MAR 20170001: PEACE RIVER

A report on Sandstone exploration on the Peace River property near Peace River.

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Mar 20170001

Canadian Silica Industries exploration of the Paddy Member sandstone, Peace River, Alberta

Metallic and Industrial Minerals permit 9315070282

Part B, assessment report

Project Name: Cdn Silica 2015

Resubmitted with revisions by S. Fraser Dec. 7, 2017

Report by: Stuart Fraser, P. Geol., of S. Fraser Geological Contracting Ltd.

Edmonton, Alberta

Client Name: Canadian Silica Industries, Inc.

Suite 702, 505 2nd Street SW., Calgary, T2P 1N8

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1.0 SUMMARY

In 2015 the author carried out exploration on behalf of Canadian Silica Industries (CSI) on their Metallic and Industrial Minerals (MAIM) permit 9315070282 in the Peace River area, Alberta, directly south of the Town of Peace River. The work, consisting of fieldwork in May and September and October 2015 as well as geological studies of water well reports and hydraulic engineering maps and sections from Alberta Environment, form the basis for this report.

The geological fieldwork consisted of mapping and sampling the Lower Cretaceous Paddy Member sandstone, uppermost part of the Peace River Formation which underlies the Shaftesbury Formation shale. The objective of the fieldwork is to determine potential thickness of the Paddy Member sandstone which is thought to lie directly beneath the Peace River.

From the west side of the Peace River, Paddy Member sandstone samples were collected for sieve analysis to characterize the quality of the sand as a potential frac sand resource. Alberta Environment water well drilling records were researched to record (interpreted) Paddy Member sandstone thickness and occurrence, based on drillers reports from cuttings of sand (Paddy Member sandstone) underlying clay (Shaftesbury formation shale).

Sections and plan maps from the Hydraulic Engineering Branch of Alberta Environment helped to show depths to bottom of the Peace River and potential for thickness for the Paddy Member sandstone.

2.0 INTRODUCTION

Canadian Silica Industries Inc. (CSI) operates a silica sand quarry/pit on the east side of the Peace River, approximately nine kilometres northwest of the town of Peace River. CSI mines the lower Cretaceous (Upper Albian) aged Paddy member sandstone, uppermost sequence of the Peace River Formation. The Peace River Formation underlies the lower to upper Cretaceous, Shaftesbury Formation shale. Underlying the Paddy member sandstone is the unconformable Cadotte Member, a siderite cemented, marine sandstone which forms prominent cliffs along the west side of the Peace River (west of CSI's quarry area). At the CSI Peace River mining operations, CSI rips the Paddy Member sandstone, as a poorly cemented, friable (quartz rich) sandstone, without use of explosives. The CSI operation has a wet and dry milling operation at Peace River and produces a silica sand or frac sand, which is used in oil and gas operations within Western Canada.

CSI staked mineral permit 9315070282 to explore for additional silica sand resources. This Metallic and Industrial Minerals (MAIM) permit is situated south of the town of Peace River. The CSI mineral permit covers much of the area along the west side of the Peace River and east to the boundary of the recently created Wildwood (Alberta) Provincial Park.

Leckie and Singh (1991) have described the Paddy Member sandstone as an estuarine fill with varying tidal/fluvial facies with three variable units, and lesser mud and coal rich facies. At the CSI pit along the east side of the Peace River, coal has been mapped within the sequence and work by Hamilton (1989) has shown that coal has been found in varying positions within the stratigraphy locally.

Leckie and Singh (1991) have suggested there may be up to 5 metres with varying topography in contact relationships between the Paddy member base and Cadotte member sandstone top locally. They suggest the basal Paddy Member sandstone filled variable incised portions of the Cadotte sandstone. Siderite has been noted as nodules (along the north side of the Heart River) as well as a 3-metre lens thought to be near or at the Paddy member/Cadotte contact near the northwest end of the CSI property boundary, (Fraser, 2014).

The work outlined in this assessment report for the 1st work period for mineral permit 9315070282 indicates where Paddy Member sandstone has been sampled and/or mapped from outcrop. In addition, Shaftesbury Formation shale is noted in outcrop and the contact with underlying Paddy Member sandstone has been recorded with a handheld Garmin gps and by CSI staff surveyor George Millen. Water well drill hole data available through Alberta Environment suggests probable Paddy Member sandstone thickness, based on observations from cuttings recorded from water well drillers. No borehole drilling has been completed by CSI to confirm Paddy Member thickness. A longitudinal section profiled along the Peace River suggests resource potential for the Paddy Member sandstone based on outcrop observations and the water well drilling reports. The Hydraulic Engineering Branch of Alberta Environment was useful in supplying plan maps and depth profiles of selected locations which cross the Peace River.

3.0 LOCATION AND ACCESS

The location of the Peace River area is shown in **Figure 1**. Highway 2 provides good access to the town of Peace River.

Figure 2 illustrates the permit area which is aligned along the length of the Peace River, south of the Town of Peace River and lies adjacent the Wildwood Provincial Park

4.0 CSI PERMITS, PROPERTY AND EXPENDITURES

4.1 Property

Table 1 below lists the legal description for the sections which make up permit 9315070282.

Table 1 Permit legal description

MAIM permit	Meridian-Range-Township	**Section;** LSD	Area in hectares	Term Date	Required expense & date due
9315070282	**Tract: 01**		1671	July 23, 2015	July 23, 2017
	5-21-083	**7WP; 17NW; 18SP,NW,NEP**			
	5-22-082	**32NE**			
	5-22-083	**1NP; 2NP;3SP,NW,NEP; 4SEP,SW 10SE; 11SEP; 11NE**,L3P,L5P,L6P; portion of lot 32; **12SP,N**; **13S,NE**			
	Tract:02				
	5-21-083	**19SP,NEP; 20SWP**			
		portion within the bed of the Peace River			
	Tract: 03				
	5-21-083	**19SP,NEP; 20SWP**			
		portion outside the bed of the Peace River			

4.2 Expenditures

A summary of expenditures for the CSI 2015 May and October field programs is outlined in Appendix 1.

5.0 GEOLOGICAL SETTING

5.1 Regional Geology and Stratigraphy

In the Peace River area, generally flat-lying sandstones of the Lower Cretaceous Peace River Formation are overlain by shales of the mid-Cretaceous Shaftesbury Formation shale. The Peace River Formation is variable in thickness and ranges from 50 metres in the Clear Hills area of the Peace River region to 5 metres and less along its margins to the north and east. Stratigraphically the Peace River Formation

Canadian Silica Industries

Figure 1 Location map

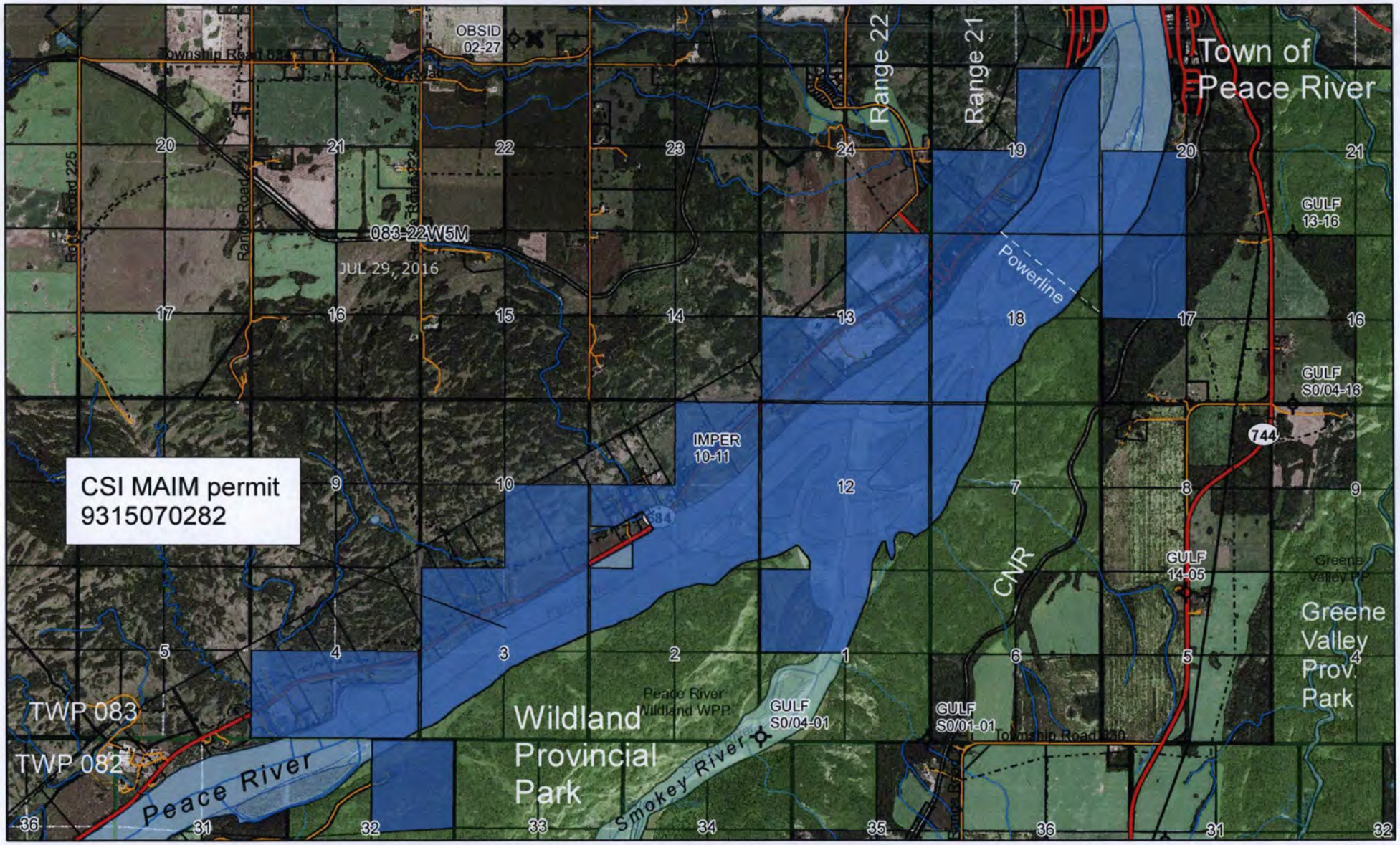


Figure 2 CSI Maim permit 9315070282 situated south of the Town of Peace River, Alberta

Canadian Silica Industries
Part B assessment report

Drawing by: S. Fraser, P. Geol. updated Dec. 5, 2017

0 0.5 1 2 km

1:50,000 scale

consists of 3 members with the Harmon shale, a marine shale at its base, overlain gradationally by the Cadotte sandstone, a very fine to fine grained salt and pepper marine sandstone with shaly sections. The upper sections appear to be siderite cemented and locally siderite lenses to 4 metres length have been noted. Along the Heart River siderite nodules, to 10 cm, form within the Cadotte, close to the contact with the overlying Paddy Mbr sandstone. The Cadotte is also variable in thickness and forms prominent cliffs north of the town of Peace River along the west side of the river to 25 metres thickness. A map of the regional geology is shown in **Figure 3**. A stratigraphic column for this regional geology is listed in Table 2.

Unconformably overlying the Cadotte Member is the Paddy Member sandstone, which Leckie and Singh (1991) have described as varying from low energy shoreface to tidal to inner estuarine. Waddell (1956) used drill core and wireline electric log data from oil and gas wells to illustrate a thickness isopach map of the Paddy Member (**Figure 4**). He describes the Paddy Member configuration as a bird's foot pattern of a delta formed over a broad shelf with locally the Paddy Mbr. sandstone cutting into the Cadotte top as much as 5 meters locally (Leckie and Singh, 1991). Unconformably overlying the Paddy Member sandstone is the Shaftesbury Formation shale, a marine shale with a distinctive layer with fish scales, bones and fish debris and represents an important stratigraphic marker unit for oil and gas drilling. A stratigraphic column is shown in Table 3. Near the Canadian Silica Industries mining area, the Paddy member sandstone reaches thicknesses of 7-9 metres based on 5 test holes (Hamilton, 1998).

Hamilton (1998) compiled a list of drill hole data from historic drilling from both sides of the Peace River and estimated tonnages available from quarriable leases. He provides sieve analysis from 5 test holes drilled for the company Peace River Silica Sand Ltd, test holes E89-01 to 05.

6.0 2015 FIELDWORK

In 2015, the author carried out limited fieldwork with 3 days exploration in May, (May 19, 21 and 24th). Contact relationships were noted along the Heart River, where Leckie and Singh (1991) earlier recognized Paddy Member (Mbr.) sandstone in contact with Cadotte Member sandstone. During this same fieldwork period, Paddy member sandstone was chip sampled along the west side of the Peace River at locations Leckie 1 and 2 (**Figure 5a**). Samples Leckie 1 and 2 were run for sieve analysis at Tetra Teck EBA Engineering in Edmonton and sieve analysis results (in retained %) for those 2 samples are listed below in **Table 2.**

From September 25 to October 1, 2015, 6.5 days fieldwork was spent near the confluence of the Peace and Smokey Rivers to try and locate the Paddy Member sandstone in outcrop. Near the confluence of the two rivers, 3 handheld auger holes (holes 1-3) were drilled, with mainly Shaftesbury Formation shale found in cuttings. The first auger hole was drilled south of the permit and is not shown in **Figure 5a**. Locations of the six auger holes and descriptions of their cuttings is listed in **Appendix 4**. Along the west side of the Peace River, Shaftesbury Formation shale outcrops and auger holes 4-6 were drilled. Auger hole 6 was drilled through the contact between the Shaftesbury and Paddy Member sandstone, just east of the water treatment plant, (situated at the south end of the town of Peace River).

