

SASK. HIGHWAYS AND TRANSPORTATION

**GEOLOGY OF HIGHWAY 16 BETWEEN THE BORDEN
BRIDGE AND LANGHAM**

Report 0161-002

October 7, 1996

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October 7, 1996

Saskatchewan Highway and Transportation
3130 - 8th Street East
Saskatoon, Saskatchewan
S7K 2H6

Attention: Mr. N.W. Richardson, P. Eng.

Dear Mr. Richardson:

Enclosed please find six copies of Report 0161-002 on the "Geology of Highway 16 between the Borden bridge and Langham with special emphasis on the gully area."

If you have any queries about the report, please contact me.

Sincerely yours,

E.A. Christiansen, P. Eng., P. Geol.



ASSOCIATION OF PROFESSIONAL ENGINEERS OF SASKATCHEWAN		
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SUMMARY

This investigation of geology along Highway 16 between the Borden bridge and Langham (C.S. 16-23), with particular emphasis on the gully area, was conducted to check reports on possible groundwater problems. Although high groundwater levels were encountered, only locally occurring, thin sands and gravels were found during the drilling program. The Dalmeny aquifer was traced to within 2.5 km of Highway 16. The proximity of the Dalmeny aquifer to Highway 16 and its high head is thought to be the cause of the high groundwater levels in the study area. The low water level encountered in a deep sand and gravel aquifer in the gully area suggests a continuity of the aquifer to the North Saskatchewan River valley.

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1. INTRODUCTION

1.1 Objective

The objective is to determine the stratigraphy along Highway 16 (C.S. 16-23) between the Borden bridge and Langham with particular emphasis on the gully where a groundwater problem was believed to exist.

1.2 Location

The locations of cross sections A-A', B-B', and C-C' is shown in Drawing 0161-002-01.

1.3 Previous work

Previous work includes: (a) geological maps and cross sections of the Saskatoon area (73-B) (Christiansen 1967), (b) geological maps, cross sections, and aquifer maps (Christiansen 1970, Meneley 1970), and (3) a cross section from Saskatoon to the Langham area (Sauer and Christiansen 1996). The soils of the area under study were investigated by Acton and Ellis (1978).

1.4 Present study

The present study includes the examination of cutting samples from SHT Langham 117 (site 5), 118 (site 2), 119 (site 10), 120 (site 4), 121 (site 3), 122 (site 14), and 123 (site 13) (Table 1, Appendix A). Samples were selected from these boreholes for carbonate analysis (Table 2, Appendix B). Geological logs were compiled for these boreholes (Appendix 1). The present study includes also the drawing of three cross sections (Drawing 0161-002-02-04), all of which intersect at the gully, central between Langham and the Borden bridge. Cross section A-A' (Drawing 0161-002-02) extends along Highway 16 from south of the Borden bridge to the Lookout and from there along the North Saskatchewan River valley to a point 3 km northwest of

Table 1. Index of logs in cross sections A-A', B-B', and C-C'.

HOLE NO.	NAME	DLS	UTM
1	UofS Eagle 14 (Langham)	NE-03-19-39-08-W3	5803500N/354000E
2 (118)	SHT Langham 118	NE-14-15-39-08-W3	5803105N/358958E
3 (121)	SHT Langham 121	SE-02-22-39-08-W3	5803151N/359198E
4 (120)	SHT Langham 120	NW-13-14-39-08-W3	5802964N/359902E
5 (117)	SHT Langham 117	SE-03-23-39-08-W3	5803094N/360411E
6	UofS Eagle 15 (Langham)	SE-03-23-39-08-W3	5803000N/360600E
7 (110)	SHT Langham 110	SW-01-23-39-08-W3	5083150N/361150E
8	SDH Langham	NW-10-19-39-07-W3	5804100N/363950E
9	NRC Langham	SE-15-33-38-07-W3	5797650N/367850E
10 (119)	SHT Langham 119	SE-01-10-39-08-W3	5799896N/359681E
11	FFIB Nemanishen, N.	SE-08-10-39-08-W3	5800350N/359600E
12	SOHIO Petroleum 1	01-12-39-08-W3	5803450N/359700E
13 (123)	SHT Langham 123	NE-16-15-39-08-W3	5802922N/359591E
14 (122)	SHT Langham 122	SW-13-14-39-08-W3	5802281N/359784E

Table 2. Carbonate content of tills in cross sections A-A', B-B', and C-C'.

STRATIGRAPHIC UNIT	N	X	SD
Floral and Battleford Fms.	49	29	6
Warman Formation	14	15	6
Dundurn Formation, upper till	67	26	4
Dundurn Formation, lower till	69	24	4

Table 3. Piezometric data, September 18, 1996 provided by E.K. Sauer.

Well	Ground elevation (m).	Depth to water (m)	Total head (m)	Depth of well (m)	Conductivity of water ms/cm
119A	501.72	5.00	496.7	49.4	2250
119B	501.59	5.00	496.6	36.6	2600
120A	496.42	6.90	489.5	14.5	2100
120B	496.36	25.69	470.7	45.1	5500
121	496.77	0.80	496.0	12.5	3290
123	500.23	5.00	495.2	7.6	5550

Langham (Drawing 0161-002-01). Cross section B-B' (Drawing 0161-002-03) extends from the Dalmeny aquifer as defined by Meneley (1970) and Sauer and Christiansen (1996) to the North Saskatchewan River. Cross section C-C' (Drawing 0161-002-04) represents an expanded version of part of cross section A-A' to accommodate the six boreholes in the gully area.

2. STRATIGRAPHY

2.1 Bedrock sediments

The bedrock sediments are composed of gray, noncalcareous, marine clay of the Lea Park Formation and Upper Colorado Group (Fig. 1). These sediments are combined because they cannot be separated in electric logs. Presumably, most of these sediments belong to the Lea Park Formation. Within these clays is a structure marker bed composed of 15 m of silt and sand (Drawings 0161-002-02-04).

2.2 Glacial sediments

2.2.1 Sutherland Group

The Sutherland Group is composed of extensive, thick lower and upper tills of the Dundurn Formation and discontinuous, thin deposits of the Warman Formation.

The lower till unit of the Dundurn Formation is composed of 17 to 30 m of till, the lower part of which is gray and unoxidized and the upper part of which olive and oxidized. The lower till has a mean carbonate content of 24 ± 4 mL CO₂/g. The lower till unit contains an eight-m thick sand and gravel bed (Drawing 0161-002-03, site 4) which presumably extends to the North Saskatchewan River valley as suggested by the low head in the aquifer (Table 3). The areal distribution of this sand and gravel unit is not known. The contact

TIME UNIT		STRATIGRAPHIC UNIT			
		GROUP	FORMATION	DEPOSIT	
QUATERNARY	HOLOCENE	SASKATOON		Alluvium Sand and silt	
	PLEISTOCENE			Glaciodeltaic Sand + SILT	
				SILT AND CLAY Glaciolacustrine	
			Floral and Battleford fms.	Till	
			Floral Formation	Dalmeny aquifer	
				Clay	
			Warman Formation	Till	
			Dundurn Fm.	Upper till	
				Lower till	
CRETACIOUS		MONTANA AND UPPER COLORADO GROUPS	Lea Park Fm. and U. Colorado Group	Clay	
				Silt and sand	
				Clay	

Figure 1. Stratigraphic chart.

between the Lea Park Formation and the lower till of the Dundurn Formation is nonconformable.

The upper till of the Dundurn Formation is composed of less than 1 m to 30 m of brown and olive, gypsiferous till which undoubtedly has a pronounced effect on the quality of groundwater of the area (Table 3).

The upper till has a mean carbonate content of 26 ± 4 mL CO₂/g which is similar to that of the lower till of the Dundurn Formation (Table 2).

The contact between the lower and upper tills of the Dundurn Formation is nonconformable and is marked commonly by a noticeable increase in oxidation in the upper part of the lower till.

The Warman Formation is composed of less than 1 m to 8 m of clayey, gypsiferous, olive and gray, mottled till which has a mean carbonate content of 15 ± 6 mL CO₂/g. The contact between the Dundurn and Warman formations is nonconformable.

2.2.2 Saskatoon Group

The Saskatoon Group is composed of a basal clay bed; Dalmeny aquifer; Floral and Battleford formations, undifferentiated; glaciolacustrine and glaciodeltaic sediments; and alluvium in the North Saskatchewan River valley.

A basal gray, unoxidized clay is between the oxidized Warman Formation and unoxidized sand in the Dalmeny aquifer (Drawing 0161-002-03, site 9).

The clay unit ranges in thickness from less than 1 m to 3 m. The contact between the Warman Formation and the clay unit is nonconformable.

The Dalmeny aquifer, named by Meneley (1970), is a major aquifer in Saskatoon-Langham area. The sand in the aquifer ranges in thickness from less than 1 m to 35 m in the study area.

The Floral and Battleford formations are composed of less than 1 m to

18 m of sandy, gypsiferous, brown till which has a mean carbonate content of 29 ± 6 mL CO₂/g. These formations can be separated where hard, jointed, and stained till of the Floral Formation underlies soft, massive, and unstained till of the Battleford Formation. The lower and upper contacts of the Dalmeny aquifer and the contact between the Floral and Battleford formations are all nonconformable. Glaciolacustrine sediments, composed of less than 1 m to 13 m of silt and clay blanket most of the study area. Locally, glaciodeltaic sands up to 3 m thick cover the surface (Drawing 0161-002-02,04; site 2). The lower and upper contacts of the glaciolacustrine sediments are conformable.

3. STRUCTURE

3.1 Bedrock structure

In cross sections A-A' and C-C', the structure marker bed is essentially flat lying. In cross section B-B', the marker bed shows a broad, low anticline with an apparent closure of 20 m and a maximum apparent dip of 2 m/km.

