

FINAL REPORT

Hydrogeology and MODFLOW Modeling
HOWSE PROPERTY

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1 INTRODUCTION

Howse Minerals Limited (HML) holds mineral claims of the unmined Howse deposit which is of Direct Shipping Ore (DSO) type. HML needs to apply for regulatory and environmental approvals to start the mining of the deposit. Hydrogeological study is part of the permitting process. HML granted a first mandate to Golder Associates in 2013. Geofor environnement (Geofor) was subsequently mandated in 2014 to pursue the initiated hydrogeological study. In 2015, Geofor completed the study started in 2014. This report synthesizes and interprets the results of all activities carried up to date.

1.1 LOCATION

The Howse deposit is located about 30 km north of Schefferville, which is 570 km north of Sept-Îles, Québec. The Municipality of Schefferville is accessible via the Tshuetin railroad that offers freight/passenger rail service from Sept-Îles. Schefferville is also serviced by an airport with daily flights to Sept-Îles and Montréal.

An old IOCC mine haul road that is well maintained connects Schefferville to within 1 km of the Howse deposit. The remaining distance is covered by narrow trails that are easily navigable with 4x4 pickup trucks. The TSMC camp site is located along the road from Schefferville, about 7 km south of the Howse deposit. Figure 1 shows the location of the deposit within the general area.

1.2 CHRONOLOGY AND RATIONALE OF THE HYDROGEOLOGICAL CAMPAIGNS

All wells or boreholes used for the hydrogeological study by Geofor are located on Figure 2 and briefly described in Table 1.

A part of the data collected by Golder Associates and presented integrally in their report of Appendix VI was incorporated in this report. The Golder's drilling campaign started on November 14, 2013 and ended on December 17, 2013 and was comprised of the drilling of the following boreholes located in Figure 2 for the boreholes integrated in this report and in Figure 1 of Appendix VI for the others:

- 3 boreholes drilled into bedrock with a reverse circulation (RC) drilling rig (HW-RC13-001, HW-RC13-002 and HW-RC13-003);
- 1 boreholes drilled into bedrock with a diamond drilling rig (DD) which was submitted to packer tests (HW-GT-13-001);
- 1 borehole drilled in overburden only with a DD rig (HW-BH-13-01).

This allowed establishing the 2014 hydrogeological program which was comprised of the drilling of 3 wells into the overburden to the rock interface (HW-RC14-WE01OB, HW-RC14-WE02OB, HW-RC14-WE03OB) and of 3 wells into the rock at a planned depth of 180 m below ground surface of the Howse (HW-RC14-WE01R, HW-RC14-WE02R, HW-RC14-WE03R).