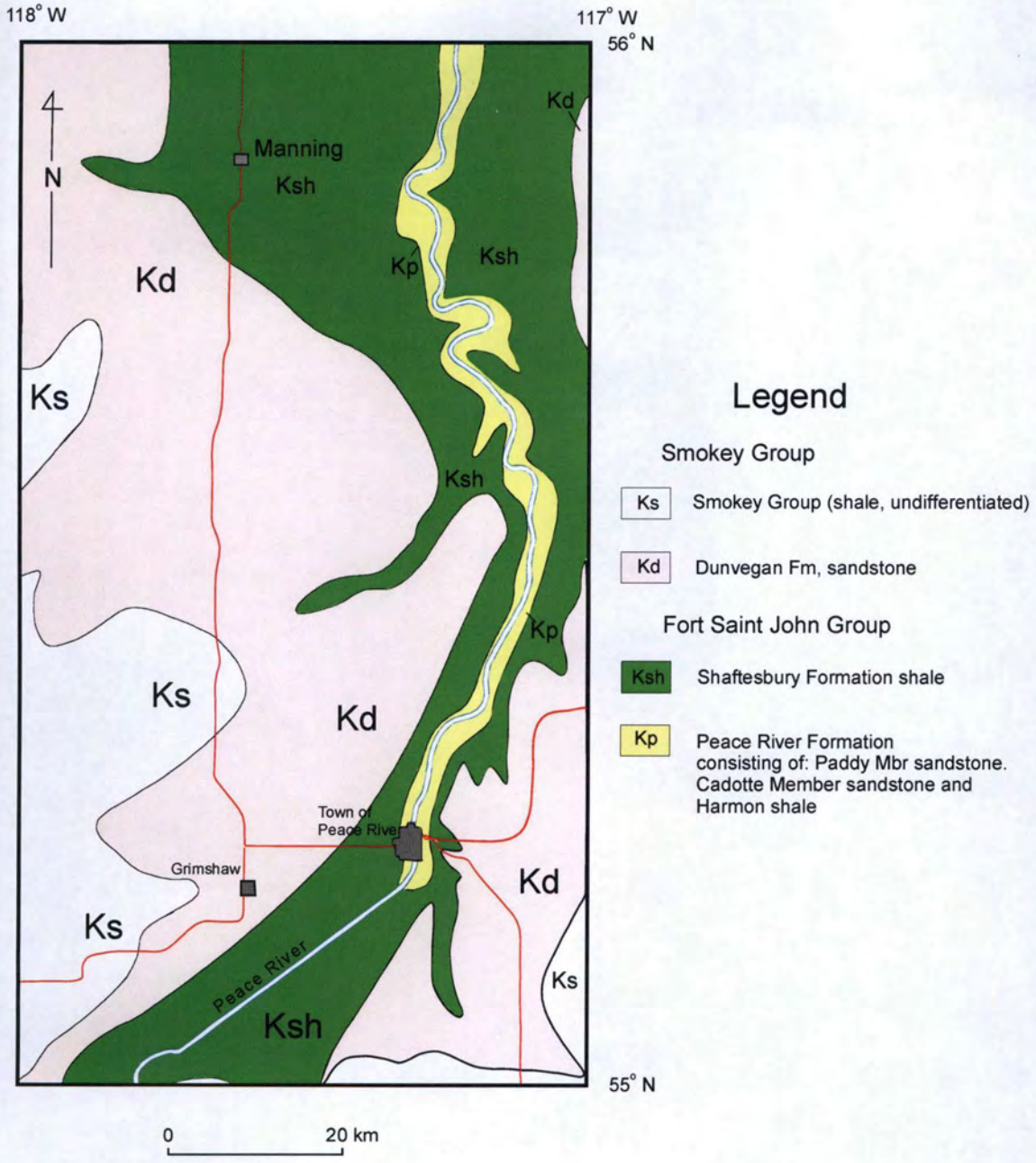


Figure 3 Regional Geology (adapted from Louise and Fenton, 1994)

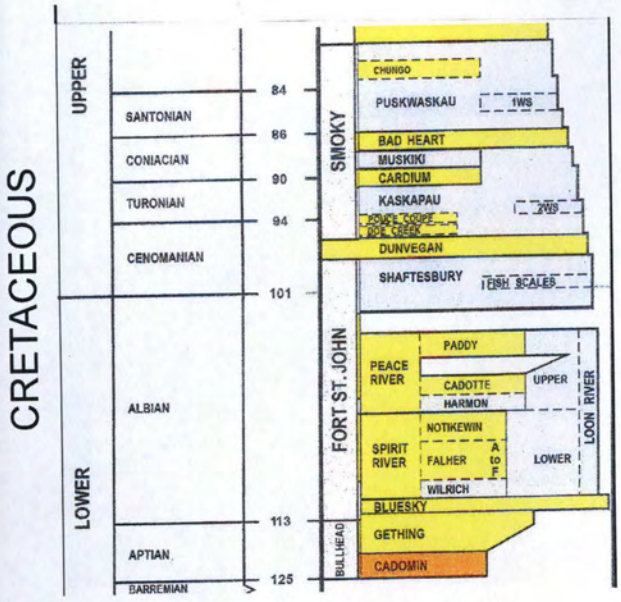
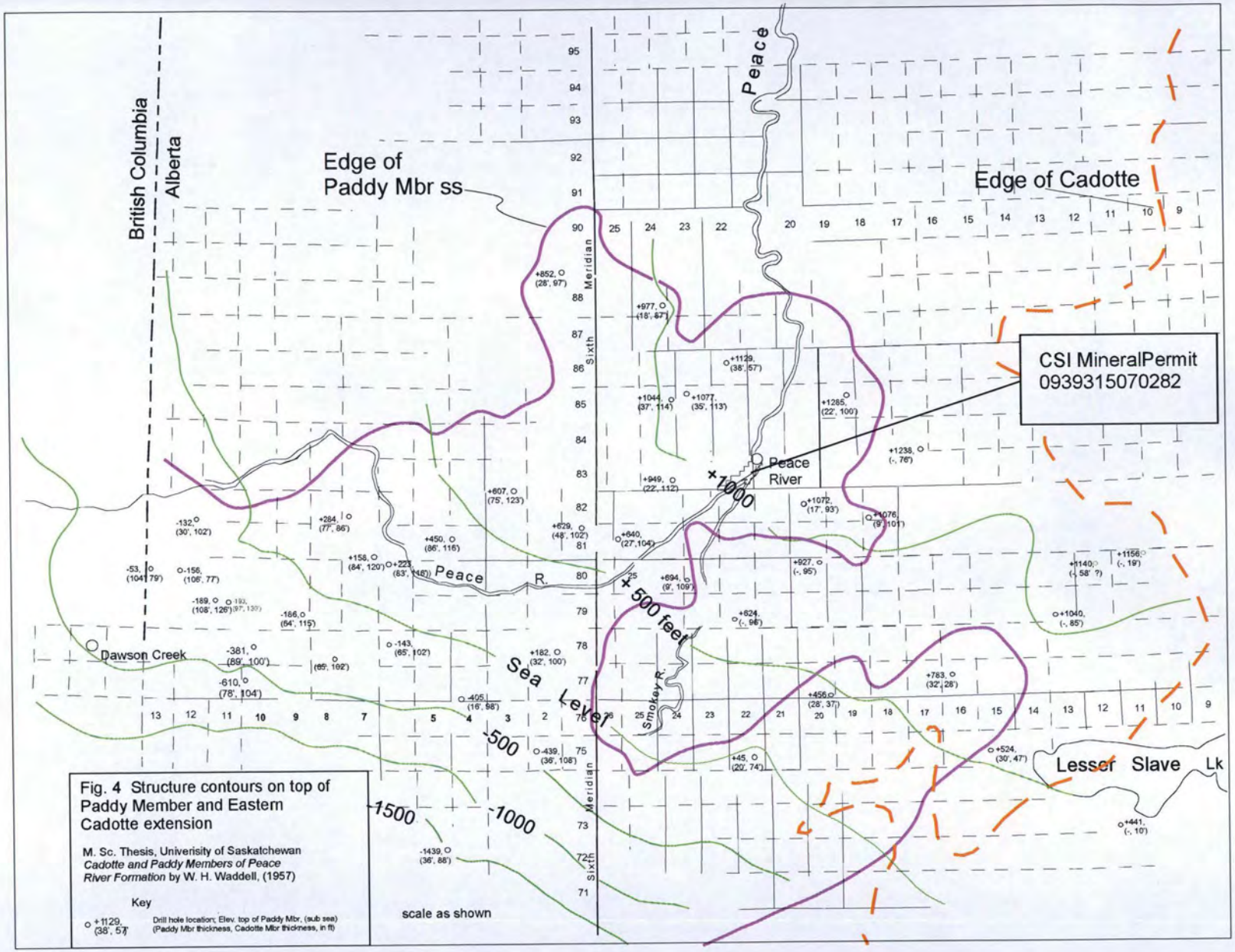
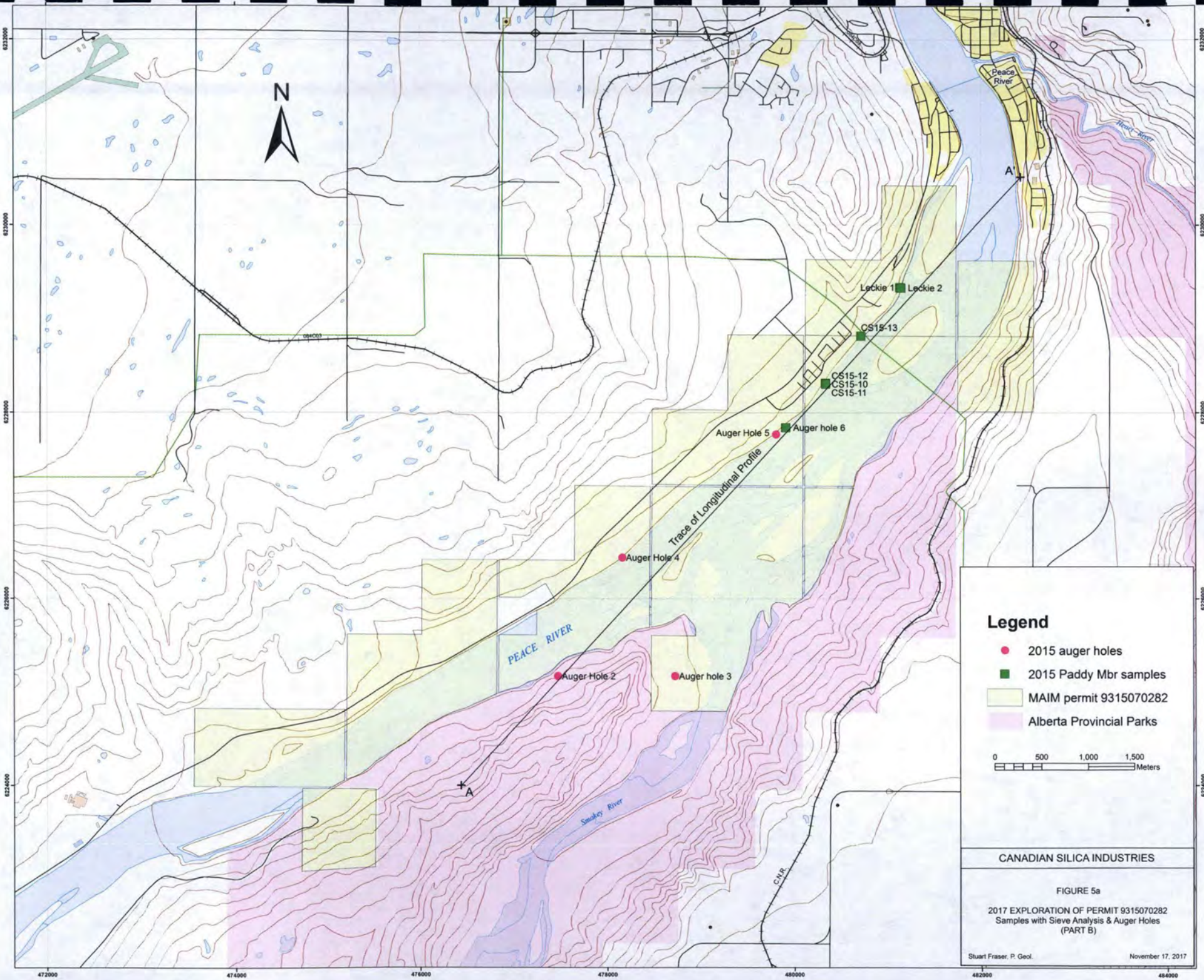


Table 2 Stratigraphic Column for the Peace River area


British Columbia
Alberta
Edge of Paddy Mbr ss
Edge of Cadotte
Peace
CSI MineralPermit
0939315070282
Peace River
+1000
+500 feet
Sea Level
-500
-1000
-1500
Peace R.
Smokey R.
Dawson Creek
Lesser Slave Lk
Sixth Meridian
Fig. 4 Structure contours on top of Paddy Member and Eastern Cadotte extension
M. Sc. Thesis, Univerisity of Saskatchewan
Cadotte and Paddy Members of Peace River Formation by W. H. Waddell, (1957)
Key
+1129, (38', 57') Drill hole location; Elev. top of Paddy Mbr, (sub sea) (Paddy Mbr thickness, Cadotte Mbr thickness, in ft)
scale as shown


N
Peace River
Heart River
A'
A
Leckie 1
Leckie 2
CS15-13
CS15-12
CS15-10
CS15-11
Auger Hole 5
Auger hole 6
Trace of Longitudinal Profile
Auger Hole 4
PEACE RIVER
Auger Hole 2
Auger hole 3
Smoky River
C.N.R.
Legend
2015 auger holes
2015 Paddy Mbr samples
MAIM permit 9315070282
Alberta Provincial Parks
0 500 1,000 1,500
Meters
CANADIAN SILICA INDUSTRIES
FIGURE 5a
2017 EXPLORATION OF PERMIT 9315070282
Samples with Sieve Analysis & Auger Holes
(PART B)
Stuart Fraser, P. Geol.
November 17, 2017
6232000
6230000
6228000
6226000
6224000
472000
474000
476000
478000
480000
482000
484000

Paddy Member sandstone was collected for sieve analysis from 1.4 to 2.0m from auger hole 6. In addition, 4 channel samples of Paddy Member sandstone (samples CS15-10, 11, 12 and 13) were collected north of the contact area for sieve analysis. These samples were cut into the sandstone in roughly a 5-cm wide continuous channel. The most northerly outcrop samples were collected close to where a major powerline cuts across the Peace River. A cut line or clearing is visible in **Figure 2** on the island east of the sampling. Sieve analyses for these samples are listed in **Table 2.** No exploration fieldwork was carried out on the eastern side of the Peace River, south of the town of Peace River.