3.2 Glacial structure

Glacial deposits exposed in the gully immediately north of Highway 16 are glacially deformed featuring joints, faults, and folds. The Dalmeny aquifer lies on a glacially eroded surface similar in the Fielding-Radisson area (Christiansen 1995, Drawing 0155-002-02). In Drawing 0161-002-03, the glacially eroded depression cut into the lower till of the Dundurn Formation is filled with sand of the Dalmeny aquifer indicating that the depression is pre-Floral or Floral in age. Presumably, the depression was eroded by the glacier that deposited the upper till of the Floral Formation. It is possible that the deformation in the gully also happened at this time.

4. GROUNDWATER

Saline patches of ground in lower areas which occur along Highway 16 between the Borden bridge and Langham are indicative of high groundwater levels. This relationship was verified by installing a piezometer at site 3 (Drawing 0161-002-02,03) where the water rose in the pipe to 0.8 m below the ground surface (Table 3) indicating that the saline areas are the result of high groundwater levels.

The Dalmeny aquifer is the only known aquifer in the Langham area that could cause these high groundwater levels (Drawing 0161-002-03). The Dalmeny aquifer was traced from site 9 to sites 10 and 11. The northern pinchout of the aquifer is between sites 11 and 14 (Drawing 0161-002-03), the exact location of which is not known. Consequently, another borehole is proposed. The Dalmeny aquifer was not encountered in the six boreholes drilled along Highway 16 in the vicinity of the gully (Drawing 0161-002-01).

The high gypsum content of tills in the Floral and Battleford formations, Warman Formation, and the upper till of the Dundurn Formation probably is the reason for the high electrical conductivity of the groundwater (Table 3). The lowest groundwater levels (Table 3) occur in a sand and gravel unit in the lower till of the Dundurn Formation (Drawings 0161-002-02,03,04). This low water level suggests that the aquifer has continuity to the North Saskatchewan River valley.

5. LITERATURE CITED

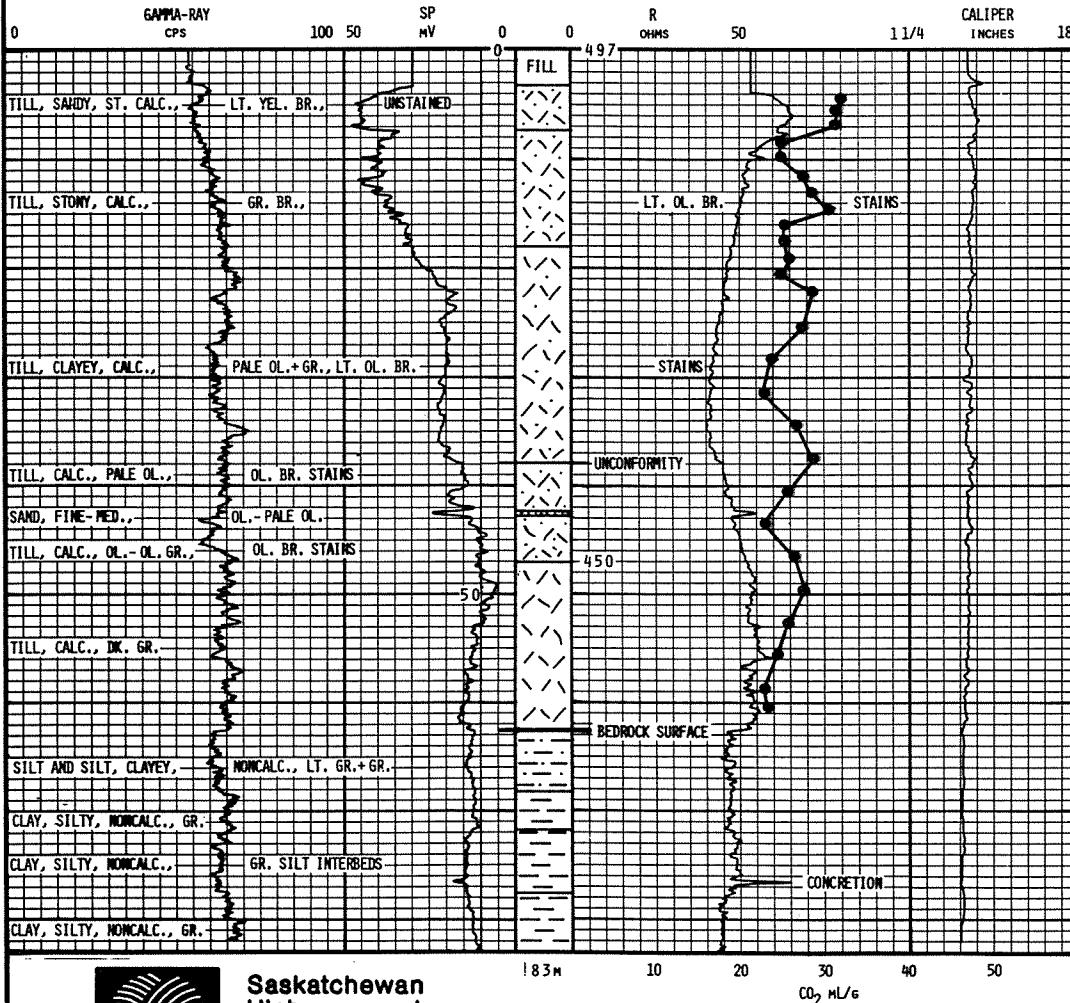
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- Meneley, W.A. 1970. Groundwater resources. In Physical environment of Saskatoon, Canada. Edited by E.A. Christiansen, Saskatchewan Research Council in cooperation with The National Research Council of Canada, NRC Publication number 11378:39-48.
- Sauer, E.K. and Christiansen E.A. 1996. Geological site characterization guidelines. Saskatchewan Environmental Resources Management, Saskatoon.

Appendix A. Geologic logs compiled in this study.

SHT 73B/06 1996
 LANGHAM NO.117
 SE-03-23-39-08-W3
 13:360411E/5803094N
 BOREHOLE

BOREHOLE NO.	117	MTS 73-B/06	PROJECT	LANGHAM
LAND LOCATION	SW-03-23-39-08-W3	CONTROL SECTION	16-23	
UTM COORD.	13:360411E/5803094N	STATION	34+015.46 M.	OFFSET 185.84 M N
GRD. ELEV.	497.371 M	CUTTING SAMPLE INTERVAL	1.5 M	
DATE DRILLED	MAY 22 TO MAY 22 1996	CORE SAMPLE INTERVAL		
COND. WATER	450	FROM		
COND. MUD	1000	CASING DEPTH		
SPECIFIC GRAVITY MUD		CASING WALL THICKNESS		
SUPERVISOR	L. SINCLAIR	WATER OR MUD LEVEL		
ASST SUPERVISOR		ABANDONMENT	GROUTED	
LOGGED BY	L. SINCLAIR	BIT SIZE	4 3/4" HALMAC	INTERVAL 0-83.85 M
INSTRUMENT	WILCO 1500	BIT SIZE		INTERVAL
PROBE ELECTRIC		BIT SIZE		INTERVAL
PROBE GAMMA		TYPE OF DRILL RIG	1250 FAILING	
PROBE CALIPER		DEPTH	SP	SCALE SPEED
DATE LOGGED	MAY 22 1996	SP	83 M	50 mV 15m/min
TIME OF LOGGING	1630 HRS TO 1800 HRS	RES.	83 M	50 ohms 15m/min
DRILL OPERATOR	M. MILLER	GAMMA	82 M	0-100 cps 8m/min
CONTRACTOR		CAL	82 M	1 1/4"-18" 15m/min
REMARKS	ASS'T OPERATOR: M. MINCHUK	GAMMA TIME CONSTANT (T.C.)	5	SECONDS
		GEOLOGY BY	E.A. CHRISTIANSEN	17/08/96

CUTTING SAMPLE DESCRIPTION



Saskatchewan
 Highways and
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SHT 73B/06 1996

