MAR 19950030: PEACE RIVER

Received date: Dec 15, 1995

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ASSESSMENT REPORT
DRILLING PROGRAM
AND
FRAC TEST ANALYSES

COVERING LAND
HELD UNDER
METALLIC & INDUSTRIAL MINERALS PERMIT
NO. 9393080332
PEACE RIVER SILICA DEPOSIT

FOR

ULTRASONIC INDUSTRIAL SCIENCES LTD.

DECEMBER 7, 1995

Ultrasonic Industrial Sciences Ltd.
200, 17834 - 106A Avenue, Edmonton, Alberta T5S 1V3
Tel: (403) 448-0349 Fax: (403) 448-2160

January 23, 1996

Alberta Energy
Petroleum Plaza - North Tower
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

Attention: Brian Hudson

Dear Brain:

Re: <u>Assessment filing on Metallic & Industrial Minerals Permit No. 939080332</u>

As to our telephone conversation of January 16, 1996 re the aforementioned permit and further to the filing of assessment as covered in our letter dated December 15, 1995; Please find enclosed a break down of assessment dollars as filed. Also please find enclosed a break down of additional assessment dollars spent of the property.
As to filing of December 15, 1995

#2	$11,265.12
#3	$950.16
#4	$960.16
#5	$6342.16
Total	$19,507.60

Additional filing of the above mentioned.

#2	$41,692.88	for a total of $52,958.00
#3	as filed	for a total of $950.16
#4	as filed	for a total of $950.16
#5	$17,157.84	for a total of $23,500.00

Further work for filing are as follows:

Road Contractors

Mac Millan (West)	$935.39
Herb's (West)	$743.66
Eric's Trenching (East)	$2779.86
Bisson Contracting (W & E)	$10,109.90
O'Hara (W & E)	$642.00
Total	$15,210.81

Testing R&D Contractor

[redacted]	$41,583.67

Travel

Roads and Tests	$9835.30
Total Assessment	$67,629.79

Please fine enclosed two copies of the R&D Tests results from the R& D Contractor from Salt Lake City, Utah.

Should you have any further questions please contact the writer.

Sincerely Yours

[redacted]

Ultrasonic Industrial Sciences Ltd.
Terry Hodgson

INDEX

Ultrasonic Industrial Sciences Ltd.
200, 17834 - 106A Avenue, Edmonton, Alberta T5S 1V3
Tel: (403) 448-0349 Fax: (403) 448-2160

DEC 15 1995

December 15, 1995

Albert Energy
Petroleum Plaza - North Tower
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

Attention: Hazel Hanson & Brian Hudson

Dear Sirs:

Re: **Assessment filing on Metallic & Industrial Minerals Permit No. 939080332**

In accordance with section 15(1) of the Metallic & Industrial Minerals Regulation, we hereby submit the enclosed reports for assessment filing.

As well in accordance with section 15(1) of the Metallic & Industrial Minerals Regulation, we hereby submit $19,507.60 Assessment dollars on the property covered under the above noted Permit. The assessment dollars are distributed on 1309.84 hectares for the first two years of the assessment and on 1295.84 hectares for the next to years. The second two years assessment do not include the 14 hectares converted to Lease.

If you have any questions regarding the above, you may contact the writer.

Yours Truly

[redacted]

Ultrasonic Industrial Sciences Ltd.
Terry Hodgson

SILICA SAND MATERIALS: FIBRE OPTICS, FRAC, GLASS, CERAMICS (SILICA CHEMISTRY)

Geological Evaluation of the Peace River Silica Sand Deposit

Prepared for:

Peace River Silica Sand Ltd.

by

BERTRAND GEOLOGICAL CONSULTING
A.J. Bertrand, P.Geol.

[redacted]

ALBERTA
RESEARCH
COUNCIL
Alberta Geological Survey

[redacted]

April, 1989.

DISCLAIMER

This study was undertaken at the request of Peace River Silica Sand Ltd. and was funded jointly by Peace River Silica Sand and Alberta Energy. Every possible effort was made to insure that the work conforms to accepted scientific practice. However, neither the Alberta Research Council nor any of their employees or subcontracted personnel makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favouring by the Alberta Research Council. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the Alberta Research Council.

The Alberta Research Council was engaged specifically to execute the geological component of this project and had no direct involvement in the laboratory processing, testing and evaluation of the silica sand samples for frac sand use. Those results, and the views and conclusions expressed regarding frac sand quality of the Peace River silica sand material are entirely those of the consultant, Hardy BBT Limited, and should not be construed as expressing the opinions of the Alberta Research Council.

Table of Contents

Tables
(in text)

Figures

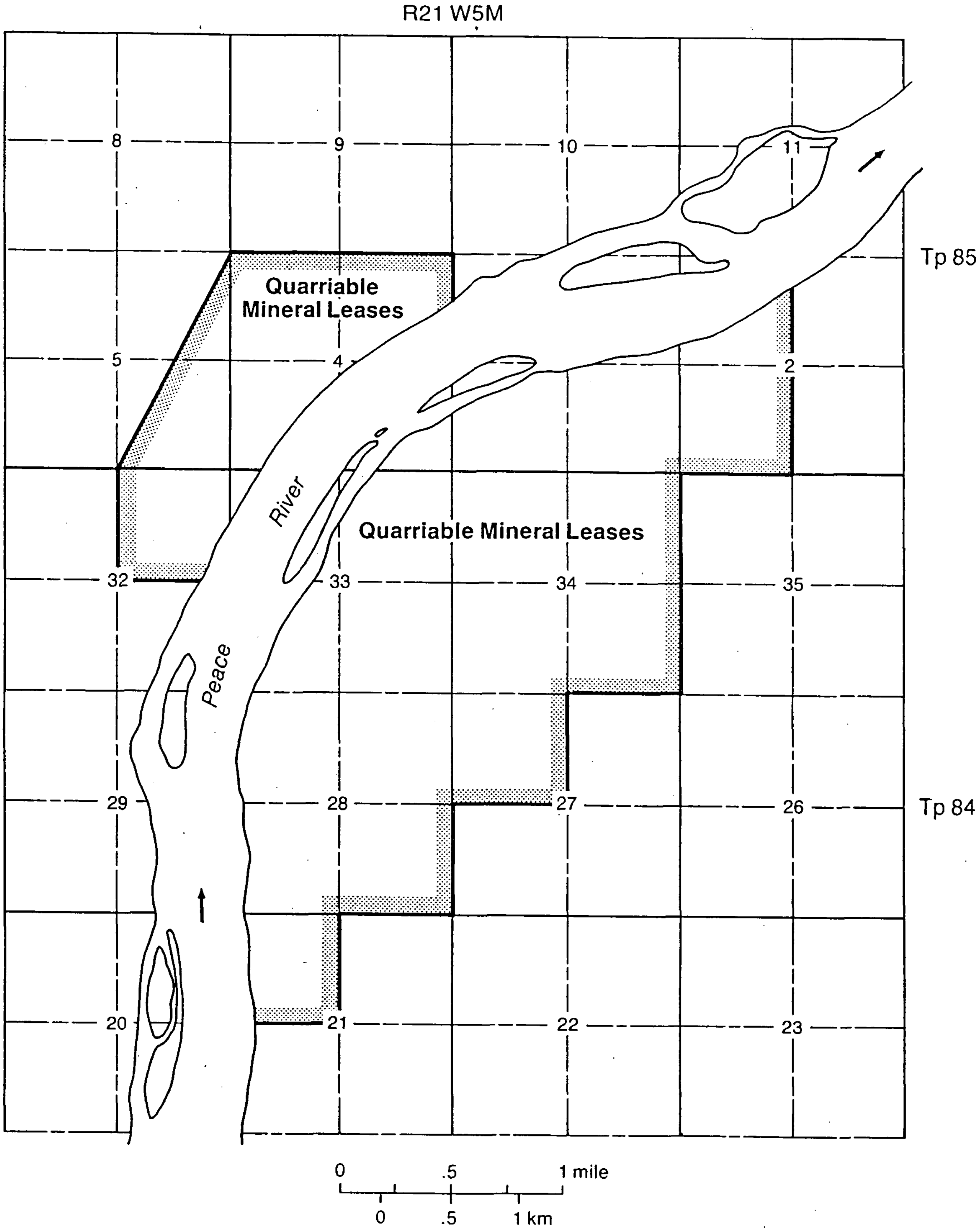
Maps

1.0 INTRODUCTION

The Peace River silica sand deposit is situated approximately 10 kilometres north of Peace River, Alberta. The quarriable mineral leases are located on both banks of the river and are referred to the East and West Blocks in this report.

A five hole test program in the East Block was executed during March, 1989. This information has been combined with relevant data garnered from previous work to re-evaluate the resource base tonnage and the suitability of the material as a propping agent used by the petroleum industry.

Propping, or "frac" sand must be of a certain roundness and strength, as well acid resistant in order to maintain shape under high pressure in the production zones of oil and gas wells. Samples collected from the 1989 boreholes were sent to Hardy BBT Ltd. for analysis and the results are presented in the Appendix. These results indicate that the overall values meet the suggested frac sand specifications cited by the American Petroleum Institute. Laboratory analysis has been concentrated on that portion of the silica sand representing the 20-40 mesh range. The bulk of the total frac sand sales in western Canada consists of this material.



Peace River Silica Sand Ltd.
Quarriable Mineral Leases
Figure 1-1

1.1 SUMMARY

The summary below compares the test results obtained by Hardy BBT Limited to the A.P.I. suggested requirements:

	Peace River Silica Sand 20/40 Range	Peace River Silica Sand 20/40 Average	A.P.I. Suggested Standard
Sphericity	0.7 - 0.8	0.7	0.6 or greater
Roundness	0.5 - 0.7	0.6	0.6 or greater
Turbidity	7.0 - 79.0	48 FTU	250 FTU or less
Crush Resistance	10.8 - 16.7%	13.6%	14% or less fines
Acid Solubility	0.53 - 1.12%	0.83%	2.0% max. wt. solubility

17 samples tested

The reassessment of resources shows the East Block to contain 22.26 million tonnes and the West Block 25.86 million tonnes of silica sand. These are tonnages for the total sand resource, of which the net frac sand grade (20-40 mesh) constitutes 9.47 million tonnes.

2.0 GEOLOGY

2.1 General Geology and Stratigraphy

The Peace River silica sands were deposited in marine and non-marine sediments of the Cretaceous Fort St. John Group which is overlain by Pleistocene deposits. The silica sand deposit within the project area straddles the Peace River. Erosion by the Peace River has removed much of the original silica sand dividing the deposit into two remnant segments on the east and west banks of the river.

The general stratigraphic sequence within the Peace River Silica Sand Ltd. lease area is given by the following table:

FORMATION AND LITHOLOGIES

Fort St. John Group	Dunvegan Formation (marine sandstone & shale)	
	Shaftesbury Formation (marine shale)	
	Peace River Formation	- Paddy Member non-marine sand and shale
		- Cadotte Member marine sandstone
		- Harmon Member marine shale

A brief description of each formation follows.

PEACE RIVER FORMATION

Harmon Member

The Harmon Member is comprised of fine, then bedded, dark grey marine shales. These shales can now be observed on the west bank where recent excavation of the rail access to the Daishawa pulp mill has left them exposed.

Cadotte Member

The Cadotte sandstones form the prominent cliffs for many kilometres along the Peace River, north of Peace River town. The sandstones are fine grained, well sorted, massive, and horizontally bedded. They weather gray to dark brown with a commonly observable yellowish oxide stain near the top. The total thickness of the Cadotte Member within the property boundary has not been determined, however Crockford was able to describe the upper 15 metre portion of the Member on the west bank of the river and Lichtenbelt suggests that it is at least 34 metres thick.

Paddy Member

The Paddy Member is located above the Cadotte Member. They are at times separated by minor coal and gravel beds that can be readily used as a marker horizon during exploration. The Paddy represents a case of re-worked, non-marine sands, deposited in a fluvatile environment. It is mainly very clean and consequently it is essentially uncemented. However, locally the Member contains beds of moderately cemented argillaceous material.

The sedimentary texture of the material indicates a tidal situation where the sand has been sorted into beds of larger and smaller grains. Strong cross-bedding also suggests duel wind-action above a waterline.

The grains of sand are almost entirely colorless quartz with a minor amount of smoky quartz. Silica is present also in the form of chalcedony. The occasional accessory minerals are feldspars, titanite, limonite, ilmenite and zercon.

Examination of the individual grains shows them to vary in roundness being rounded-subangular to almost spherical.

Overall, the Paddy ranges from 0 to 16.5 metres and averages 7.7 metres in thickness.

SHAFTESBURY FORMATION

The marine brown gray shales of the Shaftesbury are calcareous and contain pancake-shaped claystone beds. A thin gravel bed and a minor coal seam at the base of the formation exists on the east side of the river towards the south end of the property. The formation is at least 180 metres thick in this area.

PLEISTOCENE FLUVIAL DEPOSITS

Erosion during the Pleistocene has exposed the Peace River Formation on both banks of the river. The Peace River has deposited a 6 - 21 metre thick bed of boulders, gravel and sand on the Shaftesbury, and to a minor extent on the Paddy in the vicinity of the east bank.

2.2 Structure

Dip of the strata in the vicinity of the deposit is less than one degree to the southwest. No faults or other dislocations of the strata have been observed in any of the outcrops or interpreted by borehole. However, localized slumping of the Shaftesbury shale is evident on the West Block.

2.3 Topography

The deposit is separated into the East and West Blocks by the Pleistocene to Recent Peace River erosional channel. On the east bank the elevations range from 450 metres along the upland terrain down to 300 metres along the river edge. The terrain on the west bank is that of a 5-8 degree slope starting at the 500 metre elevation and descending to the Peace River with 45 metre vertical cliffs.

The slope of the river valley is dissected by two creeks, one of which flows all year. One has cut a gully 30 metres or more with steep walls that generally dip around 40 degrees from the horizontal. In places some are almost vertical.

3.0 EXPLORATION

3.1 Pre - 1989 Exploration

The earliest reference to the Peace River silica sands is contained in a 1953 Geological Survey of Canada report by F.H. McLean. Between 1947 and 1949, four exposures on the west bank and one on the east bank of the Peace River within the property boundaries, were described by M. Crockford of the Alberta Research Council. Size and chemical analysis of samples collected from the three localities on the west bank first indicated that the sand could be upgraded by beneficiation, at that time for glass.

A pilot plant was established early in 1953 by Peace River Glass Syndicate under the supervision of Dr. W.F. Banfield, New York City. In 1954, Dr. Banfield collected sizable bulk samples from seven trenches on the west side of the river for testing. A comprehensive report of the work was submitted. Size analysis was carried out on all of the trench samples; three of the trenches were concluded to be representative and have been used in this report.

During 1977, C.C. Bevan obtained samples for analysis from outcrop and eight drill holes located in the vicinity of the first gravel pit at the south-east corner of the property. Various testing was carried out by Halliburton, Denver Equipment Division and Smith International for frac and glass sand purposes. This test work was followed by a feasibility study written by James Wade Company Engineering concerning the construction and operation of a plant for the production of silica sand to service the petroleum, sand blasting, ceramic and glass industries.

In years 1980 and 1981 some 46 wells were drilled with over 576 samples obtained and submitted to BBT Geotechnical Consultants Ltd. Associated Mining Consultants Ltd. retained by John Tiberio completed a pre-feasibility study which was submitted to Alberta Energy and Natural Resources.

This was followed by a 1982 drill program for J. Tiberio under the geologic supervision of H. Lichtenbelt. The work was conducted on the north east portion of the property and established the existence of silica sand in that area. Unfortunately, only random samples from these boreholes were given tests to determine the quality of sand used in hydraulic fracturing operations.

3.2 1989 Test Program

Five test holes were drilled in March along the extent of the deposit on the east side of the Peace River, to provide Paddy silica sand samples. These holes were located in such a manner as to characterize that portion of the deposit considered to have sufficient reserves for commercial frac sand production.

A Hardy BBT Limited technician was on site to log the borehole cuttings a properly identify the samples. The holes were drilled by a Western Caisson, Becker-type rig, using a tricone bit and air system. Sample recovery was estimated to be very good in all of the holes except for the initial hole where the first 7.5 feet was lost. The strategy was to bag the samples at 2 metre intervals. However, some samples tended to be larger whenever drilling was difficult. A brief lithological summary of the test holes are as follows:

Hole	**Coordinates** (metres)	**Interval (feet)**		**Des.**	**# of samples Collected**
		To	**From**		
E-89-1	11,512.32N	0	0.66	Topsoil	
	9,765.45E	0.66	29.5	Gravel, sand	
	382.87EL	29.5	86.5	Shaftesbury, shale	
		86.5	94	Paddy, sand	-
		94	108	Paddy, sand	7
		108	109	coal	
		109	120	Cadotte, sandstone	
E-89-2	11,062.60N	0	0.5	Topsoil	
	9,375.08E	0.5	18.0	gravel, sand	
	387.80EL	18.0	100.5	Shaftesbury, shale	
		100.5	130.5	Paddy, sand	15
		130.5	132.0	coal	
		132.0	148.0	Cadotte, sandstone	6
E-89-3	10,538.20N	0	0.66	Topsoil	
	9,157.75E	0.66	1.0	Sand	
	391.47EL	1.0	108.0	Shaftesbury, shale	
		108	123.5	Paddy, sand	8
		123.5	124.5	Clay	
		124.5	150.5	Paddy sand	

Hole T.D. at 150.5 feet due to drill rod limitation.

E-98-4	9,893.17N	0	0.5	Topsoil	
	8,765.60E	0.5	44.5	Shaftesbury, shale	
	363.63EL	45.5	48.0	Siltstone, very fine sand	
		48.0	51.0	Gravel, sand	
		51.0	52.0	Coal	
		51.0	54.0	Gravel, sand	
		54.0	67.0	Silica Sand	4
		67.0	68.0	Coal	
		68.0	127.0	Cadotte, sandstone fine grained	1

E-89-5	11,223.47	0	32.0	Gravel, sand	
	9,628.26	32.0	110.0	Shaftesbury	
	391.01	110.0	138.0	Paddy, sand	14
	1,282.80	138.0	148.0	Coal	
		148.0	150.0	Cadotte, sandstone	1

Total feet drilled - 695.5

Total samples collected - 67

The Hardy BBT section of this report contains drill logs of more detail.

The majority of the laboratory test work on samples was carried out by Hardy BBT Limited. The mineralogical analysis was completed by the Alberta Research Council. These tests & procedures were in accordance with the American Petroleum Institute (API RP 56, first edition, March 1983) for testing of sand used in hydraulic fracturing operations.

Field surveying was completed by Coordinate Surveys Ltd. of Peace River.

The test and analysis of the samples are contained in the following report by Hardy BBT Limited.

Table 3-1 provides borehole grain-size data according to the percent weight of the material retained on the various sieves used during the testing.

1989 Test Program

TABLE 3.1

SIEVE SIZE ANALYSIS - PERCENT RETAINED

HOLE	SAMPLE NUMBER	INTERVAL (feet)	+8	+10	+16	+20	+30	+40	+50	+100	+200	-200
E-89-1		86.5 - 94	-	-	N/A	-	-	-	-	-	-	-
Paddy Member	1	94 - 96	-	-	0.1	0.4	2.5	11.0	33.0	41.3	8.7	3.0
	2	96 - 98	-	-	-	0.4	2.2	9.7	31.1	14.5	10.5	31.6
	3	98 - 100	-	-	0.2	1.4	6.0	14.1	28.8	39.0	7.4	3.1
	4	100 - 102	-	0.1	0.4	0.9	3.6	10.4	26.5	48.5	7.3	2.6
	5	102 - 104	-	0.1	0.1	0.5	1.5	4.2	15.2	60.3	13.3	5.1
	6	104 - 106	-	0.6	0.1	0.3	1.0	2.3	8.1	46.9	30.8	9.9
	7	106 - 108	-	-	0.2	0.4	1.2	2.3	7.8	47.6	29.3	11.2
Weighted	Average	94 - 108	-	0.1	0.2	0.6	2.6	7.7	21.5	42.5	15.3	9.5

SIEVE SIZE ANALYSIS - PERCENT RETAINED

HOLE	SAMPLE NUMBER	INTERVAL (feet)	+8	+10	+16	+20	+30	+40	+50	+100	+200	-200
B-89-2	1	100 - 102	-	-	0.7	3.0	8.9	10.4	11.8	22.5	17.6	25.1
	3	104 - 106	-	-	-	0.4	2.1	7.3	12.5	20.4	27.3	30.0
	5	108 - 110	-	-	-	0.1	0.1	1.3	19.2	59.0	13.0	7.3
Paddy Member	7	112 - 114	-	-	-	0.1	0.2	1.9	25.1	58.6	9.6	4.5
	9	116 - 118	-	0.1	-	0.1	-	0.2	1.8	29.6	49.0	19.2
	11	120 - 122	-	0.2	0.1	0.1	-	0.2	0.9	27.0	48.1	23.4
	13	124 - 126	-	-	-	0.1	0.2	1.2	11.8	63.2	14.3	9.2
		128 - 130	-	-	-	0.1	0.5	3.6	19.5	50.9	15.7	9.7
Weighted	Average	100 - 130	-	0.1	0.1	0.5	1.5	3.3	12.8	41.4	24.3	16.0
	18	132 - 134	-	-	0.1	0.1	-	0.1	0.3	11.0	61.0	27.4
Cadotte Member	20	136 - 141	-	0.1	0.1	-	0.3	1.0	4.9	33.5	38.5	21.6
	22	144 - 148	-	0.1	-	0.1	0.6	2.0	4.0	17.4	32.6	43.2
Weighted	Average	132 - 134	-	0.1	0.1	0.1	0.3	1.2	3.7	23.6	40.4	30.5

SIEVE SIZE ANALYSIS - PERCENT RETAINED

HOLE	SAMPLE NUMBER	INTERNAL (feet)	+8	+10	+16	+20	+30	+40	+50	+100	+200	-200
E-89-3	1	108 - 110	-	-	0.1	0.4	0.8	0.8	3.4	19.6	42.8	32.1
	3	112 - 114	-	-	0.1	0.4	0.7	0.4	0.6	17.8	46.0	34.0
	5	116 - 118	-	0.1	0.1	-	0.3	0.2	0.5	8.9	53.9	36.0
	7	120 - 122	-	0.1	-	0.1	-	0.1	0.1	9.5	56.7	33.4
	8	122 - 124	-	0.5	0.2	0.3	1.4	7.5	10.8	17.1	31.0	31.2
	9	124 - 126	-	-	0.1	0.4	3.4	15.9	22.3	15.9	11.8	30.2
	10	126 - 128	-	-	-	0.3	0.4	26.5	44.7	15.8	5.0	7.3
Paddy Member	11	128 - 130	-	0.1	0.1	0.8	7.1	28.3	43.3	13.9	3.6	2.8
	12	130 - 138	-	-	-	0.2	4.1	22.4	33.6	30.7	4.2	4.8
	13	138 - 140	-	-	0.6	1.2	3.7	18.0	26.0	19.0	16.6	16.0
	14	140 - 141	-	-	0.5	0.7	9.6	23.6	22.0	33.0	5.4	4.9
	15	141 - 144	-	0.1	0.1	0.4	2.4	8.6	14.2	52.6	14.6	7.0
	16	144 - 147	-	-	-	-	0.1	1.0	7.6	63.5	15.8	12.0
	17	147 - 150	-	-	1.0	7.1	10.8	8.2	13.1	38.4	10.6	10.8
	18	150-150.5	-	0.1	2.3	20.3	28.2	10.0	8.0	16.2	5.6	8.8
Weighted	Average	108-150.5	-	0.1	0.2	1.1	1.8	10.7	15.7	25.8	24.8	19.8

SIEVE SIZE ANALYSIS - PERCENT RETAINED

HOLE	SAMPLE NUMBER	INTERVAL (feet)	+8	+10	+16	+20	+30	+40	+50	+100	+200	-200
E-89-4	1	54 - 56	-	-	-	0.4	8.7	18.8	22.2	45.2	2.2	2.5
	2	56 - 60	-	-	0.1	0.2	3.9	12.8	18.8	54.9	5.1	4.2
	3	60 - 65	-	-	0.5	5.0	20.1	12.4	10.6	43.3	4.1	4.0
	4	65 - 67	-	0.3	2.1	7.7	18.9	14.4	9.3	26.1	12.6	8.6
Weighted	Average		-	0.1	0.5	3.2	13.2	13.8	14.7	44.6	5.4	4.5

SIEVE SIZE ANALYSIS - PERCENT RETAINED

HOLE	SAMPLE NUMBER	INTERVAL (feet)	+8	+10	+16	+20	+30	+40	+50	+100	+200	-200
B-89-5	1	110 - 112	-	-	-	0.1	0.1	0.2	1.4	13.5	53.0	31.7
	3	114 - 116	-	0.1	1.2	3.4	7.5	7.8	7.5	21.4	33.3	17.8
	4	116 - 118	-	0.1	4.4	11.8	23.2	25.3	20.2	10.5	2.8	1.7
	5	118 - 120	-	-	1.2	5.2	18.9	32.6	27.9	11.8	1.6	0.8
	6	120 - 122	-	0.1	1.5	5.7	16.9	31.5	28.7	13.3	1.6	0.7
	7	122 - 124	-	0.1	3.4	10.3	22.2	29.9	22.5	9.4	1.6	0.6
	8	124 - 126	-	0.2	3.1	8.6	18.7	27.1	23.2	15.8	2.2	1.1
	9	126 - 128	-	-	1.0	4.4	14.0	27.4	26.7	23.0	2.9	0.6
	10	128 - 130	-	0.1	2.0	4.2	10.7	22.7	32.0	25.8	1.9	0.6
	11	130 - 132	-	0.1	1.1	3.4	9.9	22.0	36.7	24.1	2.0	0.7
	12	132 - 134	-	0.1	1.6	4.1	11.4	23.3	36.2	21.3	1.5	0.5
	13	134 - 136	-	-	0.9	3.8	12.4	26.2	35.9	18.5	1.6	0.7
	14	136 - 138	-	-	1.7	4.1	9.4	16.6	27.8	33.9	4.2	2.3
Weighted	Average	110 - 138	-	0.1	1.6	4.9	12.5	20.9	23.3	18.3	11.9	6.5

4.0 RESOURCES

4.1 Block Description

East Block

In dimension the East Block is 3000 metres long in the N-S direction and 1000 metres wide in the E-W direction. The west side of the Paddy silica sand deposit outcrops from 45 to 52 metres above and on the banks of the Peace River. It pinches out at the north end of the block with the east and south limits yet to be defined.

A weighted average thickness of 7.29 metres has been determined for that portion of the resource situated in the measured category. Hole E-89-3 intersected to 12.9 metres of silica sand; the maximum thickness recorded on the east bank to date.

The lithology near the top of the Paddy in the north and south portions of the deposit does not correspond. Throughout the northern half the Shaftesbury shale makes immediate contact with the underlying Paddy. In the southern portion the contact is more complex with interbedded Cretaceous gravels, coal seams and silts situated between the Shaftesbury and main Paddy body. The appended correlation chart of the 1989 test holes (figure 4-1) illustrate this feature.

The surficial boulder, gravel, and sand aggregate covering the Shaftesbury is estimated to be in the order of 15 million cubic metres (Lichtenbelt).