Geological points of interest or waypoints were collected by Garmin gps and are recorded in **Figure 5b** and listed in Appendix 2.

In addition to the May and October fieldwork, Alberta Environment water well drilling reports for the permit area were evaluated. **Figure 5c** shows water well drill hole locations and **Appendix 3** lists legal descriptions and drillers notes from well cuttings. In the water well reports, where clay/shale were noted overlying sand (and interpreted here as Shaftesbury Formation shale overlying Paddy member sandstone), intercepts where the (interpreted) Paddy Member sandstone were found, were brought into a longitudinal section **Figure 11.** Figure 11 is intended to show the projected thickness of the Paddy and Cadotte member sandstone units along the Peace River. In addition, oil and gas well data with formation tops and lithologies were looked at to gain further insight into the potential thickness of the Paddy Member sandstone as it lies below the Peace River.

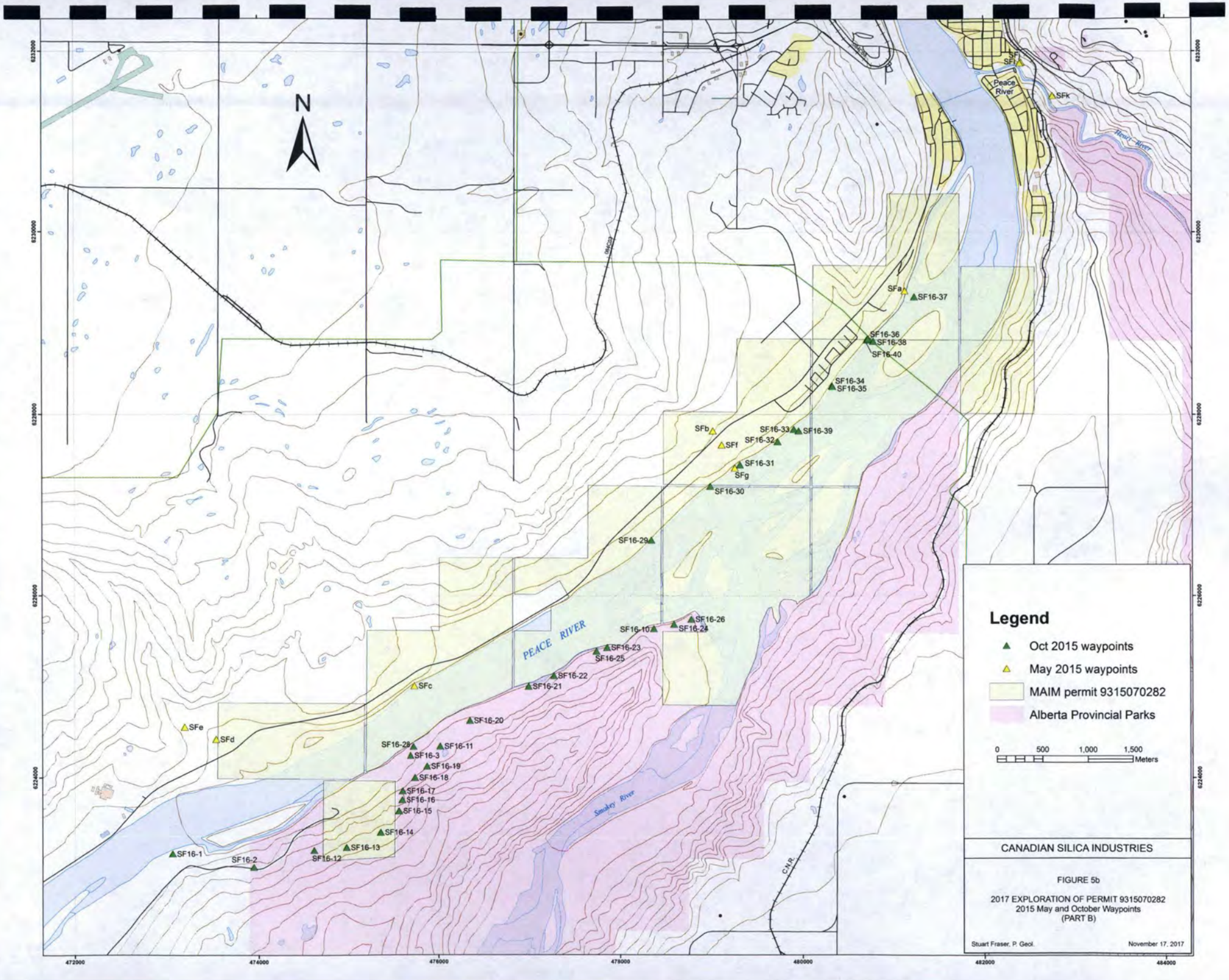
A canoe had been brought along to explore the islands, north of the confluence of the Peace and Smokey Rivers, but the current within the Peace River was too strong for this exploration approach. Three days were spent camping at Tangiers Park (near Shaftesbury Crossing) on the southeast side of the Peace River and exploration activity was carried out by pickup, from there.

7.0 RESULTS

7.1 Sieve analysis

Where the Paddy member sandstone was found in outcrop and sampled from auger hole 6 from 1.4 to 2.0m the sandstone shows moderately favorable results as a frac use. Samples CS15-11 and CS15-12 both have high silt content and CS15-13 is medium to coarse grained. No coal was found in limited channel sampling along the west side of the river. {Coal seams within the Paddy Member sandstone are viewed as deleterious). **Figure 5a** shows 7 samples collected for sieve analysis and shows locations of auger holes used to test for the Paddy Member sandstone. Table 3 below records % retained for the mesh sizes used for the 7 samples analyzed.

Appendix 5 lists sieve analysis in retained weight in grams as well as retained weight in %. Certificates from Tetra Tech EBA Engineering, Edmonton for each sample with sieve analysis are also listed in **Appendix 5**.


N
SFa
SF16-37
SF16-36
SF16-38
SF16-40
SF16-34
SF16-35
SFb
SF16-33
SF16-39
SFf
SF16-32
SF16-31
SFg
SF16-30
SF16-29
SF16-26
SF16-10
SF16-24
SF16-23
SF16-25
SF16-22
SF16-21
SFc
SF16-20
SFe
SFd
SF16-28
SF16-11
SF16-3
SF16-19
SF16-18
SF16-17
SF16-16
SF16-15
SF16-14
SF16-13
SF16-12
SF16-1
SF16-2
PEACE RIVER
Smoky River
C.N.R.
Peace River
SFk
Heart River
Legend
Oct 2015 waypoints
May 2015 waypoints
MAIM permit 9315070282
Alberta Provincial Parks
0 500 1,000 1,500
Meters
CANADIAN SILICA INDUSTRIES
FIGURE 5b
2017 EXPLORATION OF PERMIT 9315070282
2015 May and October Waypoints
(PART B)
Stuart Fraser, P. Geol.
November 17, 2017
6232000
6230000
6228000
6226000
6224000
472000
474000
476000
478000
480000
482000
484000

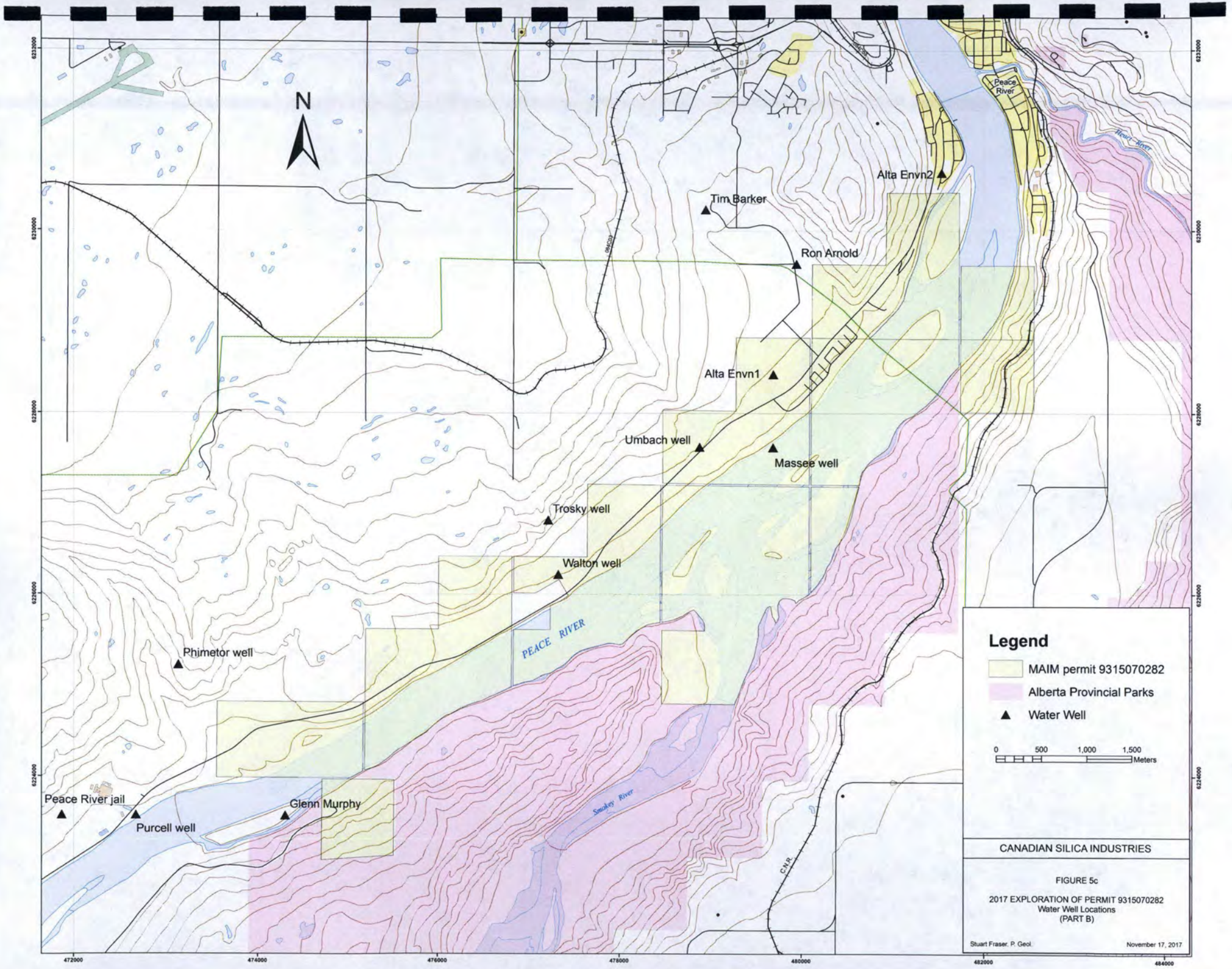
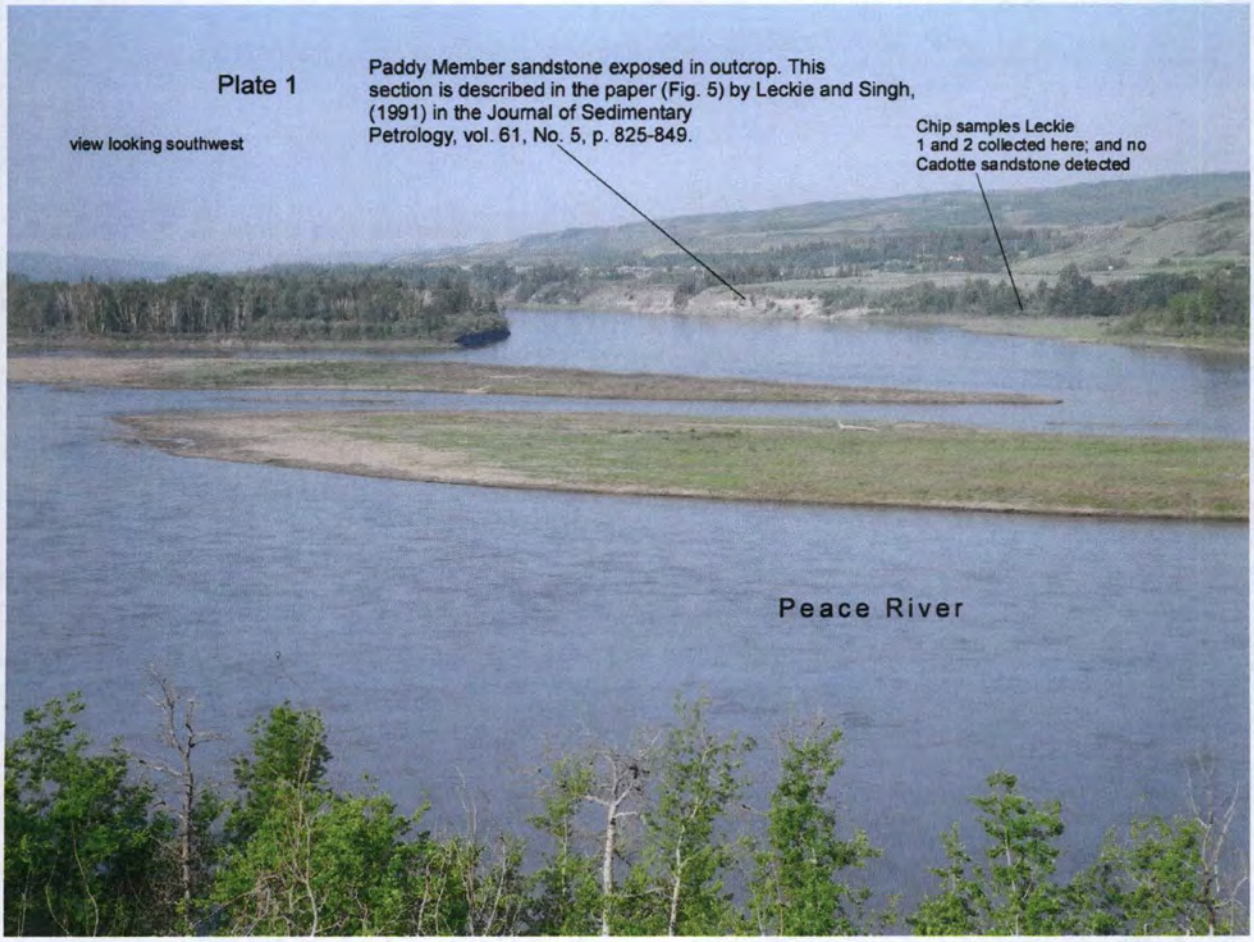

