Appendix A.

Data Sources for the Geological and Numerical Models

The data included in this appendix were used as inputs into the geological and numerical models created in Petrel and MODFLOW, respectively. These data sources include water well databases, oil and gas well locations, the data collected during the field verification of the geophysical data, and the results of the grain size analyses. Interpretations of the data sources are provided where necessary.

Wells with Corrected Gamma-ray Logs

Table A1. Unique well identifiers (UWI) and Easting and Northing coordinates for oil and gas wells within the study area that have corrected gamma-ray logs available. The spatial coordinates represent surface hole locations; however, UWI's generally apply to bottom hole locations. Therefore, borehole locations may be offset from the UWI database by up to two kilometres. From Petrel Robertson Consulting Ltd. (2015).

UWI	Easting (NAD83 Z10; m)	Northing (NAD83 Z10; m)
100/12-07-083-24W6/00	575079.2	6227248
100/01-31-083-24W6/00	576002.3	6232826.9
100/10-03-083-25W6/00	570733.2	6225373.9
102/01-12-083-25W6/00	574631	6226210.5
100/04-15-083-25W6/00	570092.8	6227886.9
100/16-17-083-25W6/00	567819.6	6229043.4
100/11-18-083-25W6/03	563754.7	6230038.2
102/12-18-083-25W6/00	563747.3	6230031.4
103/12-18-083-25W6/00	563739.3	6230024.6
100/01-23-083-25W6/00	571179.1	6230766.8
100/03-23-083-25W6/00	571157.8	6230745.3
100/03-24-083-25W6/00	573738.8	6229417.7
102/05-26-083-25W6/00	570107.7	6232406.6
100/14-26-083-25W6/00	572318	6232346.6
103/01-28-083-25W6/00	568301.8	6232739
100/02-28-083-25W6/02	567902.1	6232493.3
100/02-29-083-25W6/00	566394.4	6232356
100/10-30-083-25W6/00	564283.2	6233266.5
100/16-33-083-25W6/00	570076	6232374.9
100/10-34-083-25W6/02	572318	6232346.6
100/10-36-083-25W6/00	573938.6	6233557.7
100/01-30-084-22W6/00	595353.2	6241343.6
100/04-14-084-23W6/00	591222.6	6237995.5
100/04-24-084-23W6/00	592809.2	6239523.8
100/01-28-084-23W6/00	588803.3	6241266.6
100/08-30-084-23W6/00	585626	6241379.7
100/01-32-084-23W6/02	588803.3	6241266.6
100/05-05-084-24W6/00	576453.8	6234804.2
100/13-06-084-24W6/00	575353.8	6234022.1
100/05-07-084-24W6/00	575364.2	6234032.3

UWI	Easting (NAD83 Z10; m)	Northing (NAD83 Z10; m)
100/06-07-084-24W6/00	575375.2	6234042.5
100/04-20-084-24W6/00	576400.7	6239336.3
100/15-02-084-25W6/00	573302.4	6233747.1
100/06-02-084-25W6/03	573345.7	6233677.7
100/14-13-084-25W6/00	573226.5	6238542.5
100/09-22-084-25W6/00	571156.3	6240047
100/14-34-084-25W6/00	570050.6	6243383.8
100/16-12-084-26W6/00	564700.7	6237020.8
100/06-04-085-23W6/00	588027.4	6244736.3
100/02-07-085-23W6/00	585335.8	6246017.4
100/04-15-085-23W6/00	589347.5	6247635.1
100/01-30-085-23W6/00	585562.5	6250678.9
100/08-31-085-23W6/00	585536.7	6252853.8
100/08-35-085-24W6/00	582743.7	6253145.7
100/01-06-085-25W6/00	564105.9	6245022.2
100/09-07-085-25W6/00	566100	6246397.4
100/01-12-085-25W6/00	574548.2	6245898.2
100/10-32-085-25W6/00	567268.9	6252709.8
102/07-05-086-24W6/00	576850.2	6254251.9
100/10-11-086-24W6/00	581752.6	6256223.6
100/08-22-086-24W6/00	580429.2	6259252
100/02-23-086-25W6/00	571874.8	6258819.1
100/02-23-086-25W6/02	571874.8	6258819.1
100/04-23-086-25W6/02	571110.3	6258692.7
100/03-26-086-25W6/00	571323.7	6260220.3
100/01-34-086-25W6/02	570604.6	6261964.9
100/09-34-086-25W6/00	570500.6	6262776.9
100/13-35-086-25W6/00	570922.9	6263229.2
100/04-35-086-25W6/00	571206.6	6261983.9
100/13-36-086-25W6/00	572757.5	6263049.9
102/12-06-087-24W6/00	572288.5	6264200.7
100/13-01-087-25W6/00	570451.5	6264702.9
100/04-01-087-25W6/00	570440.7	6263572.9
100/14-11-087-25W6/00	569237.4	6266315.8
100/08-11-087-25W6/00	570264.1	6265689.4
102/08-11-087-25W6/02	570371.2	6265650
100/09-11-087-25W6/00	569918.1	6265736
100/05-23-087-25W6/00	568780.1	6268572.5
100/10-27-087-25W6/00	567937.3	6270522.4

UWI	Easting (NAD83 Z10; m)	Northing (NAD83 Z10; m)
100/10-04-088-25W6/00	566076	6273820
100/08-04-088-25W6/00	566659	6273451.9
100/02-09-088-25W6/00	565682.5	6274999.4
100/08-17-088-25W6/00	564575.9	6277319.9
202/b-058-L 094-A-04/00	563732	6230017.8
200/b-049-D 094-A-05/00	564303.5	6236949.1
200/a-009-L 094-A-05/02	562947.1	6253215.7
200/d-030-L 094-A-05/00	562035.4	6255387.5
200/d-051-I 094-B-01/00	560220.1	6231754.4
200/c-063-I 094-B-01/00	558276.5	6232918.3
200/b-071-I 094-B-01/00	562341.4	6230383.5
200/c-074-I 094-B-01/00	558280.1	6232928.4
200/b-077-I 094-B-01/00	555011.5	6233308.9
200/a-094-I 094-B-01/00	558936.1	6233641
202/c-097-I 094-B-01/00	558082.5	6232734.2
200/d-097-I 094-B-01/00	558035.5	6232819.3
200/d-006-A 094-B-08/00	558835.8	6233677.4
200/d-023-A 094-B-08/00	560112.5	6236278.9
200/d-042-A 094-B-08/00	560179.9	6239533.6
200/b-043-A 094-B-08/00	559761.6	6238374.5
200/d-053-A 094-B-08/00	560180.4	6239632.7
200/a-063-A 094-B-08/00	560089.4	6240336.1
200/d-064-A 094-B-08/00	559185.1	6240526
200/d-072-A 094-B-08/00	561022.6	6241463.6
200/a-075-A 094-B-08/00	558752.4	6241069.9
200/a-076-A 094-B-08/00	556363.4	6242754.1
202/a-076-A 094-B-08/00	556372	6242758.6
200/a-080-A 094-B-08/00	554708.9	6240975.8
202/a-083-A 094-B-08/00	558999.4	6244049.9
200/b-084-A 094-B-08/00	558964.3	6241992.3
200/b-093-A 094-B-08/00	560556.2	6242495.5
200/d-055-B 094-B-08/00	550703.5	6239700.5
200/d-081-B 094-B-08/00	553641.3	6242368.1
200/d-093-B 094-B-08/00	552336	6243282.4
200/d-074-F 094-B-08/00	543346.1	6251221.8
200/d-094-F 094-B-08/00	543302.1	6252807.5
200/c-016-G 094-B-08/00	549672.4	6245029.1
200/b-022-G 094-B-08/00	552606.3	6245476.4
202/b-022-G 094-B-08/00	552601	6245500.9

UWI	Easting (NAD83 Z10; m)	Northing (NAD83 Z10; m)
200/d-022-G 094-B-08/00	552905.3	6245983.3
200/b-024-G 094-B-08/00	551148.5	6245705.7
200/b-042-G 094-B-08/00	552664.9	6247280.5
200/b-051-G 094-B-08/00	553524.7	6248480.1
200/c-058-G 094-B-08/00	547320.7	6250537.7
200/d-059-G 094-B-08/02	547271.4	6250418.1
200/c-060-G 094-B-08/00	546282.7	6248576
200/a-061-G 094-B-08/00	553633	6249533.4
200/d-062-G 094-B-08/00	552838.3	6249532.3
200/a-063-G 094-B-08/00	552327.1	6249224.3
200/d-064-G 094-B-08/00	551332.7	6249695.2
200/a-066-G 094-B-08/00	549695.8	6249055.6
200/b-071-G 094-B-08/00	553424.2	6250276.5
200/d-072-G 094-B-08/00	551689.8	6252109.5
203/d-072-G 094-B-08/00	551634.6	6252086.6
200/a-074-G 094-B-08/00	551305.9	6250274.8
200/b-082-G 094-B-08/00	552417.1	6250935.2
200/d-084-G 094-B-08/00	551315.7	6251555.1
200/b-093-G 094-B-08/00	551858.9	6252111.6
200/a-095-G 094-B-08/00	550773.7	6252185.2
200/b-095-G 094-B-08/02	548627.8	6253378.8
202/b-095-G 094-B-08/00	548621.1	6253372.1
202/a-003-H 094-B-08/00	559862.4	6244021.9
203/c-003-H 094-B-08/00	558854.6	6246474.6
200/d-003-H 094-B-08/00	558916.1	6245377.9
200/b-006-H 094-B-08/00	557307.8	6243947.8
200/c-009-H 094-B-08/00	556354.8	6242748.4
200/a-010-H 094-B-08/00	554405.2	6243764.9
200/c-014-H 094-B-08/00	558845.6	6245202.1
202/b-015-H 094-B-08/00	558982.1	6242622.6
200/c-020-H 094-B-08/00	554101.8	6245016.6
200/a-023-H 094-B-08/00	559758.4	6246498.3
202/d-043-H 094-B-08/00	558795.2	6249696.4
200/b-045-H 094-B-08/00	558812.7	6245523.4
200/b-049-H 094-B-08/00	556303.6	6245962.5
202/b-049-H 094-B-08/00	556317.1	6245968.3
200/d-006-H 094-B-08/00	556331.2	6245975.1
203/b-049-H 094-B-08/00	556358.3	6245987.7
200/c-059-H 094-B-08/00	554915.1	6248957.6

UWI	Easting (NAD83 Z10; m)	Northing (NAD83 Z10; m)
200/b-074-H 094-B-08/00	559119.5	6248180.3
200/a-080-H 094-B-08/00	554309.8	6250361.3
200/b-085-H 094-B-08/00	558773.9	6249718.4
200/c-085-H 094-B-08/00	558819.8	6249657.8
200/c-015-I 094-B-08/00	557727.2	6254665.4
200/b-051-I 094-B-08/00	560855.2	6257860.7
200/c-057-I 094-B-08/00	556448.2	6258113.5
200/b-062-I 094-B-08/00	560253.1	6258461
202/b-062-I 094-B-08/00	560144.2	6258841.2
200/a-083-I 094-B-08/00	559790.2	6260689.7
200/d-004-J 094-B-08/00	551294.8	6253284.6
200/c-023-J 094-B-08/00	552635.9	6253697.4
200/d-024-J 094-B-08/00	552616.5	6253720.5
200/c-029-J 094-B-08/00	548575.2	6253397.1
202/d-029-J 094-B-08/00	548581.9	6253403.9
200/b-045-J 094-B-08/00	550295.9	6256766.7
200/b-004-K 094-B-08/00	543225.5	6252996
200/a-018-K 094-B-08/00	540478.8	6254410
200/a-095-K 094-B-08/00	542632.2	6261307.9
200/c-072-L 094-B-08/00	536947.3	6259713.4
200/d-015-A 094-B-09/00	558354	6263948.8
200/d-017-A 094-B-09/00	556716.6	6263883.1
200/b-019-A 094-B-09/00	554875.2	6263498.1
200/c-025-A 094-B-09/00	557947.5	6264741.2
200/b-030-A 094-B-09/00	553936.9	6264153.7
200/b-035-A 094-B-09/02	557753.1	6265051.3
200/b-046-A 094-B-09/00	556910.3	6266238.6
200/d-047-A 094-B-09/02	556587.7	6266538.1
200/d-048-A 094-B-09/00	555772.3	6266478.2
200/a-056-A 094-B-09/00	557017.9	6267483.3
200/d-065-A 094-B-09/00	557972.8	6268258.7
200/d-068-A 094-B-09/00	555707.2	6268253.7
200/d-086-A 094-B-09/00	557168	6270401.4
200/b-098-A 094-B-09/00	555472.2	6270806.1
200/c-037-B 094-B-09/00	548547.9	6265458.1
200/d-006-C 094-B-09/00	541934.3	6262403.8
200/b-022-C 094-B-09/00	544654.8	6264074.8
200/d-027-C 094-B-09/00	541048.3	6263447.9
200/c-033-C 094-B-09/00	543935.9	6265589.6

UWI	Easting (NAD83 Z10; m)	Northing (NAD83 Z10; m)
200/b-048-C 094-B-09/00	540110.6	6265960.8
200/b-011-D 094-B-09/00	537653	6262867.3
200/d-012-D 094-B-09/00	537331.6	6263578.9
200/d-002-G 094-B-09/00	552817.1	6272200.9
200/d-013-G 094-B-09/00	551775	6272833.4
200/d-021-G 094-B-09/00	553419	6273916
200/b-010-H 094-B-09/00	553712.2	6271605.7
200/a-020-H 094-B-09/00	554206.8	6272471.3
200/c-020-H 094-B-09/00	553907.3	6272980.6
200/c-052-H 094-B-09/02	560736.4	6274969.5
200/d-053-H 094-B-09/00	560736.5	6274962.9
200/d-067-H 094-B-09/00	557286.2	6276085.3
100/16-32-083-25W6/00	569042	6232628.5

WELLS Database Wells

Table A2. Water wells located within the study area with usable lithologic logs. Modelled Geology column indicates the lithology that was input into the geologic model. Asteriks (*) next to WTN's indicate the well was also used in modelling the Quaternary-bedrock contact. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations based off of the driller's descriptions. Compiled from Toews and Allen (2007, unpublished report) and the WELLS database (BC Ministry of Environment, 2017).