West Block

The West Block is approximately 3300 by 800 metres in size. Like the East Block the Paddy sands outcrops on the banks of the Peace River. The overall thickness ranges between 2 metres at the north and to 16.4 metres in hole 112 located near the center of the deposit. The weighted average thickness within the area designated measured is 8.06 metres. The possible lithologic variations of the Paddy here have not been investigated, however a minor basal coal seam was reported by Banfield.

4.2 Silica Sand Resource Summary

Location	Measured (tonnes-millions)	Inferred (tonnes-millions)	Measured and Inferred
East Block	13.67	8.59	22.26
West Block	14.89	10.97	25.86
	28.56	19.56	48.12

The detailed calculations are presented in tables 4.1 and 4.2 at the end of this chapter.

4.2.1 Resource Estimation Methodology

The resources were measured by planimetering the area between total silica sand (Paddy Member) isopach lines drawn on a 1:5000 scale plan. The thickness of the unit was derived by averaging the values of the isopachs bordering a particular area. This provided the volume, in cubic yards, of sand situated in each bank within the measured and inferred resource categories.

The tonnages (2000 lb short tons) were determined on a "dry" sand basis because commercial specifications are referred to as a "dry" product. Densities of 1.35

tons/cubic yard for the west bank sand and that of 1.31 tons/cubic yard for the east bank sand were used to compute short tons. The variation in densities is a reflection of the average grain size in each of the resource blocks. The short ton values were subsequently converted to metric meters.

4.2.2 Resource Classification Scheme

The degree of confidence in the estimated quantities of resource in the silica sand deposit is designated by the terms "measured" and "inferred".

Measured resources - are tonnages computed from data revealed in outcrops, trenches and boreholes for which the density and quality of points of observation are sufficient to allow a reliable estimate of sand unit thickness.

Inferred resources - estimates are computed by projection of thickness, sample and geologic data from outcrops, trenches and drill holes for a 250 metre distances. There are no sample measurements or inspection sites in the inferred resource area.

4.2.3 Base Data

A thorough review of the existing files was carried out to compile data base for the resource and quality estimations of the deposit. Regrettably, a portion of the records were found to be sketchy or missing and had to be excluded. Geological work completed by Crockford 1947, Banfield 1953, and Lichtenbelt 1982, was considered the most acceptable as these individuals provided the necessary geologic control and descriptions. A summary of the number of data points used in each of the reserve blocks is as follows.

East Block

Number of boreholes - 48

West Block

Number of boreholes - 10
Trenches - 7
Outcrop localities - 5

Map sheet No. 4.1 illustrates the total thickness of the Paddy silica sand unit, borehole distribution, trenches and outcrop localities.

TABLE 4.1

EAST BLOCK RESOURCE ESTIMATE

Measured Category

AREA DESIGNATION	AREA SQUARE FEET	THICKNESS FEET	CUBIC YARDS
E1.1	139,671	10	51,730
E1.2	113,483	12.5	52,538
E1.3	96,024	17.5	62,238
E1.4	122,212	22.5	101,843
E1.5	494,087	27.5	503,237
E1.6	673,913	30.0	748,792
E1.7	310,768	22.5	258,973
E1.8	134,433	17.5	87,132
E1.9	165,859	12.5	76,786
E1.10	57,614	10.0	21,338
E2.1	80,310	41.25	122,696
E2.2	712,323	35.50	936,573
E2.3	1,099,910	32.50	1,323,966
E2.4	1,024,837	30.0	1,138,707
E2.5	588,264	27.5	599,260
E2.6	314,260	22.5	261,883
E2.7	165,859	17.5	107,501
E2.8	235,695	15.0	130,942
E2.9	2,548,999	27.5	2,596,203
E2.10	122,212	22.5	101,843
E2.11	61,106	17.5	39,606
E2.12	13,967	15.0	7,759
E2.13	1,220,377	22.5	1,016,980
E2.14	944,520	17.5	612,193
E2.15	928,813	12.5	430,006
E2.16	293,309	7.5	81,475
E2.17	322,989	2.5	29,906
	12,985,920	23.9	11,502,105

Silica Sand (dry tons) = 1.31* x 11,502,105 = 15,067,757

(or 13,669,168 metric tonnes)

* Density = 1.31 tons per cubic yard

Weighted average thickness of silica sand unit within the East Block measured category is 23.91 feet or 7.29 metres.

EA FEET	THICKNESS FEET	CUBIC YARDS
18[illegible]	2.5	22,147
695	7.5	65,471
,100	13.5	783,050
495	13.5	372,747
530	17.5	198,029
143	22.5	480,119
.666	27.5	793,085
792	31.25	470,824
350	12.5	44,838
,789	17.5	43,289
719	22.5	130,599
440	27.5	200,078
.306	30.0	917,562
686	27.5	352,087
69	22.5	293,890
79	30.0	616,310
,232	27.5	736,625
607	22.5	705,506
84	21.6	7,225,256

1.31 x 7,226,256 = 9,466,395

(or 8,587,724 metric tonnes)

[illegible] of silica sand unit in East

is 21.6 feet or 6.58 metres.

HICKNESS FEET	CUBIC YARDS
26.45	8,289,186
8.5	665,416
22.8	8,954,602

4,602 = 12,088,713

6,638 metric tonnes)

sand unit within the

feet or 6.95 metres.

5.0 QUALITY

5.1 Grain Size

In the East Block, 200 Paddy Member silica sand samples collected from 21 boreholes were used to estimate the grain size average percentages. In the West Block, 105 samples from 7 boreholes were combined with the results from 3 bulk trench samples to estimate the average grain size of the sand.

Tables 5.1 and 5.2 illustrate the database used in the calculation. It is apparent that there is significant variation in the distribution of grain size throughout the deposit.

The following U.S. Standard Sieve Size ranges on a percent basis indicated within the deposit are:

U.S. Sieve	East Block	West Block
0- 12	1.0	0.2
12- 20	2.8	6.2
20- 40	16.4	22.5
40- 60	20.2	30.5
60-100	31.4	21.3
100-200	14.4	14.9
Minus 200	13.8	4.4
	100%	100%

The total estimated silica sand resources so far defined in the East and West Blocks are 22.26 and 25.86 million tonnes, respectively. Portioning the resource into the various sieve size ranges amounts to the possible tonnages listed below:

U.S. Sieve	Block East	 West	Total East & West Blocks
		(million tonnes)	
0- 12	0.22	0.05	0.27
12- 20	0.63	1.60	2.23
20- 40	3.65	5.82	9.47
40- 60	4.50	7.89	12.39
60-100	6.99	5.51	12.50
100-200	3.20	3.85	7.05
Minus	3.07	1.14	4.21
	26.26 Mt.	25.86 Mt.	48.12 Mt.

EAST BLOCK GRAIN-SIZE ESTIMATION

TABLE 5.1

EAST BLOCK SOUTH END (TOTAL UNIT)

HOLE	NUMBER OF SAMPLES	THICKNESS	SCREEN SIZE -% RETAINED +4	+10	+20	+40	+60	+100	+200	-200
63A	10	20	-	1.1	7.1	12.0	5.5	14.7	48.5	10.8
64	10	20	0.4	1.5	3.8	11.0	7.9	19.6	39.1	16.1
66	14	28	-	0.9	3.2	4.9	7.1	37.1	39.1	7.5
67	11	22	0.8	2.4	6.7	9.8	7.1	20.9	38.7	13.1
68	12	24	-	0.4	6.9	17.8	15.6	34.2	18.6	6.4
73	6	12	-	-	0.7	7.8	29.6	55.3	5.1	1.4
74	14	28	0.1	1.2	6.1	17.8	14.1	45.6	10.7	4.1
75	15	30	-	0.6	3.7	8.9	13.7	50.9	16.0	8.4
77	4	8	-	0.70	10.8	19.2	10.3	12.0	30.6	13.0
78	3	6	-	5.7	14.3	25.3	8.3	12.3	22.8	11.3
79	6	12	-	4.8	6.2	14.3	6.3	15.2	26.2	27.1
87	7	14	-	1.1	3.4	15.9	28.8	28.2	11.1	11.4
92	10	20	-	1.0	5.3	20.2	18.5	33.8	12.2	8.9
94	13	26	-	0.2	3.0	8.0	17.8	53.8	12.6	4.5
E-89-4	4	13	-	0.1	3.7	27.6	-	-	5.4	4.5
Weighted Average 15 holes			0.1	1.2	5.1	13.1	13.3	34.4	22.7	10.1

EAST BLOCK - NORTH END (TOTAL UNIT)

HOLE	NUMBER OF SAMPLES	THICKNESS	+8	+10	+16	+20	+30	+40	+50	+100	+200	-200
E-89-1	7	21.5	-	0.1	0.2	0.6	2.6	7.7	21.5	42.5	15.3	9.5
E-89-2	8	30	-	0.1	0.1	0.5	1.5	3.3	12.8	41.4	24.3	16.0
E-89-3	15	42.5	-	0.1	0.2	1.1	1.8	10.7	15.7	25.8	24.8	19.8
E-89-5	13	28	-	0.1	1.6	4.9	12.5	20.9	23.3	18.3	11.9	6.5
E-81-1	8	N/A	-	0.1	2.6	1.7	9.6	18.0	30.2	-	-	-
E-81-2	10	N/A	0.1	0.1	4.9	3.2	8.4	12.3	27.3	-	-	-
			0.1	0.1	1.3	1.9	5.4	11.6	20.20	32.1	12.7	14.6

AVERAGE GRAIN SIZE EAST BLOCK
MESH RANGE

	WEIGHTING	+10	10-20	20-40	40-100	100-200	-200
SOUTH END	17%	1.3	5.1	13.1	47.7	22.7	10.1
NORTH END	83%	0.2	3.2	17.0	52.3	12.7	14.6
	100	3.5	3.5	16.4	51.6	14.4	13.8

WEST BLOCK-GRAIN SIZE ESTIMATION

TABLE 5.2

WEST BLOCK NORTH END (TOTAL UNIT)

HOLE	NUMBER OF SAMPLES	FEET THICKNESS	SCREEN SIZE - % RETAINED							
			+4	+10	+20	+40	+60	+100	+200	-200
102	11	22	-	0.55	8.5	32.8	34.1	18.0	3.9	1.7
109	24	48	-	0.10	14.8	32.0	30.6	16.25	3.9	1.6
111	11	22	-	0.6	1.4	6.2	43.8	33.0	12.1	2.8
112	28	56	-	-	3.1	32.0	39.3	14.9	7.3	2.2
113	19	38	-	-	4.7	17.1	29.3	26.7	8.0	4.2
114	7	14	-	-	1.6	11.3	43.1	28.4	12.0	3.6
116	5	10	-	-	1.2	5.8	37.2	42.4	10.7	2.7
TRENCH 1		17.5				35.71	36.18	16.33		
TRENCH 2		20				33.35	34.76	19.14		
TRENCH 3		16				47.18	35.86	10.08		
WEIGHTED AVERAGE			-	0.1	6.3	27.1	35.8	20.6	7.3	2.7

WEST BLOCK - SOUTH END (TOTAL UNIT)

HOLE	NUMBER OF SAMPLES	THICKNESS (feet)	+4	+10	+20	+40	+60	+100	+200	-200
117	13	26	-	0.4	5.2	8.5	24.6	31.5	23.9	7.5
119	10	20	-	2.0	7.9	23.3	13.6	18.8	28.9	6.2
120	11	22	-	0.2	6.0	23.8	35.2	13.8	15.3	4.8
			-	0.3	6.2	17.8	24.9	22.1	22.5	6.2

AVERAGE GRAIN SIZE - WEST BLOCK
MESH RANGE

	WEIGHTING	+10	10-20	20-40	40-100	100-200	-200
SOUTH END	50%	0.3	6.2	17.8	47.0	22.5	6.2
NORTH END	50%	0.1	6.3	27.2	56.4	7.3	2.7
		0.2	6.2	22.5	51.7	14.9	4.4

5.2 Chemical Analysis

A limited number of chemical analyses were carried out in the past, but no detailed conclusions can be reached from these results since the small number of samples cannot be considered representative of the whole deposit. General indications are that the sand is sufficiently clean for frac sand and that it can be treated to obtain glass quality sand.

A simple arithmetic average of the available chemical analysis of sand from the Paddy Member is as follows:

	East Block %	West Block %
SiO_2	98.20	98.36
FeO_2	0.478	0.153
Al_2O_3	0.127	0.782
TiO_2	0.08	0.257
CaO	0.16	0.04
MgO	0.007	Trace
Na_2O	0.009	0.162
K_2O	0.89	0.23
MnO	0.0039	--
Total	99.955%	99.984%

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

Our Project No. EA-11423
Your Reference No.

April 24, 1989

Peace River Silica Sand Ltd.
14010 - 128 Avenue
EDMONTON, Alberta
T5L 4M8

Attention: Mr. Joe M. Grguras, President

Subject: Field Investigation and Laboratory Testing Program
Silica Sand Deposit
Near Peace River, Alberta

Gentlemen:

1.0 INTRODUCTION

As requested, a field and laboratory test program was recently undertaken in accordance with your letter of authorization dated February 20, 1989. The work scope undertaken was in general conformance with the Hardy BBT Limited proposal for the subject project dated January 10, 1989. The program involved advancing five boreholes, recovering selected sand samples, and conducting a series of tests utilizing the American Petroleum Institute, Recommended Practices, for Testing Sand Used in Hydraulic Fracturing Operations, API RP56, First Edition, March, 1983.

The field work portion of the study was completed in March, 1989 and although the laboratory work is nearly complete, the results and findings compiled to-date are presented in this letter-report. The laboratory work scope still underway consists of the sand mineralogical analyses (x-ray differention tests) which are being conducted by the Alberta Research Council. This phase of the study is expected to be completed and available by the end of May, 1989.

2.0 FIELD EXPLORATION

The field work portion of the investigation, including site reconnaissance, borehole drilling, and soil sampling, was conducted during the time period of March 5 to 12, 1989. A total of five boreholes were drilled to depths ranging from 127 feet to 150.5 feet below the existing ground surface elevations. The boreholes were advanced at locations determined and surveyed by representatives of, or acting on behalf of, Peace River Silica Sand Ltd. The locations of the boreholes are shown on the

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PEACE RIVER PRINCE ALBERT PRINCE GEORGE RED DEER REGINA SASKATOON VANCOUVER

attached site plan, Drawing No. EA11423-1. Continuous logs of the subsurface conditions, as encountered in the boreholes, were recorded at the time of drilling and are presented on the attached borehole logs, Drawing Nos. EA11423-2 to -6. Drilling was accomplished with a truck mounted Becker drill rig utilizing a combination of casing and hammer, and tri-cone drilling.

Soil sampling consisted of recovering disturbed soil samples from the drill cuttings at selected depths in all of the boreholes. Additionally, two sand samples were recovered from sand deposits within the area, at locations identified by representatives of Peace River Silica Sand Ltd. All soil samples recovered in the field were sealed to prevent moisture loss and were taken to the Edmonton laboratory for testing and analysis.

3.0 LABORATORY TESTING

Selected sand samples were tested in the laboratory to determine certain physical properties of the material relative to the use of the sand for use in hydraulic fracturing operations. Grain size analyses were conducted on a majority of the recovered sand samples to determine the particle size distributions. On the basis of the grain size distributions, a limited number of sand samples were selected for additional testing. The samples were prepared for this phase of the testing by washing and sieving in order to achieve a grain size analysis for each sample which satisfied the 20/40 fractured sand size designation as given in Table 4.1 - API RP 56, First Edition, March, 1983. Subsequent to the processing, the individual samples were tested to determine sphericity and roundness, solubility in acid, turbidity, and crush resistance determinations. All of the above tests were conducted in accordance with the recommended practices of the American Petroleum Institute, API RP 56, First Edition, March, 1983.

The test data and supplementary notes are presented on the attached Table Nos. 1 to 10. Test results which indicated compliance or non-compliance of materials with the American Petroleum Institute recommended criterion are identified.

If there are any questions please contact this office.

Respectfully submitted

Hardy BBT Limited

[redacted]

D.F. Cox, P.Eng.
Senior Engineer
Materials Engineering

DFC/jh/EA11423L.DFC

Distribution: (12) Addressee

Enclosures: Table Nos. 1 to 10
Drawing Nos. EA11423-1 to -6

TABLE 1

GRADATION ANALYSES CONDUCTED ON SAND DEPOSITS
BOREHOLE NO. E89-1

Total Percent Passing (By Mass)

Sample No.	1	2	3	4	5	6	7
Depth (feet)	94-96	96-98	98-100	100-102	102-104	104-106	106-108
Sieve Designation*							
8	100	100	100	100	100	100	100
10	100	100	100	99.9	99.9	99.4	100
16	99.9	100	99.8	99.6	99.8	99.3	99.8
20	99.5	99.6	98.4	98.7	99.3	99.0	99.4
30	97.0	97.4	92.4	95.1	97.8	98.0	98.2
40	86.0	87.7	78.3	84.7	93.6	95.7	95.9
50	53.0	56.6	49.5	58.2	78.4	87.6	88.1
100	11.7	15.1	10.5	10.0	18.4	40.7	40.5
200	3.0	4.6	3.1	2.7	5.1	9.9	11.2

* U.S.A. Sieve Series (ASTM E 11-81)

TABLE 2

GRADATION ANALYSES CONDUCTED ON SAND DEPOSITS
BOREHOLE NO. E89-2

Total Percent Passing (By Mass)

Sample No.	1	3	5	7	9	11	13	15	18	20	22
Depth (feet)	100-102	104-106	108-110	112-114	116-118	120-122	124-126	128-130	132-134	136-141	144-148
Sieve Designation*											
8	100	100	100	100	100	100	100	100	100	100	100
10	100	100	100	100	99.9	99.8	100	100	100	99.9	99.9
16	99.3	100	100	100	99.9	99.7	100	100	99.9	99.8	99.9
20	96.3	99.6	99.9	99.9	99.8	99.6	99.9	99.9	99.8	99.8	99.8
30	87.4	97.5	99.8	99.7	99.8	99.6	99.7	99.4	99.8	99.5	99.2
40	77.0	90.2	98.5	97.8	99.6	99.4	98.5	95.8	99.7	98.5	97.2
50	65.2	77.7	79.3	72.7	97.8	98.5	86.7	76.3	99.4	93.6	93.2
100	42.7	57.3	20.3	14.1	68.2	71.5	23.5	25.4	88.4	60.1	75.8
200	25.1	30.0	7.3	4.5	19.2	23.4	9.2	9.7	27.4	21.6	43.2

* U.S.A. Sieve Series (ASTM E 11-81)

TABLE 3

GRADATION ANALYSES CONDUCTED ON SAND DEPOSITS
BOREHOLE NO. E89-3

Total Percent Passing (By Mass)

Sample No.	1	3	5	7	8	9	10	11	12	13	14	15	16	17	18
Depth (feet)	108-110	112-114	116-118	120-122	122-124	124-126	126-128	128-130	130-138	138-140	140-141	141-144	144-147	147-150	150-150.5
Sieve Designation*															
8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10	100	100	99.9	99.9	99.5	100	100	99.9	100	100	100	99.9	100	100	99.9
16	99.9	99.9	99.8	99.9	99.3	99.9	100	99.8	100	99.4	99.5	99.8	100	99.0	97.6
20	99.5	99.5	99.8	99.8	99.0	99.5	99.7	99.0	99.8	98.2	98.8	99.4	100	91.9	76.8
30	98.7	98.8	99.5	99.8	97.6	96.1	99.3	91.9	95.7	88.3	89.2	97.0	99.9	81.1	48.6
40	97.9	98.4	99.3	99.7	90.1	80.2	72.8	63.6	73.3	63.3	65.6	88.4	98.9	72.9	38.6
50	94.5	97.8	98.8	99.6	79.3	57.9	28.1	20.3	39.7	36.2	43.6	74.2	91.3	59.8	30.6
100	74.9	80.0	89.9	90.1	62.2	42.0	12.3	6.4	9.0	6.1	10.3	21.6	27.8	21.4	14.4
200	32.1	34.0	36.2	33.4	31.2	30.2	7.3	2.8	4.8	2.4	4.9	7.0	12.0	10.8	8.8

* U.S.A. Sieve Series (ASTM E 11-81)

TABLE 4

GRADATION ANALYSES CONDUCTED ON SAND DEPOSITS BOREHOLE NO. E89-4

Total Percent Passing (By Mass)

Sieve Designation*	Sample No. Depth (feet)	1 54-56	2 56-60	3 60-65	4 65-67	5 112-114
8		100	100	100	100	100
10		100	100	100	99.7	100
16		100	99.9	99.5	97.6	99.9
20		99.6	99.7	94.5	89.9	99.8
30		90.9	95.8	74.4	71.0	99.2
40		72.1	83.0	62.0	56.6	98.2
50		49.9	64.2	51.4	47.3	96.6
100		4.7	9.3	8.1	21.2	93.2
200		2.5	4.2	4.0	8.6	29.1

* U.S.A. Sieve Series (ASTM E 11-81)

TABLE 5

GRADATION ANALYSES CONDUCTED ON SAND DEPOSITS
BOREHOLE NO. E89-5

Total Percent Passing (By Mass)

Sample No.	1	3	4	5	6	7	8	9	10	11	12	13	14
Depth (feet)	110-112	114-116	116-118	118-120	120-122	122-124	124-126	126-128	128-130	130-132	132-134	134-136	136-138
Sieve Designation*													
8	100	100	100	100	100	100	100	100	100	100	100	100	100
10	100	99.9	99.9	100	99.9	99.9	99.8	100	99.9	99.9	99.9	100	100
16	100	98.7	95.5	98.8	98.4	96.5	96.7	99.0	97.9	98.8	98.3	99.1	98.3
20	99.9	95.3	83.7	93.6	92.7	86.2	88.1	94.6	93.7	95.4	94.2	95.3	94.2
30	99.8	87.8	60.5	74.7	75.8	64.0	69.4	80.6	83.0	85.5	82.8	82.9	84.8
40	99.6	80.0	35.2	42.1	44.3	34.1	42.3	53.2	60.3	63.5	59.5	56.7	68.2
50	98.2	72.5	15.0	14.2	15.6	11.6	19.1	26.5	28.3	26.8	23.3	20.8	40.4
100	84.7	51.1	4.5	2.4	2.3	2.2	3.3	3.5	2.5	2.7	2.0	2.3	6.5
200	31.7	17.8	1.7	0.8	0.7	0.6	1.1	0.6	0.6	0.7	0.5	0.7	2.3

* U.S.A. Sieve Series (ASTM E 11-81)

TABLE 6

GRADATION ANALYSES CONDUCTED ON SAND DEPOSITS MISCELLANEOUS LOCATIONS

Total Percent Passing (By Mass)

Location	West Bank Trench #4	West Bank Dynamite Blast
Sieve Designation*		
8	100	100
10	99.2	100
16	95.8	99.9
20	85.8	99.9
30	69.1	99.8
40	53.0	99.8
50	30.2	99.7
100	3.5	94.5
200	0.9	18.3

* U.S.A. Sieve Series (ASTM E 11-81)

TABLE NO. 7

FRAC SAND SPHERICITY AND ROUNDNESS

Borehole No.	Sample No.	Depth (feet)	Average Sphericity*	Average Roundness**
E89-1	3	98-100	0.7	(0.5)
E89-3	9	124-126	0.7	0.6
E89-3	10	126-128	0.8	0.6
E89-3	11	128-130	0.7	0.6
E89-3	13	138-140	0.7	0.6
E89-3	14	140-141	0.7	0.6
E89-3	18	150-150.5	0.7	(0.5)
E89-4	3	60-65	0.8	(0.5)
E89-4	4	65-67	0.7	(0.5)
E89-5	4	116-118	0.7	0.6
E89-5	5	118-120	0.7	0.6
E89-5	6	120-122	0.7	0.6
E89-5	7	122-124	0.7	0.6
E89-5	8	124-126	0.8	0.7
E89-5	9	126-128	0.8	0.7
E89-5	10	128-130	0.7	0.7
E89-5	12	132-134	0.7	0.7
West Bank Trench #4		--	0.6	0.6

* API RP 56, First Edition, March, 1983, Section 5.2
** API RP 56, First Edition, March, 1983, Section 5.3
() Less than the recommended minimum value of 0.6

TABLE NO. 8

SAND SOLUBILITY IN ACID

Borehole No.	Sample No.	Depth (feet)	Solubility* (% by Weight)
E89-1	3	98-100	0.84
E89-3	9	124-126	0.80
E89-3	10	126-128	0.79
E89-3	11	128-130	0.84
E89-3	13	138-140	0.93
E89-3	14	140-141	0.84
E89-3	18	150-150.5	0.86
E89-4	3	60-65	0.53
E89-4	4	65-67	0.81
E89-5	4	116-118	0.74
E89-5	5	118-120	1.12
E89-5	6	120-122	0.82
E89-5	7	122-124	0.81
E89-5	8	124-126	0.84
E89-5	9	126-128	0.81
E89-5	10	128-130	1.01
E89-5	12	132-134	0.81

* API RP 56, First Edition, March, 1983, Section 6

() Greater than the recommended maximum value of 2.0 percent by weight

TABLE NO. 9

TURBIDITY MEASUREMENT OF SILT AND CLAY SIZE PARTICULATE MATTER

Borehole No.	Sample No.	Depth (feet)	Turbidity* (FTU)
E89-1	3	98-100	79
E89-3	9	124-126	46
E89-3	10	126-128	63
E89-3	11	128-130	60
E89-3	13	138-140	54
E89-3	14	140-141	56
E89-3	18	150-150.5	54
E89-4	3	60-65	7
E89-4	4	65-67	54
E89-5	4	116-118	44
E89-5	5	118-120	33
E89-5	6	120-122	74
E89-5	7	122-124	36
E89-5	8	124-126	37
E89-5	9	126-128	47
E89-5	10	128-130	21
E89-5	12	132-134	54

* API RP 56, First Edition, March, 1983, Section 7, Method I

() Greater than the recommended frac sand turbidity value of 250 FTU

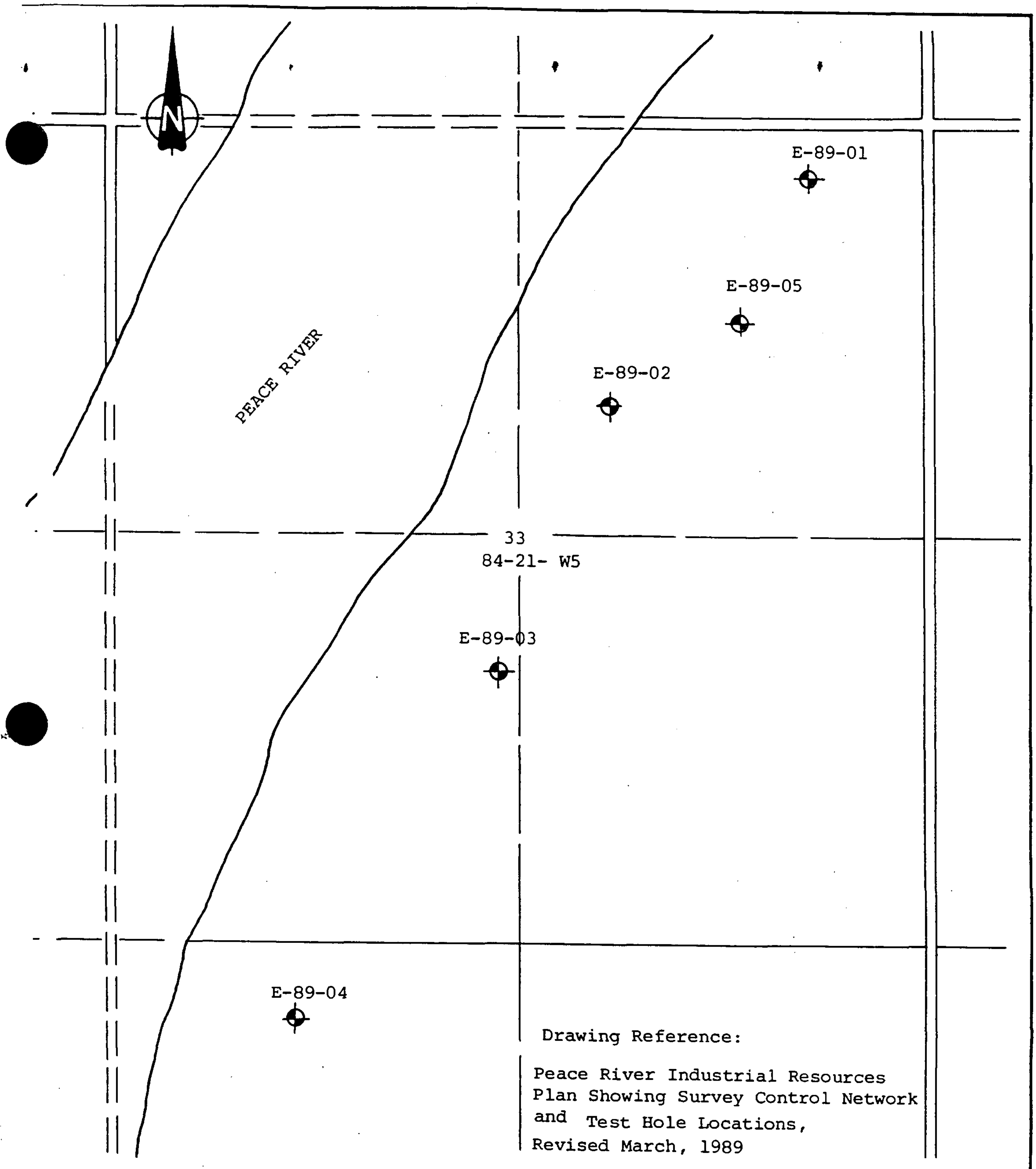
TABLE NO. 10

FRAC SAND CRUSH RESISTANCE

Borehole No.	Sample No.	Depth (feet)	Crush Resistance* (% Fines by Weight)
E89-1	3	98-100	13.9
E89-3	9	124-126	10.8
E89-3	10	126-128	(15.6)
E89-3	11	128-130	12.5
E89-3	13	138-140	12.1
E89-3	14	140-141	11.7
E89-3	18	150-150.5	13.7
E89-4	3	60-65	13.0
E89-4	4	65-67	(14.7)
E89-5	4	116-118	12.9
E89-5	5	118-120	11.9
E89-5	6	120-122	13.9
E89-5	7	122-124	(14.0)
E89-5	8	124-126	(15.2)
E89-5	9	126-128	(14.8)
E89-5	10	128-130	(16.7)
E89-5	12	132-134	(15.0)
West Bank Trench #4		--	(14.6)

* API RP 56, First Edition, March, 1983, Section 8

() Greater than or equal to the recommended maximum fines value of 14 percent by weight.