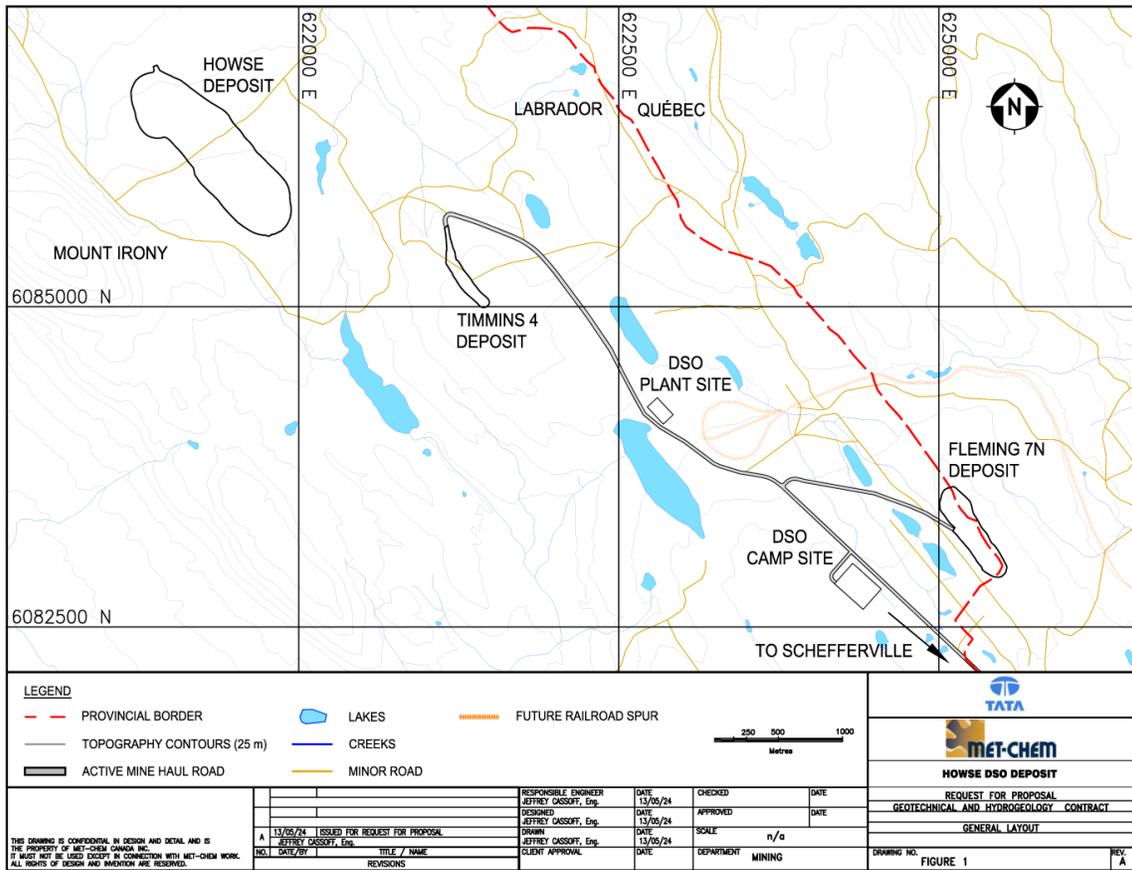


Figure 1: Location of the Howse Deposit (Figure from MET-CHEM)