LANGHAM NO.118

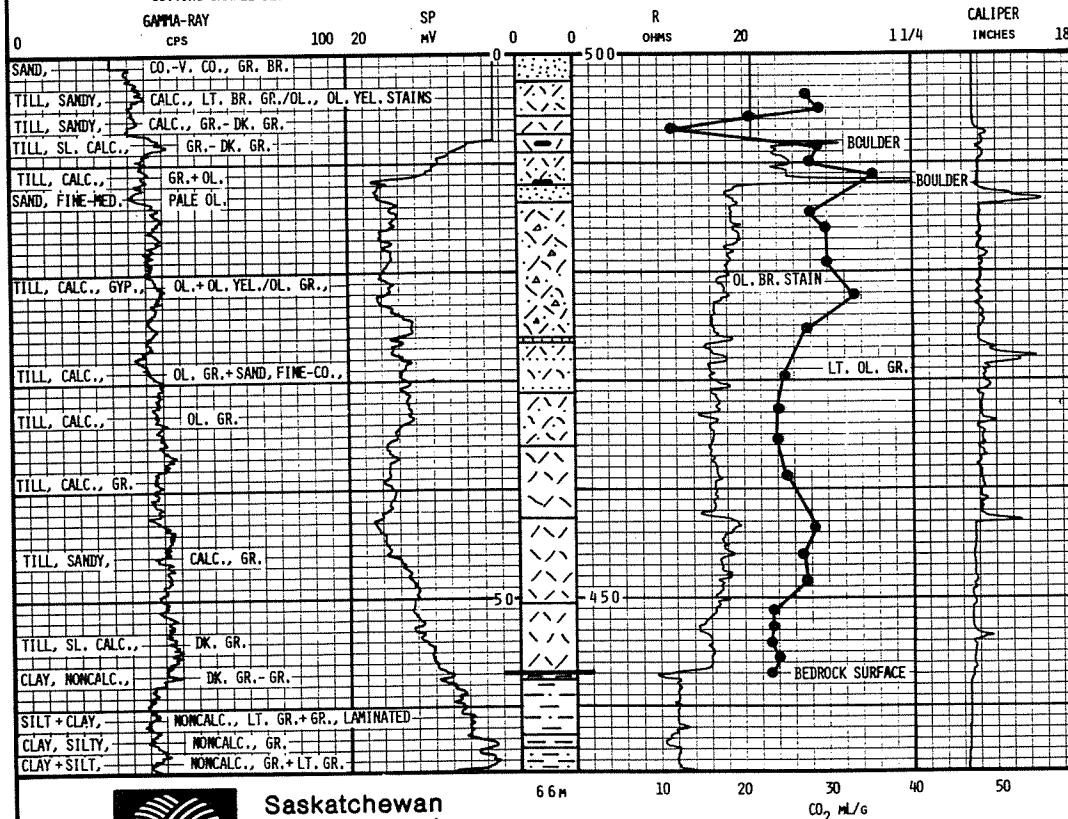
NE-14-15-39-08-W3

13:358958E/5803105N

BOREHOLE

BOREHOLE NO.	118	MTS	73-B/06
LAND LOCATION	NE-14-15-39-08-W3		
UTM COORD.	13:358957, 9779E/5803104, 5557N		
GRD. ELEV.	499.51M	DEPTH	67.05M
DATE DRILLED	JULY 29	TO	JULY 30 1996
COND. WATER	600	MICROSIEMENS/CM AT 25°C	
COND. MUD	2800	MICROSIEMENS/CM AT 25°C	
SPECIFIC GRAVITY MUD			
SUPERVISOR	L. SINCLAIR		
ASST SUPERVISOR			
LOGGED BY	L. SINCLAIR		
INSTRUMENT	WIDCO 1500		
PROBE ELECTRIC			
PROBE GAMMA			
PROBE CALIPER			
DATE LOGGED	JULY 30	1996	
TIME OF LOGGING	1230 HRS TO	1400 HRS	
DRILL OPERATOR	M. MILLER		
CONTRACTOR	M. MINCHUK		
REMARKS			
PROJECT	LANGHAM		
CONTROL SECTION	16-23		
STATION	35+473.88M	OFFSET	32.01M N
CUTTING SAMPLE INTERVAL	1.5M		
CORE SAMPLE INTERVAL			
FROM			
CASING DEPTH			
CASING WALL THICKNESS			
WATER OR MUD LEVEL			
ABANDONMENT			
BIT SIZE	4 3/4" WALMAC	INTERVAL	VARIOUS
BIT SIZE	4 3/4" TRICONE	INTERVAL	VARIOUS
BIT SIZE		INTERVAL	
TYPE OF DRILL RIG	1250 FAILING		
DEPTH		SCALE	SPEED
SP.	66 M	20 MV	15 M/MIN
RES.	66 M	20 OHMS	15 M/MIN
GAMMA	66 M	0-100 CPS	7 M/MIN
CAL	66 M	1 1/4 - 18"	15 M/MIN
GAMMA TIME CONSTANT (T.C.)	5	SECONDS	
GEOLOGY BY	E.A. CHRISTIANSEN		18/08/96

CUTTING SAMPLE DESCRIPTION



Saskatchewan
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SHT 73B/06 1996

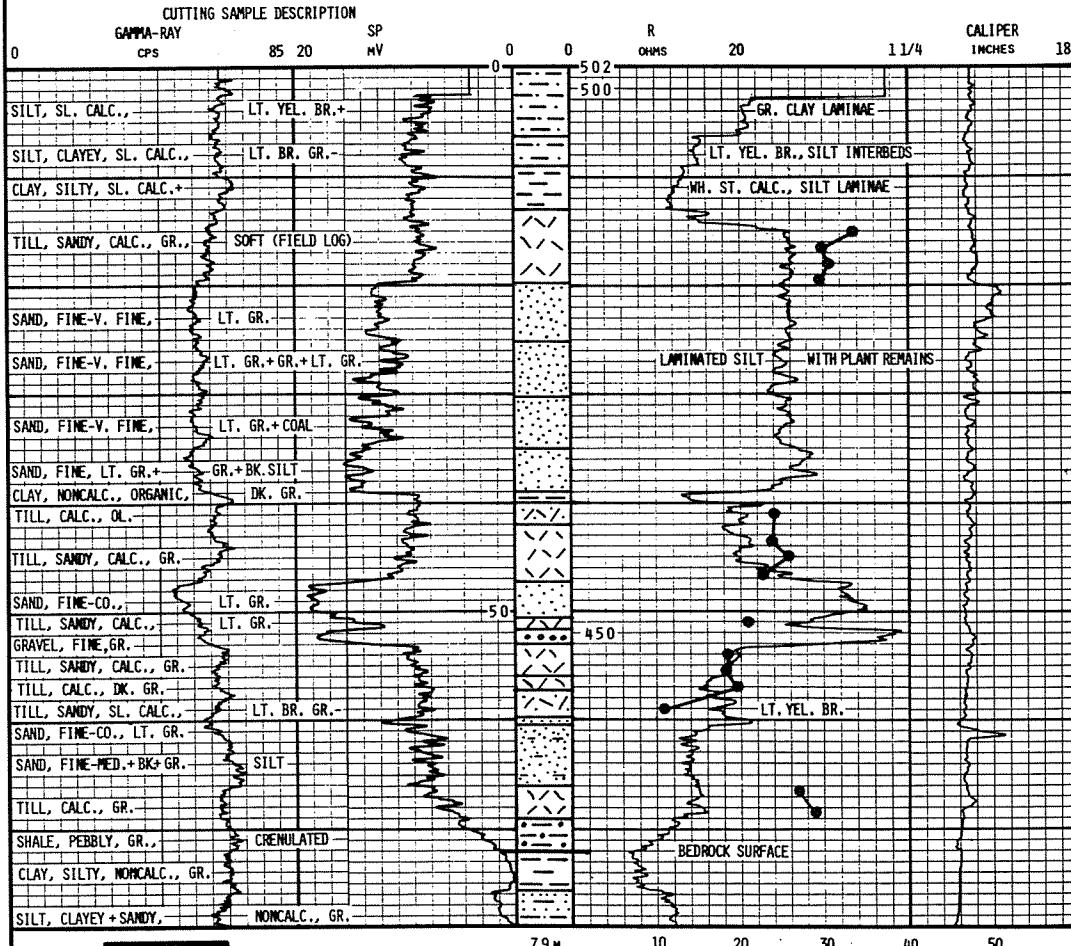
LANGHAM NO.119

SE-01-10-39-08-W3

13:359681E/5799896N

BOREHOLE

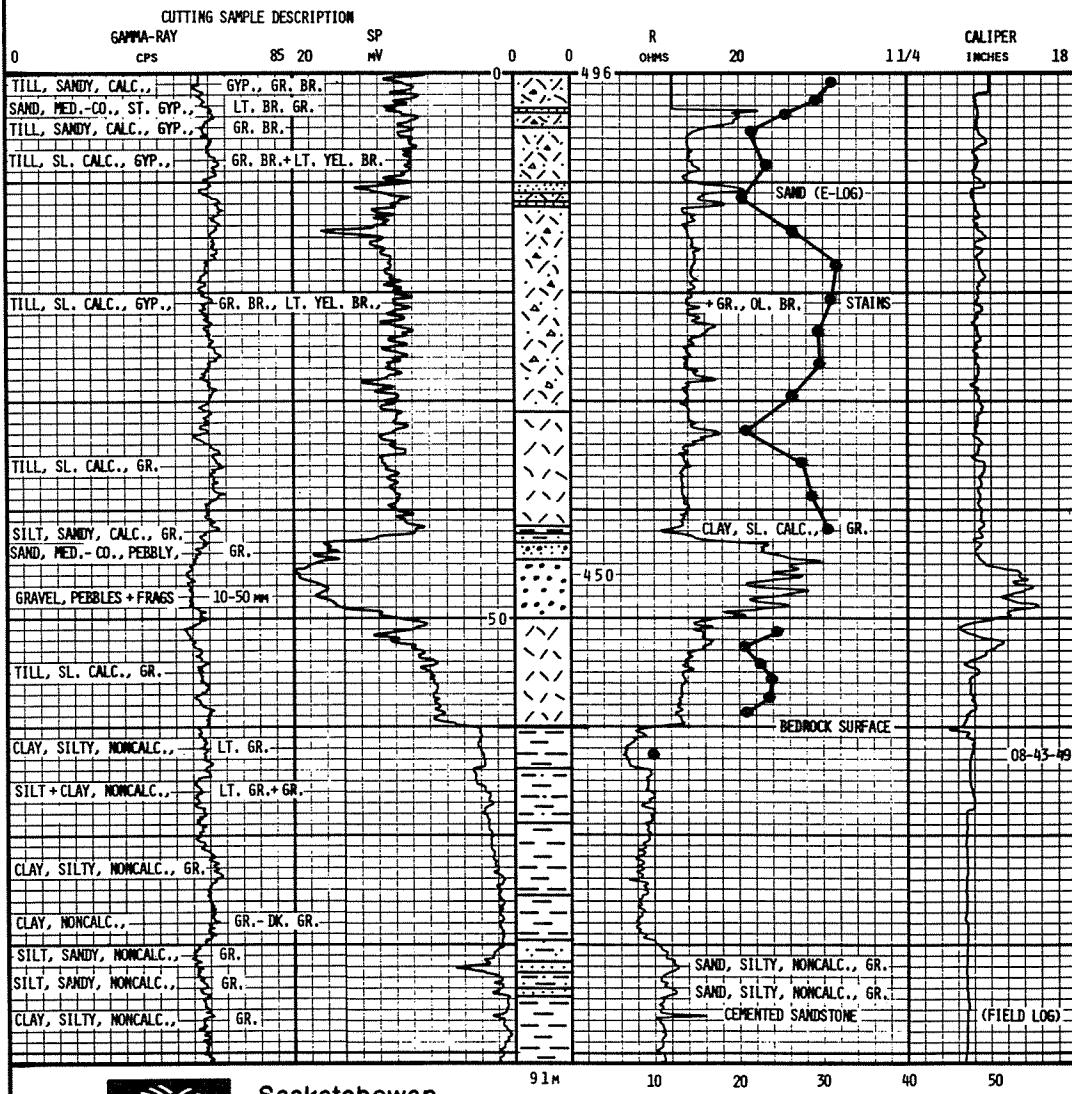
BOREHOLE NO.	119	NTS	73-B/06
LAND LOCATION	SE-01-10-39-08-W3		
UTM COORD.	13-359680, 5918E/5799895, 7077N		
GRD. ELEV.	501.911 M	DEPTH	79.25 M
DATE DRILLED	JULY 30	TO	JULY 30, 1996
COND. WATER	600	MICROSIEMENS/CM AT 25°C	
COND. MUD	2700	MICROSIEMENS/CM AT 25°C	
SPECIFIC GRAVITY MUD			
SUPERVISOR	L. SINCLAIR		
ASST SUPERVISOR			
LOGGED BY	L. SINCLAIR		
INSTRUMENT	WIDCO 1500		
PROBE ELECTRIC			
PROBE GAMMA			
PROBE CALIPER			
DATE LOGGED	JULY 30	1996	
TIME OF LOGGING	1200 HRS.	TO	1330 HRS.
DRILL OPERATOR	M. MINCHUK		
CONTRACTOR			
REMARKS	ASS'T OPERATOR: M. MILLER		
<hr/>			
PROJECT	LANGHAM		
CONTROL SECTION	16-23		
STATION	34+376.88 M	OFFSET	3067.41 M
CUTTING SAMPLE INTERVAL	1.5 M		
CORE SAMPLE INTERVAL			
FROM			
CASING DEPTH			
CASING WALL THICKNESS			
WATER OR MUD LEVEL			
ABANDONMENT	POST IN HOLE		
BIT SIZE	4 3/4" WALMAC	INTERVAL	0-79.25 M
BIT SIZE		INTERVAL	
BIT SIZE		INTERVAL	
TYPE OF DRILL RIG	1250 FAILING		
DEPTH	SCALE	SPEED	
SP.	79 M	20 MV	15 M/MIN
RES.	79 M	20 OHMS	15 M/MIN
GAMMA	79 M	0-85 CPS	8 M/MIN
CAL	79 M	1 1/4 - 18"	15 M/MIN
<hr/>			
GAMMA TIME CONSTANT (T.C.) 5 SECONDS			
GEOLOGY BY E.A. CHRISTIANSEN 18/08/96			