Drawing Reference:

Peace River Industrial Resources
Plan Showing Survey Control Network
and Test Hole Locations,
Revised March, 1989

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SITE PLAN SHOWING TEST HOLE LOCATIONS
PEACE RIVER SILICA SAND LTD.
NEAR PEACE RIVER, ALBERTA

S ALE 1:10,000	DATE Apr.12/89	MADE AV	CHKD. DFC	Drawing No. EA11423-1

4-87/11

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

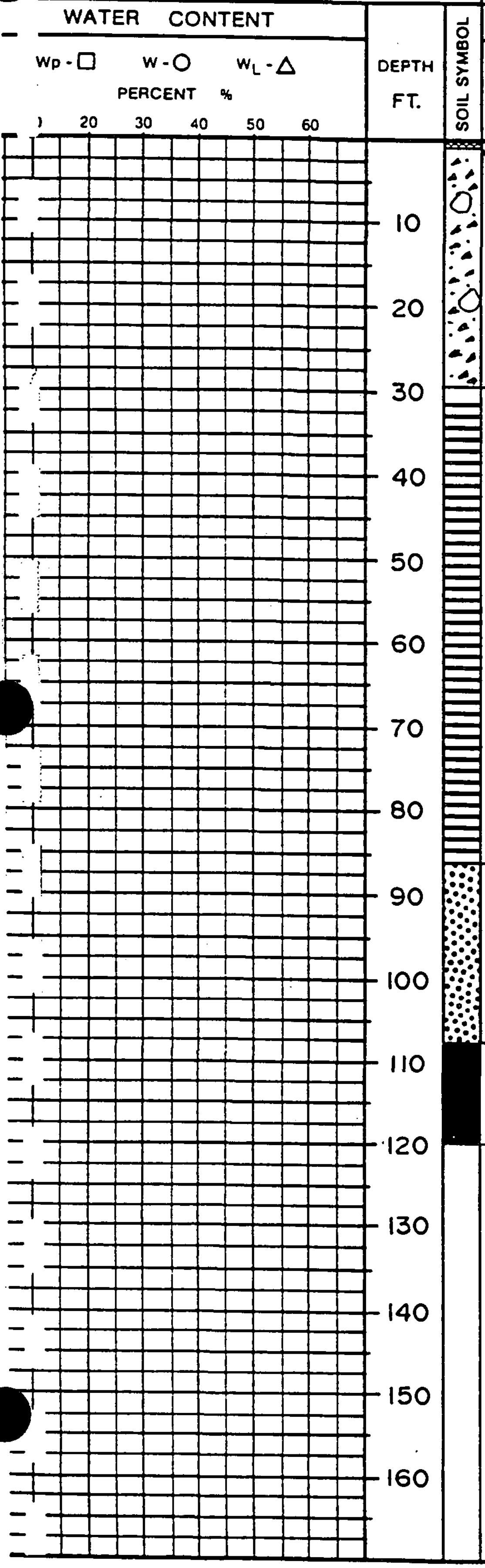
BOREHOLE LOG

PROJECT PEACE RIVER SILICA SAND LTD.
FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM
SILICA SAND DEPOSIT NEAR PEACE RIVER, ALBERTA

GED/DWN. GM/AV
CKD. DFC
DATE OF INVEST. March 7/89
JOB NO. EA-11423
HOLE NO. E89-1

DRILL TYPE Becker, 6 5/8" Casing and 4" Tricone

DATUM Geodetic
SURFACE ELEVATION 382.9 m



SOIL DESCRIPTION	SOIL SAMPLE CONDITION	TYPE	PENETRATION RESISTANCE	OTHER TESTS
TOPSOIL, dark brown, frozen				
GRAVEL, mixed with SAND, brown, damp, very dense, boulders				
CLAY (SHALE), high plastic, dark grey, damp, hard to very hard				
SAND (SILICA), light brown, damp, coarse grained - fine grained 87.5'-108' - moist 102'-108'	☒	Bag Samples		
COAL, black, seepage				▼ at completion
END OF HOLE AT 108'				

Drawing No.
EA11423-2

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

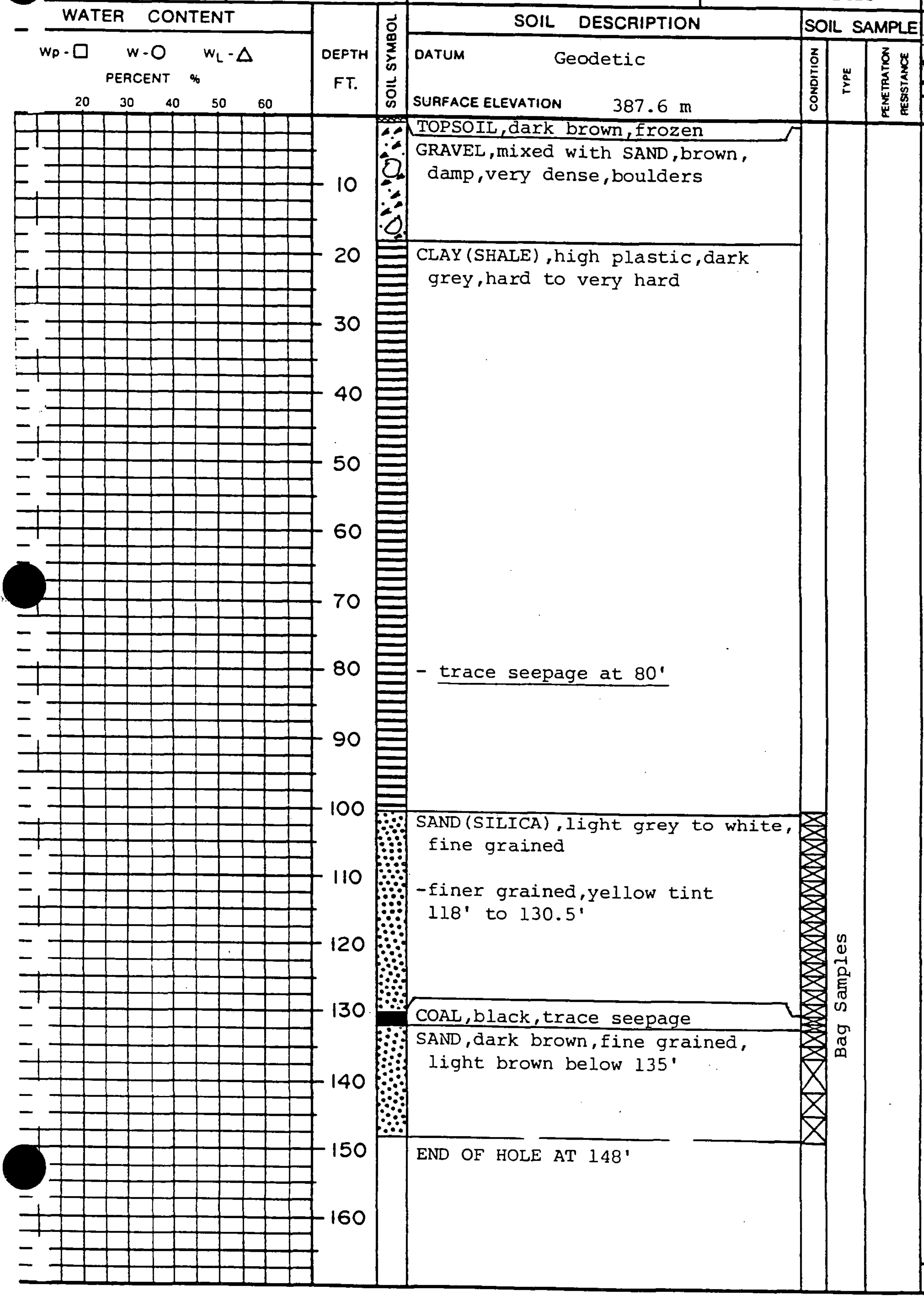
BOREHOLE LOG

PROJECT PEACE RIVER SILICA SAND LTD.
FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM
SILICA SAND DEPOSIT NEAR PEACE RIVER, ALBERTA

ED/DWN. GM/AV
CKD. DFC
DATE OF INVEST. March 8/89
JOB NO. EA-11423
HOLE NO. E89-2

DATUM Geodetic
SURFACE ELEVATION 387.6 m

DRILL TYPE Becker, 6 5/8" Casing and 4" Tricone



SOIL DESCRIPTION

TOPSOIL, dark brown, frozen

GRAVEL, mixed with SAND, brown, damp, very dense, boulders

CLAY (SHALE), high plastic, dark grey, hard to very hard

- trace seepage at 80'

SAND (SILICA), light grey to white, fine grained

-finer grained, yellow tint 118' to 130.5'

COAL, black, trace seepage

SAND, dark brown, fine grained, light brown below 135'

END OF HOLE AT 148'

OTHER TESTS

Drawing No.
EA11423-3

HT08 - 79/05

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

BOREHOLE LOG

PROJECT PEACE RIVER SILICA SAND LTD.
FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM
SILICA SAND DEPOSIT NEAR PEACE RIVER, ALBERTA

ED/DWN. GM/AV
CKD. DFC
DATE OF INVEST. March 9/89
JOB NO. EA-11423
HOLE NO. E89-3

DATUM Geodetic
SURFACE ELEVATION 391.4 m
DRILL TYPE Becker, 6 5/8" Casing and 4" Tricone

WATER CONTENT
Wp - ☐ w - ○ W_L - △
PERCENT %
20 30 40 50 60

DEPTH FT.	SOIL DESCRIPTION	SOIL SAMPLE	OTHER TESTS
	TOPSOIL, dark brown, frozen		
	SAND, brown, fine to medium, frozen		
10	CLAY, high plastic, dark grey, moist, hard, slickensides, oxide staining		
20	CLAY (SHALE), high plastic, dark grey, damp, very hard - trace seepage at 26'		
30			
40			
50			
60			
70			
80			
90			
100			
110	SAND (SILICA), light grey, damp, fine grained -very moist high plastic, clay seam 123.5' to 124.5' -coarser grained, white at 124.5' -brown, iron contamination, fine grained, powdery 140'-150' -coarser grained at 150'	☒ Bag Samples	
120		☒	
130		☒	
140		☒	
150	END OF HOLE AT 150.5'		
160			

Drawing No.
EA11423-4

HT08 - 79/05

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

BOREHOLE LOG

PROJECT PEACE RIVER SILICA SAND
FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM
SILICA SAND DEPOSIT NEAR PEACE RIVER, ALBERTA

ED/DWN. GM/AV
CKD. DFC
DATE OF INVEST. March 12/89
JOB NO. EA-11423
HOLE NO. E89-4

WATER CONTENT
Wp - ☐ W - ○ W_L - △
PERCENT %
20 30 40 50 60

DEPTH FT.

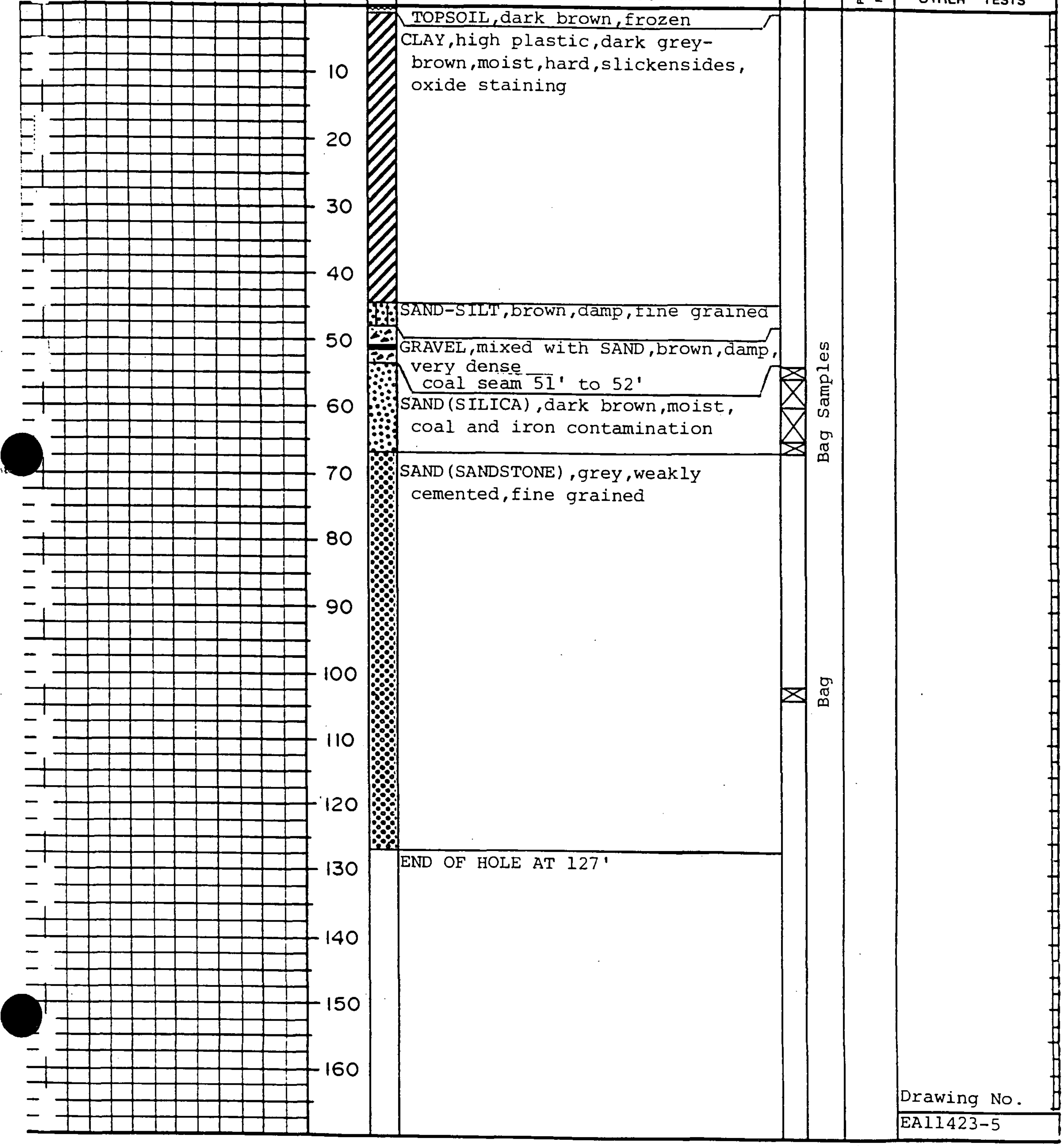
SOIL SYMBOL

SOIL DESCRIPTION
DATUM Geodetic
SURFACE ELEVATION 363.6 m

SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE

DRILL TYPE
Becker, 6 5/8" Casing and 4" Tricone

OTHER TESTS



TOPSOIL, dark brown, frozen

CLAY, high plastic, dark grey-brown, moist, hard, slickensides, oxide staining

SAND-SILT, brown, damp, fine grained

GRAVEL, mixed with SAND, brown, damp, very dense
coal seam 51' to 52'

SAND (SILICA), dark brown, moist, coal and iron contamination

SAND (SANDSTONE), grey, weakly cemented, fine grained

END OF HOLE AT 127'

Drawing No.
EA11423-5

HT08 - 79/05

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

BOREHOLE LOG

PROJECT PEACE RIVER SILICA SAND LTD.
FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM
SILICA SAND DEPOSIT NEAR PEACE RIVER, ALBERTA

ED/DWN. GM/AV
CKD. DFC
DATE OF INVEST. March 11/89
JOB NO. EA-11423
HOLE NO. E89-5

WATER CONTENT
Wp - ☐ W - ○ WL - △
PERCENT %
20 30 40 50 60

DATUM Geodetic
SURFACE ELEVATION 391.0 m

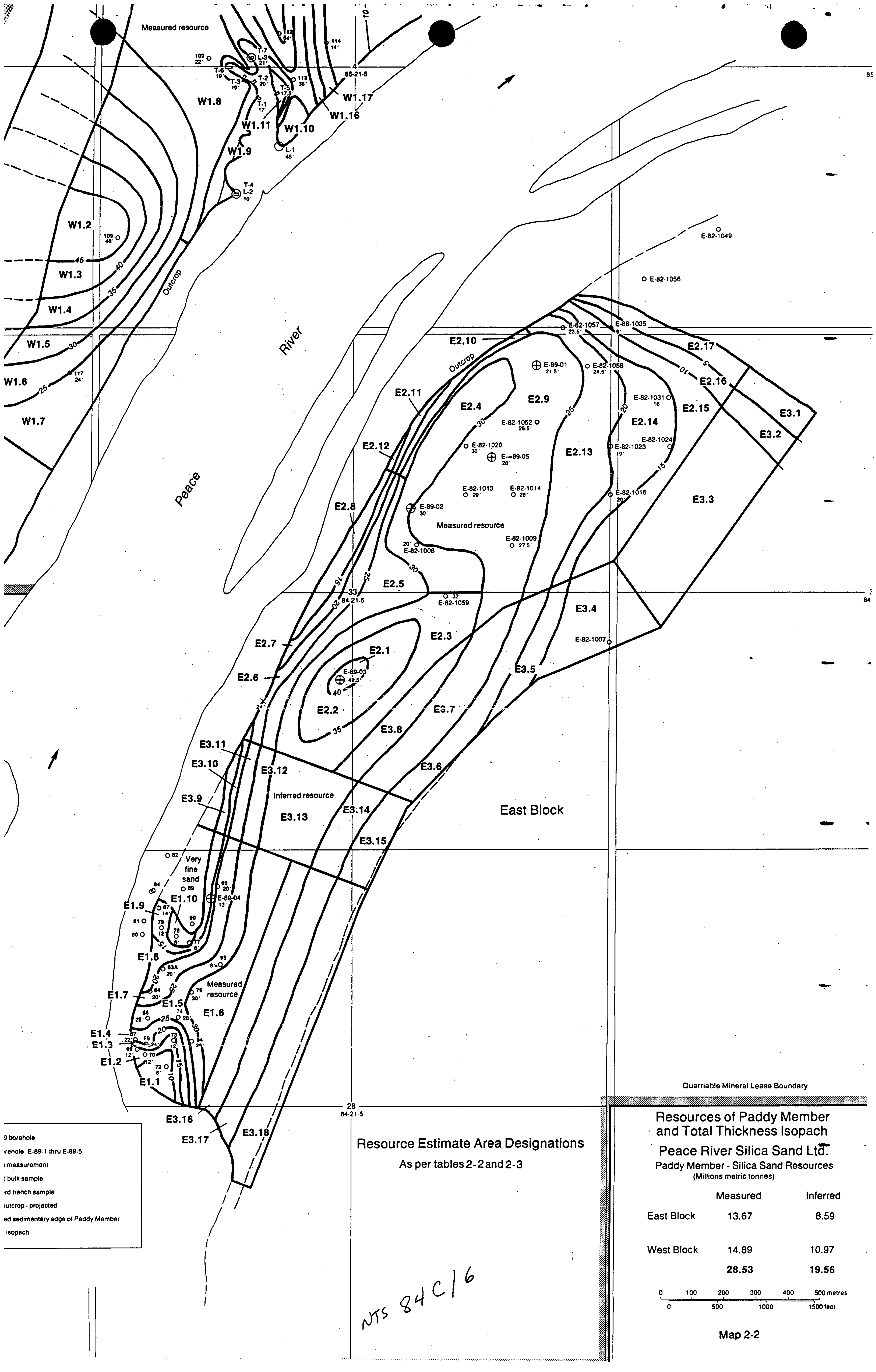
DRILL TYPE Becker, 6 5/8" Casing and 4" Tricone

DEPTH FT.	SOIL DESCRIPTION	SOIL SAMPLE CONDITION	TYPE	PENETRATION RESISTANCE	OTHER TESTS
0–31	GRAVEL, mixed with SAND, brown, damp, very dense, cobbles				
31–110	CLAY (SHALE), high plastic, dark grey, damp, very hard -trace seepage at 55'				
110–138	SAND (SILICA), grey, damp, fine to very fine grained -coarse grained, 115' to 124' -medium grained 124' to 138' -wet coal seam at 134.5'	☒	Bag Samples		
138–148	COAL, black, trace seepage				
148–150	SAND (SANDSTONE), yellow tint, fine grained, dense	☒	Bag		
	END OF HOLE AT 150'				

Depth scale: 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

Drawing No.
EA11423-6

HT08 - 79/05



Resource Estimate Area Designations

As per tables 2-2 and 2-3

NTS 84 C/6

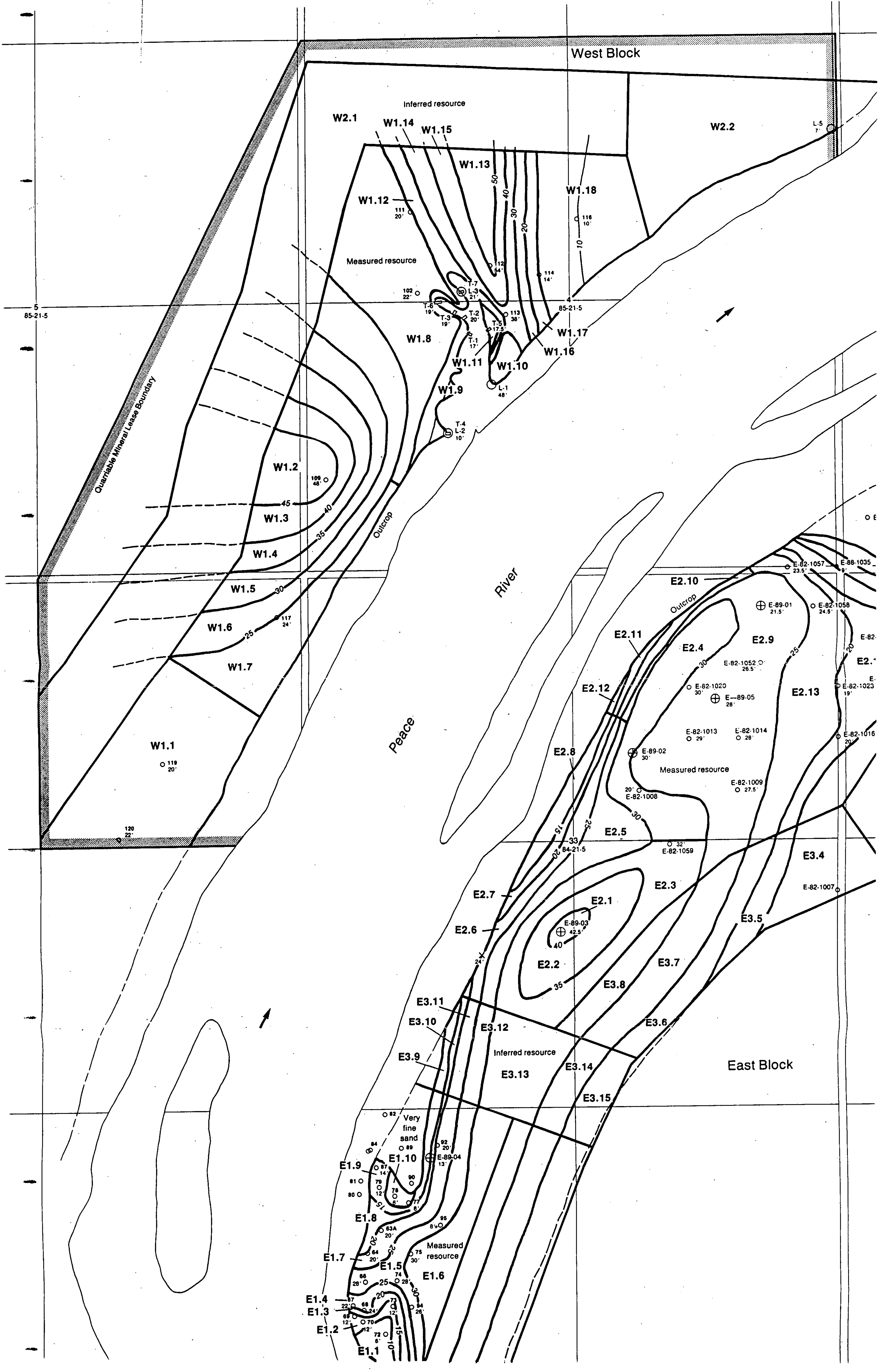
Resources of Paddy Member and Total Thickness Isopach

Peace River Silica Sand Ltd.