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
59124*	546671	6263363	0	9	Gravel and sand	sand and gravel
59124	546671	6263363	9	10	Medium grey shale - water	bedrock
59124	546671	6263363	10	12	Medium grey shale and gravel	bedrock
60090	593445	6240433	0	2	Sandy silt - brown	silt
60090	593445	6240433	2	45	Clay silt some rock - grey	till
60090	593445	6240433	45	76	Clay with sand - grey	clay
60090	593445	6240433	76	93	Gravel with clay	gravel
60656*	550200	6263500	0	2	Till	till
60656	550200	6263500	2	3	Gravel - medium with sand	gravel
60656	550200	6263500	3	4	Medium gravel with clay	gravel
60656	550200	6263500	4	6	Medium gravel and sand - 10 gpm	sand and gravel
60656	550200	6263500	6	12	Shale	bedrock
60682*	545743	6263959	0	7	Till	till
60682	545743	6263959	7	44	Sandy shale	bedrock
60682	545743	6263959	44	70	Shale with layers of hard grey sandstone	bedrock
60682	545743	6263959	59	64	Making water approximately 5 GPM	
75512*	569966	6263832	0	18	Clay	clay
75512	569966	6263832	18	24	Sandstone and shale	bedrock

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
80279	561062	6262725	0	4	Silt and sand	silt
80279	561062	6262725	4	13	Gravel	gravel
80279	561062	6262725	13	14	Sandy gravel - water	gravel
80279	561062	6262725	14	17	Very soft sand and clay	silt
80279	561062	6262725	17	21	Dark gumbo clay	clay
80279	561062	6262725	21	26	Gravel and sand	sand and gravel
80279	561062	6262725	26	27	Sand and gravel	sand and gravel
80279	561062	6262725	27	28	Clay	clay
80281*	570069	6263860	0	12	Clay	clay
80281	570069	6263860	12	30	Shale - water	bedrock
83249*	572783	6228319	0	11	Soft clay	clay
83249	572783	6228319	11	14	Hard clay	clay
83249	572783	6228319	14	16	Soft clay	clay
83249	572783	6228319	16	26	Shale	bedrock
83249	572783	6228319	26	70	Hard shale	bedrock
83250*	572674	6228379	0	11	Soft clay	clay
83250	572674	6228379	11	32	Clay	clay
83250	572674	6228379	32	71	Hard shale	bedrock
83251*	572426	6229131	0	10	Clay	clay
83251	572426	6229131	10	15	Rock	
83251	572426	6229131	15	31	Shale	bedrock
83255*	573440	6228364	0	11	Clay	clay
83255	573440	6228364	11	37	Shale	bedrock
98361*	569963	6263818	0	5	Soft brown clay	clay
98361	569963	6263818	5	7	Medium brown clay with boulders	clay
98361	569963	6263818	7	9	Hard brown clay	clay
98361	569963	6263818	9	37	Hard grey shale	bedrock
102511	573190	6229161	0	10	Medium grey clay	clay
102511	573190	6229161	10	15	Hard brown rock	bedrock
102511	573190	6229161	15	31	Medium grey shale	bedrock
102636*	548109	6265538	0	3	Sand gravel	sand and gravel
102636	548109	6265538	3	24	Soft shale	bedrock
102636	548109	6265538	24	32	Sandstone dark grey hard with shale layers	bedrock

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
102658*	546551	6263345	0	2	Till sand and gravel	sand
102658	546551	6263345	2	3	Gravel medium cobbles	gravel
102658	546551	6263345	3	5	Medium black sand	sand
102658	546551	6263345	5	5	Sand medium to fine some clay	sand
102658	546551	6263345	5	9	Shale	bedrock
102658	546551	6263345	9	9	Fine hard grey dirty sandstone	bedrock
102658	546551	6263345	9	12	Hard shale	bedrock
102658	546551	6263345	12	13	Sandstone medium brown	bedrock
102658	546551	6263345	13	19	Sandstone fine grey	bedrock
102658	546551	6263345	19	21	Sandstone medium to fine	bedrock
102672*	559865	6261411	0	9	Gravel and sand	sand and gravel
102672	559865	6261411	9	10	Medium grey shale	bedrock
102672	559865	6261411	10	12	Medium grey shale and gravel	bedrock
102703*	543383	6263817	0	7	Sand, coarse gravel some clay and boulders	sand and gravel
102703	543383	6263817	7	10	Shale	bedrock
102703	543383	6263817	10	12	Shale	bedrock
102740*	556466	6236530	0	3	Clay till	till
102740	556466	6236530	3	38	Fine grain sandstone very dirty with shale stringers	bedrock
102743*	556090	6237792	0	4	Clay	clay
102743	556090	6237792	4	6	Clay till	till
102743	556090	6237792	6	10	Sand and gravel	sand and gravel
102743	556090	6237792	10	21	Clay	clay
102743	556090	6237792	21	37	Fine grain sandstone very hard with shale lens	bedrock
102825*	556833	6262261	0	4	Gravel	gravel
102825	556833	6262261	4	5	Gravel with clay	gravel
102825	556833	6262261	5	123	Shale grey - thin rock layers	bedrock

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
102828	557642	6261800	0	1	Clay	clay
102828	557642	6261800	1	2	Gravel and sand	sand and gravel
102828	557642	6261800	2	3	Sand hard compact mineralized	sand
102828	557642	6261800	3	4	Till gravel and broken sandstone	gravel
102852*	585558	6248069	0	4	Grey brown clay	clay
102852	585558	6248069	4	5	Loose caving shale	bedrock
102852	585558	6248069	5	27	Dark grey shale clay	bedrock
102852	585558	6248069	27	50	Dark grey shale	bedrock
102881	584923	6248131	0	7	Clay with small amount of rock	clay
102881	584923	6248131	7	102	Dark grey shale clay	bedrock
102881	584923	6248131	102	106	Shale rock medium sed rock layers	bedrock
102881	584923	6248131	106	148	Shale dark grey	bedrock
102911*	556486	6236530	0	30	Clay Till	till
102911	556486	6236530	30	35	Sandstone shale till	bedrock
102911	556486	6236530	35	37	Clay	bedrock
102911	556486	6236530	37	39	Sandstone shale till	bedrock
102911	556486	6236530	39	49	Shale	bedrock
102913	556446	6236530	0	10	Clay	clay
102913	556446	6236530	10	5	Hard slate	bedrock
104386*	571851	6257017	0	9	Sand and gravels	sand and gravel
104386	571851	6257017	9	9	Grey clay	clay
104386	571851	6257017	9	11	dirty gravel	gravel
104386	571851	6257017	11	14	Bedrock	bedrock
104450*	565273	6262349	0	1	Topsoil	silt
104450	565273	6262349	1	5	Sand and gravel	sand and gravel
104450	565273	6262349	5	9	Sandy clay	clay
104450	565273	6262349	9	22	Silty gravel	gravel
104450	565273	6262349	22	22	White sand	sand
104450	565273	6262349	22	24	Gravelly clay	clay
104450	565273	6262349	24	49	Siltstone	bedrock

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
104451*	565300	6262349	0	1	Topsoil	silt
104451	565300	6262349	1	5	Silty sand	sand
104451	565300	6262349	5	7	Silty sand	sand
104451	565300	6262349	7	9	Silty clay	clay
104451	565300	6262349	9	14	Clay silt	silt
104451	565300	6262349	14	16	Silty gravel	gravel
104451	565300	6262349	16	27	Grey silt	silt
104451	565300	6262349	27	110	Siltstone	bedrock
104452*	565330	6262349	0	1	Topsoil	silt
104452	565330	6262349	1	4	dirty gravel	gravel
104452	565330	6262349	4	5	Sand and gravel	sand and gravel
104452	565330	6262349	5	28	Till	till
104452	565330	6262349	28	37	dirty gravel	till
104452	565330	6262349	37	40	Sand	sand
104452	565330	6262349	40	44	Sand and gravel	sand and gravel
104452	565330	6262349	44	47	Clay	clay
104452	565330	6262349	47	73	Shale	bedrock
105938	553845	6240277	0	2	Brown sand silts	silt
105938	553845	6240277	2	5	Gravel PRS	gravel
105938	553845	6240277	5	35	Grey silt wet	silt
105938	553845	6240277	35	49		
109909	560721	6262774	0	4	Very soft - brown	
109909	560721	6262774	4	21	Loose gravel sand - dry brown	sand and gravel
109909	560721	6262774	21	26	Very soft - dry (wet at 66.5 feet static brown)	
109909	560721	6262774	26	30	Very soft - grey	
109909	560721	6262774	30	32	Loose sand with clay and gravel - black	sand
109909	560721	6262774	32	37	Loose sand with some gravel - grey	sand and gravel
109909	560721	6262774	37	41	Hard. 14 gallons per min - grey	

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
109942	567975	6229717	0	3	Mud and gravel - grey	till
109942	567975	6229717	3	3	Grey	
109942	567975	6229717	3	10	Grey	
109942	567975	6229717	10	10	Grey	
109942	567975	6229717	10	42	Grey	
109942	567975	6229717	42	62	Grey	
109942	567975	6229717	62	66	Hard - grey	
109954	568284	6228251	0	2	Mud and sand - grey	till
109954	568284	6228251	2	44	Grey	
109954	568284	6228251	44	45	Grey	
109954	568284	6228251	45	50	Grey	
109954	568284	6228251	50	56	Mud and stone	
109954	568284	6228251	56	151	Shale and sandstone lenses - grey	
109954	568284	6228251	151	155	Grey	
109954	568284	6228251	155	181	Shale and sandstone lenses - grey	
111527*	554226	6248411	0	43	Soft silty clay - grey	clay
111527	554226	6248411	43	59	Medium till, shale, sandstone, clay - grey	
111527	554226	6248411	59	79	Medium shale-siltstone - grey	
111527	554226	6248411	79	84	Medium shale 13 gallons per min fractured - grey	

WTN	Easting	Northing	From (m)	To (m)	Driller's Description	Modelled Geology
112868	578821	6230215	0	12	Medium brown grey, vari-colored	
112868	578821	6230215	12	13	Soft dark grey	
112868	578821	6230215	13	27	Soft brown grey, vari-colored	
112868	578821	6230215	27	29	Hard bouldery till/clay - grey	till
112868	578821	6230215	29	30	Medium gravel/till with fines, wet, dark	till
112868	578821	6230215	30	45	Medium clay with gravelly till, grey	clay
112868	578821	6230215	45	48	Soft silty clay with organics - black	clay
112868	578821	6230215	48	49	Medium gravel/clay	till
112868	578821	6230215	49	50	Hard dark grey clay with some gravel - M.W. dark	till
112868	578821	6230215	50	52	Medium gravel and clay - M.W. green	till
112868	578821	6230215	52	53	Soft silt with fine sand/fine till and clay particles - grey	silt
112868	578821	6230215	53	57	Hard silty clay with till, brown grey	till
112868	578821	6230215	57	59	Hard, black	
112868	578821	6230215	59	83	Hard 2 gallons per min @240' black	
112868	578821	6230215	83	84	Hard dark grey	
112868	578821	6230215	84	87	Hard shale/ironstone lenses 7 gallons per min fractured @280' - black	
112868	578821	6230215	87	90	Hard shale/ironstone lenses - black	

Field Verification of Geophysical Data: Drilling Logs and Borehole Geophysical Logs

The data presented in this section were collected during a drilling campaign in Northeast BC in the Fort St. John and Hudson's Hope areas. This campaign took place between March and May 2017 and involved collaboration between Geoscience BC, Ministry of Forests, Lands, and Natural Resource Operations, Simon Fraser University, Bemex Consulting International and Quaternary Geosciences Inc.

Table A3. Hole 6a lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	6a			**Easting:**	546650	**Notes:**	Terrace above Halfway/Graham River confluence. Coarse gravel terrace about 15 m above river level; sandstone outcrops common in area along the river. Sunny weather.	
Method:	Sonic			**Northing:**	6262600			
Logged by:	Vic Levson, May 3, 2017			**Elevation (masl):**	667			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0	0.5	0.15	0-16'	63	Silt	wet	massive silts; organic rich (including rootlets, leaves, etc); dark brown; low density; lower contact sharp	silt
0.5	1	0.30			Pebble gravel	moist	Sandy, pebble to small cobble gravel; clast supported; matrix-filled; massive; matrix silty fine to medium sand; low density; dark brown; clasts sub-rounded (SR) to well rounded (WR); some clasts fractured from drilling; mainly medium to large pebbles, maximum diameter 10 cm; varied lithologies: mainly local sandstone and siltstone, some shale and carbonates, and quartzites; lower contact gradational	gravel
1	3	0.91			Cobble gravel	dry	Sandy pebble to cobble gravel; clast supported; matrix-filled; massive; matrix white medium sand, quartz rich; low density; numerous angular quartz sandstone clasts (unit is likely dominated by sandstone clasts crushed during drilling); lower contact sharp	gravel
3	6	1.83			Pebble gravel	dry	same as pebble gravel above but matrix mainly medium to coarse sand; abundant freshly fractured clasts; lower contact sharp	gravel

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
6	14	4.27			Pebble to cobble gravel	dry	massive; poorly sorted; clast supported, matrix-filled; matrix fine to coarse sand; grey at top to dark brown at base; numerous cobbles up to ~ 10 cm diameter; varied lithologies: mainly sandstone, some carbonates; lower contact sharp	gravel
14	15	4.57			Sandy, large pebble gravel	dry	massive; well sorted; fine to medium sand matrix; clasts mainly angular (A) to subangular (SA) white sandstone (probably crushed cobble or boulder); color varies from tan/orange (oxidized) to white; lower contact sharp	gravel
15	16	4.88			Cobble gravel	dry	similar to 6-14' above but moderately dense and more local angular clasts; lower contact gradational	gravel
16	18	5.49	16-26'	60	Pebble to cobble gravel	wet (possible drill water)	massive; clast-supported; open-work gravels at top grading down into muddy matrix-filled gravels at base (possibly due to drilling water washing gravel at top of run - see notes below); clast lithologies: local (A-SA) sandstone, siltstone and shale clasts as well as R-WR sandstones, quartzites and carbonates; grey color; lower contact sharp	gravel
18	20	6.10			Pebbly mud	moist to wet	mainly silts and clays with about 10% pebbles; low density; massive; abundant angular local clasts (shales); dark grey to black; unit may be shale ground-up by drilling (at least partially); lower contact sharp	till
20	21	6.40			Pebbly silt	dry	same as above but the silt matrix is dry, light grey and a few more rounded clasts are present; lower contact sharp	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
21	22	6.71			Pebbly mud	dry	as above except: denser and dark brown color; some cohesive mud "clasts" up to 10 cm diameter; gravel clasts almost entirely A-SA shale fragments; lower contact sharp	till
22	26	7.92			Sandstone	moist	fine sandstone; very well sorted; dense solid core; some fractures; light grey-brown; quartz rich; unoxidized	bedrock
26	46	14.02	26-46'	95	Sandstone	moist	fine sandstone as above; well sorted; well laminated; some low-angle cross-laminae; locally fractured: fracture spacing about 15-30 cm; fracture abundance decreases with depth (longest solid core length is 2.5' from about 41'-43.5'); some oxidation along fractures at 38'; relatively intense, rubbly fracture zones occur at about 28', 35', 38' and 44'; most other fractures are single plane, smooth fractures that are parallel to bedding planes.	bedrock

TD 46 ft. (14 m)

NOTES:

Water testing: wet open-work gravels at 16-18 feet were considered to be a potential aquifer so the casing was pulled back and the water level rose to about 16' in the hole; after pumping hard the water level dropped to 25' but the pump could not drain the hole dry and eventually the water began to rise in the hole about 0.5' every 15 minutes (water input was exceeding the pump capacity); a five gallon pail was filled in 15 seconds 20 gals/minute. However, it could not be determined if the water was coming into the hole from the bedrock or the basal gravel so further water testing was deferred for the monitoring well water test (see monitoring well log). The hole was cased and grouted for geophysics and a second hole drilled for a monitoring well (6a-monitoring well).