Saskatchewan
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SHT 73B/06 1996
 LANGHAM NO.120
 NW-13-14-39-08-W3
 13:359902E/5802964N
 BOREHOLE

BOREHOLE NO.	120	MTS	73-B/06
LAND LOCATION	NW-13-14-39-08-W3		
UTM COORD	13:359901.6739E/5802963.7621N		
GRD. ELEV.	496.465 M	DEPTH	91.45 M
DATE DRILLED	JULY 30 TO AUG. 1	1996	
COND. WATER	600	MICROSIEMENS/CM AT 25°C	
COND. MUD	2600	MICROSIEMENS/CM AT 25°C	
SPECIFIC GRAVITY MUD			
SUPERVISOR	L. SINCLAIR		
ASST SUPERVISOR			
LOGGED BY	L. SINCLAIR		
INSTRUMENT	WIDCO 1500		
PROBE ELECTRIC			
PROBE GAMMA			
PROBE CALIPER			
DATE LOGGED	AUGUST 1	1996	
TIME OF LOGGING	1330 HRS TO 1500 HRS		
DRILL OPERATOR	M. BLENCHUK		
CONTRACTOR	ASS'T OPERATOR: M. MILLER		
REMARKS			
PROJECT	LANGHAM		
CONTROL SECTION	16-23		
STATION	34+520.12 M	OFFSET	5.05 M N
CUTTING SAMPLE INTERVAL		1.5 M	
CORE SAMPLE INTERVAL			
FROM			
CASING DEPTH			
CASING WALL THICKNESS			
WATER OR MUD LEVEL			
ABANDONMENT	POST IN HOLE		
BIT SIZE 4 3/4"	HALMAC	INTERVAL	VARIOUS
BIT SIZE 4 3/4"	TRICONE	INTERVAL	VARIOUS
BIT SIZE		INTERVAL	
TYPE OF DRILL RIG	1250 FAILING		
DEPTH	SCALE	SPEED	
SP.	91 M	20 MV	15 M/MIN
RES.	91 M	20 OHMS	15 M/MIN
GAMMA	91 M	0-85 CPS	8 M/MIN
CAL.	91 M	11 1/4-18"	15 M/MIN
GAMMA TIME CONSTANT (T.C.)	5	SECONDS	
GEOLOGY BY	E.A. CHRISTIANSEN	18/08/96	

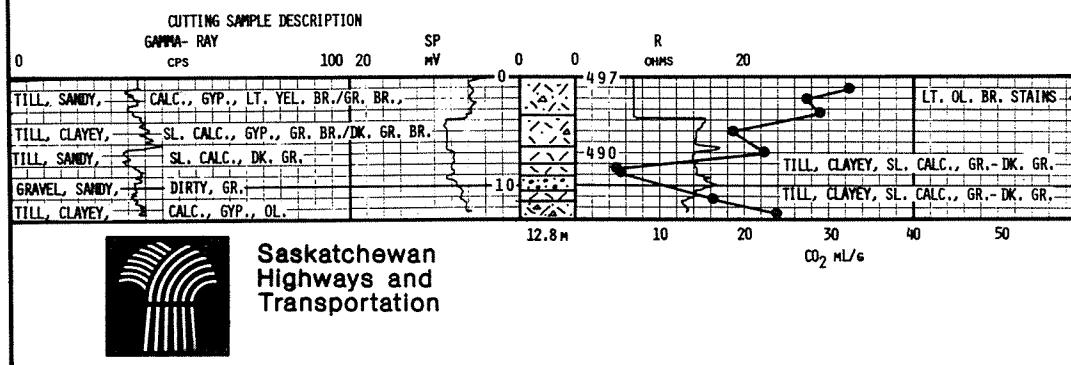


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08-43-96-8% SAND, 43% SILT, 49% CLAY

SHT 73B/06 1996
 LANGHAM NO.121
 SE-02-22-39-08-W3
 13:359198E/5803151N
BOREHOLE

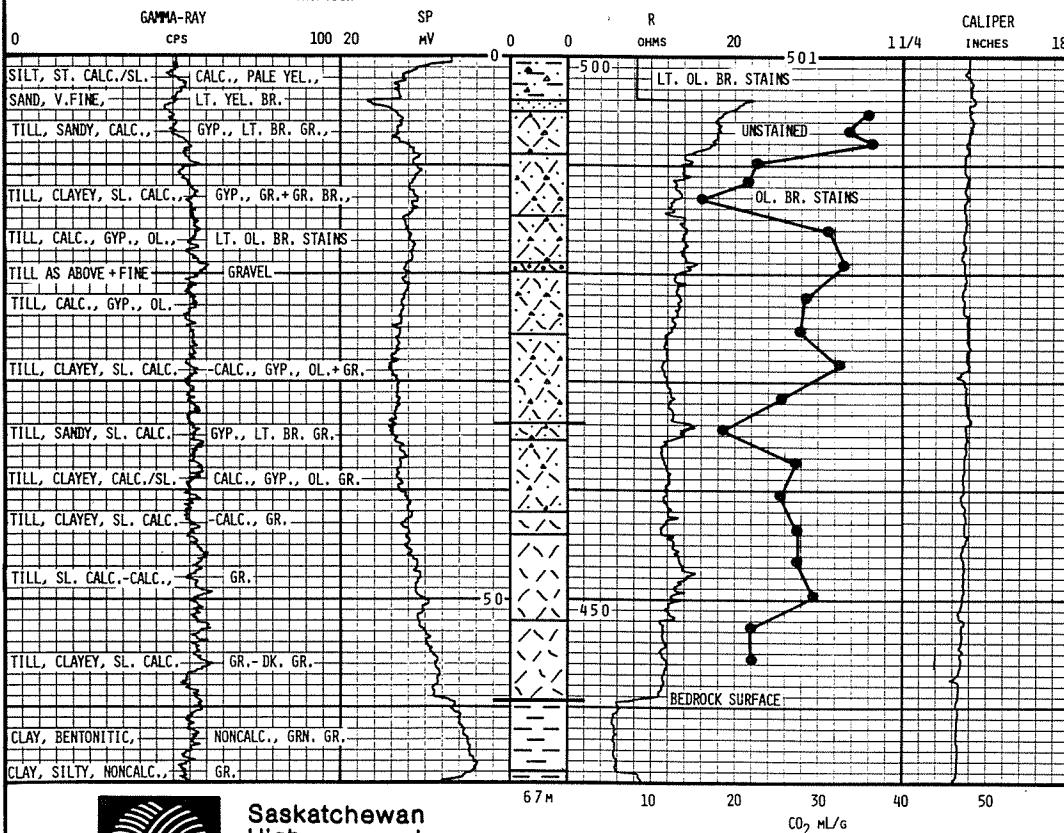
BOREHOLE NO.	121	MTS	73-B/06	PROJECT	LANGHAM		
LAND LOCATION	SE-02-22-39-08-W3			CONTROL SECTION	16-23		
UTM COORD.	13:359198.2888E/5803150.86827N			STATION	35+240.83 M		
GRD. ELEV.	496.77 M	DEPTH	12.8 M	OFFSET	106.72 M		
DATE DRILLED	AUG. 12 TO AUG. 13	1996		CUTTING SAMPLE INTERVAL	1.5 M		
COND. WATER	600	MICROSIEMENS/CM AT 25°C		CORE SAMPLE INTERVAL			
COND. MUO	3200	MICROSIEMENS/CM AT 25°C		FROM			
SPECIFIC GRAVITY MUO				CASING DEPTH			
SUPERVISOR	L. SINCLAIR			CASING WALL THICKNESS			
ASST SUPERVISOR	L. SINCLAIR			WATER OR MUD LEVEL			
LOGGED BY	L. SINCLAIR			ABANDONMENT	STANDPIPE INSTALLED		
INSTRUMENT	WIDCO 1500			BIT SIZE	4 3/4" WALMAC INTERVAL 0-12.8 M		
PROBE ELECTRIC				BIT SIZE			
PROBE GAMMA				BIT SIZE			
PROBE CALIPER				TYPE OF DRILL RIG	1250 FAILING		
DATE LOGGED	AUGUST 13	1996		DEPTH	SCALE	SPEED	
TIME OF LOGGING	0930 HRS TO 1030 HRS			SP.	12.3 M	20 MV	15 M/MIN
DRILL OPERATOR	M. MILLER			RES.	12.3 M	20 OHMS	15 M/MIN
CONTRACTOR	ASS'T OPERATOR: M. MINCHUK			GAMMA	12.8 M	0-85 CPS	8 M/MIN
REMARKS				CAL			
				GAMMA TIME CONSTANT (T.C.)	5	SECONDS	
				GEOLOGY BY	E.A. CHRISTIANSEN	18/08/96	