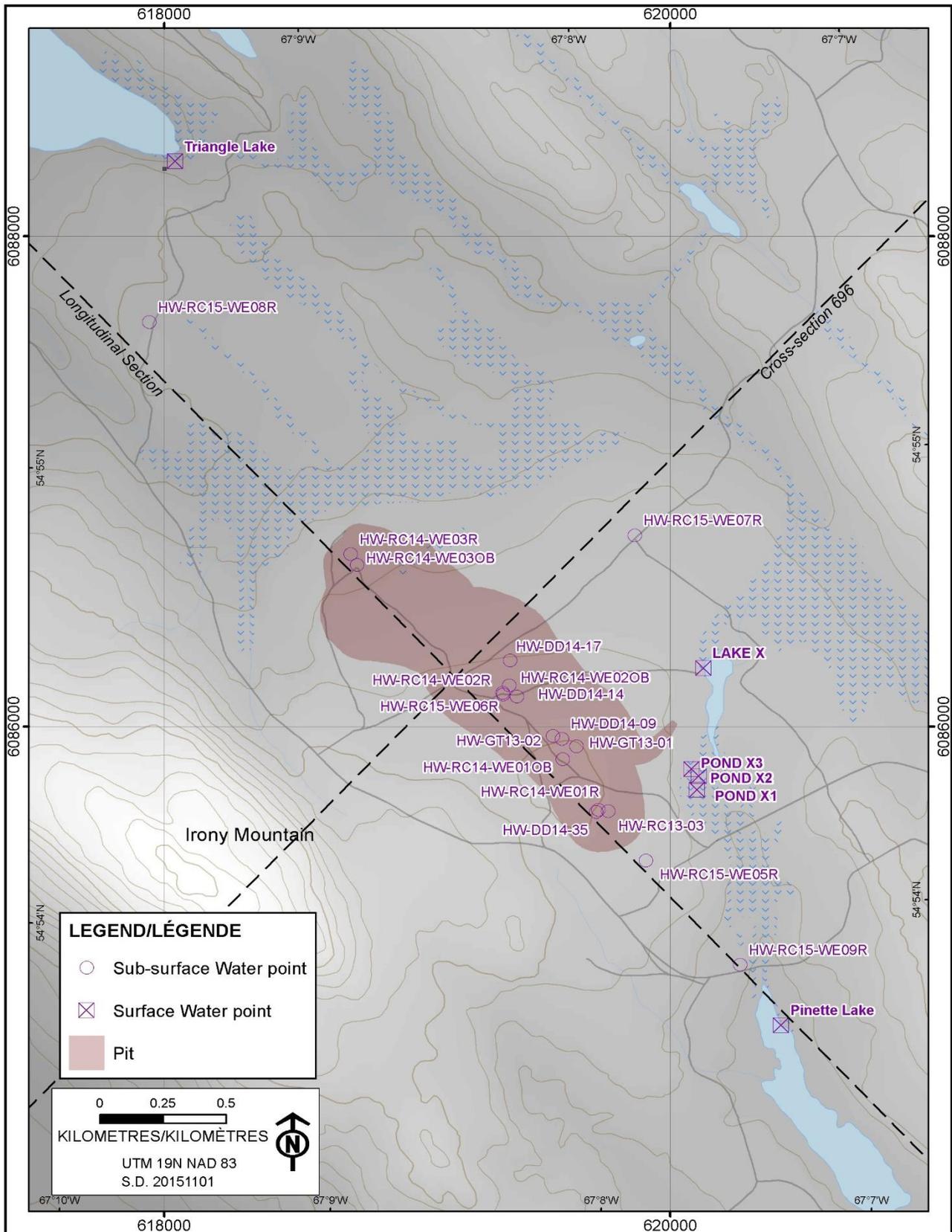


Figure 2: Location of Wells, Piezometers and Boreholes of the Howse Area

Table 1: List of Wells, Piezometers and Boreholes in the Howse and TSMC/ DSO3 Area

HOLE ID.	Origin	Well Ø (mm)	Easting (mE) zone 19	Northing (mN) zone 19	Elevation (TOC) (m)	final depth (m)	water depth (toc) Nov. 4, 2015 (m)	Groundwater Elevation (m)	Final diameter mm	Construction End Date (m)
WELLS AND PIEZOMETERS OF THE HOWSE AREA										
HW-RC14-WE01R	Geofor, 2014	152	619715	6085660	684.173	164.00	88.76	595.41	152	2014-09-13
HW-RC14-WE02R	Geofor, 2014	203	619338	6086138	671.032	182.00	90.05	580.98	178	2014-09-24
HW-RC14-WE03R	Geofor, 2014	152	618737	6086703	640.145	180.00	67.32	572.83	152	2014-10-19
HW-RC15-WE05R	Geofor, 2015	152	619903	6085454	679.07	181.4	76.35	602.72	152	2015-08-28
HW-RC15-WE06R	Geofor, 2015	305	619339	6086132	672.30	168.2	90.48	581.82	305	2015-09-02
HW-RC15-WE07R	Geofor, 2015	203	619859	6086780	656.21	97.6	58.37	597.84	203	2015-09-11
HW-RC15-WE08R	Geofor, 2015	184	617942	6087650	613.07	73.2	44.53	568.54	203	2015-09-10
HW-RC15-WE09R	Geofor, 2015	184	620275	6085028	646.46	97.6	39.39	607.07	203	2105-09-08
HW-RC14-WE01OE	Geofor, 2014	203	619575	6085867	684.368	40	38.89	645.48	203	2014-09-03
HW-RC14-WE02OE	Geofor, 2014	203	619363	6086168	671.051	28.5	dry	dry	203	2014-09-01
HW-RC14-WE03OE	Geofor, 2014	203	618762	6086659	644.937	35	dry	dry	203	2014-08-29
HW-DD14-09	TSMC, 2014	123	619571	6085950	681.599	150.00	95.08	586.52	83	2014-08-20
HW-DD14-14	TSMC, 2014	123	619393	6086123	674.179	102.00	89.5	584.68	83	2014-08-27
HW-DD14-17	TSMC, 2014	123	619367	6086270	665.707	101.00	84.84	580.87	83	2014-08-27
HW-DD14-35	TSMC, 2014	123	619706	6085652	684.722	94.50	86.41	598.31	83	2014-10-09
HW-RC13-03	Golder, 2013	123	619755	6085655	683.449	180.00	87.37	596.08	83	2013-12-07
HW-GT13-01	Golder, 2014	123	619628	6085922		184.40			83	2013-12-03
HW-GT13-02	Golder, 2015	123	619535	6085961		183.90			83	2013-12-12
WELLS AND PIEZOMETERS OF THE TSMC/DSO3 AREA										
11T6GW-01	TSMC, 2011	152	621425	6085872	665.130	92.40		622.43	152	2011-10-09
11T6GW-02	TSMC, 2011	152	621746	6085581	684.600	103.70		635.82	152	2011-10-08
11T6GW-03	TSMC, 2011	152	622131	6085690	704.150	103.70		639.65	152	2011-10-06
11T4GW-02	TSMC, 2011	152	620945	6085630	677.97	97.6		616.84	152	2011-10-11
Plant Well #1	TSMC, 2011	152	622800	6084167	680.55	103.7		652.63	152	2011-10-14
Plant Well B1	TSMC, 2011	152	622843	6084242	681.78	97.6		663.40	152	2011-10-30
10-WTH-02	TSMC, 2010	152	622372	6084662	693.04	140.2		659.71	152	2010-10-05
10-WTH-01A	TSMC, 2010	152	622376	6085195	699.29	79.25		648.19	152	2010-10-29
10-WTH-01	TSMC, 2010	152	622387	6085191	699.05	73.15		645.25	152	2010-10-06
10-WTH-03	TSMC, 2010	152	622639	6084499	682.81	94.5		650.10	152	2010-10-07
TI3010H	TSMC, 2009	152	624039	6084096	694.13	74		674.80	152	2009-10-27
TI3011H	TSMC, 2009	152	624021	6084085	694.46	110		677.77	152	2009-10-31
10-WTH-06	TSMC, 2010	152	625028	6083256	739.14	134.1		686.25	152	2010-11-05
10-WTH-06A	TSMC, 2010	152	625032	6083251	739.23	140.2		684.48	152	2010-11-12
SURFACE WATER IN THE HOWSE AREA										
LAKE X			6086239	620132				658.61		
POND X1			6085741	620106				661.82		
POND X2			6085797	620114				661.96		
POND X3			6085827	620085				662.46		
Pinette Lake			6084782	620439				635.73		
Triangle Lake			6088305	618045				584.2		