Paddy Member - Silica Sand Resources
(Millions metric tonnes)

	Measured	Inferred
East Block	13.67	8.59
West Block	14.89	10.97
	28.53	**19.56**

Map 2-2


West Block
Inferred resource
W2.1
W1.14
W1.15
W1.13
W2.2
L-5 7'
W1.12
111 20'
W1.18
116 10'
50
40
30
20
10
Measured resource
112 54'
114 14'
T-7
L-3 21'
102 22'
T-6 19'
T-3 19'
T-2 20'
T-5 17.5'
113 38'
T-1 17'
5
85-21-5
4
85-21-5
W1.17
W1.16
W1.8
W1.11
W1.10
L-1 48'
W1.9
T-4
L-2 10'
Quarriable Mineral Lease Boundary
W1.2
109 48'
45
40
35
W1.3
Outcrop
W1.4
W1.5
30
River
117 24'
W1.6
25
W1.7
Peace
W1.1
119 20'
120 22'
E-82-1057 23.5'
E-88-1035 9'
E2.10
Outcrop
E-89-01 21.5'
E-82-1058 24.5'
E2.11
E2.4
E2.9
30
25
20
E-82-1052 26.5'
E-82-1020 30'
E-89-05 28'
E2.13
E-82-1023 19'
E2.12
E-82-1013 29'
E-82-1014 28'
E-82-1016 20'
E2.8
E-89-02 30'
Measured resource
E-82-1009 27.5'
20' E-82-1008
30
15
25
33
84-21-5
20
E2.5
32' E-82-1059
E3.4
E2.3
E-82-1007
E2.7
E2.1
E-89-03 42.5'
E2.6
40
E3.5
24'
E2.2
E3.7
35
E3.8
E3.11
E3.10
E3.12
E3.6
Inferred resource
E3.9
E3.13
E3.14
East Block
E3.15
82
Very fine sand
84
89
92 20'
E-89-04 13'
E1.9
E1.10
87 14'
81
79 12'
90
80
78 6'
77 8'
15
E1.8
95 8'
63A 20'
20
25
Measured resource
75 30'
E1.7
64 20'
E1.5
E1.6
66 28'
74 28'
25
30
20
E1.4
67 22'
68 24'
73 12'
94 26'
E1.3
69 12'
70
15
E1.2
71 12'
72 6'
10
E1.1

ALBERTA
RESEARCH
COUNCIL

ANAYLTICAL SERVICES

Manufacturing Technologies Department

Client: Ultrasonic Industrial Sciences Ltd.
Edmonton , Alberta

RE: Sand analysis report's appendix 1 and 2

Analyst: Wendy Wade
Date: October 17,1994

Appendix 1 Lithium Metaborate Analysis Procedure

The analytical procedure used to completely dissolve the sand samples uses lithium metaborate as the decomposition reagent. The salts formed during the fusion are dissolved in a weak acid solution to give a clear solution. The solution is analyzed by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP).

Procedure:

Step 1	The sample is ground to a fine power in a Shatterbox.
Step 2	The ground sample is weighed into a platinum crucible along with the lithium metaborate.
Step 3	The crucible is heated over a propane flame until the fusion is completed. The resulting molten material is poured into a solution of nitric acid and water.
Step 4	The solution is stirred until the fused sample is completely dissolved at which time it is diluted to a known volume.
Step 5	The resulting solution is analyzed by ICP (Inductively Coupled Plasma-Atomic Emission Spectroscopy)
Step 6	The results from the ICP are reported as the detected minor elements and as the calculated oxides from the major elements.
Step 7	A loss on ignition analysis was conducted on all samples. (at 1000° C)

Note:

This method is used to analyze bulk samples for major and minor elements.

Appendix 2 Individual Analysis Reports

See the following 12 pages

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #1

Lab ID: Ultra 1

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 1 ug/gm as detected by ICP
Titanium	Ti	315
Aluminum	Al	2050
Iron	Fe	2443
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	1355
Phosphorus	P	<50
Sulfur	S	<50

Component	Symbol	ULTRA 1 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.05
Aluminum Oxide	Al_2O_3	0.39
Ferric Oxide	Fe_2O_3	0.35
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.16
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.30
Silicon Dioxide ***	SiO_2	98.74

***Note : Silicon Dioxide % was calulated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 1 ug/gm as detected by ICP
Barium	Ba	59
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	92
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #2

Lab ID: Ultra 2

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 2 ug/gm as detected by ICP
Titanium	Ti	101
Aluminum	Al	715
Iron	Fe	2494
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	76
Phosphorus	P	<50
Sulfur	S	<50

Component	Symbol	ULTRA 2 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.02
Aluminum Oxide	Al_2O_3	0.14
Ferric Oxide	Fe_2O_3	0.36
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	<0.01
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	<0.1
Silicon Dioxide ***	SiO_2	99.48

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 2 ug/gm as detected by ICP
Barium	Ba	<50
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	66
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #3

Lab ID: Ultra 3

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 3 ug/gm as detected by ICP
Titanium	Ti	200
Aluminum	Al	2271
Iron	Fe	2729
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	1564
Phosphorus	P	<50
Sulfur	S	<50

Component	Symbol	ULTRA 3 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.03
Aluminum Oxide	Al_2O_3	0.43
Ferric Oxide	Fe_2O_3	0.39
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.19
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.40
Silicon Dioxide ***	SiO_2	98.56

***Note : Silicon Dioxide % was calculated by difference.
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 3 ug/gm as detected by ICP
Barium	Ba	72
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	97
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OFSAMPLE AS RECIEVED #4

Lab ID: Ultra 4

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 4 ug/gm as detected by ICP
Titanium	Ti	85
Aluminum	Al	697
Iron	Fe	1743
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	59
Phosphorus	P	<50
Sulfur	S	80

Component	Symbol	ULTRA 4 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.01
Aluminum Oxide	Al_2O_3	0.13
Ferric Oxide	Fe_2O_3	0.25
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	<0.01
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.20
Silicon Dioxide ***	SiO_2	99.40

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 4 ug/gm as detected by ICP
Barium	Ba	<50
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	106
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #5

Lab ID: Ultra 5

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA ug/gm as detected by ICP
Titanium	Ti	89
Aluminum	Al	1028
Iron	Fe	2924
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	364
Phosphorus	P	<50
Sulfur	S	<50

Component	Symbol	ULTRA %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.01
Aluminum Oxide	Al_2O_3	0.19
Ferric Oxide	Fe_2O_3	0.42
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.04
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.30
Silicon Dioxide ***	SiO_2	99.02

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 1 ug/gm as detected by ICP
Barium	Ba	<50
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	67
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #6

Lab ID: Ultra 6

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 6 ug/gm as detected by ICP
Titanium	Ti	689
Aluminum	Al	3405
Iron	Fe	6748
Manganese	Mn	50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	2550
Phosphorus	P	<50
Sulfur	S	<50

Component	Symbol	ULTRA 6 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.11
Aluminum Oxide	Al_2O_3	0.64
Ferric Oxide	Fe_2O_3	0.96
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.31
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.50
Silicon Dioxide ***	SiO_2	97.46

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 6 ug/gm as detected by ICP
Barium	Ba	113
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	101
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

W/W

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #7

Lab ID: Ultra 7

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 7 ug/gm as detected by ICP
Titanium	Ti	290
Aluminum	Al	1377
Iron	Fe	2557
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	59
Sodium	Na	<50
Potassium	K	603
Phosphorus	P	<50
Sulfur	S	65

Component	Symbol	ULTRA 7 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.05
Aluminum Oxide	Al_2O_3	0.26
Ferric Oxide	Fe_2O_3	0.37
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.07
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.20
Silicon Dioxide ***	SiO_2	99.04

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 7 ug/gm as detected by ICP
Barium	Ba	<50
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	117
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #8

Lab ID: **Ultra 8**

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 8 ug/gm as detected by ICP
Titanium	Ti	135
Aluminum	Al	734
Iron	Fe	2163
Manganese	Mn	<50
Magnesium	Mg	<50
Calcium	Ca	<50
Sodium	Na	<50
Potassium	K	422
Phosphorus	P	<50
Sulfur	S	103

Component	Symbol	ULTRA 8 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.02
Aluminum Oxide	Al_2O_3	0.14
Ferric Oxide	Fe_2O_3	0.31
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.05
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	0.01
Lost on Ignition at 1000 C	L.O.I.	0.20
Silicon Dioxide ***	SiO_2	99.27

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 8 ug/gm as detected by ICP
Barium	Ba	<50
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	<50
Chromium	Cr	<50
Vanadium	V	<50
Selenium	Se	101
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50

Analyst: Wendy Wade

REPORT OF ANALYLSIS

ICATION OF SAMPLE AS RECIEVED #1 (Duplicate of sample #1) **5)**

ithiummetaborat Fusion and ICP Analysis

ol	ULTRA 1 dup ug/gm as detected by ICP
	335
Al	2071
	2375
	<50
g	<50
	<50
	<50
K	1331
	<50
	<50

Component	Symbol	ULTRA 1 dup %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.06
Aluminum Oxide	Al_2O_3	0.39
Ferric Oxide	Fe_2O_3	0.34
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	<0.01
Calcium Oxide	CaO	<0.01
Sodium Oxide	Na_2O	<0.01
Potassium Oxide	K_2O	0.16
Phosphorus Pentoxide	P_2O_5	<0.01
Sulfur	S	<0.01
Lost on Ignition at 1000 C	L.O.I.	0.30
Silicon Dioxide ***	SiO_2	98.75

A 5 dup n/100gm) ted as oxide
0.01
0.19
0.42
0.01
0.01
0.01
0.01
0.04
0.01
0.01
0.30
9.03

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

ol	ULTRA 1 dup ug/gm as detected by ICP
	62
	<50
n	<50
b	<50
	<50
	<50
r	<50
	<50
	<50
e	95
	<50
	<50
W	<50

Analyst: Wendy Wade

ndy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #9

Lab ID: Ultra 9

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Analyst: Wendy Wade

Major Elements

Element Name	Symbol	ULTRA 9 ug/gm as detected by ICP
Titanium	Ti	802
Aluminum	Al	18319
Iron	Fe	74889
Manganese	Mn	299
Magnesium	Mg	1819
Calcium	Ca	1549
Sodium	Na	207
Potassium	K	6280
Phosphorus	P	835
Sulfur	S	246

Component	Symbol	ULTRA 9 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.13
Aluminum Oxide	Al_2O_3	3.46
Ferric Oxide	Fe_2O_3	10.70
Manganosite	MnO	0.04
Magnesium Oxide	MgO	0.30
Calcium Oxide	CaO	0.22
Sodium Oxide	Na_2O	0.03
Potassium Oxide	K_2O	0.76
Phosphorus Pentoxide	P_2O_5	0.19
Sulfur	S	0.02
Lost on Ignition at 1000 C	L.O.I.	4.30
Silicon Dioxide ***	SiO_2	79.85

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 9 ug/gm as detected by ICP
Barium	Ba	446
Molybdenum	Mo	<50
Zinc	Zn	334
Antimony	Sb	<50
Lead	Pb	81
Cobalt	Co	<50
Strontium	Sr	66
Chromium	Cr	<50
Vanadium	V	501
Selenium	Se	242
Cadmium	Cd	<50
Nickel	Ni	55
Tungsten	W	<50
Silver	Ag	<50
Gold	Au	107

Analyst: Wendy Wade

REPORT OF ANALYLSIS

IDENTFICATION OF SAMPLE AS RECIEVED #10

Lab ID: Ultra 10

Method of analysis : Lithiummetaborat Fusion and ICP Analysis

Major Elements

Element Name	Symbol	ULTRA 10 ug/gm as detected by ICP
Titanium	Ti	715
Aluminum	Al	9069
Iron	Fe	20857
Manganese	Mn	<50
Magnesium	Mg	449
Calcium	Ca	750
Sodium	Na	159
Potassium	K	3921
Phosphorus	P	1154
Sulfur	S	2809

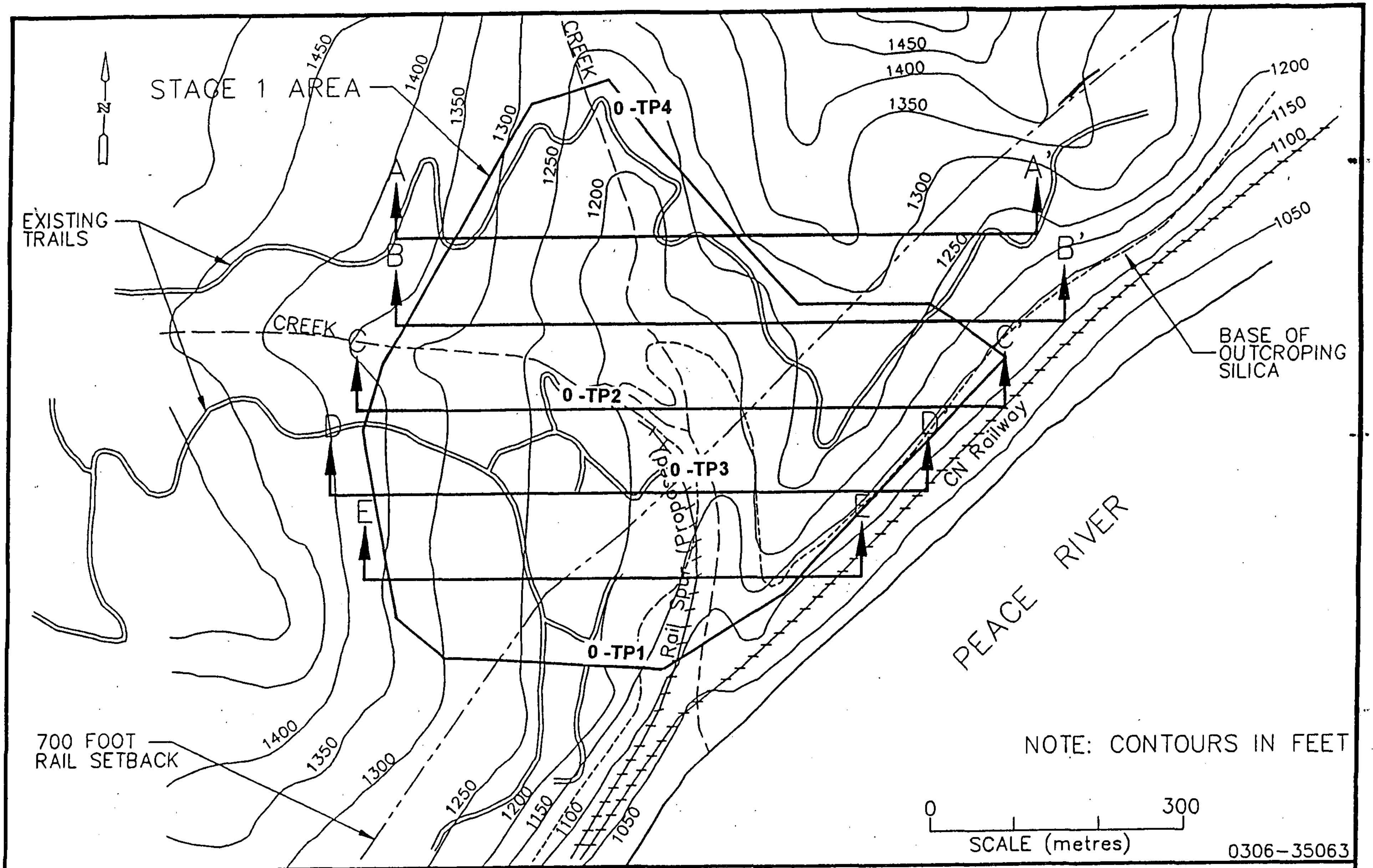
Component	Symbol	ULTRA 10 %(gm/100gm) Calculated as oxide
Titanium Dioxide	TiO_2	0.12
Aluminum Oxide	Al_2O_3	1.71
Ferric Oxide	Fe_2O_3	2.98
Manganosite	MnO	<0.01
Magnesium Oxide	MgO	0.07
Calcium Oxide	CaO	0.10
Sodium Oxide	Na_2O	0.02
Potassium Oxide	K_2O	0.47
Phosphorus Pentoxide	P_2O_5	0.26
Sulfur	S	0.28
Lost on Ignition at 1000 C	L.O.I.	3.00
Silicon Dioxide ***	SiO_2	90.97

***Note : Silicon Dioxide % was calculated by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements

Element Name	Symbol	ULTRA 10 ug/gm as detected by ICP
Barium	Ba	319
Molybdenum	Mo	<50
Zinc	Zn	<50
Antimony	Sb	<50
Lead	Pb	<50
Cobalt	Co	<50
Strontium	Sr	77
Chromium	Cr	<50
Vanadium	V	160
Selenium	Se	149
Cadmium	Cd	<50
Nickel	Ni	<50
Tungsten	W	<50
Silver	Ag	<50
Gold	Au	79

Analyst: Wendy Wade



EBA Engineering Consultants Ltd.

PROJECT
PEACE RIVER SILICA

CLIENT
ULTRASONIC INDUSTRIAL
SCIENCES LTD.

TITLE
STAGE 1 AREA
SITE PLAN

DATE	94/04/29	DWN.	LCP	CHKD.	NRM	FILE NO. DATA\35063SIT	FIGURE 2

ALBERTA
RESEARCH
COUNCIL Manufacturing Technologies

September 15,1994

Ultrasonic Industrial Sciences Ltd.
Suite 200
17834 106A Ave
Edmonton, Alberta
T5S 1V3

Dear Mr.Christensen,

RE: Sand analysis.

Enclosed are the metal analyses of the sand samples submitted on August 5,1994. Also enclosed is the trace metal analysis of the water sample submitted on August 10, 1994. These reports were send by FAX earlier to you. If you have any questions about the analysis, please call me, Wendy Wade, at 450-5433.

Yours truly,

[redacted]

Wendy Wade
Analytical Chemistry
Manufacturing Technologies

Mailing address
PO Box 8330
Edmonton, Alberta
Canada T6H 5X2

● 250 Karl Clark Road
Edmonton, Alberta
☎ 403/450-5400
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1021 Hayter Road
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Edmonton, Alberta

Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta

1 Oil Patch Drive
Devon, Alberta

3rd Floor, Digital Building
6815 - 8 Street NE
Calgary, Alberta

Appendix 1 Lithium Metaborate Analysis Procedure

The analytical procedure used to completely dissolve the sand samples uses lithium metaborate as the decomposition reagent. The salts formed during the fusion are dissolved in a weak acid solution to give a clear solution. The solution is analyzed by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP).

Procedure:

Step 1	The sample is ground to a fine power in a Shatterbox.
Step 2	The ground sample is weighed into a platinum crucible along with the lithium metaborate.
Step 3	The crucible is heated over a propane flame until the fusion is completed. The resulting molten material is poured into a solution of nitric acid and water.
Step 4	The solution is stirred until the fused sample is completely dissolved at which time it is diluted to a known volume.
Step 5	The resulting solution is analyzed by ICP (Inductively Coupled Plasma-Atomic Emission Spectroscopy)
Step 6	The results from the ICP are reported as the detected minor elements and as the calculated oxides from the major elements.
Step 7	A loss on ignition analysis was conducted on all samples. (at 1000° C)

Note:

This method is used to analyze bulk samples for major and minor elements.

ANALYTICAL SERVICES
Manufacturing Technolgies Department

Client : B. Christensen
Ultrasonic Industrial Sciences Ltd
Edmonton Alberta

Analyst : Wendy Wade
Date : August 19,1994

Requested Analysis : Analysis for elements in sand samples

Major Elements Concentration units % ie:(gm/100gm)

Name	Symbol	ULTRA 1	ULTRA 2	ULTRA 3	ULTRA 4	ULTRA 5
Silicon Dioxide ***	SiO_2	98.74	99.48	98.56	99.40	99.02
Titanium Dioxide	TiO_2	0.05	0.02	0.03	0.01	0.01
Aluminum Oxide	Al_2O_3	0.39	0.14	0.43	0.13	0.19
Ferric Oxide	Fe_2O_3	0.35	0.36	0.39	0.25	0.42
Manganosite	MnO	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium Oxide	MgO	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium Oxide	CaO	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium Oxide	Na_2O	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium Oxide	K_2O	0.16	<0.01	0.19	<0.01	0.04
Lose on Ignition at 1000 C	L.O.I.	0.30	<0.1	0.40	0.20	0.30
Phosphorus Pentoxide	P_2O_5	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfur	S	<0.01	<0.01	<0.01	<0.01	<0.01
Total recovered %		100.00	99.99	100.00	99.99	100.00

***Note : Silicon Dioxide % was determined by difference .
The % L.O.I was included in the final silicon dioxide calculation.

Minor Elements Concentration units ug/gm ie:ppm

Name	Symbol	ULTRA 1	ULTRA 2	ULTRA 3	ULTRA 4	ULTRA 5
Barium	Ba	59	<50	72	<50	<50
Molybdenum	Mo	<50	<50	<50	<50	<50
Zinc	Zn	<50	<50	<50	<50	<50
Antimony	Sb	<50	<50	<50	<50	<50
Lead	Pb	<50	<50	<50	<50	<50
Cobalt	Co	<50	<50	<50	<50	<50
Strontium	Sr	<50	<50	<50	<50	<50
Chromium	Cr	<50	<50	<50	<50	<50
Vanadium	V	<50	<50	<50	<50	<50
Selenium	Se	92	66	97	106	67
Cadmium	Cd	<50	<50	<50	<50	<50
Nickel	Ni	<50	<50	<50	<50	<50
Tungsten	W	<50	<50	<50	<50	<50

Major Elements Concentration units % ie:(gm/100gm)

Name	Symbol	ULTRA 6	ULTRA 7	ULTRA 8	ULTRA 1 DUP	ULTRA 5 DUP
Silicon Dioxide***	SiO_2	97.46	99.04	99.27	98.75	99.03
Titanium Dioxide	TiO_2	0.11	0.05	0.02	0.06	0.01
Aluminum Oxide	Al_2O_3	0.64	0.26	0.14	0.39	0.19
Ferric Oxide	Fe_2O_3	0.96	0.37	0.31	0.34	0.42
Manganosite	MnO	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium Oxide	MgO	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium Oxide	CaO	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium Oxide	Na_2O	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium Oxide	K_2O	0.31	0.07	0.05	0.16	0.04
Lose on Ignition at 1000 C	L.O.I	0.50	0.20	0.20	0.30	0.30
Phosphorus Pentoxide	P_2O_5	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfur	S	<0.01	<0.01	0.01	<0.01	<0.01
Total recovered %		99.99	99.99	100.00	100.00	99.99

Minor Elements Concentration units ug/gm ie:ppm

Name	Symbol	ULTRA 6	ULTRA 7	ULTRA 8	ULTRA 1 DUP	ULTRA 5 DUP
Barium	Ba	113	<50	<50	62	<50
Molybdenum	Mo	<50	<50	<50	<50	<50
Zinc	Zn	<50	<50	<50	<50	<50
Antimony	Sb	<50	<50	<50	<50	<50
Lead	Pb	<50	<50	<50	<50	<50
Cobalt	Co	<50	<50	<50	<50	<50
Strontium	Sr	<50	<50	<50	<50	<50
Chromium	Cr	<50	<50	<50	<50	<50
Vanadium	V	<50	<50	<50	<50	<50
Selenium	Se	101	117	101	95	94
Cadmium	Cd	<50	<50	<50	<50	<50
Nickel	Ni	<50	<50	<50	<50	<50
Tungsten	W	<50	<50	<50	<50	<50

Note Samples # 1 and # 5 were duplicated and are seen as Ultra 1 DUP and Ultra 5 DUP

Major Elements Concentration units % ie:(gm/100gm)

Name	Symbol	ULTRA 9	ULTRA 10
Silicon Dioxide***	Si02	79.85	90.97
Titanium Dioxide	Ti02	0.13	0.12
Aluminum Oxide	Al203	3.46	1.71
Ferric Oxide	Fe203	10.70	2.98
Manganosite	Mn0	0.04	<0.01
Magnesium Oxide	Mg0	0.30	0.07
Calcium Oxide	Ca0	0.22	0.10
Sodium Oxide	Na20	0.03	0.02
Potassium Oxide	K20	0.76	0.47
Lose on Ignition at 1000 C	L.0.I	4.30	3.00
Phosphorus Pentoxide	P205	0.19	0.26
Sulfur	S	0.02	0.28
Total recovered %		100.00	100.00

Minor Elements Concentration units ug/gm ie:ppm

Name	Symbol	ULTRA 9	ULTRA 10
Barium	Ba	446	319
Molybdenum	Mo	<50	<50
Zinc	Zn	334	<50
Antimony	Sb	<50	<50
Lead	Pb	81	<50
Cobalt	Co	<50	<50
Strontuim	Sr	66	77
Chromium	Cr	<50	<50
Vanadium	V	501	160
Selenium	Se	242	149
Cadmium	Cd	<50	<50
Nickel	Ni	55	<50
Tungsten	W	<50	<50
Silver	Ag	<50	<50
Gold	Au	107	79

#38

GEOLOGICAL REPORT

on

PEACE RIVER INDUSTRIAL SANDS PROJECT

1982

Prepared for:

PEACE RIVER INDUSTRIAL RESOURCES LTD.

By:

DRS. JOHN H. LICHTENBELT
Prof. Geol.

TIME-STATIGRAPHIC CORRELATIONS LTD.
128 Scarboro Avenue South West,
CALGARY, Alberta, T3C 2H1
CANADA

Telephone: (403) 244-8721

PROFESSIONAL GEOLOGIST ALBERTA
JOHN LICHTENBELT

TABLE OF CONTENTS

INTRODUCTION

This report, prepared for PEACE RIVER INDUSTRIAL RESOURCES LTD., describes the geology of the Cretaceous Peace River Formation, the overlying Shaftesbury Formation and the overlying Pleistocene gravels and sands.

The purpose of this report is to clarify the geological setting leading to the deposition of sands, which are of commercial and industrial importance.

The occurrence of sands of apparent industrial interest in the Peace River Area was known since 1918, when F. H. McLean (GSC) investigated the site and wrote a report.

Investigations since then have suffered from lapses in time and quality of work undertaken. A good example is the drilling of 61 wells since 1977. A total of some 4,940 feet of hole was drilled with very sketchy sample descriptions, uncertain location determinations and often no elevation values. Poor administrative control made the acquired information unreliable.

In order to obtain factual information, a drilling program was designed and executed from August 24th to September 14th, 1982 in an area 10 miles N.E. of the Peace River Town. The area is in Sections 28 and 33 of Township 84, Range 21, West of the 5th Meridian, and the exploration area is covered by SML Licence No. 4288.

A total of 17 wells with a footage of 2,179.5 feet were drilled. The results of this drilling are expressed on the eight maps accompanying this report.

This drilling and the mapping allowed for the calculation of reserves of total sand deposits and net sand reserves, both proven and inferred additional reserves.

II GEOLOGY

Definition of Formations and members involved

The Cretaceous beds involved are in descending order:

SHAFTESBURY FORMATION	Shales, dark grey brown, calcareous	Marine
PEACE RIVER FORMATION or equiv. Viking Formation	(Paddy member: Sand	non-Marine
	(Cadotte mbr: Sandstones	Marine
	(Harmon mbr: Shales dark grey	Marine

1 CRETACEOUS

a) HARMON MEMBER:

The Harmon shales consist of fine thin-bedded dark gray marine shales. The type locality is found on the East bank of the Peace River in Section 21, Township 84, Range 21, West of the 5th Meridian, which is only one mile South of the exploration area.