SHT 73B/06 1996
 LANGHAM NO.122
 SW-13-14-39-08-W3
 13:359784E/5802814N
 BOREHOLE

BOREHOLE NO.	122	NTS	73-B/06	PROJECT	LANGHAM		
LAND LOCATION	SH-13-14-39-08-W3			CONTROL SECTION	16-23		
UTM COORD.	13:359783.748E/5802813.893N			STATION	OFFSET		
GRD. ELEV.	501.135 M.	DEPTH	67.05 M	CUTTING SAMPLE INTERVAL	1.5 M		
DATE DRILLED	AUG. 27	TO	AUG. 27	1996	CORE SAMPLE INTERVAL		
COND. WATER	600	MICROSIEMENS/CM AT 25°C		FROM			
COND. MUD	3500	MICROSIEMENS/CM AT 25°C		CASING DEPTH			
SPECIFIC GRAVITY MUD				CASING WALL THICKNESS			
SUPERVISOR	L. SINCLAIR			WATER OR MUD LEVEL			
ASST SUPERVISOR				ABANDONMENT	GROUTED		
LOGGED BY	L. SINCLAIR			BIT SIZE	4 3/4" WALMAC		
INSTRUMENT	WIDCO 1500			INTERVAL	0-67.05 M		
PROBE ELECTRIC				BIT SIZE			
PROBE GAMMA				INTERVAL			
PROBE CALIPER				BIT SIZE			
DATE LOGGED	AUGUST 27	1996		TYPE OF DRILL RIG	1250 FAILING		
TIME OF LOGGING	1700 HRS	TO	1830 HRS	DEPTH	SCALE	SPEED	
DRILL OPERATOR	M. MILLER			SP.	67 M	20 mV	15 M/MIN
CONTRACTOR				RES.	67 M	20 OHMS	15 M/MIN
REMARKS	ASS'T OPERATOR: T. GELECH			GAMMA	67 M	0-100 CPS	8 M/MIN
				CAL	67 M	1 1/4-18"	15 M/MIN
				GAMMA TIME CONSTANT (C.C.)	5	SECONDS	
				GEOLOGY BY	E.A. CHRISTIANSEN	11/09/96	

CUTTING SAMPLE DESCRIPTION

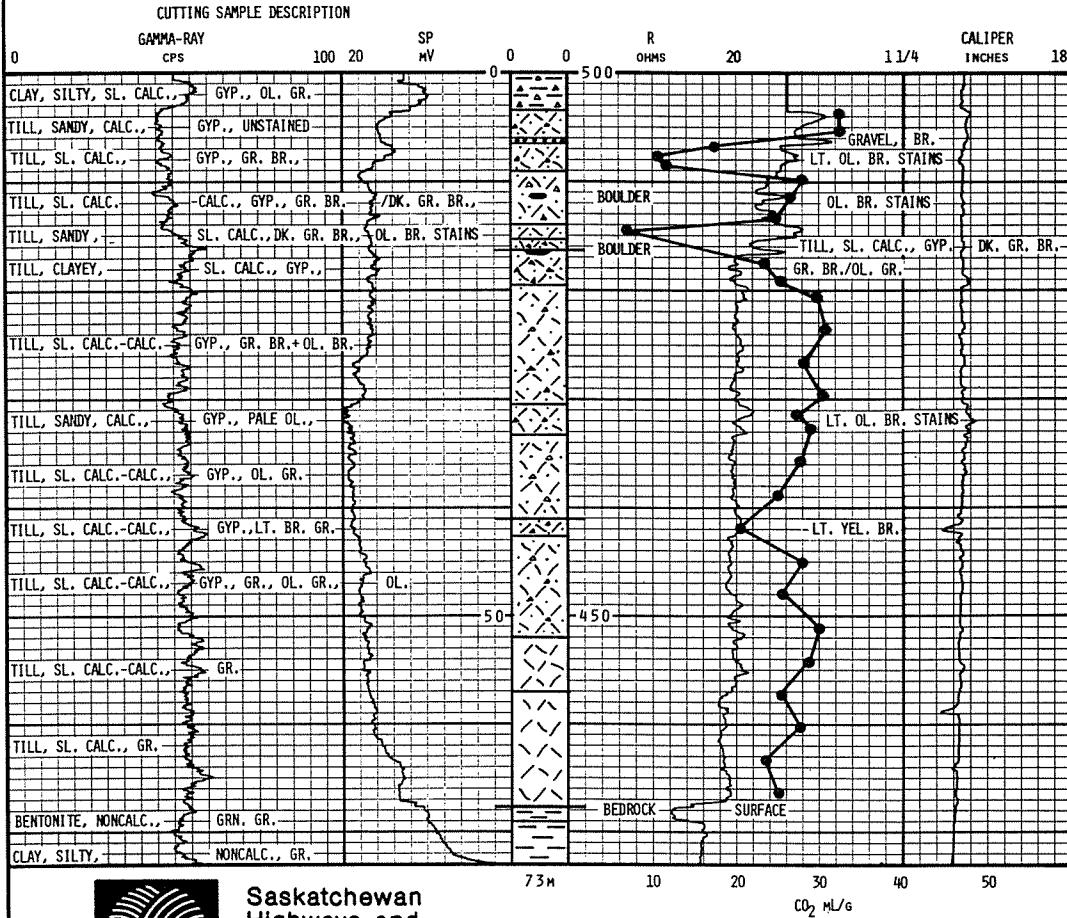


Saskatchewan
 Highways and
 Transportation

SHT 73B/06 1996
 LANGHAM NO.123
 NE-16-15-39-08-W3
 13:359591E/5802922N
 BOREHOLE

BOREHOLE NO.	123	MTS	73-B/06
LAND LOCATION	NE-16-15-39-08-W3		
UTM COORD.	13:359591E/5802922, 185M		
GRD. ELEV.	500.226 M	DEPTH	73.15 M
DATE DRILLED	AUG. 28 TO AUG. 28, 1996		
COND. WATER	600	MICROSIEMENS/CM AT 25°C	
COND. MUD	2600	MICROSIEMENS/CM AT 25°C	
SPECIFIC GRAVITY MUD			
SUPERVISOR	L. SINCLAIR		
ASST SUPERVISOR			
LOGGED BY	L. SINCLAIR		
INSTRUMENT	WIDCO 1500		
PROBE ELECTRIC			
PROBE GAMMA			
PROBE CALIPER			
DATE LOGGED	AUGUST 28	1996	
TIME OF LOGGING	1530 HRS	TO	1630 HRS
DRILL OPERATOR	M. MILLER		
CONTRACTOR			
REMARKS	ASS'T OPERATOR: T. GELECH		

PROJECT	LANGHAM		
CONTROL SECTION	16-23		
STATION	34+823.422 M OFFSET 73,344 M SOUTH		
CUTTING SAMPLE INTERVAL	1.5 M		
CORE SAMPLE INTERVAL			
FROM			
CASING DEPTH			
CASING WALL THICKNESS			
WATER OR MUD LEVEL			
ABANDONMENT	GROUTED		
BIT SIZE	4 3/4" WALMAC		
INTERVAL	0-73.15 M		
BIT SIZE			
INTERVAL			
BIT SIZE			
INTERVAL			
TYPE OF DRILL RIG	1250 FAILING		
DEPTH	SCALE	SPEED	
SP.	73 M	20 MV	15 M/MIN
RES.	73 M	20 OHMS	15 M/MIN
GAMMA	73 M	0-100 CPS	8 M/MIN
CAL	73 M	1 1/4-18"	15 M/MIN
GAMMA TIME CONSTANT (C.C.)		5 SECONDS	
GEOLOGY BY E.A. CHRISTIANSEN 11/09/96			



Saskatchewan
Highways and
Transportation

Appendix B. Carbonate content of tills, particle size analysis of bedrock, and X-ray diffraction analysis of bentonite.