N
Peace River
Heart River
Alta Envn2
Tim Barker
Ron Arnold
Alta Envn1
Umbach well
Massee well
Trosky well
Walton well
PEACE RIVER
Phimetor well
Peace River jail
Purcell well
Glenn Murphy
Smokey River
C.N.R.
Legend
MAIM permit 9315070282
Alberta Provincial Parks
Water Well
0 500 1,000 1,500
Meters
CANADIAN SILICA INDUSTRIES
FIGURE 5c
2017 EXPLORATION OF PERMIT 9315070282
Water Well Locations
(PART B)
Stuart Fraser. P. Geol.
November 17, 2017
6232000
6230000
6228000
6226000
6224000
472000
474000
476000
478000
480000
482000
484000

Table 3 CSI permit exploration																
SIEVE ANALYSIS: retained weight in %																
Analyses from Tetra Teck EBA Engineering, Edmonton																
Rock sample #	**Sieve sizes**										SUM (%)	**initial weight (grams)**	**lithology/description**	NAD 83 UTM coordinates		
	4	12	20	40	60	70	100	140	200	PAN				Easting	Northing	elev (m)
CS15-10	0	1.5	1.1	2.6	10.3	7.0	25.8	35.8	12.1	3.1	99.3	348.4	Upper Paddy mbr; 0-1.3m chip sample from outcrop. Contact with overlying Shaftesbury Fm shale exposed in bank.	**480333**	**6228315**	315
CS15-11	1.5	2.9	1.4	2.2	2.8	1.4	6.8	38.9	**34.4**	7.7	100	396.9	continuous sampling from above, but offset 2m south, 1.3-2.4m; moderately silty			
CS15-12	1.8	2.6	1.7	3.3	4.0	1.7	8.6	43.8	**24.4**	8.1	100	459.2	Continued from above, 2.4-3.2m. Base of sample at height of water along river; moderately silty.	**480335**	**6228309**	**310**
CS15-13	0.3	1.1	1.1	6.1	25.0	18.2	37.7	7.7	1.4	1.4	100	351.3	Upper Paddy Mbr sandstone in o/c, sampled over 1.2m. Shaftesbury Fm shale contact exposed in bank (**photo here; Plate 2**). Sample is medium to coarse grained.	**480715**	**6228818**	**322**
***Auger hole 6**	0	0.5	0.3	1.5	6.1	6.3	26.8	26.1	17.3	14.9	99.9	351.3	Auger hole 6 located 120m southeast of water treatment plant. Collar of hole 0.5m above height of river. **Unconsolidated sand from 1.4-2.0m (interpreted as Paddy Mbr sandstone).**	**479909**	**6227838**	**316**
Leckie 1	0	0.02	1.1	2.9	6.4	5.3	22.1	43.2	14.9	4.0	100.0	510.4	Paddy Mbr. Sandstone, chip sampled over 4m thickness	**481131**	**6229334**	**334**
Leckie 2	0	0	0.4	2.2	11.6	8.7	49.2	24.7	1.2	1.8	100.0	524.9	Paddy Mbr sandstone, chip sample 6-8m	**481143**	**6229330**	**322**
*Auger hole 6 drilled to 2.0m, with 0-0.5m sand, 0.5-1.4m clay, 1.4-2.0m Paddy Member sandstone																

7.2 Projected Paddy Member thickness beneath the Peace River

A plan map (**Figure 6**) and profiles (**Figures 7-10**) obtained courtesy of the Hydraulic Engineering Branch of Alberta Environment show water depth profiles and these cross sections are incorporated into a Longitudinal section (**Figure 11**).

Plate 1 below shows a view to the southwest showing Paddy member sandstone outcropping along the west bank of the Peace River. Leckie and Singh, (1991) in Figure 5 of their publication, report Cadotte member sandstone outcropping and underlying the Paddy Member sandstone. The Cadotte member sandstone was not detected in outcrop sampling at locations Leckie 1 and 2 (Figure 5a) in the May 2015 fieldwork, which is located north of the outcrop viewed in this photo (**Plate 1**). Additional sampling and mapping is recommended in this area to determine the Cadotte member sandstone top.



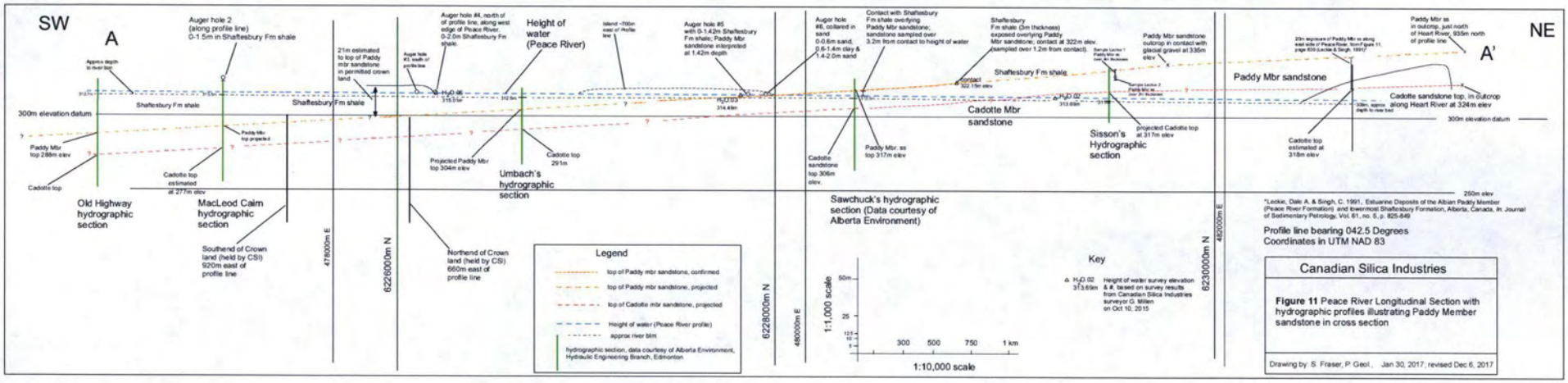

SW
A
A'
NE
Auger hole 2 (along profile line) 0-1.5m in Shaftesbury Fm shale
Shaftesbury Fm shale
300m elevation datum
Paddy Mbr top 288m elev
Cadotte top
Cadotte top estimated at 277m elev
Paddy Mbr top projected
Old Highway hydrographic section
MacLeod Caim hydrographic section
Southend of Crown land (held by CSI) 920m east of profile line
479000m E
21m estimated to top of Paddy mbr sandstone in permitted crown land
Auger hole #4, north of of profile line, along west edge of Peace River. 0-2.0m Shaftesbury Fm shale.
H2O 05 315.51m
312.5m
Height of water (Peace River)
Island ~700m east of Profile line
Auger hole #5 with 0-1.42m Shaftesbury Fm shale; Paddy Mbr sandstone interpreted at 1.42m depth
H2O 03 314.49m
Projected Paddy Mbr top 304m elev
Umbach's hydrographic section
Cadotte top 291m
Northend of Crown land (held by CSI) 660m east of profile line
6226000m N
6228000m N
480000m E
Auger hole #6, collared in sand 0-0.6m sand, 0.6-1.4m clay & 1.4-2.0m sand
Contact with Shaftesbury Fm shale overlying Paddy Mbr sandstone; sandstone sampled over 3.2m from contact to height of water
Cadotte sandstone top 306m elev.
Paddy Mbr. ss top 317m elev
Shaftesbury Fm shale (3m thickness) exposed overlying Paddy Mbr sandstone; contact at 322m elev. (sampled over 1.2m from contact).
Contact 322.15m elev
H2O 02 313.69m
Cadotte Mbr sandstone
Sisson's Hydrographic section
projected Cadotte top at 317m elev
Paddy Mbr sandstone outcrop in contact with glacial gravel at 335m elev
Paddy Mbr sandstone
Cadotte sandstone top, in outcrop along Heart River at 324m elev
300m elevation datum
Cadotte top estimated at 318m elev
250m elev
Paddy Mbr ss in outcrop, just north of Heart River, 935m north of profile line.
Sawchuck's hydrographic section (Data courtesy of Alberta Environment)
1:1,000 scale
50m
25
12.5
10
5
300
500
750
1 km
1:10,000 scale
Legend
top of Paddy mbr sandstone, confirmed
top of Paddy mbr sandstone, projected
top of Cadotte mbr sandstone, projected
Height of water (Peace River profile)
approx river btm
hydrographic section, data courtesy of Alberta Environment, Hydraulic Engineering Branch, Edmonton
Key
H2O 02 313.69m
Height of water survey elevation & # based on survey results from Canadian Silica Industries surveyor G. Millen on Oct 10, 2015
6230000m N
480000m E
*Leckie, Dale A. & Singh, C. 1991, Estuarine Deposits of the Albian Paddy Member (Peace River Formation) and lowermost Shaftesbury Formation, Alberta, Canada, In Journal of Sedimentary Petrology, Vol. 61, no. 5, p. 825-849
Profile line bearing 042.5 Degrees
Coordinates in UTM NAD 83
Canadian Silica Industries
Figure 11 Peace River Longitudinal Section with hydrographic profiles illustrating Paddy Member sandstone in cross section
Drawing by: S. Fraser, P. Geol., Jan 30, 2017; revised Dec 6, 2017

Plate 2 below shows the contact with Shaftesbury Formation shale overlying the upper Paddy member sandstone along the west bank of the Peace River, just south from where the powerline crosses the Peace River in Figure 2.