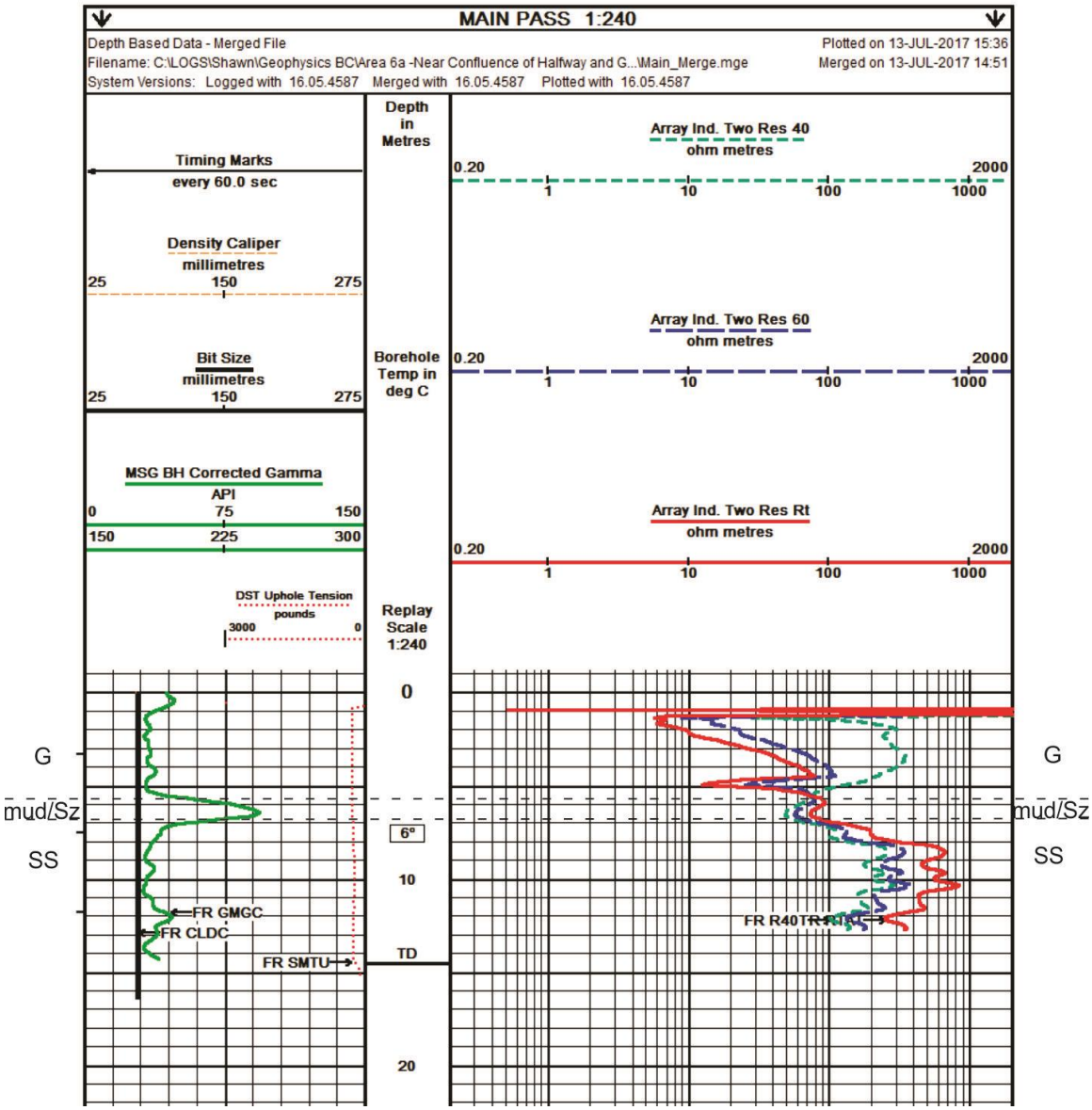

Figure A1. Borehole geophysical logs for hole 6a. Lithologic summary from drilling is provided (see Table A3): G=gravel; S=sand;Sz=silt; SS=sandstone. Main Pass at 1:240 resolution shown.

Table A4. Hole 6a-MW lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	6a-MW			**Easting:**	546658	**Notes:**	Terrace above Halfway/Graham River confluence. Coarse gravel terrace about 15 m above river level. Sunny weather.	
Method:	Sonic			**Northing:**	6262602			
Logged by:	Vic Levson, May 3, 2017			**Elevation (masl):**	667			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0	6	1.83	0-6'	0	Gravel		no recovery: zone washed out for rapid drilling	gravel
6	10	3.05	6-16'	90	Pebble to small cobble gravel	wet to moist	Sandy, pebble to small cobble gravel; gravels washed clean by drill water, especially in the upper part; clasts mainly rounded (R) to well rounded (WR); varied lithologies: mainly sandstone, siltstone, limestone, quartzite; lower contact gradational	gravel
10	16	4.88		90	Pebble to cobble gravel	mainly dry but wet from ~14-16'	Sandy pebble to cobble gravel; clast supported; matrix-filled; massive; sandy matrix; low density; numerous angular quartz sandstone clasts (unit is likely dominated by sandstone clasts crushed during drilling); lower contact gradational	gravel
16	17	5.18	16-21'	100	Pebble gravel	wet (possibly drill water)	open-work pebble gravel; clast-supported; rounded to well rounded; lower contact sharp	gravel

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
17	21	6.40		100	Gravelly mud	Dry except top 6"	mainly silts and clays with abundant (~10-20%) pebble-sized shale clasts; moderate density; massive; clasts mainly angular shale but also some soft, angular, fine sandstones; dark grey to black; unit may be a shaley mud breccia; lower contact sharp	gravel
21	22	6.71	21-36'	80	Large pebble to cobble gravel	wet	about 1 foot of gravels at the top of the 21-36' drill interval are probably sloughed-in gravels from overlying units: gravels are similar to those in the 16-17' zone: rounded to well rounded, open-work gravels; the gravels were likely washed from an unsuccessful attempt to recover water from the gravels at about 16 feet (see notes below)	gravel
22	38	11.58		80	Sandstone	moist	fine sandstone; grey; very well sorted; well laminated; some low-angle cross-laminae; dense solid core; fractured at about 15-60 cm intervals; one fracture with prominent oxidation at 22.5'; fewer fractures with depth; core very broken at core break (35-36'); lower contact sharp	bedrock
38	40	12.19	36-46'	95	Sandstone and shale	moist	very fine sandstone and black shale; unit is heavily fractured with shaley zone from ~39'-40'; minor coal fragments; water return temporarily lost in this interval during drilling; lower contact clear	bedrock
40	46	14.02		95	Sandstone	moist	fine sandstone as above; periodic fractures	bedrock
TD 46 ft (14 m)								
NOTES:								

Water testing: a possible aquifer at the base of the gravels was tested by pulling the casing back to 15 feet (after drilling to 21 feet) and washing out the bottom of the hole; only about 1 foot of water filled in the hole and recovery was very slow with pumping, confirming that the main water production in the adjacent well 6a was in the sandstone and not in the gravels; the well was drilled to a depth of 46 feet; the next morning the water level in the well was 8 feet below surface; the casing was pulled back to 36 feet exposing the lower 10 ft of sandstone and pumped dry; water level recovery was very slow so the well washed flushed out and pumped for 30 minutes; an initial production rate of 2 gals/minute improved to 10-11 gals/min and the water clarity improved but remained quite silty; Note that water in 6a was produced at ~20 gals/min and was clear with minor silt; the well was pumped for another 30 minutes and the clarity continued to improve but the water production rate did not (NOTE: the grout pump was used for this test so the production rates should be considered a minimum); the water level after completing the well was 15.5 feet below the ground surface.	

Table A5. Hole 7 lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	7			**Easting:**	570796.61	**Notes:**	Southeast of Halfway River. Weather cloudy, warm (~10C)	
Method:	Sonic			**Northing:**	6262071.43			
Logged by:	Vic Levson, May 5, 2017			**Elevation (masl):**	676			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0	1.5	0.46	0-16'	94	Very-fine sandy silt	wet	structureless; well sorted; soft; very wet; minor organics (roots and charcoal in upper 5"); grey; lower contact sharp	silt
1.5	3	0.91			Silt	moist	laminated to massive; light brown; minor clay laminae (black); moderately dense; cohesive; lower contact sharp	silt
3	16	4.88			Very fine sand and silt	wet (slightly drier at base)	mainly very fine sand; wet; structureless; liquifies when disturbed; coarsens slightly downhole to a fine sand; very weak bedding; lower contact gradational	silt
16	26	7.92	16-26'	100	Fine sands	wet	similar to above; slight coarsening down; grey; crudely bedded but difficult to confirm due to high water content; lower contact sharp	sand
26	26.3	8.02	26-36'	80	Silt	wet	thinly laminated; grey; soft; lower contact sharp	silt
26.3	27.15	8.28			Very fine sand and silt	wet	same as above (3-16' interval); lower contact sharp	silt
27.15	27.5	8.38			Silt	wet	same as above (26-26.3' interval); lower contact sharp	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
27.5	29.5	8.99			Very fine sand and silt	wet	same as above (3-16' interval); lower contact sharp	silt
29.5	29.75	9.07			Silt and very-fine sand	wet	similar to above (27.5-29.5' interval) except silt dominates over very fine sands; lower contact sharp	silt
29.75	31	9.45			Clay and silt	wet	massive (no laminae seen); similar to above silt units except dominated by clay; soft; grey; lower contact sharp	silt
31	36	10.97	36-56'	100	Very fine sand	wet	mainly very fine sand but with some silt/clay; ~ 3 inch thick silt/clay bed at 32 feet; lower contact sharp	sand
36	56	17.07			Very fine to fine sands	wet (to moist in lower 2')	mostly structureless (highly liquefied) but some deformed bedding preserved in drier sands near the base; grey; soft (low density); no clasts; very well sorted; lower contact at base of drill interval	sand
56	59	17.98	56-76'	120	Very fine sands	wet	same as above but slightly coarser; lower contact sharp	sand
59	69	21.03			Silt and clay	moist	well laminated (deformed laminae); very well sorted; grey; no clasts; low density; lower contact sharp	silt
69	73	22.25			Very fine sand	moist to wet	same as above (36-56' interval) except minor silt/clay laminae towards the base of unit; moderately dense; grey; lower contact gradational	sand

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
73	76	23.16			Interbedded silt/clay and very fine sand	moist	mainly silt and clay beds about 1 cm thick; very fine sand laminae generally <0.5 cm; sands often highly deformed (rounded ball and pillow structures; possible drilling deformation); silt and clay beds show better preservation; lower contact gradational	clay
76	85.2	25.97	76-96'	125	Silt and clay	moist	mainly massive; rare highly deformed laminae locally observed; some very fine sand interlaminae present near the base of the unit; lower contact clear	silt
85.2	85.6	26.09			Very fine sand	moist	mostly structureless (liquefied) but minor deformed bedding preserved; grey; moderately dense; no clasts; very well sorted; lower contact gradational	sand
85.6	86.5	26.37			Silt and clay	moist	same as above (76-85' interval); lower contact clear	silt
86.5	100	30.48			Very fine sand	moist	same as above (69-73' interval); mainly massive but very weak deformed bedding locally present; moderately dense; lower contact sharp	sand
100	114	34.75			Silt and clay	moist	massive to crudely bedded; minor very fine sand interlaminae; sandy laminae observed at ~103', 110' and 112' (see photos); brown; low to moderate density; lower contact gradational	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
114	116	35.36			Interbedded silts/clays and sands	moist	well bedded; well sorted; no gravel clasts; very fine sand interlaminated with silt/clay beds throughout unit; lower contact at end of drill interval	silt
116	127.5	38.86	116-136'	125	Interbedded silts/clays and sands	moist	similar to above (114-116'); low to moderate density; lower contact clear	silt
127.5	136	41.45			Silts and clays	moist	minor very fine sand interlaminae; low to moderate density; sporadic small pebbles (up to 1 cm diameter), mainly subangular local sandstones; lower contact at end of drill interval	silt
136	140	42.67	136-156'	140	Silts and clays	moist	unit is heavily disturbed by drilling (mainly mud-balls and highly contorted core); lower contact gradational	silt
140	156	47.55			Gravelly mud	moist	mostly massive but some faint laminae preserved locally; dark grey; moderately dense to dense; about 2-5% gravel; density and stone content increase with depth; clasts mainly SA-SR small pebbles; rare large pebbles up to about 2 cm (one sandstone at 145' and one striated and polished limestone at 146'); lower contact at base of drill interval	till
156	160	48.77	156-176'	110	Gravelly mud	moist	same as above but increasing density with depth; upper few feet of unit heavily disturbed by drilling (mainly soft, hollow core "peel"); lower contact gradational	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
160	176	53.64			Silty clay diamict	moist	massive; matrix-supported; silty clay matrix with some fine sands; dense to very dense at base; grey; poorly sorted; clasts up to 5 cm diameter; mainly SA-SR; sandstone, siltstone and shale common; few erratics; fractures common (core breaks every 5-25 cm, mainly where larger clasts are present); weak striae seen on some clasts	till
TD 176 ft (53.64 m)								

