.5	1913	2332	4818	8226	7.65
L97-P95-2-L	09/14/95	24.1	20.5	1850	21	1860	<0.5	1901	2317	4934	8261	7.56
minimum		24.1	20.5	1560	21	1440	0.5	1602	1953	4051	6967	7.39
meximum		27.7	24.7	1870	25.8	1860	16.5	1913	2332	4934	8261	7.74
mean		26.0	21.8	1785	23.8	1631	6.5	1811	2207	4596	7829	7.59

Klohn-Grippe

Table 10 Concentrations of Dissolved Metals and Cyanide in Groundwater in the Study Area (mg/L)

Parameter		Surficia										
raiametei		Surficia	Sano	No of		Basal A	quiler	No of		Limes	tone.	
	Min	Median	Max	Samples	Min	Median	Max	Samples	Min	Median	Max	No of Samples
Aluminum	< 0.01	0.05	0.5	18	< 0.01	0.02	0.07	15	0.02	0.025	0.04	4
Arsenic (μg/L)	< 0.2	0.3	0.5	6	< 0.2	0.2	1.6	5	0.6	0.6	0.6	1
Barium	< 0.01	0.06	0.21	18	0.16	0.75	3	15	0.17	0.205	0.24	4
Beryllium	< 0.001	< 0.001	0.002	18	< 0.001	< 0.001	0.002	15	< 0.001	< 0.001	< 0.001	4
Boron	< 0.01	0.025	0.79	18	2.33	3.87	4.45	15	3.2	3.735	4	4
Cyanide	< 0.001	0.001	0.001	12	< 0.001	0.001	0.002	11	0.001	0.001	0.001	3
Cadmium (µg/L)	< 3	< 3	4	18	< 3	< 3	3	15	< 3	< 3	< 3	4
Chromium	< 0.002	< 0.002	0.013	18	< 0.002	< 0.002	0.018	15	< 0.002	< 0.002	0.002	4
Cobalt	< 0.003	< 0.003	0.004	18	< 0.003	0.005	0.031	15	< 0.003	< 0.003	0.004	4
Соррег	< 0.001	0.001	0.003	18	< 0.001	0.002	0.008	15	0.001	0.0015	0.004	4
Iron	< 0.01	0.07	0.42	18	< 0.01	0.7	5.63	15	< 0.01	0.75	0.82	4
Lead	< 0.02	< 0.02	< 0.02	18	< 0.02	< 0.02	0.04	15	< 0.02	< 0.02	< 0.02	4
Lithium	< 0.001	0.005	0.055	18	0.355	0.753	1.79	15	0.291	0.3655	0.387	4
Manganese	0.007	0.068	0.589	18	0.029	0.277	4.02	15	0.034	0.0835	0.099	4
Mercury (μg/L)	< 0.05	< 0.05	0.1	12	< 0.05	< 0.05	1.6	9	< 0.05	0.075	0.23	4
Molybdenum	< 0.003	< 0.003	0.006	18	< 0.003	< 0.003	0.019	15	0.003	0.005	0.009	4
Nickel	< 0.005	0.0065	0.018	18	< 0.005	< 0.005	0.113	15	< 0.005	< 0.005	0.007	4
Phosphorous	< 0.1	< 0.1	0.4	18	< 0.1	< 0.1	0.7	15	< 0.1	< 0.1	< 0.1	4
Selenium (µg/L)	< 0.2	< 0.2	0.4	12	< 0.2	< 0.2	0.8	8	< 0.2	< 0.2	< 0.2	4
Silver (µg/L)	< 2	< 2	3	18	< 2	< 2	5	15	< 2	< 2	3	4
Sulphur	0.5	3.5	10	18	1.4	2.6	25.7	15	2.8	3.45	3.7	4
Strontium	0.027	0.101	0.302	18	0.487	4.14	14.7	15	1.26	1.38	1.49	4
Titanium	< 0.003	< 0.003	0.012	18	< 0.003	< 0.003	0.012	15	< 0.003	< 0.003	< 0.003	4
Uranium	< 0.5	< 0.5	< 0.5	18	< 0.5	< 0.5	< 0.5	15	< 0.5	< 0.5	< 0.5	4
Vanadium	< 0.002	< 0.002	0.003	18	< 0.002	< 0.002	0.009	15	< 0.002	< 0.002	< 0.002	4
Zinc	0.004	0.012	0.04	18	< 0.001	0.004	0.009	15	0.004	0.004	0.014	4

Table 11 Concentrations of Organic Compounds in Groundwater in the Study Area (μ g/L)

		Surficial	Sand		<u> </u>	Basal A	quifer			Lämest	one	
	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples
PAH and Alkylated PAH's												
Naphthalene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	0.05	5	< 0.02	0.035	0.05	2
Acenaphthene	< 0.02	< 0.02	< 0.02	6	< 0.02	0.03	0.04	5	0.04	0.06	0.08	2
Fluorene	< 0.02	< 0.02	< 0.02	6	< 0.02	0.02	0.06	5	0.07	0.075	0.08	2
Dibenzothiophene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	0.02	0.02	2
Phenanthrene	< 0.02	< 0.02	< 0.02	6	0.02	0.03	0.07	5	0.11	0.125	0.14	2
Anthracene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	< 0.02	< 0.02	2
Fluoranthene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	< 0.02	< 0.02	2
Pyrene	< 0.02	< 0.02	0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	0.025	0.03	2
Benzo(a)anthracene/Chrysene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	0.02	5	< 0.02	0.03	0.04	2
Methyl naphthalene	< 0.02	< 0.02	< 0.02	6	< 0.02	0.04	0.07	5	< 0.02	0.03	0.04	2
C2 sub'd naphthalene	< 0.04	< 0.04	< 0.04	6	< 0.04	0.09	0.32	5	< 0.04	0.05	0.06	2
C3 sub'd naphthalene	< 0.04	< 0.04	0.17	6	0.04	0.12	0.82	5	0.31	0.42	0.53	2
C4 sub'd naphthalene	< 0.04	< 0.04	0.2	6	< 0.04	0.09	0.5	5	0.19	0.27	0.35	2
Biphenyl	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	< 0.04	5	< 0.04	< 0.04	< 0.04	2
Methyl biphenyl	< 0.04	< 0.04	< 0.04	б	< 0.04	< 0.04	< 0.04	5	< 0.04	0.04	0.04	2
C2 sub'd biphenyl	< 0.04	< 0.04	< 0.04	б	< 0.04	< 0.04	< 0.04	5	< 0.04	0.075	0.11	2
Methyl acenaphthene	< 0.04	< 0.04	< 0.04	б	< 0.04	< 0.04	0.06	5	< 0.04	0.06	0.08	2
Methyl fluorene	< 0.04	< 0.04	0.04	6	< 0.04	0.04	0.14	5	0.08	0.125	0.17	2
C2 sub'd fluorene	< 0.04	< 0.04	0.06	6	< 0.04	0.07	0.13	5	0.09	0.155	0.22	2
Methyl phenanthrene/anthracene	< 0.04	< 0.04	< 0.04	6	0.05	0.1	0.13	5	0.22	0.265	0.31	2
C2 sub'd phenanthrene/anth	< 0.04	< 0.04	0.05	6	< 0.04	0.09	0.23	5	0.15	0.25	0.35	2
C3 sub'd phenanthrene/anth	< 0.04	< 0.04	0.06	6	< 0.04	0.05	0.21	5	0.11	0.2	0.29	2
C4 sub'd phenanthrene/anth	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.16	5	0.04	0.085	0.13	2
Methyl dibenzothiophene	< 0.04	< 0.04	< 0.04	6	< 0.04	0.06	0.16	5	0.12	0.18	0.24	2
C2 sub'd dibenzothiophene	< 0.04	< 0.04	0.04	6	< 0.04	0.08	0.13	5	0.15	0.29	0.43	2
C3 sub'd dibenzothiophene	< 0.04	< 0.04	0.06	6	< 0.04	0.09	0.24	5	0.19	0.32	0.45	2
C4 sub'd dibenzothiophene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.06	5	< 0.04	0.15	0.26	2
Methyl fluoranthene/pyrene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.06	5	< 0.04	0.045	0.05	2
Methyl B(a)A/chrysene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.05	5	< 0.04	0.045	0.05	2
C2 sub'd B(a)A/chrysene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.05	5	< 0.04	0.05	0.06	2
Phenolic Compounds in Water												
o-Cresol	< 0.2	< 0.1	< 0.1	6	< 2	< 0.2	< 0.1	5	0.1	0.1	0.1	2
o-Cresol	< 0.2	< 0.1	< 0.1	6	< 2	< 0.2	0.2	5	0.3	0.3	0.3	2
2,4-Dimethylphenol	< 0.2	< 0.1	< 0.1	6	< 2	< 0.2	< 0.1	5	0.1	0.15	0.2	2
PANH and Alkylated PANH's		٠.										
7-Methyl quinoline	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	4	5	< 0.02	< 0.02	< 0.02	2
C2 Alkyl substd quinolines	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	0.32	5	< 0.02	< 0.02	< 0.02	2
Volatile Organics (MS):Water	nd	nd	nd _		nd	nd	nd	contemporary	nd .	nd	nd	E-proposed and a second
•							. '}		* *			

Table 12 - Naphthenic Acid and Microtox Test Results in Groundwater from the Study Area

				Microtox	Microtox	Microtox	Microtox	Naph-
WELL	DATE	Field Conductivity	Field pi l	IC50 15 min %	IC40 15 min	IC30 15 min	1C20 15 min %	thenic Acid
Surficial Sand			Balakarai aski			· · · · · · · · · · · · · · · · · · ·		Entra to - Contract
L97-P95-OB-1	03/17/95		l l					
L97-P95-OB-1	07/03/95	515	7.81	100	100	100	100	<4
L97-P95-OB-1	09/12/95	450	7.71	100	100	100	100	5
L97-P95-OB-2	03/17/95							
L97-P95-OB-2	06/29/95	939	8.07	100	100	100	100	6
L97-P95-OB-2	09/13/95	841	8.05	100	100	100	100	5
L97-P95-OB-3	03/17/95							
L97-P95-OB-3	07/04/95		5.93	100	100	100	100	<3
L97-P95-OB-3	09/12/95	4290	5.95	100	100	100	100	4
L97-P95-OB-4	03/13/95							
L97-P95-OB-4	07/03/95	69	7.16	100	100	100	100	<3
L97-P95-OB-4	09/12/95	47	6.34	100	100	100	100	4
L97-P95-OB-5	03/13/95	······································						
L97-P95-OB-5	07/05/95	955	7.16	100	100	100	100	6
L97-P95-OB-5	09/14/95	968	7.48	100	100	100	100	7
FL7-BRDG-4	03/13/95							
FL7-BRDG-4	07/06/95	487	8.46	100	100	100	100	2
FL7-BRDG-4	09/13/95	181	7.55	100	100	100	100	1
Basal Aquifer								
L97-P95-1-BA	03/13/95							
L97-P95-1-BA	06/28/95	21500	7.18	100	100	100	100	22
L97-P95-1-BA	09/12/95	20700	7.41	100	100	100	100	21
L97-P95-3-BA	03/13/95							
L97-P95-3-BA	07/04/95	14210	6.17	100	100	100	100	31
L97-P95-3-BA	09/13/95	14100	7.28	100	100	100	71	29
FL3-P95-6-BA	03/13/95							
FL3-P95-6-BA	07/10/95	38400	6.51	100	100	100	100	8
FL3-P95-6-BA	09/15/95	43500	6.96	100	100	100	100	9
L97-P95-8-BA	06/28/95	3820	8.03	100	100	100	80	31
L97-P95-8-BA	09/13/95	4710	7.5	100	100	91	34	36
FL3-P95-13-BA	03/13/95							
FL3-P95-13-BA	07/05/95	12280	6.71	100	100	100	100	13
FL3-P95-13-BA	07/05/95	12010	6.66	100	100	100	100	12
FL3-P95-13-BA	09/14/95	14030	7.06	100	100	100	100	12
Limestone								
L97-P95-2-L	03/13/95							
L97-P95-2-L	06/29/95	7770	7.66	100	100	100	59	47
L97-P95-2-L	09/14/95	7620	7.55	100	100	100	75	52
L97-P95-2-L	09/14/95	8150	7.55	100	100	100	49	57

This indicates that the groundwater is meteoric, and has not been affected by any processes such as evaporation.

In general, the chemistry of surficial groundwater from the uplands in the Study Area resembles the regional data presented in Table 6. As a preliminary assessment, it appears that the low TDS groundwater is associated with interaction with water from muskeg. The high TDS groundwater in the surficial sand is probably more closely associated with flow from till and bedrock deposits.

5.1.2 Valley Slopes

Groundwater flow in the slope colluvium is expected to be in the direction of the slope. Localized groundwater discharge occurs along some breaks in slope, and where contrasts in hydraulic conductivity occur.

Evidence of groundwater discharge from the surficial deposits was apparent on both the north and south banks of the Steepbank River. The slopes of the Steepbank and Athabasca Rivers are saturated and unstable in areas.

The groundwater flowing through the colluvium is expected to originate mainly from the surficial deposits on the uplands. The chemistry of the groundwater in the colluvium is therefore probably similar to the chemistry of water in the surficial deposits in the upland. In localized areas, seepage from the Oil Sands beneath the colluvium is likely to be occurring. Where there is seepage, the groundwater in the colluvium may be brackish, with high concentrations of sodium, chloride, and possibly some organic compounds.

5.1.3 Floodplain

5.1.3.1 Hydraulic Conductivity of Surficial Material in Floodplain

One piezometer, FL1-BRDG-#4, was completed in the alluvium in the Athabasca River valley. Unfortunately, the piezometer could not be adequately developed, so it was not tested to determine hydraulic conductivity. The colluvium at the site consisted of 85 per cent sand, with 15 per cent silt and clay (Appendix 1). The hydraulic conductivity of the alluvium is therefore expected to be similar to that measured in sand at Suncor. From Table 4, the range of hydraulic conductivity of sand in the area ranges from 1.1×10^{-8} m/s to 1.0×10^{-3} m/s, with a mean of 1.1×10^{-5} m/s.

The hydraulic conductivity of meltwater sediments in the floodplain has not been measured in the Study Area. The sand and gravel deposits at Suncor are probably a suitable surrogate of what occurs on the east side of the river.

From Table 4, the range of hydraulic conductivity of sand and gravel at Suncor ranges from 7.0×10^{-6} m/s to 1.0×10^{-3} m/s, with a mean of 3.8×10^{-4} m/s.

5.1.3.2 Groundwater Flow in Surficial Material in the Floodplain

The direction of groundwater flow in the floodplain deposits is toward the Athabasca River, with a slight downstream component reflecting the influence of the gradient of the river. The surficial material is believed to be in hydraulic connection with the slope colluvium, the Basal Aquifer and the Upper Devonian.

5.1.3.3 Groundwater Chemistry in Surficial Material in the Floodplain

The groundwater from FL1-BRDG-#4 is representative of one type of water that will be found in the floodplain. Because the predominant direction of groundwater flow in all hydrogeologic units is toward the Athabasca River, the groundwater in the floodplain probably contains mixtures of freshwater from precipitation and surficial deposits, brackish water from bedrock discharge, and possibly river water from bank storage. The chemistry of groundwater in the floodplain is therefore expected to be quite variable, both spatially and temporally.

Groundwater samples from sediments in the floodplain were collected from piezometer FL1-BRDG-#4 in March, July and September. The major ion chemistry of the sample is shown in Table 9. The water is very fresh, with TDS ranging from 81 to 96 mg/L. As shown in the Piper plot in Drawing B-2779-02-22, the water from FL1-BRDG-#4 is very similar to the low TDS groundwater found in the uplands. It is probably groundwater from muskeg and shallow sand deposits that is flowing from the uplands, down through the colluvium toward the river.

Microtox toxicity testing indicates the groundwater is non toxic. Naphthenic acid values range from 1 to 2 mg/L, as shown in Table 15. The surficial groundwater isotopes from this well plot on the meteoric water line (Drawing A-2779-02-23).

5.2 Bedrock Materials

5.2.1 Clearwater Formation

5.2.1.1 Hydraulic Conductivity of Clearwater Formation

The hydraulic conductivity of the Clearwater Formation has not been measured in the Study Area. Hackbarth and Nastasa (1979) found that the hydraulic conductivity ranged from 1.0×10^{-9} m/s to 1.0×10^{-6} m/s, with a mean of 1.5×10^{-7} m/s as shown in Table 5. These values are slightly higher than would be expected for a massive shale deposit. They indicate that fractures and sandstone layers influence the hydraulic conductivity of the formation.

5.2.1.2 Groundwater Flow in Clearwater Formation

The primary direction of groundwater flow in the Clearwater Formation is expected to be downward in the Study Area. The hydraulic head in the overlying surficial deposits is near groundwater level. The head in the Basal Aquifer is 30 m to 70 m below ground, as shown in cross sections C to H (Drawings B-2779-02-12 to B-2779-02-17). Therefore, the hydraulic gradient across the Clearwater is downward. Because the Clearwater Formation has relatively low hydraulic conductivity, the rate of flow through the shale is not great.

5.2.1.3 Chemistry of Groundwater in Clearwater Formation

No groundwater samples have been collected from the Clearwater Formation in the Study Area. The regional data in Table 7 indicates that the groundwater in the Clearwater Formation is slightly brackish, with sodium and bicarbonate being the major ions.

5.2.2 McMurray Oil Sands

5.2.2.1 Hydraulic Conductivity of Oil Sands

The Oil Sands has also not been tested for hydraulic conductivity in the Study Area. As shown in Table 5, the hydraulic conductivity of Oil Sands in the region has been found to range between $3.5 \text{ x}^{-9} \text{ m/s}$ and $3.2 \text{ x } 10^{-7} \text{ m/s}$. Hydraulic conductivity in the order of $1.5 \times 10^{-7} \text{ m/s}$ is expected to be representative of Oil Sands in the Study Area.

5.2.2.2 Groundwater Flow in McMurray Oil Sands

The direction and rate of groundwater flow in the Oil Sands is similar to flow in the Clearwater Formation The hydraulic gradient is predominantly downward in the Study Area. The rate of flow in the Oil Sands is low, because of the relatively low hydraulic conductivity of the unit.

Where the Oil Sands is exposed in the river valleys, some groundwater may seep out of the slope face from zones of lower oil saturation. The amount of water flowing through these zones is expected to be small, and not significant in terms of this EIA.

5.2.2.3 Chemistry of Groundwater in McMurray Oil Sands

No groundwater samples have been collected from the Oil Sands in the Study Area. The regional groundwater chemistry data in Table 7 indicates that the groundwater in the Oil Sands varies widely from fresh to saline. Sodium, chloride and bicarbonate are the major ions in groundwater. Organic compounds are also found in groundwater from the Oil Sands.

5.2.3 Basal Aquifer

5.2.3.1 Hydraulic Conductivity of the Basal Aquifer

Four piezometers in the Basal Aquifer in the Study Area were subjected to short term pumping tests. Table 13 shows the transmissivity calculated from the response in the piezometers. The transmissivity ranged from 0.07 m^2 /day to 11.2 m^2 /day, with a mean of 2.0 m^2 /day. The hydraulic conductivity range from $8.6 \times 10^{-8} \text{ m/s}$ to $0.6 \times 10^{-5} \text{ m/s}$, with a mean of $4.1 \times 10^{-6} \text{ m/s}$. These values are approximately an order of magnitude less than what was found in the Alsands area (Table 5). This indicates that the Basal Aquifer in the Study Area may not be quite as productive as in the Alsands area.

5.2.3.2 Groundwater Flow in the Basal Aquifer

The predominant direction of groundwater flow in the Basal Aquifer is west, toward the Athabasca River. The hydraulic head measured in the aquifer is plotted on cross sections C to H (Drawings B-2779-02-12 to B-2779-02-17). The head in the aquifer is 306 masl in piezometer FL1-P95-13-BA (Drawing B-2779-02-24). Closer to the Athabasca River, the head approaches the level of the river. Farther to the east, the head in the aquifer is expected to approach ground level, as has been found at Alsands.

A horizontal component of flow in the Basal Aquifer is also expected to be directed toward the Steepbank River. This flow occurs in places where the Steepbank River has incised below the bottom of the Oil Sands. In places where the Upper Devonian surface is high, and the Basal Aquifer is absent, groundwater probably flows from the Basal Aquifer through the Devonian. Therefore, at the west end of the Steepbank River, which has cut into the limestone, groundwater probably flows from the Basal Aquifer, through the limestone, and discharges into the river. This interpretation is supported by the fact that both the Basal Aquifer and Upper Devonian have similar hydraulic conductivities and heads. The groundwater flow map presented in Drawing B-2779-02-24 shows the direction of flow in the Basal Aquifer and Upper Devonian.

5.2.3.3 Chemistry of Groundwater in the Basal Aquifer

Groundwater from four piezometers (L97-P95-1-BA, L97-P95-3-BA, FL3-P95-6-BA and FL3-P95-13-BA) was collected in March, July and September, 1995. The data in Table 9 shows groundwater in the Basal Aquifer is brackish to saline. The major ions are sodium, potassium, chloride and bicarbondate. The TDS of the water ranged from 2620 mg/L to 29 383 mg/L, with a mean of 11 723 mg/L. This is slightly higher than the range of concentrations found in the Basal Aquifer in the Alsands area (Table 7). In general, the water quality in the aquifer in the Study Area is very similar to the regional water in the Basal Aquifer.

Table 13
Summary of Transmissivity and Hydraulic Conductivity Measured in Bedrock in the Study Area

Piezometer/Well Number	Location	Date	Thickness (m)	Flow (Q) (m³/day)	Transmissivit y (T) (m²/day)	Hydraulic Conductivity (m/s)
L97-P95-1-BA	7-20-92-9W4	1995/03	5.8	6	11.2	2.2 x 10 ⁻⁵
L97-P95-3-BA	6-20-92-9W4	1995/03	3.6	5	1.8	5.8 x 10 ⁻⁶
FL3-P95-6-BA	12-9-92-9W4	1995/03	9.8	3	0.07	8.6 x 10 ⁻⁸
FL1-P95-13-BA	13 - 28-92- 9W4	1995/03	5.0	11	11.2	2.6 x 10 ⁻⁵
		A	Geometric Me	ean	2.0	4.1 x 10 ⁻⁶
Waterways Fm.						
L97-P-95-2-L	15-17-92- 9W4	1995/03	4.5	6	2.2	5.8 x 10 ⁻⁶

Organic compounds, in particular PAH, alkylated PAH's, PANH and alkylated PANH's, were detected in groundwater from the Basal Aquifer as shown in Table 11. Naphthenic acid values range from 8 to 36 mg/L with a mean of 20 mg/L (Table 12). Microtox toxicity testing indicates the groundwater is non-toxic. Basal Aquifer groundwater isotopes plot on the meteoric water line, (Drawing A-2779-02-23) indicating the water is meteoric.

-37-

An additional note about groundwater in the Basal Aquifer concerns natural gas. Gas was observed to effervesce from the groundwater when exposed to atmospheric pressure.

5.2.4 Upper Devonian

5.2.4.1 Hydraulic Conductivity of the Upper Devonian

Piezometer L97-P95-2-L was subjected to a short pumping test. The transmissivity of the Upper Devonian limestone calculated from the test results was 2.2 m²/day, as shown in Table 13. In terms of hydraulic conductivity, this equates to 5.8 x 10⁻⁶ m/s. This is within the range of values found for the Upper Devonian elsewhere in the region (Table 5). It is also the same order of magnitude as the hydraulic conductivity of the Basal Aquifer.

5.2.4.2 Groundwater Flow in the Upper Devonian

As has been discussed in Section 5.3.2 above, it appears likely that groundwater flow in the Basal Aquifer and Upper Devonian is interconnected. As shown in the cross sections in Drawing B-2779-02-12 to B-2779-02-17, the hydraulic head in the two units is similar. Because the two units have similar hydraulic conductivity, there is no hydraulic barrier to impede flow between them. Furthermore, as can be seen in the cross sections, the Upper Devonian surface protrudes above the top of the Basal Aquifer in many locations. Therefore water flowing horizontally through the Basal Aquifer probably flows through the highs in the Upper Devonian surface and back into the Basal Aquifer. This interpretation is consistent with observations made by Hackbarth and Nastasa (1979).

As in the Basal Aquifer, the primary direction of groundwater flow in the Upper Devonian is toward the Athabasca River. There is also a component of groundwater flow toward to lower reach of the Steepbank River, where the river is incised below the bottom of the Oil Sands. The direction of horizontal flow in the Upper Devonian and Basal Aquifer is illustrated in the groundwater flow map in Drawing B-2779-02-24.

Vertical hydraulic gradients, both upward and downward, are also present in the Upper Devonian strata. These gradients were measured in pairs of nested pneumatic piezometers (L97-P95-4A,B-L, L97-P95-5A,B-L, L97-P95-7A,B-L, and L97-P95-14A,B-L). The locations of the piezometers are shown in Drawing B-2779-02-02. The cross sections in Drawings B-2779-02-12, B-2779-02-14 and B-2779-02-15 show the elevation

PA2779 0201 2779-GIA.wpd -38-

May 21, 1996

of head in some of these piezometers. The pattern of vertical gradients in the Upper Devonian strata is not yet

understood.

5.2.4.3 Chemistry of Groundwater in the Upper Devonian

Groundwater from the Upper Devonian limestone was collected from piezometer L97-P-2-L in March, June and

September 1995. The major ion chemistry of the water is shown in Table 9. The groundwater from the limestone

is brackish, with TDS ranging from 4051 to 4934 mg/L. This is within the range of concentrations from in the

Upper Devonian at Alsands and Suncor, but lower than the mean level of 11 807 mg/L (Table 7). The major ions

in the groundwater are sodium, chloride and bicarbonate, which is also consistent with what has been found

elsewhere in the region.

Organic compounds, in particular PAH, alkylated PAH's and phenolic compounds, were detected in groundwater

from the Upper Devonian limestone (Table 11). Naphthenic acid values range from 47 to 57 mg/L, with a mean

of 52 mg/L (Table 12). Microtox toxicity testing indicates the groundwater is non-toxic. Upper Devonian

groundwater isotopes plot on the meteoric water line, indicating the groundwater is meteoric (Drawing A-2779-02-

23).

5.3 Potential for Groundwater Use as a Resource

Currently, there are no groundwater users in the Study Area. There are no water wells on the east side of the

Athabasca River or south of the Steepbank River within 10 km of the Study Area.

The potential for groundwater to be used in the area as a resource is dependant upon the productivity of the

aquifers, and the natural quality of the groundwater. The productivity of the aquifers has been assessed on the basis

of their long term yield. In Alberta, this is commonly quantified by calculating the 20-year yield, or Q_{20} (Alberta

Environment 1983). The Q₂₀ is an estimate of the maximum rate at which water can be withdrawn from a well for

20 years that will not lower the water level in the well below the top of the aquifer. It is calculated using the

following equation:

 $Q_{20} = 0.683 \text{ THF}$

where,

T = transmissivity of the aquifer, m2/day

H = available drawdown in the aquifer, m

F = a factor of safety, in this case assumed to be 0.7.

Klohn-Crippen

The recommended minimum Q₂₀ for a single dwelling in Alberta is 1 m³/day (Alberta Environment 1983).

The water quality of the aquifers has been assessed on the basis of CCME (1991) criteria and the concentrations of naturally-occurring organic compounds. Table 15 shows a summary of the water quality parameters in the groundwater that exceed the CCME guidelines.

There are two potential sources of groundwater from surficial deposits. These are the sand aquifer in the uplands, and the sand and gravel aquifer in the Athabasca River valley.

Table 14
Groundwater Quality Parameters Which Exceed CCME Guidelines

	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Iron (mg/L)	Mercury (mg/L)	Manganese (mg/L)
Median Concentr	ation Found in	Groundwater a	t Steepbank Min	e		,
Basal Aquifer	3290	4090	8613	0.7	1.6	0.28
Limestone	1855	1613	4700	0.75	0.23	0.08
Surficial Aquifer	9.4	4.3	183	0.07	1.	0.07
CCME Guideline	s					
Drinking Water	200	250	500	0.3	1	_
Irrigation	-	_	500-3500	5	-	0.01-0.05
Watering Livestock	-	100-700	3000		-	0.5

In the upland, the water quality in the sand aquifer is good, as discussed in Section 5.1. However, the productivity of the aquifer is limited by the following factors:

- relatively low hydraulic conductivity;
- the thinness of the aquifer; and
- lack of available drawdown.

The mean hydraulic conductivity of the aquifer is 3.6×10^{-6} m/s (Table 8). The aquifer ranges in thickness from 1 m to 10 m, with an average of less than 3 m. Therefore the transmissivity of the aquifer (the product of hydraulic conductivity and thickness) is roughly 0.95 m²/day trapless. The available drawdown, which is the difference

between the elevations of the potentiometric surface and the top of the aquifer, is approximately 2 m. From the equation shown above, the Q₂₀ for the sand aquifer is estimated to 0.9 m³/day, which is less than the recommended minimum of 1 m³/day. The sand aquifer in the upland is therefore not a viable source of water for domestic use.

In the Athabasca River valley, the surficial sand and gravel aquifer is expected to be more productive. As has been discussed in Section 5.1, the hydraulic conductivity of the aquifer is expected to be in the order of 3.8 x 10⁻⁴ m/s (Table 4). Although the aquifer is limited areally to the valley, it is hydraulically connected to the river. Therefore, wells can probably be constructed in the aquifer that will induce water from the Athabasca River. The long-term yield from this aquifer is therefore expected to be greater than 780 m³/day.

In the bedrock aquifers (the Basal Aquifer and Upper Devonian limestone), the transmissivity is 2 m²/day, and the available drawdown is in the order of 40 m. Therefore, the Q₂₀ for the bedrock aquifers is approximately 40 m³/day, which would be adequate for many water supply purposes. However, the water quality in the bedrock is poor. As shown in Table 15, the water exceeds CCME criteria for sodium, chloride, mercury, iron, manganese and total dissolved solids. Furthermore, as shown in Tables 11 and 12, the bedrock groundwater contains naturally-occurring organic compounds. The groundwater is therefore not suitable for drinking water or agricultural use, without pre-treatment. Hence the bedrock aquifers are not a valuable water supply resource, with the exception perhaps, as industrial water supply.

5.4 Groundwater/Surface Water Interaction

The interaction of groundwater with surface water bodies in the Steepbank Mine area is expected to be the most important issue of the hydrogeologic component of the EIA. As has been discussed in Sections 3 and 5, groundwater from both the surficial material and the bedrock flows toward the river valley. This section discusses the rate of groundwater discharge into the surface water bodies in the Study Area: the Athabasca River, the Steepbank River, Shipyard Lake, and the small creeks that drain the Study Area; Leggett Creek, Wood Creek, and an unnamed creek (shown in Drawing A-2779-02-01).

5.4.1 Methodology

The groundwater discharge has been calculated for flow from surficial deposits and bedrock. The water in muskeg has not been included as groundwater. Flow from muskeg is presented in the hydrology component of the EIA.

The discharge of groundwater has been estimated using the following equations, which are adaptations of Darcy' Law:

from surficial aquifers;

Q = KbiL

from bedrock aquifers

Q = TiL

where:

Q = the rate of discharge into the river

K = the hydraulic conductivity of the aquifer, m/s

b = the thickness of the aquifer, m

T = the transmissivity of the aquifer, m2/day

i= the hydraulic gradient in the aquifer, m/m

L = the length of reach over which the aquifer is exposed to the surface water body, m.

A thin veneer of sandy material is present within the surficial deposits over most of the uplands in the Study Area. Because it is believed that the hydraulic conductivity of the sand is much higher than that of any other surficial deposits, the sand is the only surficial deposit for which groundwater discharge has been calculated. The mean hydraulic conductivity of the sand is 3.7 x 10⁻⁶ m/s (Table 8). There is not enough water level information from the surficial aquifer to determine the hydraulic gradient. It has therefore been assumed that the hydraulic gradient in the surficial aquifer in the upland is approximately equal to the gradient of the land surface.

In the bedrock, the two main aquifers are the Basal Aquifer and the limestone in the Upper Devonian strata. The formations that are above these deposits (McMurray Oil Sands and Clearwater shale) are several orders of magnitude less permeable to water than these aquifers. The mean transmissivity of the Basal Aquifer is 2.0 m²/day (Table 13). The transmissivity of the limestone has been found to be 2.2 m²/day. The Basal Aquifer is present in only a small portion of the area that will actually be excavated to mine the ore. The limestone is present over the entire site. As the transmissivities of the two units appear to be so similar, and the Basal Aquifer is discontinuous, groundwater discharge from bedrock has been calculated using a transmissivity of 2.0 m²/day.

The estimated rates of groundwater discharge from the surficial and bedrock aquifers to surface water are shown in Table 15. The discharge to each surface water body is discussed below.

Table 15

Baseline Flow Rates of Groundwater Discharge to Surface WaterBodies in the Study Area

		I	Discharge Re	ntes (L/s)			
Source	Athabasca River	Steepbank River	Shipyard Lake	Leggett Creek	Wood Creek	unnamed	TOTALS
Surficial Deposits	0.44	0.22	0.17	0	0	0	0.83
Bedrock Aquifers	0.93	0.20	0.56	0	0	0	1.69
TOTALS	1.37	0.42	0.73	0	10	10	2.52

5.4.2 Athabasca River

The length of the reach of the Athabasca River in the Study Area that will be adjacent to the mine area is approximately 8 km. Shipyard Lake, which will probably intercept groundwater before it discharges into the Athabasca River, is approximately 3 km long. Therefore, the length over which groundwater will discharge directly to the Athabasca River is roughly 5 km.

The gradient of the ground surface in the upland is about 0.01. Therefore, as explained above, the hydraulic gradient of the surficial aquifer is estimated to be 0.01. The thickness of the surficial aquifer in the upland varies across the site. North of the un-named creek (Drawing B-2779-02-09), the average thickness of the sand unit is roughly 3 m. South of the un-named creek, it is approximately 1.5 m thick. The length of river on the north side of the creek is approximately 3 km. The rate of groundwater discharge on the north side of the creek from the surficial aquifer is therefore approximately 0.33 L/s (29 m³/day). On the south side of the creek, the length of river (less the length of Shipyard Lake) is roughly 2 km. Therefore, the rate of groundwater discharge on the south side of the creek is approximately 0.11 L/s (9.5 m³/day). Hence, the total baseline groundwater discharge from the surficial aquifer to the Athabasca River is 0.44 L/s (38 m³/day).

The hydraulic gradient in the bedrock aquifers has been estimated from Drawing B-2779-02-24 to be 0.008. Therefore, the rate of groundwater discharge from the bedrock aquifers to the Athabasca River is approximately 0.93 L/s (80 m³/day).

5.4.3 Steepbank River

The length of the reach of the Steepbank River that will be adjacent to the proposed mine area is approximately 2 km. The slope of the ground surface, and therefore the hydraulic gradient in the surficial aquifer, is roughly Klohn-Crippen

PA2779 0201 May 21, 1996 2779-GIA.wpd

0.01. Therefore, the rate of groundwater discharge from the surficial aquifer to the Steepbank River is 0.22 L/s

(19 m³/day).

The hydraulic gradient toward the Steepbank River from the bedrock aquifers (Drawing B-2779-02-24) is

about 0.004. Therefore, the groundwater discharge from the bedrock aquifers to the Steepbank River is

0.20 L/s (16 m³/day).

5.4.4 Shipyard Lake

The groundwater discharge from the Study Area to Shipyard Lake can be estimated in the same manner as was

done for discharge to the Athabasca River. The only change between the two calculations is the length of

wetland over which the discharge occurs. Shipyard Lake is approximately 3 km long. Therefore, the rate of

groundwater discharge into the wetland from the surficial aquifer is 0.17 L/s (15 m³/day). The rate of

groundwater discharge into the wetlands from the bedrock aquifers is 0.56 L/s (48 m³/day). It is possible that

some of the groundwater flowing in the bedrock aquifers may pass under Shipyard Lake, and discharge into the

Athabasca River. Therefore, this estimate of groundwater discharge to Shipyard Lake may represent a slight

overestimate.

5.4.5 Leggett Creek, Wood Creek and Unnamed Creek

The baseflows (i.e. winter flows) in Leggett Creek, Wood Creek and the unnamed creek are zero, (Klohn-

Crippen 1996). This indicates that the rate of groundwater discharge into the creeks in winter is zero. Based

on observations made during field visits, it is expected that the rate groundwater discharge to these creeks is

essentially zero.

5.4.6 Summary of Groundwater/Surface Water Interaction

The rates of groundwater discharge from the surficial and bedrock aquifers in the Study Area to surface waters

are very low. As shown in Table 15, the total rate of groundwater discharge to all surface water bodies in the

Study Area is estimated to be 2.52 L/s. The rates of groundwater discharge to the Athabasca River, the

Steepbank River, and Shipyard Lake are 1.37 L/s, 0.42 L/s and 0.73 L/s, respectively. In comparison, the

minimum monthly flows recorded in the Athabasca and Steepbank Rivers (Klohn-Crippen 1996) are:

Athabasca River

101,000 L/s

(

Steepbank River

168 L/s.

PA2779 0201 2779-GIA.wpd -44-

May 21, 1996

Shipyard Lake

111 L/s.

Therefore, the rates of groundwater discharge in the Study Area are less than 1 % of the minimum average surface water flows in the Athabasca and Steepbank Rivers, and less than 1 % of the average flow into Shipyard Lake.

6. CONCLUSIONS

6.1 Geology

The geology of the surficial deposits is characterized in three physiographic settings; uplands, valley slopes and floodplain. The stratigraphy of surficial deposits in the uplands is, from top to bottom:

muskeg stratified sediments till bedrock

Most of the upland is covered with muskeg, which is generally less than 1 m thick. The underlying stratified sediments form a discontinuous layer of sand over the Study Area. The sand appears to be glaciolacustrine or glaciofluvial in origin. The stratified sediments range in thickness from 1 m to 10 m. Beneath the stratified sediments, till rests on bedrock over nearly the entire upland. The till ranges from being sandy, where it rests on sandstone, to very clayey, where it is in contact with shale. From its lithology, the till appears to be the Firebag till described by McPherson and Kathol (1977). The thickness of the till ranges from zero at the edge of the uplands to 28 m. The total thickness of the surficial deposits in the uplands ranges from 1 m to 45 m. The thickest deposits appear to be in Lease 19. There is no evidence of buried channel deposits in the uplands.

The valley slopes along the Steepbank River and the Athabasca River are covered with colluvium, which consists mainly of sandy and silty material, with some bituminous sand.

The floodplain on the east bank of the Athabasca River is comprised of organic material and alluvial sand silt and clay, with some sand and gravel meltwater deposits. The thickness of sediments in the floodplain is as great as 25 m.

The simplified bedrock stratigraphy in the area is:

Clearwater Formation
McMurray Oil Sands
Basal Aquifer
Upper Devonian Klohn-Crippen

Shale of the Clearwater Formation is the uppermost bedrock unit over most of the upland. The shale is approximately 10 m thick in the east portion of the Study Area, and thins toward the west. The Oil Sands deposit in the Study Area is between 50 m and 75 m thick. It subcrops in the Athabasca River valley and outcrops along the lower reaches of the Steepbank River.

-45-

The Basal Aquifer is an extensive discontinuous unit within the McMurray Formation. The aquifer is generally positioned at the bottom of the Oil Sands, and is commonly absent above topographic highs in the surface of the underlying Devonian. The aquifer is up to 50 m thick in Fee Lot 1, and ranges from zero to 30 m thick throughout the rest of the Study Area. The Basal Aquifer is absent in the south half of Lease 97, and the northwest of Fee Lot 1.

The Upper Devonian deposit is limestone of the Waterways Formation. The Upper Devonian surface has 100 m of relief, with numerous depressions and topographic highs. The highly irregular surface is the result of karstification, and collapse of karst features. The rock observed in outcrops and core samples is weathered and highly fractured. The Upper Devonian is exposed along the Athabasca River, and the lower reaches of the Steepbank River.

6.2 Hydrogeology

Groundwater flow in the stratified surficial sediments is toward the Steepbank and Athabasca Rivers. On the north side of the Steepbank, most of the flow is to the Steepbank River. South of the Steepbank, the vast majority of the groundwater in the surficial sand flows toward the Athabasca River. The mean hydraulic conductivity of the sand is 3.7×10^{-6} m/s.

The direction of hydraulic gradients in the till, the Clearwater Formation and the McMurray Oil Sands is predominantly vertically downward. These units have relatively low hydraulic conductivity, in the order of 10⁻⁷ m/s.

The groundwater in the Basal Aquifer and the Upper Devonian is flowing predominantly toward the Athabasca River. In the vicinity of the lower reach of the Steepbank River, where the river has cut below the bottom of the Oil Sands, a component of the flow in the aquifer is toward the Steepbank River.

Under most of the upland area, the hydraulic head in both the Basal Aquifer and the Upper Devonian is above the bottom of the McMurray Oil Sands. The Basal Aquifer and Upper Devonian appear to have similar hydraulic conductivities. The mean hydraulic conductivity of the Basal Aquifer is 4.1 x 10⁻⁶ m/s. The hydraulic conductivity measured in one piezometer completed in the Upper Devonian is 5.8 x 10⁻⁶ m/s.

The groundwater in surficial deposits is quite fresh. The concentration of total dissolved solids ranges from 24 mg/L to 623 mg/L. The freshest water is similar to water found in the muskeg. The water with higher TDS is associated with till and bedrock. The major ions in the surficial groundwater are calcium, magnesium and bicarbonate. The water with higher TDS levels also tends to have higher concentrations of sodium.

In the Oil Sands, Basal Aquifer and Upper Devonian, the groundwater chemistry ranges from brackish to saline. The units contain similar water, with the major ions being sodium, chloride and bicarbonate. The water in the Oil Sands also contains organic compounds, including naphthenic acid. In the Basal Aquifer, the concentration of TDS ranges from 2,620 mg/L to 29,383 mg/L. The concentration of naphthenic acid in the Basal Aquifer ranges from 6 mg/L to 36 mg/L. Mercury was found at a concentration of 1.6 µg/L in one sample of groundwater from the Basal Aquifer. In the Upper Devonian, the concentration of TDS has been found to range from 1,108 mg/L to 29,024 mg/L. In the Study Area, the median TDS in groundwater from the one piezometer completed in the Upper Devonian was 4,700 mg/L. The median concentration of naphthenic acid in the limestone was 52 mg/L.

In terms of groundwater resources, the surficial aquifer in the uplands and the bedrock aquifers were found to be unsuitable sources of water supply. The long-term yield (Q₂₀) from the surficial aquifer is inadequate (less than 1 m³/day). The bedrock aquifers are capable of yielding higher volumes of water. However, the water quality in the bedrock aquifers is poor, and could not be utilized for drinking water or agricultural purposes without pre-treatment.

The surficial aquifer in the Athabasca River valley is expected to be a viable source of groundwater.

The contribution of groundwater discharge to surface water has been found to be very minor. The total rate of groundwater discharge from surficial and bedrock aquifers to all water bodies in the Study Area is estimated to be 2.52 L/s. The rates of groundwater discharge are less than 1 % of the minimum average surface water flows in the Athabasca and Steepbank Rivers, and less than 1 % of the average flow into Shipyard Lake.

PA2779 0201 2779-GIA.wpd

PART III - IMPACT ASSESSMENT - MINING AND POST-RECLAMATION

1. INTRODUCTION

The purpose of the hydrogeologic component of the Environmental Impact Assessment is to identify changes to surface water or groundwater that may result from the development of the proposed Steepbank Mine. In particular, this assessment evaluates the impact of the mine on two groundwater-related issues of special concern, which have been identified in a process of consultation with stakeholders, regulators and environmental professionals. These issues are encapsulated in the following key Hypothesis Statements:

-47-

- 1. Flows in the Athabasca and Steepbank Rivers would be significantly changed by mine development, withdrawals for extraction and upgrading, or reclamation.
- Groundwater quality could be affected by contaminant migration from processing and extraction activities.

In addition, some of the information in this report has been used to identify the effect of mine development on other environmental resources; in particular the aquatic resources (Suncor 1996). The impacts on specific disciplines, such as human health, soils, vegetation and terrain, aquatic resources and wildlife, are evaluated and discussed in other reports that support the Environmental Impact Assessment.

2. KEY FACTORS USED TO ASSESS IMPACT

The impacts to groundwater of the development and reclamation of the mine have been evaluated on the basis of changes to:

Direction of groundwater flow;

Rate of groundwater discharge to surface water bodies; and

Groundwater quality.

The term "water quality" refers to the concentration of dissolved and suspended compounds found, either naturally or otherwise, in the water.

The degree of significance of various impacts was assessed by a qualitative evaluation of the severity, duration and anticipated areal extent of each impact. The severity of each impact was assessed as either high, medium or low, based on the impacts to either flow or water quality. The duration of the impact was categorized as being short term if the impact occurred through the life of the mine or long-term if beyond the life of the mine. The areal extent of the impact was considered local if the effect was in the immediate mine area, or regional if beyond the immediate mine area. A final assessment of the degree of concern was made based on the expected impact on the receiving water body (either the Athabasca or Steepbank Rivers, or Shipyard Lake).

3. MINE DEVELOPMENT

3.1 Design Philosophy

During the construction and operation of the mine, both surface run-off and groundwater will be diverted to facilitate mining. The Steepbank Mine will be designed with systems to handle this water, to ensure that only water of acceptible quality flows into receiving waters. To achieve this, there will be one drainage system to collect all water that has contacted Oil Sands or mine processing, or that has been produced from the bedrock aquifers. The water in this system will be piped across the river, and used as process water. All water from up-gradient of the mine, including surface run-off and groundwater diverted from surficial deposits by dewatering, will be released into existing surface water bodies. These drainage systems are described more fully in the surface water impact analysis document, (Klohn-Crippen 1996).

3.2 Chronology of Mine Development

Following is a brief description and chronology of the components of mine development pertinent to the assessment of impacts on water resources in the Study Area. Plans showing the overall mine development and drainage plans in 2001, 2009 and 2020, and post reclamation are attached (Drawings A-2770-01-003 to A-2770-01-006).

1995 Baseline Conditions

- Background or pre-mine conditions.

- 1997 - 2001 (Facility Construction)

- Bridge construction will start in 1997 and is expected to be completed in 1999. Until this time, the Athabasca River will be crossed by barge or using an ice bridge.
- Permanent access roads will be constructed in 1998.
- The gravel pit will be developed in 1997 and 1998.
- Initial site drainage for Pit 1, stormwater retention ponds A, B, C and D will be completed by 2000.
- Surficial deposits at Pit 1 are dewatered, and groundwater is diverted around the pit.
- The excavation of Pit 1 will start in 2000. Overburden will be placed in the active mine area.
- Plant facilities, water supply systems and sewage disposal system will be constructed between 1997 and 2000.
- Two water wells for supplying plant and shop facilities have been completed in the surficial deposits on the Athabasca River floodplain. Total well production is estimated to be approximately 7.6 L/s (650 m³/day).
- The bridge is constructed, and plant and shop facilities are in place. Klohn-Crippen

- The North Dump is being used for overburden.
- Ditch 0-3 has been constructed to intercept natural runoff flowing west towards Pit 1 and convey it to Shipyard Lake.

-49-

2001 - 2009 (Pit 1 Development)

- Excavation of Pit 1 continues until 2009.
- Construction of Dyke 10 starts in 2002. Until 2005, there will be limited opportunity for storing excess mine drainage in Pit 1. It is assumed that Dyke 10 will be revegetated as construction progresses.
- Dyke 10A is built in 2007 and 2008. This dyke, together with Dyke 10 will permit the use of Pond 7A for tailings disposal while the south portion of Pit 1 is being excavated.
- Part of Shipyard Lake is drained in 2004 in preparation for placing the West Dump and 600 000 m³ of muskeg has been removed.
- Overburden material is being placed on the North, West and East Dumps. It is planned to construct the West Dump over part of Shipyard Lake, reducing the total area of this wetlands from 144 to 92 hectares and the area of open water from 23 to 5 hectares.
- Ditches 3-A and 3-B are constructed east of Pit 1 in 2003 to collect natural runoff flowing west towards the pit and convey it to the Shipyard Lake.
- Ditches 9-A and 9-B are constructed in 2008 to intercept natural runoff. The north portion of the runoff is conveyed to Shipyard Lake in Ditch 9A and the southern portion of the drainage is conveyed to Leggett Creek in Ditch 9-B.
- Mine stormwater retention pond D' is constructed.
- It is assumed that de-pressurizing the Basal Aquifer under the southern portion of Pit 1 commences in this period.
- The mining of Pit 1 is completed in 2009 and the excavated area is used for disposal of consolidated tailings (CT) (Ponds 7A and 7B). The water surface elevation in the ponds will be 297 m (above Geodetic Datum).
- The excavation of Pit 2 starts in 2009.
- The construction of Dyke 11 at the west edge of Pit 2 is started.

2009 - 2020 (Pit 2 Development)

- The mining of Pit 2 continues until 2020.
- Surficial deposits at Pit 2 are dewatered and shallow groundwater is diverted around the pit.
- Overburden is being placed on the South Dump.
- It is expected that the Basal Aquifer and Upper Devonian limestone under Pit 2 have been de-pressurized.
- In 2015, tailings disposal begins in Pond 8A.

- Perimeter drainage ditches 15-A and 15-B are constructed in 2012 and Ditch 15-C in 2015.
 These ditches divert natural runoff from the area to the east of the mine to Wood Creek.
 Construction of the perimeter ditch will increase the area draining to Wood Creek by 240% and will reduce the area draining to Shipyard Lake by 83%.
- Construction of Dyke 11 is completed in 2016. Dyke 11A and 11B are built between 2013 and 2016, and 2015 and 2019, respectively. The construction of Dyke 12 at the east side of Pit 2 is started in 2017.
- Consolidated tailings (CT) start to be placed in Pond 8A in 2016.
- As of 2020, the mining in Pit 2 is finished. The static level in the deep bedrock aquifers (Basal Aquifer and Upper Devonian) is expected to have returned to pre-mine levels.
- The water surface elevation in Pond 7 and Pond 8 is 326 m and 304 m, respectively.

Post Closure Equilibrium

- It is expected that the same closure philosophy proposed for the existing Lease 86 mine will be adopted for the Steepbank Mine. This will include reclaiming and seeding disturbed areas, seeding overburden dumps and exposed dyke slopes, providing drainage systems to remove excess water from the tailings areas and vegetating the dry tailings surfaces.
- As the tailings consolidate, water is released. Initially, the water release rate is estimated to be approximately 90 L/s from Pond 7 and 100 L/s from Pond 8. It is expected that this discharge will be channelled to Shipyard Lake with pre-treatment if the water quality is not considered acceptable. This discharge is expected to reduce to nearly zero over a period of 60 to 80 years.
- Both Ponds 7 and 8 have been filled with consolidated tailings (CT) to 327 m elevation.

4. METHODOLOGY

4.1 Spatial and Temporal Boundaries

The Study Area of the hydrogeologic impact assessment is the same as the baseline Study Area, which is shown in Drawing A-2779-02-01. The temporal boundaries of the Impact Analysis have been selected to compare the three main stages of the mine development with the baseline conditions:

Construction Phase (1997 to 2001); Operational Phase (2001 to 2020); and Post Reclamation.

The construction and operation phases have been assessed by evaluating the conditions that are expected to exist in 2001, 2009 and 2020. The post reclamation conditions in the Study Area have been assessed as the long-term, steady state conditions that will exist several years after the closure and reclamation of the mine. These are the same 'snap shots' in time that have been evaluated in the aquatics impact analysis (Suncor 1996), in which the results of the hydrogeologic impact analysis have been incorporated. Drawings A-2779-

02-25 to B-2779-02-28 show the mine development and drainage plans for 2001, 2009, 2020 and post reclamation.

4.2 Changes in Groundwater Flow Rates

All changes in flows caused by activities at the mine have been treated as being instantaneous. That is to say, aquifer storage, and travel time have not been included in any calculations. This has the effect of accelerating any impacts, and results in a slightly conservative impact assessment. This approach has also provided two benefits. It allows the evaluations of the impacts to be performed with relatively simple calculations. It also makes it easier to discuss the potential impacts of each aspect of mine development - i.e. both cause and effect can be discussed in the same time frame.

5 IMPACTS OF MINE DEVELOPMENT ON GROUNDWATER

5.1 Construction Phase (1997 - 2000? [2001?])

In the period from 1997 to 2000, during the construction phase of the mine development, three things may impact the groundwater system. These are:

The commencement of de-watering of the surficial deposits;

The commencement of mining from Pit 1; and

The construction of water supply wells.

At this early stage in the mine development, the initial de-watering of the surficial deposits and excavation of Pit 1 are expected to have only a very minor impact on the groundwater. This is because the mining activity will start at the north end of Pit 1, in a relatively small area, where surficial deposits are very thin. The effects of de-watering and mining will be more pronounced after 2001. Those impacts are discussed in the sections to follow.

The primary effect that the construction phase is expected to have on the groundwater system is associated with the water supply wells for the new facility. It is planned that two or three water wells will be constructed in the sand and gravel between the Athabasca River and the outflow from Shipyard Lake. The combined withdrawal rate of these wells will be approximately 7.5 L/s (650 m³/day). Because of the proximity of the wells to the river, the majority of the well production will be induced infiltration from the Athabasca River. The effect of the wells on the groundwater will therefore be localized to a small area in the river valley. Hence, in terms of groundwater discharge to surface water, there will be no real change in the rate of discharge to any of the water bodies, although the new wells will reduce the flow in the Athabasca River by an amount roughly equal to their pumping rate.

5.2 Mine Operations (2000 -2009)

During the first ten years of the operation of the mine, the effects imposed on the groundwater system will be associated with the excavation of Pit 1. The activities that will affect the groundwater are:

The surficial deposits will be de-watered;

The bedrock aquifers may be de-pressurized;

Pit 1 will be mined; and

Consolidated tailings (CT) will be placed in the pit once the ore has been mined.

As is discussed below, the result of these acitivities will be slight changes to the direction of flow, rates of discharge and quality of some components of the groundwater system. Table 16 shows the rates of groundwater discharge to surface water that are expected to occur in 2009, at the end of this phase of mine development.

Surficial Deposits

The surficial deposits up-gradient of Pit 1 will be de-watered, to facilitate the stripping of overburden prior to the mining of Pit 1. The groundwater flow in the surficial aquifer will be intercepted with a diversion system on the east side of the mine which is connected to the surface water pre-mine drainage system. By 2009, groundwater in the surficial aquifer up-gradient of both Pits 1 and 2 will be diverted to Shipyard Lake and Leggett Creek. From there, it will ultimately discharge into the Athabasca River. The diversion of groundwater from the surficial aquifer is expected to continue after the closure of the mine.

The total volume of groundwater discharging from the surficial aquifer to the surface water environment will not change. However, the nature of groundwater discharge to surface water will change. Currently, the discharge occurs as seepage to the Athabasca River, Steepbank River and Shipyard Lake, along the reach of these water bodies adjacent to the Study Area. This broad discharge will be replaced by discharge from point sources into Shipyard Lake and Leggett Creek.

As shown in Table 16, the discharge of groundwater from the surficial aquifer to the Athabasca River will decrease from 0.44 L/s in 1995 to 0.2 L/s by 2009. The discharge into Shipyard Lake will increase from 0.17 L/s to 0.4 L/s, due to point source discharge. The discharge into Leggett Creek in 2009 will be approximately 0.23 L/s. The groundwater discharge to the Steepbank River will reduce to near zero as the surficial aquifer will have been mined out. As has been discussed in Part I of this report, the groundwater discharge to the Athabasca and Steepbank Rivers and Shipyard Lake is extremely minor in comparison to the flow in these streams. Therefore, the severity of the impact of these changes in groundwater discharge is very low.

Table 16
Estimated Groundwater Discharge Rates to Surface Water Bodies in the Study During Mining and Post Reclamation

Destination	1995	2001	2009	2020	Post-2020
Surficial Groundwater				,	, .
Athabasca River	0.44	0.44	0,2	0	0
Steepbank River	0.22	0.22	0	0	0
Shipyard Lake	0.17	0.17	0.40	0.20	0.20
Leggett Creek	0	0	0.23	0	0
Wood Creek	0	0	0	0.63	0.63
Bedrock Groundwater					
Athabasca River	0.93	0.93	0.93	0.93	0.93
Steepbank River	0.20	0.20	0.20	0.20	0.20
Shipyard Lake	0.56	0.56	0.56	0.56	0.56
Leggett Creek	0	0	0	0	0
Wood Creek	0	0	0	0	0
CT Water from Tailings Pond					
Athabasca River	0	0	2.20	5.80	5.83
Steepbank River	0	0	1.10	1.40	1.30
Shipyard Lake	0	0	0.30	0.40	0.43
Leggett Creek	0	0 -	0 .	0	0
Wood Creek	0	0	0	0	0

An effect of the de-watering of the surficial deposits will be that the water table in the vicinity of the de-watering system will be lowered. The distance that this impact will extend from the de-watering system is difficult to determine precisely, due to the variability of the surficial deposits. A distance of 300 m has been calculated, using simple trench de-watering equations. This appears to be somewhat of an over-estimate of the areal extent of the impact of de-watering. In comparison, the Athabasca River valley is essentially a large trench, that de-waters both the surficial deposits and the shallow bedrock. The water table in the upland remains quite close to the ground surface, right up to the edge of the escarpment. This indicates that the areal extent of the effect of the valley on the water table is limited to within a few hundred metres of the escarpment. Hence, it is reasonable to conclude that the areal extent of the impact of the Steepbank Mine de-watering system will be limited to the mine area.

Bedrock Aquifers

As has been discussed in Part 1, the hydraulic head in the bedrock aquifers is higher than the elevation of the base of the McMurray Oil Sands. It is likely that the head in the bedrock aquifers in the vicinity of Pit 1 will be lowered during mining from the pit. This would happen in one of two ways. The pressure (or hydraulic head) in the aquifers may be released as groundwater seeps into the mine. Or, it is possible that the bedrock aquifers

may have to be de-pressurized before all the ore in the proposed Pit 1 mine can be excavated. This will be required if it is determined that the walls and floor of the mine will be unstable due to the uplift pressures exerted by the water pressure in the aquifers. Such an analysis will be conducted as part of the final design of the mine. Should de-pressurization be required, water wells will be installed in the bedrock aquifers, and water will be pumped out to reduce the pressure (or hydraulic head) in the aquifers. This water will be discharged to the mine drainage system, and piped across the river to the processing plant.

The result of the depressed hydraulic head around the mine would be a change in the direction of groundwater flow in the bedrock aquifers, and the rate of discharge to surface waters would be reduced. Groundwater in the bedrock would flow toward Pit 1. The areal extent of this impact would be limited to within 2 km of the pit. The groundwater discharge from bedrock in the vicinity of Pit 1 would be more or less eliminated, while water is being pumped out of the aquifers. Therefore groundwater discharge to the Athabasca River and Shipyard Lake will be decreased by approximately half, from 0.93 L/s to roughly 0.46 L/s, and from 0.56 L/s to roughly 0.28 L/s, respectively. The discharge from bedrock to the Steepbank River will be reduced to essentially zero.

Because the groundwater discharge to surface water is such a minor component of the flow in the Athabasca and Steepbank Rivers, and Shipyard Lake, the severity of these changes in flow direction and discharge rate is very low. The changes will be limited to the Study Area. The duration of the impact will also be quite short. By 2009, Pit 1 will be filled with consolidated tailings (CT), as shown in Drawing B-2779-02-26. Once the CT is placed in the pit, the head in the bedrock aquifers will return to pre-mining levels. The rate of groundwater discharge from the bedrock will return to pre-mining conditions as shown in Table 16. The direction of groundwater flow in the bedrock aquifers will also return to pre-mine conditions by 2009.

There is the potential, while the hydraulic head in the bedrock around Pit 1 is depressed, that water will recharge the bedrock aquifers from the Steepbank River and flow toward the pit. Based on the hydraulic conductivity of the bedrock aquifers, and the difference in elevation between the river and the pit, the maximum amount of water that may be diverted under steady state conditions is approximately 1.1 L/s. This is less than 1% of the recorded minimum monthly flow in the Steepbank River. Therefore, it does not represent a severe impact on the flow in the river. The areal extent of this effect will be limited to within 2 km of Pit 1. The duration of impact will be relatively short term. In 2009, once Pit 1 is filled with consolidated tailings (CT), groundwater from the aquifer will once again discharge to the Steepbank River.

The impacts of placing CT in Pit 1 discussed in the following section.

5.3 Mine Operations (2009 -2020)

During the period 2009 to 2020, Pit 2 will be mined. Consolidated tailings will be placed in Pond 7 (formerly Pit 1) at the beginning if this period. Pond 8 (formerly Pit 2) will be filled with CT at the end of this period..

The factors that will affect the groundwater are:

The continued de-watering of the surficial deposits;

The bedrock aquifers may be de-pressurized;

The mining of Pit 2; and

The seepage of pore water from CT.

As is discussed below, the results of these factors will be slight changes to the direction of flow, the rates of discharge and the quality of some components of the groundwater system. Table 16 shows the rates of groundwater discharge to surface water that are expected to occur in 2020, at the end of this phase of mine development.

Surficial Deposits

As Pit 2 is mined, it will advance across Leggett Creek (Drawing B-2779-02-27). The diversion system used to de-water the surficial deposits up-gradient of Pits 1 and 2 will be extended to discharge into Wood Creek. As shown in Table 16, the total rate of groundwater discharge from surficial deposits to surface water will remain constant. However, the groundwater will be diverted such that the discharge rate to Shipyard Lake decreases from 0.4 L/s to roughly 0.2 L/s. The discharge to Leggett Creek will be stopped, as the area around the creek is mined. All remaining discharge, approximately 0.63 L/s will therefore be directed to Wood Creek, from which it will flow to the Athabasca River.