All wells were drilled into the long axis of deposit. HW-RC14-WE01R and HW-C14-WE03R, were submitted to pumping tests. Some piezometers were installed in mineral exploration diamond drill holes (HW-DD14-09, HW-DD14-14, HW-DD14-17, HW-DD14-35).

The available hydrogeological data from previous studies was gathered in order to serve to establish a hydrogeological model and to simulate mine dewatering including impact on groundwater and surface water. The modeling part was subcontracted to SNC-Lavalin. The field work was completed in September and October 2014.

The 2015 program allowed obtaining new data on the aquifer around the deposit and to better understand the groundwater flow direction and, for some, the relation with surface water. The results obtained were also used by SNC-Lavalin to update the 2014 numerical model.

Five new wells were drilled in 2015 (HW-RC15-WE05R to HW-RC15-WE09R). Except for HW-RC15-WE06, which is in the middle of the long axis of the deposit, all wells are outside the deposit. HW-RC15-WE05R, HW-RC15-WE07R, HW-RC15-WE08R and HW-RC15-WE09R are located along the long axis of the iron formation containing the deposit. This axis corresponds to the dominant structural and geological northwest-southeast trend of the Labrador Through. Numerous thrust faults which are favoring the groundwater flow are also oriented in this direction. Well HW-RC15-WE07R was drilled in order to obtain information on groundwater on the northeast side of the deposit.

HW-RC15-06R, HW-RC15-07 and HW-RC15-08R were submitted to pumping tests. Well HW-RC14-WE02R, which collapsed in 2014, was clean to a certain depth with the drill and equipped as a piezometer to be used as observation well during the pumping of the HW-RC15-WE06R. The field work was performed in September 2015.

This report presents the compilation of previous knowledge and findings of all previous activities. The report presents the regional and specific geology and hydrogeology of the sector and the interpretation of the field work carried out. An updated version of the modelling with the new drilling and pumping test is also presented.

2 METHODOLOGY

2.1 DRILLING

In 2013, Golder Associate contracted Major drilling and Cabo Drilling to drill their hydrogeological holes in reverse circulation mode using a Schramm model T450GT drill rig. The 2014 drilling, supervised by Geofor, was carried out by the same drilling company using the same drill rig but operated in direct rotary mode. The 2015 drilling campaign was carried out by les Forages LBM with a Foremost DR-24 drill rig.