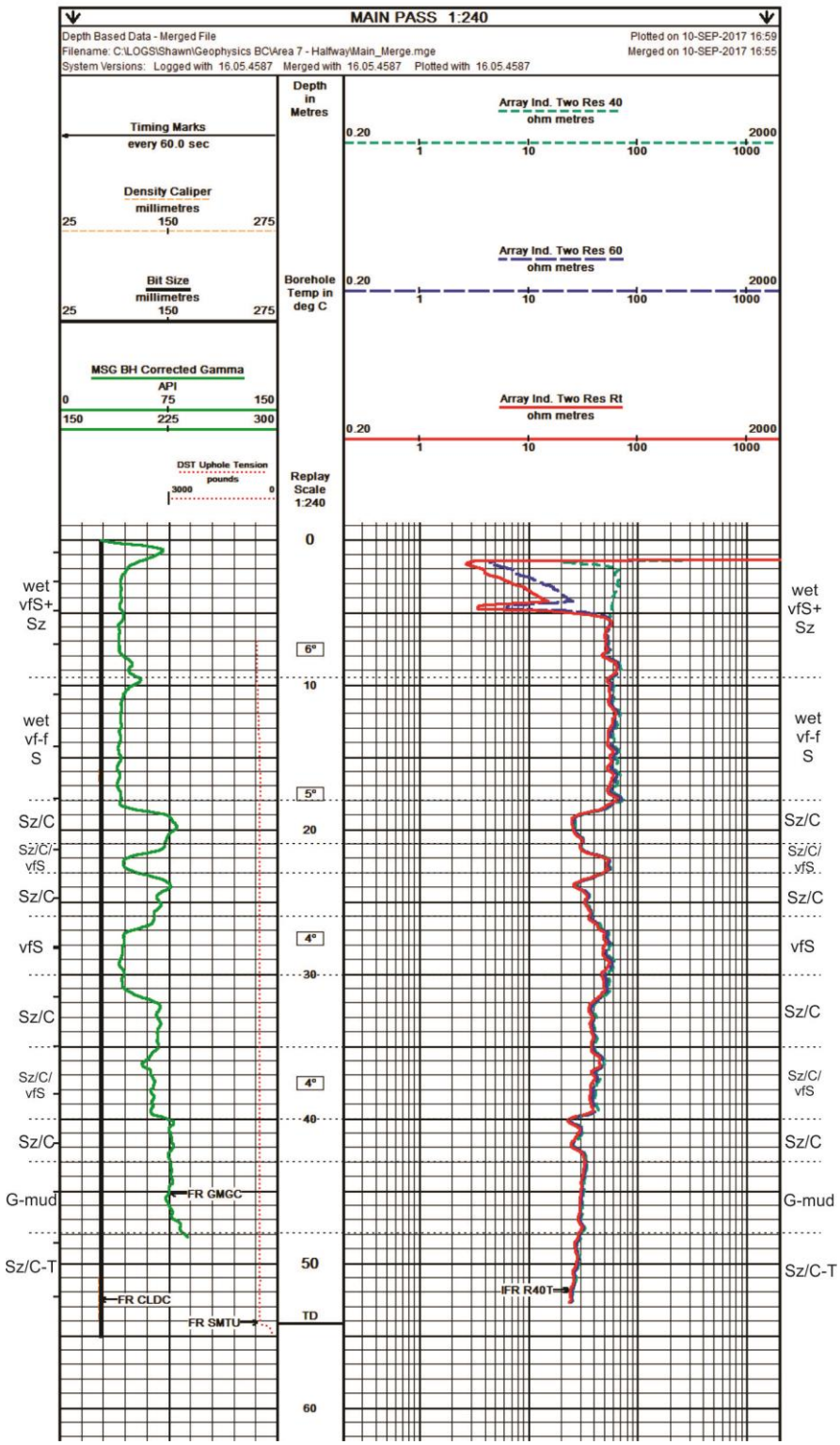

Figure A2. Borehole geophysical logs for hole 7. Lithologic summary from drilling is provided (see Table A5): G=gravel; S=sand;Sz=silt; T=till; C=clay; vf=very fine-grained; f=fine-grained. Main Pass at 1:240 resolution shown.

Table A6. Hole 10b lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	10b			**Easting:**	564660	**Notes:**	Just northeast of Beryl Prairie, just west of Lynx Creek valley. Weather sunny; snow covered ground (some heavy snow banks)	
Method:	Sonic			**Northing:**	6220787			
Logged by:	Vic Levson and Sami Morgan, March 28-29, 2017			**Elevation (masl):**	698			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0	2	0.61	0-16'	110	Silt and Clay	partially frozen	Organic-rich muds; two massive ice lenses (1-2 inches thick) in upper part; abundant rootlets and other organics; lower contact sharp	silt
2	2.3	0.70			Silty very-fine sands	wet	massive; very well sorted; minor organics; light brown; soft; lower contact gradational	silt
2.3	9	2.74			Clay and silt	moist	faintly laminated throughout; black with light brown mottles; moderately dense; lower contact gradational	clay
9	14	4.27			Silt and Clay	moist	crudely bedded with faint laminae; light brown silts with clay (black) mottles; soft; rare small to medium pebbles (SA-SR), shale, limestone; lower contact sharp	silt
14	16	4.88			Silt	dry (moist at base)	structureless (dry and crumbly) but some silty clay beds present; well sorted (no stones seen); lower contact gradational	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
16	21	6.40	16-36'	100	Silt	moist	mainly silt and minor clay; crudely bedded with minor laminae; light brown; soft; occasional small to medium pebbles; one large (~10 cm) local siltstone at top of unit; lower contact gradational	silt
21	35.4	10.79			Silt	dry	same as above except more pebbles including feldspar porphyry, local sandstone; some moist intervals where more clay is present; lower contact gradational	silt
35.4	38	11.58	36-46'	100	very-fine sand	moist	faintly bedded with some silty very-fine sand beds (~6" thick); otherwise no apparent structure; well sorted; light brown; moderately dense; lower contact sharp	sand
38	47.5	14.48			Fine sand	dry	massive; unit generally fines downward to very fine sand; soft but gets denser towards the base of the unit; dry silty powder at ~42-42.5 ft (probably a cobble crushed by drilling but could be a dense sand bed); lower contact gradational	sand
47.5	61	18.59	46-56'	100	Silty, very fine sand	wet (likely drill water)	interbedded dense silts ("hockey pucks") and loose sands; rare laminae in silts; dense sand bed at 54-55 ft (likely ground-up clast as core is very hot and powdery; silty intervals dominate from 49-53 ft and 55-61 ft; lower contact gradational to clear	sand

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
61	64	19.51			very fine to medium sands	wet	moderately well bedded; unit coarsens down; well sorted; some silty beds; light brown-grey; lower contact sharp	sand
64	72	21.95	66-76'	55	Silty very-fine sand	dry to moist	massive except one coarse sand laminae ~2 mm thick at ~65 ft; moderately dense; light brown; very well sorted; no clasts; lower contact sharp; Note: poor recovery (loss probably mostly in the underlying sand unit	sand
72	77	23.47			fine to medium sand	very dry	weakly bedded; minor silty beds in lower 4 inches; unit coarsens downwards; very well sorted; mainly grey but olive brown in silty parts; lower contact clear; Note: poor recovery	sand
77	81.3	24.78	76-86'	100	very fine sand to silt	dry to slightly moist	weakly bedded; well laminated clay lense at ~80.5-81.3 ft; sands low density but silty parts up to moderate density; light brown; lower contact sharp	sand
81.3	86	26.21			fine to medium sand	dry	weakly bedded; unit coarsens downwards to mainly medium sands; well sorted; light grey; low density; lower contact gradational	sand
86	97.8	29.81	86-96'	40	medium sand	dry	same as above but structureless other than coarsening down trend; lower contact gradational; Note: poor recovery	sand
97.8	102	31.09	96-106'	75	Fine sand	moist to dry	structureless; well sorted; slightly denser than above; upper part dry, lower part moist; lower contact gradational	sand

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
102	105	32.00			Silt	very dry	massive (largely powder ground up from drilling but a few cohesive pieces remain); white to light grey	silt
105	106	32.31			Silt	slightly moist	laminated silt and some fine sand laminae; brown; moderately dense; lower contact sharp	silt
106	117	35.66	106-116'	105	fine to medium sand	dry to moist; locally wet	weakly bedded (dark sandy bed at ~114 ft, possibly organic rich); very well sorted; no gravel clasts; muscovite grains common throughout; very wet at ~110-112 ft (saturated, perched aquifer) dry at base; lower contact clear	sand
117	121.75	37.11	116-126'	80	silty very-fine sand	dry	massive to very weakly laminated (solid pieces of silt have no apparent sedimentary structures except some very weak laminae); well sorted; one medium quartzite pebble; lower contact gradational	silt
121.8	127	38.71			fine to medium sand	dry	massive; low density; well sorted; lower foot is powdered very fine sand and silt;	sand
127	134	40.84	126-136'	110	very-fine sandy silt	dry	massive to weakly bedded; no laminae observed but medium sand beds defined at 132.5-133.1 ft and 133.5-134 ft; sands well sorted; unit fines down with generally more sand at top and silt content increasing with depth; powdery and very dry ~131-136; medium pebble of quartzite at 128 ft; lower contact gradational	silt
134	136	41.45			Very fine to fine sand	dry	similar to above but moderately well sorted (some silts and some small-medium pebbles (e.g. quartzite) present in lower part of the unit)	sand

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
136	138	42.06	136-146'	90	very fine sand	dry	structureless; well sorted; slightly moist from drilling; low-moderate density; brown to olive brown; lower contact clear	sand
138	144.75	44.12			Very fine sandy silt	dry	Laminated; some cohesive pieces of moderately dense silt; lower contact sharp	silt
144.75	146	44.50			Pebbly sand	dry	massive; poorly sorted; small-medium pebbles (2-3%), SR-WR, quartzite and siltstone; light grey to tan; low density (loose and dry)	sand
146	159	48.46	146-156'	50	Fine to coarse sand	wet	Unit coarsens down from fine sand at top to coarse sand at base; well sorted; olive brown to light brown; Note: poor recovery: driller reports that much of missing core is likely from this wet sand unit; (most of lost core recovered as a mud slurry in the next core interval); lower contact sharp	sand
159	166	50.60	156-166'	150	very fine sandy silt	dry	Massive; no laminae observed; moderately dense; dark brown to black; poorly sorted with some small-large pebbles present; striae on some larger pebbles; Note: Water level was checked at end of drill interval (156'): stable at 57 ft below ground surface for about 30 minutes but dropped quickly after pulling back the casing (see notes below); top ~5 ft of core was saturated muck (recovered core) and was added to last 5 ft of core box	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
166	176	53.64	166-176'		very fine sand and silt	dry	massive to weakly bedded; unit fines down from very fine sands to very fine sandy silts to stony muds at the base (diamict); poorly sorted; pebbly throughout unit; sands moderately dense, silts denser; dark grey; fissile with fissility increasing with depth; striated siltstone cobbles at 170 ft (~7cm dia) and 170.5 ft (~ 10 cm dia); lower contact gradational	silt
176	196	59.74	176-196'	120	silty clay diamict	dry to moist	massive; matrix-supported; silty clay matrix; very dense; ~5% small-medium pebbles throughout; SA-SR (local siltstone and sandstone, quartzite, etc.); fissile (numerous fractures producing many hockey-puck shaped pieces of core from 191-196 ft); matrix dark brown; ~15 ft of narrow core (diamict) squeezed up above the core barrel was discarded.	till
TD 196 ft (59.74 m)								
NOTES:								
A water level test was conducted on wet sands initially encountered in the 146-156 ft interval (Note: there was only 50% recovery in this interval); an additional 3 ft of wet sand were encountered in the next drilling interval (and ~ 5 ft of saturated muck were also retrieved) suggesting a wet sand zone up to a maximum thickness of about 13 ft (146 ft to 159 ft). The water level was checked at end of the drill interval (156'): water was stable at 57 ft below ground surface (bgs) for about 30 minutes but dropped quickly after the casing was pulled back 10 ft to 146, the water level dropped to 79.5 ft (bgs) in 5 minutes, the 126 ft (bgs) after 15 minutes, 142								

ft (bgs) after 30 minutes and completely drained the hole within 35 minutes! The wet sands are underlain by dry sands and silts and overlain by dry pebbly sands and it is appears that one or more of these or adjacent dry, permeable units drained the hole. The base of the hole may have collapsed when the casing was pulled back, blocking off the wet sand unit, and allowing water to drain out the overlying pebbly sand unit. Alternatively, the water may simply have drained out through the underlying fine sand unit once the drill bore physically connected with it.	

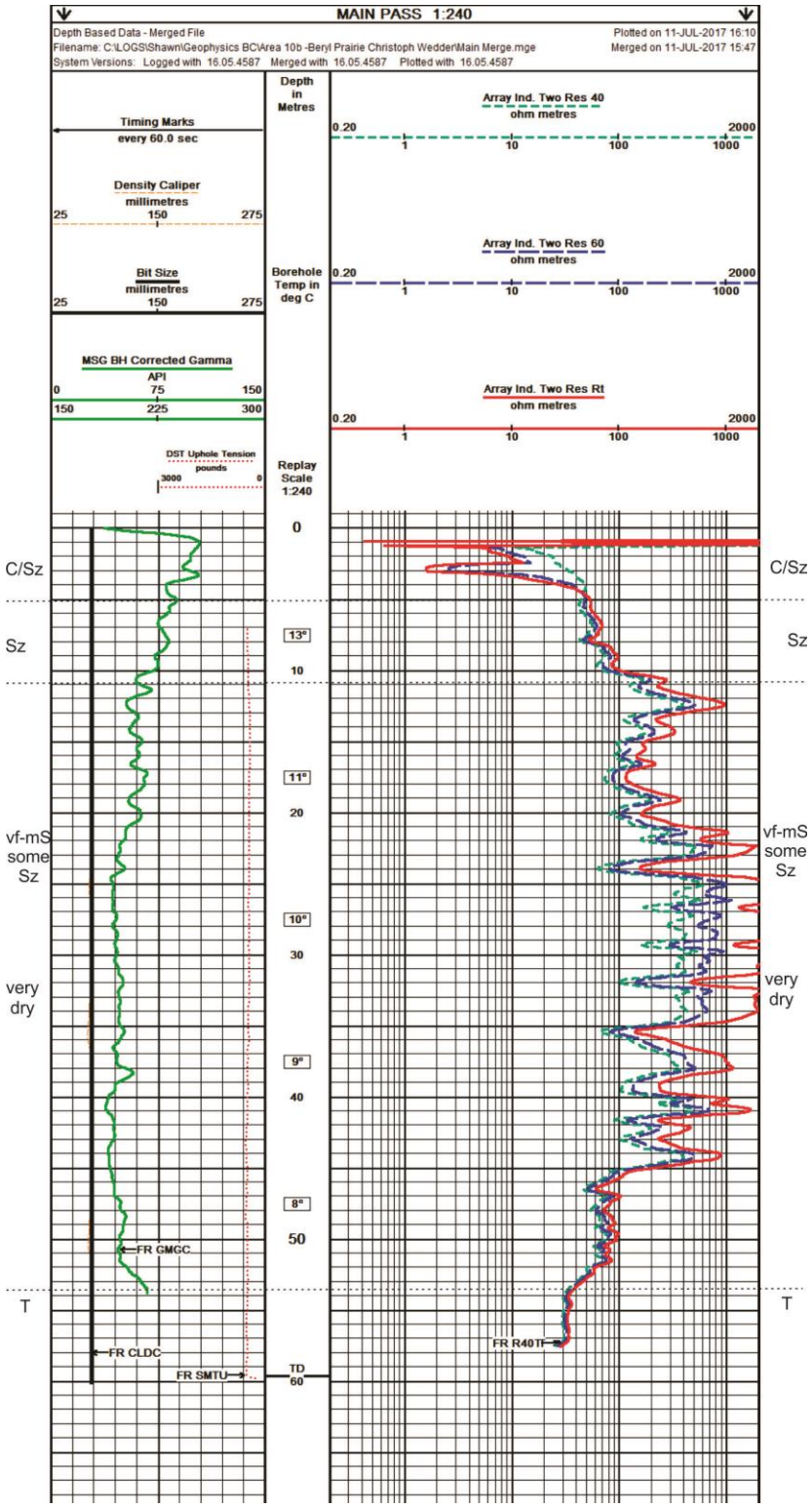

Figure A3. Borehole geophysical logs for hole 10b. Lithologic summary from drilling is provided (see Table A6):S=sand;Sz=silt; T=till; C=clay; vf= very fine-grained; m=medium-grained. Main Pass at 1:240 resolution shown.