As has been explained above, the areal extent of the impact of de-watering the surficial deposits will be limited to the Study Area. The duration of the impact will be long-term. As has been discussed in Part 1 of this report, the groundwater discharge to the Athabasca and Steepbank Rivers and Shipyard Lake is extremely minor in comparison to the flow in these streams. Therefore, the severity of the impact of these changes in groundwater discharge is very low.

Bedrock Aquifers

The effects of mining Pit 2 on the bedrock aquifers will be very similar to the effects described for Pit 1. The direction of groundwater flow in the bedrock will become directed toward Pit 2, either as the result of natural groundwater flow toward to active mine, or de-pressurization of the aquifers prior to mining. The groundwater discharge from bedrock in the vicinity of Pit 2 would be more or less reduced to zero. Therefore, the total groundwater discharge from bedrock in the Study Area to the Athabasca River and Shipyard Lake would decrease by approximately half, from 0.93 L/s to roughly 0.46 L/s to roughly 0.28 L/s, respectively.

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Because the groundwater discharge to surface water is such a minor component of the flow in the Athabasca and Shipyard Lake, the severity of these changes in flow direction and discharge rate is very low. The areal extent of the impact will be limited to the mine area, as discussed in Section 5.2. The duration of the impact will also be quite short. By 2020, Pit 2 will be filled with CT, as shown in Drawing B-2779-02-27. Once the CT is placed in the pit, the head in the bedrock aquifers will return to pre-mining levels. The rate of groundwater discharge from the bedrock will return to pre-mining conditions, as shown in Table 16. The direction of groundwater flow in the bedrock aquifers will also return to pre-mine conditions by 2009.

Consolidated Tailings

Consolidated tailings will be placed in the mine pits, as a component of the mine reclamation. The process of producing CT is relatively new, and the long-term behaviour and composition of the material has not been well documented yet. The expected benefit of placing CT in the mined pits is that the tailings will provide a stable, weight-bearing, dry surface, that will be re-vegetated with trees.

The CT is expected to interact with the groundwater in the bedrock once it is placed in the tailings ponds. Pore water within the CT will seep downward into the bedrock, and eventually discharge with the groundwater to surface water. The impact that the seepage will have on the groundwater will be the result of the combined effects of the rate of flow, and the chemical composition of the pore water. These are both discussed in the following paragraphs.

The rate of seepage from the ponds will be a function of the hydraulic conductivity of the CT, the vertical hydraulic gradient between the CT and the underlying bedrock aquifers, and the area of the ponds. The equation used to calculate the seepage rate is:

$$Q = K i A$$

where;

Q = seepage rate,

K = the hydraulic conductivity of the aquifer, m/s

i = the hydraulic gradient in the aquifer, m/m

A =area of the pond, m^2 .

The hydraulic conductivity of the CT has been estimated to be 1 x 10⁻⁹ m/s (AGRA 1996). Pond 7 will be approximately 5.9 x 10⁶ m² in area. Pond 8 will be approximately 4.5 x 10⁻⁶ m². The vertical hydraulic gradient in the ponds is difficult to predict, because it is not known what the elevation of the phreatic surface within the CT will be. However, as the hyraulic conductivity of the CT is quite low (10⁻⁹ m/s is similar to what is measured in clayey deposits), it is anticipated that the phreatic surface within the CT will be very close to ground level. Therefore, the vertical hydraulic gradient in the CT has been calculated using the estimated elevation of the top

surface of the CT. For instance, as shown in Drawing B-2779-02-28, the elevation of the CT in Pond 7 will be 297 m in 2009. The elevation of the bottom of the pond is roughly 260 m. The average elevation of the potentiometire surface in the bedrock aquifers, in the area of the ponds, is 275 m. Therefore, the vertical hydraulic gradient in the CT in Pond 7 in 2009 is estimated to be:

$$i = (297 \text{ m} - 275 \text{ m})/(297 \text{ m} - 260 \text{ m}) = 0.6$$

The total rate of seepage from Pond 7 into the bedrock aquifers is therefore calculated to be 3.6 L/s. This seepage will ultimately discharge with the groundwater into the Athabasca River, the Steepbank River, and Shipyard Lake. The exact proportions of the CT contribution to each of these water bodies will depend on a number of factors, including preferential pathways in the bedrock, the final elevation of the bottom of the pond, and variability in the composition of the CT. It is therefore not possible to predict precisely how the CT water will be divided among the three water bodies. As a rough approximation, it is assumed that 60 % of the CT seepage will flow through bedrock to the Athabasca River, 30 % will flow to the Steepbank River, and 10 % will discharge into Shipyard Lake. In accordance with these assumptions, the approximate discharge rates of CT the Athabasca and Steepbank Rivers and Shipyard Lake will be 2.2 L/s, 1.1 L/s and 0.3 L/s respectively.

These estimates of seepage of CT pore water to surface water are also shown in Table 16.

In 2020, the elevation of CT in Pond 7 will have been raised to 326 m. CT will be placed in Pond 8 to an elevation of 304 m, as shown in Drawing B-2779-02-28. The vertical hydraulic gradients in the ponds will be approximately 0.77 and 0.66, respectively. The resulting rates of discharge of CT pore water to the Athabasca and Steepbank Rivers and Shipyard Lake (assuming all seepage from Pond 8 discharges into the Athabasca River) are 5.8 L/s, 1.4 L/s and 0.4 L/s, respectively. The rate of seepage represents less than 1 % of the flow in any of these water bodies.

Chemical analyses have been conducted on pore water samples collected from test batches of consolidated tailings. Tables 17 and 18 show the results of inorganic analyses of CT pore water. Table 19 shows the results of organic analyses, including naphthenic acids, of the CT porewater.

The results of the evaluations of the chemistry of CT pore water are quite preliminary. Ongoing research into the composition of the pore water is being conducted by Suncor. The results shown in Tables 17 and 18 indicate the inorganic chemistry of the CT pore water is relatively benign with respect to the potential impacts to surface water. The pore water does contain dissolved organic compounds, including phenols, PAHs and naphthenic acids. However, as shown in Table 20, the types and concentrations of organic compounds found in the CT pore water are similar to the naturally-occurring organic composition of the groundwater in the bedrock aquifers. Of the 33 organic compounds detected in the CT pore water three were also found to be naturally present in the

groundwater from the limestone. These three compounds were acenaphthylene, phenol and m-cresol. The range of concentrations of naphthenic acids measured in the CT pore water (62 mg/L to 94 mg/L) is slightly higher than in the bedrock aquifers (8 mg/L to 57 mg/L).

The severity of the impacts associated with the seepage of CT pore water from the ponds is expected to be low. The rate of seepage is less than 1 % of the flows in the receiving water in the Athabasca and Steepbank Rivers, and Shipyard Lake. The chemistry of the CT pore water is similar to the chemistry of the groundwater in the bedrock aquifers that currently discharges to surface water in the in the Study Area. Therefore, the chemistry of the receiving waters is not expected to be altered by the seepage of the CT from the ponds. The areal extent of the impact of the seepage will be limited to the area between the ponds and the Athabasca River. The impacts of the seepage will however be long-term. It is expected that the seepage will continue more or less in perpetuity after the closure of the mine. Considering the rates and quality of the seepage, the severity of the impact from the CT pore water will be low.

5.4 Post Reclamation

Following the closure and reclamation of the mine, the factors that will continue to impact the groundwater are:

The continued de-watering of the surficial deposits;

The long-term seepage of pore water from CT.

Table 17
Consolidated Tailings (CT) - Major Ions in Pore Water

Parameter	Detection Limits	Units	Min	Max	Median	No. of Samples
Calcium	0.003	mg/L	<0.003	0.0066	<0.003	9
Magnesium	0.01	mg/L	7.2	28	12	18
Sodium	0.01	mg/L	347	1170	445	18
Potassium	0.02	mg/L	11.5	29	16.6	18
Chloride	0.5	mg/L	45.4	510	55	18
Sulphate Total Alkalinity Bicarbonate Silicon Total Dissolved Solids	0.5	mg/L	555	1290	659	18
	0.5	mg/L	277	688	353.5	18
	0.5	mg/L	331	800	409	18
	0.02	mg/L	<2.3	5.6	2.9	8
	1	mg/L	1400	1805	1600	7
Specific Conductance	0.1	μS/c	1891	4900	2337	9
pH	0.01	m	7.9	8.5	8.3	18
Phenols	0.001	Units	<0.002	0.016	0.004	5
Dissolved Organic Carbon	0.2	mg/L	52	65.3	60.6	8
Nitrite + Nitrate	0.003	mg/L	<0.003	0.05	0.016	18
Total Phosphorus (ICP)	0.1	mg/L	<0.1	0.1	<0.1	6

Data obtained from Chemex Labs (Suncor ID: RW 162, 163, 164)

Samples collected in July, August and September 1995

Other CT samples from Suncor: CT Wilden-Crippen

Table 18

Consolidated Tailings (CT) - Metals and Cyanide in Pore Water

Parameter	Detection Limits	Units	Min	Max	Median	No. of Samples
Aluminum Arsenic Barium Beryllium Boron	0.01 0.0002 0.01 0.001 0.01	mg/L mg/L mg/L mg/L mg/L	<0.01 0.0007 0.05 <0.001 2.26	1.92 0.0058 0.18 0.004 4.26	0.05 0.0029 0.1 <0.001 3.19	9 8 9 9
Cyanide Cadmium Chromium Cobalt Copper	0.001 0.003 0.002 0.003 0.001	mg/L mg/L mg/L mg/L mg/L	<0.001 <0.003 <0.002 <0.003 <0.001	0.055 0.0066 0.003 0.007 0.004	<0.001 <0.003 <0.002 <0.003 0.002	8 9 9 9
Iron Lead Lithium Manganese Mercury	0.01	mg/L	<0.01	1.01	0.04	9
	0.02	mg/L	<0.0003	0.02	0.02	9
	0.001	mg/L	0.16	0.27	0.19	9
	0.001	mg/L	<0.001	0.058	0.024	9
	0.05	μg/L	<0.05	0.05	<0.05	7
Molybdenum	0.003	mg/L	0.15	1.42	1.15	9
Nickel	0.005	mg/L	<0.005	0.030	0.018	9
Selenium	0.0002	mg/L	<0.0002	0.04	0.0015	8
Silver	0.002	mg/L	<0.0002	0.002	<0.002	9
Strontium	0.002	mg/L	0.75	2.12	1.02	9
Titanium	0.003	mg/L	<0.003	0.016	<0.003	9
Uranium	0.5	mg/L	0.0068	0.5	0.5	9
Vanadium	0.002	mg/L	<0.002	0.17	0.006	9
Total Ammonia	0.01	mg/L	0.098	3.98	0.7	17
Total Sulphur	0.2	mg/L	186	266	229	7
Total Kjeldhal Nitrogen	0.05	mg/L	0.95	6.8	1.82	16
Total Dissolved Solids	1	mg/L	1400	1805	1600	7
Titanium	0.003	mg/L	<0.003	0.016	<0.003	9
Total Organic Carbon	0.2	mg/L	56.1	68	64.5	6
Total Alkalinity	0.5	mg/L	277	688	354	18
Total Phosphorus Total Suspended Solids Uranium Vanadium Zinc	0.003 0.4 0.5 0.002 0.001	mg/L mg/L mg/L mg/L mg/L	0.006 <0.4 0.0068 <0.002 0.003	0.096 187 0.5 0.17 0.056	0.037 6 0.5 0.006 0.043	16 6 9 9

Data obtained from Chemex Labs (Suncor ID: RW 162, 163, 164)

Samples collected in July, August and September 1995

Other CT samples from Suncor: CT1219

Table 19 Consolidated Tailings (CT) - Organic Compounds (including Naphthenic Acids) in Pore Water (μ g/L)

Parameter		Suncor Cons	olidated Tailings	ı
	Min	Median	Max	No. of Samples
PAH&Alkylated PAH's				
Naphthalene	<0.02	<0.02	0.05	16
Acenaphthene	0.02	<0.02	0.08	16
Acenaphthylene	<0.02	0.03	0.16	16
Fluorene	<0.02	<0.02	0.03	16
Dibenzothiophene	<0.02	<0.02	0.07	14
Phenanthrene	<0.02	<0.02	0.09	16
Pyrene	<0.02	<0.02	0.04	16
Benzo(a)anthracene/Chrysene	<0.02	<0.02	0.27	16
Methyl naphthalene	0.02	<0.04	0.08	14
C2 sub'd naphthalene	<0.04	<0.04	0.25	16
C3 sub'd naphthalene	· <0.04	<0.04	0.3	16
C4 sub'd naphthalene	<0.04	<0.04	2	16
Methyl biphenyl	0.04	<0.04	0.08	16
C2 sub'd biphenyl	<0.04	<0.04	0.25	16
Methyl acenaphthene	<0.04	<0.04	0.19	16
Methyl fluorene	<0.04	< 0.04	0.3	16
C2 sub'd fluorene	<0.04	<0.04	1.1	16
Methyl phenanthrene/anthracene	<0.04	<0.04	0.79	16
C2 sub'd phenanthrene/anth.	<0.04	<0.04	4.5	16
C3 sub'd phenanthrene/anth.	<0.04	<0.04	3.6	16
C4 sub'd phenanthrene/anth.	<0.04	<0.04	1.7	15
Methyl dibenzothiophene	<0.04	<0.04	0.65	16
C2 sub'd dibenzothiophene	<0.04	<0.04	2.2	16
C3 sub'd dibenzothiophene	<0.04	<0.04	4.1	16
C4 sub'd dibenzothiophene	<0.04 <0.04	<0.04	4.4	16
Methyl fluoranthene/pyrene	<0.04	<0.04	0.65	16
Methyl B(a)/chrysene	<0.04	<0.04	0.63	16
C2 sub'd B(a)A/chrysene	<0.04 <0.04	<0.04	0.83	16
	V. V4	<u>~0.04</u>	0.63	TO TO
Phenolic Compounds in Water	_	No. of Contract		
Phenol	<0.1	0.2	0.2	6
m-Cresol	<0.1	0.3	0.5	5
m-Cresol	1	ì	1	3
p-Cresol	0.1	<0.1	0.2	5
2,4-Dimethylphenol	<0.2	0.35		4
PANH & Alkylated PANH's	nd	nd	nd	
Volatile Organics (MS):H20	nd	nd	nd	
Naphthenic Acids (mg/L)	62	76	94	
Hydrocarbons, Recoverable (mg/L)	<1	<1	22	18

Data obtained from Envirotest Laboratories (Suncor ID: RW 162, 163, 164) & PD5, CT1219

Samples Collected in July, August, September 1995

Additional CT900 & CT1400 obtained from Syncrude Research Center.

nd = not detected

Table 20 Comparison of Organic Compounds Detected in Consolidated Tailings (CT) and Groundwater Samples (µg/L)

	Suncor Consolidated Tailings			Basal Aquifer					Limestone			Surficial Sand				
Parameter	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Sample
PAH & Alkylated PAH's																
Naphthalene	< 0.02	<0.02	0.05	16	< 0.02	< 0.02	0.05	5	< 0.02	0.035	0.05	2	< 0.02	< 0.02	< 0.02	6
Acenaphthene	0.02	<0.02	0.08	16	< 0.02	0.03	0.04	5	0.04	0.06	0.08	2	< 0.02	< 0.02	< 0.02	6
Acenaphthylene	< 0.02	0.03	0.16	16	< 0.02	< 0.02	< 0.02	5	< 0.02	< 0.02	< 0.02	2	< 0.02	< 0.02	< 0.02	6
Fluorene	< 0.02	<0.02	0.03	16	< 0.02	0.02	0.06	5	0.07	0.075	0.08	2	< 0.02	< 0.02	< 0.02	6
Dibenzothiophene	< 0.02	<0.02	0.07	14	< 0.02	< 0.02	< 0.02	5	< 0.02	0.02	0.02	2	< 0.02	< 0.02	< 0.02	6
Phenanthrene	< 0.02	<0.02	0.09	16	0.02	0.03	0.07	5	0.11	0.125	0.14	2	< 0.02	< 0.02	< 0.02	6
Pyrene	< 0.02	<0.02	0.04	16	< 0.02	< 0.02	< 0.02	5	< 0.02	0.025	0.03	2	< 0.02	< 0.02	0.02	6
Benzo(a)anthracene/Chrysene	< 0.02	<0.02	0.27	16	< 0.02	< 0.02	0.02	5	< 0.02	0.03	0.04	2	< 0.02	< 0.02	< 0.02	6
Methyl naphthalene	0.02	<0.04	0.08	14	< 0.02	0.04	0.07	5	< 0.02	0.03	0.04	2	< 0.02	< 0.02	< 0.02	6
C2 sub'd naphthalene	< 0.04	<0.04	0.25	16	< 0.04	0.09	0.32	5	< 0.04	0.05	0.06	2	< 0.04	< 0.04	< 0.04	6
C3 sub'd naphthalene	< 0.04	<0.04	0.3	16	0.04	0.12	0.82	5	0.31	0.42	0.53	2	< 0.04	< 0.04	0.17	6
C4 sub'd naphthalene	< 0.04	<0.04	2	16	< 0.04	0.09	0.5	5	0.19	0.27	0.35	2	< 0.04	< 0.04	0.2	6
Methyl biphenyl	0.04	<0.04	0.08	16	< 0.04	< 0.04	< 0.04	5	< 0.04	0.04	0.04	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd biphenyl	< 0.04	<0.04	0.25	16	< 0.04	< 0.04	< 0.04	5	< 0.04	0.075	0.11	2	< 0.04	< 0.04	< 0.04	6
Methyl acenaphthene	< 0.04	<0.04	0.19	16	< 0.04	< 0.04	0.06	5	< 0.04	0.06	0.08	2	< 0.04	< 0.04	< 0.04	6
Methyl fluorene	< 0.04	<0.04	0.3	16	< 0.04	0.04	0.14	5	0.08	0.125	0.17	2	< 0.04	< 0.04	0.04	6
C2 sub'd fluorene	< 0.04	<0.04	1.1	16	< 0.04	0.07	0.13	5	0.09	0.155	0.22	2	< 0.04	< 0.04	0.06	6
Methyl phenanthrene/anthracene	< 0.04	<0.04	0.79	16	0.05	0.1	0.13	5	0.22	0.265	0.31	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd phenanthrene/anth.	< 0.04	<0.04	4.5	16	< 0.04	0.09	0.23	5	0.15	0.25	0.35	2	< 0.04	< 0.04	0.05	6
C3 sub'd phenanthrene/anth.	< 0.04	<0.04	3.6	16	< 0.04	0.05	0.21	5	0.11	0.2	0.29	. 2	< 0.04	< 0.04	0.06	6
C4 sub'd phenanthrene/anth.	< 0.04	<0.04	1.7	15	< 0.04	< 0.04	0.16	5	0.04	0.085	0.13	2	< 0.04	< 0.04	< 0.04	6
Methyl dibenzothiophene	< 0.04	<0.04	0.65	16	< 0.04	0.06	0.16	5	0.12	0.18	0.24	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd dibenzothiophene	< 0.04	<0.04	2.2	16	< 0.04	0.08	0.13	5	0.15	0.29	0.43	2	< 0.04	< 0.04	0.04	6
C3 sub'd dibenzothiophene	< 0.04	<0.04	4.1	16	< 0.04	0.09	0.24	5	0.19	0.32	0.45	2	< 0.04	< 0.04	0.06	6
C4 sub'd dibenzothiophene	< 0.04	<0.04	4.4	16	< 0.04	< 0.04	0.06	5	< 0.04	0.15	0.26	· 2	< 0.04	< 0.04	< 0.04	6
Methyl fluoranthene/pyrene	< 0.04	<0.04	0.65	16	< 0.04	< 0.04	0.06	5	< 0.04	0.045	0.05	2	< 0.04	< 0.04	< 0.04	6
Methyl B(a)A/chrysene	< 0.04	<0.04	0.5	16	< 0.04	< 0.04	0.05	5	< 0.04	0.045	0.05	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd B(a)A/chrysene	< 0.04	<0.04	0.83	16	< 0.04	< 0.04	0.05	5	< 0.04	0.05	0.06	2	< 0.04	< 0.04	< 0.04	6
Phenolic Compounds in Water																
Phenol	< 0.1	0.2	0.2	6	< 2	< 0.2	< 0.1	5	< 0.1	< 0.1	< 0.1	2	< 0.2	< 0.1	< 0.1	6
m-Cresol	< 0.1	0.3	0.5	5	< 2	< 0.2	< 0.1	5	< 0.1	< 0.1	< 0.1	2	< 0.2	< 0.1	< 0.1	6
m-Cresol	1	1	1	3						1						and the same of th
p-Cresol	0.1	<0.1	0.2	5	< 2	< 0.2	0.2	5	0.3	0.3	0.3	2	< 0.2	< 0.1	< 0.1	6
2,4-Dimethylphenol	< 0.2	0.35	1	4	< 2	< 0.2	< 0.1	5	0.1	0.15	0.2	2	< 0.2	< 0.1	< 0.1	6
PANH & Alkylated PANH's	nd	nd	nd		nd	nd	nd		nd	nd	nd		nd	nd	nd	
Volatile Organics (MS):H2O	nd	nd	nd		nd	nd	nd		nd	nd	nd		nd	nd	nd	SECUCION
Naphthenic Acids (mg/l)	62	76	94	,	8	21	36	11	47	52	57	3	< 4	4	7	12
Hydrocarbons,Recoverable (mg/l) Data obtained from Envirotest Laborat	< 1	<1	22	18	< 1	3	5	3	< 1	< 1	< 1	1	< 1	< 1	< 1	3.

nd = not detected

The effects of the re-direction of groundwater flow in the surficial deposits have been discussed above in detail. As shown in Table 16, there is expected to be no change in the flows after 2020.

Also as described above, the seepage of CT pore water from the tailings ponds is expected to carry on for a very long time after the mine area has been reclaimed. The chemistry of the seepage water is not expected to change. The total long-term rate of seepage will decrease very slightly to 10.08 L/s in comparison to the seepage rate in 2020 of 10.12 L/s. This slight decrease is due to the final elevation of the CT surface. After being allowed to settle, the CT is expected to have an equilibrium level of 314.5 m in both Ponds 7 and 8.

As has been discussed above, the level of concern of these impacts is low.

6. Requirement for Environmental Monitoring

The impacts to groundwater of the mine, as it has been designed, are expected to be negligible. There is, however, always the possibility that groundwater can be contaminated as a result of accidental spills or releases of substances. Therefore, a comprehensive sampling and analysis program, similar to that conducted as part of the existing operation, will be conducted up-gradient and down gradient of the mine area. The objective of the monitoring program will be to confirm that mining impacts are as expected, and to provide notice of any water quality and flow concerns that may arise.

7. CONCLUSIONS

With respect to the hypothesis statements in Section 1, the residual impacts of the development and reclamation of the mine are of low concern. Specifically:

- There will be no significant changes to flows in the Athabasca or Steepbank Rivers from groundwater.
- 2) The groundwater quality will not be affected by contaminant migration from processing and extraction activities at the mine.

There is no groundwater use in the area. In addition, there is little potential for groundwater to be used as a resource, except in the Athabasca River valley.

Groundwater discharge to surface water is a very minor component of the surface water flow. The rate of groundwater discharge is less than 1 % of the minimum monthly flow in the Athabasca and Steepbank Rivers, and less than 1 % of the average monthly flow in Shipyard Lake.

The following things have been evaluated, with regard to their impacts on the direction of groundwater flow, the rate of groundwater discharge, and the quality the following things have been evaluated, with regard to their impacts on the direction of groundwater flow, the rate of groundwater discharge, and the quality the following things have been evaluated, with regard to their impacts on the direction of groundwater flow, the

Construction of water wells in the Athabasca River valley;

De-watering of the surficial deposits up-gradient of the mine;

The lowering of the hydraulic head in the bedrock aquifers during mining; and

The placement of consolidated tailings (CT) in the pits to reclaim the mine.

In all instances, the areal extent of the impacts will be limited to the Study Area. Because the groundwater flow rates are so low in comparison to the flow rates in the Athabasca River, Steepbank River and Shipyard Lake, the severity of changes in groundwater flow direction and discharge rate are low.

The duration of most impacts to the groundwater will be short term, with the exception of the diversion of groundwater in the surficial deposits, and the seepage of pore water from CT.

The groundwater from the surficial deposits is expected to be diverted to Shipyard Lake and the Athabasca River, via Wood Creek. Once again, because the rate of groundwater flow in the aquifer is so low in comparison to the surface water flows, the level of concern over this impact is low.

The pore water from CT is expected to seep through the bedrock aquifers, and discharge to the Athabasca River, Steepbank River and Shipyard Lake. The quality of the CT pore water is very similar to the natural quality of groundwater in the bedrock aquifers. It contains essentially the same organic compounds as the groundwater, although at slightly higher concentrations. Therefore, the level of concern associated with the long-term seepage of pore water from CT is considered to be low.

Aside from the impact of CT in the tailings ponds, the quality of groundwater is not expected to be impacted by the mine. A program of groundwater monitoring will be used to ensure that any accidental spills or releases are detected and can be mitigated quickly.

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PART V - GLOSSARY OF TERMS

Aquifer A body of rock or soil which contains sufficient amounts of saturated permeable

material to yield economic quantities of water to wells or springs.

Aquitard A lithologic unit that impedes ground water movement and does not yield water freely

to wells or springs but that may transmit appreciable water to or from adjacent aquifers. Where sufficiently thick, may act as a ground water storage zone.

Synonymous with confining unit.

Available Drawdown The vertical distance that the equipotential surface of an aquifer can be lowered; in

confined aquifers, this is to the top of the aquifer; in unconfined aquifers, this is to the

bottom of the aquifer.

Baseline A surveyed condition which serves as a reference point to which later surveys are

coordinated or correlated.

Bedrock The body of rock which underlies the gravel, soil or other superficial material.

Borehole Log The record of geologic units penetrated, drilling progress, depth, water level, sample

recovery, volumes and types of materials used, and other significant details regarding

the drilling of an exploratory borehole or well.

Confined Aquifer An aquifer in which the potentiometric surface is above the top of the aquifer.

Consolidated Tailings The portion of ore that is deposited after washing and milling and which has undergone a reduction in volume and increase in density. (See also "Consolidation")

Consolidation The gradual reduction in volume of a soil mass resulting from an increase in applied

load.

Darcy's Law

a) Initial consolidation (initial compression): A comparatively sudden reduction in volume of a soil mass under an applied load due principally to release or the squeezing

out and compression of gas in the soil voids preceding primary consolidation

b) Primary consolidation (primary compression) (primary time effect): The reduction in volume of a soil mass caused by the application of a sustained load to the mass and due principally to a squeezing out of water from the void spaces of the mass and

accompanied by a transfer of the load from the soil water to the soil solids.

c) Secondary consolidation (secondary compression) (secondary time effect): The reduction in volume of a soil mass caused by the application of a sustained load to the mass and due principally to the adjustment of the internal structure of the soil mass

after most of the load has been transferred from the soil water to the soil solids.

A law describing the rate of flow of water through porous media. (Named for Henry

Darcy of Paris who formulated it in 1856 from extensive work on the flow of water

through sand filter beds.)

Deposit Material left in a new position by a natural transporting agent such as water, wind, ice

or gravity, or by the activity of man.

De-pressurize The process of reducing the pressure in an aquifer, by withdrawing water from it.

Deuterium A stable isotope of hydrogen, which has two neutrons.

Energy Dissipation A structure designed to dissipate the excessive structure energy of a high velocity fluid

(i.e. water), to establish a safe flow condition and prevent scour or minimize erosion.

(See also "Hydraulic structure")

Ephemeral A phenomena, feature, marriage which only lasts for a short time (ie., an ephemeral

stream is only present for short periods during the year.

Equipotential Level The level on which the potential everywhere is constant; the level at surface which the

pressure head of a body of groundwater is the same.

Floodplain Land near rivers and lakes that may be flooded during seasonally high water levels.

Fluvial Relating to a stream or river.

Glacial Till Unsorted and unstratified glacial drift, generally unconsolidated, deposited directly by

a glacier without subsequent reworking by water from the glacier, and consisting of a heterogeneous mixture of clay, silt, sand, gravel and boulders varying widely in size

and shape.

Glacio-Lacustrine Relating to the lakes that formed of the edge of glaciers as the glaciers receded.

Glacio-lacustrine sediments are commonly laminar deposits of fine sand, silt and clay.

Ground Penetrating Method of mapping subsurface layer geometry using radar.

Groundwater Water that is found below the ground surface, in soil and rock.

Groundwater Level The level below which the rock and subsoil, to unknown depths, are saturated.

Groundwater Regime Water below the land surface in a zone of saturation.

Groundwater Velocity The speed at which groundwater advances through the ground. The way that the term

is used in this document, it technically refers to the average linear velocity of the

groundwater.

Head The energy, either kinetic or potential, possessed by each unit weight of a liquid,

expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. It is used in various compound terms such as

pressure head, velocity head, and loss of head.

Hydraulic Conductivity The permeability of soil or rock to water.

Hydraulic Gradient A measure of the force moving groundwater through soil or rock. It is measured as

the rate of change in total head per unit distance of flow in a given direction. Hydraulic gradient is commonly shown as being dimensionless, since its units are

m/m, ft/ft.

Hydraulic Head The elevation with respect to a specified reference level at which water stands in a

piezometer connected to the point in question in the soil. Its definition can be extended to soil above the water table if the piezometer is replaced by a tensiometer. The hydraulic head in systems under atmospheric pressure may be identified with a potential expressed in terms of the height of a water column. More specifically, it can be identified with the sum of gravitational and capillary potentials, and may be termed

the hydraulic potential.

Hydraulic Structure Any structure which is designed to handle water in any way. This includes the

retention, conveyance, control, regulation, and dissipation of the energy of water.

Hydrogeology The study of the factors that deal with subsurface water, and the related geologic

aspects of surface water.

Inorganics Pertaining or relating to a compound that contains no carbon. (See also "Organic

compounds")

Klohn-Crippen

Landform Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape, and produced by natural causes. Lean Oil Sands Oil bearing sands, which do not have a high enough saturation of oil to make mining of them economically feasible. Microtox A measure of toxicity in a sample. (See also "Toxicity") Organic Compounds Chemicals (naturally occurring or otherwise) which contain carbon, with the exception of carbon dioxide (CO²) and carbonates (e.g., CACO3) Overburden The soil, sand, silt, or clay that overlies bedrock. In mining terms, this includes all material which has to be removed to expose the ore. Oxygen-18 A stable isotope of oxygen which has two more neutrons than the more common oxygen-16. Piezometer An instrument for measuring pressure. In groundwater and geotechnical investigations, piezometers are commonly Poly Vinyl Chloride pipe that has been sealed in a drill hole. The height to which groundwater rises in the pipe is a measure of the water pressure at the bottom of the piezometer. If water level elevations in wells completed in an aquifer are plotted on a map and Piezometric Surface contoured, the resulting surface described by the contours is known as a potentiometric or piezometric surface. Pneumatic Piezometer A type of piezometer in which the hydraulic head is measured using a compressed gas. Pore Water Water that is present between the grains of a soil or rock. An imaginary surface representing the static head of groundwater. The water table is Potentiometric Surface a particular potentiometric surface. Sediment Sampling A field procedure relating to a methodology for determining the configuration of sediment deposits. Sedimentation The process of subsidence and deposition of suspended matter carried by water, wastewater, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material. Stable Isotopes Isotopes of a particular element have the same number of protons; but different numbers of neutrons. Isotopes are stable if they do not naturally undergo radioactive decay. Static Water Level

The elevation of the top of a column of water in a monitoring well or piezometer that is not influenced by pumping.

Stratigraphy The succession and age of strata of rock and unconsolidated material. Also concerns the form, distribution, lithologic composition, fossil content and other properties of the strata.

Surficial Aquifer A surficial deposit containing water to be considered an aquifer.

Surficial Deposit A geologic deposit (like clay, silt or sand) that has been placed above bedrock. (See also "Overburden")

Tailings The portion of ore, after washing and milling, which is too low grade to warrant further processing.
Klohn-Crippen

Total Dissolved Solids (TDS)

The total concentration of all dissolved compounds solids found in a water

sample.

Toxicity

The tendency of a chemical or condition to cause harm to the life process.

Twenty Year Safe Yield (Q₂₀)

An estimation of the long term rate at which a water well will produce water. The Q20 is the rate at which a well can be pumped continuously for 20 years, without the water level dropping below the top of the aquifer. (See also "Available

drawdown")

Unconfined Aquifer

An aquifer in the which the water level is below the top of the aquifer.

Water Equivalent

As relating to snow; the depth of water that would result from melting.

Water Table

The shallowest saturated ground below ground level - technically, that surface of a body of unconfined groundwater in which the pressure is equal to atmospheric

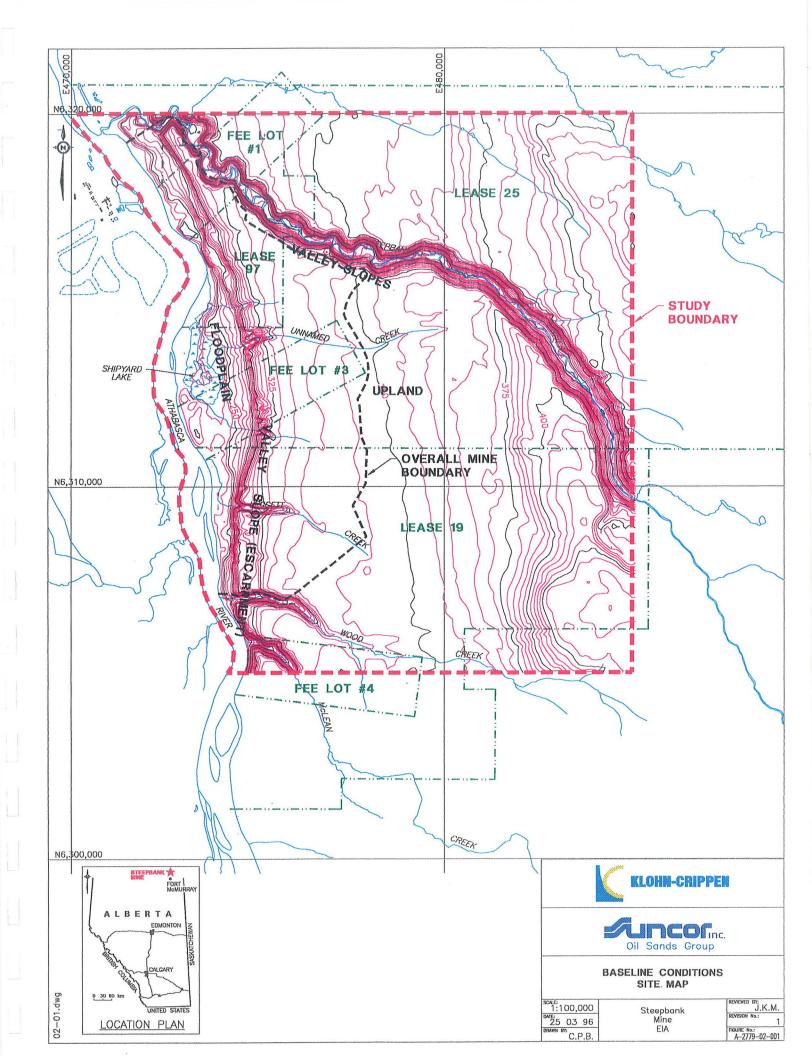
pressure.

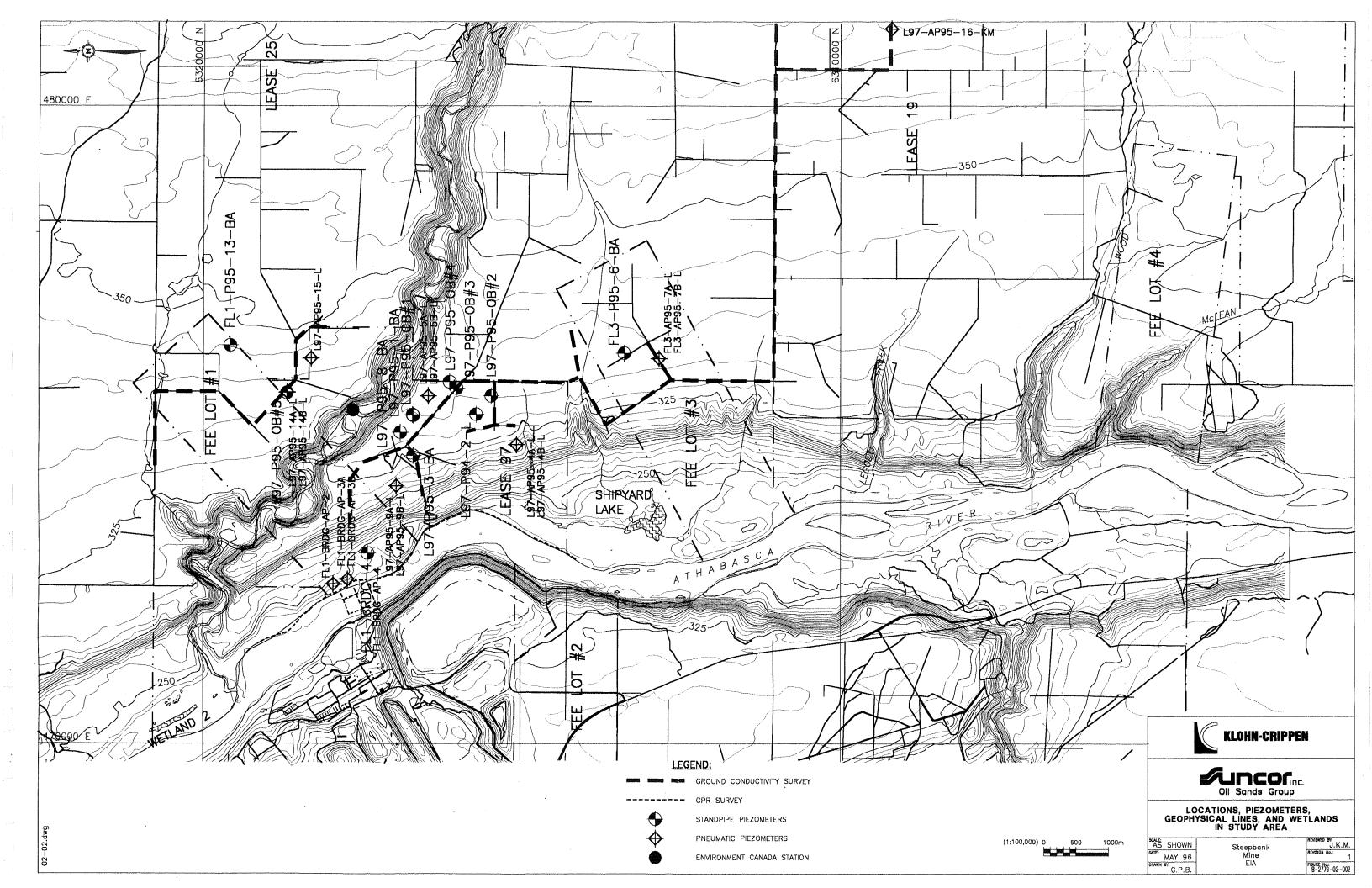
Wetlands

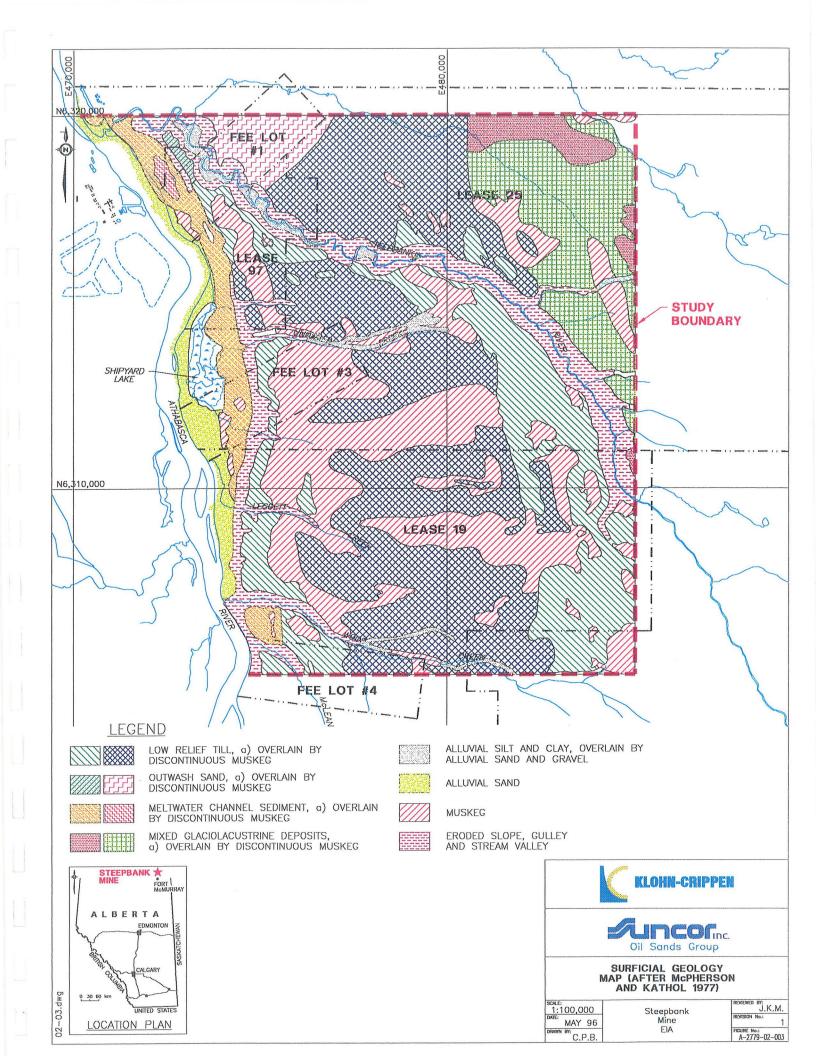
Area of surface water ponding which forms the habitat for a variety of wildlife

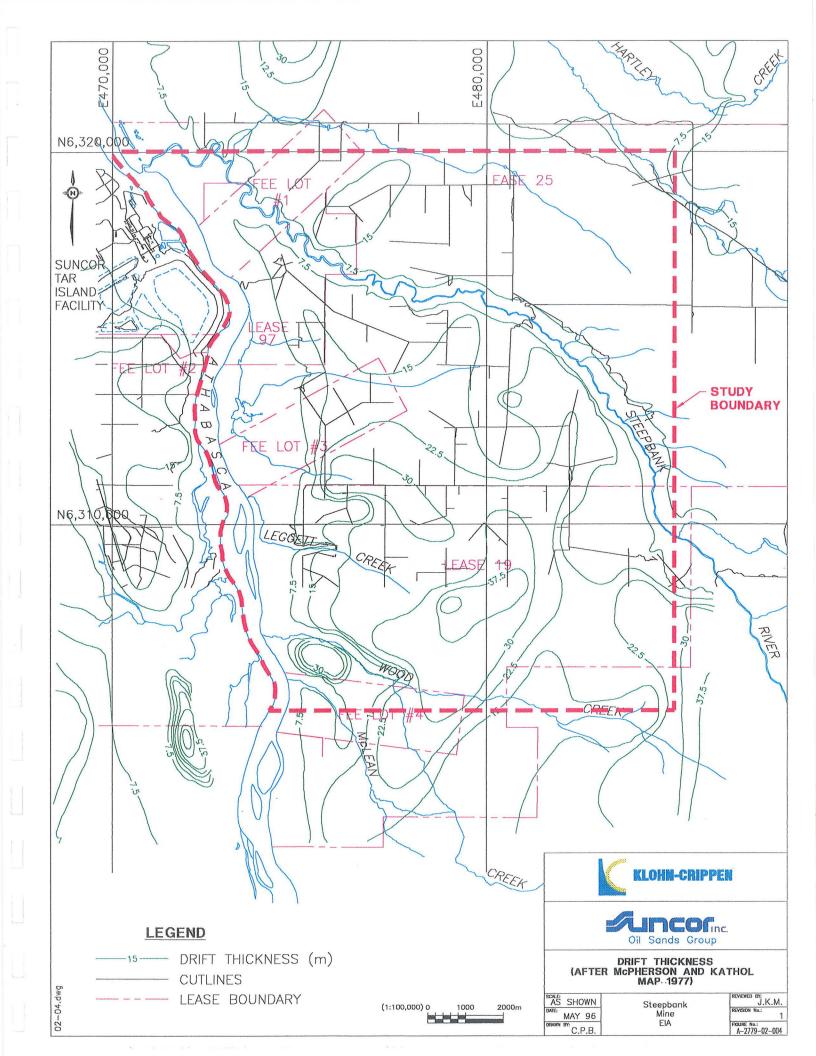
including water fowl.

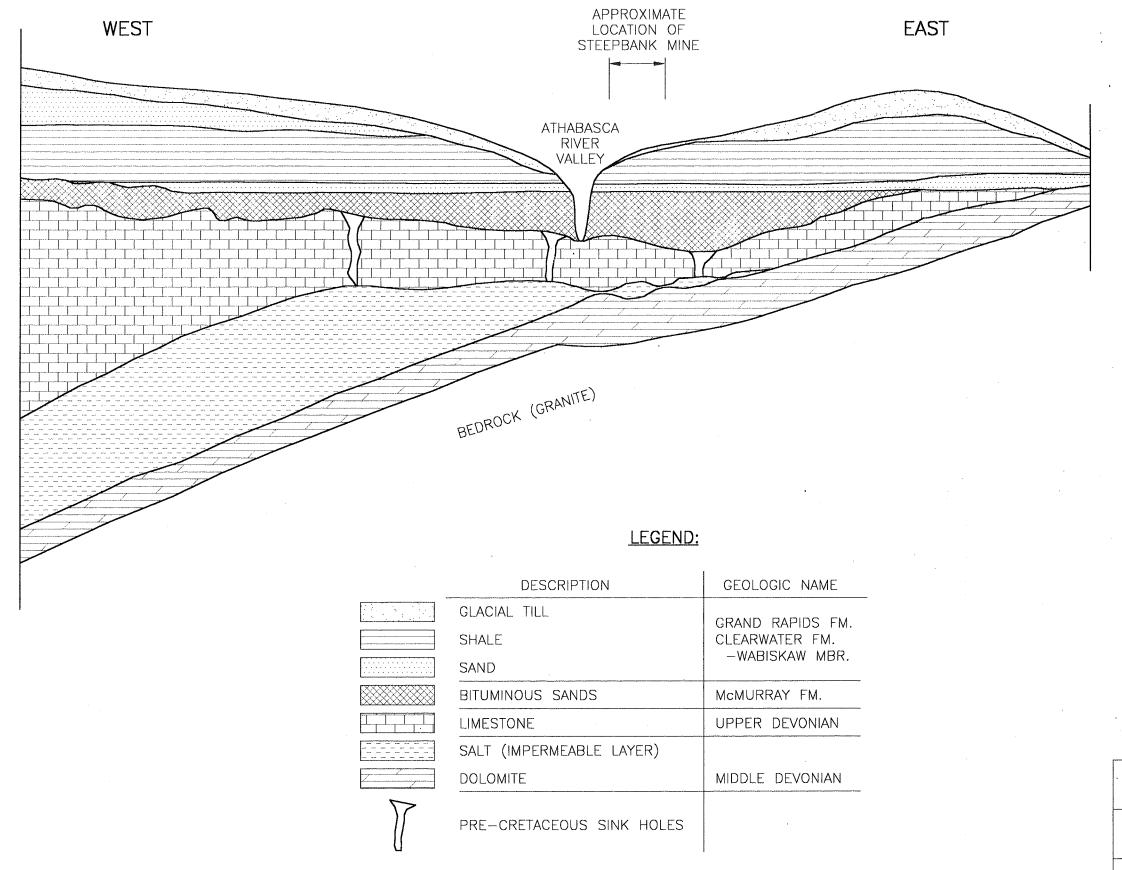
DRAWINGS















CONCEPTUALIZED REGIONAL GEOLOGY CROSS SECTION (MODIFIED FROM CARRIGY, 1973)

AS SHOWN
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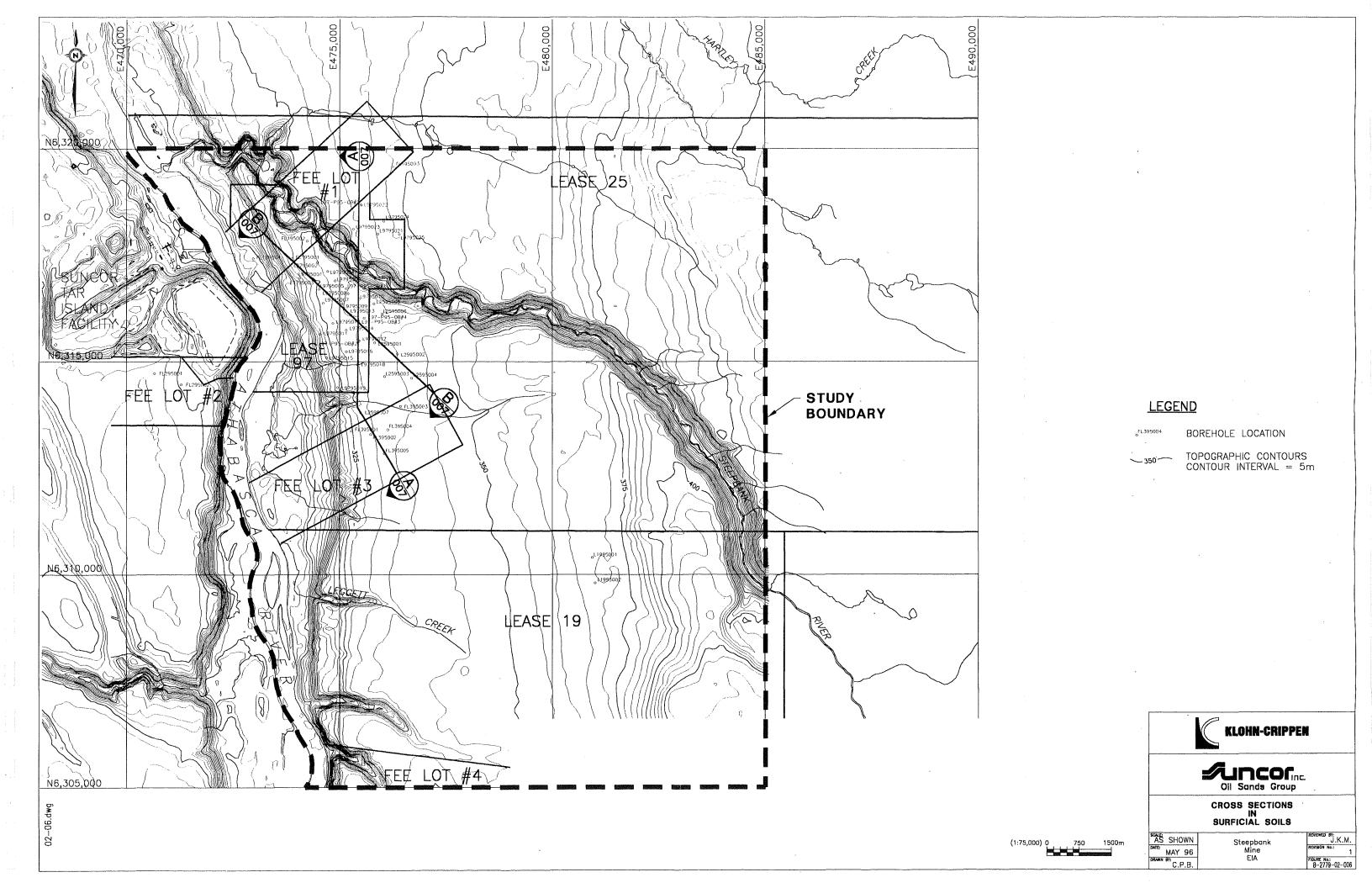
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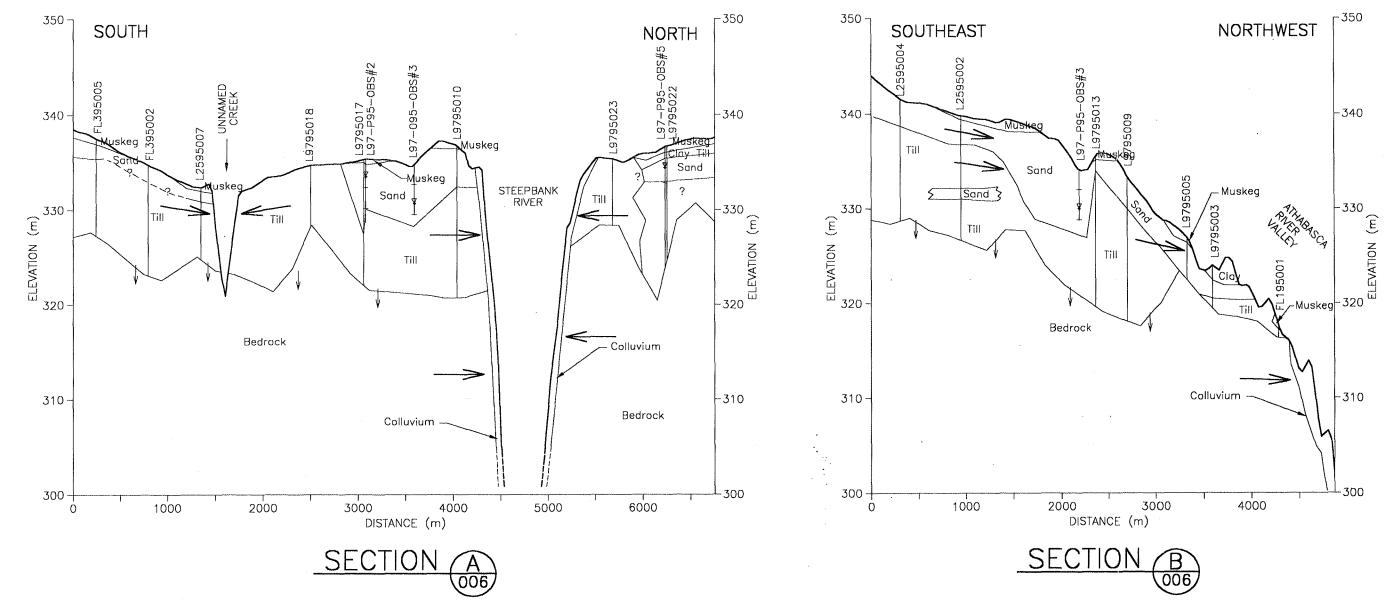
Steepbank Mine EIA REVIEWED BY:

J.K.M.

REVISION No.:

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FIGURE No.:





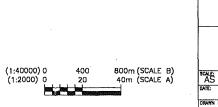
STANDPIPE PIEZOMETER

WATER LEVEL IN PIEZOMETER

DIRECTION OF GROUNDWATER FLOW

NOTE:

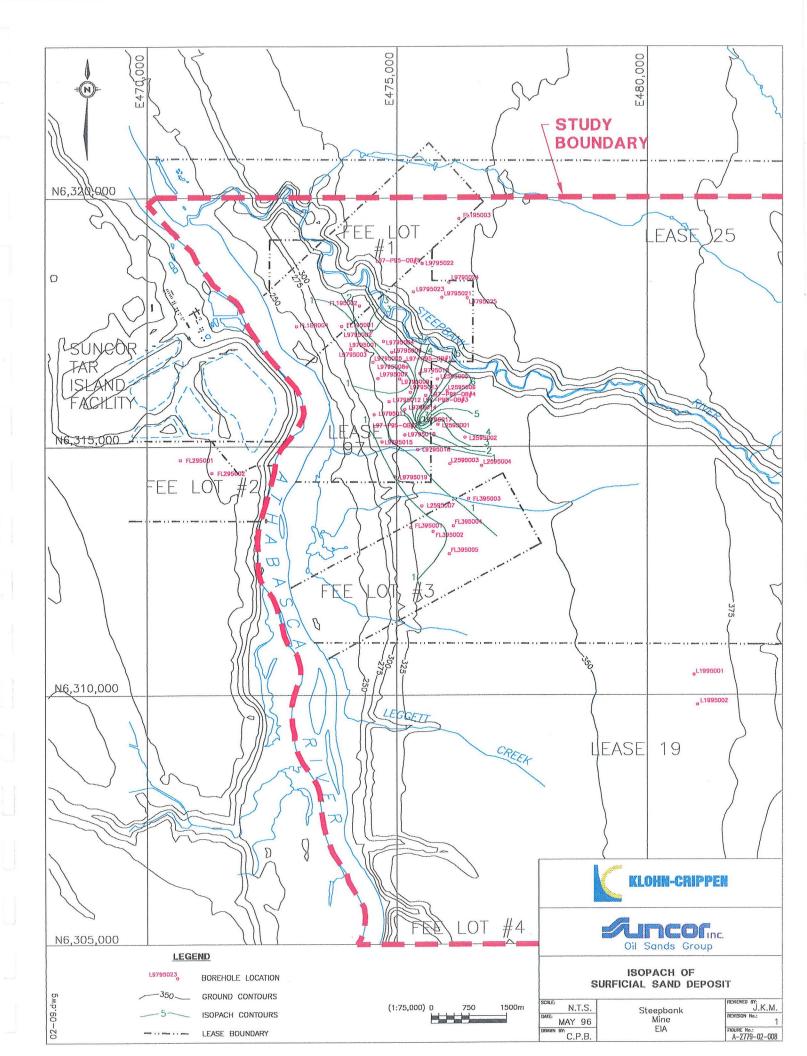
STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

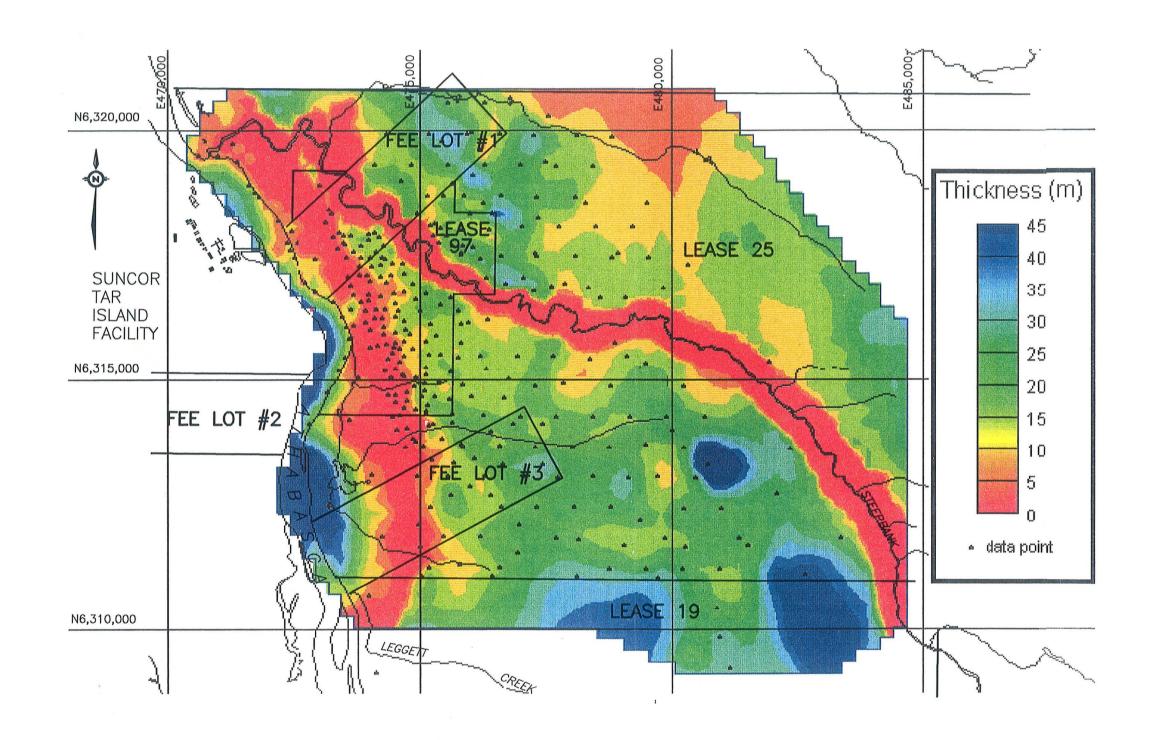




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Steepbank Mine EIA









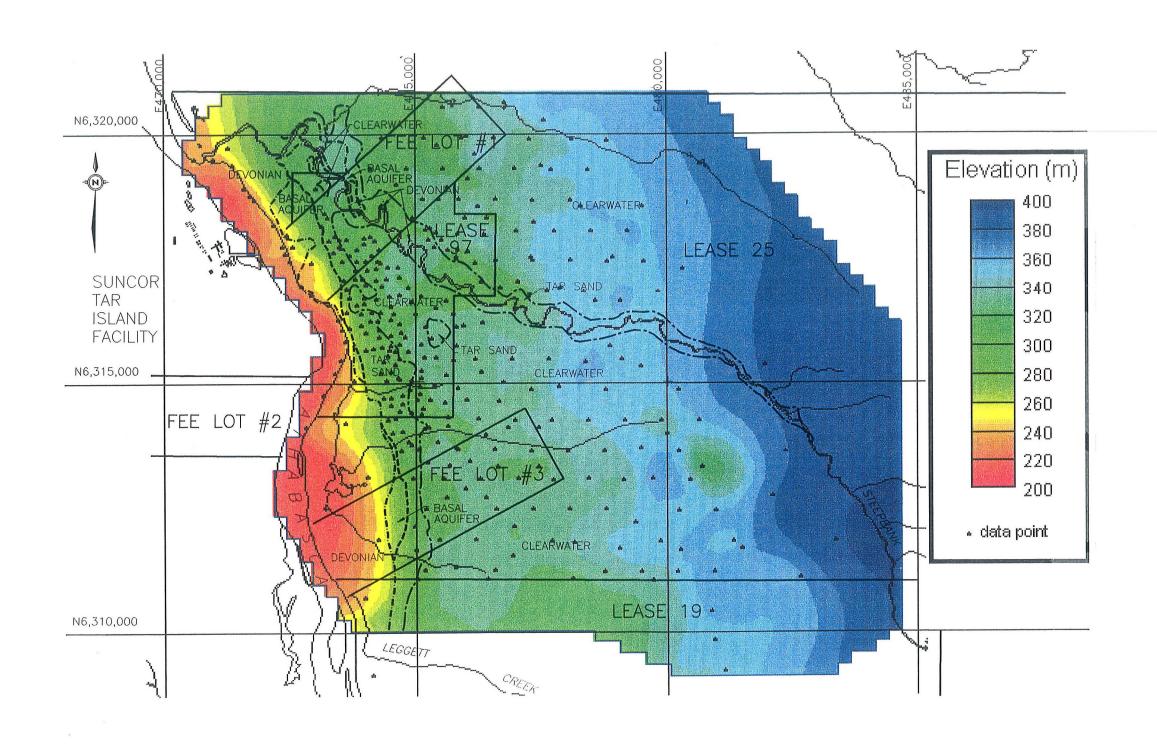
ISOPACH MAP OF SURFICIAL DEPOSITS

AS SHOWN MAY 96

RAWN BY:
C.P.B.