SASKATCHEWAN RESEARCH COUNCIL GEOCHEMICAL LAB

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SHT LANGHAM 117 BOREHOLE

M323 E.A. CHRISTIANSEN AUG. 1/96 (28) PG. 2373 [0.5 GM BR DIG.]

1 %Ca BY AA OT96.71

2 %Mg BY AA

3 Wt% DOLOMITE=COL.2*7.5852

4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973

5 TOTAL Wt% CO₃ (COL.3+COL.4)

6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)

7 CO₂ FROM CALCITE=COL.4*2.2388 CO₂ FROM DOLOMITE=COL.3*2.4299 TOTAL CO₂=COL.7+COL.8

	DEPTH m	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
BR2		5.02	1.46	11.07	6.53	17.60	1.70	14.60	26.90	41.50
LS6 670	4.3	3.56	1.31	9.94	3.50	13.43	2.84	7.83	24.14	31.96
LS6 671	5.3	3.53	1.26	9.56	3.63	13.19	2.63	8.12	23.21	31.33
LS6 672	6.9	3.52	1.27	9.63	3.56	13.20	2.70	7.97	23.40	31.37
LS6 673	8.4	2.88	0.95	7.21	3.28	10.49	2.20	7.34	17.50	24.85
LS6 674	9.9	2.63	1.08	8.19	2.12	10.31	3.86	4.75	19.90	24.65
LS6 675	11.4	3.13	1.10	8.34	3.29	11.63	2.54	7.36	20.27	27.62
LS6 676	13.0	3.46	0.99	7.51	4.56	12.07	1.65	10.22	18.24	28.46
LS6 677	14.5	3.75	1.04	7.89	5.08	12.97	1.55	11.38	19.16	30.54
LS6 678	16.0	3.15	0.86	6.52	4.33	10.85	1.51	9.68	15.85	25.53
LS6 679	17.5	3.10	0.88	6.67	4.12	10.79	1.62	9.22	16.21	25.43
LS6 680	19.1	3.16	0.90	6.83	4.19	11.01	1.63	9.37	16.58	25.95
LS6 681	20.6	2.98	0.89	6.75	3.78	10.53	1.79	8.45	16.40	24.85
LS6 682	22.1	3.51	0.96	7.28	4.81	12.09	1.51	10.77	17.69	28.46
LS6 684	25.2	3.38	0.95	7.21	4.53	11.74	1.59	10.14	17.50	27.64
LS6 686	28.2	2.83	0.88	6.67	3.44	10.12	1.94	7.71	16.21	23.92
LS6 688	31.3	2.73	0.83	6.30	3.40	9.70	1.85	7.61	15.29	22.90
LS6 690	34.3	3.13	1.01	7.66	3.66	11.32	2.09	8.19	18.61	26.80
LS6 692	37.4	3.39	1.06	8.04	4.10	12.14	1.96	9.18	19.53	28.71
LS6 694	40.4	3.11	0.91	6.90	4.02	10.92	1.72	9.00	16.77	25.76
BR2		5.09	1.55	11.76	6.33	18.09	1.86	14.17	28.56	42.72
LS6 696	43.5	2.74	0.82	6.22	3.47	9.69	1.79	7.76	15.11	22.87
LS6 698	46.5	3.26	0.88	6.67	4.52	11.19	1.48	10.11	16.21	26.33
LS6 700	49.6	3.33	0.98	7.43	4.28	11.71	1.74	9.58	18.06	27.64
LS6 702	52.6	3.09	0.93	7.05	3.89	10.94	1.81	8.70	17.13	25.84
LS6 704	55.6	3.02	0.80	6.07	4.25	10.32	1.43	9.51	14.74	24.25
LS6 706	58.7	2.90	0.73	5.54	4.24	9.77	1.31	9.48	13.45	22.93
LS6 707	60.2	2.98	0.73	5.54	4.44	9.97	1.25	9.93	13.45	23.38

REPORT

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SHT LANGHAM 118

M333 E.A. CHRISTIANSEN AUG. 13/96 (26) PG. 2422 [0.5 GM BR DIG.]
 1 %Ca BY AA OT96.75

2 %Mg BY AA

3 Wt% DOLOMITE=COL.2*7.5852

4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973

5 TOTAL Wt% CO3 (COL.3+COL.4)

6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)

7 CO2 FROM CALCITE=COL.4*2.238

8 CO2 FROM DOLOMITE=COL.3*2.429

9 TOTAL CO2=COL.7+COL.8

	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
BR2	5.00	1.55	11.76	6.11	17.86	1.93	13.66	28.56	42.22
LS6 1005-3.8m	2.95	1.19	9.03	2.47	11.49	3.66	5.52	21.93	27.45
LS6 1006-5.0m	3.03	1.30	9.86	2.21	12.08	4.45	4.96	23.95	28.91
LS6 1006-5.8m	2.24	0.89	6.75	1.93	8.68	3.50	4.32	16.40	20.72
LS6 1007-6.9m	1.27	0.48	3.64	1.20	4.84	3.05	2.68	8.84	11.52
LS6 1008-8.4m	3.26	1.14	8.65	3.45	12.09	2.51	7.72	21.00	28.72
LS6 1009-9.9m	3.24	1.07	8.12	3.69	11.80	2.20	8.25	19.71	27.96
LS6 1010-11.0m	3.85	1.53	11.61	3.32	14.92	3.50	7.42	28.19	35.61
LS6 1011-14.5m	3.47	0.94	7.13	4.80	11.93	1.49	10.73	17.32	28.05
LS6 1013-16.0m	3.63	1.04	7.89	4.78	12.67	1.65	10.71	19.16	29.87
LS6 1015-19.1m	3.71	1.01	7.66	5.11	12.77	1.50	11.43	18.61	30.04
LS6 1017-22.1m	4.39	0.94	7.13	7.09	14.22	1.01	15.87	17.32	33.19
LS6 1019-25.2m	3.42	0.92	6.98	4.75	11.73	1.47	10.64	16.95	27.59
LS6 1022-29.7m	2.99	0.89	6.75	3.80	10.55	1.78	8.51	16.40	24.91
LS6 1024-32.8m	2.90	0.85	6.45	3.74	10.19	1.72	8.38	15.66	24.04
LS6 1026-35.5m	2.86	0.87	6.60	3.56	10.16	1.85	7.97	16.03	24.00
LS6 1028-38.9m	3.07	0.85	6.45	4.17	10.61	1.55	9.33	15.66	24.99
LS6 1030-41.9m	3.54	0.93	7.05	5.01	12.07	1.41	11.22	17.13	28.35
LS6 1032-45.0m	3.25	0.95	7.21	4.21	11.41	1.71	9.41	17.50	26.91
LS6 1034-48.0m	3.33	0.95	7.21	4.40	11.61	1.64	9.86	17.50	27.36
BR2	5.18	1.53	11.61	6.64	18.24	1.75	14.85	28.19	43.04
LS6 1036-51.1m	2.93	0.78	5.92	4.11	10.02	1.44	9.19	14.37	23.56
LS6 1037-52.6m	3.03	0.72	5.46	4.60	10.06	1.19	10.30	13.27	23.57
LS6 1038-54.1m	3.04	0.68	5.16	4.79	9.95	1.08	10.72	12.53	23.25
LS6 1039-55.6m	3.04	0.76	5.76	4.46	10.23	1.29	9.99	14.00	23.99
LS6 1040-57.2m	3.00	0.70	5.31	4.61	9.92	1.15	10.32	12.90	23.21

REPORT

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SHT LANGHAM 119

M334 E.A. CHRISTIANSEN AUG. 13/96 (17) PG. 2423 [0.5 GM BR DIG.]

1 %Ca BY AA OT96.76
 2 %Mg BY AA
 3 Wt% DOLOMITE=COL.2*7.5852
 4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973
 5 TOTAL Wt% CO₃ (COL.3+COL.4)
 6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)
 7 CO₂ FROM CALCITE=COL.4*2.238
 8 CO₂ FROM DOLOMITE=COL.3*2.429
 9 TOTAL CO₂=COL.7+COL.8

	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
BR2	5.15	1.54	11.68	6.52	18.20	1.79	14.59	28.37	42.97
LS6 1056-14.5m	3.79	1.35	10.24	3.91	14.15	2.62	8.74	24.87	33.62
LS6 1057-16.0m	3.36	1.21	9.18	3.41	12.59	2.69	7.63	22.29	29.92
LS6 1058-17.5m	3.42	1.24	9.41	3.44	12.84	2.74	7.69	22.85	30.54
LS6 1059-19.1m	3.33	1.18	8.95	3.46	12.41	2.59	7.74	21.74	29.48
LS6 1074-41.0m	2.99	0.80	6.07	4.17	10.24	1.45	9.34	14.74	24.08
LS6 1075-43.5m	2.60	1.02	7.74	2.29	10.03	3.37	5.13	18.79	23.93
LS6 1076-45.0m	2.91	1.05	7.96	2.94	10.91	2.71	6.59	19.35	25.93
LS6 1077-46.5m	2.53	1.01	7.66	2.16	9.82	3.55	4.83	18.61	23.44
LS6 1078-47.4m	2.41	0.97	7.36	2.02	9.38	3.63	4.53	17.87	22.40
LS6 1080-51.0m	2.45	0.78	5.92	2.91	8.82	2.04	6.51	14.37	20.88
LS6 1082-54.1m	1.92	0.83	6.30	1.38	7.67	4.57	3.08	15.29	18.38
LS6 1083-56.4m	2.05	0.74	5.61	2.07	7.69	2.71	4.64	13.63	18.27
LS6 1084-57.0m	2.16	0.83	6.30	1.98	8.27	3.18	4.42	15.29	19.72
LS6 1085-58.7m	1.17	0.48	3.64	0.95	4.59	3.85	2.12	8.84	10.96
LS6 1090-66.6m	3.18	1.01	7.66	3.78	11.44	2.03	8.47	18.61	27.08
LS6 1091-67.4m	3.31	1.13	8.57	3.61	12.19	2.37	8.09	20.82	28.91