The Harmon Shales have not been observed in the exploration area itself and have not been reached by drilling in the subject area.

b) CADOTTE MEMBER

The Cadotte sandstones form prominent cliffs on both sides of the Peace River. The sandstones weather gray and dark brown with, near the top, a crust of a bright yellow mineral, which has not been analyzed yet.

The sandstones consist of grains of even size, and are horizontally bedded, which indicates a marine and calm deposition. The beds are massive.

b) CADOTTE MEMBER Continued:

The important observation is that rounded milky (agate) and smoke quartz grains are absent. This is in sharp contrast to the Paddy where these sand grains are abundant.

c) PADDY MEMBER:

After the deposition of the Cadotte member, the sea retreated partially.

The particular clarity of the sands of the Paddy member in the exploration area are the result of this partial regression.

The zero edge of the Paddy sands as shown on Map No. 3 indicates the position of the tidewater edge during Paddy times.

On the tidewater edge and in slightly deeper water to the Southwest the sedimentary material was agitated by wave action.

The harder material consisted of clear quartz crystals, agate and smoke quartz.

These were rounded and depending on the speed and strength of the currents, sorted in beds with larger and smaller grains.

Quick lateral and vertical changes in grain size occur.

The wave action also affected the underlying Cadotte which, being not yet diagenetically hardened, was slightly eroded. Bays and current channels were carved out in gentle and shallow shapes.

c) PADDY MEMBER Continued:

When the deposition started, allochthonous and probably some autochthonous plant material was deposited on the edge of the transgressive Paddy sea.

This material was converted to coal in subsequent times.

These coal seams, together with reworked Cadotte sands (dark brown because of weathering) and sometimes interbedded shale layers indicate the beginning of the non marine Paddy member or the end of the Cadotte marine cycle.

In fact, in this particular case, the sea did not evacuate the area completely and only converted from marine saltwater to shallow fresh water deposits.

For practical reasons we place the coal and associated brown sands and the shales into the Cadotte. The coal is a good sample marker and marks the boundary between clear Paddy sands above and the contaminated and weathered sands immediately below.

The Paddy sands were not only laid down on the water edge and below; sometimes sand was piled up by wind action in low dunes above the waterline. These sands show strong cross bedding.

On the West side of the Peace River, the Paddy sand zero edge is exposed. (See figure 1)

c) PADDY MEMBER Continued:

A curious phenomenon is the occurrence of round clusters of calcareous sandstone with coal or shale inclusions. These were formed when shale or coal particles rolled over the bottom probably in a gentle rocking motion because of wave action. Ground-up shells supplied the material which glued the sand grains together around the inclusions.

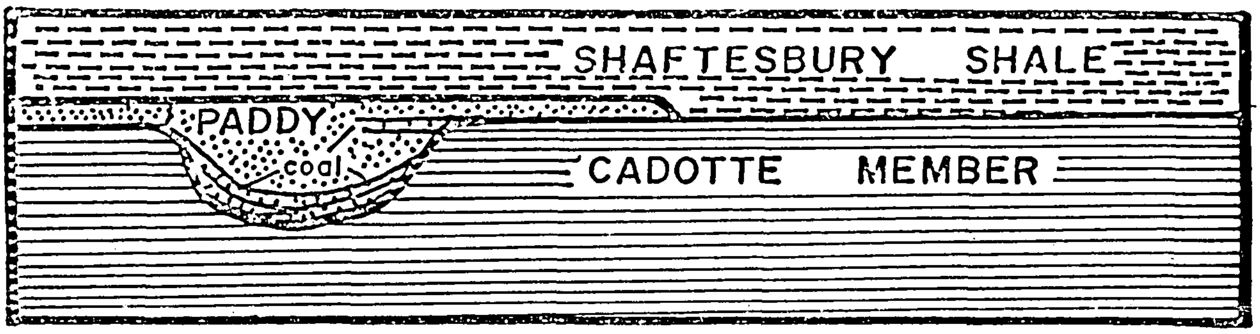


Fig 1

In general, we find the coarsest sands, which are also usually the best rounded, close to the zero edge, near the bottom and near the top of the Paddy sands.

The cleanest sands are found in the middle section. The most evenly graded in sizes are found where the section is thickest and farthest from the zero edge.

d) SHAFTESBURY FORMATION

The sea level rose rapidly and a new marine cycle started.

The Shaftesbury shales were seemingly deposited conformably on the Paddy sands.

In reality there is an angular discomformity. Evidence for this is that the thickness of the total Peace River formation in the exploration area is in the order of 130 feet. In the Gulf Peace River 16-35-85-21-W5M well only 67 feet are left.

The loss of 65 feet of section over a distance of 10 miles or 7 feet per mile is so small (1 ft./754 ft) that the angle can not be observed.

The disconformity (but not the angularity) is also expressed by the fact that NE of the Paddy zero edge, the Shaftesbury is overlying the Cadotte member directly.

The marine brown gray shales of the Shaftesbury are calcareous and contain pancake shaped claystone concretions and thin calcareous siltstone beds.

A very thin fine gravel/shale bed at the base of the formation is indicative of its transgressive nature.

2. PLEISTOCENE FLUVIAL DEPOSITS

In post-glacial times the Peace River cut a valley through the Upper Cretaceous and Lower Cretaceous beds, including the upper part of the Shaftesbury.

2. PLEISTOCENE FLUVIAL DEPOSITS Continued:

When there was a lull in the erosional cycle, the Peace River valley was wide and the river meandered.

In the exploration area the river cut sideways into the East bank (or right bank) into the lower part of the Shaftesbury formation, ca 70 feet above the base of the formation.

Subsequently the river deposited a 20-70 foot thick bed of gravel and sand on the remaining Shaftesbury Shale.

A new phase of erosion deepened the river bed, eroding through the rest of the Shaftesbury, and the Paddy Sand to the level of the top of the Cadotte member.

The river again cut sideways and removed the Paddy sand in the area of the gravel pit, replacing it with a deposit of gravel and sand.

Renewed erosion deepened the valley floor to a level some 30 feet below the top of the Cadotte. Sideways cutting removed the upper part of the Cadotte just north of the gravel pit.

When a new erosional period started, the river vacated this meander without leaving behind a deposit of gravel and sand.

At the level of the base of the Cadotte a wide meander removed the Cadotte Sandstone over a large area just south of the gravel pit.

III DRILLING:

a) Previous:

A number of drilling campaigns were conducted in the general exploration area:

October - November, 1977: 7 wells

These wells were drilled before the gravel pit was established: (See report by Trigg-Woollett Consulting Ltd. 1978).

We now have a better understanding of the geology and the information obtained by the drilling was re-correlated:

		ELEVATION	PLEISTOCENE GRAVEL & SAND	SHAFTESBURY	PADDY	CADOTTE
Loc.4	Hole 1	1170	0-37	37-82	absent	82-90
	Hole 2	1170	0-35	absent	35-40	40-74
	Hole 3	1168	0-28	absent	28-39	39-74
	Hole 4	1178	0-50	absent	50-70	70-84
	Hole 5	1178	0-45	absent	absent	45-80
Loc.6	Hole 1	1254	0-21	21-77	77-98	98-126
	Hole 2	1230	0-25	25-76	76-98	not-reached

Total Footage: 626'

Holes 1 - 5 of Location 4 are in the gravel pit area. We know now that only a few feet of Paddy Sand were spared by the fluvial erosion.

Hole 5 is located in the slide area. The surface is already below the top of the Cadotte although this is not expressed in the KB elevation given in the drilling report.

The accuracy of the given KB elevations seems to be in doubt.

See page 8, paragraph 4 of the Trigg report:

> "The elevation of the collars and the location of the drill holes were determined by Banks Well Servicing Ltd. Their plots may be subject to revision and consequently the position and the elevation of the drill holes relative to each other may not be accurate."

Trigg mentions the absence of silica sand in some locations and suggests that this absence may be attributed to erosion prior to the deposition of the Shaftesbury formation, or that the Shaftesbury slumped into an erosional channel.

We believe that the reason is a little bit more complex and we re-capitulate here what was described in Chapter 2 in length:

> Sideways erosion removed the Paddy and overlying Shaftesbury shale in the gravel pit area. The bottom levels of this erosion was a few feet above the base of the Paddy (and the coal). Gravel and sand were deposited before the river evacuated the site. Renewed erosion at a level some 30 feet lower removed Cadotte Sandstone from an area just north of the present gravel pit. The meandering river did not deposit gravel or sand in this area. Later Shaftesbury shales slumped into the erosion area vacated by the river.

Because of the uncertainty of the KB elevations of the Holes Location 6 No. 1 and 2, we do not use the elevations of the formation tops on the contour maps.

The thicknesses of the penetrated beds are independent of the elevation values and we have used these values on the Isopach maps.

1980 DRILLING CAMPAIGN

Some 36 wells were drilled with a total footage of 3363. For questionable reasons, the numbering of the wells was changed and reversed after drilling. There are serious questions, not about the location of the wells, but about the marking of the sample descriptions and of the samples tested.

The sample descriptions are also rather inadequate ("Clay and rocks"). We have attempted to re-correlate these wells (see Table II).

No values of the KB elevations were taken.

Most wells are located in the gravel pit area and the meager descriptions seem to confirm our visual observations that mainly gravel and sand overlay the coal at the top of the Cadotte directly.

East of the gravel pit Shaftesbury is present with sometimes gravel on top, sometimes underneath the Shaftesbury shale.

1980 DRILLING CAMPAIGN Continued:

In this last case the Shaftesbury slumped downhill over the much younger gravel.

Another series of 11 wells were drilled in the gravel pit with a total footage of 382. No location coordinates or KB values were obtained.

1981 DRILLING CAMPAIGN

Four wells were drilled close and parallel to the Cadotte cliff in the North-Eastern part of the exploration area.

Coordinates of all four wells and KB values on three of the wells were obtained (see map).

No other information however is available.

Later in the year (October - November) another six wells were drilled with a total drilled footage of 569.

Descriptions are available of the samples obtained. These descriptions are numbered 3 - 8 inclusive. The locations were surveyed at a later date. Because the wells were not marked, the surveyed holes are number 1 - 6 inclusive. There is no way to resolve this problem and therefore the results of the drilling cannot be used.

b) PRESENT

1982 DRILLING CAMPAIGN

In the period August 24 - September 14th, 1982, some 17 wells were drilled in the subject area under the supervision of Mr. John Tiberio, Mr. J. R. Jameson and Mr. J. H. Lichtenbelt.

These wells penetrated a total of 2179.5 feet. After some experimenting an efficient drilling procedure was developed.

The Pleistocene gravel and sand section and the soft clay at the top of the Shaftesbury were penetrated with the hammer drill.

The drilling was continued when firmer Shaftesbury shales were reached with a smaller diameter double pipe, a tricone bit and with rotary drilling, again using air to bring the samples to the surface. This method of drilling was used through the Shaftesbury shales, Paddy sands and Cadotte sandstone.

The descriptions are enclosed in the appendix No. III.

The daily drilling reports are enclosed in appendix No. IV.

V COMMENTS ON THE MAPS

The results of the drilling were used to construct eight maps which are presented in ascending order.

MAP NO, 1 CONTOUR MAP TOP CADOTTE

The top Cadotte is flat and in the area where Paddy sand was deposited on this surface, the relief is in the order of 10 - 17 feet, only.

A study of the general area (Townships 83 - 84 - 85, Ranges 20 - 21 - 22, West of the 5th Meridian) also indicates an even, flat surface with a South West dip of ± 16 feet/mile or ± 3 m/Km.

The general study also indicates a thickness of the total Peace River Formation (Paddy & Cadotte) in the order of 130 feet in the subject area.

Considering a proven thickness of the Paddy of 30 feet, this leaves a thickness of 100 - 105 feet for the Cadotte, a figure which is substantiated by the height of the cliff exposing the Cadotte and by drilling. (See drilling Campaign 1980 Table II, wells 89/74, 90/73 and 91/72).

MAP No. 2 ISOPACH MAP TOTAL PADDY SAND

The Paddy Sand facies is well defined by drilling in the northern part of the exploration area.

The shape of the zero edge is proven in the north, but only indicated on the eastern side.

MAP NO. 2 ISOPACH MAP TOTAL PADDY SAND Continued:

The Shaftesbury here is rapidly thickening and this thickness becomes prohibitive for the exploration of the underlying Paddy Sand.

From North East to South West we see the thickness of the Total Paddy Sand increasing from zero to more than 30 feet.

Close to the cliff edge the thickness decreases rapidly to zero because of erosion at the top.

The area enclosed by the 20 foot isopach line is the most attractive from a commercial standpoint.

MAP No. 3 ISOPACH MAP NET PADDY SAND

From the Total Paddy Sand section those sands were excluded which, by visual examination, were considered to be "dirty", either because of high content of mafic minerals (Fe containing Pyroxene and Amphibole), argillaceousness (clay content) or oxidation and Fe_2O_3 staining.

The finer the sand, usually the more mafic minerals are included.

The remaining thickness of "clean" sand was mapped on Map No. 3.

The Isopach lines closely parallel the Total Paddy sand isopachs.

The isopachs also infer a large area south of the drilled area in which favourable "clean" sands are developed.

MAP NO. 4 CONTOUR MAP TOP PADDY SAND

This map shows that the top Paddy Sand is practically flat.

Only five feet (in one foot contours) relief was indicated by the drilling.

From this we deduce that the new marine cycle of the Shaftesbury sea rapidly flooded the area, without transgressive erosional damage.

Only an inch of fine gravel at the base of the Shaftesbury indicates a re-working and "weaning" of the top of the Paddy by the transgressive waters.

In the Chapter Geology, Cretaceous, Chapter C, Paddy member Fig. 1, we have already discussed how the northern edge of the Paddy abruptly was buried by shales of the Shaftesbury.

MAP NO. 5 ISOPACH MAP SHAFTESBURY SHALE

From the top Paddy Sand map we know that the base of the Shaftesbury has a relief of only five feet.

The isopach map shows values from 100 - 70 feet. This is caused by erosion at the top, when the Peace river meandered sideways into the Shaftesbury shales.

The map does not show that the shales abruptly thin to zero near the edge of the cliff which they actually do.

MAP NO. 6 CONTOUR MAP TOP SHAFTESBURY SHALE

The thin areas in the Shaftesbury shales (centre of North East Quarter Section of 33 - 84 - 21 W5M and North West corner of North West Quarter Section of 34 - 84 - 21 W5M) are reflected in lows in the Contour Map on the top of the Shaftesbury Shales.

MAP NO. 7 ISOPACH MAP GRAVEL AND SAND

The lows on the top of the Shaftesbury Shales were filled in by the Pleistocene Sand and Gravels.

The isopach map shows this infill combined with the topography.

The thickest location of sand and gravel (30 - 70 ft.) is situated over the Shaftesbury lows in a generally North East - South West direction through the centre of the exploration area.

V RESERVES

To measure the surface between isopach lines, the North Star Horizon 7012 Planimeter, made by Houston Instrument Digitizers was used.

We have two different categories of reserves:

1) Reserves proven by the 1982 drilling in the area north of the East-West centre line through Section 33-84-21-W5M and;

V RESERVES Continued:

2) Inferred Reserves in the exploration area situated south of the East-West centre line through Section 33-84-21-W5M. The thicknesses are obtained by extrapolation of the isopach lines in the drilled area.

The detailed calculations are presented in tables 1, 2 and 3 at the end of this chapter.

We recapitulate here the end results of the computations:

		M3	Feet 3
Gravel & Sand	Proven Reserves	13,348,650	471,403,150
	Inferred Reserves	2,217,400	78,306,500
	Total Reserves:	**15,566,050**	**549,709,650**
Shaftesbury Shale (overburden)	Total Volume:	36,301,150	1,282,000,000
Total Paddy Sand	Proven Reserves	5,357,450	189,196,600
	Inferred Reserves	9,881,150	348,950,350
	Total Reserves:	**15,238,600**	**538,146,950**
Net Paddy Sand	Proven Reserves	3,030,100	107,006,950
	Inferred Reserves	7,315,100	258,330,350
	Total Reserves:	**10,345,200**	**365,337,300**
Cadotte	Proven Reserves	53,514,000	1,889,800,000
TOTAL SAND RESERVES: PADDY & CADOTTE		**68,752,600**	**2,427,946,950**

CADOTTE and TOTAL PADDY SAND RESERVES TABLE 1

FORMATION	RESERVES PROVEN	RESERVES INFERRED	AREA IN HECTARES	THICKNESS IN METRES	RESERVES IN METERS^3	RESERVES IN FEET^3	COMMENTS
CADOTTE	X		178.38	30	53,514,000	1,889,800,000	
TOTAL PADDY	X		9.37	.762	71,400	2,521,450	
			9.2	2.286	210,300	7,426,700	
			9.59	3.81	365,400	12,904,000	
			10.02	5.33	534,100	18,861,550	
			12.84	6.858	880,600	31,098,100	
			20.17	8.382	1,690,650	59,704,750	
			16.05	10.	1,605,000	56,680,050	PROVEN
							TOTAL
							PADDY
			87.24		5,357,450	189,196,600	SAND:
		X	21.40	1.524	326,150	11,517,900	
			39.56	4.572	1,808,950	63,882,450	
			43.36	7.620	3,304,050	116,680,000	
			44.42	10.	4,442,000	156,870,000	INFERRED
							TOTAL
							PADDY
			148.74		9,881,150	348,950,350	SAND
TOTAL PADDY			235.98		15,238,600	538,146,950	

NET PADDY SANDS

RESERVES TABLE 2

FORMATION	RESERVES PROVEN	RESERVES INFERRED	AREA IN HECTARES	THICKNESS IN METRES	RESERVES IN METERS^3	RESERVES IN FEET^3	COMMENTS
NET							
PADDY	X		12.69	.762	96,700	3,414,950	
			12.20	2.286	278,900	9,849,250	
			13.46	3.81	512,800	18,109,350	
			15.86	5.33	845,350	29,853,250	
			11.74	6.858	805,150	28,433,600	
			6.14	8.	491,200	17,346,550	
			16.05	10.	1,605,000	56,680,050	PROVEN
			72.09		3,030,100	107,006,950	NET PADDY SAND
		X	30.0	1.524	457,200	16,145,850	
			41.36	4.572	1,891,000	66,780,050	
			70.96	7.	4,966,900	175,404,450	INFERRED
			142.32		7,315,100	258,330,350	NET PADDY SAND
TOTAL NET PADDY SAND			214.41		10,345,200	365,337,300	

SHAFTESBURY SHALE OVERBURDEN PLEISTOCENE GRAVEL & SAND RESERVES TABLE 3

ORMATION	RESERVES PROVEN	RESERVES INFERRED	AREA IN HECTARES	THICKNESS IN METRES	RESERVES IN METERS^3	RESERVES IN FEET^3	COMMENTS
SHAFTESBURY SHALE	X	X	170.11	21.34	36,301,150	1,282,000,000	TOTAL OVERBURDE OF SHALES FROM ZERO EDGE (CLI TO THE 1300' CONTOUR (APPR ZERO GRAVEL L
PLEISTOCENE		X	20.97	7.62	1,597,900	56,429,300	
GRAVEL & SAND			20.13	10.67	2,147,850	75,850,600	
			14.4	13.72	1,975,700	69,771,200	
			9.64	16.76	1,615,650	57,056,150	
			21.3	19.81	4,219,550	149,012,000	
			8.15	22.00	1,792,000	63,283,900	
			94.59		13,348,650	471,403,150	PROVEN GRAVEL & SAND
		X	31.7	7.00	2,217,400	78,306,500	INFERRED GRAVEL & SAND
TOTAL RESERVE GRAVEL & SAND			126.29		15,566,050	549,709,650	

VI ABSTRACT OF TEST RESULTS OF INDUSTRIAL SANDS

1. SIEVE TEST of Paddy Sand taken from outcrop in exploration area close to well W-82-1008.

$>$ 20 : 23.0%
20 - 40 : 41.2%
40 - 100 : 33.6%
$<$ 100 : 2.2%

CRUSH TEST Standard Test

$>$ 20 Crushed : 46.0%
20 - 40 Crushed : 30.0%

2. SIEVE TEST of Paddy Sand taken from outcrop in exploration area close to well W-82-1008

$>$ 20 : 23.2%
20 - 40 : 36.2%
40 - 100 : 35.2%
$<$ 100 : 5.4%

CRUSH TEST Standard Test

$>$ 20 : 40.5%
20 - 40 : 28.8%

3. SAMPLE HOLE 03 (?) EAST (28 - 30 ft.)

SIEVE TEST

$>$ 20 : 5.0%
20 - 40 : 21.8%
40 - 100 : 68.1%
$<$ 100 : 5.0%

CRUSH TEST Standard Test

20 - 40 Crushed : 40.8%

4. UNMARKED HOLE WEST

SIEVE TEST

$>$ 20 : 2.2%
20 - 40 : 20.4%
40 - 100 : 73.0%
$<$ 100 : 2.2%

CRUSH TEST Standard Test

20 - 40 : 38.3%

V1 ABSTRACT OF TEST RESULTS OF INDUSTRIAL SANDS Continued:

5. HOLE A EAST (105 - 115 ft.)

SIEVE TEST

> 20 : 3.9%
20 - 40 : 17.6%
40 - 100 : 69.0%
< 100 : 5.5%

CRUSH TEST Standard Test

20 - 40 : 35.7%

6. HOLE 03 EAST (28 ft.)

SIEVE TEST

> 20 : 13.1%
20 - 40 : 36.8%
40 - 100 : 45.9%
< 100 : 4.5%

CRUSH TEST Standard Test

20 - 40 : 28.2%

In a report by Geotechnical Consultants Ltd. of September 29th, 1980, for Matkins Minerals, some chemical tests were reported.

Because of obtuse laboratory numbers and sample numbers, we could not retrace which wells were involved nor the depth from which the samples were retrieved.

The depth determination is very important. If obtained near the top of the Cadotte member, abnormally high Fe_2O_3 values can be expected, a value which is not representative for the rest of the Cadotte.

One series of tests reported values of Fe_2O_3% by weight of 1.56, 3.35 and 2.77. In another series of tests reported values of Fe_2O_3% by weight of 0.29, 0.38, 0.31 and 0.30 were reported. These values vary too much to be of any significance.

VI ABSTRACT OF TEST RESULTS OF INDUSTRIAL SANDS Continued:

During the 1982 drilling campaign a large amount of carefully marked samples were obtained.

These should be analyzed on a comparative basis. For instance, Paddy sands should be compared with other Paddy sands, while Cadotte samples should be taken selectively. Samples from the top of the Cadotte, which contain coal and oxydized sands, should be considered non-productive.

VII CONCLUSIONS

1. Significantly large reserves of industrial grade sands are present in the Lease area:

Total Paddy Sand	15,238,600	M^3
Net Paddy Sand	10,345,200	M^3
Total Cadotte Sandstone	53,514,000	M^3

2. Not only the Paddy Sand but also the Cadotte sandstone seem to be suitable for glass manufacturing. This increases the total reserves available greatly. Further testing should be carried out.

3. Because of the exposure of the Cadotte in the gravel pit area, exploitation could start here immediately, thereby not only assuring an immediate cash flow, but also providing an area for dumping of the Shaftesbury Shale overburden overlying the Paddy Sand to the North.

VII CONCLUSIONS Continued:

4. At present it seems that the crush-strength of the sand is insufficient for the use as frac sand for deeper wells. We believe that the Paddy sand grains are for a major part formed out of quartz crystals. The grains shatter easily along shear planes of the crystal lattices.

5. Hardened amorphous glass grains (- or small pellets) made from the sands (Paddy and Cadotte) occuring in the exploration area could overcome this problem.

6. The Author of this report is planning to pursue this avenue of benefication of the sand in the near future.

CALGARY, ALBERTA, CANADA

DRS. JOHN H. LICHTENBELT
Prof. Geol.