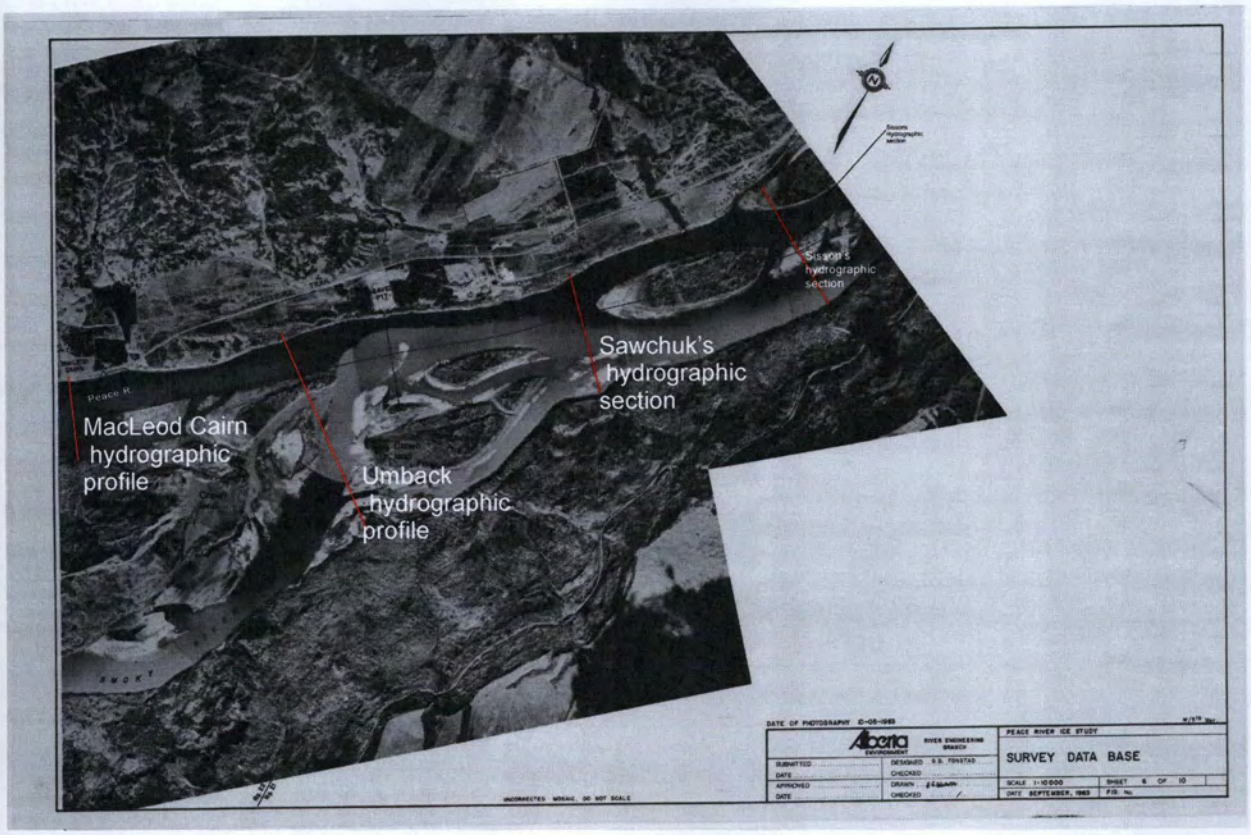


Figure 6 Air photo mosaic of plan view of the Peace River area, south of the Town of Peace River, (courtesy of Alberta Environment, Hydraulic Engineering Branch). Scale of map reduced from 1:10,000 to fit page.

Sawchuck's (hydrographic) section (modified from Alberta Environment, Hydraulic Engineering branch)

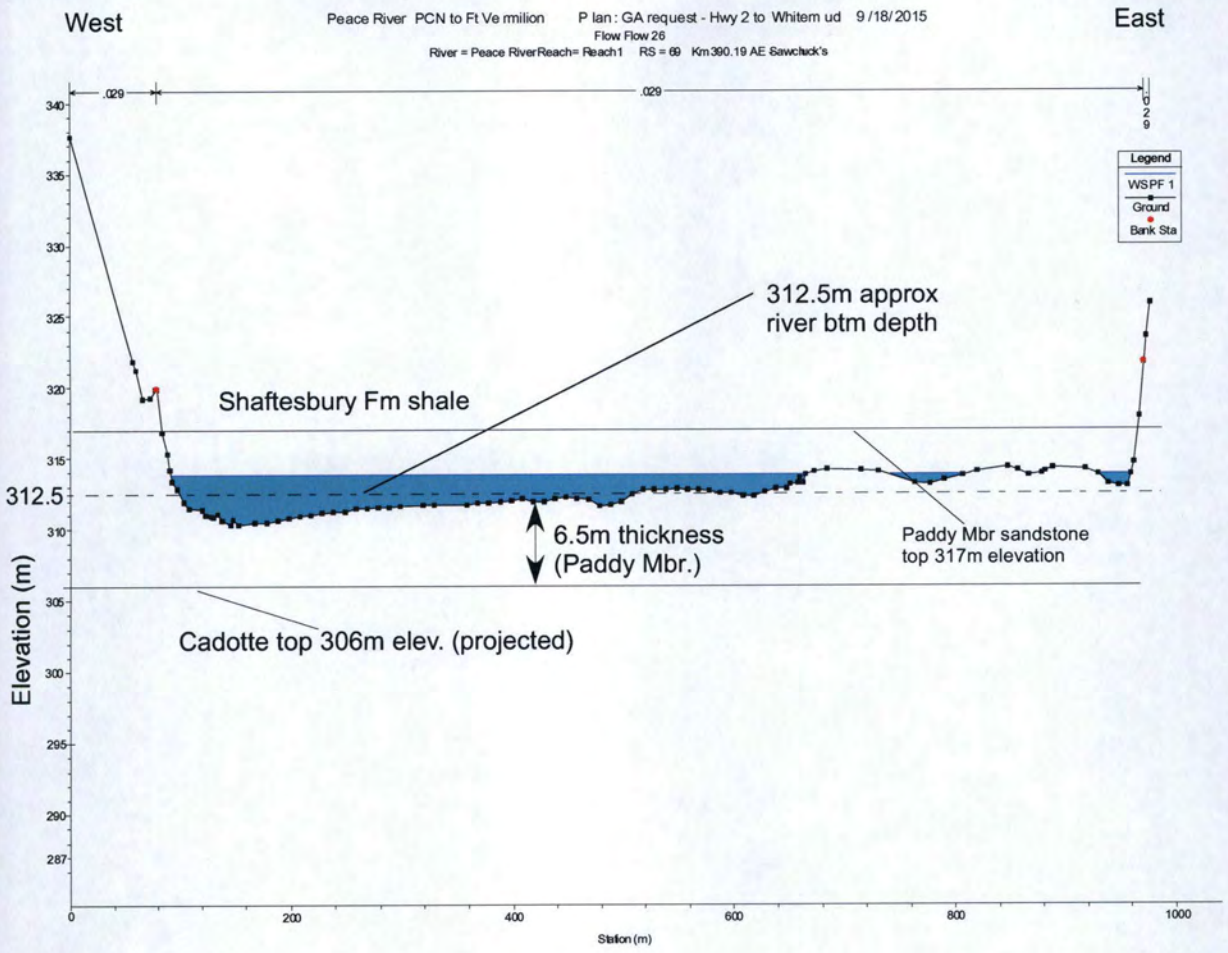


Figure 7 Sawchuck's hydrographic section, profile looking north easterly.

Umbach's (hydrographic) section (modified from Alberta Environment, Hydraulic Engineering branch)

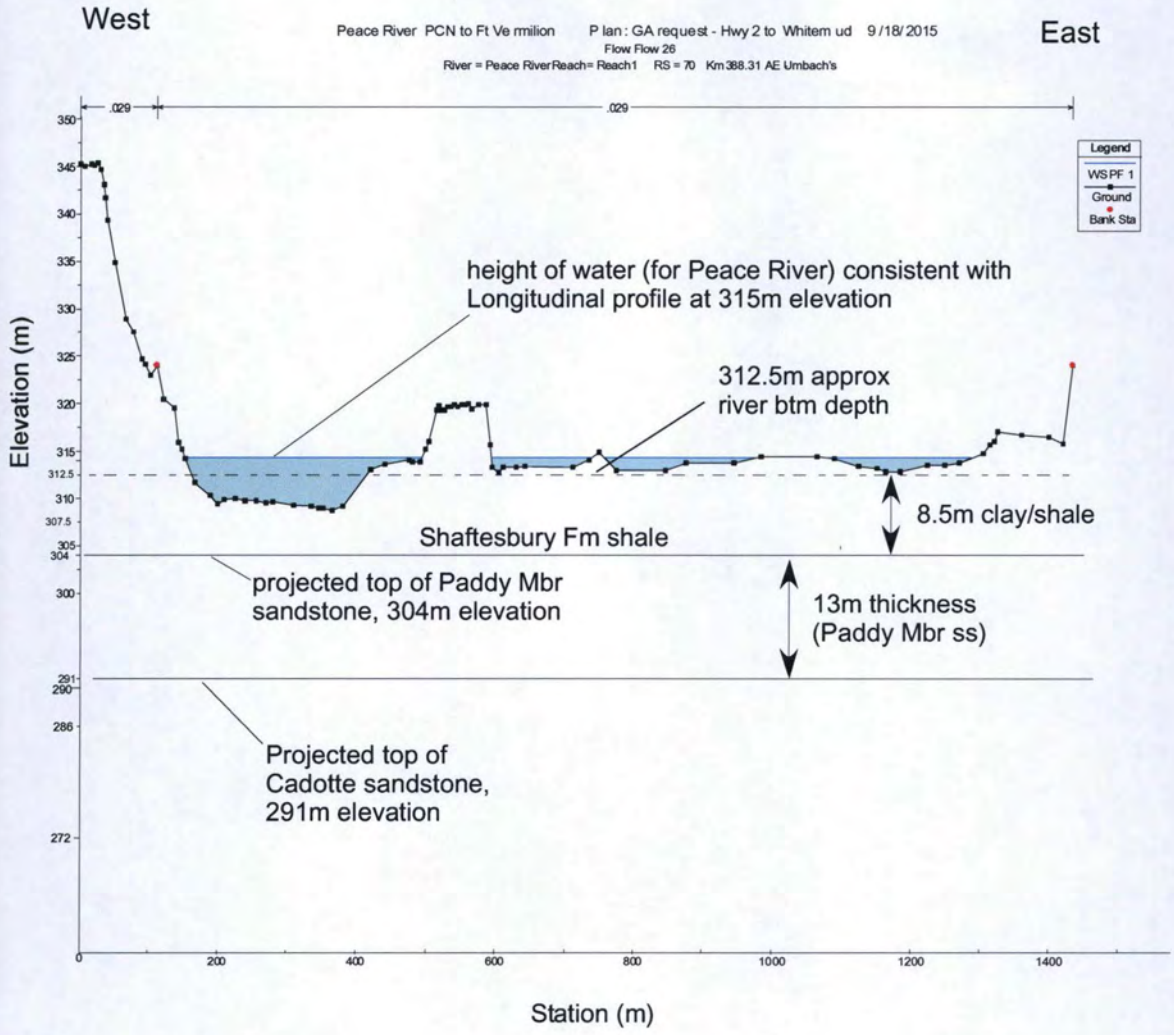


Figure 8 Umbach's hydrographic section; profile looking north easterly.