REPORT

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SHT LANGHAM 120

M335 E.A. CHRISTIANSEN AUG. 13/96 (25) PG. 2424 [0.5 GM REG. DIG.]
 1 %Ca BY AA OT96.77

2 %Mg BY AA

3 Wt% DOLOMITE=COL.2*7.5852

4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973

5 TOTAL Wt% CO3 (COL.3+COL.4)

6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)

7 CO2 FROM CALCITE=COL.4*2.238

8 CO2 FROM DOLOMITE=COL.3*2.429

9 TOTAL CO2=COL.7+COL.8

	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
BR2	5.03	1.53	11.61	6.26	17.87	1.85	14.02	28.19	42.20
LS6 1099-0.8m	3.40	1.34	10.16	2.97	13.14	3.42	6.66	24.69	31.34
LS6 1100-2.3m	3.10	1.30	9.86	2.39	12.25	4.13	5.35	23.95	29.30
LS6 1101-3.8m	2.78	1.11	8.42	2.37	10.79	3.55	5.31	20.45	25.76
LS6 1102-5.3m	2.28	0.95	7.21	1.78	8.99	4.04	3.99	17.50	21.49
LS6 1104-8.4m	2.61	0.95	7.21	2.61	9.81	2.76	5.83	17.50	23.34
LS6 1106-11.4m	2.29	0.82	6.22	2.34	8.56	2.65	5.24	15.11	20.35
LS6 1108-14.5m	3.16	0.94	7.13	4.02	11.15	1.77	9.00	17.32	26.32
LS6 1110-17.5m	3.88	1.09	8.27	5.20	13.47	1.59	11.64	20.08	31.72
LS6 1112-20.6m	4.01	0.92	6.98	6.23	13.20	1.12	13.93	16.95	30.89
LS6 1114-23.6m	3.59	1.04	7.89	4.68	12.57	1.68	10.48	19.16	29.64
LS6 1116-26.7m	3.69	0.96	7.28	5.26	12.54	1.38	11.78	17.69	29.47
LS6 1118-29.7m	3.28	0.84	6.37	4.73	11.10	1.35	10.59	15.48	26.07
LS6 1120-32.8m	2.48	0.75	5.69	3.11	8.79	1.83	6.95	13.82	20.77
LS6 1122-35.8m	3.29	0.98	7.43	4.18	11.61	1.78	9.36	18.06	27.41
LS6 1124-38.9m	3.49	0.97	7.36	4.72	12.08	1.56	10.57	17.87	28.44
LS6 1126-41.9m	3.81	1.01	7.66	5.36	13.02	1.43	11.99	18.61	30.60
LS6 1132-51.1m	3.04	0.79	5.99	4.34	10.33	1.38	9.71	14.56	24.27
LS6 1133-52.6m	2.66	0.62	4.70	4.09	8.79	1.15	9.15	11.42	20.58
LS6 1134-54.1m	2.91	0.65	4.93	4.59	9.52	1.07	10.27	11.98	22.25
BR2	5.19	1.53	11.61	6.66	18.27	1.74	14.91	28.19	43.10
LS6 1135-55.6m	3.09	0.72	5.46	4.75	10.21	1.15	10.64	13.27	23.90
LS6 1136-57.2m	3.01	0.73	5.54	4.51	10.05	1.23	10.10	13.45	23.55
LS6 1137-58.7m	2.58	0.68	5.16	3.64	8.80	1.42	8.15	12.53	20.68
LS6 1139-61.8m	1.00	0.47	3.57	0.56	4.13	6.34	1.26	8.66	9.92

REPORT

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SHT LANGHAM #121

M357 E.A. CHRISTIANSEN AUG. 20/96 (10) PG. 2495 [0.5 GM BR DIG]

1 %Ca BY ICP OT96.89

2 %Mg BY ICP

3 Wt% DOLOMITE=COL.2*7.5852

4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973

5 TOTAL Wt% CO₃ (COL.3+COL.4)

6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)

7 CO₂ FROM CALCITE=COL.4*2.2388 CO₂ FROM DOLOMITE=COL.3*2.4299 TOTAL CO₂=COL.7+COL.8

	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
BR2	5.21	1.57	11.91	6.55	18.46	1.82	14.65	28.93	43.58
LS6 1159-1.1m	3.50	1.39	10.54	3.02	13.56	3.49	6.75	25.61	32.36
LS6 1160-2.3m	2.93	1.20	9.10	2.38	11.48	3.83	5.32	22.11	27.43
LS6 1161-3.8m	3.31	1.16	8.80	3.49	12.29	2.52	7.81	21.37	29.18
LS6 1162-5.6m	1.96	0.83	6.30	1.48	7.77	4.26	3.31	15.29	18.60
LS6 1163-6.9m	2.50	0.91	6.90	2.50	9.40	2.76	5.59	16.77	22.35
LS6 1164-8.4m	0.45	0.28	2.12	-0.03	2.09	-73.27	-0.06	5.16	5.09
LS6 1165-9.9m	0.50	0.31	2.35	-0.03	2.32	-85.09	-0.06	5.71	5.65
LS6 1166-11.1m	1.79	0.68	5.16	1.67	6.83	3.09	3.74	12.53	16.27
LS6 1167-12.5m	3.04	0.75	5.69	4.50	10.19	1.26	10.08	13.82	23.90

REPORT

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SHT LANGHAM 122

M420 E. A. CHRISTIANSEN SEPT 9/96 (22) PG. 2598 [CA/MG DIG]
 1 %Ca BY ICP OT96.111

- 2 %Mg BY ICP
- 3 Wt% DOLOMITE=COL.2*7.5852
- 4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973
- 5 TOTAL Wt% CO₃ (COL.3+COL.4)
- 6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)
- 7 CO₂ FROM CALCITE=COL.4*2.238
- 8 CO₂ FROM DOLOMITE=COL.3*2.429
- 9 TOTAL CO₂=COL.7+COL.8

	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
BR2	5.21	1.53	11.61	6.71	18.32	1.73	15.02	28.19	43.21
LS6 1171-5.3m	4.07	1.44	10.92	4.24	15.16	2.58	9.48	26.53	36.01
LS6 1172-6.9m	3.83	1.34	10.16	4.05	14.21	2.51	9.06	24.69	33.75
LS6 1173-8.0m	4.27	1.33	10.09	5.19	15.28	1.94	11.61	24.50	36.11
LS6 1174-9.9m	2.43	0.96	7.28	2.12	9.40	3.44	4.74	17.69	22.42
LS6 1175-11.4m	2.52	0.83	6.30	2.88	9.17	2.19	6.44	15.29	21.73
LS6 1176-13.0m	1.81	0.64	4.85	1.89	6.74	2.58	4.22	11.79	16.01
LS6 1178-16.0m	4.03	0.94	7.13	6.19	13.32	1.15	13.86	17.32	31.18
LS6 1180-19.1m	4.23	1.02	7.74	6.36	14.10	1.22	14.24	18.79	33.04
LS6 1182-22.1m	3.53	0.95	7.21	4.90	12.11	1.47	10.98	17.50	28.48
LS6 1184-25.2m	3.43	0.94	7.13	4.70	11.83	1.52	10.51	17.32	27.83
LS6 1186-28.2m	3.95	1.11	8.42	5.29	13.71	1.59	11.85	20.45	32.30
LS6 1188-31.3m	3.15	0.88	6.67	4.24	10.92	1.57	9.50	16.21	25.71
LS6 1190-34.3m	2.23	0.66	5.01	2.85	7.86	1.76	6.38	12.16	18.54
LS6 1192-37.4m	3.29	0.97	7.36	4.22	11.58	1.74	9.45	17.87	27.32
LS6 1194-40.4m	3.09	0.91	6.90	3.97	10.87	1.74	8.89	16.77	25.65
LS6 1196-43.5m	3.45	0.90	6.83	4.91	11.74	1.39	10.99	16.58	27.57
LS6 1198-46.5m	3.38	0.95	7.21	4.53	11.74	1.59	10.14	17.50	27.64
LS6 1200-49.6m	3.68	0.96	7.28	5.24	12.52	1.39	11.72	17.69	29.41
LS6 1202-52.6m	2.81	0.69	5.23	4.18	9.41	1.25	9.35	12.71	22.06
BR2	5.15	1.60	12.14	6.27	18.41	1.93	14.04	29.48	43.52
LS6 1204-55.6m	2.78	0.71	5.39	4.02	9.40	1.34	9.00	13.08	22.08