(1:75,000) 0

Steepbank Mine EIA







BEDROCK TOPOGRAPHY MAP

TO AS SHOWN

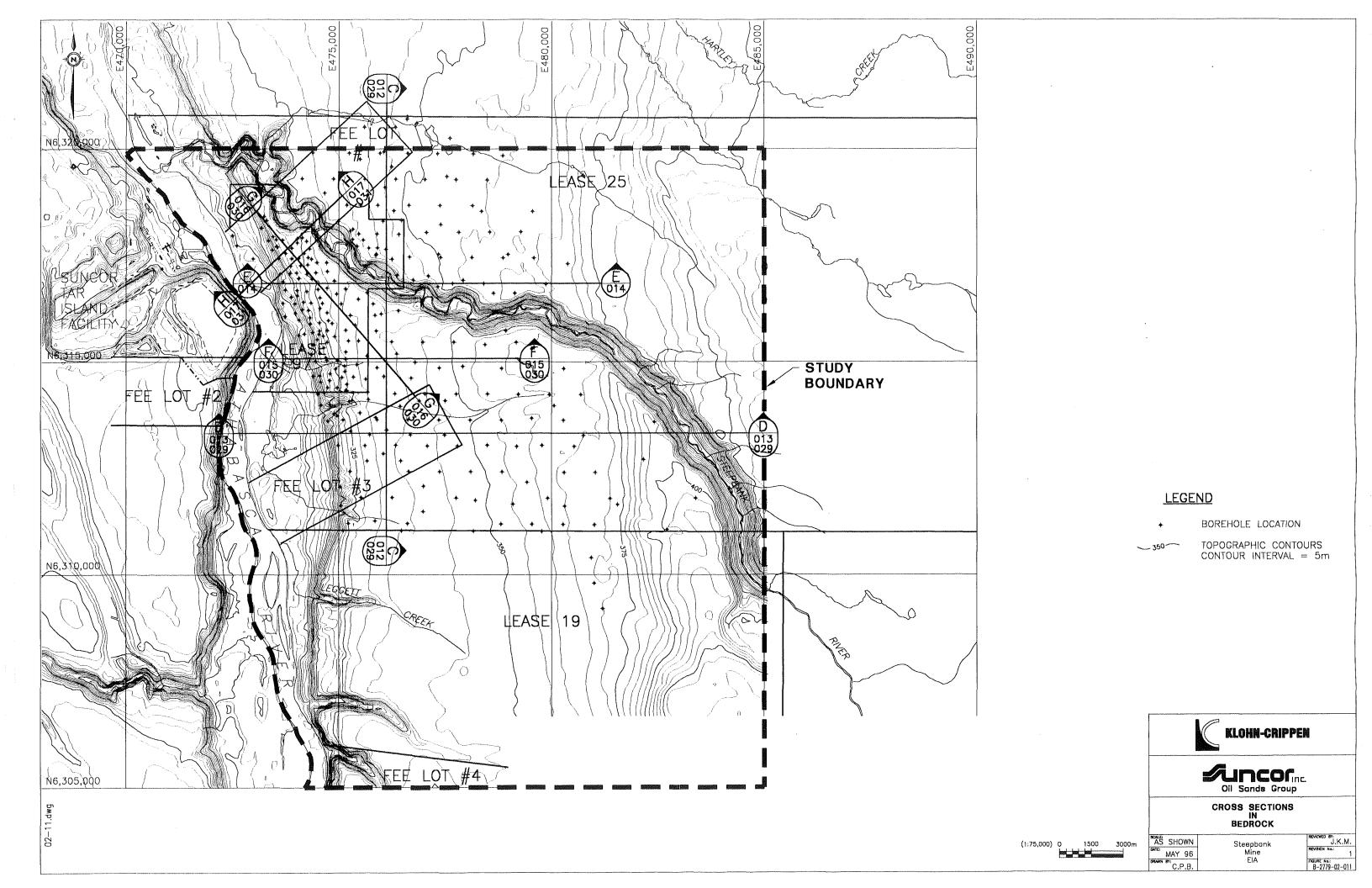
DATE: MAY 96

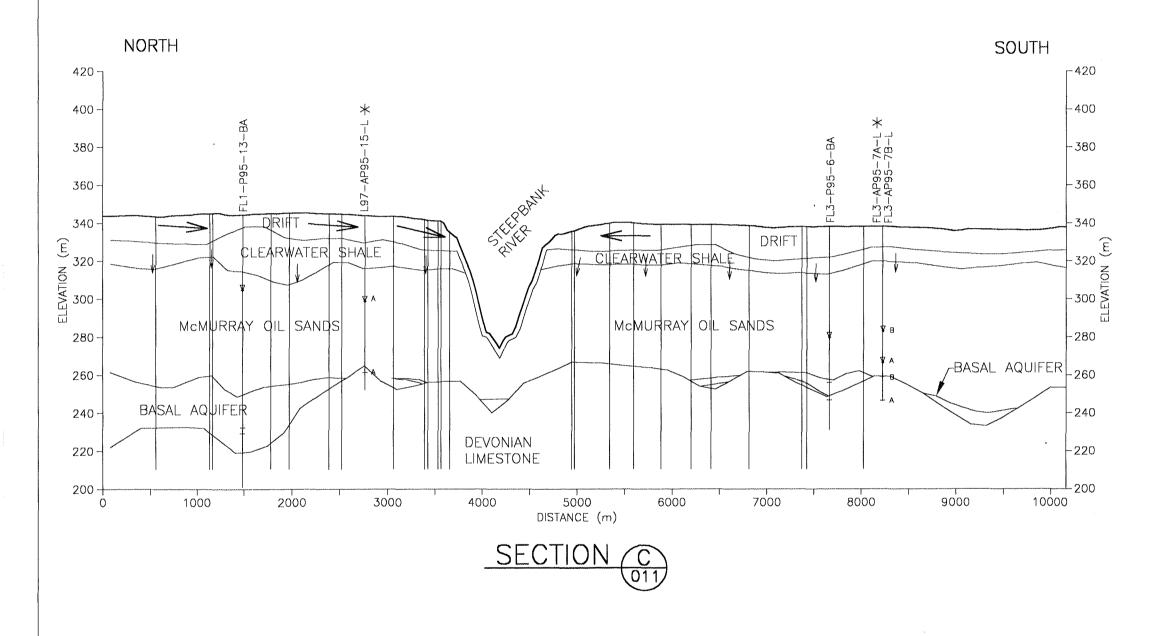
DRAWN BY: C.P.B.

(1:75,000) 0

OWN Steepbank 96 Mine EIA

REMEWED EY:
J.K.M.
REMISION No.:
1
FRUIRE No.:
B-2779-02-016





STANDPIPE PIEZOMETER

PNEUMATIC PIEZOMETER

WATER LEVEL IN PIEZOMETER

HYDRAULIC HEAD AT PNEUMATIC PIEZOMETER

L97-P95-x-BA PIEZOMETER COMPLETED IN BASAL AQUIFER

L97-AP95-x-L PIEZOMETER COMPLETED IN LIMESTONE

← DIRECTION OF GROUNDWATER FLOW

THE COMPLETION ZONES
OF PIEZOMETERS OFFSET FROM
THE SECTION MAY NOT LINE UP
WITH THE SECTION'S STRATIGRAPHY.

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN





BEDROCK CROSS SECTION C BASELINE CONDITIONS

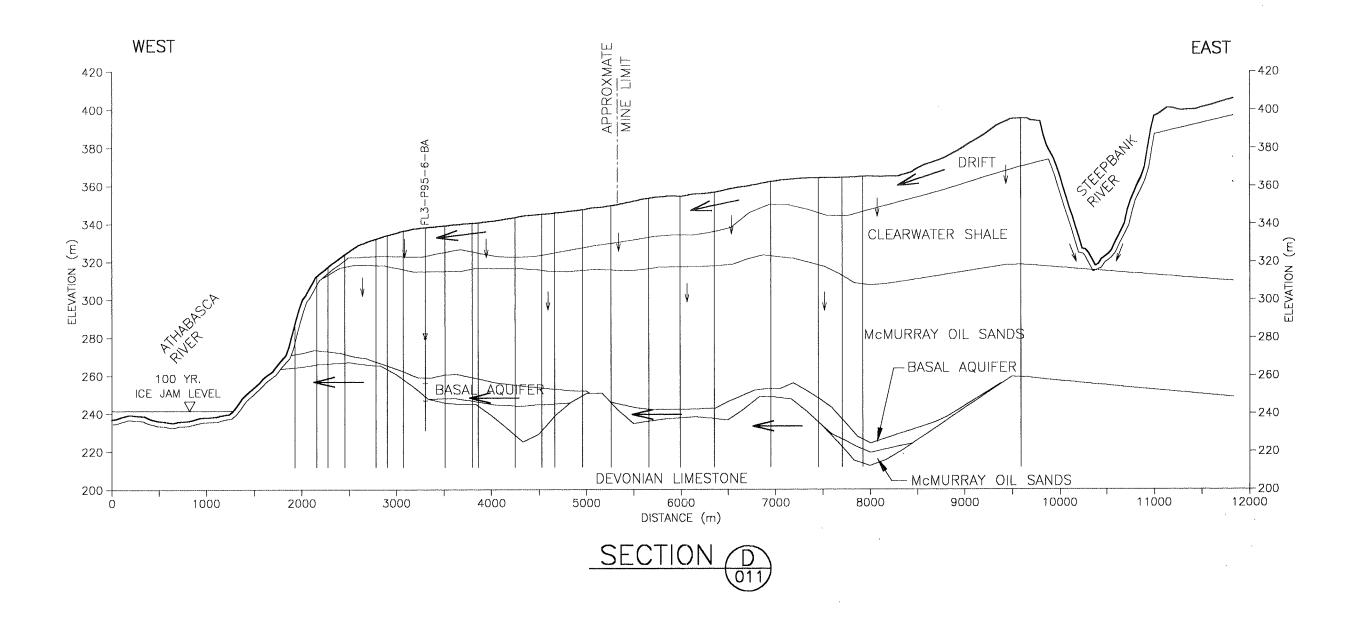
(1:40,000) 0 400 800m (SCALE E (1:2,000) 0 20 40m (SCALE E

AS SHOWN

DATE: MAY 96

DRAWN BY: C P.R.

Steepbank J.K.I
Mine EIA REVISION No.:



STANDPIPE PIEZOMETER

WATER LEVEL IN PIEZOMETER

L97-P95-x-BA PIEZOMETER COMPLETED IN BASAL AQUIFER

DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

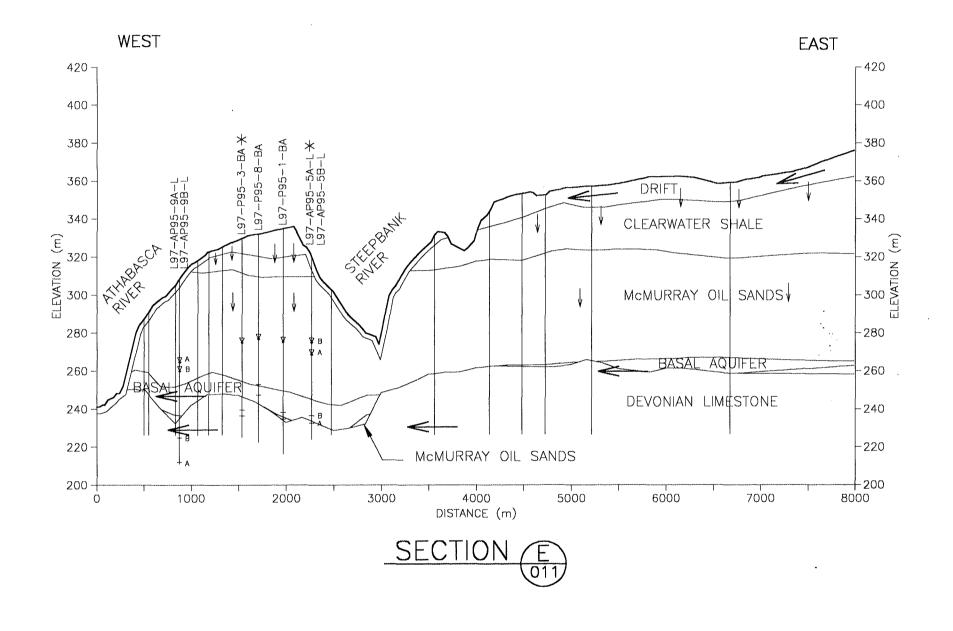


Oil Sands Group

BEDROCK CROSS SECTION D, BASELINE CONDITIONS

(1:40,000) 0 (1:2,000) 0

AS SHOWN DRAWN BY: C.P.B. Steepbank Mine EIA



- STANDPIPE PIEZOMETER
- PNEUMATIC PIEZOMETER
- HYDRAULIC HEAD AT PNEUMATIC PIEZOMETER
- L97-P95-x-BA PIEZOMETER COMPLETED IN BASAL AQUIFER
- L97-AP95-x-L PIEZOMETER COMPLETED IN LIMESTONE
 - DIRECTION OF GROUNDWATER FLOW
 - NOTE: THE COMPLETION ZONES
 OF PIEZOMETERS OFFSET FROM
 THE SECTION MAY NOT LINE UP
 WITH THE SECTION'S STRATIGRAPHY.

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN





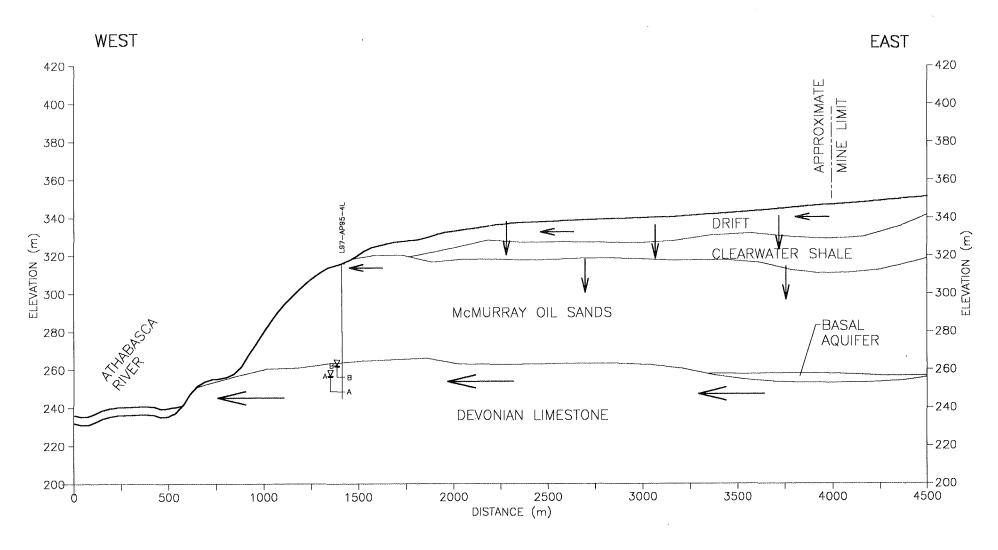
BEDROCK CROSS SECTION E BASELINE CONDITIONS

0 400 800m (SCALE B) 0 20 40m (SCALE A)

AS SHOWN
DATE:
MAY 96
DRAWN BY:

Steepbank
Mine
EIA

02-14.dwg





STANDPIPE PIEZOMETER

WATER LEVEL IN PIEZOMETER

L97-P95-x-BA PIEZOMETER COMPLETED IN BASAL AQUIFER

DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

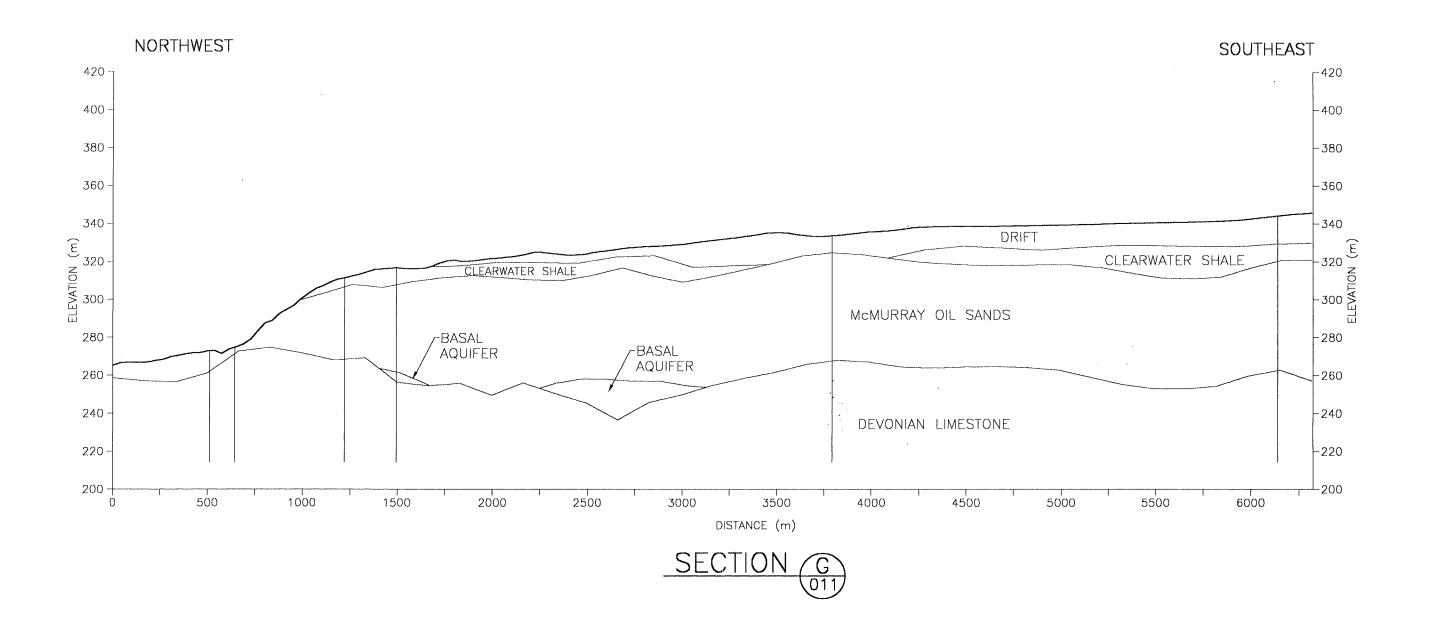


BEDROCK CROSS SECTION F BASELINE CONDITIONS

AS SHOWN MAY 96

Steepbank Mine EIA

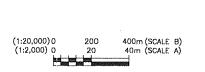
400m (SCALE B) 40m (SCALE A) (1:20,000)0

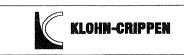


TESTHOLE LOCATION

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN





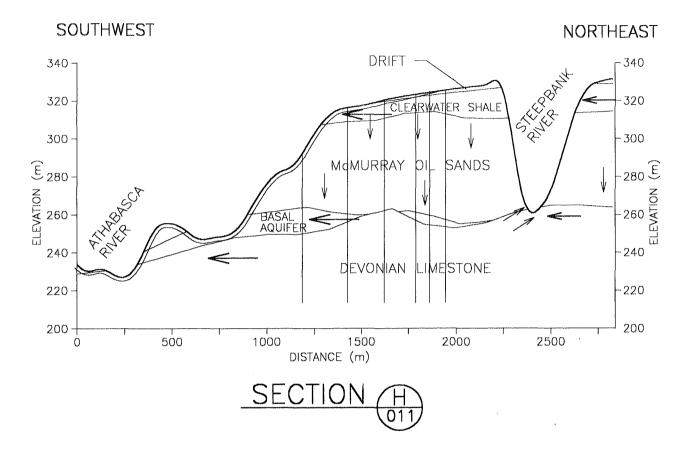


BEDROCK CROSS SECTION G BASELINE CONDITION

AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank Mine EIA REMISION NO.:

FIGURE No.:
B-2779-02-016



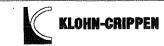
<u>LEGEND</u>

TESTHOLE LOCATION

DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

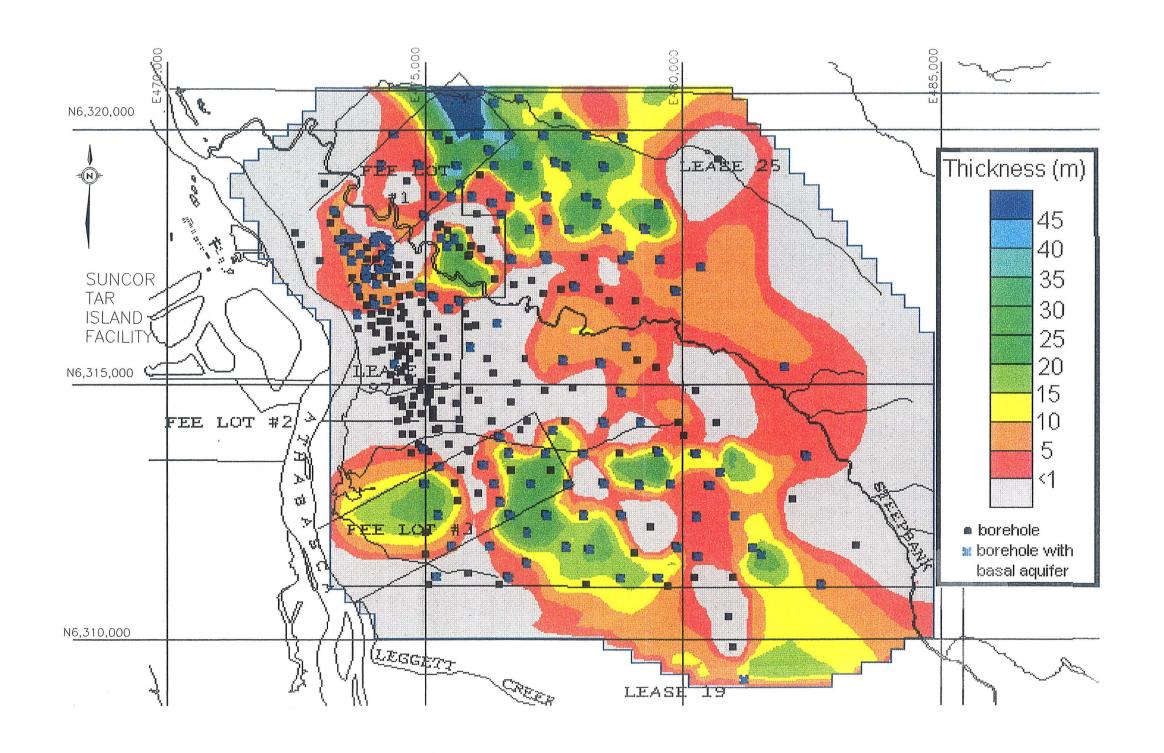




BEDROCK CROSS SECTION H BASELINE CONDITIONS

,000) 0 200 400m (SCALE B) ,000) 0 20 40m (SCALE A)

SCALE: AS SHOWN DATE: MAY 96 Steepbank Mine EIA







ISOPACH MAP OF BASAL AQUIFER

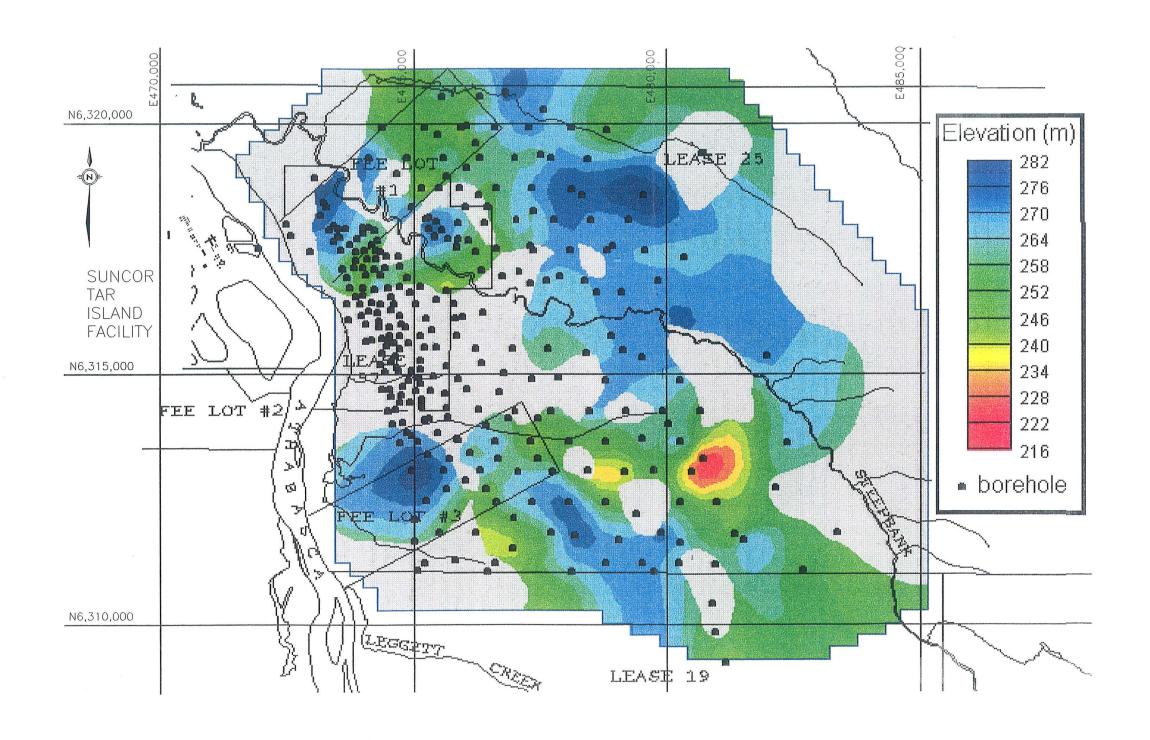
SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank Mine EIA

TIK J.K.M.

REVISION No.: 1

FROURE No.: B-2779-02-018

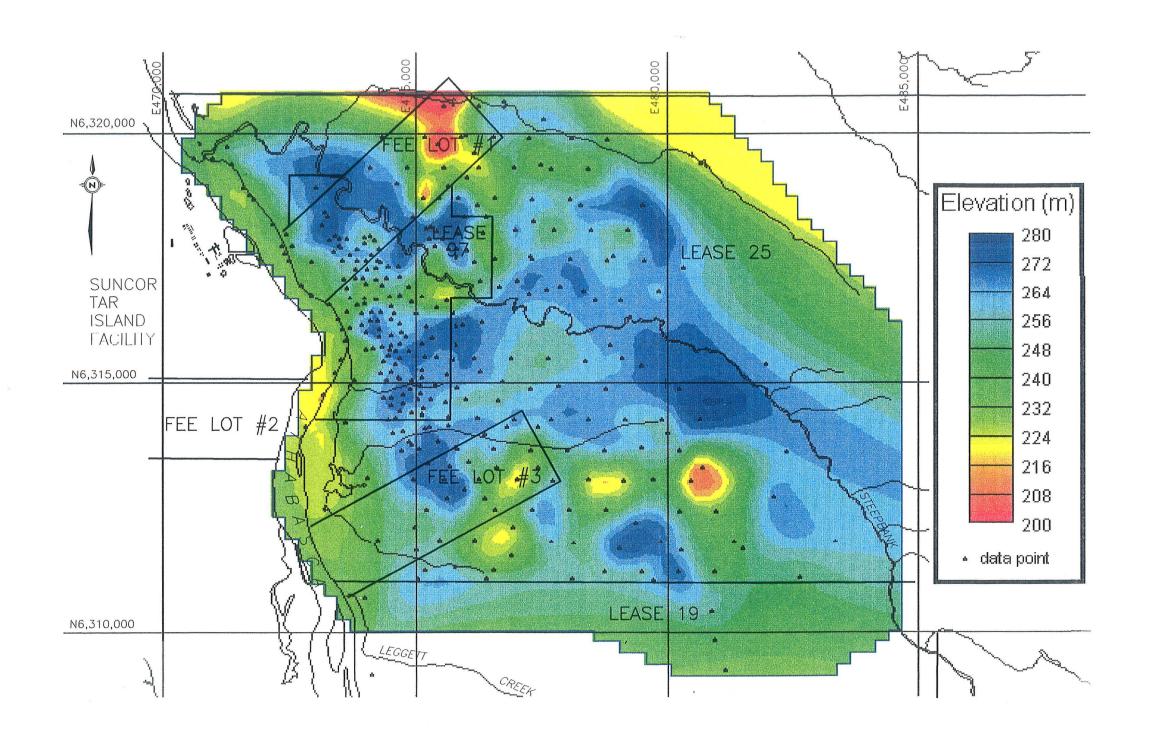






STRUCTURE MAP OF BASAL AQUIFER

AS:	SHOWN
DATE:	MAY 96
DRAWN	BY:



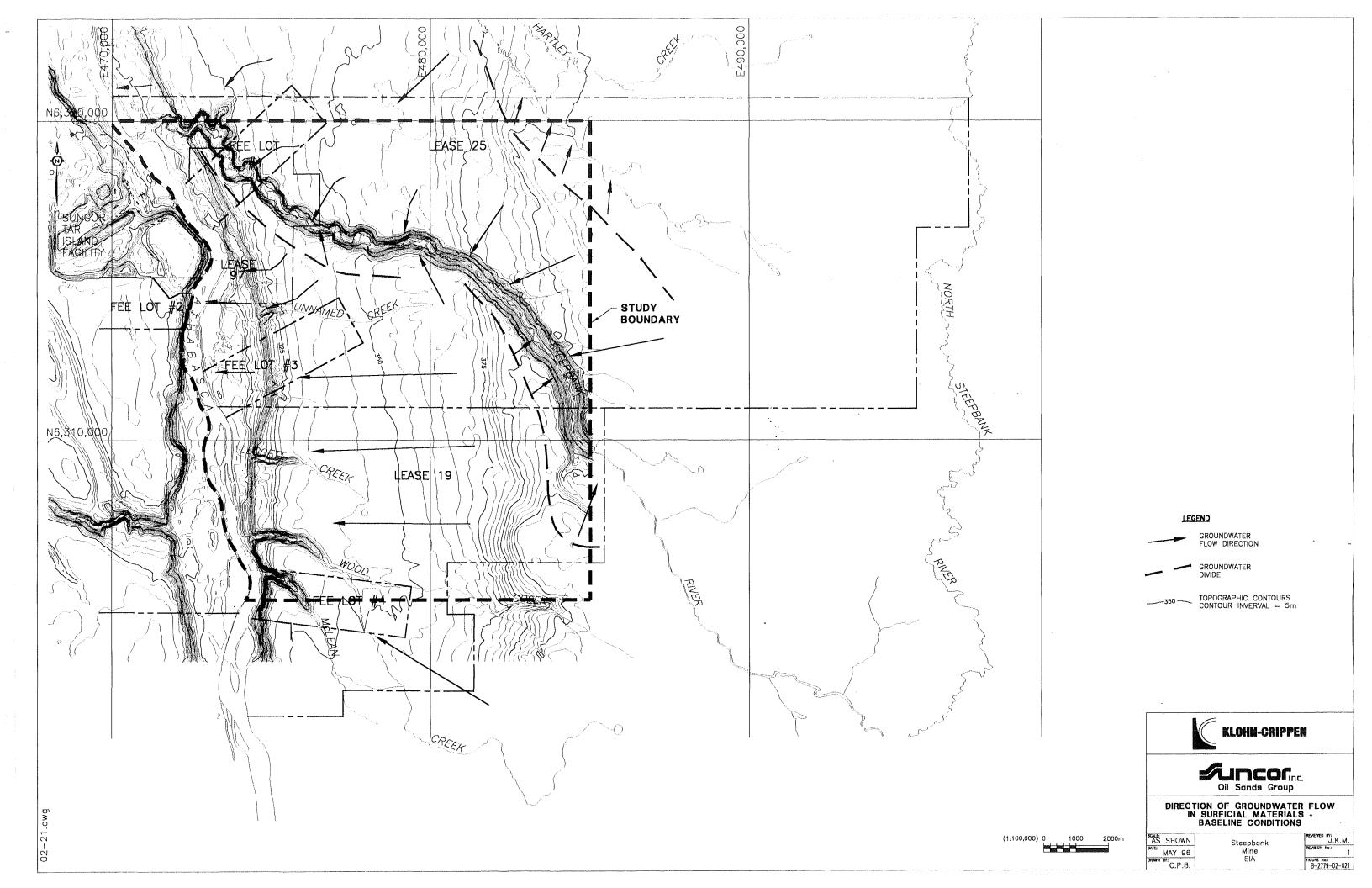


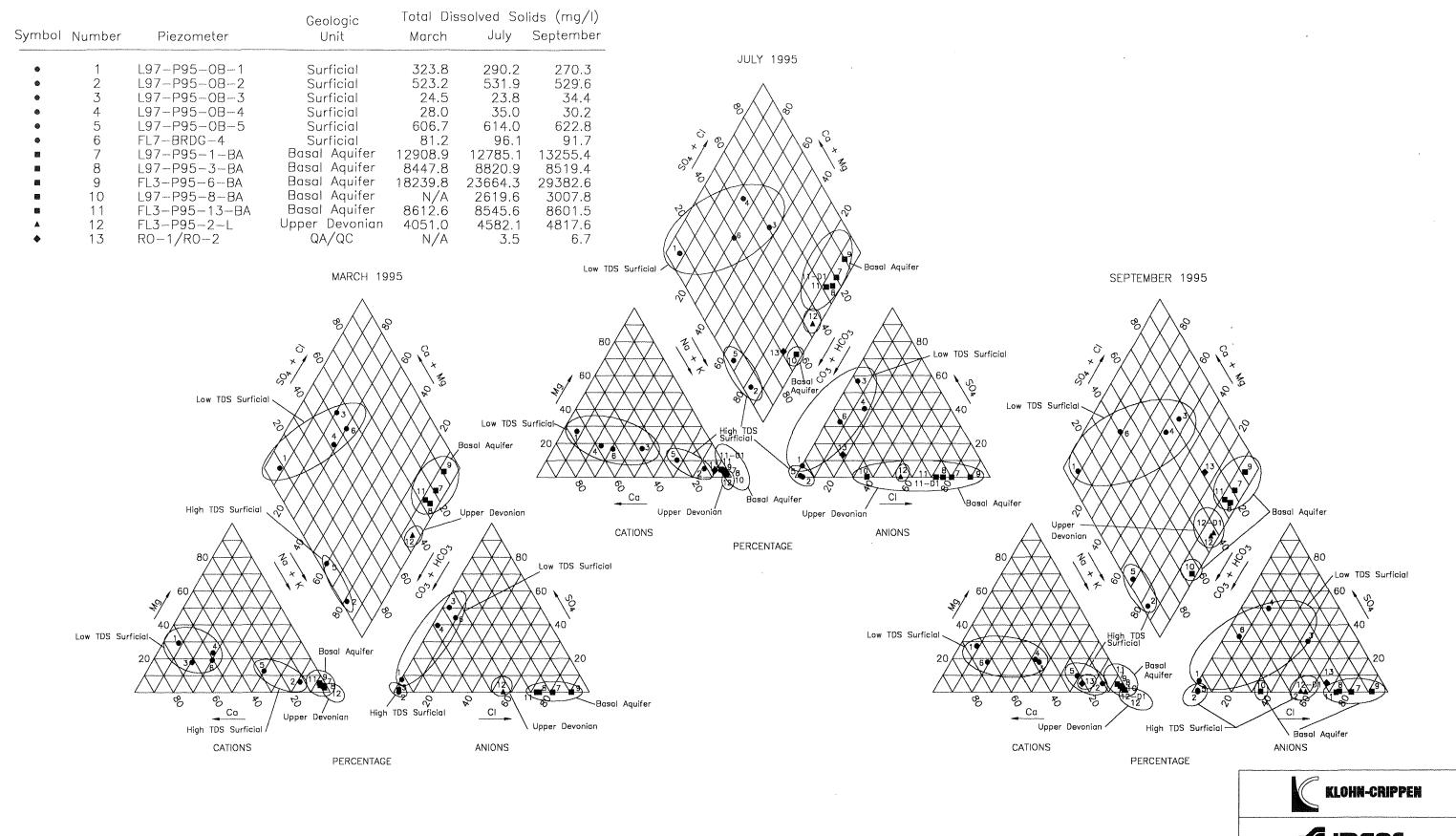


STRUCTURE MAP OF UPPER DEVONIAN

AS:	SHOWN	
ATE:	MAY 96	
RAWN	C.P.B.	

(1:75,000) 0







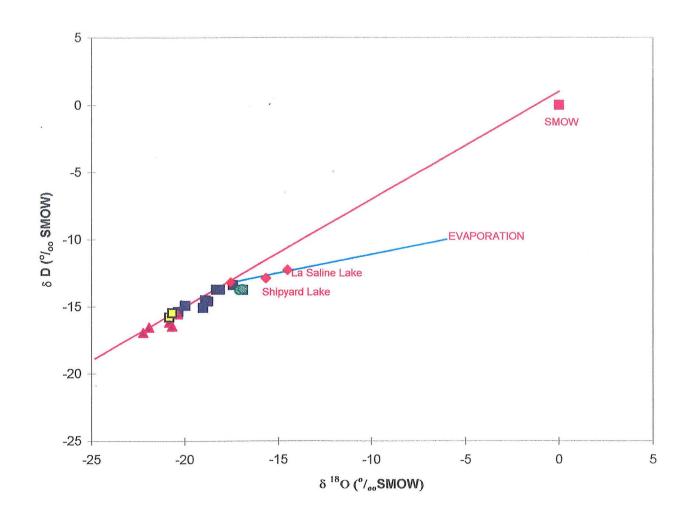
PIPER PLOT GROUNDWATER SAMPLES 1995

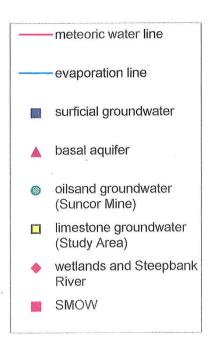
AS SHOWN
DATE: MAY 96
DRUWN BY: O. P. P.

Steepbank Mine EIA

FIGURE No.: B-2779-02-02

Scatter Diagram of δD and δO^{18} , in surface water and groundwater in the Study Area







DATE: N.T.S.

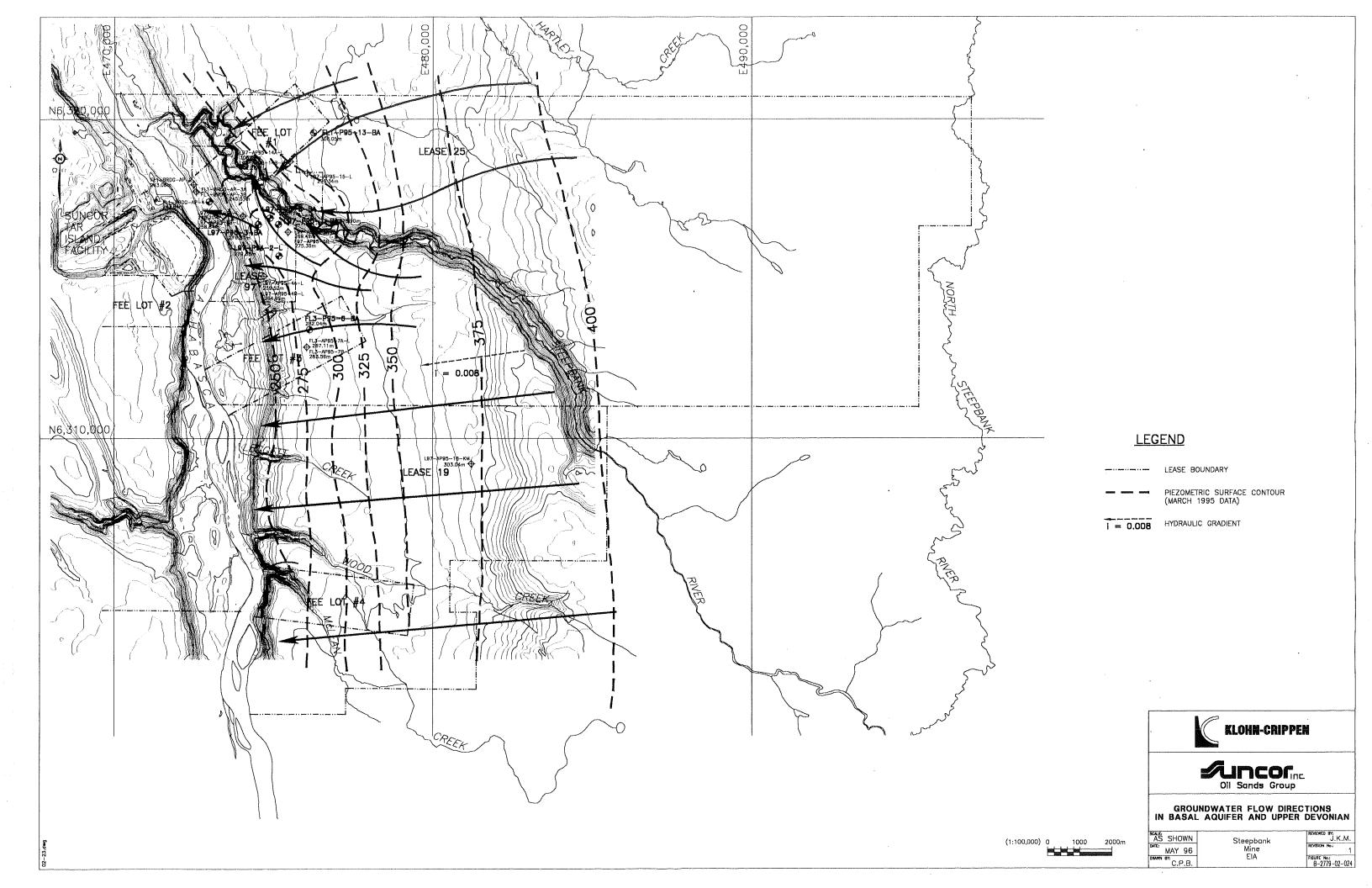
DATE: 25 03 96

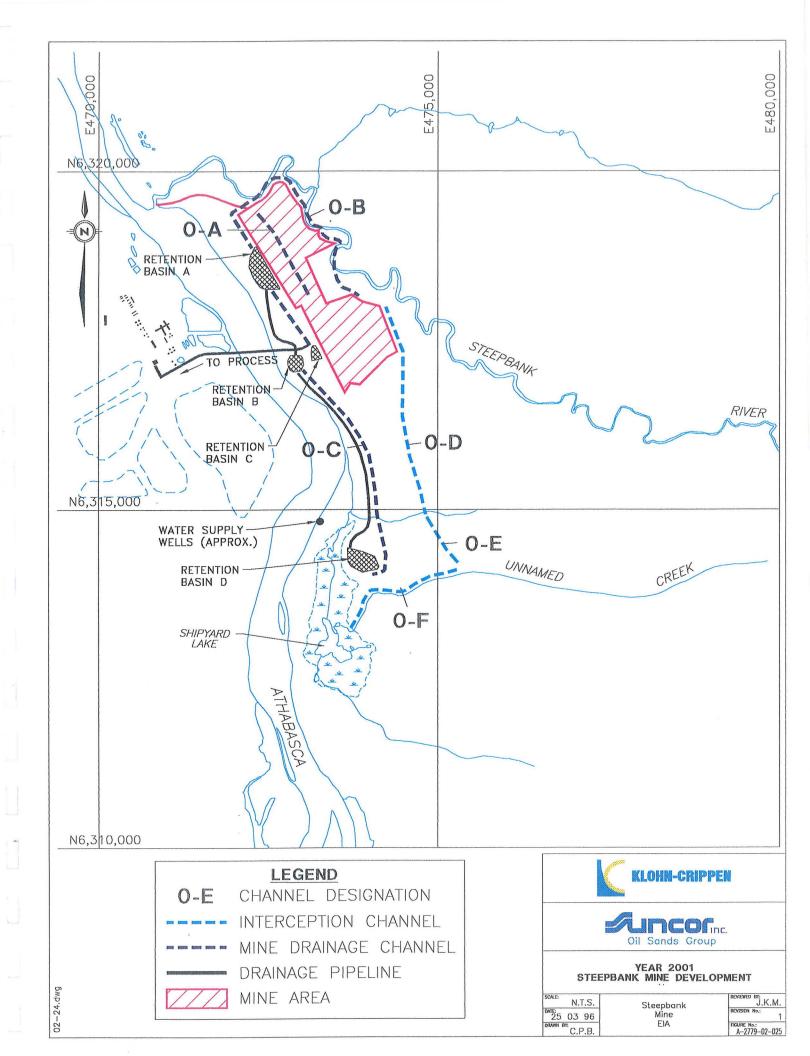
DRAWN BY: C.P.B.

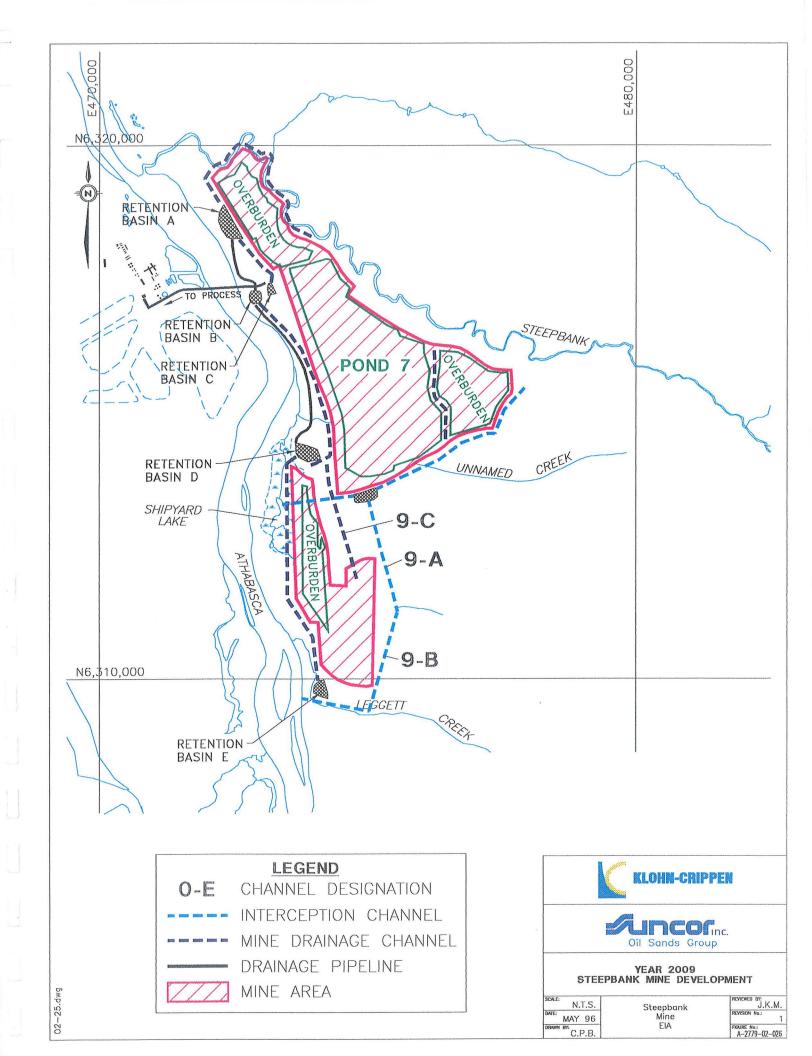
Steepbank Oilsands Mine

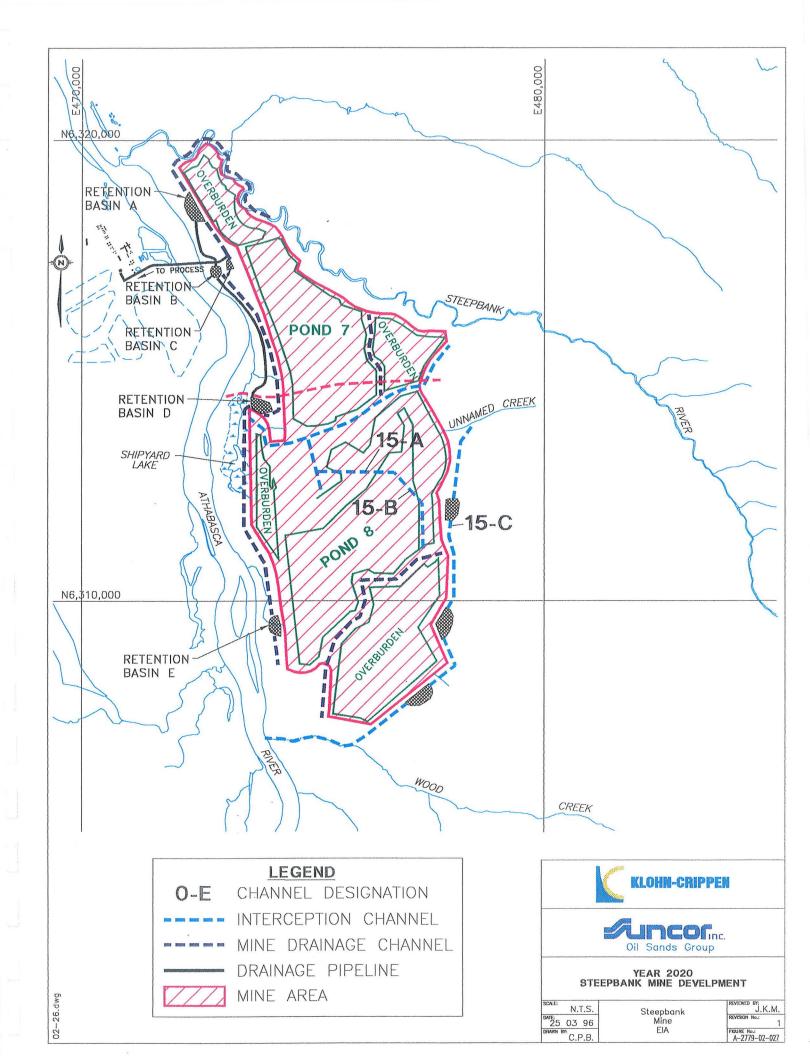
J.K.M.
REVISION No.:

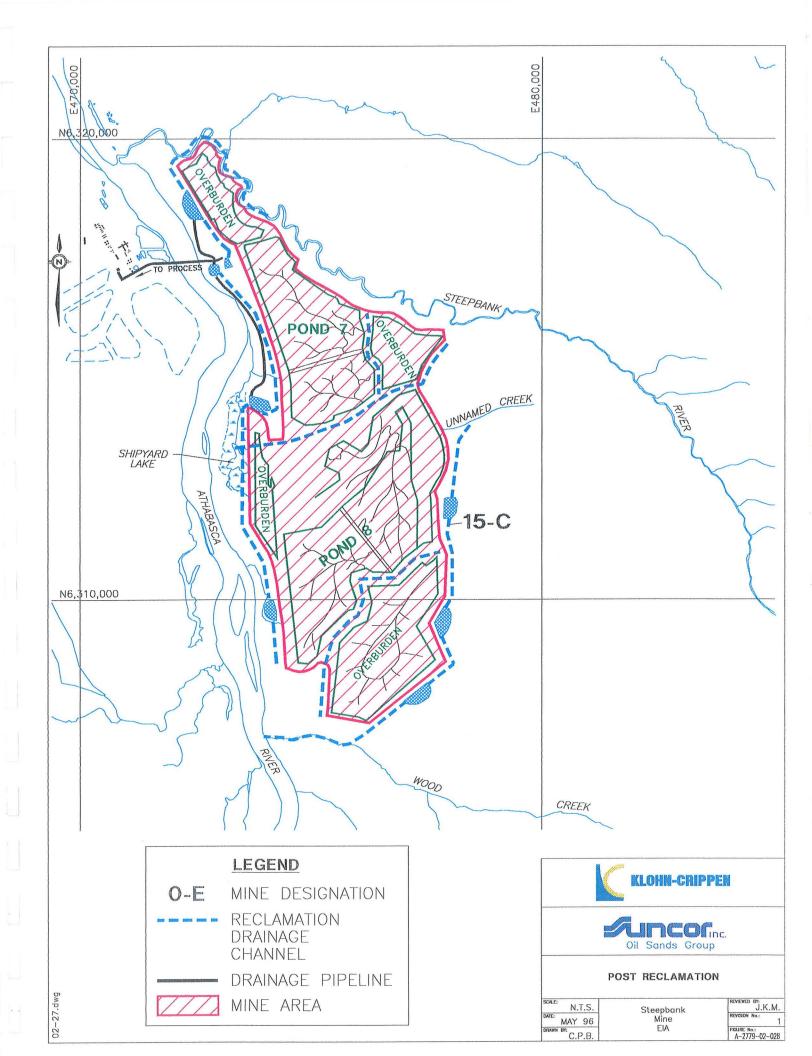
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FIGURE No.:
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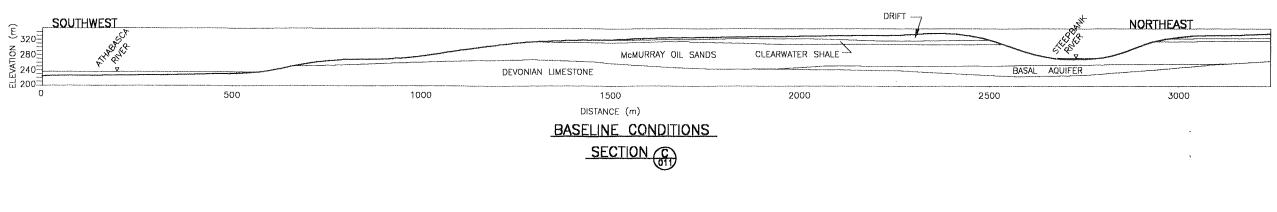


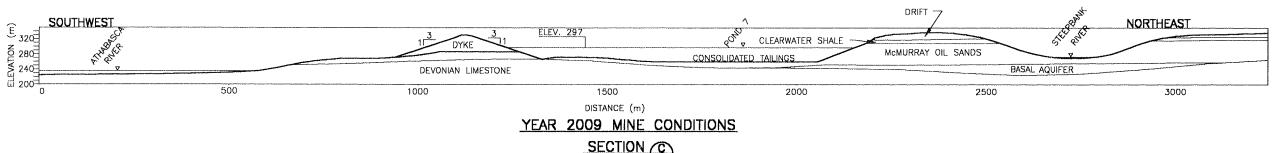


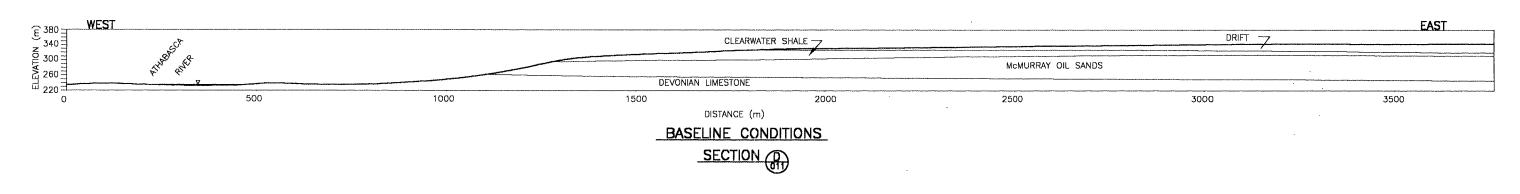


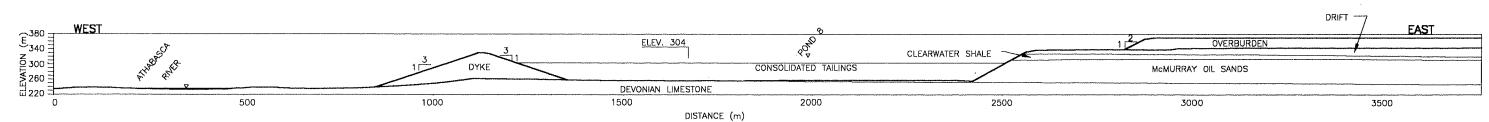












YEAR 2020 MINE CONDITIONS
SECTION



(1:10000) 0 100 200m

AS SHOWN

ONTE: MAY 96

DRAWN 67 C.P.B.

Steepbank
Mine
EIA

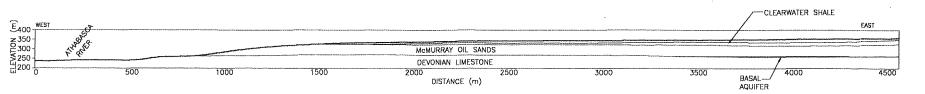
Steepbank

Mr. MEMSON No.:

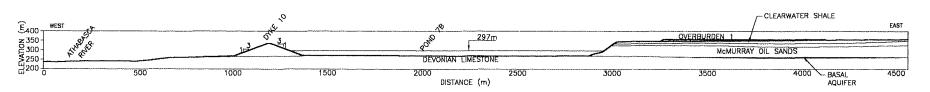
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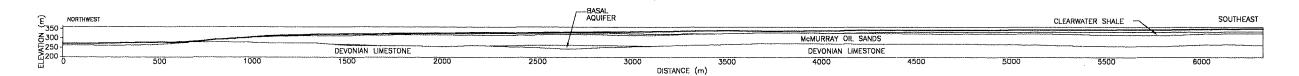


BASELINE CONDITIONS

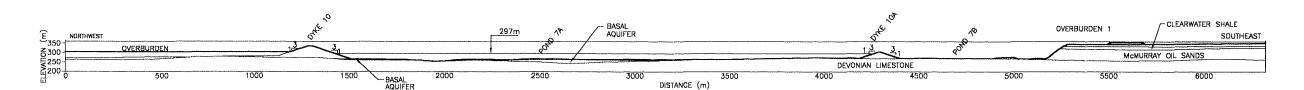


YEAR 2009 MINE CONDITIONS

SECTION F HOR: SCALE B VERT: SCALE A



BASELINE CONDITIONS



YEAR 2009 MINE CONDITIONS

SECTION G HOR: SCALE B VERT: SCALE A



GEOLOGIC CROSS SECTIONS F & G BEFORE AND AFTER MINING

AS SHOWN DATE: MAY 96 DAANN BY: L.G.H.