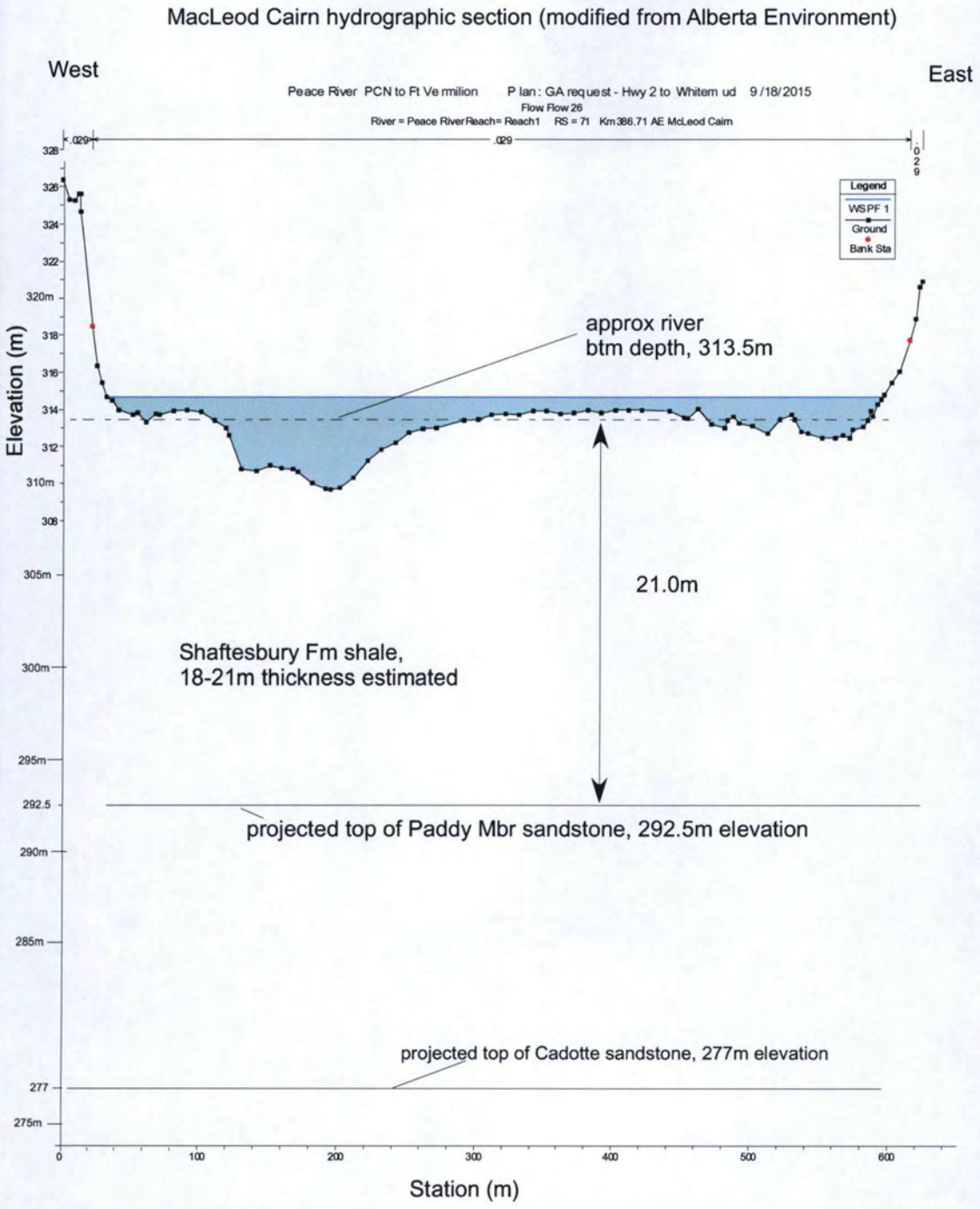


Fig. 9 MacLeod Cairn hydrographic section

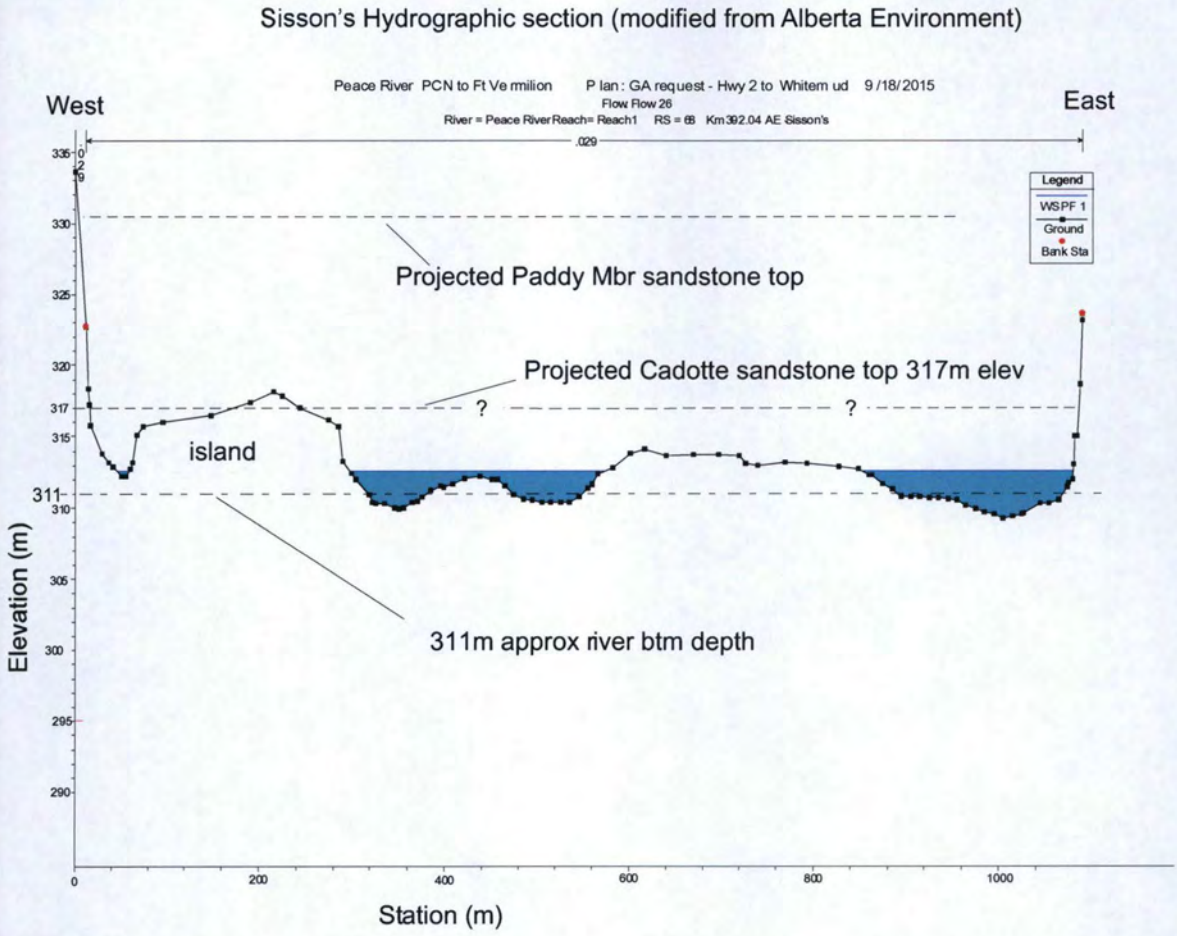


Figure 10 Sisson's hydrographic section; profile looking north easterly.

8.0 Conclusions and Discussion

The longitudinal section (**Figure 11**) outlines projected Paddy member sandstone thickness beneath the Peace River. An estimated 15 to 20 metres of Paddy member sandstone is projected to lie beneath the Peace River within mineral permit 9315070282. Preliminary sieve analysis from limited chip samples from Paddy member sandstone outcrop and minimal handheld, auger hole drilling suggests silica sand potential. More chip sampling is required and truck mounted, borehole drilling is recommended before a resource potential can be determined.

The preliminary sieve sample results listed in Table 2 indicate generally fine-grained silica sand from chip sample results and locally silty sections. Additional chip sampling of Paddy Member sandstone outcrop, north of the powerline crossing, along the west side of the Peace River, is recommended. This is the area described in the Leckie and Singh (1991) report, (their Figure 5) which suggests Cadotte member sandstone is exposed in outcrop. To date, most of the sampling of the Paddy Member has been from the upper portion of the Paddy Member sandstone. Further exploration sampling is suggested on the east side of the river, just south of the town of Peace River.

Water well drill hole records available through Alberta Environment has been very useful in recognizing Paddy Member sandstone from water well drillers notes. The results of this are seen in the longitudinal section.

While thin coal seams have been noted within the Paddy Mbr. sandstone in the Heart River area, no coal has been detected from preliminary sampling on the west side of the Peace River within the Paddy Member sandstone.

9.0 Statement of Qualifications

I, Stuart C. Fraser, P. Geol. reside in Edmonton, Alberta and am a Professional Geologist registered with APEGA since 1997, licence member number 47638 and APEGBC since 2012.

I am the principle in the corporation S. Fraser Geological Contracting Ltd., incorporated November 28, 2012. I have a permit to practice geology through APEGA, permit to practice number 12168.

I have a B. Sc. Degree in geology from Dalhousie University, graduated in 1973 and a Master's Degree in Geology from the University of Alberta in 1996.

I have practiced my profession since graduation and have worked on minerals as well as oil and gas projects through my career.

The details in this assessment report are true and have been completed to be best of my ability. I am a qualified person for the purposes of this report, and have no stock in the company of Canadian Silica Industries (CSI) and expect to gain no special services with the completion of this report. I am being paid as a consultant for the completion of this report and expect nothing further.

I have had extensive experience with the Peace River silica sand project/quarry (as a qualified person) having run a drill program with CSI in 2014 with completion of 16 boreholes testing the Cretaceous Paddy Member sandstone. In addition, I also worked with Dr. John Godfrey, former consultant geologist, on this same silica sand project in 1998 and 1999 with United Industrial Services Ltd. (UISL), Calgary.

Stuart Fraser, P. Geol.

Date Dec. 6, 2017

10.0 Selected References

Fraser, S., 2014, Compilation of geological data from Peace River silica sand project, Peace River, Alberta, internal report for: Canadian Silica Industries.

Hamilton, W., 1998, Frac sand evaluation, Peace River Silica Sand Deposit, final report, prepared for: Peace River Silica Sand Ltd., Alberta Research Council, Open File Report 1998-08

Leckie, Dale A. and Singh, C., 1991, Estuarine deposits of the Albian Paddy Member (Peace River Formation) and lowermost Shaftesbury Formation, Alberta, Canada, Journal of Sedimentary Petrology, Vol. 5, p.825-849.

Leslie, L. E. and Fenton, M. M., 2001, Quaternary stratigraphy and surficial geology Peace River-final report, Alberta Geological Survey Special Report 10, p. 156.

Waddell, William Henry, 1957, Cadotte and Paddy Members of Peace River Formation, A thesis submitted to the Graduate Studies in partial fulfilment of the requirements for the Degree of Master of Science in the Department of Geology, University of Saskatchewan.

Appendix 1 Assessment Expenditures Summary

Total assessment credits for mineral permit 093 9315070282 (as of March 8, 2017) include:

	total costs
mileage & field rate charges (S. Fraser Geological Contracting Ltd)	17990.43
Accommodation & meals	716.55
Analytical & consulting costs (EBA Engineering)	1344.00
Printing, scanning & other charges	488.66
Subtotal	**20539.64**
Overhead 10%	2053.96
Total CSI expenditure from compilation study, fieldwork & reporting	**22,593.60**
Assessment charges for 1st work period consisting of 1671 hectares is 1671 x $5/hectare	**8355.00**
***Remainder $14,238.60 to be applied to work period 2, due July 23, 2019. Total charges expected for the next work period at $10/hectare would be $16, 710 based on the present 1671 hectares within the existing permit block.**	**14,238.60**

Appendix 2

Waypoints from May and October 2015 fieldwork

May 2015 waypoints

Name	Easting	Northing	elevation	Description
SFa	481134	6229352	335	wpt along cliff where Paddy Mbr sandstone is in contact with glacial gravels
SFb	479022	6227820	340	SE corner of pit floor;1.4 km south of Leckie field
SFc	475735	6225010	333	Shaftesbury Fm shale in outcrop
SFd	473539	6224422	329	Shaftesbury slump debris in ck bank
SFe	473199	6224557	341	Shaftesbury slump debris in creek
SFf	479119	6227663	340	pit floor
SFg	479263	6227409	318	River edge with gravel exposed
SFh	469395	6207805	541	3m thick sandstone lens within Shaftesbury (?) Fm
SFi	482418	6231881	344	top of Paddy Mbr in o/c
SFj	482404	6231873	334	Base of Paddy Mbr
SFk	482762	6231511	323	Cadotte sandstone top with siderite nodules along Heart River

October 2015 waypoints

Waypoints	Easting	Northing	Elev.	Date	Description
SF16-1	473065	6223153	329	Sep 28, 2015	west edge of Freeland property
SF16-2	473947	6223004	367	Sep-25	Wildland Prov. Park boundary
SF16-3	475689	6224244	330	Sep-25	Access trail, point 1
SF16-4	468708	6217560	374	Sep-26	gravel exposed along range road
SF16-5	470965	6221377	315	Sep-26	elevation of height of water in Peace River
SF16-6	468995	6217808	340	Sep-26	Shaftesbury Fm shale in o/c
SF16-7	469086	6217897	332	Sep-26	Shaftesbury o/c along west side of road
SF16-8	470941	6220176	330	Sep-26	Freeland access road & Range Road 234
SF16-9	468689	6217597	345	Sep-26	gravel site along Range Rd 234
SF16-10	478374	6225636	326	Sep-25	entrance to Crown land
SF16-11	476020	6224347	343	Sep-27	access trail
SF16-12	474612	6223190	394	Sep-27	access trail
SF16-13	474973	6223222	405	Sep-27	access trail
SF16-14	475351	6223391	401	Sep-27	access trail
SF16-15	475556	6223629	387	Sep-27	access trail
SF16-16	475592	6223752	372	Sep-27	access trail
SF16-17	475597	6223851	366	Sep-27	access trail
SF16-18	475740	6223999	369	Sep-27	access trail
SF16-19	475873	6224126	347	Sep-27	access trail
SF16-20	476347	6224629	340	Sep-27	access trail
SF16-21	476995	6225004	323	Sep-27	access trail
SF16-22	477274	6225120	321	Sep-27	access trail
SF16-23	477860	6225429	323	Sep-27	access trail
SF16-24	478595	6225684	319	Sep-27	access trail
SF16-25	477743	6225389	327	Sep-27	access trail
SF16-26	478783	6225741	314	Sep-27	confluence of Smokey & Peace rivers
SF16-27	468458	6217594	320	Sep-29	Shaftesbury Formation

					shale o/c
SF16-28	475724	6224343	329	Sep-29	North end Young property
SF16-29	478348	6226612	314	Sep-29	Shaftesbury o/c along west side of river
SF16-30	478992	6227207	314	Sep-29	Shaftesbury Fm shale o/c
SF16-31	479319	6227443	318	Sep-29	Shaftesbury Fm shale o/c
SF16-32	479732	6227697	314	Sep-29	Shaftesbury Fm shale o/c
SF16-33	479909	6227836	316		Paddy Member ss o/c exposed along river
SF16-34	480333	6228315	315		top of Paddy Mbr ssandstone; chip sample
SF16-35	480335	6228309	310	Oct-01	Bottom of chip sample & heigth of river
SF16-36	480715	6228818	322	Oct-01	Shaftesbury Fm shale in contact with Paddy Mbr sandstone
SF16-37	481239	6229287	322.2		height of water in river
SF16-38	480786	6228802	313.3	Oct. 1, 2015	height of water in river, pt3;
SF16-39	479963	6227818	313.7		height of water, pt4
SF16-40	480727	6228829	322		Contact Shafts & Paddy Mbr sandstone