APPENDIX I DRILLING 1980

ORIGINAL NUMBERS	REVERSED NUMBERS	ELEVATION	PLEISTOCENE GRAVEL & SAND	SHAFTESBURY	PADDY	CADOTTE
63	99	No Elev.	0 - 7	X	X	7 - 75
64	98	"	0 - 28	X	X	28 - 75
65	97	"	0 - 8	X	X	8 - 75
66	96	"	0 - 5	X	X	5 - 75
67	95	"	0 - 3	X	X	3 - 75
68	94	"	0 - 5	X	X	5 - 75
69	93	"	0 - 7	X	X	7 - 60
70	92	"	0 - 4	X	X	4 - 75
71	91	"	X	0 - 90		
72	90	"	X	0 - 20		
73	89	"	X	0 - 39	X	39 - 90
74	88	"	X	0 - 37	X	37 - 70
75	87	"	X	0 - 34	X	34 - 90
76	86	"	0 - 27	X	X	27 - 42
77	85	"	0 - 27	X	X	27 - 120
78	84	"	0 - 9	9 - 18	X	18 - 90
79	83	"	X	0 - 13	X	13 - 90
80	82	"	X	X	X	0 - 60
81	81	"	X	X	X	0 - 60
82	80	"	0 - 8	8 - 49	X	49 - 90
83	79	"	X	0 - 58	X	58 - 75
84	78	"	X	0 - 15	X	15 - 90
85	77	"	X	0 - 12	X	12 - 75
86	76	"	0 - 25			
87	75	"	0 - 5	5 - 37	X	37 - 105
89	74	"	X	0 - 27	X	27 - 120
90	73	"	0 -	23	X	23 - 120
91	72	"	0 - 3	3 - 47	X	47 - 150
92	71	"	0 - 5	5 - 53	X	53 - 136
93	70	"	X	0 - 43	X	43 - 105
94	69	"	X	0 - 68	X	68 - 135
95	68	"	0 - 4	4 - 75	X	75 - 120
96	67	"	X	0 - 150		
97	66	"	X	0 - 150		
98	65	"	0 -	97	97 -	150
99	64	"	0 - 28	28 - 89	89-105	

APPENDIX II LITHOLOGICAL SYMBOLS USED IN THIS REPORT

⁰°⁰°⁰	GRAVEL
∴∴∴	SAND
≡≡≡	CLAY or SHALE
— — — —	ARGILLACEOUS
⋯⋯⋯	SILTSTONE
⌶ ⌶ ⌶ ⌶ ⌶	CLAYSTONE
⊥ ⊥ ⊥	CALC. SHALE
▬	COAL

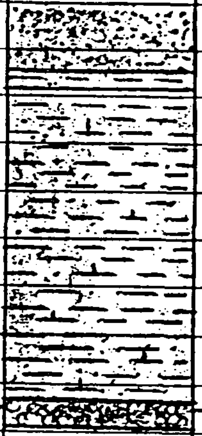
COLOR CODE USED:

GRAVEL & SAND	FLUVIAL	PLEISTOCENE	
CLAY - SHALE	MARINE	CRETACEOUS	SHAFTESBURY FORMATION
SAND	NON-MARINE	CRETACEOUS	PADDY SAND MEMBERS
SANDSTONE	MARINE	CRETACEOUS	CADOTTE MEMBER

a/a	as above
arg	argillaceous (part clay content)
blk.	black
brn.	brown
calc	calcareous (part lime content)
carb	carbonaceous (part coal content)
cly	clay
crs	coarse
dk	dark
f	fine
gry	gray
grn	green
lt	light

m	medium
pk.	pink
Py	Pyrite
rnd	round(ed)
rd	red
S	Sand
Sh	Shale
Slt	Siltstone
SS	Sandstone
v	very
yel	yellow
( )	minor
(( ))	trace
-	major
=	Large majority

WELL: E - 82 - 1007 Spud & Compl Aug 25 1982 Td 89' ELEVATION: 421,8 2 M = 1384 ft KB PAGE: 1

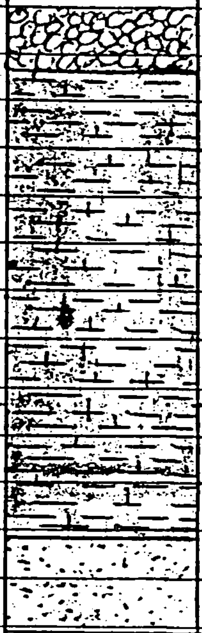
DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	AG	Thiohness	MINERALS	Lith Log	FORMATION TOPS
FROM	TO								
0 ~~14~~	14	m brn	Sand	Sd,mbrn, f-m,calc, femic min.,sub rounded.	1,2	14	Amph,Pyrox.		Shaftesbury
14	18	gry brn	Cly , Slt	Cly gry brn,v slt,calc.					
18	83	gry	Cly	Cly,gry,calc,(silty)	3 4 - 10	69			
83	89	Wht-gry-pk	Gravel	Gravel:Qtz gry,Qtz wht,Granite pk,Diorite.	10 -11	6			+ 1300
									+ 1200

WELL: E - 82 - 1008 Spud Aug 26 1982 Td 131'
Comp Aug 27 1982

ELEVATION: 391.287 M = 1284 ' KB

PAGE: 2

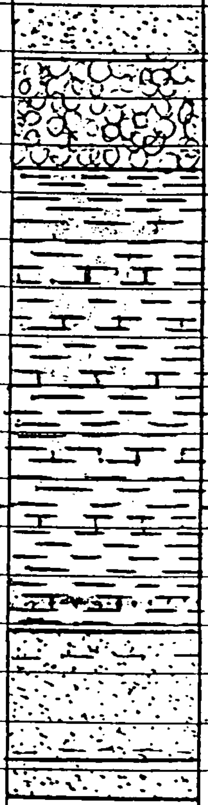
DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag	Thickness		Lith Log	FORMATION TOPS
FROM	TO								
0	14	Gravel	Gravel	Gravel m-crs.Qtz wht-brn.Granite pk.Diorite	1	14			
14	111	gry-brn	Cly-Sh	Cly-Sh gry brn,v.calc : Siltst gry hard bands 96-98 '	2-4				14 Shaftesbury
111	112	" "	Sand	Sand f-(crs)rounded , arg ((calc));crs:grains are:t smoke Qtz	5				
112	118			Poor sample because of water and soap	6	97			
118	120	lt brn	Sand	Sand f-m clear-milky,rounded,(Siderite),((Glauc)), (Amph,Pyrox)	7				
120 124	124	lt brn	Sand	Sand v f,lt brn; Feldspar,Amph,Pyrox.,Siderite.	8				+1200
124	124'6''	drkbrn	Sand/Clay	Mixture of Sand f a/a / Clay drk brn ((calc))	9				
124'6''	128	lt brn	Sand	Sand lt brn v fine,clear,sub rounded;Pyrox,Amph; Feldspar;(Siderite)	10				111 +1173
128	131	" "	Sand v fine	Sand v fine a/a	11	20+			Paddy Sand
									+/ 1100



Spud Sept 12 1982
WELL: B - 82 - 1009 · Comp Sept 12 1982 TD 167

ELEVATION: 397.903M - 1305' KB

PAGE: 3

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag		Thickness	Lith log	FORMATION TOPS
FROM	TO								
0	12	brn-drk brn	Sand	Sand f brn-red-drk brn.	1				
12	17		Gravel	Gravel f / Sand a/a.					
17	28		Gravel	Gravel f - crs.			37		
28	34		Gravel	Gravel crs / Sand a/a.					
34	37		Sand	Sand crs / Gravel f-m.	2				
37	131	brn gry	Clay	Clay brn gry.					37 + 1268
				@ 57 Clay a/a / Claystone.					Shaftesbury Sh
				@ 65 " "					
				@ 79 " "					
				@ 95 " "			94		
				@ 108 " "					
				@ 127 " / (SS wht / Claystone/Gravel)					
131	132		Sand	Sand f clean ((mafic min.)) sub rnd-rnd.	3				
132	137		Sand	Sand f clean.	4				
137	138	brn	Sand	Sand f brn (Arg)	2x 5				
138	147		Sand	Sand f - crs ,smoke,agate.	6				
147	151		Sand	Sand f-m-crs clean.					+ 1200
151	153		Sand	Sand f-m.	7				
153	155 1/2	lt brn	Sand	Sand f lt brn.					
155 1/2	157	" "	Sand	Sand a/a (arg)					
157	158 1/2	" "	Sand	Sand a/a (Wet)	8				
158 1/2	159	" "	Sand	Sand a/a / ((Coal))					131 + 1174
159	167	red	Sand	Sand f red (Fe_2O_3)			27 1/2		Paddy Sand
									158 1/2 + 1146 1/2
									Cadotte mbr
								TD 167	
									+ 1100

WELL: E-82-1013 Spud Aug 28 1982
Comp Aug 28 1982
147

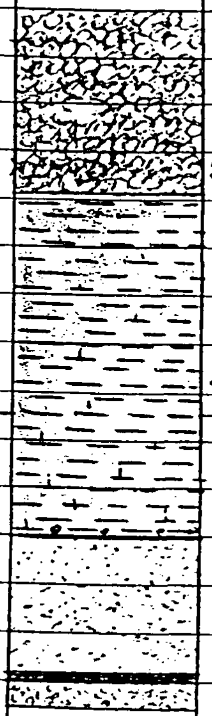
ELEVATION: 391.2 76M = 1284 ' KB

PAGE: 4

DEPTH FROM	DEPTH TO	COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag
0	38		Gravel	Gravel m-crs, Qtz wht-lt brn, Granite pk, Diorite.	
38	110	gry-brn	Cly-Sh	Cly-Sh, gry btn, v.calc,; Siltst drk gry, v.hard at 106 1/2	1
110	114	lt brn	Sand	Sand v f clear ; Mafic Min	2
114	118	lt brn-wht	"	" f - (crs) clear, well sorted	3
118	123	" "	"	" f - (crs angular)	4
123	128	" "	"	" f - m subrounded, clear.	5
~~128 133~~	133	" "	"	" f , clear, well sorted	6
133	138	" "	"	" a/a , with tight spot	7
138	139	" "	"	" a/a	8
139	140	blk	Coal	Coal blk	
140	143 1/2	drk brn	Sand dr	Sand drk brn	9
143 1/2	147	lt brn	"	Sand f, lt brn	10

Thickness
38
72
29
8+

Lith Log



FORMATION TOPS

38
Shaftesbury Sh

+ 1200

110 + 1174
Paddy Sand

139 + 1145
Top Cadotte

+ 1100

WELL: E-82-1014 A
Spud Aug 29 1982
Comp Aug 29 1982
160

ELEVATION: 394 -1295 ' KB

PAGE: 4

DEPTH FROM	DEPTH TO	COLOR	MAIN ROCK TYPE	DESCRIPTION	BEDDING	Bag
0	40		Gravel ,Sand	Gravel Qtz wht-lt brn,Granite pk,Diorite	1	
40	124	gry brn	Cly-Sh	Cly-Shale gry brn,v calc : Claystone gry,hard @ 45,' 89.Some sand f at 120'	2	
124	127	off white	Sand	Sand f-(crs);sharp,Mafic min.	}3	
127	129	" "	#	" crs,rounded / Sand f		
129	132	" "	"	" f-m-crs , sub rnd-rnd,(smoke),some rose Qtz	}4	
132	134	" "	"	" vf-m.		
134	139	" "	"	" f-m-crs,sub rnd-rnd (smoke)	5 2x	
139	144	" "	"	# f-m-(crs),clear,sub rnd-rnd (smoke)	6	
144	149	" "	"	" f-(m)-(crs) " " " "	7	
149	158	blk-lt brn	Coal,Sand	@ 152 Coal blk; @153 Sand lt brn;@154 Coal blk; @ 155 Sand brn f.	8	
158	160	lt brn	Sand	Sand brn f.	9	

Thickness

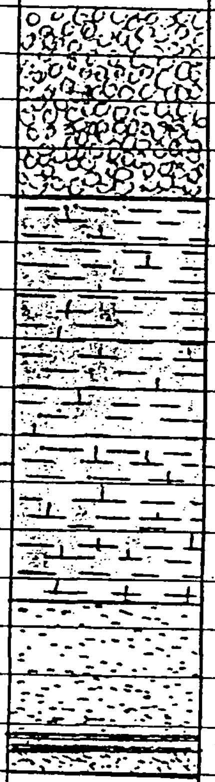
40

84

28

8+

Lith Log



FORMATION TOPS

40

Shaftesbur S

+1200

124 +1171
Paddy Sand

152 +1143
Top Cadotte

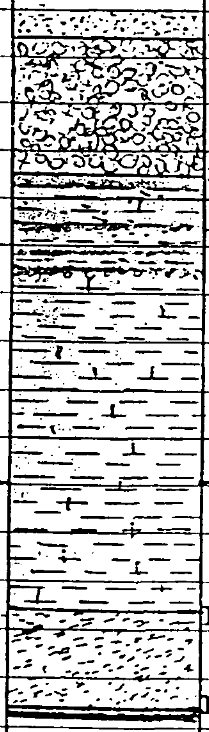
+1180

WELL: E - 82 - 1016 Spud 30 Aug 1982
Comp 30 Aug 1982 TD 146 1/2 '

ELEVATION: 396,95 M -1299' KB

DEPTH FROM	DEPTH TO	COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag	Thickness
0	5	brn	Sand	Sand brn		
5	35 1/2	Gr ,S	Gravel,Sand Gravel	Gravel,m-crs.Granite,Qtz,Diorite	1	35 1/2
35 1/2	45	brn	Cly	Cly brn (Sandy)	2	
45	46	brn	Sand	Sand brn f-m		
46	48	brn gry	Cly	Cly brn gry silty,moist		
48	52	" "	Cly,Sand	Cly brn gry,silty,moist; Sand brn moist		
52	53	" "	" "	Cly ,Sand a/a; Siltst 1-2 "		
53	54	"	Sand	Sand brn,crs,arg.		
54	54 1/2	"	S / Gravel	Sand,Gravel,Siltst,Cly,moist		
54 1/2	55	"	Clay	Clay brn		
55	56 1/2	"	Clay,Sand	Clay brn ,Sand brn,wet.		
56 1/2	126 1/2	brn gry	Clay/Shale	Clay/Shale brn gry; Clyst layer @ 8o,124.		91
126 1/2	128	lt gry	Sand	Sand f-(m),smoke,rnd-sub rnd.	3	
128	1 29		Sand	Sand a/a clear,(mica).	2x4	
129	130	"	"	Sand m-crs	5	
1 3 0	135 1/2	"	"	Sand f-(m) a/a		
135 1/2	146 1/2	"	"	Sand vf : mafic min,well sorted.	2x6	
146 1/2	146	brn	Sand	Sand f,carb	7	
14 6	146 1/2	blk-brn	Clay,Coal	Clay brn,Coal blk.		20
						1/2 +

Lith Log



FORMATION TOPS

5

35 1/2
Shaftesbury Sh

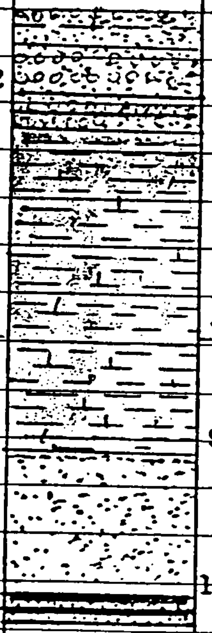
1200

126 1/2 + 1172 1/
Paddy Sand mbr

146 1/2 + 1152 1/
Cadotte mbr

1100'

WELL: E - 82 - 1020 Spud Sept 2 1982
Comp Sept 2 1982 TD 128 1/2' ELEVATION: 386.22 1M -1269' KB

DEPTH FROM	DEPTH TO	COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag		Thickness	Lith Log	FORMATION TOPS
0	8		Grav/S./Clay	Gravel crs, Sand, Clay					
8	19	brn	" "	Gravel f.well rnd;Sand crs brn.;@ 14'(Sand arg wet)	1				8
19	21	"	Sand brn crs clean		2				19
21	22		Gravel, Sand	Gravel f, Sand a/a			25 1/2		
22	23	"	Sand	Sand crs clean.					25 1/2
23	25 1/2	#	Gravel	Gravel n.	3				
25 1/2	93	brn gry	Clay	Clay brn gry.					Shaftesbury Sh
25									
93	94	brn	Sand brn f-m	Sand brn f-m.	4				
94	95		"	" f, clean, sub rnd			67 1/2		
95	99	yel	"	" f Sub rnd (Mafic min)/Siderite, yellow					+ 1200
99	108		SS"	SS f / Siderite / mafic min.					
		" -brn	"	@ 100' and 102' Fe $_2O_3$ layers.	5				
				@ 103 1/2 S m-crs clean rnd (smoke)	6				
108	111 1/2			S a/a m.					93 + 1176
				@ 108 1/2 S a/a f-m yrllow. well rnd, (Fe$_3$O)					
111 1/2	113		"	S a/a clean rnd.	7				Paddy Sand
113	118		"	S a/a v f.	8		30		
118	120 1/2		"	S a/a f(m)					
120 1/2	122 1/2		"	S a/a red (Fe$_2$O$_3$)					
120 1/2	123		"	S a/a clean					123
123	123 1/2	blk	Coal	Coal blk					Cadotte mbr
123 1/2	124 1/2		" /Sand	Coal / S f-m brn	9			TD 128 1/2	
124 1/2	127		" "	Coal / S v f.					
127	128		" "	" " arg, moist.	10				
128	128 1/2	gry brn	Sand	Sand v f lt gry brn.					
									+1100

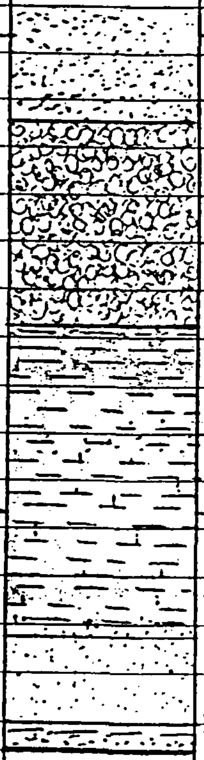
Spud Sept 1 1982
WELL: E - 28 - 102-3 Comp Sept 2 1982 TD 155

ELEVATION: 397.929M = 1306' KB

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag
FROM	TO				
0	24	brn	Sand	Sand brn f-m, clean	
24	30	brn	Sand, Gravel	Sand a/a, Gravel f-m-(crs)	~~1,2~~
~~30~~	~~33~~	~~brn~~	~~Gravel~~	~~Gravel f-(m).~~	
33	48	brn	Gravel, Sand	Gravel f-m, Sand brn crs	
~~48~~	~~53~~	"	" "	" a/a " a/a ; Water @ 49'	3
53	67 1/2	"	" "	" a/a " a/a ; Water	
67 1/2	70	brn gry	Clay	Clay brn gry (sandy) wet	
~~70~~	~~86~~	" "	"	" " " ~~solid (dry)~~	4
86	94	gry	"	" gry ; Silt f (powder) (@ 90' water?)	5
94	106	brn gry	Cly-Shale	" -Sh brn gry calc.	6
~~106~~	~~127~~	" "	" "	" " ~~a/a / (Siltst gry)~~	
127	130 1/2	" "	" "	" " a/a / Silt / (Siltst)	
130 1/2	131	lt brn	Sand	Sand f-m sub rnd (smoke)	7
131	131 1/2	gry	Siltst	Siltst (2") gry	
~~131 1/2~~	~~132~~	~~lt brn~~	~~Sand~~	~~Sand f-m rnd ; clean (smoke)~~	8
132	135	"	"	" f-m clean rnd.	
135	137	"	"	" f	9
137	150 1/2	"	"	" v f (no mafic min.)	10
150 1/2	152	v drk brn	Clay	Clay v drk brn, hard	
~~152~~	~~154 1/2~~	"	~~Sand~~	~~Sand drk brn~~	11
154 1/2	155	"	"	" v drk brn /Coal.	12

Thickness
24
43 1/2
water
"
"
64
19
4 1/2†

Lith Log

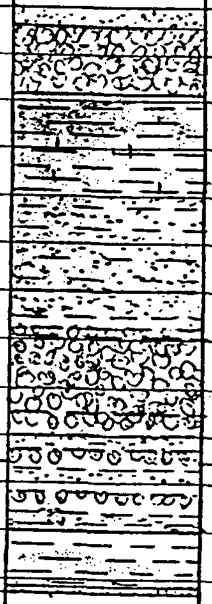


TD 155

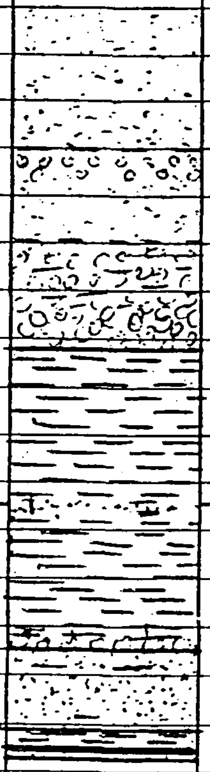
FORMATION TOPS
+1300
24
67 1/2 + 1238 1/
Shaftesbury
+1200
131 1/2 + 1174 1/2
Paddy Sand
150 1/2 + 1155 1/2
Cadotte mbr
+ 1100

WELL E - 82 - 1024 Spud Aug 31 1982
Comp Sept 1 1982 TD 122 1/2 ELEVATION 394,563M = 1294 ' KB

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag		Thickness	Lith Log	FORMATION TOPS
FROM	TO								
0	4	brn	Sand brn	Sand brn					
4	12		Gravel	Gravel	1		18		4
12	18		Clay	Clay / Sand / Gravel					18
18	42	brn	Clay	Clay brn					Shaftesbury Sl
42	46	brn	Sand	Sand drk brn f-(m),carb mat.;Sand v f brn arg			92		
46	47	brn gry	Clay	Clay brn gry (silty)					
47	48	drk brn	"	" drk brn,carb mat.					
48	66	brn	Silt / Clay	Silt-Clay brn v f (powder)					
66	68	drk brn	Clay drk brn	Clay drk brn,moist	2				
68	70	" "	"	" " " dry					
70	78	# "	"	" " " sandy			103		
78	85		Gravel /w	Gravel /w Granite pk,m, well rnd.					
85	87	drk brn	Clay	Clay drk brn calk					
87	110	" "	Clay	Clay " " /Gravel v f / Sand v crs.					
110	121	m gry	"	Clay m gry (Bentonite)	2x3				+1200
121	122	drk brn	Sand drk brn f	Sand drk brn f -(m) sub rnd / Sand crs (smoke) sub rnd					
122	122 1/2	lt brn	Sand	Sand f-m (smoke) sub rnd.	4				
									110 +1184
							11		
									121 +1173 Paddy Sand
									+1100

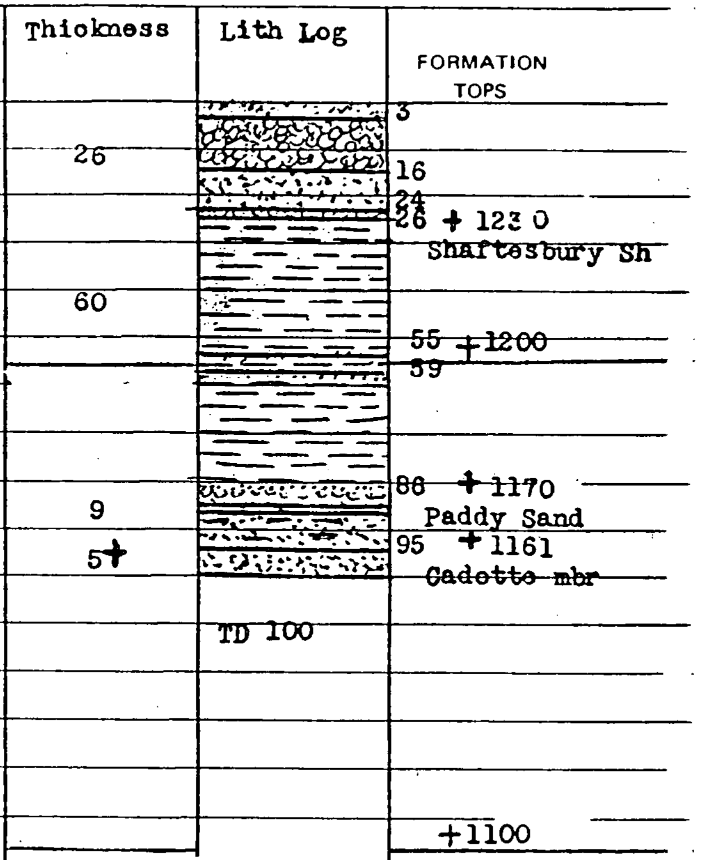


WELL: E - 82 - 1031 Spud Sept 11 1982
Comp Sept 11 1982 TD 157 ELEVATION:397.662M - 1305' KB

DEPTH FROM	DEPTH TO	COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag		Thickness	Lith Log	FORMATION TOPS
0	25	brn	Sand	Sand brn f.					
25	38	brn	Sand	Sand a/a m					
				@ 30 / ((Clay lt brn;glacial))					
				@ 34 / (Gravel f)					
				@ 36 / Sand m-crs / Gravel f-m.	1		72		
38	52	brn	Sand	Sand brn m-crs / ((Gravel f-m))					
				@ 50 / ((Clay lt brn,glacial))	2				
52	64		Gravel	Gravel f /((Clay a/a))					
64	72		Gravel	Gravel a/a m-crs;wet.					
72	130	brn	Clay	Clay brn; @ 107 Siltst-Clayst.v lt brn.					
130	135		Shale	Shale a/a /Clayst /((Gravel f))					
135	138	gray	Sand	Sand gry v f ((arg)) sub rnd.	3				72 +1233 Shaftesbury Sl
138	142		Sand	Sand f well rnd clean / ((Sand v crs well rnd))	4				
142	150	lt brn	Sand	Sand lt brn (arg);Uniform quality.	5				
150	151	brn-drkbrn	Sand	Sand f brn-drk brn,arg / Clay brn silty.	6				
151	154	brn	Clay-Shale	Clay-Shale brn silty.	7		63		
154	155	blk	Coal	Coal.					
155	157	brn	Sand	Sand v f brn / Coal.					+1200
									135 +1170 Paddy Sand
							16		151 +1154
							6+		Cadotte mbr
								TD 157	
									+1100

Spud Sept 7 1982
WELL: E - 82 - 1035 Comp Sept 8 1982 TD 100 ELEVATION: 382.86 M = 1256 ft KB PAGE: 10

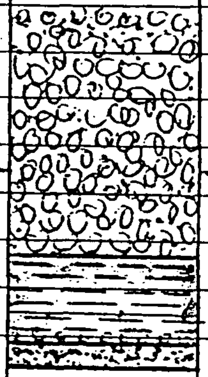
DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag	
FROM	TO					
0	3	brn	Sand	Sand brn		
3	16		Gravel	Gravel		
16	24	brn	Sand	Sand brn m	1	
24	26		Gravel	Gravel	2	
26	55	brn gry	Clay	Clay brn gry;@ 30 Clay - Sh;@ 43 Claystone gry hard		
55	70	" "	Clay	Clay a/a;@ 55 & 59 SS wht-lt gry;		
70	85	drk gry	Clay	Clay drk gry (powder);@82 Siltst;@ 84 Gravel v f	3	
85	86	" "	Clay-S-Silt.	Clay a/a/ Sand v f /Silt		
86	90	gry	Sand - Silt	Sand-Silt v f arg gry dirty.		
90	93		Sand	Sand f-m-(crs) clear,sub rnd-rnd.	4	
93	94		Sand	Sand f-(m),rnd ((dirty))		
94	95		Sand	Sand a/a-(crs)((smoke))(dirty)(arg).	5	
95	100	lt brn	Sand	Sand v f lt brn,dirty.		