Table A7. Hole 10x lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	10x			**Easting:**	570720	**Notes:**	West of Farrell Creek road (~3.5 km). Weather sunny; snow covered ground (some heavy banks)	
Method:	Sonic			**Northing:**	6225047			
Logged by:	Vic Levson, March 31-April 2, 2017			**Elevation (masl):**	703			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0	4	1.22	0-9'	110	fine sand	moist	abundant organics; frozen in upper foot; rare small-medium pebbles; dark brown; low density; wet in upper 2 ft from drill water; lower contact gradational	sand
4	14	4.27	9-17'	125	Clayey silt diamict		massive; matrix supported; low to moderate density; dark brown; gravel content, clay content and density increase with depth; minor very fine sand in matrix; up to ~8-10% gravel; clasts SA-SR, varied lithologies, small to large pebbles; lower contact gradational	till
14	16	4.88			Clayey silt diamict	moist to dry	same as above but with slightly sandy, oxidized, light brown mottled patches; lower contact gradational	till
16	26	7.92	17-25'	125	Silty diamict	dry	same as above but matrix mainly silt, minor clay, and more clasts (up to small cobble size, ~10 cm diameter); minor very fine sand; moderate density; dark grey; lower contact gradational	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
26	39	11.89	25-32'	125	fine sandy silt diamict	dry to moist	massive; matrix supported; moderate to high density, increasing with depth; matrix mainly silt and very fine sand, minor clay; dark grey-brown; gravel content ~15%,mainly small-large pebbles, varied lithologies, striate, facets and bullet-shapes common; lower contact very sharp	till
39	46	14.02	40-48'	125	Fine sand	wet	mainly very fine to fine sand; massive; very well sorted (no pebbles or coarse sands); low density; grey; liquefies when disturbed (structureless); lower contact gradational; [SFU sample taken for grain-size analysis at 42 ft]	sand
46	56	17.07	48-56'	110	Very-fine to fine sand	wet	similar to above but not liquefied and contains rare small pebbles; lower contact gradational; [SFU sample taken for grain-size analysis at 55 ft]	sand
56	61	18.59	56-66'	100	very-fine sand and some silt	moist to wet	faintly bedded (e.g. at 60'); light grey; rare small to large pebbles (up to 2 cm); drier than underlying unit; lower contact gradational	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
61	66	20.12			Pebbly silt and sand	wet	horizontally bedded: very fine sand bed (~5 cm thick) at 62 ft and medium sand bed (2-5 cm thick) at ~63 ft; matrix mainly silt with some very fine sand; ~1-2% clasts, mainly medium to large pebbles; dark grey; moderately dense; lower contact at base of cored interval: water level measured before drilling continued (water level at 4:20 PM was 23 ft and rising slowly; at 5:30 the water level was 27 ft and dropping slowly; water sample was attempted at 6 PM but failed - see notes below)	sand
66	69.5	21.18	66-76'	100	Very fine sand and some silt	wet (likely drill water)	massive; soft; grey; moderately well sorted; rare medium pebbles; upper foot of core contaminated with filter sand from water test; lower contact sharp	silt
69.5	74.5	22.71			Silt	dry to moist	massive; soft, grey; moderately well sorted: some very fine sand and ~2% small to large pebbles (max ~ 2 cm); lower contact clear	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
74.5	81	24.69	76-86	~60 (See note)	Pebbly fine sand	moist to wet (lower 2 ft very wet)	massive; poorly sorted with some silt in matrix; ~10% pebbles up to small cobbles (6 cm); varied lithologies including one pink granite; matrix coarsens down from fine sand at top to coarse sand at base; grey; soft; lower contact sharp; NOTE: only a few feet of pebbly sand were recovered in this unit but with silts above and below, it was assumed that most of the unrecovered sample in the 76-86' interval was in the sandy unit. A water test was conducted after completion of this drilling interval at 86 ft (see below)	sand
81	86	26.21		~100	Silty diamict	moist	massive; matrix-supported; moderately dense; ~10-15% clasts; density and clay content increase with depth; dark grey-brown; lower contact gradational	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
86	96	29.26	86-96'	130	Silty clay diamict	moist	massive; matrix-supported; moderately dense to dense; few fractures; clay content and density increasing with depth; ~10% pebbles, SA-SR, mainly small to medium pebbles (up to ~2 cm); mainly quartzite, siltstone, mudstone and carbonates; lower contact sharp	till
96	97.0	29.57	96-106'	150	Pebble to cobble gravel	moist	massive; poorly sorted with silty, fine-medium sand matrix; clasts SR-WR; numerous (~6) cobbles up to ~10 cm diameter in this thin unit; varied lithologies; lower contact sharp	gravel
97.0	106	32.31			Clay diamict	moist	massive; matrix-supported; grey; moderately dense to dense; ~5% clasts, SA-SR, some local shales and sandstone clasts; lower contact clear	till
106	116.5	35.51	106-116'	70	Sandy silt diamict	moist	massive; matrix-supported; dark grey brown; very dense; ~25-30% clasts (up to 70% at ~109' and 116'); SA-SR, mainly small-large pebbles up to 3 cm diameter; abundant quartzite, carbonate, sandstone and shale; one sandstone clast cuts across entire core at 107 ft; lower contact sharp	till
116.5	136	41.45	116-136'	110	Silty clay diamict	moist	similar to 86-96 ft interval but dense to very dense; grey color with minor oxidized patches mostly around local sandstone clasts; mainly small-medium pebbles: shale, quartzite, limestone, sandstone and siltstone (no granites seen)	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
136	156	47.55	13-156'	110	Silty clay diamict	moist	same as above: striated limestone bullet-shaped clast at 153 ft, oxidized sandstone pebble (~2 cm) at 154 ft and small carbonate cobble (~10 cm) at 155 ft.	till
156	176	53.64	156-176'	115	Silty clay diamict	moist	same as above: quartzite cobbles at 156.5 ft (rounded, ~ 6 cm) and 165 ft (SR, ~10 cm); limestone cobble at 170 ft (striated, faceted and bullet-shaped); sandstone cobble at 163 ft (SA, ~7 cm)	till
176	186	56.69	176-186'	150	Silty clay diamict	moist	same as above: clasts mainly small-large pebbles, SA-SR; very large pebbles at 184.5 ft (quartzite and siltstone, SA, ~ 5 cm each) and 185 ft (carbonate, WR, ~4 cm)	till
186	189.5	57.76	186-196'	130	Silty clay diamict	moist	same as above; lower contact sharp to clear	till
189.5	197.5	60.20			Silt	moist	mainly silt, some clay and very fine sand; well laminated throughout; thin silt/clay laminae (~1-2 mm thick) and some very fine sand beds (up to ~ 1 cm thick); soft; grey; rare (~1%) small pebbles throughout but mainly in lower few feet; clay content and density increase with depth; organic rich (black) very fine sand bed at base of unit sampled for C14 (VLE-2017-1, 10x-197.5); lower contact sharp	silt
197.5	199.5	60.81	196-206'	110	Pebbly silt	dry	massive; soft; clast content ~20-30%; up to large pebbles; very poorly sorted; brown to grey; lower contact clear	silt

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
199.5	201	61.26			Very fine sand and silt	dry	well bedded but heavily disturbed by drilling; poorly sorted: rare small pebbles; soft; grey; some sandy patches weakly oxidized; lower contact sharp	silt
201	208	63.40			Pebble to small cobble gravel	dry to moist	massive; very poorly sorted; matrix silty sand; very silty at 202-203 ft and 206-208 ft; oxidized; brown; clasts mainly local sandstone and siltstone, SA-SR; lower contact clear	gravel
208	210	64.01	206-216'	110	Silty sandy pebble gravel	very dry	massive; no structure; grey-brown; low density (loose); ~50% clasts, SA-WR, up to about 2 cm; lower contact sharp	gravel
210	212	64.62			Pebbly silt	moist to dry	weakly laminated; ~20% clasts, SA-SR; moderately dense; large siltstone cobble at 211 ft partially pulverized by drill into a dry powder; lower contact clear	silt
212	216	65.84			Silt and clay	moist	well laminated throughout; rhythmically interlaminated black clays (mainly 1-2 mm) and dark brown silt laminae (up to 1 cm thick); rare stones; very dense	silt
216	227	69.19	216-236'	120	Silt and clay	moist	same as above: very dense, grey, well laminated at top but more massive towards base; very well sorted; very rare stones except within thin beds of massive, granular to small pebbly mud at 223-223.5 ft and 224-224.5 ft; lower 2 feet of interval is massive clay; lower contact sharp.	clay

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
227	229	69.80			Pebbly clay and silt	dry	granular to small pebbly clay and silt; massive; clasts mainly soft local lithologies (smear readily with trowel); lower contact clear	clay
229	231	70.41			Silt and Clay	dry	weakly laminated; very dense; some small pebbles; some horizontal fractures; lower contact clear	silt
231	234	71.32			Pebbly clay and silt	dry	granular to small pebbly clay and silt; massive; very dense; dark grey no obvious stratification; heavily fractured (broken along many horizontal fractures creating hockey puck-shaped pieces); lower contact gradational	clay
234	236	71.93			Pebbly silt	dry	some distorted laminae in silt-rich parts of the unit; moderately dense; ~20% clasts, varied lithologies, some faceted and striated; some large pebbles (sandstone, siltstone, SA-SR, striated) and one intrusive (granodiorite) rounded cobble (~10 cm) at base of hole. TD 236 ft	silt
TD 236 ft (71.93 m)								
NOTES:								
Water sampling was attempted on the wet fine sands and silty sands encountered at 39-66 ft: the casing was pulled up to 56 ft to expose 10 ft of sands and stony sands; the isoflow was dropped to the bottom of the hole but the loose sandy sediments likely collapsed into the hole and the isoflow pump was immersed in the soft sediments. The test was delayed until the following morning when 2 bags of filter sand were poured down hole and the 4 ft isoflow screen was set on top of the sand at 60 ft depth. The casing was pulled back 5 ft more to expose more wet sand and the well was pumped hard until dry. The water subsequently recovered was very silty and recharge was too slow to permit adequate water sampling so the water test was deferred until the								

second 10x hole (10x-2) was drilled 5 m away as originally planned. The water level measured at 8:30 AM on April 1 was 10 ft from surface (water level the evening before was fluctuating around 23-27').	
A second water test was conducted at the end of the 76-86 drilling interval by pulling the casing back to 75 ft to expose the pebbly sand (at ~74.5-81') and pumping hard for 20 minutes with the isoflow pump (no screen downhole): the water remained silty but the water table was stable at a pump rate of ~10 gals/minute. Water level was checked before pumping and was stable at 10 ft from surface for 15 minutes. After pumping for ~30 minutes the water level dropped to about 14 ft below surface but was slowly rising and likely would stabilize at ~10 ft below ground level (as indicated by earlier measurements).	

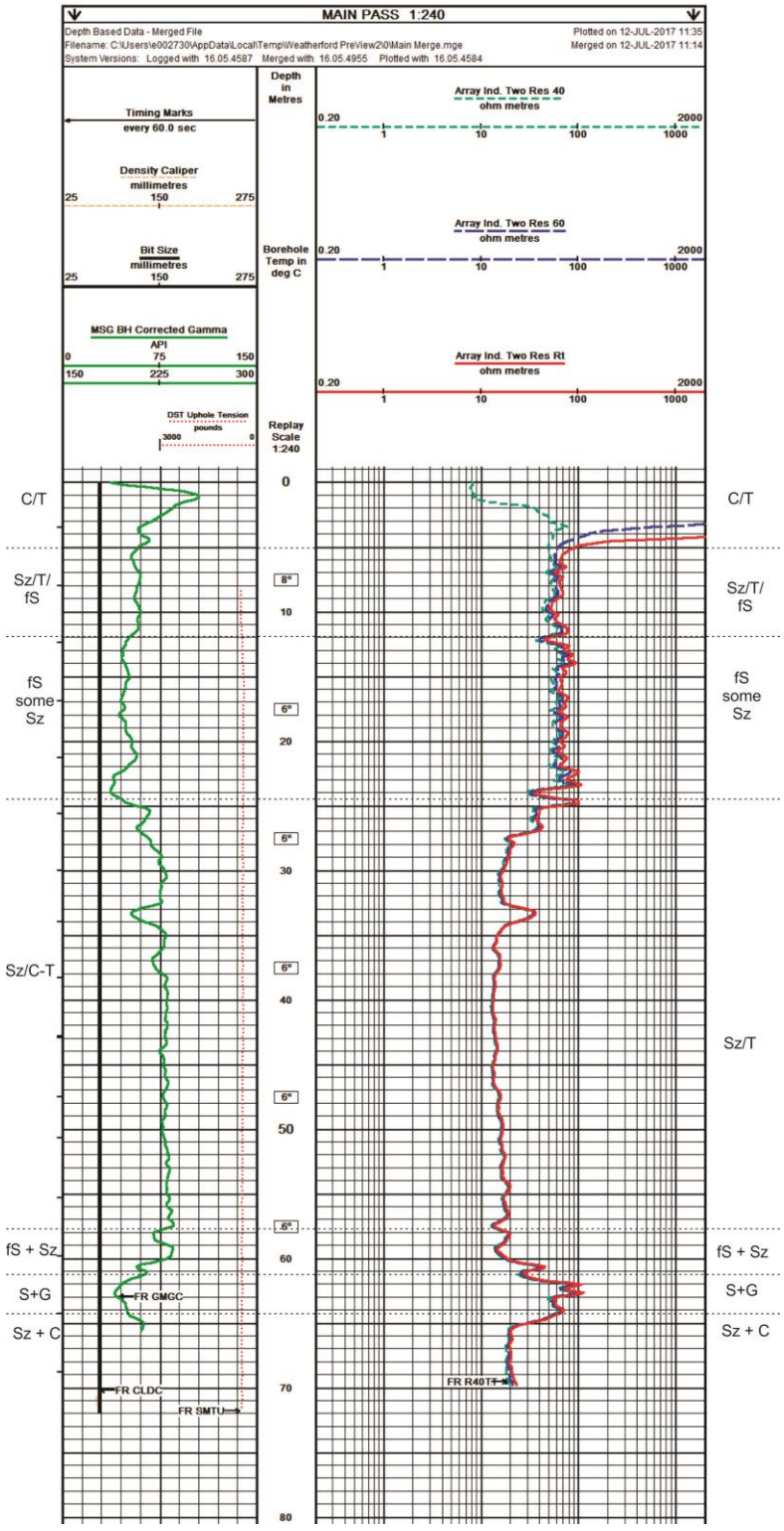

Figure A5. Borehole geophysical logs for hole 10x. Lithologic summary from drilling is provided (see Table A7): G=gravel; S=sand;Sz=silt; T=till; C=clay; f=fine-grained. Main Pass at 1:240 resolution shown.