The often much altered rock in the Howse area is non-cohesive till important depth. Drilling with a water drill rig into the rock in the Howse area must be conducted using casing until the cohesion of the rock is judge sufficient by the driller to be continued without casing or sometime till the end of the hole. The presence of casing blocks water bearing zones, if any, impeding the entrance of the groundwater in the well. The water bearing zone must then be identified and located in order to slot the casing in place with a special tool to let the water flow into the well. In order to reach the planned depth in unstable rock, the well is initiated with a casing of larger diameter which is decrease when the hole reaches a depth where the casing cannot be driven deeper.

All wells and piezometers and some elements of the hydrographic network were surveyed with a DGPS and integrated in the same official geodetic reference system. The details of construction of each well and piezometer drilled in the rock with the simplified geology met by the drill are shown in Appendix I in Figures A1-1 to A1-15 only for the wells of the Howse area. The geological logs of the overburden holes are shown in Appendix II.

Drilling was supervised by a hydrogeologist or a geologist. During drilling, the water bearing zones were identified and their capacities were evaluated by the driller. This was done by injecting compressed air in the bottom of the well through the drilling rods and measuring the volume of water blown at surface by period of time. At the end of the hole, the casing was slotted, if necessary, along the water bearing zones to allow the entrance of the water

2.2 GROUNDWATER FLOW DETERMINATION IN THE GOODREAM BASIN

All existing hydrogeological data on wells and piezometers in Howse and TSMC/DSO3 area were used to define the groundwater flow in the Goodream basin in which is located the Howse deposit. The TSMC/DSO sector is a mining area containing DSO deposits (mine or unmined) circling the TSMC plant site located on Figure 1. The Table 1 shows the main specification for all used wells which locations are presented in Figure 2 for the Howse area and, in Figure 3 for the TSMC/DSO3 area.

Except for the three wells with an identification name ending by OB, all others were drilled into the bedrock. The boreholes drilled for mineral exploration and equipped with piezometers contain the letters DD for Diamond Drill in their identification name. These boreholes are mainly useful to obtain an approximation of the elevation of the water table at these locations. They were not used to perform slug tests because polymers, used for their drilling, were expected to block partially the water bearing zones and skew the results of permeability tests.

2.3 PUMPING TEST

Pumping tests were conducted on the two usable wells HW-RC14-WE01R and HW-RC14-WE03R in 2014 and on HW-RC15-WE06R, HW-RC15-WE07R and HW-RC15-WE08R in 2015. Wells were successively submitted to step tests and to a constant flow pumping tests following the specifications shown in Table 2. Depending upon the expected flow rate and the diameter of the well, a submersible pump of 10 HP or 40 HP, powered electrically by a diesel generator, was installed into the tested well. An initial step-drawdown pumping test was performed to estimate yields, to assess well efficiency and to determine the optimum flow rate for a constant pumping test. The specification of the step tests are shown in Table 2. A step-drawdown pumping test is performed by pumping at several successively higher rates for equal period of time and noting the effect on drawdown of the phreatic level.

After the recovery from the step test, a constant flow rate pumping test was performed on the wells to estimate their long-term capacity and some of their hydrogeological parameters. The pumping rates for this test were based on the results of the step-drawdown pumping tests. The wells HW-DD14-35 and HW-RC13-03 were used as observation wells during the pumping of HW-RC14-WE01R. No observation well was available for HW-RC14-03R since the existing one was accidentally destroyed by the machinery prior to the test. Well HW-RC14-WE02R was used as observation well during the pumping of HW-RC15-WE06R.