WELL: E - 82 - 1049 Spud Sept 8 1982
Comp Sept 9 1982 TD 76 ELEVATION: 377.173 M 1237 ft KB PAGE: 11

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag
FROM	TO				
0	53	brn	Gravel&Sand	Gravel m-crs / Sand; @ 50 ' water.	
53	60	brn gry	Shale	Shale brn gry,weathered.	1
~~60~~	~~70~~	~~gry~~	~~Shale~~	~~Shale gry (powder);@ 67 thin Claystone beds.~~	
70	71	gry	Shale	Shale a/a/((Gravel f))/((Sand m-crs dirty))	2
71	76	brn	Sand	Sand f-brn,sharp.	3

Thickness	Lith Log	FORMATION TOPS
53		+1200
18		53 +1184 Shaftesbury Sh
5+		71 +1166 Cadotte mbr
	TD 76	
		+1100



WELL: E - 82 - 1052 Spud Sept 7 1982
Comp Sept 7 1982 TD 146'

ELEVATION: 391.428M 1284 ft KB

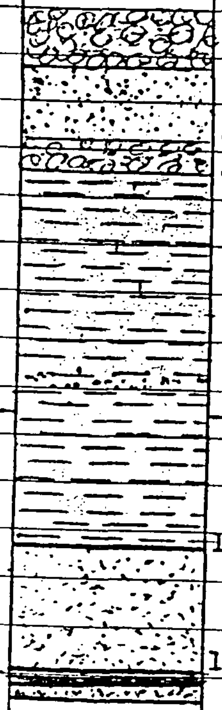
PAGE: 12

DEPTH FROM	DEPTH TO	COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag
0	12	brn	Gravel -Sand	Gravel / Sand brn f-crs Good quality	
12	28	"	Sand	Sand brn m Good quality	
28	34			Gravel and Sand ? No return ,Bit plugged by rock.	I
34	80	gry brn	Shale	Shale gry brn / (Claystone gry)	
80	113	" "	"	Shale a/a / (SS f I"?)	2
113	118	gry	Sand	Sand f gry,mafic min.,dirty.	
118	123		Sand	Sand f-m,v clean,rnd.	3
123	134		Sand	Sand a/a & crs (smoke) clean.	4
134	139 1/2	gry	Sand	Sand f,mafic min.	5
139 1/2	140	brn	Sand	Sand f brn.	6
140	142 1/2	blk	Coal	Coal /Water when commenced drilling.	7
142 1/2	145	blk brn	Coal	Coal / Sand m brn.	8
145	146	brn	Sand	Sand f brn,sharp.	9

Thickness

Lith Log

FORMATION TOPS



34

79

26 1/2

6 1/2

TD 146

12

28

34 Shaftesbury Sh

+1250

+1200

113 + 1171
Paddy Sand

139 1/2 + 1144 1/

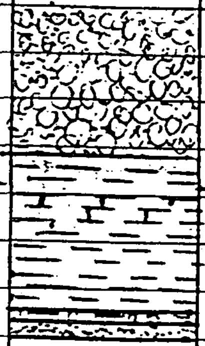
Cadotte mbr

+1100

WELL: W - 82 - 1056 Spud Sept 9 1982
Comp Sept 10 1982 TD 70

ELEVATION: 377.221M = 1238' KB

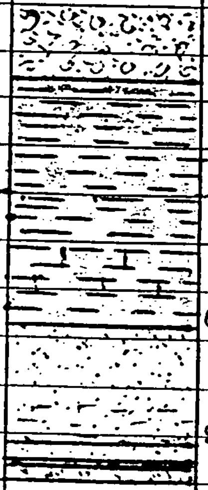
PAGE: 13

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag		Thickness	Lith Log	FORMATION TOPS
FROM	TO								
0	32	brn	Sand & Gravel	Sand brn m-crs / Gravel f-(crs) @ 18' drk brn and wet ; @	1		32		
32	65	brn gry	Clay	Clay brn gry / @ 40'. 3" Claystone bed. @ 43 ' a/a @ 45 ' powder	2		36		32 + 1206 + 1200 Shaftesbury Sh
65	68	brn gry	Clay & Gravel	Clay brn gry / (Gravel v f)					
68	70	brn	Sand	Sand f brn sharp.	3		2+		68 + 1170 Cadotte mbr
								TD 70	
									+ 1100

WELL: E - 82 - 1057 Spud Sept 10 1982
Comp Sept 10 1982 TD 100

ELEVATION: 377.876M - 1240' KB

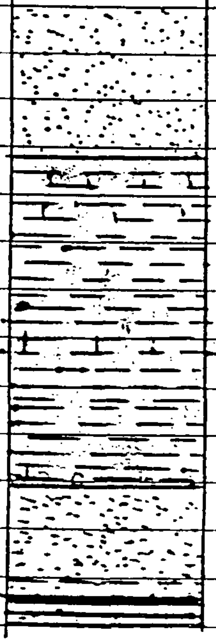
DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag	
FROM	TO					
0	17	brn	Sand & Gravel	Sand m-crs brn / Gravel f-m.		
17	68 1/2	brn gry	Shale	Shale brn gry; @ 56' ((Clayst));@65-68 ((Siltstone))	1	
68 1/2	75	lt brn	Sand	Sand f lt brn	2	
75	80		Sand	Sand f- (m) sub rnd clean.	3	
80	85		Sand	Sand a/a ; ((mafic min.))	3x4 5	
85	90	lt brn	Sand	Sand a/a / Sand f arg lt brn / ((Sh brn)),moist.		
90	92	brn	Sand	Sand brn f arg ,dirty.	2x6	
92	95	drk brn	Sand	Sand f drk brn ;(Coal)	7	
95	97	blk	Coal	Coal blk.		
97	99	drk brn	Sand	Sand drk brn v f.		
99	100	lt brn-rd	Sand	Sand lt brn-rd v f.	8	

Thickness	Lith Log	FORMATION TOPS
17		17
51 1/2		Shaftesbury Sh +1200
		68 1/2 +1171 1/
		Paddy Sand
23 1/2		
8 +		92 +1148 Cadotte mbr
	TD 100	+1100

WELL: E - 82 - 1058
Spud Sept 10 1982
Compl Sept 11 1982
TD 130'
ELEVATION: 388.627 = 1273' KB
PAGE: 15

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag
FROM	TO				
0	32	brn	Sand	Sand brn m-crs / (Gravel f-(m))	1
32	100	gry brn	Clay	Clay gry brn; @ 43 Claystone @ 70 "	2
100	101	gry brn	Clay	Clay a/a / Claystone /Gravel v f.	
101	106		Sand v f.		3
106	116		Sand f-(m) clean (@115 wet)		4
116	122 1/2		Sand v f.		5
122 1/2	123		Clay/Sand	Clay/Sand	6
123	125 1/2		Sand	Sand v f arg	7
125 1/2	127		Coal	Coal	
127	129		Coal / (Sand)	Coal / (Sand crs).	
129	130		Sand	Sand v f brn.	8

Lith Log



TD 130

Thickness	FORMATION TOPS
32	32 + 1241 Shaftesbury Sh
69	+ 1200
24 1/2	101 + 1172 Paddy sand
4 1/2	125 1/2 + 1147 1/2 Cadotte mbr
	+ 1100

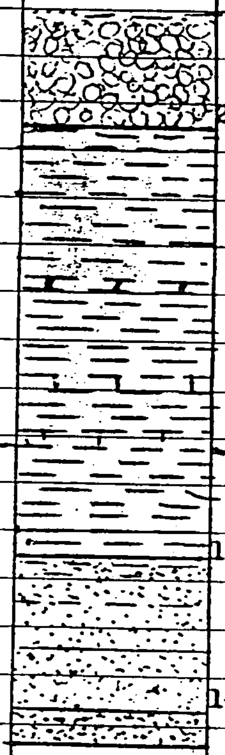
WELL: B - 82 - 1059 Spud Sept 12 1982
Comp Sept 13 1962 TD 154 ELEVATION: 393.659M = 1292' KB PAGE: 16

DEPTH		COLOR	MAIN ROCK TYPE	DESCRIPTION	Bag	
FROM	TO					
0	3	brn	Clay	Clay brn / Sand f brn.		
3	16		Gravel	Gravel clean	1	
16	25		Gravel	Gravel / ((Sand))	2	
25	116	brn gry	Clay	Clay brn gry,firm,undisturbed. @ 28 Water. @ 58 Claystone. @ 78 & 89 Claystone.		
116	117	brn	Sand / Clay	Sand f-crs arg / Clay.	3	
117	119	gry	Sand	Sand gry v f arg.	4	
119	124		Sand	Sand f clean rnd,well sorted.	5	
124	125		Sand	Sand a/a /(Clay brn)	2x 6	
125	133 1/2		Sand	Sand v f lt brn ((arg))	7	
133 1/2	135	brn	Sand	Sand a/a Brn ((Coal))	8	
135	137		Sand	Sand a/a f clean.	2x 9	
137	145		Sand	Sand a/a / (crs)	2x10	
145	148		Sand	Sand m-crs clean.	11	
148	154	drk brn-rd	Sand	Sand f drk brn-red.(Fe_2O_3).	12	

Thickness

Lith Log

FORMATION TOPS



25

25 +1267
Shaftesbury Sh

91

+1200

116 +1176
Paddy Sand

32

148 +1144
Cadotte mbr

6 +

TD 154

+1100

HOLE E - 82 - 1008 ELEVATION 391.287 M August 26th, 1982
T D - 130 1/2' 1287 Ft.

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	10:00	0'	Gravel	Start Hammer drill
	10:05	3'	Gravel	
1	10:15	6 1/2'	Gravel	Rock stuck in bit - pulled out
	10:25		Gravel	Start drilling
	10:32	9'	Gravel	Connection
	10:44	11-14'	Clay	Rock in bit - pulled - Changed pipe
	11:05		Clay	Back on bottom
2	11:08	17'	Clay	
	11:08	18'	Clay	Connection
	11:29	26'	Clay	
	11:37	27'	Clay	
	11:42	28'	Clay very hard	
	11:45			Put on 2' sub
	11:55	30'	Clay & Shale	Stopped to change to rotary
	12:40			Tripping in
	12:50			Commenced rotary drilling
3	13:05	38'	Clay-Shale brown-gray & ((Siltstone - Claystone hard))	Connection
	13:15			Start drilling
	13:23	48'	"	Connection
	13:30	48'	"	Start drilling
	13:36	58'	"	Connection
	13:43	58'	"	Start drilling
	13:54	68'	"	Connection
	14:01	68'	"	Start drilling
	14:25	71'	Clay sticking	Bit plugged tripping
	15:30	71'	Shale brown gray hard White claystone at 76' (1")	Commenced drilling with less weight
4	15:52	78'		Connection
	16:02			Start drilling
	16:17	86'	Shale	
	16:20	88'		Connection

HOLE E - 82 - 1008   ELEVATION 391.287 M   August 26th, 1982
T D 130 1/2'   1284 Ft.   Page 2

B	NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
		16:29	88'	Shale	Started drilling
		16:53	96 1/2'	Claystone 2 - 4"	
	4	16:59	98'	Shale & Claystone layers	
		17:00	98'		Connection
		17:20	106'	Claystone layers	
		17:25	108'		Connection
		17:30	109'		Repairs on rig

HOLE E - 82 - 1008　　ELEVATION 391.287 M　　August 27th, 1982
T D - 130 1/2'　　1284 Ft.　　Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
5	11:00	109'		Started drilling
	11:20	112'	Sand	Added soap
6	13:30	112'		Commenced drilling: water & soap
	14:10	117 1/2'	Sandstone layer; Fine Sand & Siderite & ((glauc))	
	14:20	118'		Connection
	14:35	118'		Commenced drilling
7	14:48	120'		Tripped out. Changed bit & Holed Tubes at 10', 50', 90' & 120'
	15:38	120'		Tripping in.
	16:24	120'		Reached bottom.
8	16:30	123'	Sand - fine	
	16:31	124'	Sand - fine	
9	16:33	124 1/2'	Clay layer & Sand arg.	
10	16:38	126'		
	16:45	128'	Sandstone layers, Sand & Siderite & Mafic min.	
11	16:50			Commenced drilling
	16:56	129 1/2'	Sand very fine - Sand caving in	
		130 1/2'		
	17:30			Pulling out to move
	19:03			Leaving location
	19:12			Arrived at new location (1013)

HOLE E - 82 - 1013 ELEVATION 391.276 M August 27th, 1982
T D - 147' 1284 Ft. Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	19:12			Rig on location Aug.27/82
	19:22			Rig set up. Finished for the day.
	7:37			August 28th, 1982 Crew arrived and departed, forgot keys.
	8:30			Arrived for second time.
	9:00	0'		Commenced Hammer drilling
	9:03	3'	Sand & Soil & Gravel	
	9:05	8'	Gravel Qtz White-Brown, Granite & Diorite	Connection
	9:15	8'	Gravel & Sand	Commenced drilling
	9:38	17'		Repair screen o-ring seal
	10:02	17'		Commenced drilling
	10:06	18'	Gravel & Sand	
	10:08	19'		Connection
	10:13	19'		Commenced drilling.
	10:14	20'	Gravel & Sand	
	10:25	29'		Connection
	10:30	29'	Gravel & Sand	Commenced drilling.
	10:42	38'	Gravel & Sand	
	10:43	39'	Gravel & Sand	Connection
	10:48	39'		Commenced drilling
	10:49	40'	Clay	
	11:01	45'		Pull back to next joint Set 3' sub & 5' sub
	11:09			Hammer - change over to Rotary drilling
	11:21	46'	Clay & thin hard beds	
2	12:35	48'		Changed sub above bit to prevent air from going outside the pipe
	13:00			Resume drilling after sub change over.
	13:05	49'	On bottom; some wet clay	Connection (6' pipe)
	13:08			Commenced drilling
	13:17	55'	Shale brown	Connection - drill pipe plugged

NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	14:03	55'		Tripping out Drill with cone bit
	14:15	60'		Connection
	14:17	60'	Shale/Clay	Commenced drilling
	14:50	70'		Connection
	14:54		Shale/Clay	Commenced drilling
	15:02	80'	Shale/Clay	Connection
2	15:10	80'	Shale/Clay	Commenced drilling
	15:15	90'	Shale/Clay	Connection
	15:17	90'	Shale/Clay	Commenced drilling
	15:25	100'	Shale/Clay	Connection
	15:27	100'	Shale/Clay 106 1/2' Silt dark gray very hard 107' Shale/Clay a/a	Commenced drilling
	15:40	109'	Sand mers sharp, clear Qtz	
		109 1/2'	Shale brown	
	15:43	110'		Connection
	15:46	110'	Sand very fine & mafic mineral, clean	Commenced drilling
3	15:55	114'	Sand fine(coarse) clean	Tripping for soft fm (Andy) bit
	16:35	114'	Sand	Commenced drilling
4	16:49	118'	Sand fine - clear - well sorted	Connection
5	16:55			Commenced drilling
	17:17	123'	Sand fine & (coarse-angular)	
6	17:27	128'		Connection
	17:31	128'	Sand fine-medium sub-rounded - clear	Commenced drilling
2x7	17:40	133'	Sand fine clear, well sorted	
	18:45	138'	Sand a/a & tight spot	Connection
	19:53	138'		Commenced drilling
8	19:57	140'	Coal	139 Top Cadotte
	19:59	142'	Sand, dark brown	
	20:00	143 1/2'	Sand fine-light brown	
9	20:14	147'	Total Depth	
	20	34	Left Location	

HOLE E - 82 - 1009 ELEVATION 397.903 M September 12th, 1982
TD 167' & 1305 ft.

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:45			Arrived on location
	8:30	0'	Sand - fine, brown - red - dark brown	Started Hammer drill
	8:40	8'		Connection
	8:43	8'		Commenced drilling
		12'	Gravel - fine & Sand, as above	
		17'	Gravel fine - coarse	
1	8:54	18'		Connection
	8:58	18'		Commenced drilling
	9:00	23'		Boulder stuck in bit
	9:27			Back on bottom
	9:30	28'		Hose plugged with rock. Connection
	9:35	28'	Gravel - coarse & Sand, as above	Commenced drilling
		34'	Sand - coarse & Gravel - fine - medium	
	9:43	37'	Clay - brown gray	
	9:46	38'		Connection
	10:00	48'	7' sub to KB	Commenced drilling
	11:05	50'		Connection - Changed over to Rotary drill
	11:10	50'		Commenced drilling
		57'	Clay, as above/Claystone	
2	11:38	60'		Connection
	11:42	60'		Commenced drilling
		65'	Clay, as above/Claystone	
	12:05	70'		Connection
	12:12	70'		Commenced drilling
		79'	Clay, as above/Claystone	
	12:29	80'		Connection
	12:35	80'		Commenced drilling
	12:50	90'		Connection
	12:57	90'		Commenced drilling

HOLE E - 82 - 1009 ELEVATION 397.903 M September 12th, 1982
T D 167' & 1305 ft. Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
		95'	Clay, as above/Claystone	
	13:10	100'		Connection
	13:16	100'		Commenced drilling
		108'	Clay, as above/Claystone	
	13:32	110'		Connection
	13:37	110'		Commenced drilling
2	13:48	120'		Connection
	13:55	120'		Commenced drilling
		127'	Clay, as above/(Sandstone, white & Claystone & Gravel)	
	14:05	130'		Connection
	14:10	130'		Commenced drilling
3		131'	Sand - fine, clean ((mafic min)) subrounded - rounded	
		132'	Sand, as above, clean	
4		137'	Sand, as above (arg brown)	
		138'	Sand, as above/<u>coarse</u>, smoke agate	
2x5	14:26	140'		Connection
	14:31	140'		Commenced drilling
		147'	Sand, as above - fine-medium-coarse, clean	
2x6	15:26	150'		Connection
	15:30	150'		Commenced drilling
		151'	Sand, as above, fine-medium	
		153'	Sand, as above, fine-light brown	
		155 1/2'	Sand - fine, light brown (arg)	
8		157	Sand - fine, light brown (wet)	
		158 1/2'	Sand - fine, light brown/((Coal))	
		159'	Sand - fine red <u>(Fe2 03)</u>	
	15:37	160'		Connection
	15:42	160'		Commenced drilling
	15:47	167'	T D	
	16:00			Left Location

DAILY DRILLING REPORTS OF WELLS DRILLED IN 1982 APPENDIX IV

HOLE E - 82 - 1007 ELEVATION 421.820 M August 25th, 1982
T D - 91' 1384 Ft.

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:30			Arrived on Site.
	8:45	0-13'	Sand	Start drilling
	9:10	13-14'	Start clay at 14'	
	9:40	42'	Clay	Bit plugged - Delay 5 min.
	9:50	48'	Clay	Connection
	10:10	53	Clay	Plugged - 1 min.
	10:20	57'	Clay	Pulled up 3'
1	10:27	60'	Clay	Connection
	10:50	64'	Clay	
	11:07	69'	Clay	Connection
	11:38	74'	Clay	Start drilling
	11:46	74'	Clay	Back at bottom
	12:05	78 1/2'	Clay	Put on 2' sub
	12:16	80'	Clay	Changed to rotary
	5:23	80'	Clay	Start drilling
	5:45	81'	Clay	Plugged - added water
2	6:50	83'	Gravel	
	7:03	84	Clay	Hit large rock
	7:34	89'	Clay & gravel	Gravel caving in
	8:05			Start pulling small pipe
	8:20	91'		Finish pulling small pipe

HOLE E - 82 - 1014 A   ELEVATION 394.828 M   August 29th, 1982
T D 160'   1295 Ft.   Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
				Arrived on Location 20:36; on August 28th, 1982. Finished for the day
				Arrived at 8:00 Aug. 29/82
	9:11	0'	3 ft. soil; then Sand and Gravel	Start drilling (Hammer)
1	9:18	8'		Connection
	9:25	8'		Commenced drilling
	9:55	17'		Abandoned Hole; moved 3' South to new Hole E-82-1014A
	10:10	0'		Start drill (Hammer)
	10:16	8'		Connection
	10:21	8'		Commenced drilling
	10:26	16'		Return - Hose plugged
	10:27	16'		Commenced drilling
24	10:31	18'		Connection
	10:37	18'		Commenced drilling
	10:41	26'		Return hose plugged, stopped hammer
	10:43	26'		Commenced drilling
	10:45	28'		Connection
	10:50	28'		Commenced drilling
	10:56	38'		Connection
	11:00	38'		Commenced drilling
	11:00	38'	(Water)	
	11:04	40'	Clay - Gray-Brown	
	11:10	43'	Shale/Clay	
2	11:14	45'	Clay & Claystone - Gray, hard	Pulled out and changed to Rotary
	12:15	45'		Commenced drilling
	12:30	50'		Connection
	12:37	50'		Commenced drilling
	12:54	60'		Connection
	12:59	60'		Commenced drilling
	13:15	68'	Shale	

HOLE E - 82 - 1014 A   ELEVATION 394.828 M   August 29th, 1982
T D 160'   1295 Ft.   Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	13:23	70'		Connection
	13:26	70'		Commenced drilling
	13:48	80'		Connection
	13:53	80'		Commenced drilling
	14:05	89'	Shale is moist; Thin Claystone beds	
	14:07	90'		Connection
	14:20	90'		Commenced drilling
2	14:33	100'		Connection
	14:41	100'		Commenced drilling
	15:01	110'		Connection
	15:11	110'		Commenced drilling
	15:23	120'	Sand - much finer	Connection
	15:30	120'		Commenced drilling
	15:37	124'	First Sand fine-(coarse) smoke rounded	
		128'	Sand fine-((medium)) clear Sharp & Mafic Min	
3		127-129'	Sand coarse, round/ Sand fine	
	15:50	129'		Pulled out to change to Andy bit
4	16:30	129'	129-132' Sand fine-medium-coarse subrounded-found (smoke) some rose Qtz. 133' Sand very fine-medium	
	16:45	134'		
x 5	17:00	139'		Connection
	17:05	139'		Commenced drilling
6	17:18	149'		Connection
2x7	17:23	149'		Commenced drilling
	17:24	152'	Coal (black)	Top Cadotte
	17:25	153'	Light brown Sand	
8		154'	Coal black	
		155'	Sand brown fine	
9	17:40	160'	T D	Pulling out

HOLE E - 82 - 1016 ELEVATION 396.050 M August 30th, 1982
T D 146 1/2' 1299 Ft. Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:40			Crew Arrived
	8:45	0'	Sand - Brown	Started Hammer drill
	8:55	5'	Sand & Gravel	
	8:57	8'		Connection
	9:00	8'		Commenced drilling
1	9:07	18'		Connection
	9:10	18'	Sand & (Gravel)	Commenced drilling
	9:23	28'	Sand & Gravel; Qtz; Granite, Diorite	Connection
	9:30	28'	at 35' fine gravel & Sand brown	Commenced drilling
	9:39	35 1/2'	Clay Brown (Sandy)	
	9:40	38'	Clay Brown	Connection
	9:45	38'	At 45', Sand fine-med, brown 46' Clay silty, moist	Commenced drilling
	10:00	48'		Connection
		48'	Clay silty, moist, Sand brown moist	Commenced drilling
2		52'	Siltstone 1-2"	
		53'	Sand, coarse brown arg	
		54'	Sand & Gravel & Siltstone & Clay, moist	
		54 1/2'	Clay brown	
		55'	Clay & Sand, wet	
		56'	Clay - gray brown - solid	
	10:29	56 1/2'		Pull out 10' pipe, substitute 5' & 2' to get surfaced pipe at KB
	11:45	57'	Shale, brown calc dry	Commenced drilling with cone bit
	12:10	60'		Connection
3	12:15	60'		Commenced drilling
	12:42	70'	Blowing mud & water	Connection
	12:50	70'	Shale, brown gray	Commenced drilling
	13:15	80'		Connection
	13:22	80'	Shale a/a & thin claystone layers	Commenced drilling

HOLE E - 82 - 1016　ELEVATION 396.050 M　August 30th, 1982
T D 146 1/2'　1299 Ft.　Page 2

G NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	13:45	90'		Connection
	13:54	90'	Shale brown calc	Commenced drilling
	14:16	100'		Connection
	14:25	100'	Shale a/a	Commenced drilling
	14:45	110'		Connection
3	14:53	110'	Shale a/a	Commenced drilling
	15:13	120'		Connection
	15:22	120'	Shale a/a	Commenced drilling
		124'	Siltstone layer	
	15:32	126 1/2'	Sand, fine-(medium), smoke, round-subrounded	Pulling out to change to Andy bit Air tubes at 10', 50' & 90'
2x4	16:10	126 1/2'	Sand, fine-(medium) a/a	Commenced drilling
	16:25	128'		Connection
	16:28	128'	Sand fine(medium) clean ((mica))	Commenced drilling
5		129'	medium - coarse	
		130'	Sand fine-(medium) a/a	
		133'		
2x6		135 1/2'	Sand very fine	
	16:45	138'		Connection
	16:50	138'	Sand very fine & mafic min - well sorted	Commenced drilling
7		145 1/2'	Sand fine - carb material	
	17:05	146 1/2'	Clay - brown & Coal	Stopped drilling (Top Cadotte 145 1/2')

HOLE E - 82 - 1020 ELEVATION 386.821 M September 2nd, 1982
TD 128 1/2' & 1269' Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
1	14:45			Arrived at location
	15:15	0'	Coarse gravel & Sand & Clay	Started Hammer drill
		8'	Gravel fine well rounded & Sand coarse brown	
	15:25	10	Gravel fine well rounded	Connection
	15:29	10'	at 14' - some sand arg. (wet)	Commenced drilling
		19'	Sand brown coarse clean	
2	15:40	20'		Connection
	15:43	20'		Commenced drilling
		21'	Gravel fine & Sand	
		22'	Sand coarse clean	
		23'	Gravel medium	
		25 1/2'	Clay brown gray	
3	15:47	28'		Connection
		28'		Commenced drilling
	16:15	35'		Change over to rotary cone drilling
	17:00	35'		Commenced drilling
	17:15	40'		Connection
	17:24	40'		Commenced drilling
	17:38	50'		Connection
	17:45	50'		Commenced drilling
	18:01	60'		Connection
	18:08	60'		Commenced drilling
	18:20	70'		Connection
	18:27	70'		Commenced drilling
	18:38	80'		Connection
	18:43	80'		Commenced drilling
	18:58	90'		Connection
4	19:04	90'		Commenced drilling
	19:07	93'	Sand brown fine - medium	

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
4	19:08	94'	Sand fine clean subrounded	Stop drilling - Pulling out. Leaving for the day.
	19:30			Crew left location

HOLE E - 82 - 1020 ELEVATION 386.821 M September 3rd, 1982
TD 128 1/2' & 1269' Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	8:00			Crew arrived at location.
	8:30	94'	Sand fine subrounded (mafic min) & Siderite, yellow	Commenced drilling
4				Bit plugged. Commenced drilling. Bit plugged again (Bit formed cores of Siderite Sandstone) Pulling out going in with Tricone Bit.
	10:10	99'	Sandstone - fine & Siderite & Mafic min	
	10:20	100'		Connection
5	10:25	100'	At 100' & 102' Fe2 03 layers	Commenced drilling
			at 102 1/2' Sand - medium coarse clean rounded (smoke)	
	10:35	105'		Tripping out for Sand bit
	11:04	105'		Commenced drilling
		108'	Sand a/a medium	
6		108'	S a/a fine-medium yellow (Fe2 03 content) well rounded	
	11:07	109'		Connection
	11:10	109		Commenced drilling
7		111 1/2'	Sand a/a clean well round	
		113'	Sand a/a/ very fine	
8		118'	Sand a/a/ fine-(medium)	
	11:15	119'		Connection
	11:19	119'		Commenced drilling
		120 1/2'	Sand a/a red (Fe2 03)	
		122 1/2'	Sand a/a clean	
9		123'	Coal	Cadotte member
		123 1/2'	Coal & Sand - fine-medium brown	
		124 1/2'	Coal & Sand - very fine	
		127'	Coal & Sand - very fine - arg moist	
10		128'	Sand very fine light gray brown	
	11:30	128 1/2'	Sand very fine lt. gray brown	
			T D 128 1/2'	

HOLE E - 82 - 1023 ELEVANTION 397.929 M September 1st, 1982
T D 155' 1306 Ft. Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	12:28			Crew & rig arrived on location.
	12:37	0'	Sand fine-medium - brown - clean	
1	12:40	8'		Connection
	12:45	8'		Commenced drilling
18'	12:50	18'		Connection
2	12:55	18'		Commenced drilling
24'		24'	Sand & gravel - fine to medium - (coarse)	
	13:00	28'		Connection
		28'		Commenced drilling
		30'	Gravel fine-(medium)	
	13:14	38'	Gravel	Connection
	13:20	38'	Gravel	Commenced drilling
3	13:23	48'	Gravel	Connection
	13:30	48'	Gravel/Water at 49'	Commenced drilling
		53'	Gravel coarse & Water	
	13:42	58'	Gravel coarse & water	Connection
	14:00	58'	Gravel coarse & water	Commenced drilling
		67 1/2'	Clay brown gray (sandy) wet	
	14:10	68'		Connection
	14:14	68'		Commenced drilling
				Bit plugged - pulling out
	15:38	68'		Back on bottom
4	15:42	70'	Clay brown gray solid	Start Hammer drill
	15:55	73'		put in 5' sub
	16:40			Change over to rotary drill
	17:00			Start tricone rotary
	17:30	80'		Shut down for the day

HOLE E - 82 - 1023 ELEVATION 397.929 M September 2nd, 1982
T D 155' 1306 Ft. Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:30			Crew arrived at location
	8:00	80'		
5		86'	Clay-gray/Silt-fine (powder)	Commenced drilling
	8:44	90'	Clay-gray/Silt-fine (powder)	Connection
	8:47	90'	((Water))	Commenced drilling
		94'	Clay-Shale brown gray calc	
	9:05	100'		Connection
	9:14	100'		Commenced drilling
6		106'	Clay-Shale brown gray calc & (Siltstone gray)	
	9:31	110'		Connection
	9:40	110'		Commenced drilling
	10:00	120'		Connection
	10:07	120'		Commenced drilling
		127'	Clay/Shale brown gray & Silt & (Siltstone)	
	10:25	130'	Clay/Shale "	Connection
	10:32	130'	Clay/Shale "	Commenced drilling
		130 1/2'	Sand fine-medium sub-round (smoke)	
7		131'	Siltstone (2") gray	
		131 1/2'	Sand fine-medium round clean (smoke)	
	10:38	132'		Pulling out for Andy bit Cleaning pipe with air
	11:30	132'	Sand fine-<u>medium</u> clean round	Commenced drilling
8		135'	Sand - <u>fine</u>	
		137'	Sand - very fine (no mafic min!!)	
9 142'	11:35	139'	Sand - very fine	Connection
10 147'	11:50	149'		Connection (nearly stuck)
	12:27	149'		Commenced drilling

HOLE E - 82 - 1058 ELEVATION 388.027 M September 10th, 1982
T D 130' & 1273 ft.