400m (SCALE B) 400m (SCALE A)

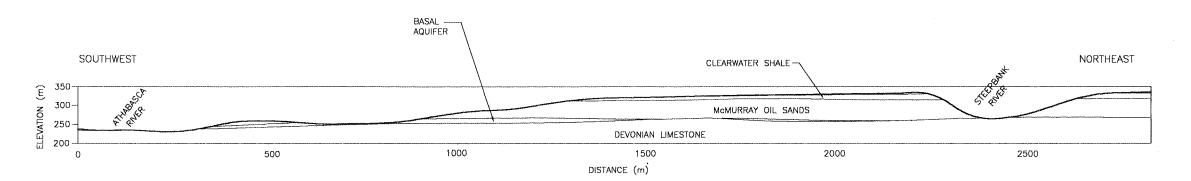
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Steepbank Mine EIA

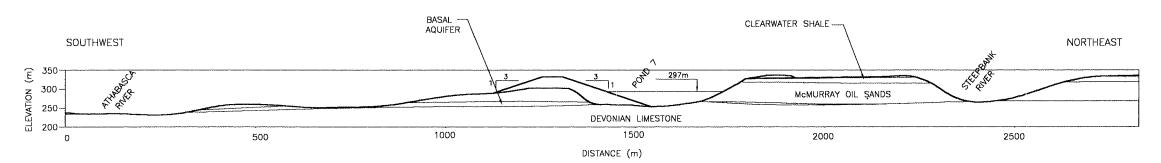
REVIEWED BY:

J.K.M.
REVIEWON No.:

1



BASELINE CONDITIONS



YEAR 2009 MINE CONDITIONS

SECTION H HOR: SCALE B VERT: SCALE A





GEOLOGIC CROSS SECTION H BEFORE AND AFTER MINING

200m (SCALE B) AS SHOWN

MAY 96

Steepbank Mine EIA

APPENDICES

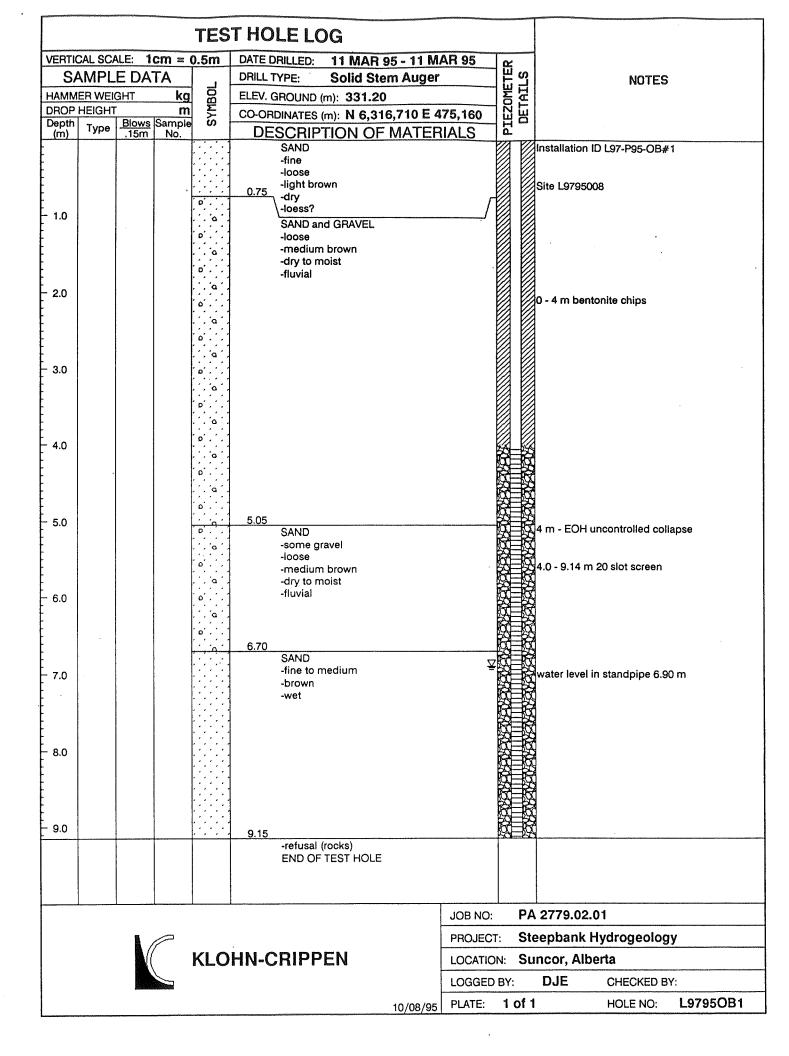
APPENDIX I

BOREHOLE LOGS AND WELL COMPLETION DETAILS

Steepbank Mine Standpipe Piezometers

			Ground				Water Level	Water Elevation
Installation ID	Northing	Easting	Elevation	Stick-up	Screen	Interval	(Mar/95)	(Mar/95)
L97-P95-1-BA	6316710	475160	331.2	0.79	93.00	96.00	55.09	276.90
L97-P94-2-L	6315740	475160	332.558	0.81	65.80	68.90	53.71	279.66
L97-P95-3-BA	6316700	474520	325.647	0.91	86.30	89.30	49.89	276.67
FL3-P95-6-BA	6313400	476130	339.25	0.96	82.10	91.30	58.17	282.04
L97-P95-8-BA	6316900	474900	330.655	0.94	77.20	83.30	52.47	279.13
FL1-P95-13-BA	6319580	476240	345.07	.?	111.80	114.90	39.42	306.05
FL1-BRDG-#4	6317415	472990	246.965	.?	1.50	5.20	4.43	243.44
L97-P95-OB#1	6316710	475160	331.2	.?	4.00	9.15	6.90	325.20
L97-P95-OB#2	6315483	475455	336.1	0.56	3.00	5.20	1.84	334.82
L97-P95-OB#3	6316025	475575	338.2	0.71	2.10	5.30	4.10	334.81
L97-P95-OB#4	6316133	475676	337.43	0.84	2.40	5.50	3.48	334.79
L97-P95-OB#5	6318680	475510	336.95	.?	1.80	3.80	2.17	335.68

- Water levels for standpipes are in meters below top of pipe
- Water level measurements were made in March, 1995
- The screen interval refers to the top and bottom depths in meters



VERTIC	CAL SC/	LE: 1	cm = (0.5m	DATE DRILLED: 11 MAR 95 - 11 M	AR 95	Ω	**************************************	•
SA	AMPL	E DA	TA		DRILL TYPE: Solid Stem Auger		PTFZOMFTFD	ည်း	NOTES
	ER WEI		kg		ELEV. GROUND (m): 336.10		Ē	DETAILS	
DROP Depth	HEIGHT	Blowe	m Sample	\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \	CO-ORDINATES (m): N 6,315,483 E 4	75,455	Ĺ		
(m)	Туре	.15m	No. I		DESCRIPTION OF MATER	IALS	a	=	
.			1 1	四 亞	I TO CITE OF SHIRL I SHITT				Installation ID L97-P95-OB#2
[77 77					stickup 0.56 m
-					0.60 SAND				Site L9795017
1.0					-silty				
ļ '.					-some gravel -broken rock fragments				
Ė					-non-fluvial		•		
-									
- - 2.0						峹			water level in standpipe 1.84 m
2.0						j			
Ė									
F							i		
- 3.0 -						ļ		= ::	
						ļ		目::	
-								目::	3.0 - 5.2 m 20/40 sand
4.0					under broding at about 4 m			= ::	
- 4.0					-water bearing at about 4 m			目::	3.0 - 5.2 m 20 slot screen
								= ::	
								目::	
								= ::	
5.0					5.00			目::	
-					5.30 CLAY				
					plastic -stiff				
-					-dark grey				
- 6.0			,		-bitumen odour				
-									
					6.70				
					END OF TEST HOLE				
	1								
								Viteron Landschaft (1994)	
						JOB NO:		P/	A 2779.02.01
						PROJECT:	******	St	eepbank Hydrogeology
		M(KLO	HN-CRIPPEN	LOCATION	! :	Sı	ıncor, Alberta
						LOGGED E	3Y	:	DJE CHECKED BY:
					22/08/95	PLATE:	1	of ·	1 HOLE NO: L9795OB2

	TEST HOLE LOG											
VERTIC	CAL SC	NLE: 1	cm =	0.5m	DATE DRILLED:	- 11 MAR	95 c	۲ .	•			
SA	MPL	E DA	TA		DRILL TYPE:	Solid Stem			DETAILS	NOTES		
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 338.20		Z 2	DETAILS			
DROP	HEIGHT		m	X.	CO-ORDINATES	(m): N 6,316, 0	25 E 475,	575				
Depth (m)	Type	.15m	Sample No.	<u> </u>	DESCRIP	TION OF M	<u>ATERIAL</u>	S E				
- -					SAND -fine to r	medium				Installation ID L97-P95-OB#3		
					-no grav	el				stickup 0.71 m		
-					-mediun	n brown						
_ 1.0			,									
‡ '.º												
-												
E												
2.0									∐:•	•		
										•		
				[····]						2.1 - 3.35 m 20/40 sand		
<u> </u>					bassess	ning moist				•		
- 3.0 -					-becom	ming moist				2.1 - 5.3 m 20 slot screen		
-												
E								2		3.35 m - EOH uncontrolled collapse		
4.0								₹	, ⊸∧	water level in standpipe 4.10 m		
-								i i i		d		
								E E				
-								Ď				
5.0					F 20							
					5,30 -refusal							
					END OF	TEST HOLE						
										·		
								·				

		•					JO	B NO:	P/	À 2779.02.01		
		1					PR	PROJECT: Steepbank Hydrogeology				
				KLO	HN-CRIPP	EN	LC	CATION:	Sı	ıncor, Alberta		
							LC	GGED BY	/ :	DJE CHECKED BY:		
						22	ļ		of ·	1 HOLE NO: L9795OB3		

				TES	T HOLE LOG					
		ALE: 1		0.5m		MAR 95 - 11 MA	R 95	α	**************************************	
	THE RESERVE OF THE PERSON NAMED IN	<u>E DA</u>			The state of the s	olid Stem Auger	***************************************	PTEZOMETER	DETAILS	NOTES
	ER WEI		kg		ELEV. GROUND (m):			Š	2	
Depth	HEIGHT	Blows	Sample	3 5		N 6,316,133 E 47		1	띰	
Depth (m)	Type	Blows .15m	No.	1,,	<u>DESCRIPTIO</u>	<u>ON OF MATERI</u>	<u>ALS</u>	à	•	
ļ				· . · . · . ·	SAND -fine					Installation ID L97-P95-OB#4
					-trace silt					stickup 0.84 m
-		İ			-poorly grad -brown	ed (uniform)				
F					11WOIG-					
1.0						-				
-				: : : : · : ·						
Ė								,		
Ę.										
2.0										
		}			-becomming	moist				
									三	X
<u> </u>										
3.0								38	郑	9 02.4 - 5.5 m collapse
-				. : . : . : .				8		3.5 33
<u> </u>		l		.			五			water level in standpipe 3.48 m
Ļ i								Ź		Water to vor in examplipe 3.45 m
4.0								\mathcal{C}		1 22.4 - 5.5 m 20 slot screen
<u> </u>				\				X		A2.4 - 5.5 III 20 SIOL SCIEEN
F				<u> </u>				\bigotimes		
								\otimes	以	
5.0								公公		
ļ				\						
<u> </u>					5.50			8		
					-refusal (rock END OF TES	T HOLE				
					in					
	<u>L</u>	<u> </u>	Landensen	-	harmonia anno anno anno anno anno anno anno	interfere a ministrative de announce protectiques assistant en la communication de prima administrativo degenera	JOB NO:		P/	2779.02.01
							PROJECT	:	St	eepbank Hydrogeology
			,	KLO	HN-CRIPPE		LOCATIO	N:	Sı	ıncor, Alberta
					LOGGED BY: DJE CHECKED BY:					

LOGGED BY: **DJE** CHECKED BY: 22/08/95 PLATE: 1 of 1 HOLE NO: **L9795OB4**

TEST HOLE LOG												
VERTIC	CAL SCA	ALE: 1	cm =	0.5m	DATE	RILLED:	11 MAR	95 - 11 M	AR 95	Ια.	- Company and the Company and	
SA	AMPL	E DA	TA		DRILL 1	YPE:	Solid Se	em Auger		PIEZOMETER	က	NOTES
	ER WEI		kg	SYMBOL	ELEV. (GROUND	(m): 336.9	5] 품	A	·
	HEIGHT	Dieve	m Sample	ξ	CO-OR	DINATES	(m): N 6,3	18,685 E 4	75,504	EŽ.	<u>H</u>	
Depth (m)	Type	.15m	Sample No.					MATER		I	(Lagradi	
-				立立		PEAT						Installation ID L97-P95-OB#5
-				1 27 7		-brown						:
				쓸쓸	0.60	01.41/		***************************************				Site L9795022
						CLAY -some ro	ocks					
- 1.0				-	1.20	-grey	-					
-						(Till) SAND				\mathscr{U}		
						-silty		i				
-				::::::1		-fine to n	nedium					
2.0						-grey				##E]:::	
-				[····]					Ž	1:: [∄:::	water level in standpipe 2.17 m
										l::E	∃∷:	
										i:E	3:::	1.8 - 3.8 m 20/40 sand
3.0										::E] :::	
3.0										li:E		1.8 - 3.8 m 20 slot screen
-				[::::::]		-brown				l::E	∃:::	
-					3.70					l::E	= :::	
						MUDST	ONE			1		
4.0						-greenisi (Clearwa	1 iter)					
-	·					(0.00	,					
5.0												
•					5.20	END OF	TEST HOLE	•		<i>[[]</i>		
						LIND OF	TEST TIOLL	•				
												·
	•											
					***************************************				JOB NO:		PA	2779.02.01
									PROJEC*	Т:	Ste	eepbank Hydrogeology
				KLO	HN-C	RIPP	EN		LOCATIO	N:	Su	ncor, Alberta
									LOGGED			DJE CHECKED BY:
		. –						14/08/95	PLATE:	1 (of 1	HOLE NO: L9795OB5

	TEST HOLE LOG VERTICAL SCALE: 1cm = 1.0m DATE DRILLED: 7 JAN 95 -														
VERTIC	CAL SCA	NLE: 1	cm =	1.0m	DATE	PRILLED:	7 J/	\N 95 -			Ιœ	ATTING CONTROL OF THE			
SA	MPL	E DA	TA		DRILL:	TYPE:		l Rotary			PIEZOMETER	ഗ		NOTES	3 .
	ER WEI		kg	100	ELEV. (GROUND	(m): 3:	31.20			E	臣			
	HEIGHT	Blows	M Sample	SYMBOL			-	6,316,710		with the contract of the contr	EZ	DETAILS			
Depth (m)	Туре	.15m	Sample No.		DE	SCRIP	<u> TION</u>	<u>I OF MA</u>	<u>TER</u>	IALS	0.				
				 / 	0.30	ORGANI SAND	CS	**************************************	ang ang Salah S				Installation IC) L97-P95-1-B	A
Ε.						-medium	1								
													Borehole ID I	.9795008	
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		E DA			DRILL TYPE:	Mud Rota			田,	ဟ		NOTES	:
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				KLO	HN-CRIPP	EN	1	LOCATION	N: \$	Sui	ncor, Albe	rta	
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							27/07/95	PLATE:	2 01	f 6		HOLE NO:	L9795008

				TES	T HOLE L	OG							
VERTIC	CAL SC/	ALE: 1	cm = ·	1.0m	DATE DRILLED:	7 JAN 95 -	•		02				
SA	MPL	E DA	TA		DRILL TYPE:	Mud Rota	ry		PIEZOMETER	ျှ		NOTES	
HAMM	ER WEI	GHT	<u>kg</u>	SYMBOL	ELEV. GROUND			and the second s	5	DETAILS			
DROP	HEIGHT	Blows	m Sample No.	S	CO-ORDINATES					Ы			
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						a 2 a 0		PROJECT	***************************************	***************************************	The state of the s	lydrogeolog	y monocionissississississississississississississ
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		E DA			DRILL TYPE:	Mud Rotary		1 🖽	ဟ		NOTES	
НАММ	ER WEI	GHT	kg	<u> </u>	ELEV. GROUND	(m): 331.20		풀	B			
DROP	HEIGHT	Diama	m Communic	E	CO-ORDINATES	(m): N 6,316,710	E 475,160		띰			
(m)	Type	.15m	No.	0)				2				
	HEIGHT	•		SYMBOL	62.00 Interbure	(m): N 6,316,710 PTION OF MAT		PIEZOMETER		2* dia. sch. 4		
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			.	KLO	HN-CRIPP	'EN	LOCATIO		Su	ncor, Albe		
							LOGGED	BY:		Suncor	CHECKED B	
						27/07	/95 PLATE:	4 0	f 6		HOLE NO:	L9795008

				TES	T HOLE L	OG						
			cm = 1	1.0m	DATE DRILLED:	7 JAN 95 -		Jα.	**********			•
		E DA			DRILL TYPE:	Mud Rotary		PIEZOMETER	ရှ		NOTES	
	ER WEI		<u>kg</u>	SYMBOL	ELEV. GROUND	Partie Committee of the Partie	Complete Control of the Control of t] <u>§</u>	DETAILS			
Depth	HEIGHT	Blows	m Sample	S		(m): N 6,316,710		12	띰			
Depth (m)	Туре	.15m	Sample No.		DESCRIF	PTION OF MAT	<u>ERIALS</u>	0.	6225			
85.0					84.40 SANDS Basal A	TONE (McMurray Fm. quifer)					
90.0										top of filter s	and 91.8 m	
95.0					99.70					tip of screen	en 0.020 slots	
-	the Helicology of Languages and Commenced	L			99,70	Continu	ed JOB NO:	₩	Ω₩ ΛQ	2779.02.0) d	r til årt kild inn mill kæningsssskir for når frimnar en år se sammelskeppingsstadshannsvar
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			اا	NLU	HN-CRIPF	CIV	LOCATIO	****		ncor, Albe		
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TEST HOLE LOG		
VERTICAL SCALE: 1cm = 1.0m DATE DRILLED: 7 JAN 95 -	L C	
SAMPLE DATA DRILL TYPE: Mud Rotary		NOTES
HAMMER WEIGHT kg DROP HEIGHT m Depth Blows Sample CO-ORDINATES (m): N 6,316,710 E 4	5 E	
DROP HEIGHT M CO-ORDINATES (m): N 6,316,710 E 4	75,160 日日	
(m) Type .15m No. DESCRIPTION OF MATER	IALS E	·
Depth Type Blows Sample (n) Type Isome Iso		
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VERTIC	CAL SCA	VLE: 1	cm =	1.0m	DATE DRILLED:	14 JAN 95 -		l a				
SA	MPL	E DA	TA	e	DRILL TYPE:	Mud Rotary		60 P	្ន		NOTES	•
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 332.56		Ž	DETAILS			
DROP	HEIGHT	Diame	m oler-ole	Ž	CO-ORDINATES	(m): N 6,315,74	0 E 475,1	60	W F			
Depth (m)	Type	.15m	Sample No.	۷,	DESCRIF	TION OF MA		S	r -1			
				<u>, , , , , , , , , , , , , , , , , , , </u>	0.30 ORGAN	ICS				Installation I	D L97-P95-2-L	
					SAND							
										Borehole ID	L9795014	
				· · · · · ·	2.40	~				stick-up 0.81	m PVC	
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							PRO	DJECT:	Ste	eepbank H	lydrogeology	enterente de la constitució de la const
		$\mathbb{N}($	<i>(</i>	KLO	HN-CRIPF	EN	LOC	CATION:	Su	ncor, Albe	rta	
							LOG	GED BY	·:	Suncor	CHECKED BY	
						27/	07/05 PLA	TE: 1	of 4		HOLE NO:	L9795014

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			<u>cm = '</u>	1.0m	DATE (ORILLED:	14 JA	N 95 -] <u>o</u> ∠				
S/	<u>AMPL</u>	E DA	TA		DRILL.	TYPE:	Mud	Rotary		PIEZOMETER	DETAILS		NOTES	;
	ER WEI		kg	00	ELEV.	GROUND	(m): 332	2.56		_ ፮	E			
Depth	HEIGHT	Blows	Sample	SYMBOL					E 475,160		H			
Depth (m)	Туре	.15m	Sample No.	,,,,,	DE	SCRIF	MOIT	OF MAT	<u>ERIALS</u>	a.	127		A CONTRACTOR OF THE PARTY OF TH	
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								27/07/			of 4	****	HOLE NO:	L9795014

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VERTIC	AL SCA	\LE: 1	cm = ·	1.0m	DATE DRILLED:	14 JAN 95 -				·
SA	MPL	E DA	TA		DRILL TYPE:	Mud Rotary	*	5,160 ALS	2	NOTES
HAMM			<u>kg</u>	SYMBOL	ELEV. GROUND	Company of the Committee of the Committe	ogijyiji da kalendari	\	DETAILS	
DROP Depth		Blows	m Sample	Š		(m): N 6,315,7		5,160	H K	
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		$\mathbb{N}($		KLO	HN-CRIPP	EN	L	OCATION:	Su	ncor, Alberta
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27/07/95 PLATE: 3 Of 4

HOLE NO:

L9795014

				TES	T HOLE LOG				
VERTIC	CAL SCA	ALE: 1	cm =	1.0m	DATE DRILLED: 14 JAN 95 -		O;		•
SA	MPL	E DA	TA	,	DRILL TYPE: Mud Rotary		PIEZOMETER	DETAILS	NOTES
	ER WEI		kg	SYMBOL	ELEV. GROUND (m): 332.56		£ !	F	
	HEIGHT	Blows	m Semale	Ϋ́	CO-ORDINATES (m): N 6,315,740 E 47	5,160	EZ		
Depth (m)	Туре	.15m	Sample No.	0,	DESCRIPTION OF MATERIA	ALS	6		
- 70.0					72.00 END OF TEST HOLE (Approximate				2" dia. sch. 40 PVC pipe top of upper seal 62.2 m top of filter sand 65.4 m top of screen 65.8 m sch. 40 screen 0.020 slots tip of screen 68.9 m top of bottom seal
				KLO	HN-CRIPPEN	JOB NO: PROJECT: LOCATION LOGGED PLATE:	N: \$	Ste	2779.02.01 epbank Hydrogeology ncor, Alberta Suncor CHECKED BY: HOLE NO: L9795014

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	ER WEI	ORANGO CHARLES AND AND AND AND AND AND AND AND AND AND	kg	20	ELEV. G	ROUND	(m): 32				띭	7		1469 1 500	•
DROP	HEIGHT		m	SYMBOL	***************************************	-		3,316,700	E 474,520		ַלַ עֲ	UE HILS			
Depth (m)	Туре	.15m	Sample No.	S				OF MAT			E L	_			
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-													Borehole ID	L9795005	
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-							-						stick-up 0.91	m PVC	
													0.41 m	steel	
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									LOGGE	***********	***********		Suncor	CHECKED B	
								28/07/	95 PLATE:	1	of	O		HOLE NO:	L9795005

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			cm = 1	.0m	DATE DRILLED:	13 JAN	95 -		α				:
	MPL			.	DRILL TYPE:	Mud Ro			PIEZOMETER	DETAILS		NOTES	;
	ER WEI		<u>kg</u>	1	ELEV. GROUND				P.	TAI			
Depth	HEIGHT	Blows	m Sample	SYMBOL	CO-ORDINATES				图	띰			
Depth (m)	Туре	.15m	Sample No.		DESCRIF	<u>PTION O</u>	<u>F MATER</u>	<u>IIALS</u>	a.	- 77	w. 2017		14.7.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1
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						-		LOGGED			Suncor	CHECKED E	BY:
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			cm = '	1.0m	DATE DRILLED:	13 JAN			œ			
Barrer and the same of the sam		E DA		4	DRILL TYPE:	Mud R			PIEZOMETER DETATI S		NOTE	S
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Depth (m)	Туре	Blows	Sample No.	တ်	CO-ORDINATES	(m): N 6,	316,700 E 2 OF MATER	1/4,520 DIALC	描드	1		
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				Carle cards de co		ethnology \$5 YES		LOGGED	**********	Suncor	*************	3V·
							28/07/95		3 of		HOLE NO:	L9795005
i							28/07/95	1 cm/1 1 km s		₩.	IIVEE IVV.	

				TES	T HOLE LOC	É						
VERTIC	CAL SCA	ALE: 1	cm = :	1.0m		3 JAN 95 -] ₀ 2	***************************************	1		
SA	MPL	E DA		1	DRILL TYPE:	/lud Rotary		PIEZOMETER	DETAILS		NOTES	
HAMM	ER WEI	GHT	kg	SYMBOL	ELEV. GROUND (m)			1	FI			
DROP	HEIGHT	Blows	m Sample	S.	CO-ORDINATES (m)				H			
Depth (m)	Туре	.15m	Sample No.		DESCRIPTI	ON OF MATE	RIALS	O.			**************************************	
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				TES	T HOLE LO	OG						
			cm =	1.0m	DATE DRILLED:	13 JAN			œ			
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	ER WEI		<u>kg</u>		ELEV. GROUND	COLUMN TO THE OWNER OF THE OWNER O	Market Street, Contract of Contract Con		E E			
Depth	HEIGHT	Blows	Sample No.	Σ	CO-ORDINATES							
Depth (m)	iypa	.15m	No.		DESCRIP	<u>TION O</u>	<u>F MATEF</u>	RIALS	O.		57420+1131+1131+1131+1131+1131+1131+1131+11	
85.0										2" dia. sch. 4 top of upper top of filter s top of scree	r seal 85.1 m sand 86.0 m n 86.3 m	
90.0					90.00 LIMESTO	ONE (Water	ways Fm.)			tip of screer	en 0.020 slots n 89.3 m m seal 89.6 m	
95.0							. •					
	garretreller som som garret	L	L		description of the second of t	weetasysva-www.wood	Continued	JOB NO:	<u> </u>	∞ A 2779.02.0	n1	
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				NLU	HN-CRIPP	EN		LOCATIO		uncor, Albe		and the second s
								LOGGED	BY:	Suncor	CHECKED B	Y:
							16/06/95	PLATE:	5 of	6	HOLE NO:	L9795005

				TES	T HOLE LO)G				8		
VERTIC	CAL SCA	ALE: 1	cm = '	1.0m	DATE DRILLED:	13 JAN 95			600			•
SA	MPL	E DA	TA	_,	DRILL TYPE:	Mud Rotar	y .		2 4		NOTES	
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 325.65			PIEZOMETER DETAILS			
DROP	HEIGHT	Playe	m elemes	\ <u>\{\}</u>	CO-ORDINATES	(m): N 6,316,	700 E 4	74,520	EZ			
Depth (m)	Туре	.15m	Sample No.	07	DESCRIP'	TION OF M	1ATER	IALS	2			
-					100.40		~					
					END OF	TEST HOLE				total depth 1	00.4 m	
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								JOB NO:	PA	2779.02.0)1	
		1						PROJECT	: Ste	eepbank H	ydrogeolog	У
			*	KLO	HN-CRIPP	EN		LOCATIO		ncor, Albe	····	
					_			LOGGED		Suncor	CHECKED BY	·:
			THE STATE OF THE S				0 /00 /0-	PLATE:	6 of 6		HOLE NO:	L9795005
						1	6/06/95	, 	~ VI V		· · · · · · · · · · · · · · · · · · ·	

				TES	T HOLE LO	OG				•	
VERTIC	CAL SC	NE: 1	cm = '	1.0m	DATE DRILLED:	15 JAN 95 -		100			
SA	MPL	E DA	TA		DRILL TYPE:	Mud Rotary	an an aire an an an an aire ann an	PIEZOMETER DETAILS		NOTES	
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 318.75	***************************************	EZOMETE DETAILS			
DROP	HEIGHT	Dlove	m leanale	Ž	CO-ORDINATES	(m): N 6,315,090	E 474,700				
Depth (m)	Тура	.15m	Sample No.	~~	DESCRIP	TION OF MAT	ERIALS				
				, , , ,	0.40 ORGANI	ICS			Installation I) L97-AP95-4-L	·
					SAND						
					-silty 1.50				Borehole ID	L9795015	
				::::::		ID (McMurray Fm.)					
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-	at William in the comment to the commence.				uugga pärilliitiinni eliittä on onniin yytei egymyyte <u>a s</u> yytäiniddin tehinii va maanna		·····		1		eneroscensificiologico considerante
		pos				Continue		······································	\ 2779.02.0		
				KIA	HN-CRIPP		PROJECT	~~~~~		ydrogeology 	***************************************
						Bonna 61 V61	LOCATIO	~~~~	Incor, Albe Suncor	CHECKED BY:	
		wandibility (III)	Population			16/06/	95 PLATE:	1 of 4		HOLE NO: L9795	015

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				TES	T HOLE L	OG				,		,
			cm = '	1.0m	DATE DRILLED:	15 JAN 9)5 -		œ	1		
		E DA			DRILL TYPE:	Mud Rot	The second secon		13 13		NOTES	3
	ER WEI		<u>kg</u>		ELEV. GROUND				泛			
Depth (m)	HEIGH1	Blows	Sample No.	Σ	CO-ORDINATES				PIEZOMETER DETAILS			
(m)	Type	.15m	No.	::::::	DESCRIF	TION OF	MAILR	IALS	0. 7/X/X//		·	
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<u> </u>			<u> </u>				Continued	JOB NO:	DA	2779.02.0		
		3 .					Jonandou	PROJECT			lydrogeolog	Jy
				KLO	HN-CRIPF	PEN		LOCATION		ıncor, Albe		
								LOGGED		Suncor	CHECKED B	Y:
							16/06/05	PLATE:	2 of 4	,	HOLE NO:	L9795015

				TES	T HOLE LO	OG						
			cm = 1	l.Om	DATE DRILLED:	15 JAN			 			
		E DA			DRILL TYPE:	Mud Ro	The state of the s		PIEZOMETER DETAILS		NOTES	
	ER WEI		kg	SYMBOL	ELEV. GROUND		The state of the s		₩		·	
Depth	HEIGHT	Blows	m Sample	2	CO-ORDINATES				四四			
Depth (m)	Туре	.15m	Sample No.	,,,,,	DESCRIP	<u>IO NOIT'</u>	<u>F MATER</u>	<u>RIALS</u>	a.			
45.0												
50.0												
	,							Ā		tip B water le	evel 53.76 m	
55.0					55.10 LIMEST	ONE (Waterv	ways Fm.)			top of seal 5		
								모		tip A water le	3 58.9 m 200' l evel 59.24 m	ead
							Continued	JOB NO:	РД	2779.02.0)1	Thinks the second second second second second second second second second second second second second second s
								PROJECT	: St	eepbank H	ydrogeolog	У
		$\mathbb{N}($		KLO	HN-CRIPP	EN		LOCATIO	N: Su	ıncor, Albe	rta	
								LOGGED	BY:	Suncor	CHECKED B	Y:
			constitution (CS)				16/06/95		3 of 4	***************************************	HOLE NO:	L9795015
Name and the second sec	commonweal and the common	security consistence and the construction of t					10/00/90					wood with the about it gift.

TEST HOLE LOG												
VERTICAL SCALE: 1cm = 1.0m					DATE DRILLED:		œ	NOTES				
SAMPLE DATA				DATE DRILLED: 15 JAN 95 - DRILL TYPE: Mud Rotary							PIEZOMETER DETAILS	
	ER WEI		kg	BOI	ELEV. GROUND		E E	10110				
DROP HEIGHT M			SYMBOL	CO-ORDINATES	(m): N 6,315	5,090 E 4	74,700	TEZOMETE DETAILS				
Depth (m)	th Type Blows Sample .15m No.		6)	DESCRIP				PI				
(m) 65.0	Тура	.15m	No.			TION OF	MATER	IIALS		top of upper bentonite chi top of sand 6 tip A # 18831 top of botton bentonite chi	ips 66.8 m 67.1 m 300' lea n seal 67.4 m	d
					71.00 END OF	TEST HOLE				total depth 7	1.0 m	
	KLOHN-CRIPPEN							JOB NO: PROJECT LOCATION LOGGED PLATE:	: Ste	ncor, Albe Suncor	ydrogeology rta CHECKED BY:	

TEST HOLE LOG														
VERTIC	CAL SCA	NE: 1	cm =	Company of the Compan	American Company of the Company of t	RILLED:		N 95 -		Ta	P	-		•
SA	MPL	E DA	TA	,	DRILL		CONTROL CONTRO	Rotary .		DTC70MCTC0	ျှ		NOTES	
	ER WEI		kg	SYMBOL	ELEV. (ROUND	(m): 337	7.61		٦ 🖁	DETAILS		***************************************	
DROP HEIGHT M		Ę				,316,470 E	475,460	ĭ						
Depth (m)	Туре	.15m	Sample No.	0)				OF MATE		a	4			
				<u> </u>	0.30_	ORGAN	ICS					Installation I	D L97-AP95-5-L	
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5.0				٠٠٠٥.		-some g								
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					6.00	V-101-10-10-10-10-10-10-10-10-10-10-10-10		***************************************						
						CLAY TI	LL							
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									7					
10.0												coment - he	ntonite grout	
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15.0								•				two lead cat	oles	
					17.00	A11015				-0				
						SHALE	(Clearwate	er Hm.)						
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								Continued	JOB NO:	manacas	PΔ	\ 2779.02.0)1	to the state of th
									PROJEC*	T:	St	eepbank H	lydrogeolog	J
				KLO	HN-C	RIPP	'EN		LOCATIO	N:	Su			
									LOGGED	BY	': 	Suncor	CHECKED BY	
								16/06/95	PLATE:	4	of 6)	HOLE NO:	L9795010

TEST HOLE LOG															
			cm = 1	.0m	DATE C	RILLED:		AN 95 -			<u>œ</u> .			, ,	
SAMPLE DATA					DRILL 1			Rotary			PIEZOMETER DETAILS		NOTES	:	
	HAMMER WEIGHT kg			180	ELEV. (GROUND	(m): 33	7.61			CEZOMETE DETAILS				
DROP HEIGHT m Depth Type Blows Sample		SYMBOL				6,316,470		30							
Depth (m)	Туре	.15m	No.	400	DE	SCRIF	MOIT	OF MAT	ERIALS	3	2				
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					23.00						XX			*	
				::::::		OIL SAN	ND (McMi	urray Fm.)	,		XX				
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		S						Continu		NO: JECT:		2779.02.0	ydrogeolog	ıv	
			~ 	KLO	HN-C	RIPF	PEN			ATION		ncor, Albe		, , , , , , , , , , , , , , , , , , ,	
										GED E		Suncor	CHECKED E	Y:	
								16/06	95 PLAT	TE: 2	2 of 6		HOLE NO:	L9795010	

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VERTICAL SCALE: 1cm = 1.0m					DATE DRILLED:				ĸ			
SAMPLE DATA					DRILL TYPE:	Mud R	***************************************		PIEZOMETER DETAILS		NOTES	•
HAMMER WEIGHT kg					ELEV. GROUND			*******************************	IEZOME'I DETATIL			
Depth (m)	DROP HEIGHT m Depth Type Blows Sample (m) .15m No.			S	CO-ORDINATES (m): N 6,316,470 E 475,460							
(m)	туре	.15m	No.	ļ.,,,,,	DESCRII	<u>PTION C</u>	F MATER	IIALS	0 72727			
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							Continued	JOB NO:	РА	2779.02.0)1	
				8 <i>1</i> / P				PROJECT:	The state of the s	***************************************	ydrogeolog	y
				KLO	HN-CRIP	ZEN		LOCATION	l: Su	ncor, Albe	rta	
								LOGGED E	*****************	Suncor	CHECKED B	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
							16/06/95	PLATE:	3 of 6		HOLE NO:	L9795010

				TES	T HOLE LO							
VERTIC	AL SC	NE: 1	cm =	1.0m	DATE DRILLED:	17 JAN 95	-		02	no estable		
SA	MPL	E DA	TA		DRILL TYPE:	Mud Rotar		•	PIEZOMETER DETATIS	3	NOTES	•
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 337.61			CEZOMETE			
DROP	HEIGHT	Blows	Sample	λ¥	CO-ORDINATES				EZ L	3		
Depth (m)	Туре	.15m	Sample No.	٥,	DESCRIF	PTION OF M	MATERI	ALS	2			
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				::::::						tip B water le	evel 62.28 m	
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			· \	KLO	HN-CRIPF	PEN		LOCATIO		uncor, Albe	······································	
		ia Maria dal		•			 	LOGGED		Suncor	CHECKED B	
						1	6/06/95	PLATE:	4 of	6	HOLE NO:	L9795010

			cm = '	1.0m	DATE DRILLED:	17 JA	AN 95 -		l œ			
		E DA	AND DESCRIPTION OF THE PARTY OF		DRILL TYPE:	Mud	Rotary		PIEZOMETER DETAILS		NOTES	•
	ER WEI		<u>kg</u>	SYMBOL	ELEV. GROUND		**************************************	THE RESERVE OF THE PROPERTY OF	EZOMETE DETAILS			
Depth	HEIGHT Type	Blows	m Sample No.	Š	CO-ORDINATES				四四			
Depth (m)	Type	.15m	No.	*****	DESCRI	<u>PTION</u>	OF MATE	RIALS	a.			and the state of t
						-						
85.0					85.50 SANDS	TONE						
					SANDS Basal A	TONE Aquifer (Ma	cMurray Fm.)					
90.0					95.20							
						TONE (Wa	iterways Fm.)			top of seal 9/ bentonite ch top of sand 9 tip B #18826	ips	lead
					a resource a series and an electric designation of the series of the ser		Continued	JOB NO:	PA	2779.02.0		And the second s
								PROJECT	: Ste	eepbank H	ydrogeolog	IV
			, 	KLO	HN-CRIPI	PEN		LOCATIO	DOWNSON, NAME OF STREET	ncor, Albe		· · · · · · · · · · · · · · · · · · ·
								LOGGED	-	Suncor	CHECKED B	·
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	en in the second second second second second second second second second second second second second second se		ASSESSED PROPERTY AND ADDRESS OF THE PROPERTY	near water and the second	suunnissa oven kennon suunnissa suuri Kalinin käänin käänin käänin suunnan pii 149 hilli kinnaussa.	www.powwadalinininininggg	16/06/95	I WAIG.	O IV v		INCLEINU:	willy Color

TEST HOLE LOG		
VERTICAL SCALE: 1cm = 1.0m DATE DRILLED: 17 JAN 95 -	Ια.	
SAMPLE DATA DRILL TYPE: Mud Rotary	H &	NOTES
HAMMER WEIGHT kg ELEV. GROUND (m): 337.61		
DROP HEIGHT M CO-ORDINATES (m): N 6,316,470 E	475,460 입 년	
(m) Type 1.15m No. DESCRIPTION OF MATE	RIALS E	
DROP HEIGHT M CO-ORDINATES (m): N 6,316,470 E	TOTAL TOTAL	top of upper seal 100.0 m bentonite chips top of sand 103 m tip A #18829 103.9 m 400' lead top of bottom seal bentonite chips total depth 113.7 m
KLOHN-CRIPPEN	PROJECT: S LOCATION: S LOGGED BY:	A 2779.02.01 teepbank Hydrogeology uncor, Alberta Suncor CHECKED BY: 6 HOLE NO: L9795010

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		ALE: 10		1.0m	DATE D		N 95 -		œ			
SA	MPL	E DA	TA		DRILL T	YPE: Mud	Rotary		PIEZOMETER NETATIS	3	NOTES	
	ER WEI		<u>kg</u>		ELEV. C	GROUND (m): 339	9.25		CEZOMETE NETATI S			
DROP	HEIGHT	Blowe	m	\ \frac{1}{2}		DINATES (m): N 6		76,130		3		
Depth (m)	Type	.15m	Sample No.		DE	SCRIPTION	OF MATER	IALS				a .
				0		SAND	Company State Co			Installation I	D FL3-P95-6-BA	,
						- silty, gravelly						
				0	1.50					Borehole ID	FL395004	
					1.30	SAND TILL						
						-clayey, gravelly				stick-up 0.96	Sm PVC	
						-brown		. [0.48 m	steel	*
				<u> </u>	3.00							
						CLAY TILL -silty						
				-		-grey						
5.0												
5.0												
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						-clayey, gravelly						
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C		L	L				Continued	JOB NO:	ca_k P	A 2779.02.0)1	39-149 management
								PROJECT:	S	teepbank F	lydrogeology	
\(\lambda\)(\(\lambda\)KLC					HN-C	RIPPEN		LOCATION:	: S	uncor, Albe	erta	
								LOGGED B	Y:	Suncor	CHECKED BY:	
							22 122 122	PLATE: 1	l of	6	HOLE NO:	FI 395004

28/07/95

VERTIC	CAL SCA	ALE: 1	cm = 1	.0m	DATE DRILLED:	23 JAN	95 -		o:				•
		E DA			DRILL TYPE:	Mud Ro	tary	1	PIEZOMETER	ပ္		NOTES	
HAMM	ER WEI	GHT	kg	80	ELEV. GROUND				FO.	DETAILS			
DROP	HEIGHT	Blows	Sample	SYMBOL	CO-ORDINATES	(m): N 6,3	13,400 E 4	76,130	IEZ	Ы			
Depth (m)	Туре	.15m	Sample No.		DESCRIF	<u>TION OI</u>	<u>F MATEF</u>	IIALS	۵.	.,,			
- 25.0													
				,,,,,,	26.50								
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							Continued	JOB NO:			2779.02.0		
								PROJECT				ydrogeolog	ıy
				KLO	HN-CRIPF	'EN		LOCATIO		Su	ncor, Albe		
		No. 1						LOGGED			Suncor	CHECKED E	
							16/06/95	PLATE:	20	f 6		HOLE NO:	FL395004

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VERTIC	DAL SCA	ALE: 1	cm = '	DESCRIPTION OF THE PARTY OF THE	DATE DRILLED:	23 JAN 9	95 -		œ				
SA	AMPL	E DA	TA	8	DRILL TYPE:	Mud Ro	tary	and the state of t	PIEZOMETER	ഗ്വ		NOTES	
HAMM	ER WEI	GHT	kg	SYMBOL	ELEV. GROUND	(m): 339.2	5		F	DETAILS			
DROP	HEIGHT	Plows	m elgmos	\ \	CO-ORDINATES	(m): N 6,3 1	13,400 E 4	76,130	Z	Ы			
Depth (m)	Туре	.15m	Sample No.		DESCRIP	TION OF	- MATER	IALS	۵				
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				KLO	HN-CRIPP	EN	ļ	PROJECT	-	***************************************	eepbank Hy ncor, Albert		y
							ľ	LOGGED		*********		CHECKED B	<i>(</i> :
		*c+4000000/4226	· · · · · · · · · · · · · · · · · · ·				28/07/95			of 6		HOLE NO:	FL395004

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				TES	THOLEL				•				
VERTI	CAL SC	ALE: 1	cm = :	1.0m	DATE DRILLED:	23 JAN	95 -	West of the second seco	<u></u>	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
S	AMPL	E DA	TA		DRILL TYPE:	Mud Ro	otary		PIEZOMETER	DETAILS		NOTES	
НАММ	IER WEI	GHT	kg	SYMBOL	ELEV. GROUND	(m): 339. 2	25		ఠ	F			
DROP	HEIGHT	Rlows	Sample	3YR	CO-ORDINATES	(m): N 6,3	13,400 E 4	76,130		삠			
Depth (m)	Туре	.15m	Sample No.		DESCRI	O MOITS	F MATER	IALS	a.	177			
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											2" dia. sch. 4	io PVC pipe	
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										₿	top of upper	seai /9.0 M	
	<u></u>	<u></u>	<u></u>				Continued	JOB NO:	₩	_ <u>₩</u>	2779.02.0)1	· · · · · · · · · · · · · · · · · · ·
		B					Johnnaca	PROJEC				lydrogeolog	IV
				KLO	HN-CRIPE	PEN		LOCATIO			ncor, Albe	······································	
				_	* ***			LOGGED			Suncor	CHECKED B	Υ:
							16/06/95	PLATE:	4	of 6		HOLE NO:	FL395004

VERTIC	CAL SCA	NE: 10	cm = '	1.0m	DATE DRILLED: 23 JAN 95	CD		œ	
SA	MPL	E DA	AND DESCRIPTION OF THE PERSON		DRILL TYPE: Mud Rotar	ry	·	PIEZOMETER DETAILS	NOTES
	ER WEI		<u>kg</u>	9	ELEV. GROUND (m): 339.25			EZOMETE DETAILS	
DROP Depth	HEIGHT	Rlows	m Sample	SYMBOL	CO-ORDINATES (m): N 6,313		3,130		
(m)	Туре	.15m	No.		DESCRIPTION OF I	<u>MATERIA</u>	\LS	<u>a</u>	
					Induration 81.8 - 83.0 m	1			bentonite top of filter sand 81.7 m top of screen 82.1 m
85.0					SANDSTONE Basal Aquifer (McMurra	y Fm.)	,		sch. 40 screen 0.020 slots
90.0					91.40				≾tip of screen 91.3 m
95.0					LIMESTONE (Waterway	rs Fm.)			top of bottom seal 91.5 m
	:								bentonite
					C	ontinued J	JOB NO:	P/	A 2779.02.01
		i i				***************************************	PROJECT:		teepbank Hydrogeology
			<i>(</i>	KIO	HN-CRIPPEN		OCATION	***************************************	uncor, Alberta
				a # 6000		**********	OGGED B		Suncor CHECKED BY:
						}		or: 5 of 6	
						16/06/95 F	PLATE: {) VI C	6 HOLE NO: FL395004

				TES			4000 11				
			<u>cm = </u> 1		DATE DRILLED:	23 JAN 9			œ		
		E DA			DRILL TYPE:	Mud Rot	the same of the sa		PIEZOMETER DETAILS		NOTES
	ER WEI		kg		ELEV. GROUND	***************************************	The second secon		₽E		
Depth (m)	HEIGHT Type	Blows	m Sample No.	SYI	CO-ORDINATES				出出		
(m)	Type	.15m	No.		DESCRIF	TION OF	MATER	IALS	<u>α</u> .		**************************************
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105.0											
105.0											
					_107.00						
					END OF	TEST HOLE			*******	total depth 1	07.0 m
								!			
	i										
	i										
	,										·
								JOB NO:	DΛ	2779.02.0)1
		1						PROJECT			lydrogeology
			, 	KLO	HN-CRIPF	EN		LOCATIO		incor, Albe	
					-			LOGGED		Suncor	CHECKED BY:
							16/06/05	PLATE:	6 of 6		HOLE NO: FL395004

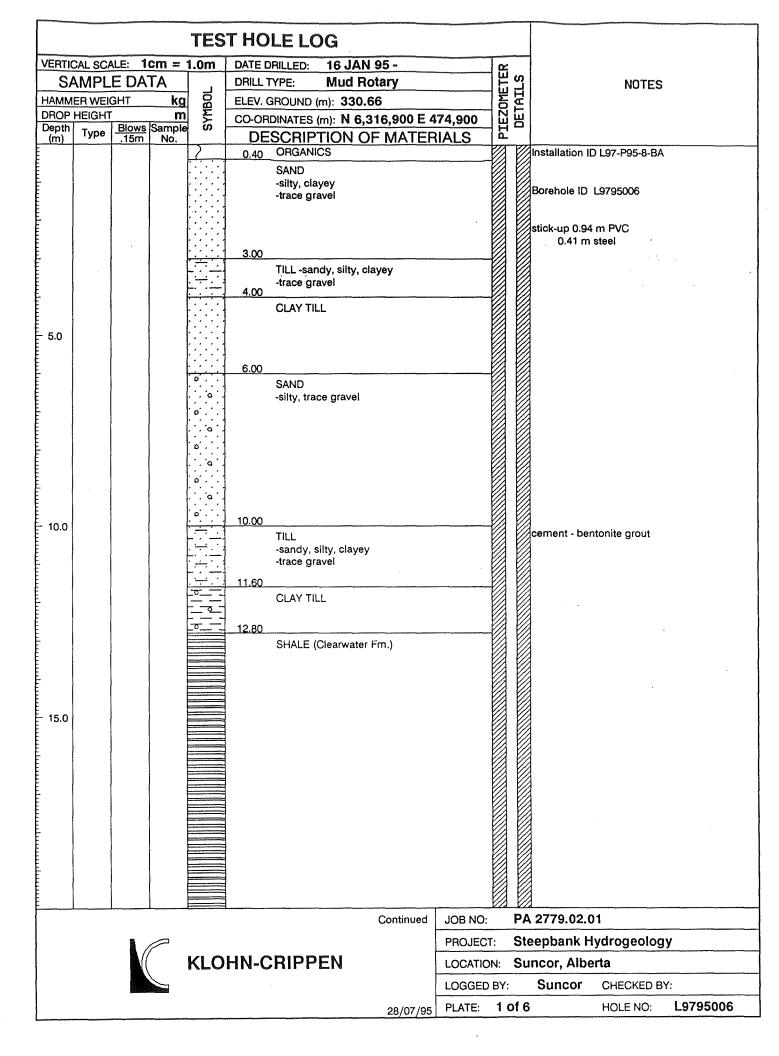
	TEST HOLE LOG													
VERTICAL SCALE: 1cm = 1.0m				1.0m	DATE	RILLED:	23 JAN	95 -		Ιœ	in the second			٠
SA	MPL	E DA	TA		DRILL:	Commentation of the Comment of the C	Mud Ro	A CONTRACTOR OF THE PROPERTY O	The same of the sa	Ш	ഗ		NOTES	
	ER WEI		kg	BO	ELEV. (GROUND	(m): 338.6	1	Annual Interview of Authors Commissions of Commissi	E	E			
	HEIGHT		m Sample		CO-OR	DINATES	(m): N 6,3	12,840 E 4	76,050	PIEZOMETER	DETAILS			
Depth (m)	Туре	.15m	No.	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	DE	<u>SCRIP</u>	TION OF	MATER	NALS	٦				
]	ļ.,	0.40	ORGANI	CS				W	Installation II) FL3-AP95-7-L	
						SAND					X//			
											X	Borehole ID I	FL395005	
					2.00						X			
				0		SAND TI					X)			
					3.00	-some g	ravel				X)			
				<u> </u>		CLAY TI			•		X			
				6	!	-sandy, s	some gravel				X//			
5.0											X			
3.0											X			
					!						X			
											X			
											X			
											X//			
				-							X //			
											X//			
				<u> </u>										•
10.0											W			
10.0												cement - ber	tonite grout	
					11.00	0.3 m gr	een SILTSTC	ONE						
					•	SHALE (Clearwater F	m.)						
											X	•		
			,											
<u>:</u>														
-														
15.0								•						
												two lead cab	les	
											X			
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-											W			
					l									
											W			
				77777	18.50				Vennue OFFICE CONTRACTOR OF THE					
						OIL SAN	D (McMurray	/ Fm.)			W			
				::::::										
:	/////////////////////////////////////			[]	L			Continued	JOB NO:	VXL	28// PD M	2779.02.0	4	Perfect immers and position and passed against 2000 to the commence professional and account a group.
								Joinnaga	PROJECT	44/11-030-044-04		THE THE THE THE THE THE THE THE THE THE	ydrogeolog	
				KLO	HN-C	RIPP	EN		LOCATIO	AND THE PROPERTY OF THE PARTY O	*****	ncor, Albe		y
							<u></u> – 7		LOGGED	-		Suncor	CHECKED BY	And the second name of the second second second second second second second second second second second second
								19/06/95	PLATE:	10	ı 5		HOLE NO:	FL395005

				TES								
VERTIC	CAL SCA	NLE: 1	cm =	1.0m	DATE DRILLED:	23 JAN 9	5 -	Control of the second s] ρς	otal.		•
SA	MPL	E DA	TA	1	DRILL TYPE:	Mud Rota	ary		CEZOMETE DETAILS		NOTES	•
HAMM	ER WEI	3HT	kg	B0	ELEV. GROUND	(m): 338.61			돌			
DROP	HEIGHT	Diama	m	Ϋ́	CO-ORDINATES	(m): N 6,31	2,840 E 4	76,050	H E			
(m)	Type	.15m	Sample No.	0,	DESCRIF	TION OF	MATER	IALS	[
DROP Depth (m) 25.0	HEIGHT Type	Blows .15m	Sample No.	ОДИВОГ		(m): N 6,31 PTION OF			PIEZOMETER DETAILS			
				KLO	HN-CRIPF		Continued	JOB NO: PROJECT LOCATIO LOGGED	r: S 1 N: S 1 BY:	uncor, Albe Suncor	ydrogeolog erta CHECKED B	Y:
							19/06/95	PLATE:	2 of	b	HOLE NO:	FL395005

VERTIC	CAL SCA	LE: 1	cm = 1	1.0m	DATE DRILLED:	23 JAN 95 -		Tος				
SA	MPL	E DA	TΑ	9	DRILL TYPE:	Mud Rotary		PIEZOMETER	9		NOTES	
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 338.61		3	DETAILS		•	•
DROP	HEIGHT	Blowe	m alama2l	3.4.M	CO-ORDINATES	(m): N 6,312,8	40 E 476,050					
Depth (m)	Туре	.15m	Sample No.		DESCRIP	PTION OF M	ATERIALS	6				
- 45.0					46.50 Interbui	den						
- 50.0					52.20		A					
- 55.0					OIL SAI	ND (McMurray Fm		<u> </u>			evel 55.05 m	
						Con	inued JOB NO	·	PA 2779.	02.0)1	
							PROJEC	CT:	Steepbai	nk H	ydrogeolog	У
		M(KLO	HN-CRIPE	PEN	LOCATI		Suncor,		***************************************	,
							LOGGE	****	Sunc		CHECKED BY	delementative ministrative delevirante mentende de metalementative de la companya del companya de la companya de la companya del companya de la companya del companya de la companya de la companya de la companya de la companya del companya de la companya dela companya de la companya de la companya dela companya de la companya dela companya de la companya dela companya dela compan
						10	/06/95 PLATE:		of 5		HOLE NO:	FL395005

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VERTIC	CAL SCA	\LE: 1	cm =	1.0m	DATE DRILLED:	23 JAN 9	5 -		OZ.			
SA	AMPL	E DA	TA		DRILL TYPE:	Mud Rota			PIEZOMETER DETAILS		NOTES	•
	ER WEI		kg		ELEV. GROUND	(m): 338.61			EZOMETE DETAILS			
DROP	HEIGHT	Blows	m Seconda	} }	CO-ORDINATES	(m): N 6,31	2,840 E 4	76,050	E E			
Depth (m)	Type	.15m	Sample No.		DESCRIP	TION OF	MATER	IALS	2			
						-						
65.0						-						
70.0												
					72.50 72.5 - 76	5.5 m not logg	ed	Ā		tip A water le	evel 71.50 m	
75.0												
					76.50 LIMEST	ONE (Waterwa	ays Fm.)	And the second		top of seal 7 bentonite ch	iips	
							Continued	JOB NO:	D	tip B #18830 top of upper	0 79.0 m 300' le ' seal 79.0 m	ad
		_				(Jonanueu					
		1				man a r		PROJECT			lydrogeolog	у
				KLO	HN-CRIPP	EN		LOCATIO	N: SI	uncor, Albe	erta	
				•			l	LOGGED	BY:	Suncor	CHECKED BY	' :
							19/06/95	PLATE:	4 of	···	HOLE NO:	FL395005

				TES	THOLELO)G			-		944-00 to the second of the se	
		NLE: 1		1.0m	DATE DRILLED:	23 JAN 9	TOTAL STREET,					
		E DA			DRILL TYPE:	Mud Rota			PIEZOMETER DETAILS		NOTES	•
	ER WEI HEIGHT		<u>kg</u>		ELEV. GROUND				₽ĕ			
		Blows	m Sample	S	CO-ORDINATES							
(m)	туре	.15m	No.		DESCRIP	<u>TION OF</u>	MATER	RIALS	0.			
Depth (m) - 85.0	Туре	.15m	Sample No.		DESCRIP	TION OF	MATER	RIALS		bentonite ch	iips	
					91.80 END OF	TEST HOLE				top of sand 9 tip A #16943 top of bottor total depth 9	3 91.5 m 320' k n seal 91.5 m	ead
				KLO	HN-CRIPP	EN	19/06/95	JOB NO: PROJECT LOCATION LOGGED PLATE:	: Ste	ncor, Albe Suncor	lydrogeolog	



				TES	T HOLE LO)G			**************************************			ere en en en en en en en en en en en en en	- Andrew Mit Andrew Copy and Angres and Angres Angres Angres Angres Angres Angres Angres Angres Angres Angres
VERTIC	CAL SCA	NLE: 1	cm =	1.0m	DATE DRILLEÓ:	16 JAN 95) es	**************************************	02	AND DESCRIPTION OF THE PARTY OF			
		E DA			DRILL TYPE:	Mud Rota		TO CHOOL OF THE PROPERTY OF TH	PIEZOMETER	ഗ		NOTES	
HAMM	10111111111111111111111111111111111111		kg	SYMBOL	ELEV. GROUND (m): 330.66			품	DETAILS			
DROP			m	ξ	CO-ORDINATES		,900 E 4	74,900	EZ	ᇤ			
Depth (m)	Type	Blows .15m	Sample No.	ഗ	DESCRIP				6	لسا			
						**************************************	The state of the s		7			***************************************	
					21.00								
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						C	ontinued	JOB NO:	~~~~~	-	2779.02.0	***************************************	
				8 // C	R R R R 450 5000 9 5000 9000	Econo BV B		PROJECT	******	**********	*******************	ydrogeolog	y
			\	KLO	HN-CRIPP	EN		LOCATION		Su	ncor, Albe		
								LOGGED			Suncor	CHECKED BY	
							19/06/95	PLATE:	2 (of 6		HOLE NO:	L9795006

				TES	T HOLE LO)G						-	
			cm = :	I.0m	DATE DRILLED:	16 JAN 95			ß.				
		E DA			DRILL TYPE:	Mud Rotar	у		PIEZOMETER	DETAILS		NOTES	
	ER WEI		kg	SYMBOL	ELEV. GROUND				퇽	E			
Depth	HEIGHT	Blows	m Sample	SYI	CO-ORDINATES				H	H			
<u>(m)</u>	туре	.15m	No.		DESCRIP	TION OF N	<u> MATER</u>	<u>IALS</u>	0_			**************************************	
- 45.0 - 50.0	Туре	.15m	Sample No.		DESCRIP	TION OF N	MATER	IALS	PJ		water level 5	2.47 m	
						Co	ntinued	JOB NO:			2779.02.0		
		1						PROJEC	Τ:			ydrogeolog	У
		$\mathbf{N}($		KLO	HN-CRIPP	EN	į	LOCATIO	N:	Su	ncor, Albe	erta	
								LOGGED	BY:	_	Suncor	CHECKED BY	/ :
						,	28/07/95	PLATE:	3 (of 6		HOLE NO:	L9795006

				TES	THOLEL	.OG						•
		ALE: 1		1.0m	DATE DRILLED	16 JAN	l 95 -		<u>o</u>			
-	THE REAL PROPERTY AND ADDRESS OF THE PERSON NAMED AND ADDRESS	E DA	AND DESCRIPTION OF THE PARTY OF		DRILL TYPE:	Mud R	otary	Marine and American A	PIEZOMETER DETAILS		NOTES	
	ER WEI		<u>kg</u>		ELEV. GROUNI	***************************************		**************************************	₩ ₩			
Depth	HEIGHT	Blows	m Sample	\$ \$	CO-ORDINATE							
Depth (m)	Туре	.15m	Sample No.	*****	DESCRI	<u>PTION C</u>	<u> F MATEF</u>	RIALS	<u>o.</u>	ya.	Davida 2000 kalaban maringaya 100 kilininin a qoqo dalab baharinin ka shirin baharin ka shirin baharin ka shiri	
75.0		. ISM	NO.		77.00	STONE (McM		iials.			sand 76.6 m	
	******************************	<u></u>				Obstate Providencial interestable delector and accompagn energy	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		i.H:		manusconstantini material del constantini del constanti del constantini del constantini del constantini del co	\$100°40 (100°40)
							Continued	JOB NO:		\ 2779.02.0		
					61 M 01 52	wa wana a sa		PROJECT		**************************	<u>lydrogeolog</u>	y
		M(KLO	HN-CRIP	PEN		LOCATIO	N: Su	ıncor, Albe	erta	
								LOGGED	BY:	Suncor	CHECKED BY	/ :
							19/06/05	PLATE:	4 of 6)	HOLE NO:	L9795006

			and the second second second	TES	T HOLE LO)G				and the second second	and a region of the second pressure of the se	australius (grande propos de consequence de consequ
VERTIC	CAL SC	ALE: 1	cm =	1.0m	DATE DRILLED:	16 JAI	N 95 -	The state of the s	ſα	7		
SA	MPL	E DA	TA		DRILL TYPE:	Mud F		***************************************	PIEZOMETER DETAILS		NOTES	
\$	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 330	.66		EEZOMETE DETAILS			
DROP	HEIGHT	T = .	m	Ξ	CO-ORDINATES			74,900	EZ EZ			
Depth (m)	Type	.15m	Sample No.	ഗ			OF MATER		겁			
85.0		.13111	NO.		86.00 CLAY -slickens and SAN	ided	JI WATEI	·		tip of screen	83.3 m n seal 83.6 m	
90.0					- quartzo							
95.0						DNE (Wate	erway Fm.)	-				
l							Continued	JOB NO:	₩₩₩ ₽ <i>1</i>	я \ 2779.02.0)1	
			<u> </u>				Johnnada				lydrogeolog	
		1		<i></i>	HN-CRIPP			PROJECT				<u>y</u>
			\	NLU	MIN-CRIPP	CIV		LOCATION		ıncor, Albe		
								LOGGED	BY:	Suncor	CHECKED BY	<u>/:</u>
							19/06/95	PLATE:	5 of 6	3	HOLE NO:	L9795006

				TES	T HOLE LOG			
VERTIC	CAL SCA	NE: 1	cm =	1.0m	DATE DRILLED: 16 JAN 95 -		œ	
SA	MPL	E DA	TA		DRILL TYPE: Mud Rotary	And the second s	m a	NOTES
HAMM	ER WEI	3HT	kg		ELEV. GROUND (m): 330.66		E E	,
DROP	<u>HEIGHT</u>		m	SYMBOL	CO-ORDINATES (m): N 6,316,900 E 47	74,900	EZ	į
Depth (m)	Туре	.15m	Sample No.	ഗ			PIEZOMETER DETAILS	,
(m) - 105.0		.15m	No.		108.40 END OF TEST HOLE	IALS	P:	
						IOR NO:	ÞΔ	2779 02 04
				KLO	HN-CRIPPEN	JOB NO: PROJECT: LOCATION	: Ste	2779.02.01 eepbank Hydrogeology ncor, Alberta



Suncor LOGGED BY: CHECKED BY:

19/06/95 PLATE: 6 of 6 HOLE NO: L9795006

				TES	T HOLE LO	OG	The state of the s				
VERTIC	CAL SCA	NE: 1	cm =	1.0m	DATE DRILLED:	24 JAN 95 -			02		
		E DA			DRILL TYPE:	Mud Rotary		***************************************	PIEZOMETER DETAILS		NOTES
HAMM	ER WEI	ЭНТ	kg	B01	ELEV. GROUND ((m): 315.21			F. H		
DROP	HEIGHT	Dia	m M		CO-ORDINATES ((m): N 6,316,9 6	60 E 474	,070	EZOMETE DETAILS		
Depth (m)	Type	.15m	Sample No.	1,,,	DESCRIP [*]	TION OF MA	TERIA	LS			
					CLAY TIL	LL				Installation IC) L97-AP95-9-L
									XX		
								į.		Borehole ID (9795001
									XX		
								·			
									XX		
:					3.40				XX		,
				::::::	OIL SANI	ID (McMurray Fm.)			XX		
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- 5.0											
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		截	<u>/</u> =			Cont		OB NO: PROJECT:		2779.02.0	ydrogeology
				KLO	HN-CRIPP	'EN		OCATION		incor, Albe	
				m		nadii V		OGGED E		Suncor	CHECKED BY:
						197	06/95 P		1 of 6		HOLE NO: L9795001

				TES	THO	ELC)G								
		NLE: 1		1.0m	DATE DI	RILLED:	24 JA	N 95 -		Γœ.					•
		E DA	CONTRACTOR OF THE PERSON AND PARTY.		DRILL T	/PE:	Mud F	<u> totary</u>		PIEZOMETER	DETAILS		NOTI	ES	
	ER WEI		<u>kg</u>				(m): 315		***************************************	Į	TAI				
DROP Depth (m)	HEIGHT Type	Blows	m Sample No.	₹				,316,960 E		E	В				
(m)	туре	.15m	No.		DES	<u> SCRIP</u>	TION (OF MATER	<u>RIALS</u>	0.	7877		Daniel Walter Control	**************************************	
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	hezonezonezonezo	Carried Committee Committee				vannagarin gang kila 1900 Melauk kilaminda aras		Continued	JOB NO:	VX.		2779.02.0	······································		
								Johnned	PROJECT		-	epbank H	***************************************	ogy	
			<i>(</i> *	KLO	HN-C	RIPP	EN		LOCATIO	***************************************	*******	ncor, Albe	***************************************	₩ ð	
									LOGGED			Suncor	CHECKED	BY:	
								19/06/95	PLATE:	20	ıf 6	AFT-000000000000000000000000000000000000	HOLE NO:	Lg	795001

				TES	T HOLE LO	OG						,
	CAL SC			1.0m	DATE DRILLED:	24 JAN	95 -		<u>k</u>			•
S	AMPL	E DA			DRILL TYPE:	Mud R	otary		PIEZOMETER DETAILS		NOTES	
	ER WEI		kg		ELEV. GROUND				CEZOMETE DETAILS			
DROP	HEIGHT	Blows	m Sample	SYR	CO-ORDINATES				田田			
Depth (m)	Туре	.15m	Sample No.	ļ,,,,,	DESCRIF	TION C	<u> F MATEI</u>	RIALS	0.			
45.0			110.									
55.0					· •			.		tip A water le		
				KLO	HN-CRIPP	PEN	Continued 19/06/95	JOB NO: PROJEC' LOCATIO LOGGED PLATE:	r: St	uncor, Albe Suncor	lydrogeolog	

				TES	THOLEL	.OG						ge account of 100 fe filt free and first an energy of the containing in the first and the consequence over
VERTIC	CAL SC/	ALE: 1	cm =	1.0m	DATE DRILLED	: 24 JAI	N 95 -		œ			
SA	MPL	E DA	TA		DRILL TYPE:	Mud F	otary	-	PIEZOMETER DETAILS	ĺ	NOTES	
	ER WEI		kg	8	ELEV. GROUN	O (m): 315	.21	-	풀물			
DROP	HEIGHT	Blows	Sample	SYMBOL	CO-ORDINATE				DETAILS	<u> </u>		
Depth (m)	Туре	.15m	Sample No.		DESCRI	<u>PTION (</u>	OF MATER	RIALS	<u>C</u>			
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							Sommord	PROJECT			ydrogeolog	
			/	KLO	HN-CRIP	PEN		LOCATIO		ncor, Albe	***************************************	t d
					A 40 M 1			LOGGED		Suncor	CHECKED B	Y:
				27000000	50000000000000000000000000000000000000	77.77.77.77.77.77.77.77.77.77.77.77.77.	19/06/95		4 of 6		HOLE NO:	L9795001

				TES	T HOLE LO)G	- Committee of Com					
VERTIC	CAL SCA	ALE: 1	cm =	1.0m	DATE DRILLED:	24 JAN	95 -	NATIONAL PROPERTY OF THE PROPE	œ			
SA	MPL	E DA	TA		DRILL TYPE:	Mud Ro	otary	-	H S		NOTES	•
	ER WEI		kg	SYMBOL	ELEV. GROUND	(m): 315.2	21		PIEZOMETER DETAILS			
	HEIGHT	Diame	m	Ž	CO-ORDINATES	(m): N 6,3	16,960 E 4	74,070	EZ			
Depth (m)	Type	Blows .15m	Sample No.		DESCRIP				T .			
85.0												
					88.40 LIMESTO	DNE (Water	ways Fm.)			top of seal 87		
- 90.0		-								top of sand 9	90.2 m i 90.6 m 300' le	ad
- 95.0										bentonite ch		
							Continued	JOB NO:	PA	2779.02.0	1	
								PROJECT	: Ste	epbank H	ydrogeolog	y
			,	KLO	HN-CRIPP	EN		LOCATIO		ncor, Albe		
								LOGGED		Suncor	CHECKED BY	' :
							10/06/05	PLATE:			HOLE NO:	L9795001

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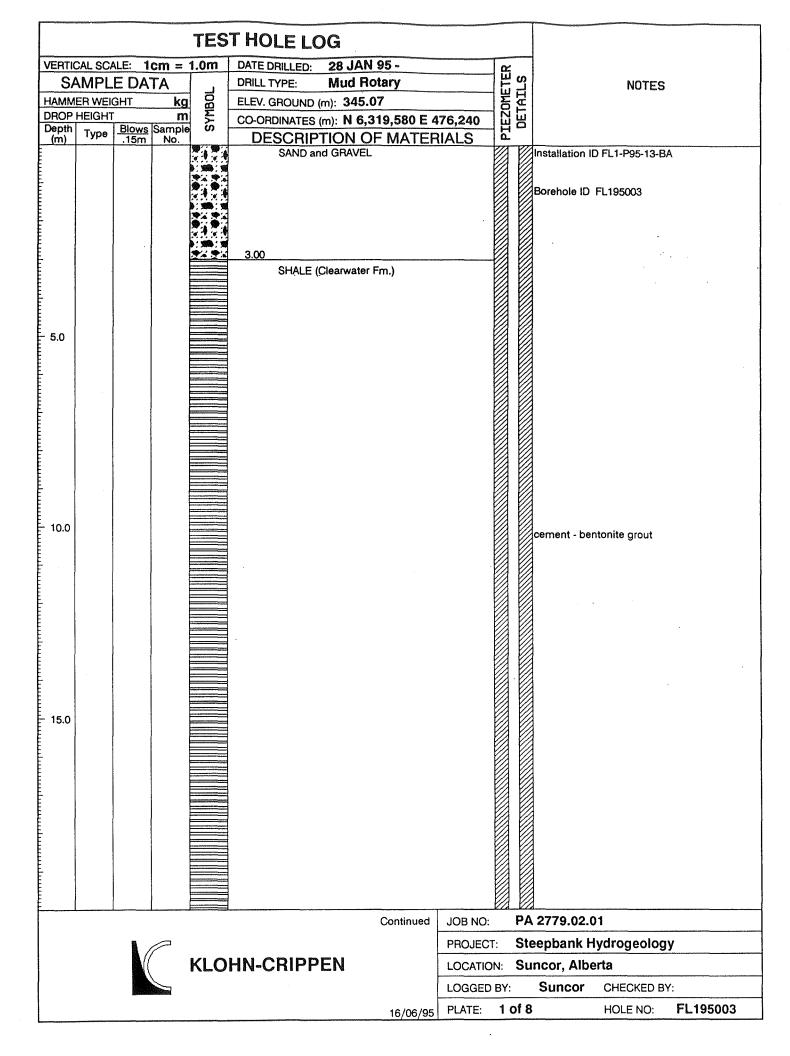
MERICAL SCALE 10m = 1.0m					TES						
Inp of sand 102.6 m sport seed top of bottom seal 102.9 m stored top of bottom seal 102.9 m lotal depth-103.0 m. END OF TEST HOLE JOB NO: PA 2779.02.01 PROJECT: Steanbank Hydrographony	VERTIC	CAL SC	ALE: 1	cm = '	1.0m	DATE DRILLED:	: 24 JAN 9	95 -		O.	
Inp of sand 102.6 m sport seed top of bottom seal 102.9 m stored top of bottom seal 102.9 m lotal depth-103.0 m. END OF TEST HOLE JOB NO: PA 2779.02.01 PROJECT: Steanbank Hydrographony	SA	MPL	E DA	TA		DRILL TYPE:	Mud Rot	lary		H S	NOTES
Inp of sand 102.6 m sport seed top of bottom seal 102.9 m stored top of bottom seal 102.9 m lotal depth-103.0 m. END OF TEST HOLE JOB NO: PA 2779.02.01 PROJECT: Steanbank Hydrographony					00	ELEV. GROUND) (m): 315.2°	1		E E	
Inp of sand 102.6 m sport seed top of bottom seal 102.9 m stored top of bottom seal 102.9 m lotal depth-103.0 m. END OF TEST HOLE JOB NO: PA 2779.02.01 PROJECT: Steanbank Hydrographony	DROP	***************************************	Dlowe	m alamala) ¥	CO-ORDINATES	S (m): N 6,31	16,960 E 4	74,070		
JOB NO: PA 2779.02.01	(m)	Туре	.15m	No.		DESCRI	PTION OF	MATER	IALS	2	
PRO IECT: Steenhank Hydrogeology		HEIGHT	•	m	SYMB(CO-ORDINATES DESCRII	S (m): N 6,3 1 PTION OF	16,960 E 4	AND DESCRIPTION OF THE PERSON		tip A #16950 102.9 m 350' lead top of bottom seal 102.9 m
KLOHN-CRIPPEN PROJECT: Steepbank Hydrogeology LOCATION: Suncor, Alberta									JOB NO:	PA	2779.02.01
KLOHN-CRIPPEN LOCATION: Suncor, Alberta									PROJECT:	: Ste	eepbank Hydrogeology
					KLO	HN-CRIPI	PEN		LOCATION		



LOGGED BY: Suncor CHECKED BY:

L9795001

19/06/95 PLATE: **6 of 6** HOLE NO:



			cm = 1	l.0m	DATE D		28 JAN			œ			
<u></u>		E DA		_	DRILL T		Mud R	**************************************	***************************************	PIEZOMETER	2	NOTE	:S
	ER WEIGHT		kg m	SYMBOL			m): 345.		***************************************	Ž Š			
Depth (m)	Туре	Blows	Sample No.	્રે	CO-ORI	DINATES	m): N 6,	319,580 E 4	76,240	Ä	4		
(m)	Type	.15m	No.	***************************************	DE:	<u> SCRIP</u>	HON C	F MATER	<u>IIALS</u>	<u>o.</u> 27 T		Mineral Control of the Control of th	in the second control and the second control
25.0													
30.0					30.90								
					, sylva	OIL SAN	DS (McMu	rray Fm.)					
35.0								• •	<u>⊽</u>				
			**************************************		**************************************			Continued	JOB NO:	F	A 2779.02.	01	errene (PAPAT TOTALIS BARBARIA BARBARIA ARABARIA ARABARIA ARABARIA ARABARIA ARABARIA ARABARIA ARABARIA ARABARI
									PROJECT	***************************************	teepbank l		MIV
			-	KIA	HN-C	RIPD	EN				****		7 39 3
					W"P111		Acces II W		LOCATION	***************************************	Suncor, Alb		
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			cm = :	1.0m	DATE DRILLED:	28 JAN 9	95 -		œ	муничанатия -			·
		E DA			DRILL TYPE:	Mud Rot	ary		PIEZOMETER	က္ခ		NOTES	•
HAMM	ER WEI	GHT	<u>kg</u>	SYMBOL	ELEV. GROUND				동	DETAILS			
DROP	HEIGHT	Blows	Sample	S≺	CO-ORDINATES	(m): N 6,31	9,580 E 4	76,240	臣	Ы			
Depth (m)	Type	.15m	Sample No.		DESCRIF	PTION OF	MATER	IALS	a.	122			***************************************
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								PROJECT	:	Ste	epbank H	iydrogeolog	ıy
			ا	KLO	HN-CRIPF	PEN		LOCATION	N:	Su	ncor, Albe	erta	
								LOGGED			Suncor	CHECKED B	
							16/06/95	PLATE:	3 (of 8		HOLE NO:	FL195003

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VERTICAL SCAL	.E: 10		emanagement of the control of the	T HOLE LO	28 JAN 95 -		œ	
SAMPLE	E DAT	ГА	. 1	DRILL TYPE:	Mud Rotary		PIEZOMETER DETAILS	NOTES
HAMMER WEIG	нт	kg	SYMBOL	ELEV. GROUND	(m): 345.07		CEZOMETE DETAILS	
DROP HEIGHT	Blows	m	~		(m): N 6,319,580 E	476,240		
Depth Type -	.15m	Sample No.		DESCRIP	TION OF MATE	RIALS		<u> </u>
- 65.0	.1311	INO.		DESCRIP	THOM OF WATER	IIALS		
70.0								
- 75.0								
					Continued	JOB NO:	P/	A 2779.02.01
	1					PROJECT:	St	eepbank Hydrogeology
	$\mathcal{N}($		KLO	HN-CRIPP	EN	LOCATION		uncor, Alberta
						LOGGED B		Suncor CHECKED BY:

16/06/95 PLATE: 4 of 8

HOLE NO:

FL195003

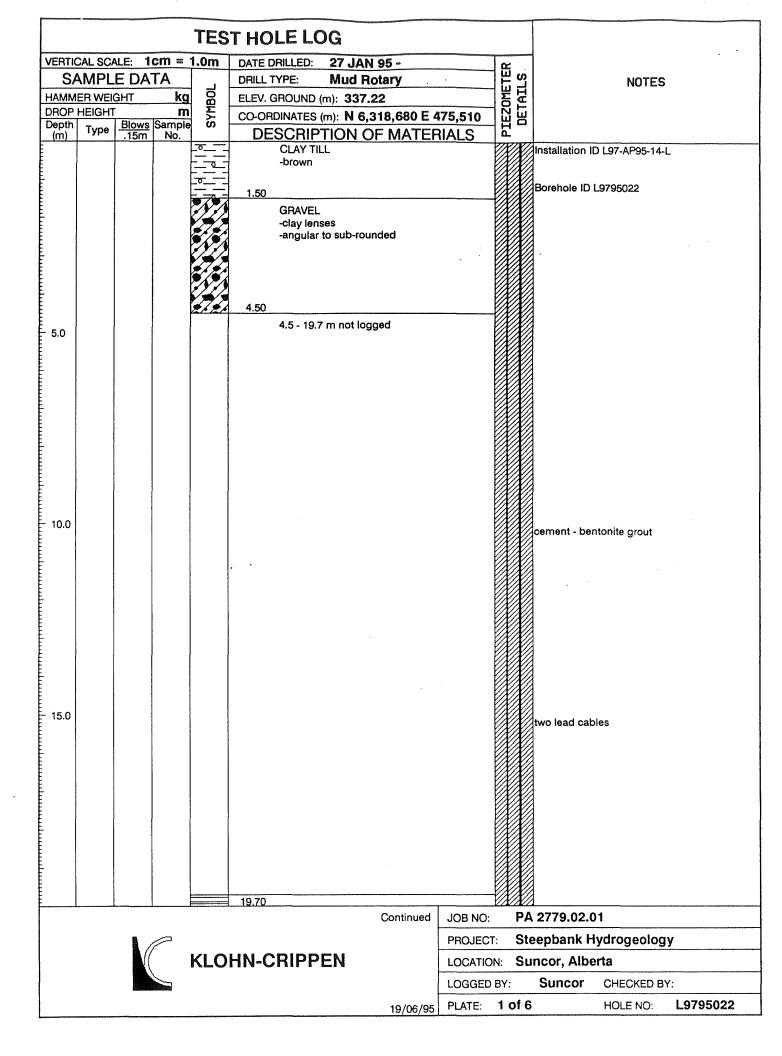
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VERTIC	CAL SC	ALE: 1	cm =	1.0m	DATE DRIL	LED:	28 JAN	V 95 -		Tα	·				
		E DA		j	DRILL TYP	E:	Mud R	otary		- μ	S		NOTES		
	ER WEI		kg	00	ELEV. GRO	OUND (n	n): 345.	07			IAI				
DROP	HEIGHT	Blows	m elome2	SYMBOL	CO-ORDIN	IATES (r	n): N 6,	319,580 E	476,240]	DETAILS				
(m)	Туре	.15m	No.		DESC	CRIPT	TON C	OF MATE	RIALS	ā	1 •				
Depth (m) 85.0	Туре	Blows .15m	Sample No.	λS						PTEZOMETER					
95.0					S/	ANDSTC	DNE (McNifer	Aurray Fm.)				2" dia. sch. 4	40 PVC pipe seal 96.0 m		
<u>.</u>								Continued	JOB NO);	PA	2779.02.0)1		
		8							PROJEC				lydrogeolog	V	
				KI O	HN-CR	IDDE	=N		LOCATIO			ncor, Albe		<u> </u>	
				ILU	1114-AU	. s a . s . L	P VI							4.	
									LOGGE			Suncor	CHECKED B		
								16/06/95	PLATE:	5	of 8		HOLE NO:	FL195003	

		ALE: 1		1.0m	DATE DRILLED:	28 JAN 9)5 -		œ	noontaki			
SA	MPL	E DA	TA		DRILL TYPE:	Mud Rot	ary		H	ഗ്വ		NOTES	•
	ER WEI		kg	SYMBOL	ELEV. GROUND				8	DETAILS			
DROP	HEIGHT	Riows	Sample	Š	CO-ORDINATES				PIEZOMETER				
Depth (m)	Туре	.15m	Sample No.		DESCRIP	TION OF	MATER	IIALS					
											bentonite ch	ips	
105.0													
110.0		·								**************************************	top of filter s	and 110.3 m	
115.0											tip of screen	en 0.020 slots	
						ı	Continued	JOB NO:		PA	2779.02.0)1	
								PROJECT:		Ste	epbank H	ydrogeolog	У
			, 	KLO	HN-CRIPP	EN		LOCATION		*************	ncor, Albe		
			,	en estates was	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	employed by All				40M	Suncor	CHECKED BY	/·
								LOGGED E	*********	e -		***************************************	
							16/06/95	PLATE:	6 0	18		HOLE NO:	FL195003

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			cm = '	1.0m	DATE DRILLED:	28 JAN	95 -	tterande s des sussesses a partement accommendate de la casa de la	<u>a</u>			
SA	AMPL	E DA			DRILL TYPE:	Mud Ro	tary		PIEZOMETER DETAILS		NOTES	
	ER WEI		kg	180	ELEV. GROUND				문단			
DROP	HEIGHT	Blows	Sample	SYMBOL	CO-ORDINATES	(m): N 6,3	19,580 E	176,240	EZOMETE DETAILS			
Depth (m)	Туре	.15m	Sample No.		DESCRIF	<u>IO NOIT</u>	E MATER	RIALS	6		**************************************	
- 125.0					128.30							
130.0						ONE (Waterv	vays Fm.)					
							Continued	JOB NO:		. 2779.02.0		
								PROJECT	: Ste	eepbank H	lydrogeolog	У
				KLO	HN-CRIPP	EN		LOCATIO	n: Su	ncor, Albe	erta	
								LOGGED		Suncor	CHECKED B	Y:
							16/06/95	ļ	7 of 8		HOLE NO:	FL195003

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A-municipality		***************************************	cm = '	1.0m	DATE DRILLED:	28 JAN 95 -			ω.			•
SA	MPL	E DA			DRILL TYPE:	Mud Rotary	у .		PIEZOMETER DETAILS		NOTES	
	ER WEI		kg	SYMBOL	ELEV. GROUND (m): 345.07			CEZOMETE DETAILS			
DROP	HEIGHT	Blows	m elome2	SY.	CO-ORDINATES							
Depth (m)	Туре	.15m	Sample No.		DESCRIP	<u>TION OF N</u>	<u> 1ATER</u>	IALS	6.			
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		1	7					PROJECT	: Sie	epbank H	ydrogeolog	y
		$\mathbb{N}($		KLO	HN-CRIPP	EN		LOCATIO	N: Su	ncor, Albe	erta	
								LOGGED	BY:	Suncor	CHECKED BY	/.
						16	6/06/95		8 of 8		HOLE NO:	FL195003



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VERTIC	CAL SCA	ALE: 1	cm =	1.0m	DATE DRILLED:	27 JAN 95	65		lα			
		E DA			DRILL TYPE:	Mud Rotai	The same of the sa	*	PIEZOMETER DETAILS		NOTES	•
	ER WEI		kg		ELEV. GROUND	(m): 337.22		**************************************	불분			
DROP	HEIGHT	I Diama	m	SYMBOL	CO-ORDINATES	(m): N 6,318	,680 E 4	75,510	LEZOMETE DETAILS			
Depth (m)	Type	.15m	Sample No.		DESCRIP	TION OF N	MATER	IALS	둽			
					SHALE	(Clearwater Fm.)			***************************************		
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35.0								Ã		Alm Dunahan la		
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		B				. Go	ontinued	JOB NO: PROJECT	***************************************	2779.02.0	ydrogeolog	N.F.
				KLO	HN-CRIPE	EN		LOCATIO	~~~~	ncor, Albe	***************************************	
				a special sales		**************************************		LOGGED		Suncor	CHECKED BY	·
							19/06/95	PLATE:	2 of 6		HOLE NO:	L9795022

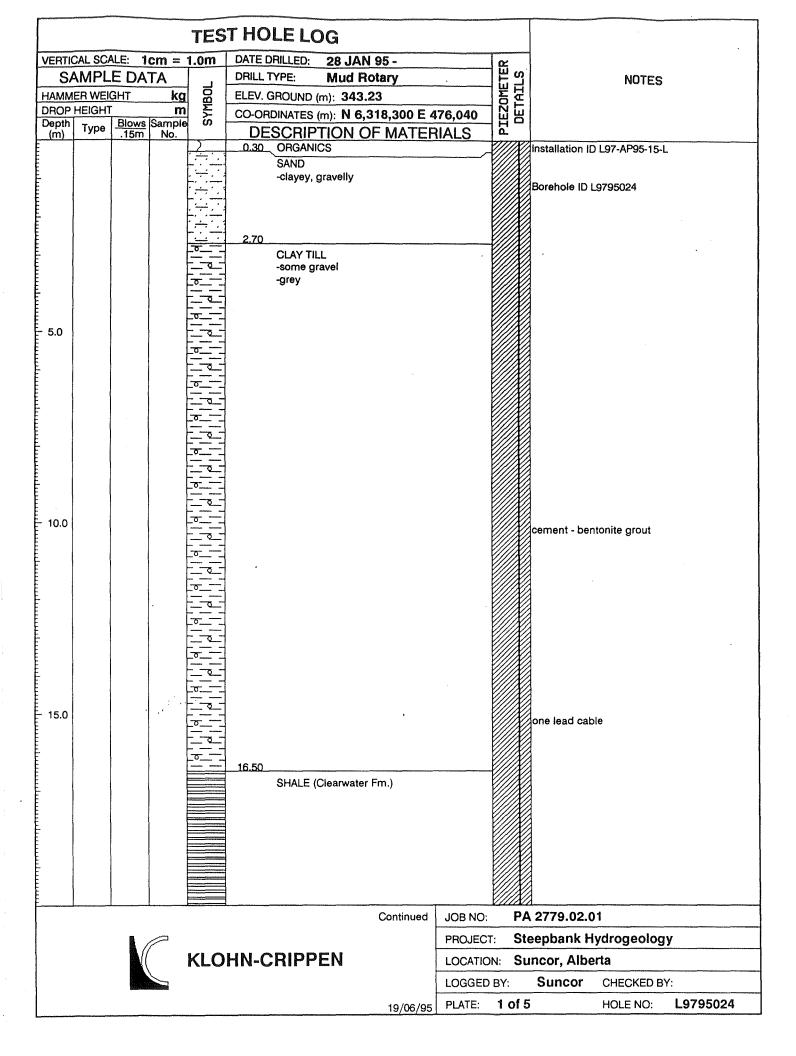
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SA	MPL	E DA	TA		DRILL TYPE:	Mud Rotary	·		ပ္		NOTES	
	ER WEI		kg	80	ELEV. GROUND	(m): 337.22		F	Ε			
DROP	HEIGHT	Rlows	m Sample	3.Y.K	CO-ORDINATES	(m): N 6,318,6 8	0 E 475,510		H			
(m)	Туре	.15m	No.		DESCRIP	TION OF MA	TERIALS	۵				
	HEIGHT	•	m Sample No.	Σ	CO-ORDINATES DESCRIP	(m): N 6,318,6 8		PIEZOMETER	DETAILS DETAILS			
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				**************************************	W	Conti	nued JOB NO):	PA 27	779.02.0	1	
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				NLU	IIIA-CUILL	r= I A	LOCAT			or, Albe		
		A					LOGGE			uncor	CHECKED BY	***************************************
						10/	06/95 PLATE:	3 0	of 6		HOLE NO:	L9795022

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VERTIC	CAL SCA	\LE: 1	cm = 1	1.0m	DATE DRILLED: 27 JAN	V 95 -		œ			
SA	MPL	E DA	TA:	_1	DRILL TYPE: Mud R	otary		PIEZOMETER DETAILS		NOTES	•
	ER WEI		kg	80	ELEV. GROUND (m): 337.	.22		E E			
DROP	HEIGHT	I Diama	m	SYMBOL	CO-ORDINATES (m): N 6,	318,680 E 4	75,510	IEZOMETE DETAILS			
Depth (m)	Type	.15m	Sample No.	0,	DESCRIPTION C	F MATER	IALS	ם			
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							PROJECT			ydrogeology	Anna unita a unido de ciclo de forma manda de manda de moderno en consequencio es de moderno men
				KLO	HN-CRIPPEN	i	LOCATION		ncor, Albe	***************************************	000000 Milliaber in cheese of memory of the 100000 Millians of the cheese and hill in the design and hill in the d
							LOGGED		Suncor	CHECKED BY	•
						19/06/95	PLATE:	4 of 6		HOLE NO:	L9795022

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VERTIC	CAL SCA	\LE: 1	cm =	1.0m	DATE DRILLED: 27 JAN 95 -	1~		
		E DA			DRILL TYPE: Mud Rotary	디	ဟ	NOTES
	ER WEI		kg	걸	ELEV. GROUND (m): 337.22	- H	戶	140123
	HEIGHT		m m	1	CO-ORDINATES (m): N 6,318,680 E 47	25,510 PIEZOMETER	DETAILS	
Depth (m)		Blows	Sample No.	တ်		3,510 H		
(m)		.15m	NO.	 ::::::	DESCRIPTION OF MATERIA	ALS L	200	
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-				H	LIMESTONE (Waterways Fm.)			
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								top of seal 93.5 m
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				$H \rightarrow H$			$\otimes \otimes$	
95.0				\Box			$\otimes \otimes$	bentonite chips
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							XX	
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				H				top of sand 97.6 m
								tip B #17506 98.2 m 300' lead top of upper seal 98.6 m
						***		top or apper soul solo in
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		L	L,	1.1	Continued	JOB NO:	PA	2779.02.01
		8			 	PROJECT:		eepbank Hydrogeology
				KLO		LOCATION:		ncor, Alberta
						LOGGED BY:		Suncor CHECKED BY:
		podenie de			 		of 6	

				TES	T HOLE L	-						
Puncture		ALE: 1		1.0m	DATE DRILLED:	27 JAN 9	A second designation of the second					
ACCOUNT OF THE PARTY OF THE PAR		E DA			DRILL TYPE:	Mud Rot			PIEZOMETER DETAILS		NOTES	1
	ER WEI		<u>kg</u>		ELEV. GROUND		the same of the sa	The same of the sa	돌물			
Depth	HEIGHT Type	Blows	m Sample No.	2	CO-ORDINATES				四四日			
Depth (m)	туре	.15m	No.		DESCRIF	PTION OF	MATER	IIALS	0_	**************************************		neverteel to the transfer of t
105.0										bentonite chi	04.6 m	
- 105.0 E	1								****	tip A #16950	105.0 m 350' n seal 105.0 m	lead
<u> </u>	<u> </u>		\	 	105,70 END OF	TEST HOLE			 	total depth 1		
		<u></u>				·····		**************************************				
							1	JOB NO:	РД	2779.02.0	1	
							:	PROJECT	r: Ste	eepbank H	ydrogeolog	У
		$\mathbb{N}($	•	KLO	HN-CRIPF	PEN	,	LOCATIO	N: Su	ncor, Albe	rta	
								LOGGED	BY:	Suncor	CHECKED B	Y:
							19/06/95		6 of 6		HOLE NO:	L9795022



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VERTIC	CAL SC/	ALE: 1	cm = '	1.0m	DATE DRILLED: 28 J	AN 95 -					
8		E DA	-		***************************************	Rotary	trade (all _{trade} processed - de chara a construence and market a c	<u> </u>	į	NOTES	2
	ER WEI		kg	8	ELEV. GROUND (m): 34	THE PERSON NAMED OF THE PE	AND AND THE PARTY OF THE PARTY	불분		1460.000	•
DROP	HEIGHT		m	ξ	CO-ORDINATES (m): N	CONTRACTOR DESCRIPTION OF THE PROPERTY OF THE	76.040	PIEZOMETER DETAILS			
Depth (m)	Туре	.15m	Sample No.	ഗ	DESCRIPTION	OF MATER	RIALS	d L			
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4		3.96 LIMESTONE (DEVONIAN BEDROCK) -very weak, some clay, highly disturbed,								TŤ	ĦŤ	Ť	Ť٦
		poor recovery											7
<u> </u>							w=7%						
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		4.40-6.10 m- lost core								19		þ	=
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- 6		6.10-6.27 m- gravel sizes, some clay								<u> </u>		-	
-		6.27-6.52 m- weak, grey 6.52-7.13 m- trace clay, weathered					w=5%	19P					
-		0.52-7.15 ffi- trace clay, weathered						'•'					-
- 							00/						
- '		7.13-8.05 m- clayey, extremely weak,	-XXX				w=3%				X		
-		weathered, medium plasticity, gravel sized harder pieces, core relatively unfractured,		<b>a</b> I		1							'
-		moderately close spaced discontinuities								64:	<b>1</b> :	32	<u>_</u>
- Ω		Gradation analysis result: 7.95-8.05 m: 63% gravel, 17% sand, 13%					w=6%	1					
-		silt, 7% clay					w = 10%	á					
		8.05-9.15 m- lost core									1/		
-		5155 5115 111 1600 6616											
- 9									::  ::				
		-extremely weak layers with stronger							<del>                                     </del>	#:	KA	-	<u> </u>
		limestone layers interbedded, slightly weathered, slight bitumen staining, harder											1
···		layers are 5 to 40 mm thick, clayey layers					w=6%				1.1		
10		are thinner, fissured									1		上
				<b>a</b> l									
							w=6%		::: <b> </b> ::				
-				8					:: ::	io:		15	
- 11			-XXX				w=9%						
-				<b>a</b> l					::: :::				
				8					:::[::				1
		11.30-12.20 m- lost core							   		E		
_				21			<u></u>	<u></u>	<u> </u>				L
DISCO	NTINUIT	Y CODES: B: BEDDING D: DRILL BRK F: FA				J: JOINT M:			S: SHE		TENSIC		F
haccontentation of the second	KNOPPOSONIZANIZANIZANIZANIZANIZANIZANIZANIZANIZA	FRACTURED CORE	UNCONF.	COM	P. STRE	:NGTH - X	: CROS	s BEDD	JING I	P: PARA	-		
											05	/05/	9:

8 & &_		-CRIPPEN	GEOLOGIC L	UG OF			OLE	NO.:	FL			)
D E	S Y			YTT/	DISCO INUI DA	ITY		LOAD TEST			OVERY ATA	
P T H (m)	M B O L	LITHOLOGIC DESCRIPTION	INSTRUMENT	HYDRAULIC CONDUCTIVIT	SE BOTT OF FO COD	MAC PR		U _c (MPa)		ORE OVERY %		Q.D %
		continued see previous pag	TING	10-6 10-4 10-2	DIP AI							
12	44	12.20		777	30	60			25 ::::::	50 75 ::::	25	50
		12.20-12.28 m- medium strong, w 12.28-12.36 m- extremely weak cl 12.36-12.75 m- medium strong, s weathered, white	lay layer 🛋 📉			ر	w=5%	37P				
13		12.75-15.25 m- lost core					,			18		7
14												
15		-strong, slightly weathered, whites spaced discontinuities -weak, very close spaced discontinuities	-XXX		,		w - F0	87P				
16		grey, trace clay 15.91-16.73 m- extremely weak, g harder pieces in medium plasticit wet, nonhomogeneous Gradation analysis result: 16.24-16.35 m: 59% gravel, 9% sa silt, 13% clay	ly clay,				w=5% w=15% LL=35% PL=17%	,		49	:	20
18		16.73-18.30 m- lost core										
19		<ul> <li>-very weak to weak, fresh, grey gr to 150 mm intermixed with 20% c extremely weak, medium plasticit olive grey, very close spaced irreg fractures</li> </ul>	clay, ty, wet,			F	w = 12% = 250kF w = 10%	a				
20					J		LL=39% PL=199 w=4%			5		31
21		20.00-21.35 m- lost core										
		-extremely weak, 70% gravel size pieces, 30% clay, stiff, medium p saturated, interbedded					w = 11%					

KL	OHN	-CRIPPEN GEOLOG	aic L	OG OF I	DRILL	HOLE	NO.:	: FL1BF	RDG2
Ď	S			>-	DISCO: INUIT	Υ	PT. LOAD TEST	ľ	COVERY DATA
E P T H (m)	Y M B O L	LITHOLOGIC DESCRIPTION	INSTRUMENT	HYDRAULIC CONDUCTIVI CM/SEC	SEE BOTTO OF FOR FOR	OTHER TESTS	U _C	CORE	R.Q.D.
			NE NE	0-01 0-01 7-01	DIP AND	i			
22	250	continued see previous page	KAKA		30 6			25 50 75	25 50 75
-		-very close spaced discontinuities			$ \ , \  $	w = 169			
- -		22.78-22.90 m- clay is brownish grey			•   •				
23						w=13%		64	
- - - -		23.31-24.40 m- lost core				LL=289 PL=149			
— 24		24.40-24.46 m- vertical half of core is grey, medium plasticity, clay				• • •			
. 25		-medium strong, very light brown 24.87				w=5%	34P		
• • •		24.87-25.90 m- lost core						31	8 -
- - 26		-some clay with harder limestone pieces, extremely weak 26.40-26.54 m- gradation analysis result:							
27		26.65 56% gravel, 26% sand, 10% silt, 8% clay - strong, very light brown, moderately close spaced discontinuities				w= 12%	73P	67	30
-		-weak to medium strong, very light grey, close spaced discontinuities, fractured			1				
28		27.82-27.87 m- extremely weak, trace clay mixed in — 27.82-28.23 m- close spaced discontinuities 28.23-28.78 m- very close spaced discontinuities —				w=6%	10P	86	26
29		28.78-29.00 m- lost core				w = 4%			
· ·		29.24 -trace clay, weak -medium strong, very light grey, very close to close spaced discontinuities - 29.69				w=4%	44P		
30		-trace clay, some bitumen staining 30.07-30.12- weak, some bitumen staining, vertical joint has clay infilling				w = 2%			
- 31		30.25-32.05 m- lost core —						37	11 -
		·							
DISCO	NTINUIT	Y CODES: B: BEDDING D: DRILL BRK F: FAUL		NEISS'TY J					: TENSION CRK
***************************************	A September 1997	FRACTURED CORE UN	JONF. C	OMP. STRE	:NGTH -	X: CROSS	BEDU	ING P: PARA	ALLEL BEDDING 05/05/95

D	S				<b>}</b>		DISCO INUIT DAT	ΓY		PT. LOAD TEST		F	RECO DA	VERY	Υ
E P T H m)	Y M B O L	LITHOLOG DESCRIPTION		INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVIT	CM/SEC	SEE BOTTO OF FO FOF CODE	E OM ORM	OTHER TESTS	U _c (MPa)		CORE	- 1		R.Q.(
		oontinued meeti		INS	10-6 10-4		DIP AN	GLE							
32		continued see previ - weak, slight bitumen sta			77	井	30 €	<u> </u>			25	50	75	25	50
33		32.50-32.75 m clayey 32.75-33.55 m- lost core	-						w=9%			47			0
34		-trace clay -white to olive grey	-						w=4%						
35		CLAY- trace harder limes medium plasticity saturat interbedding 34.81 LIMESTONE 34.81-35.16 m- gravel size bitumen staining	ed clay, some						w = 13% w = 2%	<b>1</b> 9P		62			30
36		35.16-35.44 m- weak 35.44-36.60 m- lost core -weak, light grey	-												Add Allebourne Brown
37		36.67-36.95 m- trace clay staining 36.95-37.03 m- very weak 37.00 m- vertical fracture, weathered, some slickens 37.03-37.46 m- trace clay bitumen staining 37.46-37.90 m- very weak	slightly sides infilling, slight						w = 4% w = 5%						
38		grey clay layers, 10 mm t 37.78-38.53 m- close space 38.53 37.90-medium strong, wh	hick ced discontinuities				1		w=3%	56P		.63			26
39		38.53-39.65 m- lost core													
		End of Hole at 39.65 m Install pneumatic piezom Response zone 32.50-33.	eter 20 m												
														Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Salar Sa	

				TES	T HOLE LOG				50		- kPa	50	20	<u></u>	
VERTIC	CAL SCA	VLE: 1	cm = (		DATE DRILLED: 14 FEB 95 - 15 FE	R 05	~ .	IN-SIT	50 U (VAN EAK	IE)	LAB P.P.	<b>5</b> U	۷	N ·	
		E DA			DRILL TYPE: Failing 1500		PIEZOMETER DETAILS	♦ RI	eak Emold	). LJ \	ANE				
		GHT 6		SYMBOL	ELEV. GROUND (m): 254.86	***************************************	IEZOMETE DETAILS	PLA	STIC IT %	CON	ATER TENT	0/	LIC	QUID	<i>,</i>
DROP	HEIGHT	-	.76 m	, E	CO-ORDINATES (m): N 6,317,730 E	172.580	EZ	10	( 3		0 50			AIT %	
Depth (m)	Type	.15m	Sample No.	S	DESCRIPTION OF MATER	Market Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the Committee of the	Z J		T 4		Blows	/0.3c	n i	9	<u>J</u>
					TOPSOIL-10 mm thick				TT		7		ΪŢ		
-					SAND (ALLUVIUM) (SM)						1				
					-silty, compact, damp, brown Area cleared by dozer, top 0.2 m	exposed							1	ı	
					by hand	·	(XXX)						1 1	-	
- 1.0					Overburden sampled at 1.5 m in soil description between sam	cervais, oles is							ļ		
					approximate.	E								İ	
 	SPT	50/100			-saturated(?), a few limestone ch 1.62	ips in S1		0							
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			***************************************	<u> </u>		T									Tables Williams
						JOB NO:	РА	2780				······································		~~~~	
						PROJECT:	Air	abasc	a Bri	dge					
		$\mathbb{N}($		KLO	HN-CRIPPEN	LOCATION	1: eas	st side	, cent	erline	analised ble manacau y e Mil	ared/district easy account			
								0.65 0.0		·	***************************************		Name and Association	***************************************	



CHECKED BY: LOGGED BY: JGM

PLATE: 1 of 1 FL1BRDG3 HOLE NO: 08/05/95

KL	лно.	I-CRIPPEN GEOLOGIC	CLC	G OF	DF	RILL	. Н	OLE	NO.	· F	-L11	NAME AND ADDRESS OF THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, THE OWNER, TH	NAME OF TAXABLE PARTY OF TAXABLE PARTY.	3 ·	)F 4
CLIEN		Suncor Inc. Oil Sands Group	T	JOB NO.						-					***************************************
PROJE		Athabasca Bridge		DATE HO				14/0	2/95		FINISH	HED:	15/	02/9	95
		ast side, centerline		DATUM:						~					
		ZIMUTH: —— DIP (from horiz): 90		ELEV. CO	OLLA	R: 2	254.	86 m							
~	RDINATE			ELEV. TO				~							
		OF HOLE: 37.15 m		ELEV. BO									·····		
		ER'S DRILL DESIGNATION: Failing 1500		DRILLING	3 ME	THO						OCK:		rota	ry
	NG COP ED BY:	JTRACTOR: Elgin Exploration Ltd.  JGM DATE: March 1995						LUID: V			C/	ASED			
Oddi	CD B1.	DATE: Warch 1995		ANGLE C		SCO SCO		ROM C	ORE A	<u>XIS</u>	ᆜ			IP D	<u>()                                    </u>
D	S			>		INUIT	ΓΥ		LOAD			RECO DA		Y	
E	Υ			5 E	-	DAT	Α		TEST						
P	M	1,50,000	_	96		SEE		ജ്							
T H	ВО	LITHOLOGIC		<b>S</b> S C	)   B	OTT		OTHER TESTS	U _C		COR			R.Q.E	).
m)	L	DESCRIPTION	LS	HYDRAULIC CONDUCTIVITY CM/SFC	۱۵	F FOF		0 =	(MPa)	R	ECOVE	RY			
	_	DESOMITION   E	E			CODE					%			%	
			DETAILS	0 4 <u>0</u>	DII	AN	GLE								
	<del>,,,,</del>			100	1	<u>30 6</u>	1			2	5 50	75	25	50	75
ļ		1.62 LIMESTONE (DEVONIAN BEDROCK)  Core from 2.1 m													T
2		Core none 2.1 m											_		
	242														T
ŀ	222														
-	4444	2.10-3.60 m- lost core													
ļ	<del>77,77</del>										P			P	1
ŀ	444														
ļ	<b>44</b>												1		
ļ	<b>X</b>	-clayey, extremely weak, light grey to grey,								::	$\dashv$	++	7	-	+
ŀ	222	clayey portion is interbedded with harder gravel sizes, clay is medium plasticity, olive						w=5%							
ŀ		grey, fresh								::			2		
ŀ												1 1	2		
	$\mathcal{M}$									::		1 }	/	1	
- [												1			
,											18		7	12	
-	777												2		
7		4.15-6.65 m- lost core										1 1			
. 7													/		
6													/		
į													7		
		-some bitumen staining along fractures											2		
		6.95 m- interbedded limestone and clay,					:::	w=5%					7.1		1
7		extremely weak to very weak, grey,			<u> </u>			w = 5%		:::			/		
		fractured, very close to close spaced											/		
		discontinuities, breaks easily along fractures						w=5%		:::[			//		
-	XXX	7.86-8.00 m- some rust staining						W - 076		:::E			/		
8	TH.	8.00								:::			/		
ļ		-weak, slightly weathered, grey, wet fracture surfaces, some fractures are rust stained						w=3%	15P		59		/	15	
	<del></del>									:::[			21		
										:::		1	/		1
9		8.45-9.70 m- lost core											/		
9		0.40-9.70 TH- lost core								:::			/		
F	珊									:::			/		
	Т Т					<u> </u>					<u>::: -</u>		4		
<u>CO1</u>	TIUNIT			EISS'TY							HEAR				
	·	FRACTURED CORE UNCON	IF. CC	MP. STR	ENG	TH -	X:	CROSS	BEDD	DING	P: P	ARAL		BEDD	

DEPTH(m)	S Y M B O			>	DISCON'		PT.	В	ECOVERY	***************************************
Р Т Н	M B			<u> </u>	DATA		LOAD TEST		DATA	
		LITHOLOGIC  DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVI CM/SEC	SEE BOTTOM OF FORM FOR CODES	長期	U _c	CORE RECOVEI %		).
		continued see previous page	짐핌	10-6 10-4 10-2	DIP ANGL 30 60	Ē		25 50 3	25 05 50	****
: <b> </b>		-fresh, close spaced discontinuities					6P	25 50 7	5 25 50	75 †
- 10   - 11		10.26 m- strong, slightly weathered, moderately close spaced discontinuities, slight bitumen odor, grey with dark olive brown staining, crystalline with shells  10.98  10.98  10.98				w=4% w=5%	- 1			
- 12 44 - 42 - 12 44 - 44		-trace to some clay, extremely weak, slightly weathered, grey to light grey, fissured 11.56-11.76 m- dark grey, fissile 11.66-11.76 m- 66% gravel, 19% sand, 9% silt, 6% clay 11.76-12.75 m- lost core, gamma ray log indicates limestone				: w = 15%		€ <del>&amp;</del>	33	
- 13		CLAY -30-50% harder gravel sizes, very stiff to hard, medium plasticity, olive grey, close spaced discontinuities, fissile to thinly laminated horizontally -10-20% harder gravel sized pieces				w = 11% w = 19%				-
- 14 - 15		Gradation analysis result 14.15-14.25 m- 8% gravel, 16% sand, 46% silt, 30% clay				F = 250kF LL = 40% PL = 199 w = 22% F = 275kF		PO	52	
- 16		14.90-15.80 m- lost core  16.02 -very stiff, medium plasticity, dark grey,  16.21 damp, thinly laminated				w=12%				
- 17		LIMESTONE-trace interbedded clay, very weak  16.71 CLAY- some harder pieces, very stiff to hard, medium plasticity, fissured  LIMESTONE  -weak, very light grey to white, close spaced			1	F = 360kF LL = 35% PL = 18% F = 450kF w = 17%	a			
- 18		discontinuities 17.01-17.55 m- trace clay, very weak, white to olive grey 17.55-18.53 m- weak, white to olive grey, close spaced discontinuities -shells, mottled light to dark olive brown			1 1	w=2%		:56	46	
- 19		18.53-18.85 m- lost core -slightly weathered, white, some bitumen staining				w=3% w=4%	12P 19P			
nieco.		18.85-19.26 m- close spaced discontinuities 19.26-19.64 m- very close spaced  Y CODES: B: BEDDING D: DRILL BRK F: FAULT		NEISS'TY J		1 (2)		S: SHEAR	T: TENSION C	

D	KL	лнО.	I-CRIPPEN	GEOLOG	aic Lo	OG (	OF D	DRIL	LH	OLE	NO.:	F	:L1	STATE OF THE PERSON NAMED IN	ATTACAMENTATION CONTINUES	OF 4
Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description   Description						>	-	INU	TY		LOAD		. 1			
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discontinuities 19.64-19.77 m-close spaced discontinuities 19.77-20.54 m- light olive brown, very close to close spaced discontinuities 20.54 m- 10 mm thick clay layer, had 20.68 m- trace clay, very weak, five brown, fissured, silictensiced, close spaced discontinuities 21.17 m- mediate strong, light olive brown, moderately close spaced discontinuities 21.17-21.90 m- lost core 22.03 21.90-22.03 m- very light bluish grey 22.03 21.90-22.03 m- very light bluish grey 22.03 22.03 22.05 m- interbedded extremely weak clay and harder limestone, clay is medium plasticity, well, fissile, harder pieces are <20 mm thick weak, very light olive grey 22.04-22.96 m- bitumen stained 23.33 m- weak, elighty weathered, fissured, some bitumen staining dolose spaced discontinuities fissure surfaces are bitumen stained 23.97-24.95 m- lost core  25 - very weak (<40 mm) layers interbedded with externely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained 25.95-25.10 m- bitumen stained 26.95-25.10 m- bitumen stained 27.45-28.00 m- lost core  28 - very weak to weak(), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are clive grey to white  28 - verse, grey to very light grey - very weak to makel, limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are clive grey to white  28 - vessk, grey to very light grey - very weak, light grey - very weak, light, fissile, interbedded with harder light grey layers, 60-75% clay - very weak, grey to very light grey - very weak, grey to weak, fiesh, fissile, interbedded with harder light grey layers, 60-75% clay - 29.23.2			continued see previous page	ı	INS	9-01	1 N	Į					- 50			
20.54 m- 10 mm thick clay keys, hard 20.68 m- trace ciay, very weak, clive brown, fissured, elickensided, close spaced discontinuities 21.17 m- medium strong, light olive brown, moderately close spaced discontinuities 21.47-21.90 m- lost core 22.03 22.90-22.03 m- very light bluish grey 22.03-22.52 m- interbedded externelly weak clay and harder limestone, clay is medium plasticity, wet, fissile, harder pieces are <20 mm thick weak, very light olive grey 22.44-22.96 m- bitumen stained 23.03 externelly weak, some clay 23.33 m- weak sightly bathered, fissured, some bitumen staining close spaced discontinuities fissure surfaces are bitumen stained 23.97-24.95 m- lost core  24 very weak (<40 mm) layers interbedded with extremely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained 25.96-26.15 m- medium strong, very light grey very weak to weak(), limestone with clayey interbadded layers, close spaced discontinuities, clayey layers are clive grey, harder layers are olive grey to white  27.45-28.00 m- lost core  w=3%  W=2%  UMESTONE	20		discontinuities 19.64-19.97 m- close spaced disco 19.97-20.54 m- light olive brown, v	ontinuities -				30	60	w=4%		200	5 50	75	25 5	0 75
21.17 m- medium strong, light olive brown, moderately close spaced discontinuities  21.47-21.90 m- lost core  22.03 21.90-22.03 m- very light bluish grey  22.03-22.92 m- interbedded extremely weak cleay and harder limestone, clay is medium plasticity, wet, fissile, harder pieces are < 20 mm thick  weak, very light olive grey  22.83-42.96 m- bitumen stained  23.03 extremely weak, some clay  23.13 m- medium strong  23.33 m- weak, slighty weathered, fissured, some bitumen stained  23.97-24.95 m- lost core  - very weak (<40 mm) layers interbedded with extremely weak, clayey layers (< 20 mm) fractured  24.95-25.10 m- bitumen stained  25.96-26.15 m- medium strong, very light grey  very weak to weak(-), limestone with clayey interbedded algoon/fundlies, clayey layers are olive grey, harder layers are olive grey to white  - 26  27.45-28.00 m- lost core  - 28  - weak, grey to very light grey  28.50 at 28.07 m 15 mm clayey layer  CLAY  - weak, grey to very light grey  29.23  LIMESTONE	- - - -		20.54 m- 10 mm thick clay layer, h 20.66 m- trace clay, very weak, oliv fissured, slickensided, close space	ve brown, -						w=3%	,		86		3	3
22.02 23 m- very light bluish grey 22.03 22.52 m- interbedded extremely weak clay and harder limestone, clay is medium plasticity, weft, fissile, harder pleces are <20 mm thick 4. very light olive grey 22.84-22.95 m- bitumen stained 23.03 - extremely weak, some clay 23.18 m- medium strong 23.18 m- weak, sightly weathered, fissured, some bitumen staining 4. doze spaced discontinuities 6. fissure surfaces are bitumen stained 23.97-24.95 m- lost core  25. very weak (<40 mm) layers interbedded with extremely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained 24.95-25.10 m- bitumen stained 25. ps. 26.26.15 m- medium strong, very light grey very weak to weak(), limestone with clayey interbedded elyers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to write 42.95-25.00 m- lost core  27.45-28.00 m- lost core  28. veek, grey to very light grey 42.95-25.00 m- lost core  29. 29. 29. 20. LIMESTONE  21.MESTONE	— 21 -		21.17 m- medium strong, light oliv	e brown, -						w=4%	220					-
clay and harder limestone, clay is medium plasticity, wet, fissile, harder pieces are <20 mm thick weak, very light olive grey 22.84-22-96 m- bitumen statined 23.03 extremely weak, some clay 23.18 m- weak slightly weathered, fissured, some bitumen staining close spaced discontinuities fissure surfaces are bitumen stained  23.97-24.95 m- lost core  25	_ 22		22.03 21.90-22.03 m- very light bluish gre								331			:		-
22.84-22.96 m- bitumen stained 23.09 extremely weak, some clay 23.18 m- medium strong 23.33 m- weak, slighly weathered, fissured, some bitumen staining elose spaced discontinuities fissure surfaces are bitumen stained  23.97-24.95 m- lost core  25  - very weak (< 40 mm) layers interbedded with extremely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained  25.96-26.15 m- medium strong, very light grey -very weak to weak(-), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to white  27.45-28.00 m- lost core  28  - weak, grey to very light grey at 28.50  CLAY - extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay 29.23  LIMESTONE	- -		clay and harder limestone, clay is r plasticity, wet, fissile, harder pieces mm thick	medium -						w=6%						
some bitumen staining -loose spaced discontinuities fissure surfaces are bitumen stained  23.97-24.95 m- lost core  - very weak (<40 mm) layers interbedded with extremely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained  - 26  25.96-26.15 m- medium strong, very light grey -very weak to weak(-), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to white  - 27.45-28.00 m- lost core  - 28  - weak, grey to very light grey - at 28.07 m- 15 mm clayey layer - extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay  - 29  - 29  - 29  - 24  - 29  - 24  - 29  - 24  - 29  - 29  - 29  - 29  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 21  - 20  - 20  - 20  - 20  - 21  - 21  - 22  - 23  - 24  - 24  - 25  - 27  - 27  - 28  - 28  - 29  - 29  - 29  - 29  - 29  - 29  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  - 20  -	- 23		22.84-22.96 m- bitumen stained 23.03- extremely weak, some clay 23.18 m- medium strong						: • :	w=2%						 
- very weak (<40 mm) layers interbedded with extremely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained 25.96-26.15 m- medium strong, very light grey very weak to weak(-), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to white 6P 27.45-28.00 m- lost core 48.07 m- 15 mm clayey layer CLAY - extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay 29.23 LIMESTONE	- - 24		some bitumen staining -close spaced discontinuities	-					-	w=2%	13P		.68		2	3   .
with extremely weak, clayey layers (<20 mm) fractured 24.95-25.10 m- bitumen stained  24.95-25.10 m- bitumen strong, very light grey at 28.07 m- 15 mm clayey layers  - 28  - 28  - weak, grey to very light grey at 28.07 m- 15 mm clayey layer  - CLAY - extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay  29  LIMESTONE	-		23.97-24.95 m- lost core	1							-					.
24.95-25.10 m- bitumen stained  25.96-26.15 m- medium strong, very light grey -very weak to weak(-), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to white  27.45-28.00 m- lost core  - 28  - weak, grey to very light grey at 28.07 m- 15 mm clayey layer  CLAY -extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay  29.23  LIMESTONE	- 25		with extremely weak, clayey layers					. ; . ; .	1:::	w=3%						=
grey -very weak to weak(-), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to white  27.45-28.00 m- lost core  w=3%  -weak, grey to very light grey at 28.50 at 28.07 m- 15 mm clayey layer  CLAY -extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay 29.23  LIMESTONE	- 26			n light						EQ	-					
harder layers are olive grey to white  27.45-28.00 m- lost core	-		grey -very weak to weak(-), limestone wi interbedded layers, close spaced	ith clayey					,				.82		3	6 -
- 28  -weak, grey to very light grey at 28.07 m- 15 mm clayey layer  CLAY -extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay  29.23  LIMESTONE	- 27										6P					_
-weak, grey to very light grey 28.50 at 28.07 m- 15 mm clayey layer  CLAY -extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay  29.23  LIMESTONE	-		27.45-28.00 m- lost core							w=3%						-
- extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay	28 -		28.50 at 28.07 m- 15 mm clayey layer							w=2%						
LIMESTONE	- 29		<ul> <li>extremely weak, fresh, fissile, interwith harder light grey layers, 60-75</li> </ul>							w = 10%						-
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		continued see previous page	HE	10-6 10-4 10-2	DIP ANG 30 60	1		_	F F0	ėng ga	0.00	
		piece is 60 mm, some bitumen staining				THE REST OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PA			5 50	_/s_    -    -	25 50	<u>)                                    </u>
30		-olive grey, close spaced discontinuities 30.49-31.05 m- lost core				w=3%	2P					
31		-interbedded weak limestone (85%) and				J W=4%						
		extremely weak clayey layers, olive grey to light olive grey, slight bitumen staining, very close spaced discontinuities				w=3%						
32		32.20 32.20-32.46 m- more homogeneous very weak			<b>],</b>	w=3%	12P		5.			A
33		32.46-33.56 m- medium strong, light olive grey, close spaced discontinuities				W - 376			84		34	ŀ
34		33.56  CLAY- extremely weak, olive grey, fissured 33.62-34.10 m- lost core				w=3%	32P					
*		LIMESTONE -clayey, very weak, fresh, olive grey, fissile to thinly laminated, occasional harder zones, close spaced discontinuities				w=5%	1P					
35		-increasingly interbedded, 50% weak, and 50% very weak				w = 5%			100	3		
36		36.00-36.14 m- medium strong with three 5 mm clay layers 36.14 m- clayey, very weak, olive grey, some interbedding with 60% very weak and 40% weak			J	w=7%						•
37		-close spaced discontinuities 37.10 -very weak, olive grey, fissile, homogeneous  End of Hole at 37.15 m Install two pneumatic piezometers Response zones:				w = 5%						
		10.00-11.00 m 35.70-37.00 m										
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		Athabasca Bridge	***************************************	DATE HOL	LE START	ED: 13/0	2/95	FINISHE	D: 14/02/95
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(m)	L	DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVIT CM/SEC	FOR	I	(MPa)	%	'   %
	j		SE.						
			fö	10-6 10-4 10-2	DIP ANG	i i			
		6.40 LIMESTONE (DEVONIAN BEDROCK)	747	777	30 60	2		25 50 75	25 50 75
Ē	口口	-core from 7.00 m			1 1 1				
- 7		<u>+</u>							
Ė		7.00-8.42 m- strong, light grey, trace	***			∷			
Ŀ		bitumen staining	***						
-		1	4						
- - 8		7.96-8.42 m- trace bitumen staining	$\frac{1}{2}$				84P		
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E	7///	8.42 CLAY	$\not{x}$						
ļ.		-hard, grey, damp, some harder areas,	x			w=8%		56	34
9		fissile to thinly laminated				LL = 33%			
-		8.70-10.05 m- lost core				PL=189			
r L		gamma ray log indicates clay							
<u>-</u>									
<u> </u>									
10		-interbedded medium to high plasticity clay							
-		(80%) and harder pieces (20%), fresh, slight							
F		bitumen staining, fissile, to thinly laminated				w = 12%			
<u> </u>						LL = 54%			
11 						PL=189			
ļ.		11.50				w=7%			
F	1/1/	-//						44	13
[	1/2/	LIMESTONE							
12	4242	-clayey (inferred from gamma ray log)							
	1/1/	11.40-13.10 m- lost core							
-	4/4/		/////						
E									
13	424	-interbedded weak limestone and extremely							
E	4242	weak clayey limestone, grey, damp, some			1::1::1	-;-			
-		bitumen staining				∷: w=5%			-
<u>}</u>	2/2	-trace clay, very weak							
14		<u> </u>				<u> </u>			
ļ.			////			,			
DISCO	NTINUIT	TY CODES: B: BEDDING D: DRILL BRK F: FAULT	G: Gi	VEISS'TY J	J: JOINT	M: SCHIST	''TY	S: SHEAR	T: TENSION CRK
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P T H (m)	-М В О L	LITHOLOGIC DESCRIPTION	INSTRUMENT	HYDRAULIC CONDUCTIVITY CM/SEC	SE BOT OF FO FO	TOM ORM OR	OTHER TESTS	U _c (MPa)	CORE RECOVER %	- 1	R.Q.D. %
		continued see previous page	NH NH	10-6 10-4 10-2	DIP A						
		-some clay, extremely weak, grey, damp		777	30	60	w=4%		25 50 75	25	50
15		14.60-16.15 m- lost core					W-470		49	*****	5
16		-trace clay, extremely weak, grey, slight bitumen staining					w=4%				
17		-clayey 17.04-17.19 m- weak, trace clay 17.19-18.50 m- some clay to clayey, very weak to weak, harder pieces interbedded, maximum harder piece 60 mm, very slight bitumen staining					w = 7% w = 4%	6P	77		13
19		-clayey, very weak  18.50-19.20 m- lost core					w=5%				
20		-weak, slightly weathered, light grey with extremely weak layers  20.10  CLAY -extremely weak with a harder pieces,					w=3%				
21		moist, medium plasticity, light olive, slickensided, slight bitumen staining 32% gravel, 18% sand, 29% silt, 21% clay 20.52-22.25 m- lost core					LL = 47% PL = 22% w = 20%		50		19
22		LIMESTONE (inferred from gamma ray log)  22.25  CLAY- extremely weak, high plasticity, light olive, moist, slickensided, isolated weak				1	LL = 53% PL = 23%				
23		22.70 limestone piece 22.90 LIMESTONE- weak, bitumen stained, weathered, trace oil sand filling CLAY- very stiff to hard, fresh, medium 23.51 plasticity, light olive, slickensided, fissile to				F	l	a			
24 ×		thinly laminated at 50 degrees 23.40-23.48 m- 40% gravel, 9% sand, 32% silt, 19% clay  LIMESTONE- weak, white 23.8-24.53 m- interbedded white very weak			1	,	PL = 18% w = 15%		75		22