Table 2: Specification Table of the Pumping Tests

Well	Test duration	Status	Date and time	Pumping rate (m ³ /d)	Static Level (m bgs)*	Final Drawdown (m)	Recovery Period (hour)	Residual drawdown (m)	Sampling time (hours)
HW-RC14-WE01R	1 hour steps	Pumping	2028-10-14	109/136/164/191	81.73	25.21	0.3	1.64	
HW-RC14-WE01R	72 hours	Pumping	2029-10-14	109	81.73	21.3	6	1.93	24/72
HW-RC14-DD35	72 hours	Piezo	2029-10-14	109	83.05	3.39	47	1.52	
HW-RC13-03	72 hours	Piezo	2029-10-14	109	84.36	1.63	49	0.66	
HW-RC14-WE03R	1 hour steps	Pumping	2023-10-14	273/354/436/458	67.88	4.91	0.5	0.02	
HW-RC14-WE03R	72 hours	Pumping	2023-10-14	436	67.88	4.34	0.5	0	24/72
HW-RC15-WE02R	72 Hours	Piezo of WE06R	21-09-2015 (12:05) to 25-09-2015 (9:40)			2.60	45.4	0.00	
HW-RC15-WE06R	1 hour steps	Pumping	19-09-2015 (10:03)	545/819/1090/1226/1363/1586	90.28	3,6/5,9/8,2/ 9,9/11,4/13,6	0.5		
HW-RC15-WE06R	93.5 hours	Pumping	21-09-2015 (11:59) to 25-09-2015 (9:28)	954	91,08	8.82	18.0	0.67	70
HW-RC15-WE07R	30 min steps	Pumping	15-09-2015	82/184/245/327/382	59.53	1,34/3,44/5,17/ 9,37/13,54	0.5	0.18	
HW-RC15-WE07R	24 Hours	Pumping	16-09-2015	303	59.53	10.91	0.5	0.17	24
HW-RC15-WE08R	30 min steps	Pumping	12-09-2015	180/245/329/407/466	45.1	3,31/5,36/7,93/ 10,66/13,66	0.2	0.20	
HW-RC15-WE08R	72 Hours	Pumping	13-09-2015 (10:03)	354	45.11	9.40			27