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	16:05			Arrived on location.
	16:20	0'	Sand - medium-coarse, brown/ (Gavel - fine-((medium))	Start Hammer Drill
	16:23	8'		Connection
	16:25	8'		Commenced drilling
	16:32	18'	Sand as above/ Gravel as above	Connection
1	16:40	18'	Sand as above	Commenced drilling
	16:45	28'		Connection
	16:50	28'	Pipe plugged 5 min.	Commenced drilling
		32'	Clay - gray, brown	
		40'		Connection
		40'		Commenced drilling
		43'	Claystone - 5' sub.	
	17:42	45'		Change to rotary drill.
	18:10	45'		Commenced drilling
	18:25	50'		Connection
2	18:29	50'		Commenced drilling
	18:55	60'		Connection
	19:00	60'		Commenced drilling
	19:30	70'		Stopped for the day
	20:00			Left Location

HOLE E - 82 - 1057 ELEVATION 377.876 M September 10th, 1982
T D 100' & 1240 ft. Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
7		95'	((<u>Coal</u>))	
8		97'	Sand - very fine, dark brown	
		99'	Sand - very fine, light brown - red	
	14:45	100'	T D	
	15:50			Left Location

HOLE E - 82 - 1058 ELEVATION 388.027 M September 11th, 1982
T D 130' & 1273 ft. Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:40			Arrived on Location
	8:10			Start back in hole
	8:20	70'	Some Water in hole. Clay as above & Claystone	Commenced drilling
2	8:35	80'		Connection
	9:10	90'		Connection
	9:23	100'	Shale, as above & Claystone & Gravel, very fine	Connection
		101'	Sand - very fine	
3		106'	Sand fine-(medium), clean	
4	9:35	110'		Connection
5		115'	Sand fine-(medium), wet	
6		116'	Sand, very fine	
		120'		Connection
		122 1/2'	Clay/Sand	
7		123'	Sand - very fine arg	
125'		125 1/2'	Coal	
		127'	Coal & (Sand - coarse)	
8		129'	Sand - very fine - brown	
		130	T D	T D
	11:30			Left Location

HOLE E - 82 - 1059 ELEVATION 393.659 M September 12th, 1982
TD 154' & 1292 ft. Page 1

G NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	16:15			Arrived at Location
	16:30	0'	Clay-brown/ Sand brown fine	Start Hammer drill
		3	Gravel - clean	
1	16:35	8'		Connection
	16:42	8'		Commenced drilling
		16'	Gravel/((Sand))	
	17:00	25'	Clay-brown/gray - Firm, undisturbed	
	17:03	28'	Clay, as above & Water	Connection
	17:10	32'	Clay	Set 5' sub to KB
	17:35	35'		Change to Rotary
	18:00	35'		Start Rotary drill
	18:10	40'		Connection
				Stop for the day
				<u>September 13th, 1982</u>
2	7:50			Arrived on location
	8:08	40'	(some water in hole)	Commenced drilling
	8:40	50'	Shale, as above	Connection
	8:45	50'	at 58' Claystone layer	Commenced drilling
	8:57	60'		Connection
	9:03	60'		Commenced drilling
	9:20	70'		Connection
		70'	at 78' Claystone	Commenced drilling
	9:47	80'		Connection
		80'	At 89' Claystone	Commenced drilling
	10:03	90'		Connection
		90'		Commenced drilling
	10:19	100'		Connection
		100'		Commenced drilling

HOLE E - 82 - 1059
TD 154'

ELEVATION 393.659 M
& 1292 ft.

September 13th, 1982
Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
2	10:31	110'		Connection
		110'		Commenced drilling
		116'	Sand-fine-coarse arg & Clay	
3		117'	Sand-gray very fine arg.	
		119'	Sand fine, clean, round, well sorted	
4	10:45	120'		Connection
	10:49	120'	Sand fine, as above	Commenced drilling
5		124'	Sand, as above/(Clay, brown)	
		125'	Sand very fine, light brown ((arg))	
2x6	10:53	130'		Connection
7	10:56	130'		Commenced drilling
		133 1/2'	Sand, as above, brown ((Coal))	
8		135'	Sand, as above, fine, clean	
2x9		137'	Sand, as above/ (coarse)	
	11:00	140'		Connection
2x10	11:03	140'		Commenced drilling
		145'	Sand medium-coarse, clean	
11		148'	Sand, fine dark brown - red (Fe2 03)	
	11:09	150'		Connection
12	11:13	150'		Commenced drilling
	11:20	154'	T D	

HOLE E - 82 - 1023 ELEVATION 397.929 M September 2nd, 1982
T D 155' 1306 Ft. Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
		150 1/2'	Clay hard very dark brown	(150 1/2' Top Cadotte)
11		152'	Sand - dark brown	
		154 1/2'	Sand fine - very dark brown - Coal	
12	12:45	155'		TD - Tripping out
				Rig moving to Location 1020

HOLE E - 82 - 1024 ELEVATION 394.563 M August 31st, 1982
TD 122 1/2' 1294 Ft. Page 1

NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:40			Crew arrived on location
1	8:10	0'	Sand - brown	Start Hammer drill
		4'	Gravel	
	8:24	12'	Clay/Sand/Gravel	Connection
	8:26	18'	Clay	Commenced drilling
	8:34	28'		Connection
	8:45	28'	Clay - gray calc	Commenced drilling
	9:04	38'		Change over for cone bit rotary - Add 2' sub to KB level
	9:20	40'	Clay gray brown calc	Connection
	9:52	40'		Commenced drilling
	10:00	40'		Connection
	10:03	40'		Commenced drilling
		42'	Sand dark brown f(m) carb. material	
		46'	Clay brown gray (silty)	
		47'	Clay dark brown & carb mat	
		48'	Silt-Clay very fine brown (Powder)	
	10:44	50'		Connection
	10:47	50'	Siltstone-Clay dark changes to light gray-dark brown (Silt-Clay)	Commenced drilling
	11:23	60'		Connection
	11:35	60'		Commenced drilling
	12:00	66'	Clay dark brown moist	Bit plugged went in with new cone bit
2	12:30	66'		Commenced drilling
		68'	Clay dark brown dry	
	12:53	70'		Connection
	13:00	70'	Clay dark brown sandy	Commenced drilling
		78'	Gravel: with Granite pink	
	13:45	80'		Connection
	14:00	80'	Gravel Qtz-Granite-med; well sorted	Commenced drilling

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	14:10	81'	While cleaning hole - water blew out	Bit plugged - Pulled out
	14:55			Commenced drilling
	15:07	85'	Clay dark brown calc	
2		87'	Clay dark brown & gravel very fine - Sand very coarse	
	15:24	90'		Connection
		90'		Commenced drilling
	16:30	100'		Connection
	16:40	100'		Commenced drilling
110' 2x3	17:10	110'	Clay medium gray very pure	
115'	17:43	120'		Connection
	17:45	120'		Commenced drilling
4		121'	Sand dark brown fine-(medium)- Subrounded - (Sand course (smoke) subrounded)	
	17:50	122 1/2'	Sand fine-medium (smoke) subrounded	
				Pull out for Andy bit (lost one foot because of sub) Bit plugged several times because of gravel in the shale section. Left the location for the day at 19:45 Sept. 1st, 1982 Crew arrived at 7:40. Tripping in with Andy bit. Plugged. Tried the cone bit & 2 x Andy bit. Gravel & Water & Mud kept plugging bits. Abandoned hole at 11:00 hours. Moved to location 23.

HOLE E - 82 - 1031 ELEVATION 397.662 M September 11th, 1982
T D 157' & 1305 ft. Page 1

NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	11:45			Arrived at Location
	12:10	0'	Sand - brown, fine	Start Hammer drill
	12:13	8'	Sand - brown, fine	Connection
	12:15	8'		Commenced drilling
	12:19	18'		Connection
1	12:24	18'	At 25' Sand as above - med.	Commenced drilling
	12:33	28'		Connection
	12:35	28'		Commenced drilling
		30'	Sand as above & ((Clay - light brown - glacial))	
		34'	Sand as above & (Gravel - fine)	
		36'	Sand as above/Sand-medium-coarse/Gravel-fine-medium	
	12:40	38'		Connection
	12:45	38'	Sand-medium-coarse, brown/ ((Gravel - fine-medium))	Commenced drilling
	12:50	48'		Connection
	12:54	48'		Commenced drilling
		50'	Sand as above/((Clay, light brown, Glacial))	
		52'	Gravel - fine & (Clay as above)	
	13:00	58'		Connection
		58'	Water in hole	Commenced drilling
		64'	Gravel - medium-coarse, wet	
	13:10	68'		Connection
	13:17	68'	Water	Commenced drilling
		72'	Clay, brown	
	13:29	78'		Pounded to KB Changing to rotary
	14:23	80'		Commenced drilling
2	14:54	90'		Connection
	14:59	90'		Commenced drilling
	15:20	100'		Connection
	15:32	100'		Commenced drilling

HOLE E - 82 - 1031 ELEVATION 397.662 M September 11th, 1982
T D 157' & 1305 ft. Page 2

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
		107'	As above & Silstone & Claystone, light brown	
	15:53	110'		Connection
	16:00	110'	((Water))	Commenced drilling
2	16:25	120'		Connection
	16:40	120'	(pipe replaced because of faulty thread) ((water))	Commenced drilling
	16:58	130'		Connection
	17:02	130'	Shale as above/Claystone/ & ((Gravel - fine))	Commenced drilling
3		135'	Sand, very fine, gray ((arg)) subrounded	
		138'	Sand fine, subrounded, clean/ (Sand very coarse well rounded)	
4	17:15	140'		Connection
		140'		Commenced drilling
5		142'	Sand, as above - light brown (arg) uniform quality	
145' 6	17:23	150'		Connection
	17:30	150'	Sand - fine brown-dark brown, arg & Clay brown silty	Commenced drilling
7		151'	Clay & Shale - brown silty	
		154'	Coal	
		155'	Sand very fine brown	
		157'	Sand fine-medium, brown & Coal	
			T D 157	Moved off Location at 19:00 hours

HOLE E - 82 - 1035 ELEVATION 383.995 M September 7th, 1982
T D 100' & 1260'

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
1	16:00			Arrived on location
	16:15	0'	3' Sand 3-8' Gravel	Start Hammer drill
	16:25	8'	Gravel	Connection
	16:35	16'	Sand brown medium	
		24'	Gravel	
2		26'	Clay brown grey	
	16:45	28'		Connection
		30'	Clay - Shale	
	17:13	37'		Changed to rotary drill
	18:08	37'		Commenced drilling
	18:20	40'		Bit plugged. Pulling out.
	18:45	40'		Commenced drilling
		43'	Clay a/a & Claystone grey, hard	
	19:10	50	Clay a/a	Connection
	19:17	50'		Commenced drilling
		55'	Sandstone layer - white - light gray	
		59'	a/a	
	19:37	60'	Water on bottom	Connection Pulled drill pipe inside Hammer drill pipe (37')
	19:45			Finished for the day
	20:00			Left location

HOLE E - 82 - 1035 ELEVATION 383.995 M September 8th, 1982
T D 100' & 1260'

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	7:45			Arrived on location
	7:55	60'		Water in hole. Trying to establish circulation.
	9:25	70'		Connection
	9:26	70'	Shale - dark gray (powder)	Commenced drilling
2	9:52	80'		Connection
	9:55	80'		Water influx under control
		82'	Shale a/a & Siltstone	
		84'	Shale a/a & Gravel very fine	
		85'	a/a & Sand very fine - Silt	
		86'	Sand-Silt very fine arg dirty gray	
3	10:52	90'		Very tight connection.
	10:54	90'	Sand fine - medium (coarse) clean, subrounded - round	Commenced drilling
		93'	Sand fine-(medium), clean rounded ((dirty))	
4		94'	a/a & (coarse) ((smoke)) (dirty) (arg)	
		95'	Sand very fine light brown, dirty & ((medium))	95 Top Cadotte
5	11:10	100'	a/a	Tight
				Abandoned Hole

HOLE E - 82 - 1049 ELEVATION 377.173 M September 8th, 1982
T D 76' & 1237' Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	13:00			Arrived on location
	13:15	0'	Gravel - coarse-medium & Sand brown	Started Hammer drill
				Commenced drilling
	13:40	30'		Connection
	13:50	40'		Connection
	14:06	50'		Started drilling
	14:10	50'	Water	
		53'	Shale brown gray, weathered	
	14:26	60'		Connection
	15:17	60'		Change to rotary drill.
	15:25	60'		Finished for the day. Rig Repair. Hydraulic leaking. Waiting for parts from Calgary.
				September 9th, 1982
	15:45	60'	Shale - grey (powder)	Commenced drilling
		67 1/2'	a/a/ & thin claystone layers	
	16:20	70'	a/a/ & ((Gravel-fine)) & ((Sand-medium-coarse, dirty))	Connection
		71'	Sand fine-brown-sharp	Top Cadotte & at + 1170
	16:35	76'	T D	
				Pulling out
	18:15			Moving to next location.

HOLE E - 82 - 1052
T D 146'

ELEVATION 391.428 M
& 1284'

September 7th, 1982
Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	8:45			Arrived at Location
	9:04	0'	Gravel & Sand brown - fine to coarse - good quality	Start Hammer Drill
	9:20	8'		Connection
	9:25	8'		Commenced drilling
		12'	Sand brown medium - good quality	
1	9:30	18'		Connection
	9:35	18'		Commenced drilling
	9:40	28'	Gravel (no return) Bit plugged by rock	Connection
	9:45	28'	"	Commenced drilling
	9:50	34'	"	Pulled pipe to unplug bit
	10:20	34'	Shale - gray/brown & Claystone - gray	Back at bottom
	10:40	40'		Change over to rotary Tricone drilling
	11:20	40'		Commenced drilling
		50'		Connection
		50'		Commenced drilling
	12:05	60'		Connection
	12:10	60'		Commenced drilling
2	12:27	70'		Connection
	12:34	70'		Commenced drilling
	12:45	80'		Connection
	12:50	80'	Shale/ a/a (Sandstone 1"?)	Commenced drilling
	13:06	90'		Connection
	13:12	90'		Commenced drilling
	13:97	100'		Connection
	13:34	100'		Commenced drilling
	13:45	110'		Connection
	13:50	110'		Commenced drilling
2x3		113'	Sand fine grey - mafic min dirty	
		118'	Sand fine-medium very clean rounded	

HOLE E - 82 - 1052
T D 146'

ELEVATION 391.428 M
& 1284'

September 7th, 1982
Page 2

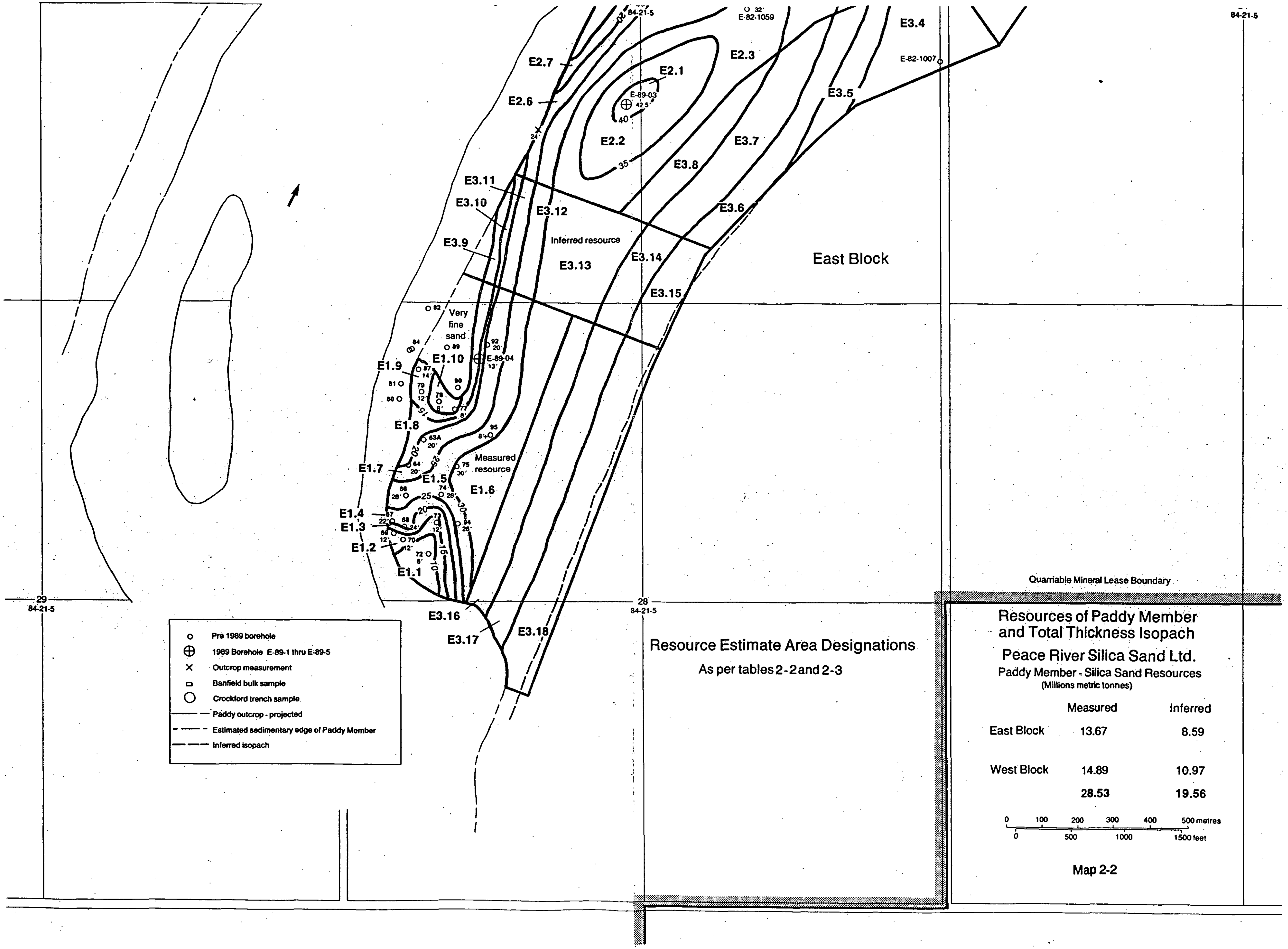
BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	13:00	120'		Connection
2x4	14:05	120'		Commenced drilling
		123'	Sand a/a & coarse (smoke)	
2x5		128'	Sand a/a fine clean	
	14:12	130'		Connection
2x6	14:15	130'		Commenced drilling
133'		134'	Sand fine & mafic min. gray	
2x7 138'		139 1/2'	Sand fine brown	
8 139½'	14:20	140'		Connection
	14:25	140'	Coal & Water when started drilling	Commenced drilling
		142 1/2'	Coal & Sand medium brown	
9	14:30	145'	Sand fine brown	Top Cadotte Sand
	14:33	146'	T D	

HOLE E - 82 - 1056 ELEVATION 377.221 M September 9th, 1982
T D 70' & 1238 ft. Page 1

BAG NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	18:30			Arrived on Location
	18:43	0'	Sand brown, medium - coarse & Gravel fine-coarse	Commenced Hammer Drill.
	18:50	8'		Connection
1	18:55	8'		Commenced drilling
	19:00	18'		Connection
	19:04	18'	As above - wet, dark brown	Commenced drilling
	19:11	28'		Connection
	19:15	28'	as above - wet	Commenced drilling
		32'	Clay - brown/gray	
	19:25	38'	Add 2' sub as above & 2" claystone	Connection
	19:40	40'	As above & 3" Claystone	Converting to rotary
				Finished for the day
				September 10th, 1982
	8:00			Arrived on location
2	8:35	40'	At 43' Claystone	Commenced drilling
			At 45' - Powder	
	9:00	50'		Connection
	9:06	50'		Commenced drilling
	9:23	60'		Connection
		60'		Commenced drilling
		65'	Clay - brown/gray/ Gravel - very fine	
		68'	Sand - fine, brown, sharp	
3	9:40	70'	T D	
	10:45			Left location

HOLE E - 82 - 1057   ELEVATION 377.876 M   September 10th, 1982
T D 100'   & 1240 ft.   Page 1

G NO.	TIME	DEPTH	LITHOLOGY	COMMENTS
	10:55			Arrived on Location
	11:10	0'	Sand - medium-coarse, brown & Gravel - fine-medium	Start Hammer drill
1	11:20	8'		Connection
	11:25	8'		Commenced drilling
		17'	Shale - brown/gray	
	11:35	18'	Hose plugged	Connection
	11:38	18'		Commenced drilling
	11:50	28'		Add 2' sub
	12:05	30'		Changing to rotary drill.
	12:38	30'		Commenced drilling
	13:06	40'		Connection
2	13:10	40'		Commenced drilling
	13:30	50'		Connection
	13:38	50'		Commenced drilling
		56'	((Claystone))	
	13:50	60'		Connection
	13:57	60'		Commenced drilling
			65 - 68' ((Siltstone))	
		68 1/2'	Sand - fine, light brown	
3	14:07	70'		Connection
	14:11	70'		Commenced drilling
3x4		75'	Sand - fine-(medium) subrounded, clean	
	14:18	80'		Connection
5		80'	Sand - fine, subrounded, clean ((mafic min))	
		85'	Sand as above/sand - fine arg light brown/((Shale-brown)) moist	
2x6	14:30	90'		Connection
7	14:34	90'	Sand, brown, fine, arg. dirty	
		92'	Sand fine, dark brown, & (Coal)	



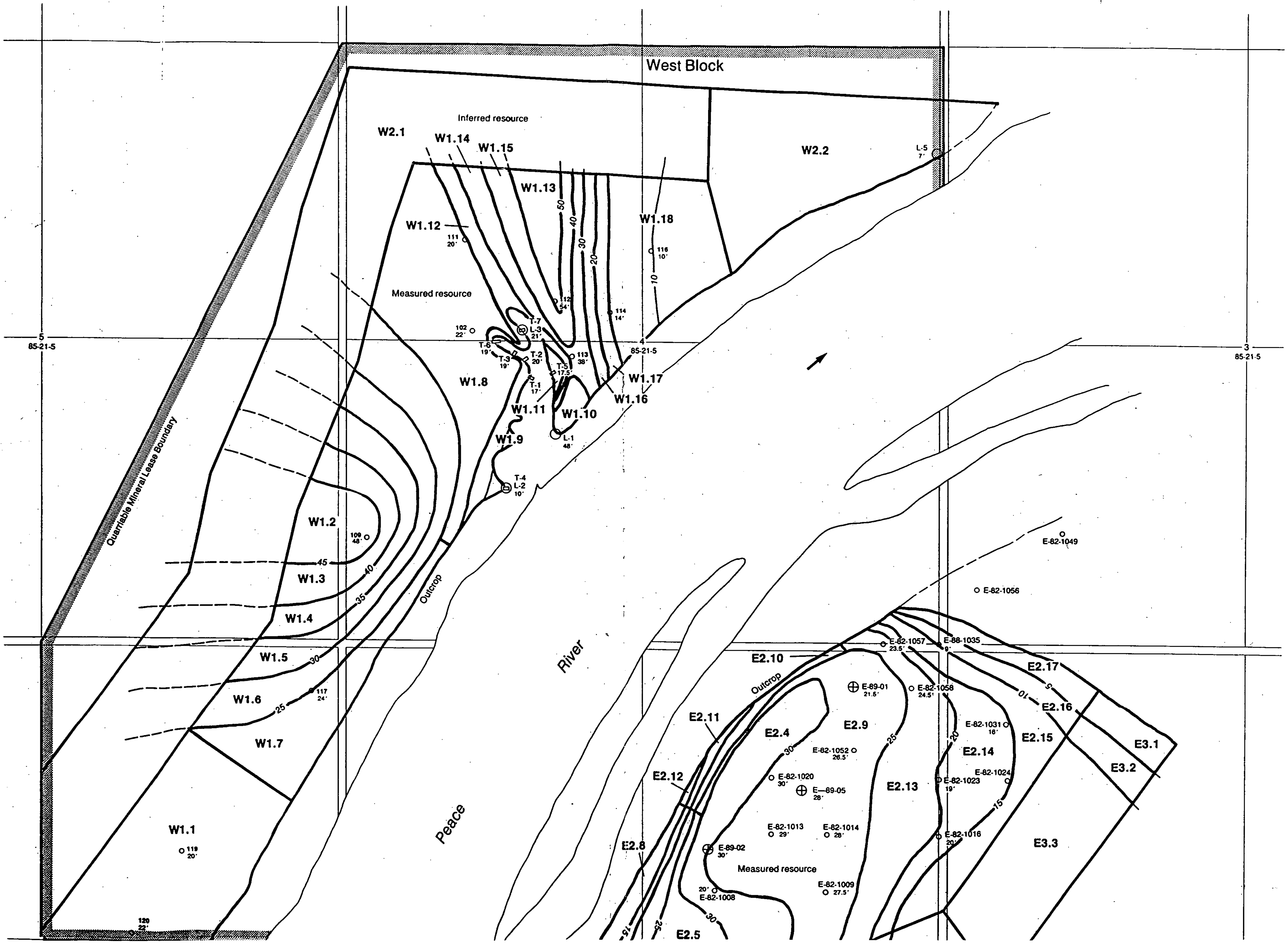
Resources of Paddy Member and Total Thickness Isopach

Peace River Silica Sand Ltd.

Paddy Member - Silica Sand Resources
(Millions metric tonnes)

	Measured	Inferred
East Block	13.67	8.59
West Block	14.89	10.97
	28.53	**19.56**

Map 2-2


West Block
Inferred resource
W2.1
W1.14
W1.15
W1.13
W2.2
L-5
7'
W1.12
111
20'
W1.18
116
10'
50
40
30
20
10
Measured resource
112
54'
114
14'
102
22'
T-7
L-3
21'
T-6
19'
T-3
19'
T-2
20'
113
38'
T-5
17.5'
T-1
17'
5
85-21-5
4
85-21-5
3
85-21-5
W1.8
W1.17
W1.16
W1.11
W1.10
L-1
48'
W1.9
T-4
L-2
10'
Quarriable Mineral Lease Boundary
W1.2
109
48'
45
W1.3
40
35
Outcrop
W1.4
E-82-1049
E-82-1056
W1.5
30
River
E-82-1057
23.5'
E-88-1035
9'
E2.10
E2.17
117
24'
W1.6
25
Outcrop
E-89-01
21.5'
E-82-1058
24.5'
5
10
E2.16
E2.11
E2.9
E-82-1031
16'
W1.7
E2.4
30
E-82-1052
26.5'
25
20
E2.14
E2.15
E3.1
E3.2
E-82-1024
E2.12
E-82-1020
30'
E—89-05
28'
E2.13
E-82-1023
19'
15
W1.1
Peace
119
20'
E-82-1013
29'
E-82-1014
28'
E-82-1016
20'
E3.3
E2.8
E-89-02
30'
Measured resource
E-82-1009
27.5'
20'
E-82-1008
120
22'
15
25
30
E2.5