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F T H (m)	М В О L	LITHOLOGIC DESCRIPTION	INSTRUMENT	AILS	HYDRAULIC CONDUCTIVIT CM/SEC	SEI BOTT OF FO FOI COD	E OM ORM R	OTHER	U _c (MPa)		ORE OVERY %	1	R.Q.D. %
		continued see previous pag	Si		0-01 0-01 0-4-01	DIP AN	ı						NOTO THE REAL PROPERTY OF THE PERSON NAMED IN COLUMN TWO IN COLUMN TO THE PERSON NAMED IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO IN COLUMN TWO
		to weak (70%) and extremely weak slightly weathered, some bitumen (24.27-24.38 m- clayey, very weal	ak clay, – n staining			30 (	50	w=9%	74460000 TOOLS	25 ::::::::::::::::::::::::::::::::::::	50 75	25	50 75
- 25		olive grey, fissile) 24.53-25.30 m- lost core Interbedded extremely weak CLA											
- - 26		grey, medium plasticity, fissile ar LIMESTONE (30%)- light grey, dr at 20 to 80 mm, very slight bitum staining, fresh	nd weak ill breaks					w = 10% w = 11%					
-		· · · · · · · · · · · · · · · · · · ·						w = 13%				*	
- 27		Gradation analysis result: 27.10-27.26 m- 15% gravel, 10% s silt, 35% clay -weak to medium strong, 5% inte clay, drill breaks at 50 mm	-\// <i>\</i>			56666665J		w = 19% L = 36% PL = 17%			79		4
- 28		27.72-28.35 m- lost core											
		Interbedded CLAY (60%), extrem high plasticity, grey, damp; and LIMESTONE (40%)- very weak to white	-1//3					w=7%					
- 29		29.25 CLAY- stiff to very stiff, grey, fissil laminated, some very weak limes pieces  LIMESTONE- medium strong to s	stone					w=2%	70P				
- 30		(90%); extremely weak clay (10% plasticity 30.02-30.12 m- very weak, slightly weathered, easily fractured 30.12-30.55 m- weak to medium:	), medium			j		w=3%	701		72		16
- 31		trace clay, interbedded 31.00 30.55-31.40 m- lost core											
- 32		-medium to strong, white to very and grey, very close spaced disc				j		w=1%					
							J	w=2%	84P				
- 33		32.92 m- close spaced discontinu 33.23 -clayey, very weak, grey, with har inclusions				J			79P		8		25
- 34		33.70 -strong, white, moderately close s 33.99 discontinuities, no jointing	spaced										
		34.09-34.45 m- lost core  Y CODES: B: BEDDING D: DRILL I	BRK F: FAULT G		EISS'TY .	1 1000		6.6.		S: SHE			ON CF

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		continued see previous pag	e	INS	10-6 10-4	DIF	ANGLE			25 50	75	05.6	-0 76
— 35 — 36		34.45 -strong, white 34.54-34.84 m-some clay, very w 34.84-35.14 m-medium strong pi 35.14-35.38 m-very weak, some of interbedded -medium strong to strong, very close spaced discontinuities  36.16 -clayey, very weak, some harder proceeding to the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series o	eak leces clay ose to					w=4% w=2%		25 50	5	25 \$	3 -
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					is snow packed parking area r	iear												
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- 1.0					approximate.	NG2 12						<b>.</b>	ļ					
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2.0		00, .00			medium plasticity, frozen, mo	ist, dark												
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-		24			3.30 -stiff (unfrozen), light olive brown ALLUVIUM (approximate bounda)					'								
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[					-silty, trace sand, low to medium	plasticity,												
					soft, saturated, grey, several n													
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- 6.0		4	ļ		-sandy, olive brown from 6.10 to 6 6.25 -grey from 6.17 m	3.17 m												
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(m)	L	DESCRIPTION   골닭		至品等	FOR CODES		<u> </u>	%	%
		N N N N N N N N N N N N N N N N N N N	;	<u>α</u> 4 <i>ú</i> 1	DIP ANGLE				
			۱ د	10-0 10-4 10-2	30 60			25 50 75	25 50 75
14		13.82 LIMESTONE (DEVONIAN BEDROCK)							
		-medium strong to strong, fresh, cherty, light brownish grey							
_		14.40 m- weak to very weak, crumbles							
		along irregular fractures, slightly weathered, light brown, contains cherty nodules, shells			<u>;:: :: ::</u>			100	
15							32P		
		15.20 m- medium strong, fresh to slightly			1,	w=2%			
-		weathered, light grey, brownish							_
		-light grey to olive, occasional shells					29P		-
16						w = 1%			
È		16.05-17.05 m- lost core							
<u>.</u>								35	
— 17									
		17.05 m- weak to medium strong, slightly weathered, dark grey to very light olive							
		17.24-17.39 m medium strong			<u> </u>				
		17.81-17.84 m- clayey, extremely weak,							
18		dark grey				w=6%			
		17.95-18.40 m- medium strong					21P	63.	15
- 		18.40-19.20 m lost core	<i>///</i>						
									Z     = :
- 19									
		-weak to medium strong, fresh, light grey to							
-		dark grey, occasional shells		CONCERNMENT					
		19.63-20.5 m- very close spaced discontinuities				w=11%			
- 20									
							9X		
	디디						,	54	
-	다니								
_ 21	二二	20.50-21,60 m- lost core							
- 6.1		EU.00-21,00 HIP lost cofe							en du
	그	1 21 60							150 Avr
		21.60							
DISCO	NTINUIT		GN	IEISS'TY J		SCHIST			TENSION CRK
		FRACTURED CORE UNCONF.	. CC	OMP. STRE	NGTH - X:	CROSS	BEDD	ING P. PARAL	LEL BEDDING

Vr	OHN.	-CRIPPEN GEO	OLO (	aic Lo	)G	OF	DRILL H	OLE	NO.:	L	86BI	RDG1	
D	S					>- -	DISCONT- INUITY DATA		PT. LOAD TEST			COVERY DATA	
E P T H (m)	Y M B O L	LITHOLOGIC DESCRIPTION		INSTRUMENT DETAILS	HYDRAULIC	CONDUCTIVE CM/SEC	SEE BOTTOM OF FORM FOR CODES		U _c (MPa)		CORE COVER	Y	⊋.D. %
				INST	9-	4 VI	DIP ANGLE						
	W	continued see previous page -weak to medium strong, fresh, light grey	v to -		7		30 60	000/		25	50 75	25 5	50 75
— 22 - - - - 23		dark grey -extremely weak clayey layers at 22.14 (1 mm), 22.35 (10 mm), 22.46 (10 mm), 22. (10 mm), 22.83 (15 mm) 22.71-22.82 m- extremely weak, fractures easily into small (<5 mm) pieces 22.86-23.05 m- extremely weak, easily fractured	10 : .56 : s :				1	w=23%			48		
24		23.05-24.65 m- lost core, gamma indicate clayey limestone											
— <b>25</b>		<ul> <li>-weak to medium strong, light to dark grebitumen staining along joint faces, slight weathered</li> <li>25.12-25.18 m- extremely weak clayey, easliy fractured, dark grey, dry</li> <li>25.34-25.52 m- white, extremely weak,</li> </ul>						w=4%	6P				
26 		slightly weathered 25.52-25.63 m- oil stained, gravel sizes 26.06-26.62 m- very weak 26.62-27.15 m- weak, very light grey, clos spaced discontinuities	se -				3,				82	3	7 -
27 		27.15-27.70 m lost core	-				J		16P 17X				-
– 28 –		27.70-28.25 m- very weak to weak, olive grey, slightly weathered, extremely close very close spaced discontinuities, slight bitumen staining 28.25-28.75 m- weak to medium strong, white to grey, close spaced discontinuities											\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
29 -		-clayey, extremely to very weak, medium plasticity, damp, grey, occasional hard concretion (<15 mm), small slickenside, fissile, horizontally bedded					]	w = 12% LL = 379 PL = 199	7X		84.	•	3
<del></del> 30		30.25-30.75 m lost core	-				F	w = 17% = 130ki					-  -  -  -
- 31 -		-extremely weak, fresh, fissile, occassion hard layers (< 10 mm) 31.28-32.30 m- extremely weak to very w	-				F	= 210ki w = 12% LL = 40%					_
DISCO	TIUNITA	Y CODES: B: BEDDING D: DRILL BRK F:				'TY 、	J: JOINT M: ENGTH - X			S: SI		T: TENSIO	

KL	OHN	-CRIPPEN GEO	LOGIC L	.og	OF	DRIL	LH	OLE	NO.:	l	_86	B	RE	)G1	Messagagayeroro	MORPHISCO.
D	S				<u>}</u>	DISCO INUI DAT	TΥ		PT. LOAD TEST		***************************************	RI	ECO' DAT	VERY TA		
E P T H (m)	Y M B O L	LITHOLOGIC DESCRIPTION	INSTRUMENT	HYDRAULIC		SE BOTT OF FO FO	E OM ORM R	S 111	U _c	RI	CO ECO %	VEF	RY		Q.D. %	
		continued see previous page		9-01	10-4 10-2	DIP AN					5 5	Λ ຈ	_			
32 - - -								PL= 199 w=8%			S	7	•		50 7 14	5
33		32.80-33.80 m lost core					,									
— 34		<ul> <li>-extremely weak to very weak, white hard layers, grey, clayey softer layers, interbedded</li> </ul>														-
35		-alternating clayey layers and harder lighte	51					w=5% = 160kF	a							
36						<b>OB</b>		w=7%	зх		g	3			38	
— 37		36.65-36.85 m lost core -extremely to very weak, alternating clayey	, -					w=8% w=2%								
-		layers (5-60 mm), with harder white limestone  37.69-38.38 m- clayey, extremely weak, fresh, homogeneous						w=8%								
38		38.38-38.70 m- weak, fresh, white to olive grey				J		w=7%	0.96X		7	7			19	
39		38.97-39.09 m medium strong, white 39.09-39.21 m clayey, extremely weak, dal olive grey, fissile 39.21-39.90 m lost core	rk					w = 2%								
40 2		-alternating extremely weak clay and weak limestone; clay layers are fissile, very close						w=4%								
41		spaced discontinuities							0.8X							
		-weak, very light grey to grey, homogeneous					J	w=3% w=5%			jţ	0:			15	-
DISCO	TIUUIT	Y CODES: B: BEDDING D: DRILL BRK F: F	FAULT G: G					SCHIST CROSS			HEA F			Wildelmman state a poor		NG

	-CRIPPEN GEOLOG	T	T		-	_			T						
S			ΥLI	I	IN	IUITY		LOAD	-		F			.Y 	
M B O L	LITHOLOGIC DESCRIPTION	TRUMENT	HYDRAULIC	CM/SEC	BO OF	TTON FORM	1	U _C	F	REC	OVE			R.Q. %	
	continued see previous page	INS	10-6 10-4	2-01	1		Ē		_	OF /					
	41.50 m- slickensides			T		7 80				25	50 7	/5  ∷∷	2	50 //	<u>)                                    </u>
					5	1	w=5%	13X							
	-very light grey to dark grey, clayey, medium plasticity, fissile, fresh, moderately close spaced discontinuities					J	w=3%	9P 19X							
	-slickensides					J									
	-grey, tresh, homogeneous, fissile, moderately close spaced discontinuities					1 1	w = 4%			1	00			100	9////
	-slickensides						w=5%	7X							////
	-disturbed, close spaced discontinuities							15X		1	00				1117
	-very weak														
	49.05 End of Hole at 49.05 m					,		2P						4	///
	Response zone 38.8-39.8 m											The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon			
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08/05/95 PLATE: 1 of 1 HOLE NO: FL1BRDG2

#### APPENDIX II

RESULTS OF LABORATORY ANALYSIS OF GROUNDWATER SAMPLES

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB1

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-1 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	78.0	0.01
Magnesium - (ÁA) Dissolved	12102L	mg/L	22.0	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	10.4	0.2
	19103L	mg/L	1.93	0.05
Chloride - Dissolved	17206L	mg/L	1.2	0.5
Sulphate - (IC)	16309L	mg/L	23.8	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	305.	0.5
оН	10301L	Units	7.19	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	372.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	286.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)	00001	mg/L	4.41	0.02
Fluoride	09105L	mg/L	0.20	0.05
Specific Conductance	02041L	umhos/Cm	580.	0.02
Total Dissolved Solids	00201L	mg/L	324.	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.136	0.003
Sulphur - (ICP) - Dissolved	0,1102	mg/L	7.3	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0003	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.10	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	0.01	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.002	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.003	0.003
Iron - Dissolved (ICP)	26109L	mg/L	0.06	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.00	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.013	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.261	0.001
Manganese "Dissuivea (ICE)	80101L	ug/L	0.201	0.05

Caigary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB1

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type : GRAB

Sample Station Code:

#### KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-1

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP)	42330L 28350L	mg/L mg/L	< <	0.003 0.005	0.003 0.005
Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP)	15450L 34105L 47450L	mg/L mg/L mg/L	<	0.1 0.0002 0.002	0.1 0.0002 0.002
Strontium - Dissolved (ICP) Titanium - Dissolved (ICP)	38111L 22111D	mg/L mg/L	<	0.174 0.003	0.002 0.002 0.003
Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP)	23330D	mg/L mg/L	< <	0.5 0.002	0.5 0.002
Zinc - Dissolved (ICP) Ion Balance	30501D	mg/L Balance	`	0.006 0.94	0.001 0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332 BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : OB1

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

Chemex Worksheet Number : 95-00280-1 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
рН	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	Ε	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	.E	NOT	APPLICAB	LE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	· 24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.

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KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : OB1

Sample Date & Time : March 17, 1995

Sampled By

: GRAB Sample Type Sample Station Code:

: DT

Sample Access Sample Matrix

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR:

Chemex Worksheet Number: 95-00280-1

Chemex Project Number : SUNC178-0501

: WATER

Report Date

PARAMETER	DATE	QA/QC		and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s	SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

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Sample Description : OB2

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-2

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	25.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	7.40	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	186.	0.2
Potassium - (Flame Photometer) Dis		mg/L	4.18	0.05
Chloride - Dissolved	17206L	mg/L	9.6	0.5
Sulphate - (IC)	16309L	mg/L	0.7	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	491.	0.5
oH	10301L	Units	7.56	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	599.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	93.0	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)	••••	mg/L	9.00	0.02
Fluoride	09105L	mg/L	0.43	0.05
Specific Conductance	02041L	umhos/Cm	873.	0.02
Total Dissolved Solids	00201L	mg/L	532.	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.018	0.003
Sulphur - (ICP) - Dissolved	• • • • • • • • • • • • • • • • • • • •	mg/L	0.5	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	0.14	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0005	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.12	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	0.44	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	0.04	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.046	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.101	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB2

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type :

: GRAB

Sample Station Code:

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-2 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP) Ion Balance	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.006 0.005 0.1 0.0002 0.002 0.213 0.006 0.5 0.002 0.011	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

Celgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332 BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON PROJ.#PA27790201

Sample Description : OB2

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type : GRAB

Sample Station Code :

Chemex Worksheet Number : 95-00280-2 Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH Number	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	L IMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
На	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	E	NOT	APPLICAB	LE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.
Lead - Dissolved (ICP).	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.
Nickel - Dissolved (ICP)	23-03 <b>-</b> 95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.

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Sample Description : OB2

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type : GRAB

Sample Type : GRA

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION : DAN EMMERSON PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-2 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER	DATE	QA/QC			SPIKES			CHECK	idzirok (komzani i pińsko z i okolok dowowiki
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB3

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

#### KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-3 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		5.10	0.01
Magnesium - (ÁA) Dissolved	12102L	mg/L		0.89	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		1.66	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		0.51	0.05
Chloride - Dissolved	17206L	mg/L	<	0.5	0.5
Sulphate - (IC)	16309L	mg/L		10.2	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		9.9	0.5
pH	10301L	Units		5.56	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		12.0	0.5
Total Hardness (as CaCO3)	10602L	mg/L		16.4	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		4.69	0.02
Fluoride	09105L	mg/L		0.08	0.05
Specific Conductance	02041L	umhos/Cm		43.0	0.02
Total Dissolved Solids	00201L	mg/L ´		24.5	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.028	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.2	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.04	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	<	0.0002	0.0002
Barium - Dissolved (ÌCP)	56109L	mg/L		0.01	0.01
Beryllium - Dissolved (IĆP)	04103L	mg/L	. <	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (IĆP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	<	0.001	0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.012	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

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Sample Description : OB3

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code:

#### KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-3

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AÀ)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (IĈP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ÍCP)	38111L	mg/L		0.031	0.002
Titanium - Dissolved (ÌCP)´	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ÌCP)		mg/L	<	0.5	0.5
Vanadium - Dissolved`(ICP)	23330D	mg/L		0.003	0.002
Zinc - Dissolved (ICP) ´	30501D	mg/L		0.009	0.001
Ion Balance		Balance		1.00	0.01

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON PROJ. #PA27790201

Sample Description : OB3

Sample Date & Time : March 17, 1995

Sampled By

Sample Type : GRAB

Sample Station Code :

Chemex Worksheet Number: 95-00280-3 Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Diș	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	Ε	NOT	APPLICAB	LE
рН	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03 <b>-</b> 95	1	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	Ε	NOT	APPLICAB	LE
Aluminum - Dissolved (ICP)	23-03 <b>-</b> 95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	. 111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.
Lithium - Dissolved (ICP)	23-03 <b>-</b> 95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.

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Sample Description : OB3

Sample Date & Time : March 17, 1995

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-3

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER	DATE	QA/QC			SPIKES	•	,	CHECK	•
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB4
Sample Date & Time : 13-03-95

Sampled By : DT

Sample Type : GRAB

Sample Station Code:

### KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-4 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		4.35	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		1.29	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		2.30	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		1.12	0.05
Chloride - Dissolved	17206L	mg/L	<	0.5	0.5
Sulphate - (IC)	16309L	mg/L		9.7	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		14.7	0.5
рН	10301L	Units		5.62	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		17.9	0.5
Total Hardness (as CaCO3)	10602L	mg/L		16.2	0.5
lydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		6.47	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance .	02041L	umhos/Cm		48.0	0.02
Total Dissolved Solids	00201L	mg/L		28.0	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.061	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.0	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.06	0.01
Arsenic – Dissolved (AÀ)	33109L	mg/L	<	0.0002	0.0002
Barium - Dissolved (ÌCP)	56109L	mg/L	<	0.01	0.01
Beryllium - Dissolveď (IĆP)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (IĆP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt – Dissolved (IČP) ´	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L		0.002	0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.05	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolvèd (ÍCP)	03109L	mg/L		0.002	0.001
Manganese - Dissolved (IĆP)	25109L	mg/L		0.016	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB4

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type : GRAB

Sample Station Code:

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

## SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-4 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP)	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	<td>0.003 0.005 0.1 0.0002 0.002 0.028 0.003 0.5 0.002</td> <td>0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001</td>	0.003 0.005 0.1 0.0002 0.002 0.028 0.003 0.5 0.002	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001
Ion Balance		Balance		0.90	0.01

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : OB4

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

Chemex Worksheet Number: 95-00280-4 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
pH	17-03-95	3	0.2	TOM	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	.E	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	· 23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON PROJ. #PA27790201

Sample Description : 084

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type : GRAB

Sample Station Code:

Chemex Worksheet Number: 95-00280-4

Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER ·	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Titanium - Dissolved (ICP) Uranium - Dissolved (ICP)	23-03-95 23-03-95	10 10	0.0	103.6 72.9	91.9 51.6	113.8 138.3	105.2 94.7	93.5 76.9	110.7 119.8
Vanadium - Dissolved (ICP)  Zinc - Dissolved (ICP)	23-03-95 23-03-95	10 10	3.2 0.3	105.1 101.5	89.1 86.1	114.4 117.4	106.3 102.3	93.1 89.4	108.8

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Sample Description : OB5
Sample Date & Time : 13-03-95

Sampled By : DT Sample Type : GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-5 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

20103L 12102L 11103L 19103L	mg/L mg/L mg/L		64.0	0.01
11103L 19103L	mg/L			
19103L			17.8	0.01
	1114 / L		159.	0.2
170001	mg/L		2.85	0.05
17206L	mg/L		7.8	0.5
16309L			10.2	0.1
10151L		<	0.1	0.1
10111L			566.	0.5
10301L	Units		7.13	0.01
06301L	mg/L	<	0.5	0.5
06201L			690.	0.5
10602L			233.	0.5
08501L		<	0.5	0.5
			8.08	0.02
09105L			0.54	0.05
02041L	umhos/Cm		1010	0.02
00201L	mg/L		607.	1.
07110L			0.027	0.003
			3.7	0.2
13109L		<	0.01	0.01
33109L			0.0004	0.0002
56109L			0.21	0.01
04103L		<	0.001	0.001
05111L			0.33	0.01
48501L		<	0.003	0.003
24360L	mg/L	<	0.002	0.002
27360L	mg/L	<	0.003	0.003
29109L	mg/L		0.001	0.001
26109L	mg/L		0.12	0.01
82111L	mg/L	<	0.02	0.02
03109L	mg/L		0.044	0.001
25109L	mg/L		0.589	0.001
80101L	ug/L	<	0.05	0.05
	16309L 10151L 10111L 10301L 06301L 06201L 10602L 08501L 09105L 02041L 00201L 07110L 13109L 33109L 56109L 04103L 05111L 48501L 24360L 27360L 29109L 82111L 03109L 25109L	16309L mg/L 10151L mg/L 10111L mg/L 10301L Units 06301L mg/L 06201L mg/L 08501L mg/L 09105L mg/L 09105L mg/L 02041L umhos/Cm 00201L mg/L 07110L mg/L 33109L mg/L 33109L mg/L 04103L mg/L 04103L mg/L 05111L mg/L 48501L mg/L 24360L mg/L 27360L mg/L 27360L mg/L 29109L mg/L 29109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L 20109L mg/L	16309L mg/L 10151L mg/L 10111L mg/L 10301L Units 06301L mg/L 06201L mg/L 10602L mg/L 08501L mg/L 09105L mg/L 09105L mg/L 02041L umhos/Cm 00201L mg/L 07110L mg/L 33109L mg/L 33109L mg/L 56109L mg/L 04103L mg/L 05111L mg/L 48501L mg/L 24360L mg/L 27360L mg/L 27360L mg/L 29109L mg/L 26109L mg/L 82111L mg/L 82111L mg/L 82111L mg/L 82111L mg/L 82109L mg/L 82110L mg/L 82110L mg/L 82110L mg/L 82110L mg/L 82110L mg/L	16309L       mg/L       10.2         10151L       mg/L       < 0.1

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Sample Description : 0B5

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ.#PA27790201

Chemex Worksheet Number: 95-00280-5

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP)	42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < <	0.003 0.007 0.1 0.0002 0.002 0.302 0.003	0.003 0.005 0.1 0.0002 0.002 0.002 0.003
Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP) Ion Balance	23330D 30501D	mg/L mg/L mg/L Balance	<	0.5 0.002 0.006 0.99	0.5 0.002 0.001 0.01

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON PROJ. #PA27790201

Sample Description : OB5 Sample Date & Time : 13-03-95

Sampled By Sample Type

Sample Station Code :

Chemex Worksheet Number: 95-00280-5 Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	ILE
На	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	ILE
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	Ε	NOT	APPLICAE	:LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	. 88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0,0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03 <b>-9</b> 5	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	<b>1</b> 0	0.0	98.9	84.8	107.3	102.5	93.1	104.
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9

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Sample Description : OB5

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-5

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Titanium - Dissolved (ICP)	23-03-95	10	0,0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109,7

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : L97-P95-1-BA

Sample Date & Time : 13-03-95

Sampled By

: DT : GRAB

Sample Type : 6 Sample Station Code : KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-6 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	76.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	105.	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	4880	0.2
Potassium - (Flame Photometer) Dis		mg/L	31.6	0.05
Chloride - Dissolved	17206L	mg/L	6520	0.5
Sulphate - (IC)	16309L	mg/L	1.0	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2130	0.5
рН	10301L	Units	6.98	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2590	0.5
Total Hardness (as CaCO3)	10602L	mg/L	622.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.26	0.02
Fluoride	09105L	mg/L	0.78	0.05
Specific Conductance	02041L	umhos/Cm	21900	0.02
Total Dissolved Solids	00201L	mg/L [′]	12900	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.029	0.003
Sulphur - (ICP) - Dissolved		mg/L	1.7	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0002	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.71	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	3.90	0.01
Cadmium - Dissolved (IĆP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.967	0.001
Manganese - Dissolved (ICP)		mg/L	0.070	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	0.32	0.05

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Sample Description : L97-P95-1-BA

Sample Date & Time : 13-03-95

Sampled By : DT Sample Type : GR.

Sample Station Code:

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-6 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP)	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.003 0.005 0.1 0.0002 0.002 4.70 0.003 0.5 0.002	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001
Ion Balance		Balance		1.00	0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION : DAN EMMERSON

PROJ. #PA27790201

Sample Description : L97-P95-1-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type : GRAB

Sample Station Code :

Chemex Worksheet Number: 95-00280-6 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
На	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	E	NOT	APPLICAB	LE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	1131
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	23-03-95	1	0.0	89.3	66.0	132.7	112.5	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

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Sample Description : L97-P95-1-BA Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code:

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-6

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

PARAMETER	DATE	QA/QC			SPIKES	CHECK			
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

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Sample Description : L97-P95-2-L Sample Date & Time : 13-03-95

Sampled By Sample Type

: DT : GRAB

Sample Station Code :

## KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

## SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-7 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E	SULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		25.8	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		20.5	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		1560	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		25.8	0.05
Chloride - Dissolved	17206L	mg/L		1440	0.5
Sulphate - (IC)	16309L	mg/L		2.4	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		1600	0.5
рН	10301L	Units		7.39	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		1950	0.5
Total Hardness (as CaCO3)	10602L	mg/L		149.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.36	0.02
Fluoride	09105L	mg/L		1.50	0.05
Specific Conductance .	02041L	umhos/Cm		6970	0.02
Total Dissolved Solids	00201L	mg/L		4050	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.016	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.6	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.04	0.01
Arsenic - Dissolved (AÀ)	33109L	mg/L		0.0006	0.0002
Barium – Dissolved (ÌCP)	56109L	mg/L		0.17	0.01
Beryllium - Dissolved (IĆP)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L		3.20	0.01
Cadmium - Dissolved (IĆP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved`(ICP)	24360L	mg/L	<	0.002	0.002
Cobalt – Dissolved (IČP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L		0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	<	0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ÍCP)	03109L	mg/L		0.291	
Manganese - Dissolved (ICP)	25109L	mg/L		0.034	
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

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Sample Description : L97-P95-2-L Sample Date & Time : 13-03-95

Sampled By : DT Sample Type : GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-7 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP) Ion Balance	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.003 0.005 0.1 0.0002 0.002 1.26 0.003 0.5 0.002 0.004 0.98	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332 BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

PROJ. #PA27790201

Sample Description : L97-P95-2-L Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

Chemex Worksheet Number : 95-00280-7 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER	DATE	QA/QC			SPIKES	,	,	CHECK	
	ANALYZED (DD-MM-YY)	BATCH Number	DUP Rr	% RECOV	CONT	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	2	1.0	95.3	90.8	108.8	97.8	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	ТОИ	APPLICAB	LE
рн	17-03-95	3	0.2	NOT	APPLICABL	E	TOM	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	.E	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	.E	NOT	APPLICAE	BLE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.

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Sample Description : L97-P95-2-L

Sample Date & Time : 13-03-95

Sampled By : DT Sample Type : GRAB

Sample Station Code :

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-7

Chemex Project Number : SUNC178-0501 Sample Access :

: : WATER

Sample Matrix Report Date

PARAMETER	DATE QA/QC			200000000000000000000000000000000000000	SPIKES		CHECK		
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

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Sample Description : L97-P95-3-BA

Sample Date & Time : 13-03-95

Sampled By : DT Sample Type : GRAB

Sample Station Code :

ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

> Chemex Worksheet Number: 95-00280-8 Chemex Project Number : SUNC178-0501

KLOHN-CRIPPEN CONSULTING LTD.

Sample Access

Sample Matrix : WATER

				*
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESUL	T S DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	45.	
Magnesium - (AA) Dissolved	12102L	mg/L	57.	
Sodium - (Flame Photometer) Dis	11103L	mg/L	3290	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	29.	
Chloride - Dissolved	17206L	mg/L	3880	0.5
Sulphate - (IC)	16309L	mg/L	1.	
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.	
Total Alkalinity (as CaCO3)	10111L	mg/L	1880	0.5
рН	10301L	Units		20 0.01
Carbonate	06301L	mg/L	< 0.	
Bicarbonate	06201L	mg/L	2290	0.5
Total Hardness (as CaCO3)	10602L	mg/L	347.	
Hydroxide	08501L	mg/L	< 0.	
Silicon - Dissolved (ICP)		mg/L		16 0.02
Fluoride	09105L	mg/L	1.	
Specific Conductance	02041L	umhos/Cm	14200	0.02
Total Dissolved Solids	00201L	mg/L	8450	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.003
Sulphur - (ICP) - Dissolved		mg/L	2.	
Aluminum - Dissolved (ICP)	13109L	mg/L		0.01
Arsenic - Dissolved (AA)	33109L	mg/L		0.0002
Barium - Dissolved (ICP)	56109L	mg/L		39 0.01
Beryllium - Dissolved (ICP)	04103L	mg/L		0.001
Boron - Dissolved (ICP)	05111L	mg/L		93 0.01
Cadmium - Dissolved (ICP)	48501L	mg/L		0.003
Chromium - Dissolved (ICP)	24360L	mg/L		0.002
Cobalt - Dissolved (ICP)	27360L	mg/L		0.003
Copper - Dissolved (ICP)	29109L	mg/L		0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.01
Lead - Dissolved (ICP)	82111L	mg/L		0.02
Lithium - Dissolved (ICP)	03109L	mg/L		0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.	.05 0.05

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Sample Description : L97-P95-3-BA Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-8

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP) Ion Balance	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.003 0.005 0.1 0.0002 0.002 2.74 0.003 0.5 0.002 0.004	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : L97-P95-3-BA

Sample Date & Time : 13-03-95

Sampled By : DT

Sample Type : GRAB

Sample Station Code :

Chemex Worksheet Number: 95-00280-8

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
рН	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	.E	NOT	APPLICAE	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	.E	том	APPLICAE	BLE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : L97-P95-3-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

Chemex Worksheet Number: 95-00280-8

Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER	DATE QA/QC				SPIKES			CHECK		
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER	
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9	
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7	
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8	
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8	
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7	

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Sample Description : FL7 BRD6 #4
Sample Date & Time : 13-03-95

Sampled By Sample Type : DT : GRAB

Sample Station Code:

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-9 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		14.2	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		3.24	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		8.90	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		1.49	0.05
Chloride - Dissolved	17206L	mg/L		4.6	0.5
Sulphate - (IC)	16309L	mg/L		28.8	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		31.6	0.5
pH	10301L	Units		6.23	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		38.5	0.5
Total Hardness (as CaCO3)	10602L	mg/L		48.8	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		4.42	0.02
Fluoride	09105L	mg/L		0.14	0.05
Specific Conductance	02041L	umhos/Cm		142.	0.02
Total Dissolved Solids	00201L	mg/L		81.2	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.168	0.003
Sulphur - (ICP) - Dissolved		mg/L		9.2	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.50	0.01
Arsenic - Dissolved (AÀ)	33109L	mg/L		0.0003	0.0002
Barium - Dissolved (ÎCP)	56109L	mg/L		0.03	0.01
Beryllium - Dissolved (IĆP)	04103L	mg/L	. <	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L		0.03	0.01
Cadmium - Dissolved (IĆP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.42	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L		0.003	0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.035	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

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Sample Description : FL7 BRD6 #4 Sample Date & Time : 13-03-95

Sampled By Sample Type

: DT : GRAB

Sample Station Code:

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

> Chemex Worksheet Number: 95-00280-9 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP) Ion Balance	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < <	0.003 0.005 0.1 0.0002 0.002 0.044 0.012 0.5 0.002 0.007 1.02	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332 BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

PROJ.#PA27790201

Sample Description : FL7 BRD6 #4
Sample Date & Time : 13-03-95

Sampled By Sample Type : DT : GRAB

Sample Station Code :

Chemex Worksheet Number : 95-00280-9
Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	% RECOV	SPIKES CONT LOWER	LIMIT UPPER	% RECOV	CHECK CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	21-03-95	1	1.2	99.4	94.6	105.6	98.5	95.0	105.0
Magnesium - (AA) Dissolved	20-03-95	1	1.0	97.7	94.1	104.8	97.5	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
pH	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	8.0	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	E	NOT	APPLICAE	LE.
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	E	NOT	APPLICAE	BLE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	- 111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.

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Sample Description : FL7 BRD6 #4

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-9

Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER	DATE	QA/QC		And the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s	SPIKES	,	escalation <del>e e e e</del> en accese <del>e relational de l'allegraps</del> distants E	CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

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Sample Description : FL3-P95-6-BA Sample Date & Time : 13-03-95

: DT Sampled By Sample Type : GRAB

Sample Station Code:

#### KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-10 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

			,	
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	190.	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	158.	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	6720	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	82.2	0.05
Chloride - Dissolved	17206L	mg/L	10200	0.5
Sulphate - (IC)	16309L	mg/L	5.0	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1450	0.5
На	10301L	Units	7.11	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	1770	0.5
Total Hardness (as CaCO3)	10602L	mg/L	1130	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.02	0.02
Fluoride	09105L	mg/L	0.28	0.05
Specific Conductance .	02041L	umhos/Cm	30800	0.02
Total Dissolved Solids	00201L	mg/L	18200	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.053	0.003
Sulphur - (ICP) - Dissolved		mg/L	4.9	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0016	0.0002
Barium - Dissolved (ÎCP)	56109L	mg/L	3.00	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	2.33	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	0.014	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.008	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.947	
Manganese - Dissolved (ICP)	25109L	mg/L	0.277	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

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Sample Description : FL3-P95-6-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type : GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-10

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE:	SULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L		0.019	0.003
Nickel - Dissolved (ICP)	28350L	mg/L		0.032	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L		0.2	0.1
Selenium - Dissolved (AA)	34105L	mg/L		0.0008	0.0002
Silver - Dissolved (ICP)	47450L	mg/L		0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		8.41	0.002
Titanium - Dissolved (ÌCP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ÌCP)		mg/L	<	0.5	0.5
Vanadium - Dissolved`(ICP)	23330D	mg/L		0.006	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.009	0.001
Ion Balance		Balance		1.00	0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : FL3-P95-6-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :

KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION : DAN EMMERSON

PROJ. #PA27790201

Chemex Worksheet Number : 95-00280-10 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date : March 31, 1995

PARAMETER	DATE ANALYZED	QA/QC Batch	DUP	%	SPIKES CONT	LIMIT	<b>%</b>	CHECK CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	21-03-95	1	1.2	99.4	94.6	105.6	98.5	95.0	105.0
Magnesium - (AA) Dissolved	20-03-95	1	1.0	97.7	94.1	104.8	97.5	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	E	NOT	APPLICAB	LE
рН	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	E	NOT	APPLICAE	BLE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	. 24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03 <b>-</b> 95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON PROJ. #PA27790201

Sample Description : FL3-P95-6-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code:

Chemex Worksheet Number: 95-00280-10

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER	DATE -	QA/QC			SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : FL%-P95-13-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

: GRAB

Sample Station Code :

#### KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

#### SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-11

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	85.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	103.	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	3230	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	26.8	0.05
Chloride - Dissolved	17206L	mg/L	3920	0.5
Sulphate - (IC)	16309L	mg/L	1.3	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	. 2050	0.5
pH	10301L	Units	7.13	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2490	0.5
Total Hardness (as CaCO3)	10602L	mg/L	636.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.25	0.02
Fluoride	09105L	mg/L	0.58	0.05
Specific Conductance	02041L	umhos/Cm	14000	0.02
Total Dissolved Solids	00201L	mg/L	8610	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.011	0.003
Sulphur - (ICP) - Dissolved		mg/L	1.8	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	0.05	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	< 0.0002	0.0002
Barium - Dissolved (ÌCP)	56109L	mg/L	0.55	0.01
Beryllium - Dissolved (IĆP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	3.40	0.01
Cadmium - Dissolved (IĆP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	0.005	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ÍCP)	03109L	mg/L	0.753	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.077	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

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Sample Description : FL∰-P95-13-BA

Sample Date & Time : 13-03-95

Sampled By Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAN EMMERSON

SUNCOR NEW LEASE PROJ. #PA27790201

Chemex Worksheet Number: 95-00280-11

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP) Nickel - Dissolved (ICP) Phosphorus - Dissolved (ICP) Selenium - Dissolved (AA) Silver - Dissolved (ICP) Strontium - Dissolved (ICP) Titanium - Dissolved (ICP) Uranium - Dissolved (ICP) Vanadium - Dissolved (ICP) Zinc - Dissolved (ICP) Ion Balance	42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < <	0.003 0.005 0.1 0.0003 0.002 3.96 0.007 0.5 0.002 0.004 1.02	0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332 BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR : KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : FL\$-P95-13-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type : GRAB

Sample Station Code :

Chemex Worksheet Number : 95-00280-11 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH Number	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	21-03-95	1	1.2	99.4	94.6	105.6	98.5	95.0	105.0
Magnesium - (AA) Dissolved	20-03-95	1	1.0	97.7	94.1	104.8	97.5	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT	APPLICABL	Ε	NOT	APPLICAB	LE
pH	17-03-95	3	0.2	NOT	APPLICABL	E	NOT	APPLICAB	LE
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT	APPLICABL	E	NOT	APPLICAE	BLE
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT	APPLICABL	E	NOT	APPLICAE	BLE
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	2	1.0	90.7	72.1	119.4	95.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	2	0.0	100.6	79.2	120.7	93.8	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

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BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR: KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION: DAN EMMERSON

PROJ. #PA27790201

Sample Description : FL3-P95-13-BA

Sample Date & Time : 13-03-95

Sampled By

: DT

Sample Type

Sample Station Code:

: GRAB

Chemex Worksheet Number: 95-00280-11

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

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Sample Description : OB-1

Sample Date & Time : 03-07-95 1200

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 04, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004 TASK 7110

Chemex Worksheet Number: 95-01909-0B-1

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: August 11, 1995

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PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		79.8	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		19.9	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		8.80	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		2.30	0.02
Chloride - Dissolved	17206L	mg/L		0.7	0.5
Sulphate - Dissolved	16306L	mg/L		18.3	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		262.	0.5
pН	10301L	Units		7.68	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		319.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		281.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		4.51	0.02
Fluoride	09105L	mg/L		0.20	0.05
Specific Conductance	02041L	umhos/Cm.		514.	0.02
Turbidity	02074L	NTU		400.	0.1
Cyanide (Available)	06608L	mg/L	<	0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		290.	1.
Dissolved Organic Carbon	06104L	mg/L		3.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.156	0.003
Total Phosphorus as P	15406L	mg/L		0.400	0.003
Sulphur - (ICP) - Dissolved	121001	mg/L		6.4 0.03	0.2 0.01
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.03	
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.10	0.01 0.001
Beryllium - Dissolved (ICP-AES)	04103L 05111L	mg/L	< <	0.001	0.001
Boron - Dissolved (ICP-AES) Cadmium - Dissolved (ICP-AES)	48501L	mg/L mg/L	<	0.01	0.01
Chromium - Dissolved (ICP-AES)	46501L 24360L	mg/L		0.003	0.003
Cobalt - Dissolved (ICP-AES)	24360L 27360L	mg/L		0.003	0.002
Copper - Dissolved (ICP-AES)	27300L 29109L	mg/L	<	0.004	0.003
I Iron - Dissolved (ICP-AES)	29109L 26109L	mg/L		0.14	0.001
11 011 - D13301VEQ (101 -ALS)	20107L	ilig/ L		U , 1 T	0.01

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Sample Description : OB-1

Sample Date & Time : 03-07-95 1200

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 04, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004 TASK 7110

Chemex Worksheet Number: 95-01909-0B-1

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: August 11, 1995

			www.pressure.com	COORDINATED STORE CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONT	
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < <	0.02 0.007 0.455 0.05 0.003 0.007 0.1 0.0004 0.002 0.149 0.003 0.5 0.002 0.040 1.07	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.002

# **ENVIRO-TEST CHEMICAL ANALYSIS REPORT**

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E507007-0 Sample Typ Collected:0	e:WATER						AISCILLD	<u> </u>
	,	Hydrocarbons, Recoverable	<1	1	mg/L		07/06/95	TT
	•	PAH & Alkylated PAH's Naphthalene	N.D.	0.02	ug/L (ppb) ug/L (ppb)	07/05/95	07/08/95	MJL
	•	Acenaphthylene Acenaphthene Fluorene	N.D. N.D.	0.02 0.02	ו עמאר (מממו	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Dibenzothiophene Phenanthrene	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Anthracene Fluoranthene	N.D. N.D.	0.02 0.02	l ua/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Pyrene Benzo(a)anthracene/Chrysene	N.D. N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Benzo(b&k)fluoranthene Benzo(a)pyrene	N.D. N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene	N.D. N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Benzo(ghi)perylene Methyl naphthalene	N.D. N.D. N.D.	0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		C2 sub'd naphthalene C3 sub'd naphthalene	N.D. N.D. N.D.	0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		C4 sub'd naphthalene Biphenyl	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95 07/05/95	07/08/95 07/08/95	MJL
		Methyl biphenyl C2 sub'd biphenyl	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95 07/05/95	07/08/95 07/08/95 07/08/95	MJL MJL MJL
		Methyl acenaphthene Methyl fluorene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95 07/08/95	MJL MJL
		C2 sub'd fluorene Methyl phenanthrene/anthracene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		C2 súb'd phenanthrene/anth. C3 sub'd phenanthrene/anth.	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		C4 sub'd phenanthrene/anth. 1-Methyl-7-isopropylphenanth.	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		Methyl dibenzothiophene C2 sub'd dibenzothiophene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		Methyl fluoranthene/pyrene Methyl B(a)A/chrysene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O Phenol	N.D.	0.04	ug/L (ppb)	07/05/95	07/03/95	MJL
		o-Cresol m-Cresol	N.D. N.D. N.D.	0.1 0.1 0.1	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/17/95 07/17/95	MBM MBM
		p-Cresol 2,4-Dimethylphenol	N.D. N.D. N.D.	0.1 0.1 0.1	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/17/95 07/17/95	MBM MBM
		2-Nitrophenol 4-Nitrophenol	N.D. N.D.	0.2 2	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95 07/05/95	07/17/95 07/17/95	MBM MBM MBM
		2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol	N.D. N.D.	2 2	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95 07/05/95	07/17/95 07/17/95 07/17/95	MBM MBM
		PANH & Alkylated PANH's Quinoline	N.D.	0.02	- ", "		07/17/95	MJL
		7-Methyl quinoline C2 Alkyl subst'd quinolines	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95 07/05/95	07/08/95 07/08/95	MJL
		C3 Alkyl subst'd quinolines Acridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95	07/08/95 07/08/95	MJL MJL
		Methyl acridine Phenanthridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
		Carbazole Methyl carbazoles	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
		C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Dichlorodifluoromethane Chloromethane Vinyl chloride	N.D. N.D. N.D.	1 10 20	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Bromomethane Chloroethane	N.D. N.D. N.D.	20 10 10	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Ethanol Trichlorofluoromethane	N.D. N.D. N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95	MA MA MA
		Acrolein Acetone	N.D. N.D.	100 100	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95	MA MA
		1,1-Dichloroethene lodomethane	N.D. N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Carbon disulfide Methylene chloride	N.D. N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
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### **ENVIRO-TEST CHEMICAL ANALYSIS REPORT**

LABID SA	AMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	RY
E507007-01 OI Sample Type:WA Collected:07/03/9	<b>B-1</b> TER 05 12:00	-						
		Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MiBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	100 1 100 1 100 1 1 1 1 1 200 1 200 1 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	MA MA MA MA MA MA MA MA MA MA MA MA MA M
E507007-02 OE Sample Type:WAT Collected:07/03/95	TER						-	
		Hydrocarbons, Recoverable PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthylene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a) anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a) pyrene Indeno(c,d-123) pyrene Dibenzo(a,h) anthracene Benzo(ghi) perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C4 sub'd biphenyl Methyl biphenyl Methyl acenaphthene Methyl fluorene C2 sub'd fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth.	<1 N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	mg/L  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)	07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95 07/05/95	07/06/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	T

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Sample Description : 08#2

Sample Date & Time : 29-06-95 1440

Sampled By

: DH

Sample Type : GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : KEN MANLY

SA-5709-A004 TASK #7110

Chemex Worksheet Number: 9501860

Chemex Project Number : SUNC178-0501

OB#2

Sample Access

Sample Matrix : WATER

Report Date

					•
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		22.8	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		6.20	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		189.	0.01
Potassium - (ICP) Dissolved	19111L	mg/L		3.30	0.02
Chloride - Dissolved	17206L	mg/L		14.2	0.5
Sulphate - Dissolved	16306L	mg/L		0.8	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		485.	0.5
рН	10301L	Units		8.10	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		591.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		82.5	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		8.90	0.02
Fluoride	09105L	mg/L		0.52	0.05
Specific Conductance .	02041L	umhos/Cm		883.	0.02
Turbidity	02074L	NTU		180.	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.047	0.001
Total Dissolved Solids	00201L	mg/L		532.	1.
Dissolved Organic Carbon	06104L	mg/L		12.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.007	0.003
Total Phosphorus as P	15406L	mg/L		0.209	0.003
Sulphur - (ICP) - Dissolved	10100	mg/L		1.1	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.14	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.09	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		0.51	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L		0.004	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.08	0.01

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Sample Description : OB#2

Sample Date & Time : 29-06-95 1440

Sampled By

: DH

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: KEN MANLY

SA-5709-A004 TASK #7110

Chemex Worksheet Number: 9501860

Chemex Project Number : SUNC178-0501

OB#2

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.052 0.137 0.003 0.005 0.2 0.002 0.191 0.003 0.5 0.003 0.017 0.98	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001 0.01

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Sample Description : OB-3

Sample Date & Time : 04-07-95 1045

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 05, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004 TASK #7110

Chemex Worksheet Number: 95-01924-2

Chemex Project Number : SUNC178-0501 Sample Access

Sample Matrix

: WATER

Report Date

: August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULT'S	DETECTION LIMIT
Calcium - (ICP) Dissolved Magnesium - (ICP) Dissolved Sodium - (ICP) Dissolved Potassium -(ICP) Dissolved Chloride - Dissolved Sulphate - Dissolved PP Alkalinity (as CaCO3) Total Alkalinity (as CaCO3) pH Carbonate Bicarbonate Total Hardness (as CaCO3) Hydroxide Silicon - Dissolved (ICP) Fluoride Specific Conductance Turbidity Cyanide (Available) Phenols Total Dissolved Solids Dissolved Organic Carbon Nitrite plus Nitrate Nitrogen as N Total Phosphorus as P Sulphur - (ICP) - Dissolved Aluminum - Dissolved (ICP-AES)	20111L 12111L 11111L 19111L 17206L 16306L 10151L 10111L 10301L 06301L 06201L 10602L 08501L 09105L 02041L 02074L 06608L 06537L 00201L 06104L 07110L 15406L	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	R E S	3.30 0.90 4.20 0.70 0.5 9.9 0.1 7.1 5.65 0.5 8.7 12.0 0.5 4.88 0.11 35.0 425. 0.001 0.003 24. 4.5 0.024 0.690 3.4 0.12	0.01 0.01 0.01 0.02 0.5 0.5 0.1 0.5 0.05 0.5 0.05 0.05 0.05 0.02 0.05 0.02 0.05 0.02 0.01 0.001 0.001 0.001 0.001
Barium - Dissolved (ICP-AES) Beryllium - Dissolved (ICP-AES) Boron - Dissolved (ICP-AES) Cadmium - Dissolved (ICP-AES) Chromium - Dissolved (ICP-AES) Cobalt - Dissolved (ICP-AES) Copper - Dissolved (ICP-AES) Iron - Dissolved (ICP-AES)	56109L 04103L 05111L 48501L 24360L 27360L 29109L 26109L	mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< <	0.02 0.002 0.02 0.003 0.012 0.003 0.003 0.03	0.01 0.001 0.01 0.003 0.002 0.003 0.001 0.01

NOTES: Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions and low conductivity.

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Sample Description : OB-3

Sample Date & Time : 04-07-95 1045

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 05, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004 TASK #7110

Chemex Worksheet Number : 95-01924-2

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

: August 11, 1995

PARAMETER DESCRIPTION	- NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < <	0.02 0.001 0.007 0.003 0.005 0.1 0.002 0.027 0.003 0.5 0.002 0.024	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.002

NOTES : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions and low conductivity.

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Sample Description : 08-1 08-4

Sample Date & Time : 03-07-95 1400 Sampled By

: GRAB Sample Type Sample Recieved Date: July 04, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004 TASK 7110

Chemex Worksheet Number: 95-01909-08-4 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date : August 11, 1995

PARAMETER DESCRIPTION	- NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved Magnesium - (ICP) Dissolved Sodium - (ICP) Dissolved Potassium -(ICP) Dissolved Chloride - Dissolved Sulphate - Dissolved PP Alkalinity (as CaCO3) Total Alkalinity (as CaCO3) pH Carbonate Bicarbonate Total Hardness (as CaCO3) Hydroxide Silicon - Dissolved (ICP) Fluoride Specific Conductance Turbidity Cyanide (Available) Phenols Total Dissolved Solids Dissolved Organic Carbon Nitrite plus Nitrate Nitrogen as N Total Phosphorus as P Sulphur - (ICP) - Dissolved Aluminum - Dissolved (ICP-AES) Barium - Dissolved (ICP-AES) Beryllium - Dissolved (ICP-AES)	20111L 12111L 11111L 11111L 19111L 17206L 16306L 10151L 10111L 10301L 06301L 06201L 10602L 08501L 09105L 02041L 02074L 06608L 06537L 00201L 06104L 07110L 15406L 13109L 56109L 04103L	UNITS  mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/	7.70 1.50 3.20 0.80 3.1 11.0 < 0.1 12.4 5.87 < 0.5 15.2 25.4 < 0.5 5.64 0.08 54.0 360. 0.001 0.003 35. 2.4 0.032 0.320 3.8 0.09 0.01 0.001	0.01 0.01 0.01 0.02 0.5 0.5 0.1 0.5 0.5 0.5 0.05 0.05 0.02 0.05 0.02 0.05 0.02 0.01 0.001 0.001 0.003 0.02 0.003 0.02 0.003 0.02
Beryllium - Dissolved (ICP-AES) Boron - Dissolved (ICP-AES) Cadmium - Dissolved (ICP-AES) Chromium - Dissolved (ICP-AES) Cobalt - Dissolved (ICP-AES) Copper - Dissolved (ICP-AES) Iron - Dissolved (ICP-AES)	04103L 05111L 48501L 24360L 27360L 29109L 26109L	mg/L mg/L mg/L mg/L mg/L mg/L	<ul> <li>0.001</li> <li>0.04</li> <li>0.003</li> <li>0.002</li> <li>0.003</li> <li>0.001</li> <li>0.09</li> </ul>	0.001 0.01 0.003 0.002 0.003 0.001 0.01

NOTES: Anion-cation balance is higher than our normal limits. Major ions

have been checked.

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : 08-1 08-4 Sample Date & Time : 03-07-95 1400

Sampled By : GB

Sample Type : GRAB

Sample Recieved Date: July 04, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAVID THOMSON SA-5709-A004

SA-5709-A002 TASK 7110

Chemex Worksheet Number : 95-01909-08-4 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < <	0.02 0.001 0.017 0.05 0.003 0.007 0.1 0.0004 0.002 0.039 0.003 0.5 0.002	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002

NOTES: Anion-cation balance is higher than our normal limits. Major ions have been checked.

# **ENVIRO-TEST CHEMICAL ANALYSIS REPORT**

LAB ID SAMPLE ID TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	
E507007-02 OB-4 Sample Type:WATER				LAMACILD	ANALYZED	BY
Collected: 07/03/95 14:00					·	
Methyl dibenzothiophene C2 sub'd dibenzothiophene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95	07/08/95	MJL
C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
Methyl fluoranthene/pyrene	N.D. N.D.	0.04 0.04	ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
Methýl B(a)A/chrysene C2 sub'd B(a)A/chrysene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/05/95	07/08/95	MJL
C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
C2 súb'd B(b&k)F/B(a)P Phenolic Compounds in H2O	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
Phenol o-Cresol	N.D. N.D.	0.1 0.1	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/17/95	MBM
m-Cresol p-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95 07/17/95	MBM MBM
2.4-Dimethylphenol	N.D. N.D.	0.1 0.1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/17/95 07/17/95	MBM MBM
2-Nitrophenol 4-Nitrophenol	N.D. N.D.	0.2	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/17/95 07/17/95	MBM
2,4-Dinitrophenol _4,6-Dinitro-2-methylphenol	N.D. N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM MBM
PANH & Alkylated PANH's		2	ug/L (ppb)	07/05/95	07/17/95	MBM
Quinoline 7-Methyl quinoline	N.D.   N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
C2 Alkýl subsť d quinolines C3 Alkyl subsť d quinolines	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95	07/08/95	MJL
Acridine  Methyl acridine	N.D.	0.02	ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
Phenanthridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL MJL
Carbazole Methyl carbazoles	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/05/95 07/05/95	07/08/95 07/08/95	MJL
C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL MJL
Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA I
Chloromethane Vinyl chloride	N.D. N.D.	10 20	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Bromomethane Chloroethane	N.D. N.D.	10	ug/L (ppb) ug/L (ppb)	07/07/95	07/08/95	MA
Ethanol	N.D.	100	ua/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
richlorofluoromethane Acrolein	N.D. N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Acetone 1,1÷Dichloroethene	N.D. N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA
lodomethane Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA MA
Methylene chloride	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Acrylonitrile trans-1,2-Dichloroethene	N.D. N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Vinyl acetate 1,1-Dichloroethane	N.D. N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95	07/08/95	MA
2-Butanone (MEK) Chloroform	N.D.	100	ua/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
1,1,1-Trichloroethane	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Carbon tetrachloride Benzene	N.D. N.D.	1	ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
1,2-Dichloroethane Trichloroethene	N.D. N.D.	1	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95	07/08/95	MA
1,2-Dichloropropane	N.D.	1	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Bromodichloromethane Dibromomethane	N.D. N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK)	N.D. N.D.	5 200	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
cis-1,3-Dichloropropene Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
Ethyl methacrylate	N.D. N.D.	200	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
trans-1,3-Dichloropropene 2-Hexanone	N.D. N.D.	200	ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
1,1,2-Trichloroethane Tetrachloroethylene	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95	07/08/95	MA
Dibromochloromethane	N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Ethylene dibromide Chlorobenzene	N.D. N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Ethylbenzene m+p-Xylenes	N.D. N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
o-Xylene Styrene	N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95	07/08/95	MA
cis-1,4-Dichloro-2-butene	N.D. N.D.	1 2	(daa) J\pu	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
			•			

#### **ENVIRO-TEST CHEMICAL ANALYSIS REPORT**

AB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	В
507007-02 ample Type collected:07				SHIPMAN SAME SAME SAME SAME SAME SAME SAME SAME	ann an tagan an an an an an an an an an an an an a			
		1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D. N.D. N.D.	5 2 5 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	MA M/ M/ MA MA
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		ESS THAN THE DETECTION LIMIT						
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#### **ENVIRO-TEST QA/QC REPORT**

#### PAH & Alkylated PAH's

<b>Average Surrogate Recovery for E507007</b>	<u>%</u>
Nitrobenzene d5	97
2-Fluorobiphenyl	92
p-Terphenyl d14	97
PANH & Alkylated PANH's	
Average Surrogate Recovery for E507007	<u>%</u>
Quinoline d7	103
Phenolic Compounds in H2O	
Average Surrogate Recovery for E507007	<u>%</u>
2-Fluorophenol	31
Phenol d5	20
2,4,6-Tribromophenol	90
Volatile Organics (MS):H20	
Average Surrogate Recovery for E507007	<u>%</u>
1,2-Dichloroethane d4	108
Toluene d8	93
4-Bromofluorobenzene	101

Relative percent difference is expressed as RPD. Percent Recovery is expressed as %. THIS IS THE LAST PAGE OF THE QAQC REPORT

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Sample Description : OB-5

Sample Date & Time : 05-07-95 1540

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

Chemex Worksheet Number: 95-02005-08-5

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	53.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	14.4	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	178.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	2.10	0.02
Chloride - Dissolved	17206L	mg/L	9.3	0.5
Sulphate - Dissolved	16306L	mg/L	5.4	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	576.	0.5
pH	10301L	Units	7.45	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	702.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	194.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	7.91	0.02
Fluoride	09105L	mg/L	0.66	0.05
Specific Conductance	02041L	umhos/Cm		0.02
Turbidity	02074L	NTU	120.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00201L	mg/L	614.	1
Dissolved Organic Carbon	06104L	mg/L	9.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.101	0.003
Sulphur - (ICP) - Dissolved		mg/L	2.8	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.04	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.17	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.42	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.003	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	< 0.01	0.01

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Sample Description : OB-5

Sample Date & Time : 05-07-95 1540

Sampled By

Sample Type

: GRAB

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004

Chemex Worksheet Number: 95-02005-0B-5

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

: August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < <	0.02 0.042 0.573 0.05 0.003 0.018 0.1 0.0002 0.222 0.002 0.222 0.003 0.5 0.002 0.007	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.002

#### **ENVIRO-TEST CHEMICAL ANALYSIS REPORT**

ABID SAM	IPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	В,
E <b>507095-03 OB-</b> 5 Sample Type:WATE		and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s		***************************************				
Collected: 07/05/95	15:30							
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride Bromomethane	N.D. N.D.	20 10	ua/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Ethanol Trichlorofluoromethane	N.D. N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	1 100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Acetone 1.1-Dichloroethene	N.D. N.D.	100	(dad) J/pu	07/07/95	07/08/95	MA
		Iodomethane	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Carbon disulfide Methylene chloride	N.D. N.D.	1	ua/L (ppb)	07/07/95	07/08/95	MA
		Acrylonitrile	N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		trans-1,2-Dichloroethene Vinyl acetate	N.D. N.D.	1 100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethane	N.D.	100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		2-Butanone (MEK) Chloroform	N.D. N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Carbon tetrachloride Benzene	N.D. N.D.	1	(dag) L/pu	07/07/95	07/08/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Trichloroethene 1,2-Dichloropropane	N.D. N.D.	1 1	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromodichloromethane	N.D.	1 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Dibromomethane 2-Chloroethylvinylether	N.D. N.D.	1 5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
	•	cis-1,3-Dichloropropene Toluene	N.D. N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		trans-1,3-Dichloropropene 2-Hexanone	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D. N.D.	200 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Tetrachloroethylene Dibromochloromethane	N.D. N.D.	1 1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Chlorobenzene Ethylbenzene	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	i	ug/L (ppb)	07/07/95	07/08/95 07/08/95	MA   MA
		o-Xylene Styrene	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95 07/08/95	MA MA
		Bromoform 1,1,2,2-Tetrachloroethane	N.D. N.D.	1 5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2 5	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene	N.D. N.D.	5 1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95 07/08/95	MA MA
	***************************************	1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
N.D NOT DETE	ECTED, LE	ESS THAN THE DETECTION LIMIT						
THIS IS THE FIN.	AL PAGE	OF THE REPORT						
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#### **ENVIRO-TEST QA/QC REPORT**

109 99

111

PAH & Alkylated PAH's	
Average Surrogate Recovery for E507095	<u>%</u>
Nitrobenzene d5	108
2-Fluorobiphenyl	75
p-Terphenyl d14	93
PANH & Alkylated PANH's	
Average Surrogate Recovery for E507095	<u>%</u>
Quinoline d7	95
Phenolic Compounds in H2O	
Volatile Organics (MS):H20	
Average Surrogate Recovery for E507095	<u>%</u>

Relative percent difference is expressed as RPD. Percent Recovery is expressed as %. THIS IS THE LAST PAGE OF THE QAQC REPORT

1,2-Dichloroethane d4 Toluene d8

4-Bromofluorobenzene

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Sample Description : BRDG-4

Sample Date & Time : 06-07-95 1445

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

#### TASK#7110

Chemex Worksheet Number: 95-01967-BRDG-4

Chemex Project Number

: SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

: August 11, 1995

					•
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		17.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		3.40	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		11.1	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		1.40	0.02
Chloride - Dissolved	17206L	mg/L		4.2	0.5
Sulphate - Dissolved	16306L	mg/L		26.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<		0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		51.0	0.5
pH	10301L	Units		6.48	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		62.2	0.5
Total Hardness (as CaCO3)	10602L	mg/L		58.2	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		3.69	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance	02041L	umhos/Cm		174.	0.02
Turbidity	02074L	NTU		950.	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.019	0.001
Total Dissolved Solids	00201L	mg/L		96.	1.
Dissolved Organic Carbon	06104L	mg/L		9.8	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.165	0.003
Total Phosphorus as P	15406L	mg/L		5.10	0.003
Sulphur - (ICP) - Dissolved		mg/L		8.7	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.09	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	<	0.03	0.01
Beryllium - Dissolved (ICP-AES)		mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.003	0.003
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.013	0.002
Copper - Dissolved (ICP-AES)	29109L	mg/L	•	0.003	0.003
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.002	0.001
1. c., 510001100 (101 /1L0)		mg/ L		0.17	0.01

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Sample Description : BRDG-4

Sample Date & Time : 06-07-95 1445

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 07, 1995 Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

#### TASK#7110

Chemex Worksheet Number: 95-01967-BRDG-4 : SUNC178-0501

Chemex Project Number

Sample Access

Sample Matrix : WATER

Report Date

: August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	U L T'S	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.001 0.013 0.003 0.011 0.1 0.002 0.047 0.003 0.5 0.002 0.013 0.99	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.002

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Sample Description 1-BA

Sample Date & Time : 28-06-95 1425

PHILL E.