Appendix 3 Water well drill hole data

Water well location	Easting	Northing	Elev (m)	Legal Desc	Comments
Ron Arnold	479951	6229636	368	LSD9_S24_Tp083_R22	23.16-24.38m cs sand & gravel; 24.38-25.30m Shaftesbury shale
Alta_Envn1	479695	6228429	357	NE quarter Sec 13 Twp 083 R22	0-1.62m boulders, 7.62-20.73 gravel & boulders, 20.73-24.38 black shale
Walton well	477330.8	6226219	337	LSD6 Sec 11 Twp 083 R22	25.3-31.09m water bearing sandstone; 31.09-34.14m shale & sandstone
Trosky well	477221	6226820		NWquarter Sec11 Twp 083 R22	28.96-32.0m blue shale (Shaftesbury ?)
Phimetor well	473140	6225227	344	NE quarter Sec 05 Twp 083 R22	12.19-12.5m gravel, 12.5-18.59m clay, 18.59-19.81m gravel
Glenn Murphy	474305	6223566	316	NW quarter Sec 32 Twp 082 R22	16.15-19.81m gray water bearing sand & gravel, 19.81-20.12m gray clay
Alta Envn2	481541	6230646	318	LSD01 Sec 30 Twp 083 R21	3.05-9.14m gravel; 9.14-9.75m sandstone (Paddy Mbr ?)
Massee well	479692	6227624	320	SE quarter Sec 13 Twp 083 R22	0-16.76m gravel; 16-31.09m shale; 31.09-32.61m sand; 32.61-34.44m shale; 34.44-38.4m sandstone
Purcell well	472679	6223577	329	NW quarter Sec 31 Twp 082 R22	no lithology available
Peace River jail well	471868	6223573	347	NE quarter Sec 36 Twp 082 R23	report by O. Tokarsky reports sandstone 69-79 ft (21-24m)
Edward Roski	470175.3	6221545	335	EH Sec 26 Twp 082 R23	2.44-7.01m gravel, 7.62-9.14m gray shale, 9.14-30.48m dk gray shale (Shaft)
Tim Barker	478957	6230233	375	LSD 14 Sec 24 Twp 083 R22	0-67.06m dk gy clay, 67.06-74.68m fn gr sand, 74.68 to 77.72m gravel; 77.72-79.25m med gr sand
Umbach well	478887	6227628	350	SW quarter Sec13 Twp 083 R22	0-15.24m gravel & boulders, 15.24-27.43m clay & rocks, 27.43-36.58m sandstone

Appendix 4

(handheld) Auger drill hole data

Auger holes	Easting	Northing	Elev (m)	comments
	UTM NAD83, Zone 11			
Auger Hole 1	470936	6220628	325	0-6.1m in Shaftesbury Fm shale
Auger Hole 2	477468	6225171	325	0-5.1m in Shaftesbury Fm shale
Auger hole 3	478721	6225171	325	0-0.9m in clay
Auger Hole 4	478156	6226439	319	0-1.5m in clay
Auger Hole 5	479802	6227763	319	0-1.2m clay; 1.2 to 1.42m Paddy Mbr sandstone
Auger hole 6	479909	6227838	316	0-0.5m sand, 0.5-1.4m clay (interpreted as Shaftesbury Fm shale), 1.4-2.0m sand (interpreted as Paddy Mbr. sandstone)

Appendix 5

Sieve Analysis & Certificates from EBA Engineering

Page 33 sieve analysis with retained weights in grams

Page 34 sieve analysis with retained weights in %

Pages 35-41 Tetra Tech EBA Engineering Certificates

Canadian Silica Industries

SIEVE ANALYSIS: retained weights in grams; dry sieved

CSI permit exploration sampling May & Sept 2015

Analyses from Tetra Tech EBA Engineering, Edmonton

Rock sample #	sieve sizes															
	4	12	20	40	60	70	100	140	200	PAN	SUM	initial weight	lithology	NAD 83 UTM coordinates		elev (m)
CS15-10	0	5.1	3.9	8.9	35.8	26.8	90.0	124.6	42.3	10.9	348.3	348.4	Upper Paddy mbr. 0-1.3m chip sample from o/c; Sept 30	480333	6228315	315
CS15-11	5.8	11.5	5.5	8.9	11.1	5.6	27.0	154.2	136.6	30.7	396.9	396.9	continuous sampling from above; 1.3-2.4m; Sept 30			
CS15-12	8.2	12.0	7.7	15.2	18.5	7.9	39.7	200.9	112.0	37.1	459.2	459.2	as above; 2.4-3.2m; Sept 30	480335	6228309	310
CS15-13	1.1	3.7	3.9	21.4	87.9	64	132.4	27.1	4.8	5.0	351.3	351.3	chip sample; 0-1.2m; Oct 1	**480715**	**6228818**	322
Auger hole 6	0	1.8	1.2	5.3	21.6	22.1	94.2	91.6	60.9	52.4	351.1	351.3	Auger hole #6; 1.4-2.0m; Sept 30	479909	6227838	316
Leckie_1	0	0.1	5.7	14.8	32.8	27.2	112.8	220.3	76.2	20.3	510.2	510.4	Paddy Mbr. Sandstone, chip sample 0-4m; May 24	481131	6229334	334
Leckie_2	0	0	2.3	11.7	61.1	45.9	258.3	129.4	6.3	9.7	524.7	524.9	Paddy Mbr sandstone, chip sample 6-8m; sampled May 24	481143	6229330	322

Canadian Silica Industries

SIEVE ANALYSIS: retained weights in %

CSI permit exploration sampling_Sept/Oct 2015

Sieve analysis from Tetra Teck EBA Engineering, Edmonton

Rock sample #	sieve sizes										SUM (%)	initial weight	lithology/description	NAD 83 UTM coordinates		elev (m)
	4	12	20	40	60	70	100	140	200	PAN				Easting	Northing	
CS15-10	0	1.5	1.1	2.6	10.3	7.0	25.8	35.8	12.1	3.1	99.3	348.4	Upper Paddy mbr; 0-1.3m chip sample from outcrop (o/c) 600m northeast of water treatment plant. Contact with overlying Shaftesbury Fm shale exposed in embankment.	480333	6228315	315
CS15-11	1.5	2.9	1.4	2.2	2.8	1.4	6.8	38.9	34.4	7.7	100	396.9	continuous sampling from above, but offset 2m south; 1.3-2.4m			
CS15-12	1.8	2.6	1.7	3.3	4.0	1.7	8.6	43.75	24.4	8.1	100	459.2	as above, 2.4-3.2m. Base of sample at height of water along river	480335	6228309	310
CS15-13	0.3	1.1	1.1	6.1	25.0	18.2	37.7	7.7	1.4	1.4	100	351.3	Upper Paddy Mbr sandstone in outcrop, 1200m northeast of water treatment plant; chip sample 0-1.2m. Shaftesbury Fm shale contact exposed in embankment.	480715	6228818	322
Auger hole # 6*	0	0.5	0.3	1.5	6.1	6.3	26.8	26.1	17.3	14.9	99.9	351.3	Auger hole 6 located 120m southeast of water treatment plant. Collar of hole 0.5m above height of river. Unconsolidated sand from 1.4-2.0m (interpreted as Paddy Mbr)	479909	6227838	316
Leckie_1	0	0.02	1.1	2.9	6.4	5.3	22.1	43.2	14.9	4.0	100.0	510.4	Paddy Mbr. Sandstone, chip sample 0-4m	481131	6229334	334
Leckie_2	0	0	0.4	2.2	11.6	8.7	49.2	24.7	1.2	1.8	100.0	524.9	Paddy Mbr sandstone, chip sample 6-8m	481143	6229330	322
													no analyses; top of Paddy Mbr in contact with glacial gravels here, no Shaftesbury Fm noted	481134	6229352	335

*Auger hole 6 drilled to 2.0m, with 0-0.5m sand, 0.5-1.4m clay, 1.4-2.0m sand **(Paddy Member)**

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: CANADIAN SILICA INDUSTRIES
Address:
Project No.: E1220 3801 - 01
Date Tested: MAY 27, 2015 By: MRG

Borehole No.: LECKIE 1
Depth: 0-4m
Sample No.: 9738.1
Sample Description:

	Initial	Washed
Wet & Tare	2776.5	
Dry & Tare	~~2738.9~~ 2740.0	
Tare Mass	733.0	
Dry Mass	2007.0	
% Moisture	1.82%	

Hydrometer Sample Wt.: _____ g
Plus No. 10 Material Yes ☐ No ☐

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before	2007.0	
Mass After (INITIAL MASS)	510.4	

Hygroscopic Moisture

		% Moisture
Wet & Tare		
Dry & Tare	CHECK: 510.4-510.2 = 0.2 ✓	
Tare		

Sieve Analysis Test

	Sieve (mm)	Mass Retained	Total Mass Passing	Total% Passing
4	4.75	0		
12	1.75	0.1		
20	0.850	5.7		
40	0.425	14.8		
60	0.250	32.8		
-70	0.212	27.2		
100	0.150	112.8		
-140	0.106	220.3		
200	0.075	76.2		
	Pans	20.3		
	SUM:	510.2		

Hydrometer Test

Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction:
Dispersant Correction:
Specify Gravity:
Cylinder No.:
Hydrometer No.:

Remarks: DRY SIEVED, AS PER CLIENT REQUEST

Tt_Particle Size_Analysis of Soils.cdr

TETRA TECH

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: CANADIAN SILICA INDUSTRIES
Address:
Project No.: E12203801-01
Date Tested: MAY 27 2015 By: MEG

Borehole No.: LECKIE 2
Depth: 6-8m
Sample No.: 9738.2
Sample Description:

	Initial	Washed
Wet & Tare	1844.4	
Dry & Tare	1840.5	
Tare Mass	636.1	
Dry Mass	1204.4	
% Moisture	0.32%	

Hydrometer Sample Wt.: _____ g
Plus No. 10 Material Yes ☐ No ☐

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before	1204.4	
Mass After (INITIAL MASS)	524.9	

Hygroscopic Moisture

		% Moisture
Wet & Tare		
Dry & Tare	CHECK: 524.9 - 524.7 = 0.2 ✓	
Tare		

Sieve Analysis Test

	Sieve (mm)	Mass Retained	Total Mass Passing	Total% Passing
4	4.75	0		
12	1.75	0		
20	0.850	2.3		
40	0.425	11.7		
60	0.250	61.1		
70	0.212	45.9		
100	0.150	258.3		
140	0.106	129.4		
200	0.075	6.3		
	Pans	9.7		
	SUM:	524.7		

Hydrometer Test

Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction:
Dispersant Correction:
Specify Gravity:
Cylinder No.:
Hydrometer No.:

Remarks: DRY SIEVED AS PER CLIENT REQUEST

Tt_Particle Size_Analysis of Soils.cdr

LRC

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: Fraser Geological General Testing
Borehole No.: Auger Hole #6
Address:
Depth: 1.4 - 2.0 m
Sample No.: 251.5
Project No.: E12203801-01
Sample Description:
Date Tested: Oct 9/15 By: mc

	Initial	Washed
Wet & Tare		
Dry & Tare	468.1	
Tare Mass	116.8	
Dry Mass	351.3	351.1
% Moisture		

Hydrometer Sample Wt.: _____ g
Plus No. 10 Material Yes ☐ No ☐

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before		
Mass After		

Hygroscopic Moisture		
Wet & Tare		% Moisture
Dry & Tare		
Tare		

Sieve Analysis Test

	Sieve	Mass Retained	Total Mass Passing	Total% Passing
4	4.75	0		
12	1.700	1.8		
20	0.850	1.2		
40	0.425	5.3		
60	0.250	21.6		
70	0.212	22.1		
100	0.150	94.2		
140	0.106	91.6		
200	0.075	60.9		
	Pans	52.4		

Hydrometer Test

Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction: _____
Dispersant Correction: _____
Specify Gravity: _____
Cylinder No.: _____
Hydrometer No.: _____

Remarks: Dry Sieved, as per client request

Tt_Particle Size_Analysis of Soils.cdr

TETRA TECH

KMC

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: Fraser Geological General Testing
Address:

Project No.: E1220380 1-01
Date Tested: Oct 9/15 By: mc

Borehole No.: BTM of Shaft (?)
Depth: 0 - 1.3 m
Sample No.: 251.1
Sample Description: Sample # CS15-10 Sampled on Sept 30/15

	Initial	Washed
Wet & Tare		
Dry & Tare	465.1	
Tare Mass	116.7	
Dry Mass	348.4	348.3
% Moisture		

Hydrometer Sample Wt.: _____ g
Plus No. 10 Material Yes ☐ No ☐

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before		
Mass After		

Hygroscopic Moisture		
Wet & Tare		% Moisture
Dry & Tare		
Tare		

Imp. (Metric)

Sieve		Mass Retained	Total Mass Passing	Total% Passing
4	4.75	0		
12	1.700	5.1		
20	0.850	3.9		
40	0.425	8.9		
60	0.250	35.8		
70	0.212	26.8		
100	0.150	90.0		
140	0.106	124.6		
200	0.075	42.3		
	Pans	10.9		

Sieve Analysis Test

Hydrometer Test					
Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction: _____
Dispersant Correction: _____
Specify Gravity: _____
Cylinder No.: _____
Hydrometer No.: _____

Remarks: Dry Sieved, as per client request
- Sampled by Client on Sept 30/15

Tt_Particle Size_Analysis of Soils.cdr

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: Fraser Geological General Testing
Address: _____

Project No.: E1220380l-01
Date Tested: Oct 9/15 By: mc

Borehole No.: Upper Paddy Mbr
Depth: 0 - 1.2 m
Sample No.: 251.4
Sample Description: Sample # CS15-13
Sampled on Oct 1/15