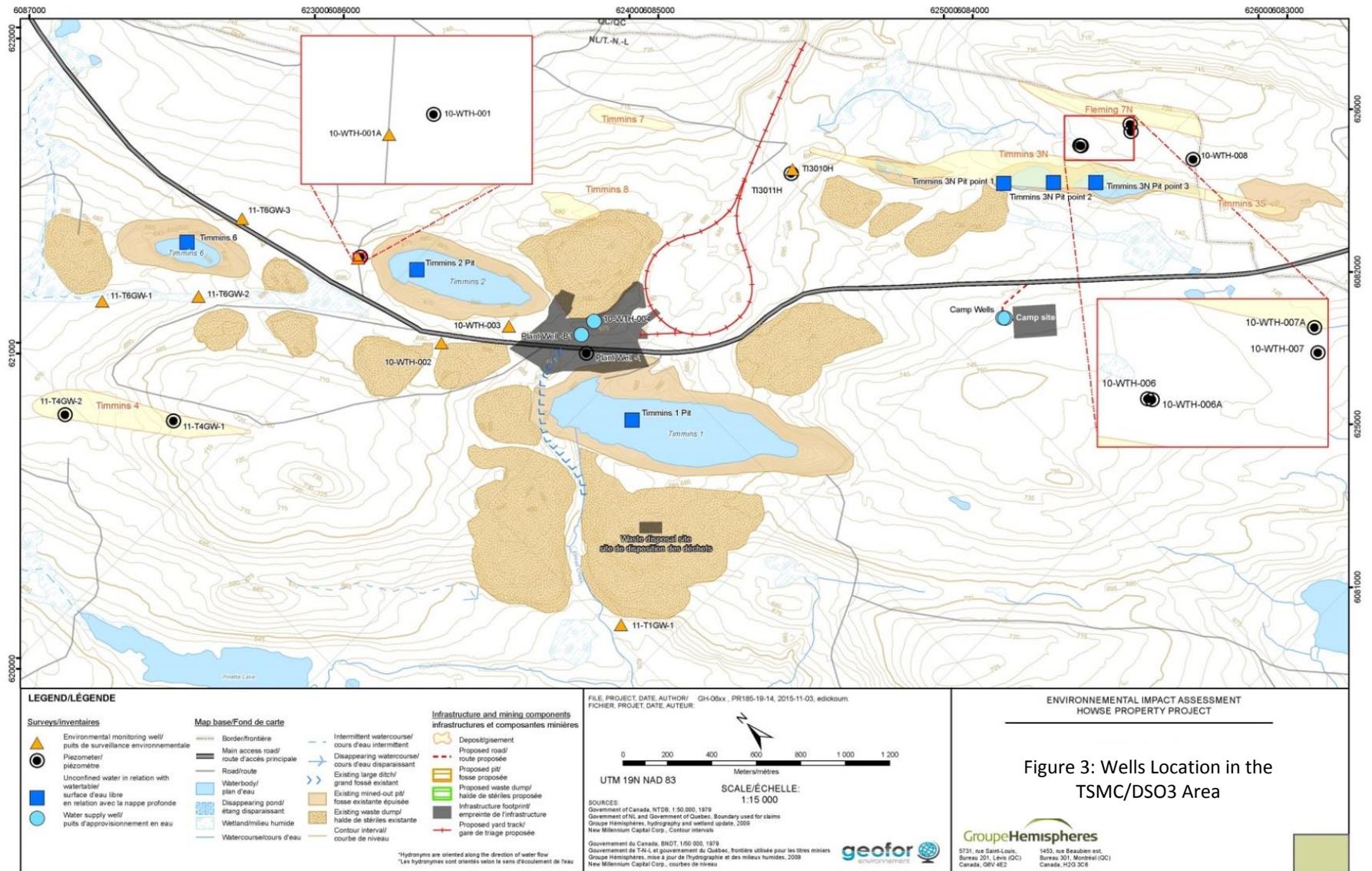


Figure 3: Wells Location in the TSMC/DSO3 Area

The water from the pumping tests was discharged at least 100 m downstream from the wellhead to prevent artificial recharge. The phreatic levels of the water during tests were recorded automatically at specific time interval by level loggers installed in the wells. Some manual readings were periodically taken with a water level tape for verification.

The 2015 pumping test data (water level drawdown versus time) was compiled and analyzed by SNC Lavalin using Aquifer Test 2011.1. This software allows comparing curves obtained from field data with different theoretical analytical model. The analytical model chosen is the one showing the best fit with field data.

2.4 WATER WELL SAMPLING AND WATER CHARACTERIZATION

In situ readings of the pH, electrical conductivity and temperature were taken during the pumping tests with a multi-parameter instrument YSI pro 1030. Samples for laboratory analysis were taken in accordance with the USEPA-approved sampling protocol (USEPA, 1985) at the time following the beginning of pumping test indicated in Table 2. All samples were kept at 4°C in a cooler and shipped to Maxxam Laboratories of Quebec City in order to be received within 48 hrs from the time of sampling. The samples were analysed for parameters identified in Table 8 of Section 5.3.4 which presents the results of chemical analysis of the water quality. The list is comprised of all the parameters included in the environmental certificate of authorization delivered to TSMC by the government of Newfoundland and Labrador for the groundwater follow-up of the TSMC/DSO3 area near the Howse area.

2.5 DEWATERING SIMULATIONS

A numerical model was developed and used as a predictive tool to estimate preliminary groundwater dewatering rates. The model will also serve as the basis for dewatering wells optimization. The 3-D groundwater flow model was constructed using the numerical code Visual MODFLOW 2011.1 Pro, a widely used and well documented computer modelling program developed by the US Geological Survey.

The model was constructed and calibrated using available geologic, hydrogeologic and geomorphologic information. It was used to simulate baseline groundwater flow (conditions without pumping) and as a predictive tool to estimate preliminary groundwater dewatering in the area of the proposed open pit. The dewatering simulation was taking into account the last phase of the mining which represents the lowest mine floor (160 m below ground surface). The model allows an estimation of the dewatering flow rates and produces a representation of the piezometric map before and during the dewatering.

3 REGIONAL GEOLOGY

Figure 4 shows the surficial geology in the Howse and TSMC/DSO3 areas which is discussed in this section and locates the cross-section 696 and the longitudinal section located in Figure 2 and shown respectively in Figure 5 and 6. Those sections include the Howse deposit and the print foot of the planned pit. The formations names and numbers used in this section refer to the Wardle sequence shown in Table 3.

The geological setting of the Howse DSO Deposit is in the centre of the Labrador Trough Precambrian continental shelf sediment sequence. The area was compressed during the Hudsonian Orogeny causing tight synclinal folding and thrust faulting which controls the ore bodies (Figure 6). The DSO deposits were developed by weathering action during the Cretaceous.