Sampled By

: DH

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : KEN MANLY

SA-5709-A004 TASK #7110

Chemex Worksheet Number : 9501860

1-BA

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

Calcium - (ICP) Dissolved 2011 Magnesium - (ICP) Dissolved 1211 Sodium - (ICP) Dissolved 1111 Potassium -(ICP) Dissolved 1911 Chloride - Dissolved 1720 Sulphate - Dissolved 1630 PP Alkalinity (as CaCO3) 1015 Total Alkalinity (as CaCO3) 1011	1L mg/L 1L mg/L 1L mg/L 6L mg/L 6L mg/L 1L mg/L 1L mg/L 1L mg/L 1L Units	<	87.3 92.6 040. 36.7 220. 0.5 0.1	0.01 0.01 0.01 0.02 0.5 0.5
Sodium - (ICP) Dissolved 1111 Potassium -(ICP) Dissolved 1911 Chloride - Dissolved 1720 Sulphate - Dissolved 1630 PP Alkalinity (as CaCO3) 1015	1L mg/L 1L mg/L 6L mg/L 6L mg/L 1L mg/L 1L mg/L 1L units	<	040. 36.7 220. 0.5 0.1	0.01 0.02 0.5 0.5 0.1
Potassium -(ICP) Dissolved 1911 Chloride - Dissolved 1720 Sulphate - Dissolved 1630 PP Alkalinity (as CaCO3) 1015	1L mg/L 6L mg/L 6L mg/L 1L mg/L 1L mg/L 1L Units	<	36.7 220. 0.5 0.1	0.02 0.5 0.5 0.1
Chloride - Dissolved 1720 Sulphate - Dissolved 1630 PP Alkalinity (as CaCO3) 1015	6L mg/L 6L mg/L 1L mg/L 1L mg/L 1L Units	<	220. 0.5 0.1	0.5 0.5 0.1
Sulphate - Dissolved 1630   PP Alkalinity (as CaCO3) 1015	6L mg/L 1L mg/L 1L mg/L 1L Units	<	0.5 0.1	0.5 0.1
PP Alkalinity (as CaCO3) 1015	1L mg/L 1L mg/L 1L Units		0.1	0.1
PP Alkalinity (as CaCO3) 1015 Total Alkalinity (as CaCO3) 1011	1L mg/L 1L Units			0.1
l Total Alkalinity (as CaCO3) 1011	1L Units	2:	150	
			<b>100.</b>	0.5
pH 1030	11 ma/1		7.44	0.01
Carbonate 0630		<	0.5	0.5
Bicarbonate 0620	1L mg/L	26	620.	0.5
Total Hardness (as CaCO3) 1060	2L mg/L		599.	0.5
Hydroxide 0850	1L mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)	mg/L		2.48	0.02
Fluoride 0910			0.78	0.05
Specific Conductance 0204		n 21	500.	0.02
Turbidity 0207	4L NTU		6.3	0.1
Cyanide (Available) 0660	8L mg/L		0.001	0.001
Phenols 0653			0.025	0.001
Total Dissolved Solids 0020		128	800.	1.
Dissolved Organic Carbon 0610		some those to	5.5	0.2
Nitrite plus Nitrate Nitrogen as N 0711		<	0.003	0.003
Total Phosphorus as P 1540			0.067	0.003
Sulphur - (ICP) - Dissolved	mg/L		6.9	0.000
Aluminum - Dissolved (ICP-AES) 1310			0.02	0.01
Barium - Dissolved (ICP-AES) 5610			0.91	0.01
Beryllium - Dissolved (ICP-AES) 0410		<	0.001	0.001
Boron - Dissolved (ICP-AES) 0511		-	4.07	0.001
Cadmium - Dissolved (ICP-AES) 4850		<	0.003	0.003
Chromium - Dissolved (ICP-AES) 2436		<	0.003	0.003
Cobalt - Dissolved (ICP-AES) 2736		7	0.002	0.002
Copper - Dissolved (ICP-AES) 2910		<	0.012	0.003
Iron - Dissolved (ICP-AES) 2610			0.70	0.001
2010	JE mg/ L		0.70	0.01

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Sample Description : 1-BA

Sample Date & Time : 28-06-95 1425

Sampled By

: DH

Sample Type : GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : KEN MANLY SA-5709-A004

TASK #7110

Chemex Worksheet Number: 9501860

Chemex Project Number : SUNC178-0501

1-BA

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < <	0.02 1.14 0.375 0.003 0.014 0.1 0.005 4.81 0.003 0.5 0.002 0.005 1.06	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001

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Sample Description /2-L

Sample Date & Time /: 29-06-95 1205

Sampled By

HQ.:

Sample Type

: GRAB

Sample Station Code :

DONE

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : KEN MANLY SA-5709-A004 TASK #7110

Chemex Worksheet Number : 9501860

Chemex Project Number

: SUNC178-0501

2-L

Sample Access

Sample Matrix

: WATER

Report Date

				•
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	27.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	21.6	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1860.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	24.4	0.02
Chloride - Dissolved	17206L	mg/L	1540.	0.5
Sulphate - Dissolved	16306L	mg/L	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.3	0.1
Total Alkalinity (as CaCO3)	101111	mg/L	1830.	0.5
pH	10301L	Units	7.74	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2230.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	158.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)	00301L	mg/L	2.65	
Fluoride	09105L	mg/L	2.05 1.49	0.02
Specific Conductance	02041L	umhos/Cm		0.05
Turbidity	02041L 02074L	NTU	50.0	0.02
Cyanide (Available)	06608L	mg/L	0.001	0.1
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00337L 00201L	mg/L	4580.	0.001
Dissolved Organic Carbon	06104L	mg/L	52.7°	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.2
Total Phosphorus as P	15406L		0.000	0.003
Sulphur - (ICP) - Dissolved	13400L	mg/L mg/L	0.120 3.7	0.003
Aluminum - Dissolved (ICP-AES)	13109L .	mg/L		0.2
Barium - Dissolved (ICP-AES)	56109L .	mg/L	0.02	0.01
Beryllium - Dissolved (ICP-AES)	04103L	•	0.20	0.01
Boron - Dissolved (ICP-AES)	04103L 05111L	mg/L	< 0.001	0.001
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	3.68	0.01
Chromium - Dissolved (ICP-AES)	46501L 24360L	mg/L	< 0.003 < 0.002	0.003
Cobalt - Dissolved (ICP-AES)	24360L 27360L	mg/L	0.00	0.002
Copper - Dissolved (ICP-AES)	27360L 29109L	mg/L	0.004	0.003
Iron - Dissolved (ICP-AES)	29109L 26109L	mg/L	0.004	0.001
11011 D133014Cd (1Cl ML3)	てのエのカビ	mg/L	0.69	0.01

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Sample Description : 2-L

Sample Date & Time : 29-06-95 1205

Sampled By

: DH

: GRAB Sample Type

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : KEN MANLY

SA-5709-A004 TASK #7110

Chemex Worksheet Number: 9501860

Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < <	0.02 0.368 0.082 0.05 0.004 0.005 0.1 0.0002 0.003 1.33 0.003 0.5 0.002 0.014	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002
Ion Balance		Balance		1.06	0.01





9936 - 67th Avenue - Edmonton, Alberta T6E 0P5

Telephone: (403) 434-9509

FAX: (403) 437-2311

#### CHEMICAL ANALYSIS REPORT

SUNCOR INC. P.O. BAG 4001 FORT MCMURRAY, ALBERTA **T9H 3E3** 

**DATE: January 26, 1996** 

ATTN: GARY BILECKI

Lab Work Order #: E506689 Sampled By:

DH/GB

**Project Reference:** 

NOT SUBMITTED

Date Received:

06/30/95

Project P.O.#:

Comments:

**SA# 005718 AMENDMENT C003** 

Doug Johnso Project Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY. ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

**ACCREDITED BY:** (Edmonton)

CANADIAN ASSOCIATION OF ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL) - For specific tests registered

with the Association

APPROVED BY:

STANDARDS COUNCIL OF CANADA - Organic & Industrial Hygiene analysis as registered with the Council
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA) - Industrial Hygiene analysis registered by AIHA
AGRICULTURE CANADA - Pesticide in Fruits and Vegetables, pesticides and PCP in meat
CANADIAN ASSOCIATION OF ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL) - For specific tests registered

CERTIFIED BY: (Calgary)

with the Association

#### **ENVIRO-TEST CHEMICAL ANALYSIS REPORT**

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E506689-01 Sample Type Collected:06								
		Hydrocarbons,Recoverable PAH & Alkylated PAH's	<1	1	mg/L		07/06/95	П
		Naphthalene Acenaphthylene	0.05 N.D.	0.02 0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Acenaphthene Fluorene	0.08	0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
		Dibenzothiophene	0.08 0.02	0.02 0.02	ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Phenanthrene Anthracene	0.14 N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
		Fluoranthene Pyrene	N.D. 0.03	0.02 0.02	l ua/L (ppb)	07/04/95	07/08/95	MJL
		Benzo(a)anthracene/Chrysene	0.04	0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
		Benzo(b&k)fluoranthene Benzo(a)pyrene	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
		Indeno(c,d-123) pyrene Dibenzo(a,h) anthracene	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Benzo(ghi)perylene Methyl naphthalene	N.D. 0.04	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95	MJL
		C2 sub'd naphthalene C3 sub'd naphthalene	0.06 0.53	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95	07/08/95 07/08/95	MJL MJL
		C4 sub'd naphthalene	0.35	0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Biphenyl Methyl biphenyl	N.D. 0.04	0.04 0.04	ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		C2 sub'd biphenyl Methyl acenaphthene	0.11 0.08	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Methýl fluorene C2 sub'd fluorene	0.17 0.22	0.04 0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl phenanthrene/anthracene	0.31	0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth.	0.35 0.29	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		C4 sub'd phenanthrene/anth. 1-Methyl-7-isopropylphenanth.	0.13 N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Methyl dibenzothiophene C2 sub'd dibenzothiophene	0.24 0.43	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95	MJL
		C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene	0.45	0.04	ug/L (ppb)	07/04/95	07/08/95 07/08/95	MJL
		Methyl fluoranthene/pyrene	0.26 0.05	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene	0.05 0.06	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
	-	Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
		Phenolic Compounds in H2O Phenol	N.D.	0.1	ug/L (ppb)	07/04/95		
		o-Cresol m-Cresol	0.1	0.1	ug/L (ppb)	07/04/95	07/17/95 07/17/95	MBM MBM
		p-Cresol	N.D. 0.3	0.1 0.1	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/17/95 07/17/95	MBM MBM
		2,4-Dimethylphenol 2-Nitrophenol	0.2 N.D.	0.1 0.2	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/17/95 07/17/95	MBM MBM
		4-Nitrophenol 2,4-Dinitrophenol	N.D. N.D.	2 2	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/17/95 07/17/95	MBM MBM
		4,6-Dinitro-2-methylphenol PANH & Alkylated PANH's	N.D.	2	ug/L (ppb)	07/04/95	07/17/95	МВМ
		Quinoline 7-Methyl quinoline	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 Alkýl subsťd quinolines	N.D.	0.02	ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL
		C3 Alkyl subst'd quinolines Acridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Methyl acridine Phenanthridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		Carbazole Methyl carbazoles	N.D. N.D.	0.02 0.02	ug/L (ppb)	07/04/95 07/04/95	07/08/95 07/08/95	MJL MJL
		C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Dichlorodifluoromethane Chloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D. N.D.	10 20	ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Bromomethane Chloroethane	N.D. N.D.	10 10	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Ethanol Trichlorofluoromethane	N.D. N.D.	100 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Acrolein Acetone	N.D. N.D.	100 100	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA
		1,1-Dichloroethene lodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA MA
		Carbon disulfide	N.D. N.D.	1	ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
			L		1	{	Į.	1

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E506689-0 Sample Typ Collected:0	e:WATER			номинесточно <u>чные в</u> ибоссточное шери деем	neumannesse get filmlet zu zu zu zugen de kennen de den einen der eine der eine der eine der eine der eine der	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s		,
		Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. D.D. D.D. D.D. D.D. D.D. D.D. D.D.	100 100 100 100 1 100 1 1 1 1 1 1 200 200	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	MAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
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		.•						

#### Appendix A Test Methodologies

#### Hydrocarbons, Recoverable

Preparation Method: Separatory funnel extraction with 80% to 20%

Hexane to MTBE; silica gel addition.

Instrumental Method: Gravimetric analysis

Method Reference: H/C ENVIRODAT 6579 APHA 5520F

#### PAH & Alkylated PAH's

Preparation Method: Liquid/liquid extraction with DCM, methylation

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3540 (modified)

Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H20

Preparation Method: Liquid/liquid extraction with DCM, acetylation

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3510 (modified)

Analytical Method: EPA 8270 (modified)

PANH & Alkylated PANH's

Volatile Organics (MS):H20

Preparation Method: Automated headspace

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3810 (modified)

Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : 3-BA

Sample Date & Time : 04-07-95 1310

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 05, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004 TASK #7110

Chemex Worksheet Number: 95-01924-1

Chemex Project Number : SUNC178-0501

Sample Access Sample Matrix

: WATER

Report Date

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Sample Description : 3-BA

Sample Date & Time : 04-07-95 1310

Sampled By

Sample Type

: GRAB

Sample Recieved Date: July 05, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON

SA-5709-A004 TASK #7110

Chemex Worksheet Number : 95-01924-1

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < <	0.02 0.709 0.146 0.003 0.005 0.1 0.004 2.65 0.003 0.5 0.002 0.008 0.97	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001 0.01

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Sample Description : 6-BA

Sample Date & Time : 10-07-95 1330

Sampled By : GB Sample Type

: GRAB

Sample Recieved Date: July 11, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

TASK #

Chemex Worksheet Number : 95-02013-1 Chemex Project Number : SUNC178-0501

Sample Access

:

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	193.	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	209.	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	9140.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	85.3	0.02
Chloride - Dissolved	17206L	mg/L	12800.	0.5
Sulphate - Dissolved	16306L	mg/L	11.3	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2010.	0.5
pH	10301L	Units	7.15	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2450.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	1340.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)	001051	mg/L	3.72	0.02
Fluoride	09105L	mg/L	0.41	0.05
Specific Conductance	02041L	umhos/Cm	39200.	0.02
Turbidity Cuanida (Availabla)	02074L	NTU	23.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols Total Dissalued Calida	06537L	mg/L	< 0.01	0.01
Total Dissolved Solids	00201L	mg/L	23700.	1.
Dissolved Organic Carbon	06104L	mg/L	. 4.8	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.038	0.003
Sulphur - (ICP) - Dissolved	101001	mg/L	1.9	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	< 0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	2.85	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.40	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES) Copper - Dissolved (ICP-AES)	27360L	mg/L	0.031	0.003
Iron - Dissolved (ICP-AES)	29109L	mg/L	0.005	0.001
TION - DISSOINER (TCL-VES)	26109L	mg/L	0.04	0.01

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Sample Description : 6-BA

Sample Date & Time : 10-07-95 1330

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 11, 1995

Sample Station Code :

**KLOHN-CRIPPEN CONSULTING LTD.** ATTENTION: DAVID THOMSON SA-5709-A004

TASK #

Chemex Worksheet Number : 95-02013-1 Chemex Project Number : SUNC178-0501

Sample Access

:

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES)	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 1.79 4.02 0.05 0.004 0.113 0.1 0.0002 0.002 13.0 0.003 0.5 0.004 0.004	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002
Zinc - Dissolved (ICP-AES) Ion Balance	30501D	mg/L Balance		1.06	0.001

	ABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	RV
1 8	E <b>507149-01 6-BA</b> Sample Type:WATER Collected:07/10/95 13:30				Account to the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s		novin i de bl	
		Hydrocarbons,Recoverable PAH & Alkylated PAH's	<1	1	mg/L		07/19/95	AH
		Naphthalene Acenaphthylene	0.03 N.D.	0.02 0.02	ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	M
	•	Acenaphthene Fluorene	0.04 0.06	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95	07/19/95	MJL MJL
		Dibenzothiophene Phenanthrene	N.D.	0.02	ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL
		Anthracene	0.07 N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	M. M.
1		Fluoranthene Pyrene	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL
		Benzo(a)anthracene/Chrysene Benzo(b&k)fluoranthene	N.D. N.D.	0.02 0.02	ug/L (ppb)	06/19/95 06/19/95	07/19/95	MJL M.
		Benzo(a)pyrene Indeno(c,d-123)pyrene	N.D. N.D.	0.02	ug/L (ppb) ug/L (ppb)	06/19/95	07/19/95 07/19/95	M.
		Dibenzo(a,h)anthracene	N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJL
		Benzo(ghi)perylene Methyl naphthalene	N.D. 0.06	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95 <b>0</b> 6/19/95	07/19/95 07/19/95	MJI Mc
		C2 sub'd naphthalene C3 sub'd naphthalene	0.32 0.82	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95	M.
		C4 sub'd naphthalene Biphenyl	0.50 N.D.	0.04 0.04	l ua/L (ppb)	06/19/95	07/19/95 07/19/95	MJL MJL
		Methyl biphenyl C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL
		Methyl acenaphthene	N.D. 0.06	0.04 0.04	l ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	M. M.
		Methyl fluorene C2 sub'd fluorene	0.14 0.13	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL
		Methyl phenanthrene/anthracene C2 sub'd phenanthrene/anth.	0.13 0.09	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95	MJI
		C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth.	0.05 N.D.	0.04 0.04	ug/L (ppb)	06/19/95	07/19/95 07/19/95	MJ MJ
		1-Methyl-7-isopropylphenanth. Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJL
		C2 sub'd dibenzothiophene	0.16 0.13	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJ
		C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene	0.09 N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJ
		Methyl fluoranthene/pyrene Methyl B(a)A/chrysene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	0.6/19/95	07/19/95	MJL
		C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P	N.D. N.D.	0.04	ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJ MJ
		Phenolic Compounds in H2O Phenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJL
		o-Cresol m-Cresol	N.D. N.D.	2 2	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/27/95 07/27/95	MJL
		p-Cresol 2,4-Dimethylphenol	N.D. N.D.	2	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/27/95	MJ
	•	2-Nitrophenol 4-Nitrophenol	N.D. N.D.	4 40	ug/L (ppb)	07/12/95	07/27/95 07/27/95	MJL
		2,4-Dinitrophenol	N.D.	40	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/27/95 07/27/95	MJL MJ
		4,6-Dinitro-2-methylphenol PANH & Alkylated PANH's	N.D.	40	ug/L (ppb)	07/12/95	07/27/95	MJ
		Quinoline 7-Methyl quinoline	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RRH
		C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines	0.32 N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RRP RR
		Acridine Methyl acridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95	RR
1		Phenanthridine Carbazole	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95 07/20/95	RR
		Methyl carbazoles	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RRR
		C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Dichlorodifluoromethane Chloromethane	N.D. N.D.	1 10	ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95	07/12/95 07/12/95	MA MA
		Vinyl chloride Bromomethane	N.D. N.D.	20 10	j ug/L (ppb)	07/11/95	07/12/95	MA
		Chloroethane	N.D.	10	ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95	07/12/95 07/12/95	MA MA
		Ethanol Trichlorofluoromethane	N.D. N.D.	100	ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95	07/12/95 07/12/95	MA MA
		Acrolein Acetone	N.D. N.D.	100 100	ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95	07/12/95 07/12/95	MA MA
		1,1-Dichloroethene lodomethane	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95	07/12/95 07/12/95	MA MA
		Carbon disulfide Methylene chloride	N.D. N.D.	i 1	ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95	07/12/95 07/12/95 07/12/95	MA MA
		stryione amonae	14.0.	*	agir (hhn)	07/11/95	07/12/95	IVIA
b			L	L		L	1	1

LABID SAMPLE ID E507149-01 6-BA	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
<b>E507149-01 6-BA</b> Sample Type:WATER Collected:07/10/95 13:30							
	Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	100 1 100 1 100 1 1 1 1 1 1 1 1 1 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	MA MA MA MA MA MA MA MA MA MA MA MA MA M
<b>E507149-02 RO-Z</b> Sample Type:WATER Collected:07/10/95 14:30							
	Hydrocarbons, Recoverable PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a) anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h) anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C5 sub'd biphenyl Methyl biphenyl Methyl deenaphthene Methyl fluorene C2 sub'd fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. 1-Methyl-7-isopropylphenanth.	V1  N.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.	1 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.0	mg/L ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb)	06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95	07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95	AH  MJL  MJL  MJL  MJL  MJL  MJL  MJL  MJ

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Sample Description : 8-BA

Sample Date & Time : 28-06-95 1115

Sampled By

: DH

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : KEN MANLY SA-5709-A004

TASK #7110

Chemex Worksheet Number: 9501860

Chemex Project Number

: SUNC178-0501

8-BA

Sample Access

Sample Matrix

: WATER

Report Date

: July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	16.0	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	8.40	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1080.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	28.6	0.02
Chloride - Dissolved	17206L	mg/L	599.	0.5
Sulphate - Dissolved	16306L	mg/L	6.9	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1450.	0.5
pH	10301L	Units	7.76	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	1760.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	74.6	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.51	0.02
Fluoride	09105L	mg/L	1.22	0.05
Specific Conductance	02041L	umhos/Cm	4240.	0.02
Turbidity	02074L	NTU	1700.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.055	0.001
Total Dissolved Solids	00201L	mg/L	2620.	1.
Dissolved Organic Carbon	06104L	mg/L	46.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.750	0.003
Sulphur - (ICP) = Dissolved		mg/L	10.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L ·	mg/L	0.04	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.19	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.1001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.61	0.001
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.005	0.003
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.002
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.003
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.001	0.001
- 1000 ( at 0) ( that )	O U	11197 L	0.20	O.OI

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Sample Description : 8-BA

Sample Date & Time : 28-06-95 1115

Sampled By

: DH

Sample Type

: GRAB

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD.

ATTENTION : KEN MANLY SA-5709-A004

TASK #7110

Chemex Worksheet Number : 9501860

Chemex Project Number : SUNC178-0501

8-BA

Sample Access

Sample Matrix

: WATER

Report Date

: July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < <	0.02 0.355 0.083 0.006 0.005 0.1 0.002 0.487 0.003 0.5 0.002 0.001	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001 0.01

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Sample Description : 13-BA

Sample Date & Time : 05-07-95 1145

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

Chemex Worksheet Number: 95-02005-13-BA

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		89.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		80.5	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		3150.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		26.2	0.02
Chloride - Dissolved	17206L	mg/L		3920.	0.5
Sulphate - Dissolved	16306L	mg/L		0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<		0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2100.	0.5
pH	10301L ·	Units		7.19	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2560.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		554.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.70	0.02
Fluoride	09105L	mg/L		0.57	0.05
Specific Conductance	02041L	umhos/Cm		13700.	0.02
Turbidity	02074L	NTU		55.0	0.1
Cyanide (Available)	06608L	mg/L		0.002	0.001
Phenols	06537L	mg/L		0.060	0.001
Total Dissolved Solids	00201L	mg/L		8550.	1.
Dissolved Organic Carbon	06104L	mg/L		5.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L	•	0.099	0.003
Sulphur - (ICP) - Dissolved		mg/L		5.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.05	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.76	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		3.70	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.006	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.010	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.007	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		4.11	0.01

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Sample Description : 13-BA

Sample Date & Time : 05-07-95 1145

Sampled By

: GB

Sample Type

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

Chemex Worksheet Number: 95-02005-13-BA

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.737 0.696 0.05 0.003 0.013 0.1 0.0002 0.004 4.14 0.003 0.5 0.002 0.002 0.002	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	F.
E507095-01 Sample Type Collected:07	:WATER		The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon		And the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of th		A COLL I & L. D	K.
		Hydrocarbons,Recoverable PAH & Alkylated PAH's	5	1	mg/L		07/19/95	AF:
		Naphthalene Acenaphthylene Acenaphthene	N.D. N.D. 0.03	0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL.
		Fluorene Dibenzothiophene	N.D. N.D.	0.02	ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJ
		Phenanthrene	0.03	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJ MJ
		Anthracene Fluoranthene	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJL
		Pyrene Benzo(a)anthracene/Chrysene	N.D. N.D.	0.02 0.02	ua/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL
		Benzo(b&k)fluoranthene Benzo(a)pyrene	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJ
		Indeno(c,d-123) pyrene Dibenzo(a,h) anthracene	N.D. N.D.	0.02 0.02	ug/L (ppb)	06/19/95	07/19/95	MJL MJL
		Benzo(ghi)perylene Methyl naphthalene	N.D.	0.02	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJ'
		C2 sub'd naphthalene	0.04 0.10	0.02 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJ
		C3 sub'd naphthalene C4 sub'd naphthalene	0.12 0.09	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJL
		Biphenyl Methyl biphenyl	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL
		C2 súb'd biphényl Methyl acenaphthene	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95	MJ
		Methyl fluorene C2 sub'd fluorene	0.04 0.07	0.04 0.04	ua/L (ppb) l	06/19/95	07/19/95 07/19/95	MJL MJL
		Methyl phenanthrene/anthracene	0.10	0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJI
		C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth.	0.21 0.18	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJ\ MJI
		C4 sub'd phenanthrene/anth. 1-Methyl-7-isopropylphenanth.	0.16 N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJL
		Methyl dibenzothiophene C2 sub'd dibenzothiophene	0.07 0.08	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJI
		C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene	0.17 0.06	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJI.
		Methyl fluoranthene/pyrene Methyl B(a)A/chrysene	0.05 0.05	0.04 0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P	0.04	0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJL MJ
		C2 sub'd B(b&k)F/B(a)P	N.D. N.D.	0.04 0.04	ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95	07/19/95 07/19/95	MJi MJ
		Phenolic Compounds in H2O Phenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
•		o-Cresol m-Cresol	N.D. N.D.	0.2 0.2	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/27/95 07/27/95	MJI
		p-Cresol 2,4-Dimethylphenol	N.D. N.D.	0.2 0.2	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/27/95 07/27/95	MJ! MJL
		2-Nitrophenol 4-Nitrophenol	N.D. N.D.	20	ug/L (ppb) ug/L (ppb)	07/12/95	07/27/95	MJL
		2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol	N.D. N.D.	20 20	ug/L (ppb)	07/12/95 07/12/95	07/27/95 07/27/95	MJL MJ:
		PANH & Alkylated PANH's Quinoline			ug/L (ppb)	07/12/95	07/27/95	MJ!
		7-Methyl quinoline	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RRR
		C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RRC RRI
		Acridine Methyl acridine	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RR: RRH
		Phenanthridine Carbazole	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95	07/20/95 07/20/95	RRR
		Methyl carbazoles C2 Alkyl subst'd carbazoles	N.D. N.D.	0.02 0.02	ug/L (ppb) ug/L (ppb)	07/12/95	07/20/95	RR
		Volatile Organics (MS):H20 Dichlorodifluoromethane				07/12/95	07/20/95	RR
		Chloromethane	N.D. N.D.	1 10	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Vinyl chloride Bromomethane	N.D. N.D.	20 10	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Chloroethane Ethanol	N.D. N.D.	10 100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Trichlorofluoromethane Acrolein	N.D. N.D.	1 100	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA
		Acetone 1,1-Dichloroethene	N.D. N.D.	100	ug/L (bbb)	07/07/95 07/07/95 07/07/95	07/08/95	MA
		lodomethane Carbon disulfide	N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95	07/08/95 07/08/95	MA MA
		Methylene chloride	N.D. N.D.	1	ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95	07/08/95 07/08/95	MA MA

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E507095-01 13-BA Sample Type:WATER Collected:07/05/95 11:45	5					The State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of	
	Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethane Trichloroethane 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene	N.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D	100 1 100 1 100 1 1 1 1 1 1 1 1 1 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	MA MA MA MA MA MA MA MA MA MA MA MA MA M
<b>E507095-02 13-BA-D1</b> Sample Type:WATER Collected:07/05/95 11:55							
	Hydrocarbons, Recoverable PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a) anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123) pyrene Dibenzo(a,h) anthracene Benzo(ghi)perylene Methyl naphthalene C3 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene Biphenyl Methyl biphenyl Methyl biphenyl Methyl fluorene C2 sub'd fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth.	3 N.D. N.D. 0.03 N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	mg/L  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95	AH  MJL  MJL  MJL  MJL  MJL  MJL  MJL  MJ

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Sample Description : 13-BA-DI

Sample Date & Time : 05-07-95 1155

Sampled By : GB Sample Type : GRAB

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAVID THOMSON SA-5709-A004

Chemex Worksheet Number: 95-02005-13-BA-DI

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved Magnesium - (ICP) Dissolved Sodium - (ICP) Dissolved	20111L 12111L	mg/L mg/L	89.1 81.2	0.01 0.01
Potassium - (ICP) Dissolved	11111L 19111L	mg/L	3080.	0.01
Chloride - Dissolved	17206L	mg/L mg/L	26.4 3880.	0.02 0.5
Sulphate - Dissolved	16306L	mg/L	< 0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2100.	0.5
pH	10301L	Units	7.22	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2560.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	557.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)	004051	mg/L	2.72	0.02
Fluoride	09105L	mg/L	0.57	0.05
Specific Conductance	02041L	umhos/Cm	13700.	0.02
Turbidity Cyanide (Available)	02074L	NTU	50.0	0.1
Phenols	06608L 06537L	mg/L	0.002	0.001
Total Dissolved Solids	00337L 00201L	mg/L mg/L	0.070 8440.	0.001
Dissolved Organic Carbon	06104L	mg/L	1 6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.114	0.003
Sulphur - (ICP) - Dissolved	10100	mg/L	2.1	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.75	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.63	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	0.005	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.008	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	4.00	0.01

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Sample Description : 13-BA-DI

Sample Date & Time : 05-07-95 1155

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 07, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

Chemex Worksheet Number: 95-02005-13-BA-DI

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < <	0.02 0.719 0.689 0.09 0.003 0.005 0.1 0.0002 0.005 4.07 0.003 0.5 0.003 0.003	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.002

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	F.,
<b>E507095-02 13-BA-D1</b> Sample Type:WATER Collected:07/05/95 11:55			Thermore a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract and a contract a	. — 1800 онд образования при при при при при при при при при при		STATE OF THE LAND OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY	
	Methyl dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O	0.06 0.12 0.24 N.D. 0.06 N.D. 0.05 N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95	MJ MJ MJ MJ MJ MJ MJ
	Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 2-Nitrophenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol PANH & Alkylated PANH's	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.2 0.2 0.2 0.2 0.2 2 20 20 20	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95	MJI MJI MJI MJI MJI MJI MJI
	Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95	RRR RRI RRI RRI RRR RRR RRF RRF
	Volatile Organics (MS):H20 Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethane Trichloroethane 1,2-Dichloropropane Bromodichloromethane 2-Chloroform 1,1,1-Trichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane 1,2-Dichloropropane Bromodichloromethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylene dibromide Styrene cis-1,4-Dichloro-2-butene Bromoform	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 100 100 100 1 1 100 1 1 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	MA MA MA MA MA MA MA MA MA MA MA MA MA M

LABID SA	AMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
<b>E507095-02 13</b> Sample Type:WAT Collected:07/05/99	- <b>BA-D1</b> TER 5 11:55	-					Attacks Cobst	
		1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D. N.D. N.D.	5 2 5 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/07/95 07/07/95 07/07/95 07/07/95 07/07/95 07/07/95	07/08/95 07/08/95 07/08/95 07/08/95 07/08/95 07/08/95	MA MA MA MA MA MA
E507095-03 OB Sample Type:WAT Collected:07/05/98	TER							
		Hydrocarbons,Recoverable PAH & Alkylated PAH's	<1	1	mg/L		07/19/95	АН
		Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenzothiophene Phenzothiophene Phenzothiophene Phenzothiophene Fluoranthene Fluoranthene Fluoranthene Benzo(a)anthracene/Chrysene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene Biphenyl Methyl biphenyl C2 sub'd biphenyl Methyl biphenyl Methyl biphenyl Methyl fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P	N.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL
		Phenolic Compounds in H2O Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.2 0.2 0.2 0.2 0.2 20 20 20	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL
		PANH & Alkylated PANH's Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95	RRR RRR RRR RRR RRR RRR RRR RRR RRR RR
		Dichlorodifluorometháne	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : RO-2

Sample Date & Time : 10-07-95 1430

Sampled By

: GB

Sample Type : GRAB

Sample Recieved Date: July 11, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION: DAVID THOMSON SA-5709-A004

#### TASK #

Chemex Worksheet Number : 95-02013-2 Chemex Project Number : SUNC178-0501

Sample Access

· LIATED

Sample Matrix

: WATER

Report Date : August 11, 1995

			•		
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved Magnesium - (ICP) Dissolved	20111L 12111L	mg/L mg/L		0.08 0.03	0.01 0.01
Sodium - (ICP) Dissolved Potassium -(ICP) Dissolved	11111L 19111L	mg/L mg/L		1.10 0.28	0.01
Chloride - Dissolved	17206L	mg/L	<	0.28	0.02 0.5
Sulphate - Dissolved	16306L	mg/L	<	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2.7	0.5
рН	10301L	Units		5.94	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate Tatal Handrage (as CaCCO)	06201L	mg/L		3.3	0.5
Total Hardness (as CaCO3)	10602L	mg/L	<	0.5	0.5
Hydroxide Silicon - Dissolved (ICP)	08501L	mg/L	< <	0.5 0.02	0.5
Fluoride	09105L	mg/L mg/L	<	0.02	0.02 0.05
Specific Conductance	02041L	umhos/Cm		1.00	0.03
Turbidity	02074L	NTU		0.4	0.02
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		4.	1.
Dissolved Organic Carbon	06104L	mg/L	< ,	0.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P Sulphur - (ICP) - Dissolved	15406L	mg/L	<	0.003	0.003
Aluminum - Dissolved (ICP-AES)	13109L	mg/L mg/L	< <	0.2 0.01	0.2
Barium - Dissolved (ICP-AES)	56109L	mg/L	<	$0.01 \\ 0.01$	$   \begin{array}{c}     0.01 \\     0.01   \end{array} $
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	$0.01 \\ 0.001$	$0.01 \\ 0.001$
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.001	0.001
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.011	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	<	0.01	0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : RO-2

Sample Date & Time : 10-07-95 1430

Sampled By

: GB

Sample Type

: GRAB

Sample Recieved Date: July 11, 1995

Sample Station Code :

KLOHN-CRIPPEN CONSULTING LTD. ATTENTION : DAVID THOMSON SA-5709-A004

#### TASK #

Chemex Worksheet Number: 95-02013-2 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

PARAMETER DESCRIPTION	- NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.008 0.94	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	PV
<b>E507149-02 RO-Z</b> Sample Type:WATER Collected:07/10/95 14:30			TOTAL CANAGE THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE OF THE SPECIAL STATE			The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	
	Methyl dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95 06/19/95	07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95 07/19/95	M. M. M. M. M. M. M. M. M. M. M. M. M. M
	Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 2-Nitrophenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitrophenol PANH & Alkylated PANH's	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.2 2 2	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95 07/27/95	MJL MJ MJL MJL MJI MJ MJ
	Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95 07/20/95	RRR RR RR RR RRR RRR RRP RR RR
	Volatile Organics (MS):H20 Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetote	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 100 100 100 100 1 1 100 1 1 100 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E507149-0 Sample Typ Collected:0	2 <b>RO-Z</b> pe:WATER p7/10/95 14:30							
		1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D. N.D. N.D.	5 2 5 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	07/11/95 07/11/95 07/11/95 07/11/95 07/11/95 07/11/95	07/12/95 07/12/95 07/12/95 07/12/95 07/12/95 07/12/95	MA MA MA MA MA MA
		ESS THAN THE DETECTION LIMIT				. '		
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Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : 1-BA

Sample Date & Time : 12-09-95 1500

Sampled By

Sample Type

: DH : GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A005

Chemex Worksheet Number: 95-03214-1-BA

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 28. 1995

PARAMETER DESCRIPTION			2000 200 Commerce (2000 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 200 April 20	·	
Magnesium - (ICP) Dissolved         12111L         mg/L         102.         0.01           Sodium - (ICP) Dissolved         11111L         mg/L         5030.         0.01           Potassium - (ICP) Dissolved         19111L         mg/L         34.8         0.02           Chloride - Dissolved         16306L         mg/L         6690.         0.5           Sulphate - Dissolved         16306L         mg/L         1.0         0.5           PP Alkalinity (as CaCO3)         10111L         mg/L         2.160.         0.5           PP Alkalinity (as CaCO3)         10111L         mg/L         2.160.         0.5           PH         10301L         Units         7.19         0.01           Carbonate         06301L         mg/L         2630.         0.5           Bicarbonate         06201L         mg/L         2630.         0.5           Total Hardness (as CaCO3)         10602L         mg/L         633.         0.5           Total Hardness (as CaCO3)         10602L         mg/L         633.         0.5           Tydroxide         08501L         mg/L         0.5         0.5           Silicon - Dissolved (ICP)         mg/L         0.5         0.5           T	PARAMETER DESCRIPTION		UNITS	RESULTS	DETECTION LIMIT
Sodium - (ICP) Dissolved         11111L         mg/L         5030.         0.01           Potassium - (ICP) Dissolved         1911L         mg/L         34.8         0.02           Chloride - Dissolved         17206L         mg/L         6690.         0.5           Sulphate - Dissolved         16306L         mg/L         1.0         0.5           PP Alkalinity (as CaCO3)         1015L         mg/L         < 0.1				85.4	
Potassium - (ICP) Dissolved   191111				102.	
Chloride - Dissolved					
Sulphate - Dissolved         16306L         mg/L         1.0         0.5           PP Alkalinity (as CaCO3)         10151L         mg/L         < 0.1					
PP Alkalinity (as CaCO3)         10151L         mg/L         < 0.1         0.1           Total Alkalinity (as CaCO3)         10111L         mg/L         2160.         0.5           pH         10301L         Units         7.19         0.01           Carbonate         06301L         mg/L         < 0.5					
Total Alkalinity (as CaCO3)	Sulphate - Dissolved				
pH         10301L         Units         7.19         0.01           Carbonate         06301L         mg/L         < 0.5	PP Alkalinity (as CaCO3)	10151L			
Carbonate         06301L         mg/L          0.5         0.5           Bicarbonate         06201L         mg/L         2630         0.5           Total Hardness (as CaCO3)         10602L         mg/L         633         0.5           Hydroxide         08501L         mg/L         0.5         0.5           Silicon - Dissolved (ICP)         mg/L         2.64         0.02           Fluoride         09105L         mg/L         0.77         0.05           Specific Conductance         02041L         umhos/Cm         21500         0.02           Turbidity         02074L         NTU         14.0         0.1           Cyanide (Available)         06608L         mg/L         0.001         0.001           Phenols         06537L         mg/L         0.060         0.001           Total Dissolved Solids         00201L         mg/L         13300         1           Dissolved Organic Carbon         06104L         mg/L         13300         1           Dissolved Organic Carbon         06104L         mg/L         11.1         0.2           Nitrite plus Nitrate Nitrogen as N         07110L         mg/L         0.008         0.003           Sulphur					
Bicarbonate					
Total Hardness (as CaCO3)					0.5
Hydroxide         08501L         mg/L         < 0.5         0.5           Silicon - Dissolved (ICP)         mg/L         2.64         0.02           Fluoride         09105L         mg/L         0.77         0.05           Specific Conductance         02041L         umhos/Cm         21500.         0.02           Turbidity         02074L         NTU         14.0         0.1           Cyanide (Available)         06608L         mg/L         0.001         0.001           Phenols         06537L         mg/L         0.060         0.001           Total Dissolved Solids         00201L         mg/L         13300.         1           Dissolved Organic Carbon         06104L         mg/L         13300.         1           Nitrite plus Nitrate Nitrogen as N         07110L         mg/L         0.008         0.003           Total Phosphorus as P         15406L         mg/L         0.060         0.003           Sulphur - (ICP) - Dissolved         mg/L         0.060         0.003           Sulphur - (ICP) - Dissolved         mg/L         0.01         0.01           Barium - Dissolved (ICP-AES)         13109L         mg/L         0.01         0.01           Beryllium - Dissolved (IC					0.5
Silicon - Dissolved (ICP)       mg/L       2.64       0.02         Fluoride       09105L       mg/L       0.77       0.05         Specific Conductance       02041L       umhos/Cm       21500.       0.02         Turbidity       02074L       NTU       14.0       0.1         Cyanide (Available)       06608L       mg/L       0.001       0.001         Phenols       06537L       mg/L       0.060       0.001         Total Dissolved Solids       00201L       mg/L       13300.       1.         Dissolved Organic Carbon       06104L       mg/L       11.1       0.2         Nitrite plus Nitrate Nitrogen as N       07110L       mg/L       0.008       0.003         Total Phosphorus as P       15406L       mg/L       0.060       0.003         Sulphur - (ICP) - Dissolved       mg/L       0.060       0.003         Aluminum - Dissolved (ICP-AES)       13109L       mg/L       0.01       0.01         Barium - Dissolved (ICP-AES)       56109L       mg/L       0.001       0.01         Beryllium - Dissolved (ICP-AES)       05111L       mg/L       0.001       0.001         Boron - Dissolved (ICP-AES)       48501L       mg/L       0.003				633.	0.5
Fluoride	Hydroxide	08501L			
Specific Conductance         02041L         umhos/Cm         21500.         0.02           Turbidity         02074L         NTU         14.0         0.1           Cyanide (Available)         06608L         mg/L         0.001         0.001           Phenols         06537L         mg/L         0.060         0.001           Total Dissolved Solids         00201L         mg/L         13300.         1.           Dissolved Organic Carbon         06104L         mg/L         11.1         0.2           Nitrite plus Nitrate Nitrogen as N         07110L         mg/L         0.008         0.003           Total Phosphorus as P         15406L         mg/L         0.060         0.003           Sulphur - (ICP) - Dissolved         mg/L         0.060         0.003           Sulphur - (ICP) - Dissolved         mg/L         0.01         0.01           Barium - Dissolved (ICP-AES)         13109L         mg/L         0.01         0.01           Beryllium - Dissolved (ICP-AES)         04103L         mg/L         0.001         0.001           Boron - Dissolved (ICP-AES)         05111L         mg/L         0.003         0.003           Chromium - Dissolved (ICP-AES)         24360L         mg/L         0.003		0.04.051			
Turbidity 02074L NTU 14.0 0.1 Cyanide (Available) 06608L mg/L 0.001 0.001 Phenols 06537L mg/L 0.060 0.001 Total Dissolved Solids 00201L mg/L 13300. 1 Dissolved Organic Carbon 06104L mg/L 11.1 0.2 Nitrite plus Nitrate Nitrogen as N 07110L mg/L 0.008 0.003 Total Phosphorus as P 15406L mg/L 0.060 0.003 Sulphur - (ICP) - Dissolved mg/L 0.060 0.003 Sulphur - (ICP) - Dissolved mg/L 0.01 0.01 Barium - Dissolved (ICP-AES) 13109L mg/L 0.01 0.01 Beryllium - Dissolved (ICP-AES) 56109L mg/L 0.01 0.01 Beryllium - Dissolved (ICP-AES) 04103L mg/L 0.001 0.001 Boron - Dissolved (ICP-AES) 48501L mg/L 0.003 0.003 Chromium - Dissolved (ICP-AES) 24360L mg/L 0.013 0.002 Cobalt - Dissolved (ICP-AES) 27360L mg/L 0.001 0.001 Copper - Dissolved (ICP-AES) 29109L mg/L 0.001 0.001					
Cyanide (Available)       06608L       mg/L       0.001       0.001         Phenols       06537L       mg/L       0.060       0.001         Total Dissolved Solids       00201L       mg/L       13300.       1         Dissolved Organic Carbon       06104L       mg/L       11.1       0.2         Nitrite plus Nitrate Nitrogen as N       07110L       mg/L       0.008       0.003         Total Phosphorus as P       15406L       mg/L       0.060       0.003         Sulphur - (ICP) - Dissolved       mg/L       2.9       0.2         Aluminum - Dissolved (ICP-AES)       13109L       mg/L       0.01       0.01         Barium - Dissolved (ICP-AES)       56109L       mg/L       0.91       0.01         Beryllium - Dissolved (ICP-AES)       04103L       mg/L       0.001       0.001         Boron - Dissolved (ICP-AES)       05111L       mg/L       4.32       0.01         Cadmium - Dissolved (ICP-AES)       48501L       mg/L       0.003       0.003         Chromium - Dissolved (ICP-AES)       24360L       mg/L       0.003       0.003         Cobalt - Dissolved (ICP-AES)       27360L       mg/L       0.003       0.003         Copper - Dissolved (ICP-AES) </td <td></td> <td></td> <td></td> <td></td> <td></td>					
Phenols         06537L         mg/L         0.060         0.001           Total Dissolved Solids         00201L         mg/L         13300.         1.           Dissolved Organic Carbon         06104L         mg/L         11.1         0.2           Nitrite plus Nitrate Nitrogen as N         07110L         mg/L         0.008         0.003           Total Phosphorus as P         15406L         mg/L         0.060         0.003           Sulphur - (ICP) - Dissolved         mg/L         2.9         0.2           Aluminum - Dissolved (ICP-AES)         13109L         mg/L         0.01         0.01           Barium - Dissolved (ICP-AES)         56109L         mg/L         0.91         0.01           Beryllium - Dissolved (ICP-AES)         04103L         mg/L         0.001         0.001           Boron - Dissolved (ICP-AES)         05111L         mg/L         0.003         0.003           Cadmium - Dissolved (ICP-AES)         48501L         mg/L         0.003         0.003           Chromium - Dissolved (ICP-AES)         24360L         mg/L         0.003         0.003           Cobalt - Dissolved (ICP-AES)         27360L         mg/L         0.003         0.003           Copper - Dissolved (ICP-AES) <td< td=""><td></td><td></td><td></td><td></td><td></td></td<>					
Total Dissolved Solids					
Dissolved Organic Carbon 06104L mg/L 11.1 0.2 Nitrite plus Nitrate Nitrogen as N 07110L mg/L 0.008 0.003 Total Phosphorus as P 15406L mg/L 0.060 0.003 Sulphur - (ICP) - Dissolved mg/L 2.9 0.2 Aluminum - Dissolved (ICP-AES) 13109L mg/L $< 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.0$					
Nitrite plus Nitrate Nitrogen as N 07110L mg/L 0.008 0.003 Total Phosphorus as P 15406L mg/L 0.060 0.003 Sulphur - (ICP) - Dissolved mg/L 2.9 0.2 Aluminum - Dissolved (ICP-AES) 13109L mg/L $<$ 0.01 0.01 Barium - Dissolved (ICP-AES) 56109L mg/L 0.91 0.01 Beryllium - Dissolved (ICP-AES) 04103L mg/L 0.001 0.001 Boron - Dissolved (ICP-AES) 05111L mg/L 4.32 0.01 Cadmium - Dissolved (ICP-AES) 48501L mg/L 0.003 0.003 Chromium - Dissolved (ICP-AES) 24360L mg/L 0.013 0.002 Cobalt - Dissolved (ICP-AES) 27360L mg/L $<$ 0.003 0.003 0.003 Copper - Dissolved (ICP-AES) 29109L mg/L 0.001 0.001					
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$\begin{array}{llllllllllllllllllllllllllllllllllll$		15406L			
$\begin{array}{llllllllllllllllllllllllllllllllllll$		10100			
Beryllium - Dissolved (ICP-AES)       04103L mg/L mg/L mg/L       0.001 0.001         Boron - Dissolved (ICP-AES)       05111L mg/L mg/L 0.003       0.01         Cadmium - Dissolved (ICP-AES)       48501L mg/L 0.003       0.003         Chromium - Dissolved (ICP-AES)       24360L mg/L 0.013       0.002         Cobalt - Dissolved (ICP-AES)       27360L mg/L 0.003       0.003         Copper - Dissolved (ICP-AES)       29109L mg/L 0.001       0.001	Panium Dissolved (ICP-AES)				
Boron - Dissolved (ICP-AES)       05111L mg/L mg/L mg/L mg/L 0.003       4.32 0.01         Cadmium - Dissolved (ICP-AES)       48501L mg/L 0.003       0.003         Chromium - Dissolved (ICP-AES)       24360L mg/L 0.013       0.002         Cobalt - Dissolved (ICP-AES)       27360L mg/L 0.003       0.003         Copper - Dissolved (ICP-AES)       29109L mg/L 0.001       0.001					
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Papan Discolved (ICP AES)				
$\begin{array}{llllllllllllllllllllllllllllllllllll$	Codmium Discolved (ICP AES)				
$\begin{array}{llllllllllllllllllllllllllllllllllll$	Chromium Discolved (ICP AES)				
Copper - Dissolved (ICP-AES) 29109L mg/L 0.001 0.001	Cobalt - Dissolved (ICP AES)				
7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7					
1.35 U.UI					
	TIOH - DISSUIVED (ICE-MES)	7010AF	mg/L	1.35	0.01

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A005

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Sample Description : 1-BA

Sample Date & Time : 12-09-95 1500

Sampled By Sample Type

: DH : GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

Chemex Worksheet Number: 95-03214-1-BA

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < <	0.02 1.08 0.335 0.006 0.018 0.1 0.003 5.19 0.003 0.5 0.009 0.005 1.00	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.002

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Sample Description : 13-BA

Sample Date & Time : 14-09-95 1100

Sampled By

: DH

Sample Type : GRAB .

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-2-L Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	O O O O O O O O O O O O O O O O O O O	24.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		20.5	0.01
Sodium - (ICP) Dissolved Potassium -(ICP) Dissolved	11111L	mg/L		1850.	0.01
Chloride - Dissolved	19111L 17206L	mg/L		21.0	0.02
Sulphate - Dissolved	16306L	mg/L	_	1860.	0.5
PP Alkalinity (as CaCO3)	10300L 10151L	mg/L	<	$0.5 \\ 0.1$	0.5
Total Alkalinity (as CaCO3)	10131L 10111L	mg/L mg/L		1900.	0.1
pH	10301L	Units		7.56	0.5 0.01
Carbonate	06301L	mg/L	<	0.5	0.01
Bicarbonate	06201L	mg/L		2320.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		145.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)	000012	mg/L	,	2.51	0.02
Fluoride	09105L	mg/L		1.57	0.05
Specific Conductance	02041L	umhos/Cm		8260.	0.02
Turbidity	02074L	NTU		22.0	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.027	0.001
Total Dissolved Solids	00201L	mg/L		4930.	1.
Dissolved Organic Carbon	06104L	mg/L		27.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.011	0.003
Total Phosphorus as P	15406L	mg/L		0.075	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.3	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.21	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		3.79	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES) Iron - Dissolved (ICP-AES)	29109L	mg/L		0.002	0.001
TI OH - D12201AER (TCL-ME2)	26109L	mg/L		0.82	0.01

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Sample Description : 13-BA

Sample Date & Time : 14-09-95 1100

Sampled By

: DH

: GRAB . Sample Type

Sample Received Date: September 18. 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-2-L : SUNC178-0501

Chemex Project Number

Sample Access Sample Matrix

: WATER

Report Date

: October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESI	U.L.T.S	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES)	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.363 0.085 0.23 0.006 0.005 0.1 0.0002 0.002 1.43 0.003 0.5 0.002	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002
Zinc - Dissolved (ICP-AES) Ion Balance	30501D	mg/L Balance		0.004 0.93	0.001 0.01

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	11011111			
E509368-02 OB-5 Sample Type:WATER Collected:09/14/95 15:40	220011111111111111111111111111111111111	MLJOLI	D.E.	UNITS	EXTRACTED	ANALYZED	<u>8</u> Y
	trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D.	de de de	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95	09/22/95 09/22/95 09/22/95 09/22/95	MAA MA MA MA
E509368-03 2-L Sample Type:WATER Collected:09/14/95 11:00						The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon	
	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)arthracene/Chrysene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C3 sub'd naphthalene C4 sub'd ophenanthrene/anthracene Biphenyl Methyl biphenyl C2 sub'd biphenyl Methyl acenaphthene Methyl fluorene Methyl phenanthrene/anth. C3 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd ophenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C3 sub'd B(a)A/chrysene C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O Phenol O-Cresol m-Cresol p-Cresol p-Cresol 2,4-Dinitro-2-methylphenol 2,4-Dinitro-2-methylphenol 2,4-Dinitro-2-methylphenol 2,4-Dinitro-2-methylphenol 2,4-Dinitro-2-methylphenol 2,4-Dinitro-2-methylphenol Ankthyl acridine Phenanthridine Carbazole Methyl carbazoles C3 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines C3 Alkyl subst'd carbazoles C4 Alkyl subst'd carbazoles C5 Alkyl subst'd carbazoles C6 Alkyl subst'd carbazoles C7 Alkyl subst'd carbazoles C8 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles C9 Alkyl subst'd carbazoles	0.0.47 0.0.47 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	b) b) c) c) c) c) c) c) c) c) c) c) c) c) c)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJI MJI MJI MJI MJI MJI MJI MJI MJI MJI

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	DOTALOTES		<del></del>
E509368-03 2-L Sample Type:WATER Collected:09/14/95 11:00		11	to de de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina de la constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della constantina della	ONITS	EXTRACTED	ANALYZED	BY
Collected: 09/14/95 11:00	Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethyvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylene dibromide Chlorobenzene styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,3-Dichlorobenzene 1,3-Dichlorobenzene 1,2-Dichlorobenzene		10 100 100 100 100 100 100 100 100 100	######################################	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	**************************************
E509368-04 2-LD1 Sample Type:WATER Collected:09/14/95 11:00	Volatile Organics (MS):H20 Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 10 100 100 100 1 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 100 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA

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Sample Description : 2-L-D1

Sample Date & Time : 14-09-95 1100

Sampled By

: DH

Sample Type : GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY

SA-5709-A004

Chemex Worksheet Number: 95-03274-2-L-D1

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		26.3	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	_	24.7	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	•	1870.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		24.1	0.02
Chloride - Dissolved	17206L	mg/L		1690.	0.5
Sulphate - Dissolved	16306L	mg/L		16.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		1910.	0.5
pH Carbonata	10301L	Units		7.65	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate Tatal Mandage (as CaCCO)	06201L	mg/L	ä	2330.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		167.	0.5
Hydroxide Siliana Distributed (ICD)	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)	007051	mg/L		3.02	0.02
Fluoride Specific Conductors	09105L	mg/L		1.62	0.05
Specific Conductance	02041L	umhos/Cm	{	3230.	0.02
Turbidity  Cyanida (Ayailahla)	02074L	NTU		17.0	0.1
Cyanide (Available) Phenols	06608L	mg/L		0.001	0.001
	06537L	mg/L		0.029	0.001
Total Dissolved Solids	00201L	mg/L	4	4820.	1.
Dissolved Organic Carbon	06104L	mg/L		28.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< .		0.003
Total Phosphorus as P	15406L	mg/L		0.085	0.003
Sulphur - (ICP) - Dissolved	101001	mg/L		2.8	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.02	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.24	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		4.00	0.01
Cadmium - Dissolved (ICP-AES) Chromium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.81	0.01

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Sample Description : 2-L-D1

Sample Date & Time : 14-09-95 1100

Sampled By

: DH

Sample Type

: GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-2-L-D1

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < <	0.02 0.387 0.099 0.10 0.009 0.007 0.1 0.0002 0.002 1.49 0.003 0.5 0.002 0.004 0.99	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001 0.01

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509368-03 Sample Type Collected:09	2-L e:WATER //14/95 11:00				The Proceedings and the Process of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contract of the Contrac		MWL1ZCU	DY.
		Chloroethane Ethanol Trichlorofiluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene	<b>0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.</b>	100 100 100 100 100 100 100 100 100 100	pbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
E509368-04 Sample Type Collected:09/	14/95 11:00	Volatile Organics (MS):H20 Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 10 100 100 1 1 100 1 100 1 100 1 100 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509368-04 Sample Typ Collected:09	3 2-LD1 e:WATER 9/14/95 11:00				•			
		1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
N.D NO	OT DETECTED, L	ESS THAN THE DETECTION LIMIT						
THIS IS TON	THE FINAL PAGE CLUDING APPENI	OF THE REPORT DICES						

#### **ENVIRO-TEST QA/QC REPORT**

#### PAH & Alkylated PAH's

Average Surrogate Recovery for E509368	%
Nitrobenzene d5	96
2-Fluorobiphenyl	86
p-Terphenyl d14	91
PANH & Alkylated PANH's	• •
Average Surrogate Recovery for E509368	<u>%</u>
Quinoline d7	102
Phenolic Compounds in H2O	
Average Surrogate Recovery for E509368	%
2-Fluorophenol	32
Phenol d5	19
2,4,6-Tribromophenol	80
Volatile Organics (MS):H20	00
voidine organico (mo)izo	
Average Surrogate Recovery for E509368	<u>%</u>
1,2-Dichloroethane d4	109
Toluene d8	103
4-Bromofluorobenzene	104

Relative percent difference is expressed as RPD. Percent Recovery is expressed as %. THIS IS THE LAST PAGE OF THE QAQC REPORT

#### Appendix A Test Methodologies

#### PAH & Alkylated PAH's

Preparation Method:

Liquid/liquid extraction with DCM, methylation

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3540 (modified) Analytical Method: EPA 8270 (modified)

#### Phenolic Compounds in H2O

Preparation Method:

Liquid/liquid extraction with DCM, acetylation

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3510 (modified) Analytical Method: EPA 8270 (modified)

#### PANH & Alkylated PANH's

#### Volatile Organics (MS):H20

Preparation Method:

Automated headspace

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3810 (modified)

Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

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Sample Description : 3-BA

Sample Date & Time : 13-09-95 1545

Sampled By : DH Sample Type : GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY

#A005

Chemex Worksheet Number : 95-03273-3-BA

Cample Access

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 29. 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	Andrewski samen kan samen samen samen samen samen samen samen samen samen samen samen samen samen samen samen	47.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		43.3	0.01
Sodium - (ICP) Dissolved Potassium -(ICP) Dissolved	11111L	mg/L		3140.	0.01
Chloride - Dissolved	19111L 17206L	mg/L		17.8	0.02
Sulphate - Dissolved		mg/L		4090.	0.5
PP Alkalinity (as CaCO3)	16306L 10151L	mg/L	_	30.5	0.5
Total Alkalinity (as CaCO3)	10131L 10111L	mg/L	<	0.1	0.1
pH	10111L 10301L	mg/L Unito		1890.	0.5
Carbonate	06301L	Units	<	7.33	0.01
Bicarbonate	06201L	mg/L	_	0.5 2300.	0.5
Total Hardness (as CaCO3)	10602L	mg/L mg/L		2300. 296.	0.5
Hydroxide	08501L	mg/L	<	290. 0.5	0.5
Silicon - Dissolved (ICP)	00301L	mg/L		0.5 2.14	0.5
Fluoride	09105L	mg/L		2.14 1.09	0.02 0.05
Specific Conductance	02041L	umhos/Cm		14300.	0.05
Turbidity	02041L 02074L	NTU		17.0	0.02
Cyanide (Available)	06608L	mg/L		0.001	0.1
Phenois	06537L	mg/L		0.001	0.001
Total Dissolved Solids	00201L	mg/L		8520.	1.
Dissolved Organic Carbon	06104L	mg/L		5.4	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.121	0.003
Sulphur - (ICP) - Dissolved	101000	mg/L	•	2.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.51	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		4.45	0.001
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.007	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.002
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.84	0.001

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Sample Description : 3-BA

Sample Date & Time : 13-09-95 1545

Sampled By

Sample Type

: GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY

#A005

Chemex Worksheet Number: 95-03273-3-BA

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < <	0.04 0.662 0.126 0.003 0.005 0.3 0.002 2.83 0.006 0.5 0.002 0.007 0.93	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001 0.01

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Sample Description : 6-BA

Sample Date & Time : 15-09-95 1400

Sampled By

Sample Type : GRAB

Sample Received Date: September 16, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY

SA-5709-A005

Chemex Worksheet Number: 95-03258-6-BA

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		198.	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		223.	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1	.0700.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		62.0	0.02
Chloride - Dissolved	17206L	mg/L	1	16900.	0.5
Sulphate - Dissolved	16306L	mg/L		80.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2080.	0.5
pH Salah ayan	10301L	Units		7.12	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate Tatal Handaga (as CaCC)	06201L	mg/L		2540.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		1410.	0.5
Hydroxide Silian Dissalued (ICD)	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)	001051	mg/L		3.22	0.02
Fluoride Specific Conductance	09105L	mg/L	,	0.45	0.05
Specific Conductance	02041L	umhos/Cm	2	13400.	0.02
Turbidity Cyanide (Available)	02074L	NTU		60.0	0.1
Phenols	06608L	mg/L	<	0.001	0.001
Total Dissolved Solids	06537L	mg/L	_	0.020	0.001
Dissolved Organic Carbon	00201L 06104L	mg/L	4	29400.	1.
		mg/L		3.0	0.2
Nitrite plus Nitrate Nitrogen as N Total Phosphorus as P	07110L	mg/L		0.007	0.003
Sulphur - (ICP) - Dissolved	15406L	mg/L		0.080	0.003
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		1.4	0.2
Arsenic - Dissolved (AA)	33109L	mg/L		0.02	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.0014	0.0002
Beryllium - Dissolved (ICP-AES)	04103L	mg/L		2.66	0.01
Boron - Dissolved (ICP-AES)	04103L 05111L	mg/L		0.002 3.70	0.001
Cadmium - Dissolved (ICP-AES)	48501L	mg/L mg/L	<	0.003	0.01
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.003	0.003 0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.015	0.002
Copper - Dissolved (ICP-AES)	27300L 29109L	mg/L	<	0.022	0.003
000000000000000000000000000000000000000		mg/	•	0.001	0.001