Table A8. Hole 10x-2 lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	10x-2			**Easting:**	570723	**Notes:**	West of Farrell Creek road (~3.5 km), step out ~5 m SW of hole 10x. Weather cloudy and cool	
Method:	Sonic			**Northing:**	6225050			
Logged by:	Vic Levson, April 2, 2017			**Elevation (masl):**	703			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0	66	20.12	none	0	see 10x log		upper 66 feet of well drilled and flushed	
66	70	21.34	66-86'	90	Pebbly silt and fine sand	moist to wet	Interbedded fine sand bed (wet) and pebbly silts (moist); ~5% pebbles, SA-SR, varied lithologies; moderately dense to dense; thick fine sand bed at ~67-68 ft (wet)	silt
70	75	22.86			Fine to medium sand	moist to wet	fine sand interbedded with medium sands; very well sorted; few pebbles; soft; clean medium sand beds at ~71-71.5 ft and ~72-72.5 ft; silty fine sands in lower 2 feet with some medium sand lenses (possible drilling disturbance)	sand
75	81	24.69			Pebbly fine sand	moist	crudely bedded; some medium sand interbeds; poorly sorted: matrix silty fine sand; very silty in lower 2 feet; ~10% clasts, SA-WR, varied lithologies; lower contact clear	sand
81	83	25.30			Pebbly fine-medium sand	moist to wet	similar to above; poorly sorted with some silt in matrix; ~10-15% pebbles, mainly R-WR; varied lithologies	sand

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
83	86	26.21			Medium sand	moist to wet	well sorted; clean (little silt); some fine sands in lower 0.5 feet; soft; grey	sand
NOTES:								
Water level was measured at the end of the day (6:24 PM) and was stable at 6.5 feet below ground level. At 7:30 AM the next day, the water level was still at 6.5 ft.								
Water sampling was conducted as follows: filter sand was used to fill the bottom of the hole; the well was pumped dry and allowed to recharge (initial rate of water rising in the well was ~ 6 inches/minute); well was pumped at a rate of 1 litre/25 seconds (this rate maintained a constant water level in the well at 48 ft); water was pumped hard to drop water level to 60 ft (to lower the water pressure in the well bore); a pumping rate of about 1 litre/15 seconds maintained the water level in the well at 60 feet; after the water cleared somewhat and the pH and conductivity etc. stabilized, water samples were taken - See water sampling note sheets for details (sample sheets available from Chelton van Geloven); After completion of the sampling, the isoflow was removed from the well and the well was completed with screened PVC, grouted, and capped.								

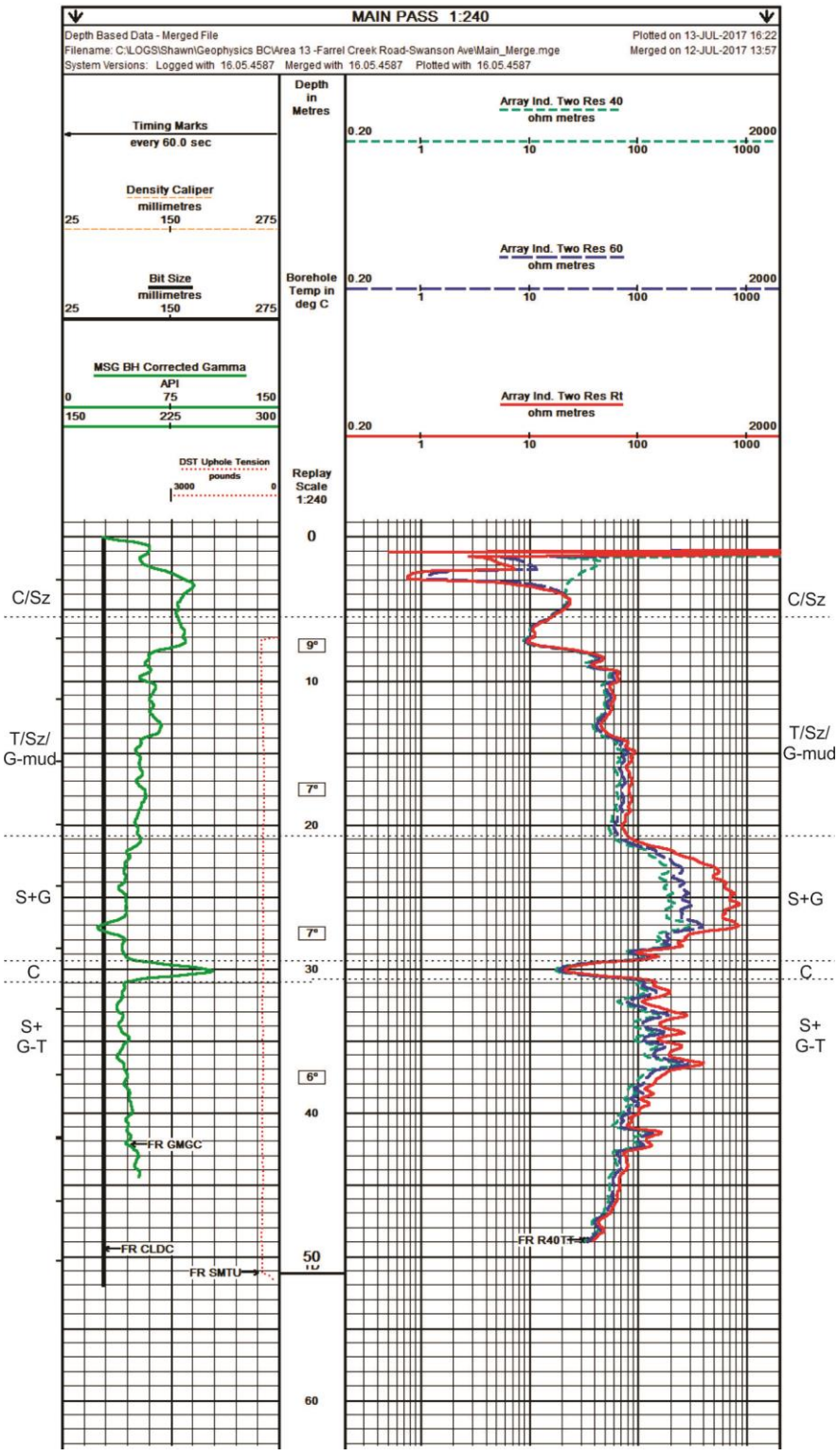

Figure A6. Borehole geophysical logs for hole 13. Lithologic summary from drilling is provided (see Table A9): G=gravel; S=sand;Sz=silt; T=till; C=clay; f=fine-grained. Main Pass at 1:240 resolution shown.

Table A9. Hole 13 lithology log. Modelled Geology column indicates the lithology that was input into the geologic model. Note that within Modelled Geology, all consolidated rock was given the designation "bedrock" as it is not possible to differentiate bedrock formations core logging in the field.

Hole:	13			**Easting:**	579923	**Notes:**	West of Farrell Creek road (~3.5 km), step out ~5 m SW of hole 10x. Weather cloudy and cool	
Method:	Sonic			**Northing:**	6234812			
Logged by:	Vic Levson, May 10, 2017			**Elevation (masl):**	645			
Top (ft)	**Base (ft)**	**Base (m)**	**Cored interval (ft)**	**Recovery (%)**	**Sediment type**	**Water content**	**Description**	**Modelled Geology**
0.0	1.5	0.46	0-16'	100	Silty clay	wet	massive; organic rich muds; locally red-brown (oxidized); soft; lower contact sharp	clay
1.5	6	1.83		100	Very fine to fine sands	wet	massive to crudely bedded; fines downwards (mainly silts in lower foot); light brown; no stones; lower contact gradational	sand
6	18	5.49		100	Silts and clays	moist	well bedded; clay beds black to dark grey; silts light grey; rhythmic bedding with clay beds 1-2 cm thick and silt beds about 2-4 cm thick; beds thin with depth; well laminated at base; lower contact clear	silt
18	32	9.75	16-36'	110	Gravelly mud	moist	massive to crudely laminated; soft; stone content increases from about 1% at top to ~10% at base of unit; clasts mainly small to medium pebbles (a few large pebbles); mainly SR-WR (some angular large shale pebbles) lower contact sharp	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
32	36	10.97	36-46'	130	Muddy gravel to diamict	moist	massive; very dense; very poorly sorted; matrix mainly sandy mud; low permeability (tight); gravelly zones are clast supported (matrix-filled); clast lithologies varied: many local siltstones and shales; some clasts with weak striae; mainly SR-WR; largest clast 5 cm diameter; lower contact gradational	till
36.0	40.5	12.34		130	Diamict	dry (wet in upper foot from drill)	massive; matrix-supported; very dense; dark grey; stony (~30% clasts); clasts mainly SA-SR, varied lithologies: mainly sandstone and siltstone, some quartzites, minor green volcanics; clasts up to small cobble size (8 cm diameter); diamict is cohesive but fractured about every 5-15 cm; lower contact sharp	till
40.5	43.0	13.11		130	Gravelly silt	moist	moderately well stratified; silt beds and some laminae visible; dense; about 10% stones; lower contact clear	silt
43.0	44.0	13.41		130	Diamict	moist	same as above (36' to 40.5' interval); lower contact clear	till
44.0	44.5	13.56		130	Gravelly silt	moist	same as above (40.5' to 43' interval); lower contact clear	till
44.5	47.5	14.48	46-56'	140	Diamict	moist	same as above (36' to 40.5' interval); clasts up to 4 cm diameter; lower contact sharp	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
47.5	48.5	14.78		140	Muddy gravel	moist	massive; clast supported; matrix muddy sand; very poor sorting; moderately dense; clasts mainly SR-WR, some A; abundant quartzite; lower contact clear	till
48.5	55.0	16.76		140	Diamict	dry	massive; matrix-supported; very dense; mostly dark grey but brown (oxidized) in upper metre; heavily fractured; clasts mainly SA-SR, varied lithologies: siltstone, quartzites, sandstone, volcanics, carbonates, etc. (ironstone pebble at 49' and feldspar porphyry cobble at 51'); diamict is cohesive but fractured about every 5-15 cm; lower contact sharp	till
55.0	55.5	16.92		140	Pebble gravel	dry	massive; loose; small to large pebble gravel (clast-supported) with matrix of fine sands; large clast fractured by drill; lower contact sharp	gravel
55.5	68.0	20.73	56-66'	120	Diamict	moist to dry (wet at 66-67 due to drill water)	massive; matrix-supported; dense; heavily fractured (2-5 cm spacing); very dry with some carbonate precipitation; oxidized in lower foot; about 20-30% clasts; gravel-rich zones at 61.5', 64', 65'; clasts up to cobble size (largest clasts >10 cm); mainly SA-SR, various lithologies: abundant quartzite, sandstone, siltstone, carbonates, vein quartz; ironstone cobble at 64'; quartzite cobble at 64.5'; lower contact gradational	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
68	72	21.95	66-76'	115	Pebble to cobble gravel	moist	structureless; clast-supported; silty sandy matrix; loose to moderately dense; poorly sorted; grey; clasts mainly SR-WR; various lithologies; abundant quartzite and siltstone; lower contact gradational	gravel
72	74	22.56		115	Sandy gravel	dry	structureless; clast-supported; fine-medium sand matrix (minor coarse sand); grey; loose; clasts mainly small to large pebbles (few very large pebbles); clasts SR-WR; varied lithologies: local sandstones and siltstones, quartzites, intrusives (diorite); lower contact gradational	gravel
74	76	23.16		115	Silty sandy gravel	dry	structureless; clast-supported; poorly sorted; matrix silty fine-sand; grey; moderately dense; clasts mainly small to medium pebbles; some large pebbles; cobbles rare; SR-WR; varied lithologies; some iron oxide cemented sandy gravel zones up to about 2 cm thick; lower contact gradational	gravel
76	77	23.47	76-86'	90	Cobble gravel	wet (drill water)	structureless; clast-supported; matrix medium to coarse sand; grey; loose; clasts mainly large pebbles to small cobbles (maximum diameter about 6 cm); clasts SR-WR; varied lithologies; lower contact sharp	gravel
77	78	23.77		90	Silty, fine sandy gravel	dry	structureless; clast-supported; poorly sorted; silty fine-sand matrix; dark grey; moderately dense; clasts mainly small to medium pebbles; some large pebbles; cobbles rare; SR-WR; varied lithologies; lower contact sharp	gravel

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
78	82	24.99		90	Pebble gravel	dry	structureless; clast-supported; matrix clean (no silt) fine to medium sand; light grey; loose; clasts mainly medium to large pebbles; rare very large pebbles; no cobbles; clasts SR-WR; varied lithologies; lower contact sharp	gravel
82	84	25.60		90	Medium to coarse sand	dry	massive to weakly laminated; brown; moderately well sorted; mainly medium to coarse sands; loose; slight fissility at base of unit (lower ~10 cm) may reflect laminae; lower contact sharp	sand
84	86	26.21		90	Pebble gravel	dry	structureless; clast-supported; matrix fine sands and some silt; poorly sorted; light grey; loose; clasts mainly small to large pebbles, up to 3 cm diameter; clasts SR-WR (some SA, rare A); varied lithologies: mainly sandstone, siltstone, small-pebble conglomerate; rare intrusives (granodiorite) lower contact clear	gravel
86	92	28.04	86-96'	100	Pebble to cobble gravel	dry (moist in top foot from drill)	structureless; clast-supported; matrix silty fine sand; poorly sorted; grey; loose (upper foot is more silty and moderately dense); clasts mainly large pebbles to small cobbles (maximum diameter 10 cm; one sandstone cobble >10 cm broken up by drill at 86'); clasts SA-WR; varied lithologies: sandstone, siltstone, small-pebble conglomerate, rare black chert; one striated limestone clast observed; lower contact clear	gravel