REPORT

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SHT LANGHAM 123

M421 E.A. CHRISTIANSEN SEPT 9/96 (30) PG. 2599 [CA/MG DIG]
 1 %Ca BY ICP OT96.112

2 %Mg BY ICP

3 Wt% DOLOMITE=COL.2*7.5852

4 Wt% CALCITE=(COL.1-(COL.2*1.6486))*2.4973

5 TOTAL Wt% CO3 (COL.3+COL.4)

6 WT%DOLOMITE/Wt% CALCITE (COL.3/COL.4)

7 CO2 FROM CALCITE=COL.4*2.238

8 CO2 FROM DOLOMITE=COL.3*2.429

9 TOTAL CO2=COL.7+COL.8

	%Ca	%Mg	WT%DO	WT%CAL	C03TOT	D0/CAL	CO2CAL	CO2DOL	CO2TOT
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BR2	5.07	1.54	11.68	6.32	18.00	1.85	14.15	28.37	42.52
LS6 1214-3.8m	3.57	1.34	10.16	3.40	13.56	2.99	7.61	24.69	32.29
LS6 1215-5.3m	3.63	1.31	9.94	3.67	13.61	2.71	8.22	24.14	32.35
LS6 1216-6.9m	1.78	0.83	6.30	1.03	7.32	6.12	2.30	15.29	17.59
LS6 1217-7.8m	1.12	0.48	3.64	0.82	4.46	4.44	1.84	8.84	10.68
LS6 1217-8.5m	1.27	0.50	3.79	1.11	4.91	3.41	2.49	9.21	11.70
LS6 1218-9.9m	3.17	1.12	8.50	3.31	11.80	2.57	7.40	20.64	28.03
LS6 1219-11.4m	2.98	1.06	8.04	3.08	11.12	2.61	6.89	19.53	26.42
LS6 1220-13.0m	2.68	1.06	8.04	2.33	10.37	3.45	5.21	19.53	24.74
LS6 1221-14.5m	0.71	0.33	2.50	0.41	2.92	6.04	0.93	6.08	7.01
LS6 1223-17.5m	2.95	0.76	5.76	4.24	10.00	1.36	9.48	14.00	23.49
LS6 1224-19.1m	3.10	0.87	6.60	4.16	10.76	1.59	9.31	16.03	25.34
LS6 1225-20.6m	3.84	0.92	6.98	5.80	12.78	1.20	12.98	16.95	29.94
LS6 1227-23.6m	3.81	1.02	7.74	5.32	13.05	1.46	11.90	18.79	30.69
LS6 1229-26.7m	3.37	1.00	7.59	4.30	11.88	1.76	9.62	18.42	28.05
LS6 1231-29.7m	3.88	0.93	7.05	5.86	12.91	1.20	13.12	17.13	30.25
LS6 1232-31.3m	3.39	0.91	6.90	4.72	11.62	1.46	10.56	16.77	27.33
LS6 1233-32.8m	3.61	0.96	7.28	5.06	12.34	1.44	11.33	17.69	29.02
LS6 1235-35.8m	3.23	1.06	8.04	3.70	11.74	2.17	8.29	19.53	27.82
LS6 1237-38.9m	2.97	0.92	6.98	3.63	10.61	1.92	8.12	16.95	25.07
BR2	5.13	1.57	11.91	6.35	18.26	1.88	14.21	28.93	43.13
LS6 1239-41.9m	2.41	0.75	5.69	2.93	8.62	1.94	6.56	13.82	20.38
LS6 1241-45.0m	3.41	0.98	7.43	4.48	11.91	1.66	10.03	18.06	28.08
LS6 1243-48.0m	3.11	0.91	6.90	4.02	10.92	1.72	9.00	16.77	25.76
LS6 1245-51.1m	3.68	1.03	7.81	4.95	12.76	1.58	11.08	18.98	30.05
LS6 1247-54.1m	3.37	1.07	8.12	4.01	12.13	2.02	8.98	19.71	28.69
LS6 1249-57.2m	3.03	0.92	6.98	3.78	10.76	1.85	8.46	16.95	25.41
LS6 1251-60.2m	3.74	0.75	5.69	6.25	11.94	0.91	13.99	13.82	27.81
LS6 1253-63.3m	3.11	0.68	5.16	4.97	10.12	1.04	11.12	12.53	23.64
LS6 1255-66.3m	3.32	0.70	5.31	5.41	10.72	0.98	12.11	12.90	25.00

ENVIRO-TEST ANALYSIS REPORT

SHT LANGHAM 120

E. A. CHRISTANSEN CONSULTING LTD.
BOX 3087
SASKATOON, SK S7K 2S9

Lab #	Client ID	Sand (%)	Silt (%)	Clay (%)
S6				
08-04401	LS6-1139 61.8M	7.8	43.1	49.1

METHOD: PSA2S - Particle Size Analysis by Pipette Method

Approved by DJ
08/16/96

FILE #S6-08044

The results of the XRD mineralogical analysis of your sample LS6-1208/61.8 is as follows:

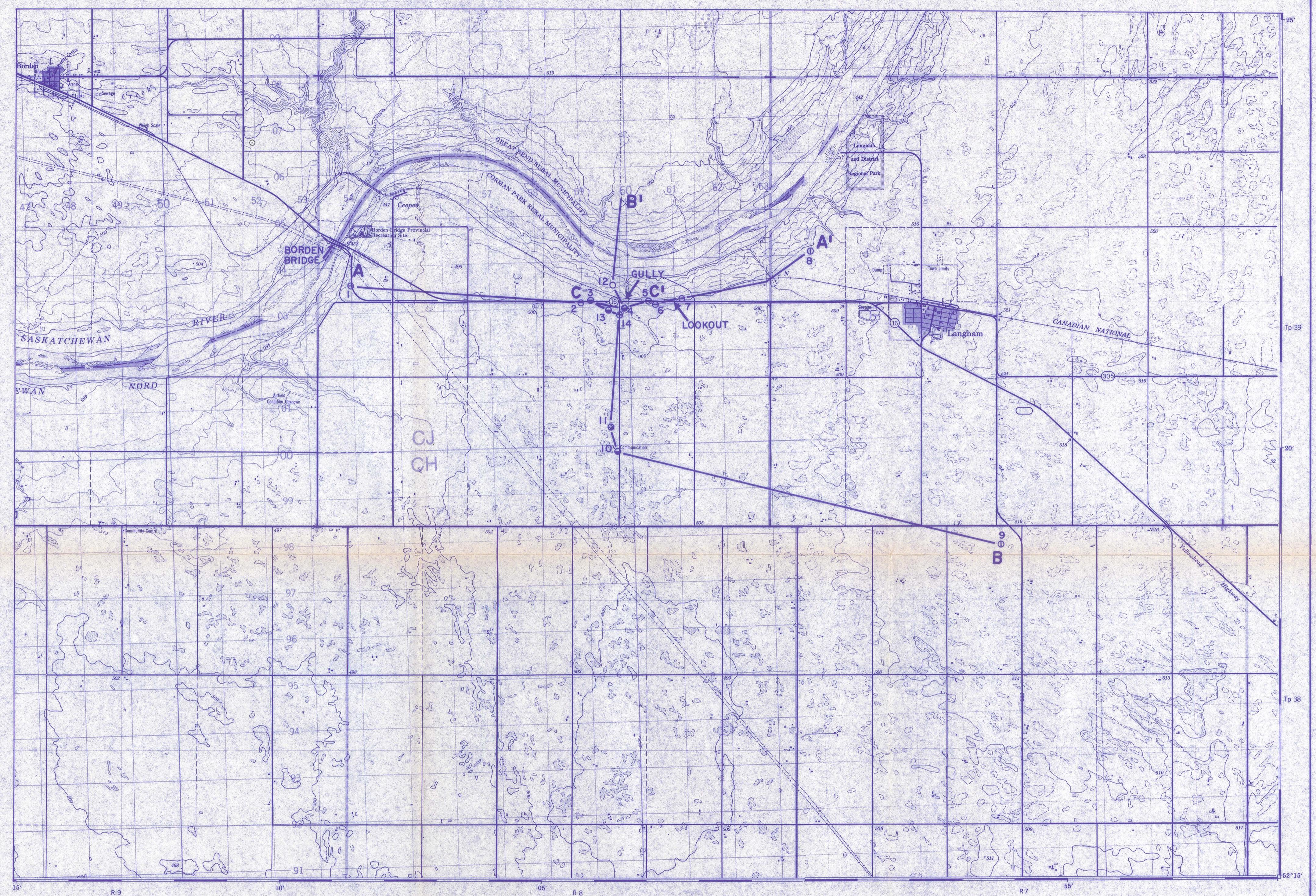
Sample	Mineralogy (%)						Mineral Ratios		
	smectite	illite	chlorite	kaolinite	quartz	plagioclase	illite: smectite	cristobalite: smectite	quartz: cristobalite
LS6-1208/61.8	95 (minimum)	0	0	0	5 (maximum)	0	0.00	0.04	0.25 (maximum)

Sincerely,

Borehole SHT Langham 122(61.8 m)

Sediment interpreted as bentonite (EAC)

David Quirt
Research Scientist
Mineral Exploration Branch



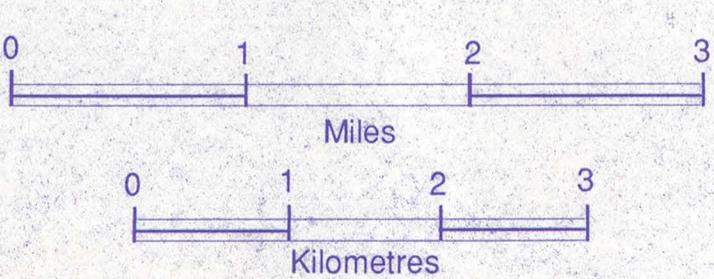
DRAWING 0161 - 002 - 01. MAP SHOWING LOCATION OF CROSS SECTIONS
IN THE LANGHAM AREA

TESTHOLES

- Ⓐ ELECTRIC LOGS, CUTTING SAMPLES, AND CORES
- Ⓑ ELECTRIC LOGS AND CUTTING SAMPLES
- Ⓒ ELECTRIC LOGS AND DRILLER'S LOGS
- Ⓓ ELECTRIC LOG ONLY

A — A' CROSS SECTION

⊖² CROSS SECTION LOG NUMBER



CONTOUR INTERVAL 10m
BASE MAP FROM ENERGY, MINES AND RESOURCES, OTTAWA

WELLS AND PIEZOMETERS

- ELECTRIC LOGS, CUTTING SAMPLES, AND CORES
- ELECTRIC LOGS AND CUTTING SAMPLES
- ELECTRIC LOGS AND DRILLER'S LOGS

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Drawing No. 0161 - 002 - 01
Drawn By E. A. Christiansen
Date SEPTEMBER 25, 1996