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Sample Description : 6-BA

Sample Date & Time : 15-09-95 1400

Sampled By

Sample Type : GRAB

Sample Received Date: September 16, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A005

Chemex Worksheet Number: 95-03258-6-BA

Chemex Project Number :

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Iron - Dissolved (ICP-AES) Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	26109L 82111L 03109L 25109L 80101L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < <	4.63 0.02 1.55 2.59 1.60 0.012 0.079 0.1 0.002 14.7 0.005 0.5 0.002 0.007 0.95	0.01 0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.002

LABID SAMPLEID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	pv
<b>E509363-01 6-BA</b> Sample Type:WATER Collected:09/15/95 14:00				and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s	The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon		
	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghijperylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C5 sub'd inpenyl Methyl biphenyl Methyl biphenyl Methyl fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd dibenzothiophene C5 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl fluoranthene/pyrene Methyl fluoranthene/pyrene Methyl B(b&k)F/B(a)P	0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N.D. 0.05 N	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	W W W W W W W W W W W W W W W W W W W
* **	C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.04 1 1 1 1 1 2 20 20 20	ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)  ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95	MBM MBM MBM MBM MBI MBI MBI MBM MBM MBM
	PANH & Alkylated PANH's Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D. 4.0 N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MIL MIL MIL MIL MIL MIL MIL MIL MIL
	Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disuffide Methylene chloride Acrylonitrile	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 10 100 1 100 100 1 1 1 100	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509363-01 6-BA Sample Type:WATER Collected:09/15/95 14:00							
	trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,3-Dichlorobenzene 1,3-Dichlorobenzene 1,2-Dichlorobenzene	0.00.00.00.00.00.00.00.00.00.00.00.00.0	100 1 100 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Description	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
E509363-02 RO-1 Sample Type:WATER Collected:09/15/95 15:10	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C3 sub'd haphthalene C4 sub'd haphthalene C5 sub'd biphenyl Methyl biphenyl Methyl diphenyl Methyl fluorene Methyl fluorene Methyl phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C2 sub'd dibenzothiophene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL

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Sample Description : 8-BA

Sample Date & Time : 13-09-95 1145

Sampled By

: DH

: GRAB Sample Type

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY

#A005

Chemex Worksheet Number: 95-03273-8-BA

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	alanay gang 2000 Tita asang karang Colonia Atlan	13.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		7.80	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		1180.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		20.0	0.02
Chloride - Dissolved	17206L	mg/L		678.	0.5
Sulphate - Dissolved	16306L	mg/L		13.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		1800.	0.5
pH	10301L	Units		7.45	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2190.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		66.4	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.09	0.02
Fluoride	09105L	mg/L		1.33	0.05
Specific Conductance	02041L	umhos/Cm		4950.	0.02
Turbidity	02074L	NTU		600.	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.033	0.001
Total Dissolved Solids	00201L	mg/L		3010.	1.
Dissolved Organic Carbon	06104L	mg/L		29.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< .	0.003	0.003
Total Phosphorus as P	15406L	mg/L	·	0.240	0.003
Sulphur - (ICP) - Dissolved		mg/L		25.7	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.06	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.16	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		3.93	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.018	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.009	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.74	0.01

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Sample Description : 8-BA

Sample Date & Time : 13-09-95 1145

Sampled By : DH

Sample Type : GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY #A005

Chemex Worksheet Number: 95-03273-8-BA

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	Ų L T Ş	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < <	0.04 0.355 0.075 0.007 0.005 0.7 0.002 0.573 0.012 0.5 0.002 0.003 0.96	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001 0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 46th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : 13-BA

Sample Date & Time : 14-09-95 1615

Sampled By

: DH

Sample Type

: GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-13-BA

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 3, 1995

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PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	90.6	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	82.7	0.01
Sodium - (ICP) Dissolved	111111	mg/L	3050.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	24.1	0.02
Chloride - Dissolved	17206L	mg/L	4090.	0.5
Sulphate - Dissolved	16306L	mg/L	0.6	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2070.	0.5
рН	10301L	Units	7.21	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2530.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	567.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.74	0.02
Fluoride	09105L	mg/L	0.58	0.05
Specific Conductance	02041L	umhos/Cm	14500.	0.02
Turbidity	02074L	NTU	50.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Pheno1s	06537L	mg/L	0.093	0.001
Total Dissolved Solids	00201L	mg/L	8600.	1:
Dissolved Organic Carbon.	06104L	mg/L	4.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.086	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	< 0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.80	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.87	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	5.63	0.01
1				

Catgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : 13-BA

Sample Date & Time : 14-09-95 1615

Sampled By Sample Type : DH : GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-13-BA

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	U.L.T.S.	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < <	0.03 0.825 0.600 0.13 0.003 0.005 0.1 0.0002 4.73 0.002 4.73 0.003 0.5 0.002 0.002	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene	N.D. N.D. N.D. N.D. N.D. 0.02	0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	M." M. M. M. M. M. M. M. M.
Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene	N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	M. M.L M.J.L M.J.L M.J. M.J. M.J. M.J. M
Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene Biphenyl Methyl biphenyl	N.D. N.D. 0.04 N.D. N.D. N.D.	0.02 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJ MJ MJ MJL MJL
Methyl acenaphthene Methyl fluorene C2 sub'd fluorene Methyl phenanthrene/anthracene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth.	N.D. N.D. N.D. 0.05 0.05 N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL
1-Methyl-/-isopropylphenanth. Methyl dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL
Phenolic Compounds in H2O Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 4-Nitrophenol 2,4-Dinitrophenol	N.D. N.D. 0.2 N.D. N.D. N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.1 2 20 20	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95	MJL MBI MBM MBI MBI MBI MBI
PANH & Alkylated PANH's Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MBM MJL MJL MJL MJL MJL MJL MJL MJL MJL MJ
Volatile Organics (MS):H20 Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 10 100 100 100 100	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA
	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(a)anthracene/Chrysene Benzo(a)pyrene Dibenzo(a,h)anthracene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C3 sub'd naphthalene C3 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene Biphenyl Methyl biphenyl C2 sub'd biphenyl Methyl fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C3 sub'd dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd benzothiophene C5 sub'd B(a)A/chrysene C2 sub'd B(a)A/chrysene C2 sub'd B(a)A/chrysene C2 sub'd B(a)A/chrysene C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P C3 sub'd B(b&k)F/B(a)P C4 sub'd B(b&k)F/B(a)P C5 sub'd B(b&k)F/B(a)P C6 sub'd B(b&k)F/B(a)P C7 sub'd B(b&k)F/B(a)P C8 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9 sub'd B(b&k)F/B(a)P C9	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Benzo(a)anthracene/Chrysene Benzo(a)anthracene Benzo(a)anthracene Benzo(a)pyrene Indeno(c.d-123)pyrene Indeno(c.d-123)pyrene Indeno(c.d-123)pyrene N.D. Benzo(ah)nthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene Dibenzo(ah)anthracene Biphenyl Methyl indeno(benyl Methyl biphenyl C2 sub'd biphenyl Methyl fluorene Methyl phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C3 sub'd dibenzothiophene C3 sub'd B(a)A/chrysene Methyl B(a)A/chrysene Methyl B(bàk)F/B(a)P N.D. C2 sub'd B(bàk)F/B(a)P N.D. C2 sub'd B(bàk)F/B(a)P N.D. C2 sub'd B(bàk)F/B(a)P N.D. C3 sub'd B(bàk)F/B(a)P N.D. C4 sub'd dibenzothiophene C2 sub'd B(a)A/chrysene Methyl B(bàk)F/B(a)P N.D. C4 sub'd biphenol C4-Nitrophenol C5-Nitrophenol C6-Dinitro-2-methylphenol C7-Resol D8-N.D. C8-Dinitro-2-methylphenol C9-Alkyl subst'd quinolines N.D. C4-Alkyl subst'd quinolines N.D. C4-Alkyl subst'd quinolines N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C5-Initrophenol N.D. C6-Initro-Compounds in H2O Phenanthridine N.D. C7-Initrophenol N.D. C8-Initrophenol N.D. C9-Initrophenol N.D. C9-Initrophenol N.D. C1-Initrophenol N.D. C1-Initrophenol N.D. C1-Initrophenol N.D. C1-Initrophenol N.D. C2-Initrophenol N.D. C3-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C4-Initrophenol N.D. C7-Initrophenol N.D. C8-Initrophenol N.D. C9-Initrophenol N.	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthylene Acenaphthylene Acenaphthylene Bibenzothiophene Dibenzothiophene Dibenzothiophene N.D. 0.02 Phenanthrene N.D. 0.02 Anthracene Phenanthrene N.D. 0.02 Anthracene Ricoranthene N.D. 0.02 Anthracene Ricoranthene N.D. 0.02 Pyrene Benzo(a)anthracene/Chrysene N.D. 0.02 Benzo(a)pyrene N.D. 0.02 Benzo(a)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.02 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(c,d-123)pyrene N.D. 0.04 Rideno(	PAH & Alkylated PAH's   Naphthalene	PAH & Alkylated PAH's   N.D.   0.02   ug/L (ppb)   09/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9/25/85   O9	PAH & Alkylated PAH's Naphthalene

LAB ID SAMPLE ID TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509368-01 13-BA Sample Type:WATER Collected:09/14/95 16:45					711012121	61
trans-1,2-Dichloroethane Vinyi acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethane Trichloroethane Trichloroethane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 100 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95 C9/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAAA MAAA MAAA MAAA MAAA MAAA MAAA MAA
E509368-02 OB-5 Sample Type:WATER Collected:09/14/95 15:40  PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd biphenyl Methyl biphenyl Methyl biphenyl Methyl fluorene Methyl fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	pp)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 468-3332

Sample Description : BRDG-4

Sample Date & Time : 13-09-95 1145

Sampled By Sample Type : DH : GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY

#A005

Chemex Worksheet Number: 95-03273-BRDG-4

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 29, 1995

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : BRDG-4

Sample Date & Time : 13-09-95 1145

Sampled By

: DH

Sample Type

: GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

Chemex Worksheet Number: 95-03273-BRDG-4

Chemex Project Number : SUNC178-0501

Sample Access

#A005

Sample Matrix

: WATER

SUNCOR INC. OIL SANDS GROUP

ATTENTION : JOHN GULLEY

Report Date

: September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < <	0.02 0.002 0.014 0.003 0.012 0.1 0.002 0.053 0.003 0.5 0.002 0.018 1.00	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001 0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB-1

Sample Date & Time : 12-09-95 1430

Sampled By Sample Type : DH : GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

**SUNCOR INC. OIL SANDS GROUP** ATTENTION: JOHN GULLEY SA-5709-A005

Chemex Worksheet Number: 95-03214-08-1

: 95-03214-08-1 : SUNC178-0501

Chemex Project Number Sample Access

Sample Matrix

: WATER

Report Date

: September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		71.9	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		18.7	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		9.80	0.01
Potassium - (ICP) Dissolved	19111L	mg/L		2.60	0.02
Chloride - Dissolved	17206L	mg/L		0.7	0.5
Sulphate - Dissolved	16306L	mg/L		16.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		245.	0.5
pH	10301L	Units	*	7.49	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		299 <i>.</i>	0.5
Total Hardness (as CaCO3)	10602L	mg/L		257.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		4.45	0.02
Fluoride	09105L	mg/L		0.18	0.05
Specific Conductance	02041L	umhos/Cm		478.	0.02
Turbidity	02074L	NTU		150.	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		270.	1.
Dissolved Organic Carbon	06104L	mg/L		3.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.183	0.003
Total Phosphorus as P	15406L	mg/L		0.213	0.003
Sulphur - (ICP) - Dissolved	404001	mg/L		5.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	<	0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.09	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L		0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		0.02	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.005	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.04	0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB-1

Sample Date & Time : 12-09-95 1430

Sampled By

: DH

Sample Type : GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A005

Chemex Worksheet Number: 95-03214-0B-1

: SUNC178-0501

Chemex Project Number

Sample Access

: WATER

Sample Matrix Report Date

: September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	` R E S	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.008 0.306 0.10 0.003 0.005 0.1 0.0002 0.002 0.149 0.003 0.5 0.002 0.002	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.001

O-Cresol M.D. 0.1 ug/L (ppb) 09/22/95 10/02/95 MBM p-Cresol N.D. 0.1 ug/L (ppb) 09/22/95 10/02/95 MBM p-Cresol N.D. 0.1 ug/L (ppb) 09/22/95 10/02/95 MBM 2.4-Dimethylphenol N.D. 0.1 ug/L (ppb) 09/22/95 10/02/95 MBM 2.4-Dimethylphenol N.D. 0.2 ug/L (ppb) 09/22/95 10/02/95 MBM 2.4-Dimethylphenol N.D. 0.2 ug/L (ppb) 09/22/95 10/02/95 MBM 2.4-Dimethylphenol N.D. 0.2 ug/L (ppb) 09/22/95 10/02/95 MBM 2.4-Dimethylphenol N.D. 0.2 ug/L (ppb) 09/22/95 10/02/95 MBM Ale Alkylated PANH's Quinoline N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MBM PANH & Alkylated PANH's Quinoline N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MBM C2 Alkyl substid quinolines N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL C2 Alkyl substid quinolines N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Acridine N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl acridine N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl acridine N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl acridine N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl acridine N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/22/95 10/02/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/19/95 09/20/95 MJL Methyl carbazoles N.D. 0.02 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 10 ug/L (ppb) 09/19/95 09/20/95 MAA Norticordilluoromethane N.D. 1 ug/L (ppb) 09/19/95 09/20/95 MAA	LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	βv
Naphthaline	Sample Type:WATER						dental supplies de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya del companya del companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la com	
Methyl fluoranthene/pyrene         N.D.         0.04         ug/L (ppb)         09/22/95         10/02/95         MJL           Methyl B(a)A/chrysene         N.D.         0.04         ug/L (ppb)         09/22/95         10/02/95         MJL           Methyl B(b&R/FI8(a)P         N.D.         0.04         ug/L (ppb)         09/22/95         10/02/95         MJL           Phenolic Compounds in H2O         N.D.         0.04         ug/L (ppb)         09/22/95         10/02/95         MJL           Phenol O-Cresol         N.D.         0.1         ug/L (ppb)         09/22/95         10/02/95         MBM           O-Cresol         N.D.         0.1         ug/L (ppb)         09/22/95         10/02/95         MBM           P-Cresol         N.D.         0.2	Collected:09/12/95 14:30	Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C2 sub'd libeneyl Methyl scenaphthene Methyl fluorene Methyl fluorene Methyl fluorene Methyl phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C5 sub'd dibenzothiophene C2 sub'd dibenzothiophene C3 sub'd dibenzothiophene C3 sub'd dibenzothiophene	8.000.000.000.000.000.000.000.000.000.0	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJ MJL MJL MJL MJL MJL MJL MJL MJL MJL M
Phenolic Compounds in H2O		C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P	N.D. N.D. N.D. N.D. N.D.	0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL
PANH & Alkylated PANH's   Quinoline   N.D.   Quinoline   N.D.   Quinoline   Quinoline   N.D.   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quinoline   Quino	• .	Phenolic Compounds in H2O Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 2-Nitrophenol 4,4-Dinitrophenol 4,6-Dinitro-2-methylphenol	N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.1 0.2 2	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MBM MBM MBM MBM MBM MBM MBM MBM
Dichlorodifluoromethane		Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles	N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL
		Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	10 20 10 10 100 100 100 100	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA

LAB ID SAMPLE ID TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509289-01 OB-1 Sample Type:WATER Collected:09/12/95 14:30						
trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylivinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	100 1100 1100 1100 1100 1100 1100 1100	Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb   Uphb	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
E509289-02 OB-4 Sample Type:WATER Collected:09/12/95 15:40  PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(a)b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C4 sub'd naphthalene C4 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C2 sub'd dibenzothiophene C2 sub'd dibenzothiophene	D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL

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Sample Description : OB-2

Sample Date & Time : 13-09-95 1510

Sampled By Sample Type : DH

: GRAB Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY #A005

Chemex Worksheet Number: 95-03273-08-2

: SUNC178-0501

Chemex Project Number

Sample Access

Sample Matrix

: WATER

Report Date

: September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RE	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		21.4	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		6.10	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		195.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		3.10	0.02
Chloride - Dissolved	17206L	mg/L		10.0	0.5
Sulphate - Dissolved	16306L	mg/L		0.8	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		481.	0.5
<b> </b> pH	10301L	Units	•	7.75	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		586.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		78.6	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		8.96	0.02
Fluoride	09105L	mg/L		0.53	0.05
Specific Conductance	02041L	umhos/Cm		885.	0.02
Turbidity	02074L	NTU		2.7	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.002	0.001
Total Dissolved Solids	00201L	mg/L		530.	1.
Dissolved Organic Carbon	06104L	mg/L		11.4	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< .		0.003
Total Phosphorus as P	15406L	mg/L		0.118	0.003
Sulphur - (ICP) - Dissolved		mg/L		1.5	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.16	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		0.79	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.004	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.02	0.01

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Sample Description : OB-2

Sample Date & Time : 13-09-95 1510

Sampled By

Sample Type

: GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY

#A005

Chemex Worksheet Number: 95-03273-08-2

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 29, 1995

PARAMETER DESCRIPTION         NAQUADAT CODE         UNITS         R E S U L T S LIMIT         DETECTION LIMIT           Lead - Dissolved (ICP-AES)         82111L mg/L						
Lithium - Dissolved (ICP-AES)       03109L       mg/L       0.055       0.001         Manganese - Dissolved (ICP-AES)       25109L       mg/L       0.121       0.001         Molybdenum - Dissolved (ICP-AES)       42330L       mg/L       0.003       0.003         Nickel - Dissolved (ICP-AES)       28350L       mg/L       0.009       0.005         Phosphorus - Dissolved (ICP-AES)       15450L       mg/L       0.4       0.1         Silver - Dissolved (ICP-AES)       47450L       mg/L       0.002       0.002         Strontium - Dissolved (ICP-AES)       38111L       mg/L       0.005       0.003         Uranium - Dissolved (ICP-AES)       22111D       mg/L       0.005       0.5         Vanadium - Dissolved (ICP-AES)       23330D       mg/L       0.002       0.002         Zinc - Dissolved (ICP-AES)       30501D       mg/L       0.002       0.002	PARAMETER DESCRIPTION		UNITS	RES	ULTS	
	Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< <	0.055 0.121 0.003 0.009 0.4 0.002 0.209 0.005 0.5 0.02	0.001 0.003 0.005 0.1 0.002 0.002 0.003 0.5 0.002 0.001

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A005

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Sample Description : OB-3

Sample Date & Time : 12-09-95 1415

Sampled By : DH Sample Type : GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

Chemex Worksheet Number : 95-03214-0B-3 Chemex Project Number : SUNC178-0501

Sample Access

. 3010170-0301

Sample Matrix

: WATER

Report Date

: September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS:	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		3.80	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		1.10	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		4.60	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		1.20	0.02
Chloride - Dissolved	17206L	mg/L		9.7	0.5
Sulphate - Dissolved	16306L	mg/L		9.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		8.0	0.5
J pH	10301L	Units	•	5.61	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		9.8	0.5
Total Hardness (as CaCO3)	10602L	mg/L		14.0	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		5.33	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance	02041L	umhos/Cm		39.0	0.02
Turbidity	02074L	NTU		850.	0.1
Cyanide (Available)	06608L	mg/L	<	0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		34.	1.
Dissolved Organic Carbon	06104L	mg/L		3.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.023	0.003
Total Phosphorus as P	15406L	mg/L		0.750	0.003
Sulphur - (ICP) - Dissolved	10100	mg/L		3.2	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.16	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.02	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L		0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.36	0.01

NOTES: Anion-cation balance is lower than our normal limit. Possibly due to low level of major ions.

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A005

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Sample Description : OB-3

Sample Date & Time : 12-09-95 1415

Sampled By

Sample Type

: GRAB Sample Received Date: September 14, 1995

Sample Station Code :

Chemex Worksheet Number: 95-03214-08-3

Chemex Project Number : SUNC178-0501

Sample Access

: WATER

Sample Matrix Report Date

: September 28, 1995

·					
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RÉS	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	82111L 03109L 25109L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < <	0.02 0.002 0.019 0.003 0.006 0.1 0.002 0.035 0.003 0.5 0.002	0.02 0.001 0.001 0.003 0.005 0.1 0.002 0.002 0.002 0.003 0.5 0.002

NOTES: Anion-cation balance is lower than our normal limit. Possibly due to

low level of major ions.

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A005

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Sample Description : OB-4

Sample Date & Time : 12-09-95 1415

Sampled By Sample Type : DH : GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

Chemex Worksheet Number : 95-03214-08-4 Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 28, 1995

			•		
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		4.60	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		1.40	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		5.20	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		1.10	0.02
Chloride - Dissolved	17206L	mg/L		2.2	0.5
Sulphate - Dissolved	16306L	mg/L		10.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		8.0	0.5
pΗ	10301L	Units		5.76	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		9.8	0.5
Total Hardness (as CaCO3)	10602L	mg/L		17.3	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		5.36	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance	02041L	umhos/Cm		50.3	0.02
Turbidity	02074L	NTU		575.	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Pheno1s Pheno1s	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		30.	1.
Dissolved Organic Carbon	06104L	mg/L		3.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.065	0.003
Total Phosphorus as P	15406L	mg/L		0.215	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.01	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.01	0.001
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.003	0.003
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.002	0.002
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.003	0.003
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.001	
2. 3 5.3337733 (101 /123)	<i>LULUJL</i>	mg/ L		0.05	0.01

 ${\sf NOTES}$  : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions.

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A005

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Sample Description : OB-4

Sample Date & Time : 12-09-95 1415

Sampled By

Sample Type

: GRAB

Sample Received Date: September 14, 1995

Sample Station Code :

Chemex Worksheet Number: 95-03214-08-4

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < <	0.02 0.003 0.015 0.05 0.003 0.010 0.1 0.0002 0.003 0.038 0.003 0.5 0.002 0.017	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.002

NOTES : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions.

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	Bv
<b>E509289-01 OB-1</b> Sample Type:WATER Collected:09/12/95 14:30		The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon					
	trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	D. D. D. D. D. D. D. D. D. D. D. D. D. D	100 100 100 11 100 11 11 11 11 11 11 11	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
E509289-02 OB-4 Sample Type:WATER Collected:09/12/95 15:40	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(a)anthracene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C3 sub'd naphthalene Biphenyl Methyl biphenyl C2 sub'd biphenyl Methyl acenaphthene Methyl fluorene Methyl fluorene Methyl phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. 1-Methyl-7-isopropylphenanth. Methyl dibenzothiophene C2 sub'd dibenzothiophene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL

LABID SAMPLEID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
<b>E509289-02 OB-4</b> Sample Type:WATER Collected:09/12/95 15:40	,						
	C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O	N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL
	Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 2-Nitrophenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol PANH & Alkylated PANH's	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.2 2 2	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MBM MBM MBM MBM MBM MBM MBM MBM MBM
	Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL
	Volatile Organics (MS):H20 Dichlorodifluoromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane		1 10 20 10 100 100 100 1 1 1 100 1 1 1 1	g/L (ppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb)  ug/L/L (pppb	09/22/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95  09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	RV
E509289-02 Sample Type Collected:09	<b>OB-4</b> e:WATER /12/95 15:40							A STATE OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE
		trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D.	5	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95	M^A M M
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### **ENVIRO-TEST QA/QC REPORT**

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Average Surrogate Recovery for E509289	<u>%</u>
Nitrobenzene d5	97
2- <u>F</u> luorobiphenyl	84
p-Terphenyl d14	90
PANH & Alkylated PANH's	
Average Surrogate Recovery for E509289	<u>%</u>
Quinoline d7	96
Phenolic Compounds in H2O	
Average Surrogate Recovery for E509289	%
2-Fluorophenol	21
Phenol d5	15
2,4,6-Tribromophenol	64
Volatile Organics (MS):H20	
Average Surrogate Recovery for E509289	<u>%</u>
1,2-Dichloroethane d4	108
Toluene d8	106
4-Bromofluorobenzene	98

Relative percent difference is expressed as RPD. Percent Recovery is expressed as %. THIS IS THE LAST PAGE OF THE QAQC REPORT

#### Appendix A Test Methodologies

#### PAH & Alkylated PAH's

Preparation Method:

Liquid/liquid extraction with DCM, methylation

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3540 (modified) Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H2O

Preparation Method:

Liquid/liquid extraction with DCM, acetylation

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3510 (modified)
Analytical Method: EPA 8270 (modified)

PANH & Alkylated PANH's

Volatile Organics (MS):H20

Preparation Method:

Automated headspace

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3810 (modified)

Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

Calgary: 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB-5

Sample Date & Time : 14-09-95 1540

Sampled By

: DH

Sample Type

: GRAB

Sample Received Date: September 18, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-0B-5

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix : WATER

Report Date

: October 3, 1995

	CODE	UNITS	IV L	30213	DETECTION LIMIT
Calcium - (ICP) Dissolved Magnesium - (ICP) Dissolved	20111L 12111L	mg/L mg/L		52.0 14.0	0.01 0.01
Sodium - (ICP) Dissolved	111111	mg/L		190.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		2.40	0.02
Chloride - Dissolved	17206L	mg/L		10.2	0.5
Sulphate - Dissolved	16306L	mg/L		5.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		573.	0.5
pH	10301L	Units		7.44	0.01
Carbonate	06301L	mg/L	<		0.5
Bicarbonate	06201L	mg/L		698.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		188	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)	004051	mg/L		9.24	0.02
Fluoride	09105L	mg/L		0.80	0.05
Specific Conductance	02041L	umhos/Cm	•	1050.	0.02
Turbidity	02074L	NTU		4.0	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001 0.001
Phenols Total Dissolved Solids	06537L 00201L	mg/L		0.003 623.	1.
Dissolved Organic Carbon	06104L	mg/L mg/L		9.8	0.2
Nitrite plus Nitrate Nitrogen as N		mg/L	<		0.2
Total Phosphorus as P	15406L	mg/L	`	0.003	0.003
Sulphur - (ICP) - Dissolved	13400L	mg/L		2.8	0.003
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.17	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		0.64	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.12	0.01

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB-5

Sample Date & Time : 14-09-95 1540

Sampled By Sample Type : DH

Sample Received Date: September 18, 1995

: GRAB

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION : JOHN GULLEY SA-5709-A004

Chemex Worksheet Number: 95-03274-08-5

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	ULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Selenium - Dissolved (AA) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES) Ion Balance	82111L 03109L 25109L 80101L 42330L 28350L 15450L 34105L 47450L 38111L 22111D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< < < < < < < < < < < < < < < < < < <	0.02 0.053 0.365 0.05 0.003 0.014 0.1 0.0002 0.240 0.004 0.5 0.002 0.002	0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.0002 0.002 0.002 0.003 0.5 0.002 0.002

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509368-01 13-BA Sample Type:WATER Collected:09/14/95 16:45	,						
	trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene		100 100 1100 1100 1100 1100 1100 1100	ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
E509368-02 OB-5 Sample Type:WATER Collected:09/14/95 15:40	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(a)anthracene Benzo(b&k)fluoranthene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene Biphenyl Methyl biphenyl C2 sub'd biphenyl Methyl fluorene C2 sub'd fluorene C2 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C2 sub'd dibenzothiophene	D. D. D. D. D. D. D. D. D. D. D. D. D. D	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL

LABID SAMPLEID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	- nv
E509368-02 OB-5 Sample Type:WATER Collected:09/14/95 15:40		71022000	nasassa kanga mananan mangga (dana danan manan manan manan manan manan manan manan manan manan manan manan man			ANALYZED	BY
	C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O	N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL
	Phenol O-Cresol M-Cresol p-Cresol 2,4-Dimethylphenol 2-Nitrophenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol PANH & Alkylated PANH's	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.1 2 20 20 20	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95	MBN MBN MBM MBN MBN MBN MBN MBN MBN MBN
	Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL
	Volatile Organics (MS):H20 Dichlorodrifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethene 1,2-Dichloroethene 1,2-Dichloroethene 1,2-Dichloroethene 1,2-Dichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	1 10 20 10 100 100 100 1 1 100 1 100 1 1 100 1 1 100 1 1 100 1 1 100 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb) ug/L (pppb)	08/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA

•	:	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
•							
•	trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D.	5 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95	09/22/95 09/22/95 09/22/95 09/22/95	MAA MAA MAA MAA
E509368-03 2-L Sample Type:WATER Collected:09/14/95 11:00							
F F F E E E II I E NO CO E NO NO NO CO 1 NO CO CO NO CO CO NO CO CO CO CO CO CO CO CO CO CO CO CO CO	AH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthylene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a) anthracene/Chrysene Benzo(b&k)fluoranthene Benzo(b&k)fluoranthene Benzo(a) pyrene ndeno(c,d-123) pyrene Dibenzo(a, h) anthracene Benzo(ghi) perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene C5 sub'd biphenyl Methyl biphenyl Methyl biphenyl Methyl fluorene Methyl fluorene Methyl fluorene C2 sub'd phenanthrene/anth C3 sub'd phenanthrene/anth C4 sub'd phenanthrene/anth C4 sub'd dibenzothiophene C3 sub'd dibenzothiophene C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene C4 sub'd dibenzothiophene C5 sub'd dibenzothiophene C4 sub'd dibenzothiophene C5 sub'd dibenzothiophene C4 sub'd B(a)A/chrysene Methyl B(a)A/chrysene Methyl B(b&k)F/B(a)P C5 sub'd B(b&k)F/B(a)P	N.D. 404 0.04 0.04 0.05 0.05 0.05 0.05 0.05 0	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL
P 0 n p 2 2 4 2 4 PA	Penolic Compounds in H2O Phenol Phenol Phenol Phenol Phenol Phenol Phenol Phenol Phitrophenol Phitrophenol Phitrophenol Phitrophenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol Phitro-Phenol	N.D. 0.1 N.D. 0.3 0.1 N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.1 2 20 20 20	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95 10/05/95	MBM MBM MBM MBM MBM MBM MBM MBM MBM
C 7 C A N P C N N V O V	Quinoline	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95 09/25/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL
D C V	Dichlorodifluorometháne Chloromethane Vinyl chloride Bromomethane	N.D. N.D. N.D. N.D.	1 10 20 10	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA

Calgary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : RO-1

Sample Date & Time : 15-09-95 1510

Sampled By

Sample Type

: GRAB

Sample Received Date: September 16. 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A005

Chemex Worksheet Number: 95-03258-RO-1

Chemex Project Number

: SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 2, 1995

			, *		• •
PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RES	SULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		0.07	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	<	0.01	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		0.27	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	<	0.02	0.02
Chloride - Dissolved	17206L	mg/L		4.4	0.5
Sulphate - Dissolved	16306L	mg/L	<	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1 2.7	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2.7	0.5
pH Canhanata	10301L	Units		5.56	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		3.3	0.5
Total Hardness (as CaCO3)	10602L	mg/L	<	0.5	0.5
Hydroxide Silicon Discolved (ICD)	08501L	mg/L	<		0.5
Silicon - Dissolved (ICP) Fluoride	001051	mg/L	<	0.02	0.02
	09105L	mg/L	<	0.05	0.05
Specific Conductance Turbidity	02041L	umhos/Cm		12.3	0.02
Cyanide (Available)	02074L	NTU		0.2	0.1
Phenols	06608L	mg/L		0.001	0.001
Total Dissolved Solids	06537L 00201L	mg/L	<	0.001	0.001
Dissolved Organic Carbon	00201L 06104L	mg/L		7.	1.
Nitrite plus Nitrate Nitrogen as N	00104L 07110L	mg/L mg/L	<	0.5	0.2
Total Phosphorus as P	15406L	mg/L	<	0.003 0.003	0.003
Sulphur - (ICP) - Dissolved	134000	mg/L mg/L	<	0.003	0.003
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	<	0.2	0.2 0.01
Arsenic - Dissolved (AA)	33109L	.mg/L mg/L	<	0.01	
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.0002	0.0002 0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	$0.01 \\ 0.001$
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.001	$0.001 \\ 0.01$
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.01	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.003	0.003
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.002	0.002
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.003	0.003
		J		J. 00	0.001

Caigary: 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468 Edmonton: 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : RO-1

Sample Date & Time : 15-09-95 1510

Sampled By

: GRAB Sample Type

Sample Received Date: September 16, 1995

Sample Station Code :

SUNCOR INC. OIL SANDS GROUP ATTENTION: JOHN GULLEY SA-5709-A005

Chemex Worksheet Number: 95-03258-R0-1

Chemex Project Number : SUNC178-0501

Sample Access

Sample Matrix

: WATER

Report Date

: October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Iron - Dissolved (ICP-AES) Lead - Dissolved (ICP-AES) Lithium - Dissolved (ICP-AES) Manganese - Dissolved (ICP-AES) Mercury - Dissolved (CVAA) Molybdenum - Dissolved (ICP-AES) Nickel - Dissolved (ICP-AES) Phosphorus - Dissolved (ICP-AES) Silver - Dissolved (ICP-AES) Strontium - Dissolved (ICP-AES) Titanium - Dissolved (ICP-AES) Uranium - Dissolved (ICP-AES) Vanadium - Dissolved (ICP-AES) Zinc - Dissolved (ICP-AES)	26109L 82111L 03109L 25109L 80101L 42330L 28350L 15450L 47450L 38111L 22111D 23330D 30501D	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	< 0.01 < 0.02 < 0.001 < 0.001 < 0.005 < 0.003 < 0.005 < 0.1 < 0.002 < 0.002 < 0.003 < 0.002 < 0.003	0.01 0.02 0.001 0.001 0.05 0.003 0.005 0.1 0.002 0.002 0.002 0.003 0.5 0.002

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BV
E509363-01 6-BA Sample Type:WATER Collected:09/15/95 14:00						AIMLIZED	8
	trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloropropane Bromodichloromethane Dibromomethane 2-Chloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene 2-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylbenzene m+p-Xylenes o-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene 1,4-Dichlorobenzene	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	100 1100 1100 1100 1100 1100 1100 1100	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAA MAA MAA MAA MAA MAA MAA MAA MAA MAA
E509363-02 RO-1 Sample Type:WATER Collected:09/15/95 15:10	PAH & Alkylated PAH's Naphthalene Acenaphthylene Acenaphthene Fluorene Dibenzothiophene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene/Chrysene Benzo(a)anthracene Benzo(a)pyrene Indeno(c,d-123)pyrene Dibenzo(a,h)anthracene Benzo(ghi)perylene Methyl naphthalene C2 sub'd naphthalene C3 sub'd naphthalene C4 sub'd naphthalene Biphenyl Methyl biphenyl C2 sub'd biphenyl Methyl acenaphthene Methyl fluorene Methyl phenanthrene/anth. C3 sub'd phenanthrene/anth. C3 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd phenanthrene/anth. C4 sub'd dibenzothiophene C2 sub'd dibenzothiophene C2 sub'd dibenzothiophene	X.D. X.D. X.D. X.D. X.D. X.D. X.D. X.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL MJL MJL MJL MJL

LABID SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	ВУ
E509363-02 RO-1 Sample Type:WATER Collected:09/15/95 15:10							
	C3 sub'd dibenzothiophene C4 sub'd dibenzothiophene Methyl fluoranthene/pyrene Methyl B(a)A/chrysene C2 sub'd B(a)A/chrysene Methyl B(b&k)F/B(a)P C2 sub'd B(b&k)F/B(a)P Phenolic Compounds in H2O	N.D. N.D. N.D. N.D. N.D. N.D.	0.04 0.04 0.04 0.04 0.04 0.04	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MJL MJL MJL MJL MJL MJL
	Phenol o-Cresol m-Cresol p-Cresol 2,4-Dimethylphenol 2-Nitrophenol 4-Nitrophenol 2,4-Dimitrophenol 4,6-Dinitrop-emol PANH & Alkylated PANH's	N.D. N.D. N.D. N.D. N.D. N.D. N.D. N.D.	0.1 0.1 0.1 0.1 0.2 2 2	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	MBM MBM MBM MBM MBM MBM MBM MBM MBM
	Quinoline 7-Methyl quinoline C2 Alkyl subst'd quinolines C3 Alkyl subst'd quinolines Acridine Methyl acridine Phenanthridine Carbazole Methyl carbazoles C2 Alkyl subst'd carbazoles Volatile Organics (MS):H20	N.D. N.D. O.03 N.D. N.D. N.D. N.D. N.D. N.D.	0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95 09/22/95	10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95 10/02/95	mil mil mil mil mil mil mil mil
	Volatile Organics (MS):H20 Dichlorodifluoromethane Chloromethane Vinyl chloride Bromomethane Chloroethane Ethanol Trichlorofluoromethane Acrolein Acetone 1,1-Dichloroethene lodomethane Carbon disulfide Methylene chloride Acrylonitrile trans-1,2-Dichloroethene Vinyl acetate 1,1-Dichloroethane 2-Butanone (MEK) Chloroform 1,1,1-Trichloroethane Carbon tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloroethene Dibromomethane Dibromomethane Dibromomethane Dibromomethane Ethyl methacrylate trans-1,3-Dichloropropene Z-Hexanone 1,1,2-Trichloroethane Tetrachloroethylvinylether 4-Methyl-2-pentanone (MIBK) cis-1,3-Dichloropropene Toluene Ethyl methacrylate trans-1,3-Dichloropropene Z-Hexanone 1,1,2-Trichloroethane Tetrachloroethylene Dibromochloromethane Ethylene dibromide Chlorobenzene Ethylenes O-Xylene Styrene cis-1,4-Dichloro-2-butene Bromoform 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane	0.00.00.00.00.00.00.00.00.00.00.00.00.0	1 10 20 10 10 10 10 10 10 10 10 10 10 10 10 10	Ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)  ug/L (ppbb)	09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95 09/20/95	MAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BA
E509363-02 Sample Type Collected:09	RO-1 e:WATER /15/95 15:10		- The second second second second second second second second second second second second second second second		The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second 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		trans-1,4-Dichloro-2-butene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	N.D. N.D. N.D. N.D.	5 1 1	ug/L (ppb) ug/L (ppb) ug/L (ppb) ug/L (ppb)	09/19/95 09/19/95 09/19/95 09/19/95	09/20/95 09/20/95 09/20/95 09/20/95	MA ^ MA MA MA.
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### **ENVIRO-TEST QA/QC REPORT**

P	A	r	&	A	ı	k	V	la	ite	d	P	A	H	's

Average Surrogate Recovery for E509363	<u>%</u>
Nitrobenzene d5	94
2-Fluorobiphenyl	86
p-Terphenyl d14	87
PANH & Alkylated PANH's	
Average Surrogate Recovery for E509363	<u>%</u>
Quinoline d7	88
Phenolic Compounds in H2O	
Average Surrogate Recovery for E509363	<u>%</u>
2-Fluorophenol	34
Phenol d5	20
2,4,6-Tribromophenol	99
Volatile Organics (MS):H20	
Average Surrogate Recovery for E509363	<u>%</u>
1,2-Dichloroethane d4	108
Toluene d8	100
4-Bromofluorobenzene	105

Relative percent difference is expressed as RPD. Percent Recovery is expressed as %. THIS IS THE LAST PAGE OF THE QAQC REPORT

#### Appendix A Test Methodologies

#### PAH & Alkylated PAH's

Preparation Method:

Liquid/liquid extraction with DCM, methylation

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3540 (modified)

Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H2O

Preparation Method:

Liquid/liquid extraction with DCM, acetylation

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3510 (modified) EPA 8270 (modified)

Analytical Method:

PANH & Alkylated PANH's

Volatile Organics (MS):H20

Preparation Method:

Automated headspace

Instrument Method:

GC/MSD analysis

Method Reference:

Extraction Method: EPA 3810 (modified) Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

**MUNIR JIVRAJ** 

#### SUNCOR GROUNDWATER STUDY

Sample	Sample		Project	Analysis				N	тох @	15 MI	V	
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC50	IC40	IC30	IC20	NAPHTHENI ACID (PPM)**
950628	1-BA	N/A	GW	950706	21500	7.18		100	100	100	100	22
950912	1-BA	N/A	GW	950918	20700	7,41		100	100	100	100	21
950705	13-BA	N/A	GW	950712	12280	6.71		100	100	100	100	13
950914	13-BA	N/A	GW	950918	14030	7.08		100	100	100	100	12
950705	13-BA-D1	N/A	GW	950712	12010	6.86		100	100	100	100	12
950629	2-L	N/A	GW	950706	7770	7.68		100	100	100	59	47
950914	2-L	N/A	GW	950918	8150	7.55		100	100	100	49	57
950912	2-L-D1	N/A	GW	950918	7620	7.55		100	100	100	75	52
950704	3-BA	N/A	GW	950706	14210	6.17	7	100	100	100	100	31
950913	3-BA	N/A_	GW	950918	14100	7.28		100	100	100	71	29
950710	6-BA	N/A	GW	950712	38400	8.51		100	100	100	100	8
950915	6-BA	N/A	GW	950918	43500	6.98		100	100	100	100	9
950628	8-BA	N/A	GW	950706	3820	8.03		100	100	100	<b>*08</b>	31
950913	8-BA	N/A	GW	950918	4710	7.5		100	100	91	34	38
950710	BRDG-4	N/A	GW	950712	487	8.46		100	100	100	100	2
950913	BRDG-4	N/A	GW	950918	181	7.55		100	100	100	100	11
950602	DUP1	N/A	GW	950608	3850	6.85		100	100	100	100	5
950602	DUP2	N/A	GW	950606	3950	6.81		100	100	100	100	4
950607	DW-1	N/A	GW	950609	6	7.33		100	100	100	100	<1
950607	DW-2	N/A	GW	950809	6	7.11		100	100	100	100	<1
950607	DW-3	N/A	GW	950609	В	8.54		100	100	100	100	<1
950524	EXPT-BLANK	N/A	GW	950524	5	6,69		100	100	100	100	<1
950717	EXPT-BLANK	N/A	GW	950717	8	6.93		100	100	100	100	<1
950815	EXPT-BLANK	N/A	GW	950815	7	6.97	<u> </u>	100	100	100	100	<1
950913	EXPT-BLANK	N/A	GW	950913	10	6.99	<u> </u>	100	100	100	100	<1
950926	EXPT-BLANK	N/A	GW	950926	8	5.69	ļ	100	100	100	100	<1
951023	EXPT-BLANK	N/A	GW	951023	12	7.12	<u> </u>	100	100	100	100	<1
950526	ME-	N/A_	GW	950529	367	6.83		20	15	11	8*	<1*
950703	OB-1	N/A	GW	950706	515	7.81	<b></b>	100	100	100	100	<4
950912	OB-1	N/A	GW	950918	450	7.71	ļ	100	100	100	100	5
950629	OB-2	N/A_	GW	950706	939	8.07		100	100	100	100	5
950913	OB-2	N/A	GW	950918	841	8.05	1 200	100	100	100	100	<3
950704	OB-3	N/A	GW	950708	?	5.93	7.02		100	100	100	+ 3
950912	OB-3	N/A	GW	950918	4290	5.95	6.72	100	100	100	100	
950703	OB-4	N/A	GW	950708	69	7.18	13.66		100	100	100	
950912	OB-4	N/A	GW	950918	47	8,34	7.15	_	100	100	100	
950705	OB-5	N/A	GW	950712	855	7.16	-	100	100	100	100	
950914	OB-5	N/A	GW	950918	968	7.48		100	100	100	100	
950518	OW84-PP1	N/A	GW	950523	3100	6.48		100	100	100	100	
950518	MANNIX	RG 003	GW	950523	218	7.83		100		100	100	
950523	ENV89-1A	RG 005	GW	950525				100	100		100	·
950919	ENV89-1A	RG 005	GW	950926			_	100				
950523	ENV89-1B	RG 006	GW	950525			_	100				
950925	ENV89-1B	RG 006	GW	951006	_			100				
950523	ENV89-1BD1	RG 006	GW	Name and Address of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner of the Owner o	The second second			100			_	
950925	ENV89-1B	RG 008-D	Market and the second	951008		THE RESERVE OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE	THE RESERVE THE PERSON NAMED IN	100				
950523	ENV89-1C	RG 007	GW	950525	1385	6.95		100				

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### SUNCOR GROUNDWATER STUDY

Sample	Sample		Project	Analysis				M	TOX @	3 15 MIN	J	
Date	SUNCOR ID	EIAID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC50	1C40	IC30	IC20	NAPHTHEN ACID (PPM)
950523	ENV89-10	RG 008	GW	950525	1353	6.85		100	100	71	32"	31
950919	ENV89-1D	RG 008	GW	950928	1352	7.83		100	100	100	100	33
950525	ENV89-2A	RG 009	GW	950529	1182	6.64		100	100	100	100	3
950920	ENV89-2A	RG 009	GW	950922	1191	7.29		100	100	100	100	5
950525	ENV89-2B	RG 010	GW	950529	1339	6.43		100	100	100	100	20
950920	ENV89-2B	RG 010	GW	950922	1510	7.18		100	90	44	22*	34
950530	ENV89-3A	RG 011	GW	950802	1580	7.13		100	100	100	100	10
951002	ENV89-3A	RG 011	GW	951006	1564	7.73		100	100	100	100	13
950530	ENV89-3AD1	RG 011	GW	950602	1510	7.07		100	100	100	100	10
951002	ENV89-3A	RG 011-D1	GW	951006	1536	7.83		100	100	100	100	12
950601	ENV89-3B	RG 012	GW	950802	1369	7.19		100	100	100	100	20
951002	ENV89-3B	RG 012	GW	951006	1359	7.84		100	100	100	100	19
950525	ENV89-4A	RG 013	GW	950529	2810	6.35	7	100	100	100	100	6
950921	ENV89-4A	RG 013	GW	950926	2340	7		100	100	100	100	7
950525	ENV89-4B	RG 014	GW	950529	1562	6.54		100	100	100	49	43
950921	ENV89-4B	RG 014	GW	950922	1708	7.05		100	91	44	21°	40
950529	ENV91-1A	RG 015	GW	950602	1912	6.85		100	100	100	100	4
950926	ENV91-1A	RG 015	GW	951006	2070	7.34		100	100	100	100	3
950529	ENV91-1B	RG 016	GW	950602	1950	6.69		100	100	100	100	31
950926	ENV91-1B	RG 016	GW	951008	2050	7.34		100	100	100	100	34
950531	ENV91-2B	RG 019	GW	950602	9990	6.67	1	100	100	100	100	12
950926	ENV91-2B	RG 019	GW	951006	10600	7.08	1	100	100	100	100	13
950518	ENV91-3A	RG 020	GW	950523	6250	8.3	7.3	100	100	100	100	8
951010	ENV91-3A	RG 020	GW	951019	5370	6.84		100	100	100	100	8
950615	ENV91-3B	RG 021	GW	950619	N/A	7.01		100	100	100	100	12
950615	ENV91-3B	RG 021-01	GW	950619	3770	6.38	7.2	100	100	100	100 100	9 11
951010	ENV91-3B	RG 021	GW	851017	2940	1-/-	<b>.</b>	100	100 100	100	100	1 11
951010	ENV91-3B	RG 021-D1 RG 022	GW GW	951019 950623	2410 9570	7.76 7.13		80	42	23	12	48
950622 950524	ENV91-5 ENV91-7A	RG 024	GW	950525	1456	8.31	<del></del>	49	28	1 18	9	52
950927	ENV91-7A	RG 024	GW	951006	1774	8.84	17	32	21	14	9	62
950524	ENV91-7B	RG 025	GW	950525	1821	6.76		100	100	100	94	23
951024	ENV91-7B	RG 025	GW	951030	1546	7.13		100	100	100	50*	27
950606	ENV91-8	RG 028	GW	950807	1419	6.67		13	10	T 7	5	19
951018	ENV91-8	RG 026	GW	951020	1604	7.04	1	26	19	14	10	21
950606	ENV91-8D1	RG 026	GW	950807	1427	8.77		15	11	9 15	6	19 17
951018	ENV91-8	RG 026-D1		951020	1595	7.13		30 100	21 100	100	100	1 6
950607	ENV92-1	RG 027	I GW	950609	4350 4670	6.42		100	100	100	100	<u> </u>
950920	ENV92-1	RG 027	GW	950922 950608	4060			100	100	100	100	5
950602	ENV92-2C	RG 028 RG 028	GW	951030			1	100	1 100	100	95	4
951019 950808	ENV92-2C ENV92-3	RG 028	GW	950609				100	100	100	100	
951019	ENV92-3	RG 029	<del>† ĞW</del>	951020				100	100	59	29*	
950606	ENV92-4A	RG 030	† ĞW	950609	2040	6.3	8.74		100		100	
950926	ENV92-4A	RG 030	GW	951008	2030			100	100		100	
950602	ENV92-48	RG 031	GW	950606				100	100			
951019	ENV92-4B	RG 031	GW					100				
950614	ENV92-6	RG 032	GW					100				
951012		RG 032						100				
951012	ENV92-6 ENV92-6	RG 032-F RG 032D						100			X	

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MUNIR JIVRAJ

### SUNCOR GROUNDWATER STUDY

Sample	Sample		Project	Analysis				N	ITOX @	15 MIN	V	
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	рН ADJ.	IC50	IC40	IC30	IC20	NAPHTHENIC ACID (PPM)***
950530	ENV92-8	RG 033	GW	950602	26900	6.73		100	100	100	100	15
950614	ENV92-8	RG-033	GW	950619	38000	8.48	7.5	100	100	71	41	24
950928	ENV92-8	RG 033	GW	951006	29000	7.54		100	100	100	100	17
950524	ENV92-9	RG 034	GW	950528	1224	7.76		100	92	47	24	46
950927	ENV92-9	RG 034	GW	951006	1226	8.2		100	100	70	31	54
950518 950518	ENV92-10A ENV92-10A-R	RG 035 RG 035	GW	950523	1453	6.76		100	100	68	31	N/A
951024	ENV92-10A-R	RG 035	GW	950525 951030	1350 N/A	6.85 N/A		100 100	100 100	100 100	55 57	28 30
950524	ENV92-10B	RG 036	GW	950528	1436	7.04		100	100	100	70	30
950612	ENV93-1	RG 037	ĞW	950615	7220	7.13		40	25	16	10	47
950526	ENV93-2A	RG 038	GW	950529	1422	6.98		100	100	100	100	31
950601	ENV93-3A	RG 040	GW	950802	1376	7.29		100	56	32	18	58
950601	ENV93-4	RG 042	GW						100	100		
			The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon	950602	1526	6.83		100			100	10 57
950605	ENV93-5	RG 043	GW	950607	1139	7.29		69	41	24	14	
950518	ENV93-8	RG 046	GW	950523	3110	6.68		100	100	100	89	N/A
950928	ENV93-8	RG 046	GW	951008	2690	8.94		100	100	100	100	12
950518	ENV93-8-R	RG 046	GW	950525	2670	6.76		100	100	100	100	8
950605	ENV93-10A	RG 048	GW	950607	1257	7.05		100	100	100	100	29
950925	ENV93-10A	RG 048	GW	951008	1218	8.18		100	100	100	100	29
950605	ENV93-10B	RG 049	GW	950607	1158	7.34	<u> </u>	54	34	21	13	53
950928	ENV93-10B	RG 049	GW	951006	1373	8,74	8.96	58	34	20	11	52
950518	ENV93-11A	RG 050	GW	950523	1458	7.24		100	100	100	42	31
950518	ENV93-11A-R	RG 050	GW	950525	1379	7.58		100	100	70	30	N/A
950530	ENV93-11B	RG 051	GW	950802	1461	7.61	T	57	36	22	14	67
950602	ENV93-11B	RG 051	GW	950606	1475	7.87		51	31	19	11	N/A
950605	ENV93-12	RG 052	GW	950807	1712	8.54		100	100	100	54	14
950616	ENV94-1	RG 053	GW	950619	1091	6,71		24	16	10	7	<3
951023	ENV94-1	RG 053	GW	951030	1325	7,15		90	61	41	28	8
950615	ENV94-2	RG 054	GW	950619	1547	7.08		100	100	100	100	10
	ENV94-2	RG 054	GW	951030	1387	7.75	1	100	100	100	100	8
951023	ENV94-3A	RG 055	GW	950623	2340	7.74	-	NA	N/A	N/A	N/A	55
950622		RG 056	GW	950523	7	7	<del>                                     </del>	100	100	100	46	N/A
950518	ENV94-3B			951006	1192	7.11	+	100	100	100	100	26
950927	ENV94-3B	RG 058	GW		994	6.72		100	100	100	65	23
950518	ENV94-3B-R	RG 056	GW	950525		6.71	+	100	100	100	100	24
950622	ENV94-5	RG 058	GW	950623	26300		<del></del>	100	100	100	83*	17
951025	ENV94-5	RG 058	GW	951030	29800				100	100	100	5
950607	ENV94-6	RG 059	GW	850809	2760	6.62		100	100	100	100	
950925	ENV94-6	RG 059	GW	951006	3110	7.41		100	100	100	100	
950806	ENV94-7	RG 060	GW	950809	6440	6.5		100	البحد ميسورين	100	100	
950925	ENV94-7	RG 080	GW	951008	7410	6.89	_	100	100	100	100	
950621	ENV94-9A	RG 063	GW	950623	N/A	7.35		100	100		100	
950620	ENV94-9B	RG 064	GW	950623		7.48		100	100			THE RESERVE THE PERSON NAMED IN COLUMN TWO
951003	ENV94-9B	RG 064	GW	951008				100	100			
950621	ENV94-10A	RG 085	GW	950623		7.16		100				THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED I
951003		RG 065	GW	951006				100				The second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linear section is the second linea
950621		RG 086		950823	4730			100				
951003		RG 086		951008	5040	7.13		100	Name of Street, or other Designation of the Owner, where the Parket of the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, where the Owner, which the Owner, where the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the Owner, which the			
950621		RG 067		950623	3380	6.4	6.9	The second lives and the second				THE REAL PROPERTY.
951003		RG 087				6.72	7.0	1 100	100	100	100	5   6

MUNIR JIVRAJ

### SUNCOR GROUNDWATER STUDY

Sample	Sample		Project	Analysis				M	тох @	15 MIN	J	
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC60	IC40	IC30	IC20	NAPHTHENII ACID (PPM)**
950619	ENV94-12	RG 068	GW	950621	3010	6.09	7.15	100	100	100	100	30
951004	ENV94-12	RG 068	GW	951006	2750	6.79	7.21	59	36	22	13	21
950819	ENV94-13	RG 069	GW	950621	1345	6.43	7.2	100	100	100	100	9
951004	ENV94-13	RG 069	GW	951008	2110	6.93		100	100	100	100	12
951004	ENV94-14	RG 070	GW	951006	2040	7.11		100	100	100	100	11
950621	L94-D8-33	RG 072	GW	950623	12660	6.93		100	100	100	100	34
951004	L94-D8-33	RG 072	GW	951006	15450	7.28		100	100	100	54"	38
951017	L94-D8-30A	RG 072?	GW	951020	17670	7.61		100	100	100	69	32
951026	L94-D8-31	NA	GW	951030	1584	7.51		100	100	100	41	34
950608	RIVER S.	RG 073	GW	950609	249	7.85		100	100	100	94	<2
951024	RIVER S.	RG 073	GW	951030	308	8.28		100	100	100	100	<1
950608	RIVER M.	RG 074	GW	950809	241	7.85		100	100	100	100	<2
951024	RIVER M.	RG 074	GW	951030	290	8.15		100	100	100	100	<1
950608	RIVER N.	RG 075	GW	950609	240	7.87	ĺ	100	100	100	100	<1
951024	RIVER N.	RG 075	GW	951030	299	8.24	Ì	100	100	100	100	<2
950525	POND-1	RG 078	GW	950526	1452	8.28		39	24	15	9	82
951016	POND-1	RG 076	GW	951020	1168	8.32		14	9	5	3	78
950525	POND-1A	RG 077	GW	950526	1414	8.1		32	21	13	8	84
951018	POND-1A	RG 077	GW	951020	1267	8.26		37	23	14	9	95
950613	POND 2/3	RG 078	GW	950615	1405	7.84		40	25	16	10	86
951016	POND 2/3	RG 078	GW	951020	1192	8.32		34	21	13	8	92
950613	POND 4	RG 079	GW	950815	1418	8.02		25	16	11	7	88
951017	POND 4	RG 079	GW	951020	1502	8.35	1	31	19	12	8	90
950613	POND 5	RG 080	GW	950615	1541	8.14		100	79	49	31	43
951018	POND 5	RG 080	GW	951030	2170	8.55	8.16	100	100	100	67	35
950524	COKE-DRAIN	RG 081	GW	950526	4210	6.88		100	100	100	100	11
951012	COKE-DRAIN	RG 081	GW	951017	3570	7.23		100	100	100	100	9
951012	COKE-DRAIN	RG 081	GW	951019	3560	7.77		100	100	100	100	9
950525	TID-DITCH	RG 082	GW	950526	1241	7.48		70	40	23	13	48
951018	TID-DITCH	RG 082	GW	951020	1412	7.52		26	17	11	7	49
950518	TID-DRAIN	RG 083	GW	950523	1356	7.79		41	26	16	10	57
950928	TID-DRAIN	RG 083	GW	951006	1396	8.09		49	31	20	13	68
950523	TID-DRAIN-R	RG 083	GW	950525	1340	7.82		100	100	100	42	N/A
950518	FROG LAKE	RG 084	GW	950523	792	6.88		100	100	100	100	<3
951018	FROG LAKE	RG 084	GW	951030		8.65	8.5	100	100	100	100	<3
950518	MILD AQUIFIR	RG 085	GW	950523	A CONTRACTOR OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY O	7.08		100	100	100	100	<1
951018	MILD AQUIFIR	The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second 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second second second second second second second second second second second second second second second second second second second second second second second second second second second secon
951016	SPECIAL	RG 086		951020		6.8		100	100	100	100	The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon
951017	SPECIAL	RG 087	GW	951017		7.98		100	100	100	100	
951012	SPECIAL	RG 088		951017	anne de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la constitución de la co	7.78		54	34	21	13	74
951012		RG 089		951017	NAME OF TAXABLE PARTY OF TAXABLE PARTY.	8.23		100	62	34	19	83
951011		RG 089-		951018	THE REAL PROPERTY OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED	8.32		100		27	13	
951025	NA	RG 090	THE RESERVE THE PERSON NAMED IN COLUMN	951030		7.44		100	THE RESERVE THE PROPERTY OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN 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951025	NA NA	RG 091		Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of th	THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	7.02	?	100		45	28	
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MUNIR JIVRAJ

#### SUNCOR GROUNDWATER STUDY

May - Oct '95

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ESPECT DATA (YOMT(S).

*****50 g of sample was utilized for extraction and was then concentrated with 8 g of Mathena Chicalds.

EESULTS NOT AVAILABLE

**DTES:** 

spec the Microtox Analysis shows acuts toxicity while the Nephthenic acid concentration is jow.

sof the reason for this anomaly is amount of from in the sample. Apparently, the bacteria in the Microtox analysis is affected by large (jran)



2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4

Faculty of SCIENCE Department of PHYSICS AND ASTRONOMY

Telephone (403) 220-5385 Facsimile (403) 289-3331 Telex 03-821545

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	•	FAX # OF RECEIVER:	274-5349
CITY/TOWN:	Calgary	NUMBER OF PAGES:	2
COUNTRY:		DATE:	Dec. 7, 1995

#030 P02 File: PA 2779. 204 PA 2705. 204

Results of Stable Isotope Analyses on vate samples for Suncar & Steephank Mire Areas. (8) Deuterium DEL 018 ( H20 ) SAMPLE -164.5 Suncor 3214-1BA (15:00, Sept.12/95) -20.67Suncor 3273-8-BA(11:45, Sept.13/95 -155.4-20.37-19.03 Suncor RG006 (14:20, Sept.25/95) -150.9Suncor RG010 (14:25, Sept.20/95 -137.5-16.89Suncor RG009 (13:40, Sept. 20/95 -146-18.75Suncor 6-BA (Sept.15/95) R/NC-1 -169.3-22.22Suncor OB#2 (15:10, Sept.13/95)R/NC-2 -153.8-20.35Suncor 3273-3-BA(15:45, Sept.13/95)R/NC-3 -161.6-20.82Suncor 3274-2-2DI(11:15, Sept.14/95)R/NC-4 -154.9-20.65Suncor 3274-0B-5(15:40, Sept.14/95)R/NC-5 -149.2-19.97 Suncor 3214 OB-4(15:40, Sept.12/95)R/NC-6 -137.4-18.13Suncor 3214-OB-3(14:15, Sept.12/95)R/NC-7 -145.2 -18.9Suncor 3214-OB-1(14:30, Sept.12/95)R/NC-8 -149.3 -19.99Suncor 3274-2-L(11:00, Sept.14/95)R/NC-9 -158 -20.81-137.4Suncor 3273-BRDG-4(11:45, Sept.13/95)R/NC-10 -18.32Suncor 3274~=13-BA(16:15,Sept.14/95)R/NC-12 -165.3-21.91Suncor 3595-RG066(9:40,)Oct.3/95)R/NC-9 -134-17.42Suncor 3861-RG026(9:40,Oct.18/95)R/NC-18 -137-16.91 -137.8-17.Ø3 Suncor 3861-RG02601(10:11,Oct.18/95)Routine -17.56 -131.9R20 Steepbeak R

R21 Ref. Wetland

Golder Assoc. AW018-C001(Saline Lake)

-128.9

-122.6

-15.66

-14.5

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