	Initial	Washed
Wet & Tare		
Dry & Tare	361.9	
Tare Mass	10.6	
Dry Mass	351.3	351.3
% Moisture		

Hydrometer Sample Wt.: _____ g
Plus No. 10 Material Yes ☐ No ☑

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before		
Mass After		

Hygroscopic Moisture		
Wet & Tare		% Moisture
Dry & Tare		
Tare		

Sieve Analysis Test

Sieve Size	Mass Retained	Total Mass Passing	Total% Passing
(Metric)			
Imp.			
4	4.75	1.1	
12	1.700	3.7	
20	0.850	3.9	
40	0.425	21.4	
60	0.250	87.9	
70	0.212	64.0	
100	0.150	132.4	
140	0.106	27.1	
200	0.075	4.8	
	Pans	5.0	

Hydrometer Test

Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction: _____
Dispersant Correction: _____
Specify Gravity: _____
Cylinder No.: _____
Hydrometer No.: _____

Remarks: Sampled from Base of Shaft
Dry Sieved, as per client request

Tt_Particle Size_Analysis of Soils.cdr

TETRA TECH

MC

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: Fraser Geological General Testing **Borehole No.:** Upper Paddy

Address: _____ **Depth:** 2.4 - 3.2 m

Sample No.: 251.3

Project No.: E12203801-01 **Sample Description:** Sample # CS15-12 Sampled on Sept 30/15

Date Tested: Oct 9/15 **By:** mc

	Initial	Washed
Wet & Tare		
Dry & Tare	553.8	
Tare Mass	94.6	
Dry Mass	459.2	459.2
% Moisture		

Hydrometer Sample Wt.: _____ g

Plus No. 10 Material Yes ☐ No ☐

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before		
Mass After		

Hygroscopic Moisture		
Wet & Tare		% Moisture
Dry & Tare		
Tare		

Sieve Analysis Test

Sieve	Mass Retained	Total Mass Passing	Total% Passing
(Metric)			
Tmp. 9.5	0		
4 4.750	8.2		
12 1.700	12.0		
20 0.850	7.7		
40 0.425	15.2		
60 0.250	18.5		
70 0.212	7.9		
100 0.150	39.7		
140 0.106	200.9		
200 0.075	112.0		
Pans	37.1		

Hydrometer Test

Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction: _____

Dispersant Correction: _____

Specify Gravity: _____

Cylinder No.: _____

Hydrometer No.: _____

Remarks: Dry Sieved, as per client request

Tt_Particle Size_Analysis of Soils.cdr

TETRA TECH

PARTICLE SIZE - ANALYSIS OF SOILS
(ASTM Designation D 422)

Project: Fraser Geological General Testing
Address:

Project No.: E12203801-01
Date Tested: Oct 9/15 By: mc

Borehole No.: Upper Paddy A
Depth: 1.3 - 2.4 m
Sample No.: 251.2
Sample Description: Sample # CS15-11 Sampled on Sept 30/15

	Initial	Washed
Wet & Tare		
Dry & Tare	407.5	
Tare Mass	10.6	
Dry Mass	396.9	396.9
% Moisture		

Hydrometer Sample Wt.: _____ g
Plus No. 10 Material Yes ☐ No ☐

This Section for Split Sieves (do not include hydrometer split)	First	Second
Split on Sieve No.		
Mass Before		
Mass After		

Hygroscopic Moisture		
Wet & Tare		% Moisture
Dry & Tare		
Tare		

Sieve Analysis Test

	Sieve	Mass Retained	Total Mass Passing	Total% Passing
4	4.75	5.8		
12	1.700	11.5		
20	0.850	5.5		
40	0.425	8.9		
60	0.250	11.1		
70	0.212	5.6		
100	0.150	27.0		
140	0.106	154.2		
200	0.075	136.6		
	Pans	30.7		

Hydrometer Test

Time	Elapsed Time	Temp. °C	Reading	Diameter mm	Total % Passing
	0				
	2				
	5				
	15				
	30				
	60				
	250				
	1440				

Meniscus Correction: _____
Dispersant Correction: _____
Specify Gravity: _____
Cylinder No.: _____
Hydrometer No.: _____

Remarks: Dry Sieved, as per client request

Tt_Particle Size_Analysis of Soils.cdr

TETRA TECH

472000 474000 476000 478000 480000 482000 484000

6232000 6230000 6228000 6226000 6224000

N

084C03

Peace River

Heart River

A'

Leckie 1 Leckie 2

CS15-13

CS15-12
CS15-10
CS15-11

Auger Hole 5 Auger hole 6

Trace of Longitudinal Profile

Auger Hole 4

PEACE RIVER

Auger Hole 2 Auger hole 3

A

Smokey River

C.N.R.

Legend

- 2015 auger holes
- 2015 Paddy Mbr samples
- MAIM permit 9315070282
- Alberta Provincial Parks

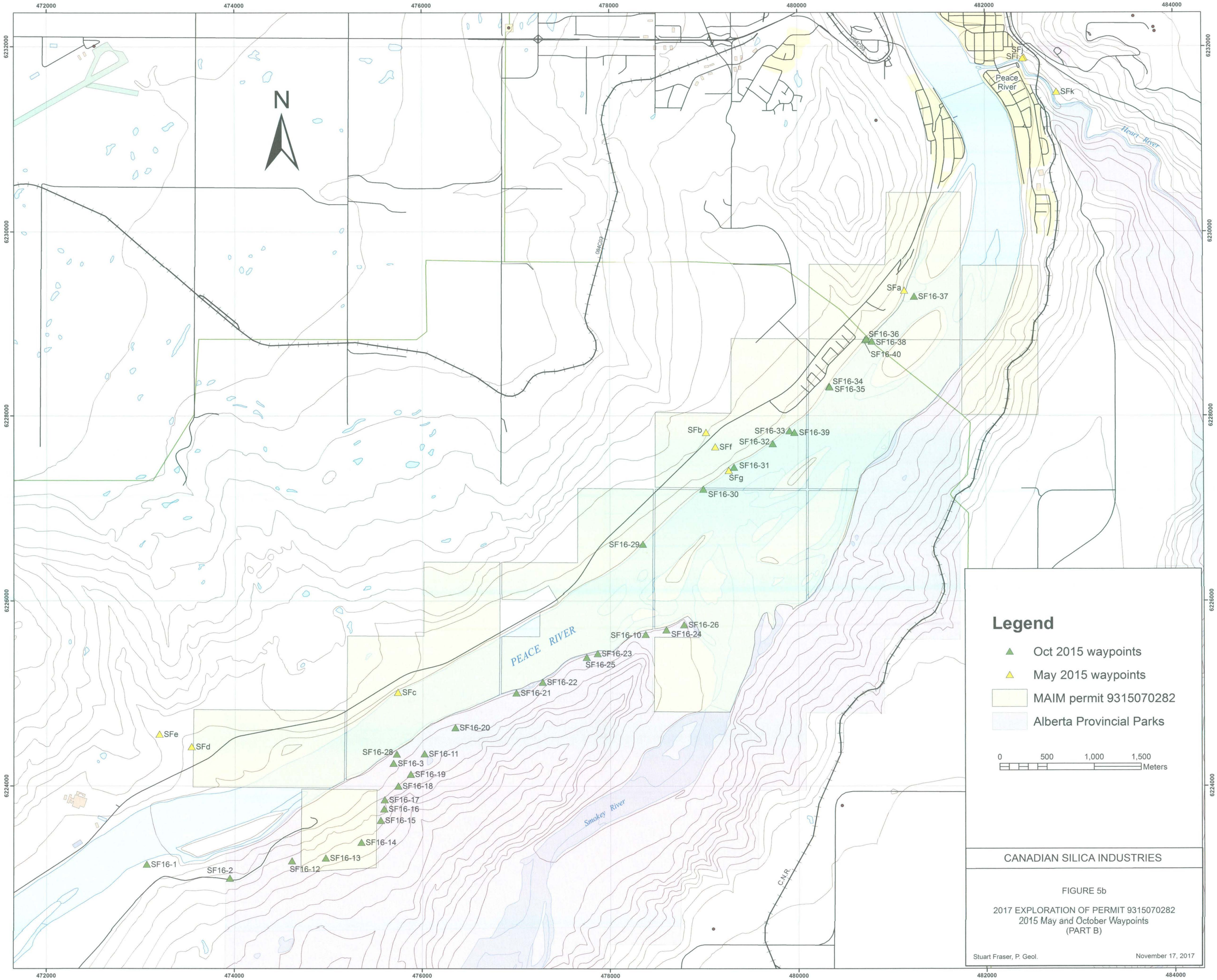
0 500 1,000 1,500 Meters

CANADIAN SILICA INDUSTRIES

FIGURE 5a

2017 EXPLORATION OF PERMIT 9315070282
Samples with Sieve Analysis & Auger Holes
(PART B)

Stuart Fraser, P. Geol. November 17, 2017


472000
474000
476000
478000
480000
482000
484000
6232000
6230000
6228000
6226000
6224000
N
D94CO3
SFj
SFl
Peace River
SFk
Heart River
SFa
SF16-37
SF16-36
SF16-38
SF16-40
SF16-34
SF16-35
SFb
SF16-33
SF16-39
SF16-32
SFf
SF16-31
SFg
SF16-30
SF16-29
SF16-26
SF16-24
SF16-10
SF16-23
SF16-25
PEACE RIVER
SF16-22
SF16-21
SFc
SF16-20
SFe
SFd
SF16-28
SF16-11
SF16-3
SF16-19
SF16-18
SF16-17
SF16-16
SF16-15
SF16-14
SF16-13
SF16-12
SF16-2
SF16-1
Smokey River
C.N.R.
Legend
Oct 2015 waypoints
May 2015 waypoints
MAIM permit 9315070282
Alberta Provincial Parks
0
500
1,000
1,500
Meters
CANADIAN SILICA INDUSTRIES
FIGURE 5b
2017 EXPLORATION OF PERMIT 9315070282
2015 May and October Waypoints
(PART B)
Stuart Fraser, P. Geol.
November 17, 2017

472000 474000 476000 478000 480000 482000 484000

6232000 6230000 6228000 6226000 6224000

N

084C06

084C03

Peace River

Heart River

Alta Envn2

Tim Barker

Ron Arnold

Alta Envn1

Umbach well

Massee well

Trosky well

Walton well

PEACE RIVER

Phimetor well

Peace River jail

Purcell well

Glenn Murphy

Smokey River

C.N.R.

Legend

- MAIM permit 9315070282
- Alberta Provincial Parks
- Water Well

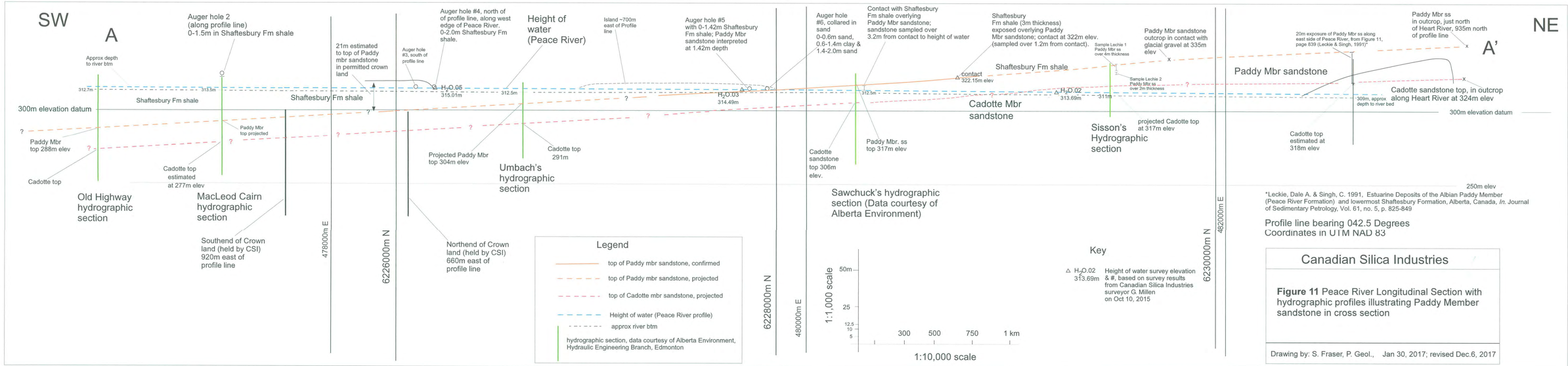
0 500 1,000 1,500 Meters

CANADIAN SILICA INDUSTRIES

FIGURE 5c

2017 EXPLORATION OF PERMIT 9315070282
Water Well Locations
(PART B)

Stuart Fraser, P. Geol. November 17, 2017



*Leckie, Dale A. & Singh, C. 1991, Estuarine Deposits of the Albian Paddy Member (Peace River Formation) and lowermost Shaftesbury Formation, Alberta, Canada, *In.* Journal of Sedimentary Petrology, Vol. 61, no. 5, p. 825-849

Profile line bearing 042.5 Degrees
Coordinates in UTM NAD 83

Canadian Silica Industries

Figure 11 Peace River Longitudinal Section with hydrographic profiles illustrating Paddy Member sandstone in cross section

Drawing by: S. Fraser, P. Geol., Jan 30, 2017; revised Dec.6, 2017