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
92	96	29.26		100	Pebble gravel	dry (slightly moist towards base)	structureless; clast-supported; matrix clean coarse sands; brown; loose; clasts mainly medium to large pebbles; rare very large pebbles and small cobbles (maximum diameter about 8 cm); clasts SR-WR; varied lithologies as above; lower contact sharp	gravel
96	99	30.18	96-116'	100	Clay and silt	moist	well laminated; dark grey; dense; no stones; very well sorted; laminae deformed; some light brown mottling (fine sandy oxidized patches - see photos); lower contact sharp	clay
99	103	31.39		100	Gravelly mud	wet	massive; matrix-supported; matrix mainly silt; up to about 30% clasts; poorly sorted; soft; brown; lower contact clear	till
103	116	35.36		100	Muddy gravel	moist	muddy gravel to gravelly diamict; about 50-60% clasts; moderately dense to dense; density increases with depth; clasts mainly medium to large pebbles, up to small cobbles (maximum diameter about 8 cm); mostly SR-WR; varied lithologies: quartzites, sandstone, siltstone, green volcanic porphyry, etc.; minor thin (<5cm) sandy to small pebbly interbeds (e.g. at 108.5' and 111'); lower contact gradational	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modellled Geology
116	134	40.84		100	Gravelly diamict	moist	massive; matrix- to clast-supported; matrix fine sandy silt; moderately dense to dense; upper half of unit brown, lower half dark grey; about 50-60% clasts; mainly pebbles, up to small cobbles; mostly SR-WR; varied lithologies: abundant quartzites, some volcanics (e.g. augite porphyry and feldspar porphyry); black shale-rich bed at 122.5-123'; large white quartzite cobble at 134'; lower contact sharp	till
134	135	41.15		100	Fine sand	moist	laminated; some thin silt laminae; well sorted; loose; grey; minor medium to large pebbles (R-WR) scattered throughout unit; lower contact sharp	sand
135	136	41.45		100	Gravelly diamict	moist	same as above (116'-134' interval) except some striated clasts observed; lower contact gradational	till
136.0	142.5	43.43	136-156'	120	Gravelly mud	moist	massive; matrix-supported; matrix fine sandy silt; about 10-15% clasts, mainly quartzites, sandstone and siltstone; poorly sorted; soft to moderately dense; dark grey; lower contact sharp	till
142.5	143.0	43.59		120	Gravelly diamict	moist	same as above (116'-134' interval); lower contact sharp	till

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
143	151	46.02		120	Gravelly mud	moist	massive; matrix-supported; matrix silty fine sand; clasts as above; better sorted with depth; soft to moderately dense; dark grey; lower contact gradational	till
151	156	47.55		120	Pebbly fine sand	moist	massive to weakly laminated; light grey; matrix fine sands (well sorted); moderately dense; laminae best preserved in thin silty beds; about 5-10% pebbles; abundant rounded quartzites; lower contact sharp	sand
156.0	157.3	47.95	156-166'	130	Gravelly mud	wet (drill water)	same as above (143'-151' interval); lower contact gradational	till
157.3	159.0	48.46		130	Pebbly fine sand	moist	structureless; matrix very fine sand; about 10% clasts, mainly small to medium pebbles; moderately dense; lower contact gradational	sand
159	161	49.07		130	Pebbly fine sand with silt/clay	moist	as above but soft and with some silt/clay laminae present; lower contact gradational	sand
161	165	50.29		130	Gravelly diamict	moist	massive; clast-supported; matrix sandy silt; dense; about 50% clasts; mainly pebbles; mostly SR-WR; varied lithologies; lower contact gradational	till
165	165.6	50.47		130	Pebbly sand	moist	structureless; matrix fine sand; soft to moderately dense; about 10% clasts, mainly small to medium pebbles; clasts mainly quartzite and siltstone, minor granite; lower contact gradational	sand

Top (ft)	Base (ft)	Base (m)	Cored interval (ft)	Recovery (%)	Sediment type	Water content	Description	Modelled Geology
165.6	166	50.60		130	Gravelly diamict	moist	same as above (161'-165'); massive; dense; some soft yellow sandstone clasts near base of unit	till
TD 166 ft (50.60 m)								

Grain Size Analysis

As described in Section 2.2.4, sediment samples were collected at holes 10b and 10x in order to obtain estimates for hydraulic conductivity of the permeable Quaternary sediments using grain size distribution data. Six approximately 500 g samples were collected at hole 10b and four samples at hole 10x. The locations (depth along core) of each sample are shown in Tables A10-A19.

All samples were analyzed using the mechanical (sieve) method. If more than 5% fines were present (material passed through the 0.063 mm sieve), the grain size distribution for the fine-grained portion was obtained using the Malvern Mastersizer laser particle size analyzer. The methodologies for the two methods are summarized below.

Sieving Method

- The samples were placed in aluminum trays and dried in an oven at 90°C for 24 hours.
- Each dry sample was then poured into a sieve stack containing sieves in ascending order: #5 sieve (125 mm) at the top and #230 sieve (0.063 mm) at the bottom.
- The sieve stack was placed in the mechanical shaker and was shaken for 10 minutes.
- The stack was removed from the shaker and the weight of each sieve with its retained sediment was recorded.

The results of the mechanical analysis are shown in Tables A10-A19.

Mastersizer Method

- Removal of organics: the dry samples were re-sieved through to the 0.5 mm sieve. 1 or 2 g was taken from the sample (1g if sandy-silt, 2 g if mostly sand) and put in a beaker with 5 mL of 30% hydrogen peroxide. The mixture was stirred and allowed to sit for 2 hours. If the sample still contained organic matter (still bubbling), the process was repeated. Once all organics were removed, the supernatant was pipetted off and the sample was allowed to sit for 24 hours.
- Dispersion: 5 g of Sodium Hexametaphosphate (SoHex) was added to 1L of de-ionized water and was allowed to sit for 24 hours. 10 mL of the 0.5% SoHex solution was added per 1 g of the sample (20 mL for a 2 g sample) and stirred to suspend the sediment. The sample was stirred vigorously for 30

seconds, three separate times with an hour break in between each stirring. The sample was then left in the SoHex solution for 24 hours.

- Mastersizer: the samples in the SoHex solution were stirred vigorously, and then emptied into the Mastersizer tank one at a time. The Mastersizer uses the technique of laser diffraction to measure the particle size distributions; large particles scatter light at small angles relative to the laser beam, whereas small particles scatter light at large angles relative to the laser beam.

The results of the Mastersizer analysis are shown in Tables A20-A25.

Table A10. Results from grain size analysis of sample 10b-1 from borehole 10b using the sieving method.

Sample I.D.:	10b-1	Logging description:		moist fine-medium sand	
Sample Depth (ft):	63.5-64	Dry sample weight (g):		298.2	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0.0	0.0	0.0	100.0
10	2	0.0	0.0	0.0	100.0
18	1	0.4	0.1	0.1	99.9
35	0.5	0.6	0.2	0.3	99.7
60	0.25	6.8	2.3	2.6	97.4
120	0.125	96.8	32.5	35.2	64.8
230	0.0625	99.1	33.3	68.5	31.5
Pan	0	93.7	31.5	100.0	0.0

Table A11. Results from grain size analysis of sample 10b-2 from borehole 10b using the sieving method.

Sample I.D.:	10b-2	Logging description:		saturated fine-medium sand	
Sample Depth (ft):	110.67-111.3	Dry sample weight (g):		643.7	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0	0.0	0.0	100.0
10	2	0.1	0.0	0.0	100.0
18	1	0.6	0.1	0.1	99.9
35	0.5	1.2	0.2	0.3	99.7
60	0.25	59.9	9.3	9.6	90.4
120	0.125	448.8	69.6	79.2	20.8
230	0.0625	76.9	11.9	91.1	8.9
Pan	0	57.4	8.9	100.0	0.0

Table A12. Results from grain size analysis of sample 10b-3 from borehole 10b using the sieving method.

Sample I.D.:	10b-3	Logging description:		dry fine-medium sand	
Sample Depth (ft):	112	Dry sample weight (g):		475.4	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0.0	0.0	0.0	100.0
10	2	0.0	0.0	0.0	100.0
18	1	0.6	0.1	0.1	99.9
35	0.5	0.4	0.1	0.2	99.8
60	0.25	26.5	5.6	5.8	94.2
120	0.125	353.1	74.6	80.4	19.6
230	0.0625	65.4	13.8	94.2	5.8
Pan	0	27.3	5.8	100.0	0.0

Table A13. Results from grain size analysis of sample 10b-4 from borehole 10b using the sieving method.

Sample I.D.:	10b-4	Logging description:		Fine-medium sand, possible organics	
Sample Depth (ft):	113.5-114	Dry sample weight (g):		814.2	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0.0	0.0	0.0	100.0
10	2	0.0	0.0	0.0	100.0
18	1	10.1	1.2	1.2	98.8
35	0.5	34.6	4.3	5.5	94.5
60	0.25	56.7	7.0	12.5	87.5
120	0.125	555.8	68.4	80.9	19.1
230	0.0625	88.4	10.9	91.8	8.2
Pan	0	67.0	8.2	100.0	0.0

Table A14. Results from grain size analysis of sample 10b-5 from borehole 10b using the sieving method.

Sample I.D.:	10b-5	Logging description:		medium sand	
Sample Depth (ft):	146.5	Dry sample weight (g):		311.1	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0.0	0.0	0.0	100.0
10	2	0.0	0.0	0.0	100.0
18	1	7.3	2.3	2.3	97.7
35	0.5	6.9	2.2	4.6	95.4
60	0.25	10.5	3.4	7.9	92.1
120	0.125	228.4	73.2	81.1	18.9
230	0.0625	44.7	14.3	95.5	4.5
Pan	0	14.1	4.5	100.0	0.0

Table A15. Results from grain size analysis of sample 10b-6 from borehole 10b using the sieving method.

Sample I.D.:	10b-6	Logging description:		coarse sand	
Sample Depth (ft):	159	Dry sample weight (g):		323.7	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	1.9	0.6	0.6	99.4
10	2	5.0	1.6	2.2	97.8
18	1	22.6	7.1	9.2	90.8
35	0.5	73.1	22.9	32.1	67.9
60	0.25	61.8	19.3	51.4	48.6
120	0.125	60.1	18.8	70.2	29.8
230	0.0625	50.4	15.8	86.0	14.0
Pan	0	44.9	14.0	100.0	0.0

Table A16. Results from grain size analysis of sample 10x @ 42' from borehole 10x using the sieving method.

Sample I.D.:	10x @ 42'	Logging description:		wet very fine-fine sand	
Sample Depth (ft):	42	Dry sample weight (g):		336.3	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0.0	0.0	0.0	100.0
10	2	0.0	0.0	0.0	100.0
18	1	0.0	0.0	0.0	100.0
35	0.5	0.2	0.1	0.1	99.9
60	0.25	0.4	0.1	0.2	99.8
120	0.125	14.2	4.2	4.4	95.6
230	0.0625	166.2	49.5	53.9	46.1
Pan	0	154.8	46.1	100.0	0.0

Table A17. Results from grain size analysis of sample 10x @ 55' from borehole 10x using the sieving method.

Sample I.D.:	10x @ 55'	Logging description:		wet very fine-fine sand w/pebbles	
Sample Depth (ft):	55	Dry sample weight (g):		391.5	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	0.0	0.0	0.0	100.0
10	2	0.0	0.0	0.0	100.0
18	1	2.7	0.7	0.7	99.3
35	0.5	1.6	0.4	1.1	98.9
60	0.25	2.0	0.5	1.6	98.4
120	0.125	6.3	1.6	3.2	96.8
230	0.0625	69.0	17.7	20.9	79.1
Pan	0	308.9	79.1	100.0	0.0

Table A18. Results from grain size analysis of sample 10x @ 80' from borehole 10x using the sieving method.

Sample I.D.:	10x @ 80'	Logging description:		very wet pebbly fine sand	
Sample Depth (ft):	80	Dry sample weight (g):		1289.9	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	504.3	39.2	39.2	60.8
10	2	112.8	8.8	47.9	52.1
18	1	112.4	8.7	56.7	43.3
35	0.5	132.8	10.3	67.0	33.0
60	0.25	185.7	14.4	81.4	18.6
120	0.125	114.2	8.9	90.3	9.7
230	0.0625	48.4	3.8	94.0	6.0
Pan	0	77.1	6.0	100.0	0.0

Table A19. Results from grain size analysis of sample 10x @ 96' from borehole 10x using the sieving method.

Sample I.D.:	10x @ 96'	Logging description:		moist pebble-cobble gravel	
Sample Depth (ft):	96	Dry sample weight (g):		990.4	
US Sieve No.	Sieve Size (mm)	Weight retained (g)	% retained	Cumulative %	% finer than
5	4	726.7	73.4	73.4	26.6
10	2	86.2	8.7	82.1	17.9
18	1	42.4	4.3	86.4	13.6
35	0.5	24.2	2.4	88.8	11.2
60	0.25	19.6	2.0	90.8	9.2
120	0.125	24.5	2.5	93.3	6.7
230	0.0625	26.8	2.7	96.0	4.0
Pan	0	40.0	4.0	100.0	0.0

Table A20. Results from grain size analysis of sample 10b-1 from borehole 10b using the Mastersizer method.

Sample I.D.:		10b-1
Sample Depth (ft):		63.5-64
Logging Description:		moist fine-medium sand
Sub Sample Weight (g)		1.9
Size (um)	**Size (mm)**	**% finer than**
0.55	0.00055	0
0.631	0.000631	0.01
0.724	0.000724	0.06
0.832	0.000832	0.13
0.955	0.000955	0.21
1.096	0.001096	0.28
1.259	0.001259	0.35
1.445	0.001445	0.42
1.66	0.00166	0.5
1.905	0.001905	0.58
2.188	0.002188	0.67
2.512	0.002512	0.76
2.884	0.002884	0.86
3.311	0.003311	0.96
3.802	0.003802	1.08
4.365	0.004365	1.2
5.012	0.005012	1.34
5.754	0.005754	1.48
6.607	0.006607	1.63
7.586	0.007586	1.79
8.71	0.00871	1.98
10	0.01	2.21
11.482	0.011482	2.51
13.183	0.013183	2.86
15.136	0.015136	3.4
17.378	0.017378	4.06
19.953	0.019953	4.91
22.909	0.022909	5.96
26.303	0.026303	7.21
30.2	0.0302	8.67
34.674	0.034674	10.33
39.811	0.039811	12.21

Size (um)	Size (mm)	% finer than
45.709	0.045709	14.36
52.481	0.052481	16.86
60.256	0.060256	19.84
69.183	0.069183	23.46
79.433	0.079433	27.88
91.201	0.091201	33.23
104.713	0.104713	39.52
120.226	0.120226	46.69
138.038	0.138038	54.52
158.486	0.158486	62.67
181.97	0.18197	70.73
208.93	0.20893	78.24
239.883	0.239883	84.83
275.423	0.275423	90.21
316.228	0.316228	94.29
363.078	0.363078	97.09
416.869	0.416869	98.79
478.63	0.47863	99.68
549.541	0.549541	99.95
630.957	0.630957	100
724.436	0.724436	100

Table A21. Results from grain size analysis of sample 10b-2 from borehole 10b using the Mastersizer method.

Sample I.D.:		10b-2
Sample Depth (ft):		110.67-111.3
Logging Description:		saturated fine-medium sand
Sub Sample Weight (g)		2.1
Size (um)	**Size (mm)**	**% finer than**
0.55	0.00055	0
0.631	0.000631	0
0.724	0.000724	0.04
0.832	0.000832	0.11
0.955	0.000955	0.19
1.096	0.001096	0.27
1.259	0.001259	0.36
1.445	0.001445	0.46
1.66	0.00166	0.56
1.905	0.001905	0.68
2.188	0.002188	0.8
2.512	0.002512	0.93
2.884	0.002884	1.06
3.311	0.003311	1.21
3.802	0.003802	1.37
4.365	0.004365	1.54
5.012	0.005012	1.72
5.754	0.005754	1.91
6.607	0.006607	2.1
7.586	0.007586	2.3
8.71	0.00871	2.5
10	0.01	2.7
11.482	0.011482	2.91
13.183	0.013183	3.14
15.136	0.015136	3.4
17.378	0.017378	3.73
19.953	0.019953	4.12
22.909	0.022909	4.6
26.303	0.026303	5.16
30.2	0.0302	5.77
34.674	0.034674	6.36
39.811	0.039811	6.98

Size (um)	Size (mm)	% finer than
45.709	0.045709	7.51
52.481	0.052481	8
60.256	0.060256	8.53
69.183	0.069183	9.31
79.433	0.079433	10.62
91.201	0.091201	12.83
104.713	0.104713	16.32
120.226	0.120226	21.43
138.038	0.138038	28.31
158.486	0.158486	36.9
181.97	0.18197	46.82
208.93	0.20893	57.48
239.883	0.239883	68.1
275.423	0.275423	77.87
316.228	0.316228	86.11
363.078	0.363078	92.4
416.869	0.416869	96.64
478.63	0.47863	99.02
549.541	0.549541	99.92
630.957	0.630957	100
724.436	0.724436	100

Table A22. Results from grain size analysis of sample 10b-4 from borehole 10b using the Mastersizer method.

Sample I.D.:		10b-4
Sample Depth (ft):		113.5-114
Logging Description:		Fine-medium sand, possible organics
Sub Sample Weight (g)		2
Size (um)	**Size (mm)**	**% finer than**
0.55	0.00055	0
0.631	0.000631	0
0.724	0.000724	0
0.832	0.000832	0
0.955	0.000955	0
1.096	0.001096	0.02
1.259	0.001259	0.09
1.445	0.001445	0.16
1.66	0.00166	0.24
1.905	0.001905	0.33
2.188	0.002188	0.43
2.512	0.002512	0.54
2.884	0.002884	0.66
3.311	0.003311	0.8
3.802	0.003802	0.95
4.365	0.004365	1.12
5.012	0.005012	1.3
5.754	0.005754	1.5
6.607	0.006607	1.71
7.586	0.007586	1.92
8.71	0.00871	2.15
10	0.01	2.38
11.482	0.011482	2.65
13.183	0.013183	2.95
15.136	0.015136	3.34
17.378	0.017378	3.81
19.953	0.019953	4.4
22.909	0.022909	5.09
26.303	0.026303	5.87
30.2	0.0302	6.67
34.674	0.034674	7.43

Size (um)	Size (mm)	% finer than
39.811	0.039811	8.07
45.709	0.045709	8.56
52.481	0.052481	8.94
60.256	0.060256	9.34
69.183	0.069183	10.05
79.433	0.079433	11.43
91.201	0.091201	13.95
104.713	0.104713	18.02
120.226	0.120226	23.94
138.038	0.138038	31.74
158.486	0.158486	41.2
181.97	0.18197	51.75
208.93	0.20893	62.64
239.883	0.239883	73.01
275.423	0.275423	82.09
316.228	0.316228	89.36
363.078	0.363078	94.59
416.869	0.416869	97.86
478.63	0.47863	99.58
549.541	0.549541	99.97
630.957	0.630957	100
724.436	0.724436	100

Table A23. Results from grain size analysis of sample 10b-6 from borehole 10b using the Mastersizer method.

Sample I.D.:		10b-6
Sample Depth (ft):		159
Logging Description:		coarse sand
Sub Sample Weight (g)		2
Size (um)	**Size (mm)**	**% finer than**
0.417	0.000417	0
0.479	0.000479	0.06
0.55	0.00055	0.14
0.631	0.000631	0.23
0.724	0.000724	0.33
0.832	0.000832	0.44
0.955	0.000955	0.56
1.096	0.001096	0.7
1.259	0.001259	0.86
1.445	0.001445	1.03
1.66	0.00166	1.21
1.905	0.001905	1.41
2.188	0.002188	1.62
2.512	0.002512	1.84
2.884	0.002884	2.08
3.311	0.003311	2.33
3.802	0.003802	2.6
4.365	0.004365	2.9
5.012	0.005012	3.22
5.754	0.005754	3.58
6.607	0.006607	3.98
7.586	0.007586	4.43
8.71	0.00871	4.94
10	0.01	5.51
11.482	0.011482	6.15
13.183	0.013183	6.86
15.136	0.015136	7.65
17.378	0.017378	8.51
19.953	0.019953	9.45
22.909	0.022909	10.47
26.303	0.026303	11.54
30.2	0.0302	12.63
34.674	0.034674	13.91

Size (um)	Size (mm)	% finer than
39.811	0.039811	15.23
45.709	0.045709	16.68
52.481	0.052481	18.33
60.256	0.060256	20.23
69.183	0.069183	22.48
79.433	0.079433	25.15
91.201	0.091201	28.28
104.713	0.104713	31.9
120.226	0.120226	35.99
138.038	0.138038	40.5
158.486	0.158486	45.38
181.97	0.18197	50.56
208.93	0.20893	55.97
239.883	0.239883	61.59
275.423	0.275423	67.35
316.228	0.316228	73.16
363.078	0.363078	78.88
416.869	0.416869	84.3
478.63	0.47863	89.16
549.541	0.549541	93.23
630.957	0.630957	96.35
724.436	0.724436	98.46
831.764	0.831764	99.64
954.993	0.954993	100
1096.478	1.096478	100

Table A24. Results from grain size analysis of sample 10x @ 42' from borehole 10x using the Mastersizer method.

Sample I.D.:		10x @ 42'
Sample Depth (ft):		42
Logging Description:		wet very fine-fine sand
Sub Sample Weight (g)		1.1
Size (um)	**Size (mm)**	**% finer than**
0.417	0.000417	0
0.479	0.000479	0
0.55	0.00055	0.07
0.631	0.000631	0.17
0.724	0.000724	0.29
0.832	0.000832	0.42
0.955	0.000955	0.55
1.096	0.001096	0.69
1.259	0.001259	0.83
1.445	0.001445	0.97
1.66	0.00166	1.11
1.905	0.001905	1.26
2.188	0.002188	1.42
2.512	0.002512	1.59
2.884	0.002884	1.76
3.311	0.003311	1.93
3.802	0.003802	2.11
4.365	0.004365	2.31
5.012	0.005012	2.52
5.754	0.005754	2.76
6.607	0.006607	3.04
7.586	0.007586	3.37
8.71	0.00871	3.79
10	0.01	4.3
11.482	0.011482	4.92
13.183	0.013183	5.67
15.136	0.015136	6.56
17.378	0.017378	7.63
19.953	0.019953	8.91
22.909	0.022909	10.47
26.303	0.026303	12.4

Size (um)	Size (mm)	% finer than
30.2	0.0302	14.82
34.674	0.034674	17.89
39.811	0.039811	21.77
45.709	0.045709	26.6
52.481	0.052481	32.45
60.256	0.060256	39.31
69.183	0.069183	47.03
79.433	0.079433	55.33
91.201	0.091201	63.82
104.713	0.104713	72.05
120.226	0.120226	79.55
138.038	0.138038	85.98
158.486	0.158486	91.09
181.97	0.18197	94.85
208.93	0.20893	97.35
239.883	0.239883	98.83
275.423	0.275423	99.56
316.228	0.316228	99.83
363.078	0.363078	99.84
416.869	0.416869	99.84
478.63	0.47863	99.84
549.541	0.549541	99.85
630.957	0.630957	99.89
724.436	0.724436	99.94
831.764	0.831764	99.98
954.993	0.954993	100
1096.478	1.096478	100

Table A25. Results from grain size analysis of sample 10x @ 55' from borehole 10x using the Mastersizer method.

Sample I.D.:		10x @ 55'
Sample Depth (ft):		55
Logging Description:		wet very fine-fine sand w/pebbles
Sub Sample Weight (g)		1
Size (um)	Size (mm)	% finer than
0.275	0.000275	0
0.316	0.000316	0.01
0.363	0.000363	0.1
0.417	0.000417	0.21
0.479	0.000479	0.35
0.55	0.00055	0.52
0.631	0.000631	0.71
0.724	0.000724	0.93
0.832	0.000832	1.16
0.955	0.000955	1.42
1.096	0.001096	1.69
1.259	0.001259	1.67
1.445	0.001445	2.25
1.66	0.00166	2.54
1.905	0.001905	2.83
2.188	0.002188	3.12
2.512	0.002512	3.41
2.884	0.002884	3.7
3.311	0.003311	4.01
3.802	0.003802	4.35
4.365	0.004365	4.72
5.012	0.005012	5.14
5.754	0.005754	5.62
6.607	0.006607	6.17
7.586	0.007586	6.8
8.71	0.00871	7.52
10	0.01	8.35
11.482	0.011482	9.35
13.183	0.013183	10.58
15.136	0.015136	12.16
17.378	0.017378	14.22
19.953	0.019953	16.92

Size (um)	Size (mm)	% finer than
22.909	0.022909	20.42
26.303	0.026303	27.84
30.2	0.0302	30.35
34.674	0.034674	36.84
39.811	0.039811	44.23
45.709	0.045709	52.58
52.481	0.052481	60.65
60.256	0.060256	68.92
69.183	0.069183	76.66
79.433	0.079433	83.51
91.201	0.091201	89.19
104.713	0.104713	93.53
120.226	0.120226	96.59
138.038	0.138038	98.5
158.486	0.158486	99.53
181.97	0.18197	99.91
208.93	0.20893	100
239.883	0.239883	100

The results from the grain size analysis were imported into SVSOILS (SoilVision Systems Ltd., 2017), and tools within SVSOILS were used to estimate the saturated hydraulic conductivity of the samples. The Kozeny-Carman equation within SVSOILS was used for samples 10b-1 to 10b-6, 10x @ 42', and 10x @ 55', and the Terzaghi equation was used for samples 10x @ 80' and 10x @ 96'. The Kozeny-Carman derivation is a widely accepted and commonly used estimation of hydraulic conductivity based on the properties of the grains (Odong, 2007); however, is not suitable for large-grained material, while the Terzaghi equation is.

Both the Kozeny-Carman and Terzaghi equations in SVSOILS require inputs of porosity, specific gravity, and dry bulk density, and use the effective grain size diameter in their determination of hydraulic conductivity. Based on the lithologic description of the samples from core logging (coarse-very fine sand), specific gravity was input at 2.65, porosity at 35%, and bulk density at 1600 kg/m^3 for coarse-medium sand, 1500 kg/m^3 for medium-fine sand, and 1400 kg/m^3 for fine-very fine sand. SVSOILS also applies a unimodal or bimodal fit to the grain size distribution data, which allows the estimation of effective grain size if there are gaps in the measured data.

The results for saturated hydraulic conductivities for all ten samples are shown in Table A26. According to these results, the lithologic description “sand” resulted in a hydraulic conductivity value that ranged over orders of magnitude. However, coarser grain sizes tend to have higher hydraulic conductivity values compared to finer grain sizes, as expected. The range of hydraulic conductivity values for the samples analyzed fall within ranges in the literature (Freeze and Cherry, 1979): Very fine-fine sands (silty sands): 10^{-7}-10^{-4} m/s; fine-coarse sands (clean sands): 10^{-5}-10^{-3} m/s; pebbly sands-gravels: 10^{-3}-10^{-1} m/s. The estimated hydraulic conductivity value for 10x @ 96’ is quite high and may not be accurate as this was a fairly poorly sorted sample.

Table A26. Saturated hydraulic conductivity values determined for samples collected from boreholes 10b and 10x in Northeast BC. Method of analysis used in SVSOILS (SoilVision Systems Ltd., 2017) is included.

Sample I.D.	K_{sat} (m/s)	Lithologic Description from Drilling	Method
10b-1	1.04×10^{-5}	moist fine - medium sand	Kozeny
10b-2	1.38×10^{-5}	saturated fine - medium sand	Kozeny
10b-3	1.15×10^{-4}	dry fine - medium sand	Kozeny
10b-4	1.97×10^{-5}	fine - medium sand, possible organics	Kozeny
10b-5	1.17×10^{-4}	medium sand	Kozeny
10b-6	2.86×10^{-4}	coarse sand	Kozeny
10x @ 42'	3.32×10^{-6}	wet very fine - fine sand	Kozeny
10x @ 55'	9.01×10^{-7}	wet very fine - fine sand w/ pebbles	Kozeny
10x @ 80'	6.16×10^{-3}	very wet pebbly fine sand	Terzaghi
10x @ 96'	1.16×10^{-1}	moist pebble - cobble gravel	Terzaghi

While obtaining samples for grain size distribution and employing empirical equations to estimate hydraulic conductivity is a common practice, empirical equations can often correlate poorly to measured hydraulic conductivity values (Rosas et al., 2014). Ideally, field-measured hydraulic conductivity values should be used when available. No field measurements of hydraulic conductivity were available in the study area; therefore, results from the grain size analysis, estimates reported in consulting reports (BGC Engineering Inc. and Hemmera Envirochem Inc., 2012) and literature values (Freeze and Cherry, 1979) were tested and applied to units within the numerical models.