3.1 LITHOLOGY

Table 3: Geological sequence of the Knob Lake Group

Wardle Map 85-5	Formation or Unit	Width* (m)	Main Rock Type
22	Montagnais	5 to 30	Diabase Dyke
Knob Lake Group			
12	Menihek	300+	Black shale
11	Sokoman	110	Iron Formation
9	Wishart	10 to 20	Quartzite, Arkose, Siltstone and Chert
5	Attikamagen	300+	Grey-green and Red-grey Argillite to Shale
Archean Basement			
1	Ashuanipi Complex		Granodioritic Gneiss

* The widths are given for unfolded formations. The width may vary in case of folding and faulting.

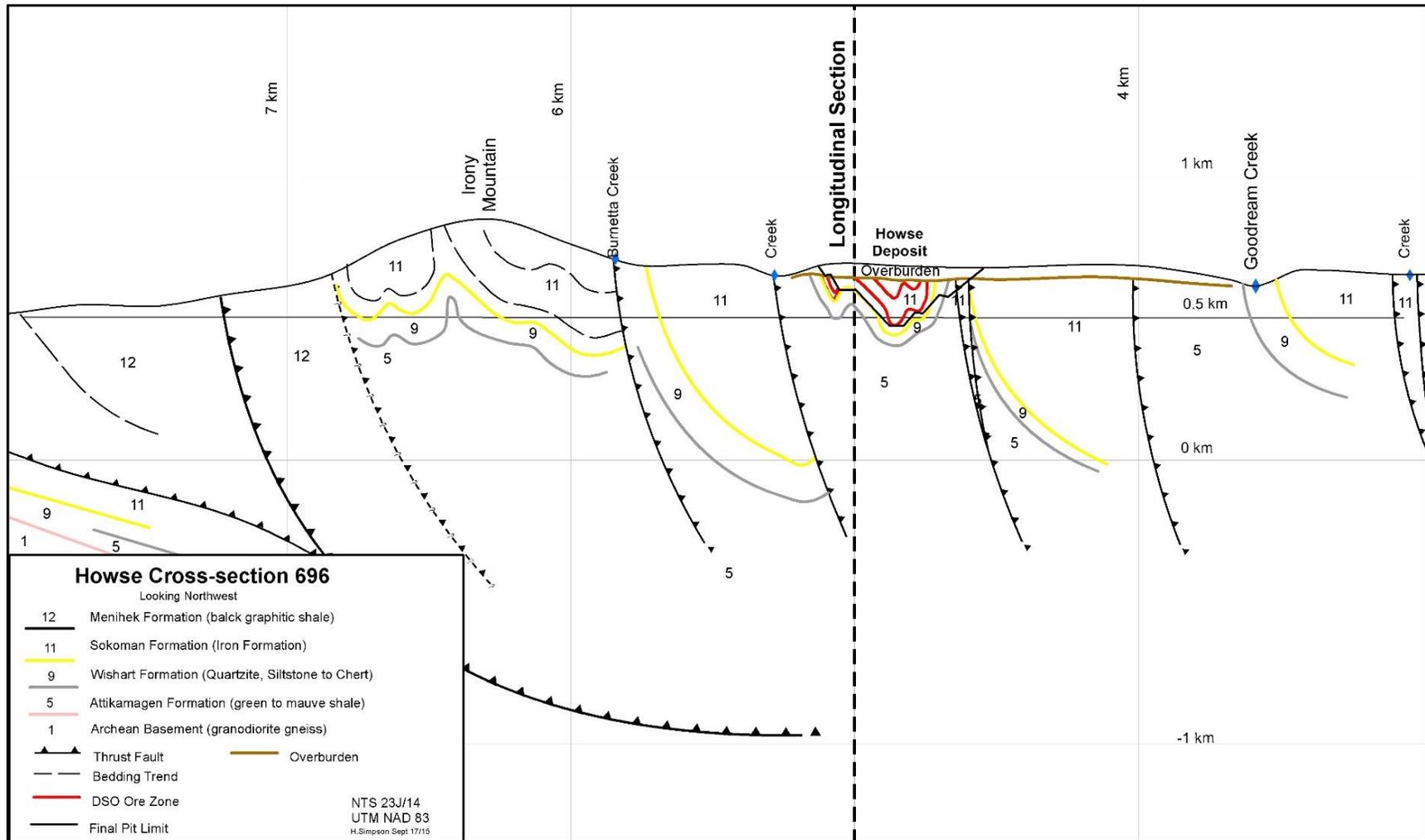


Figure 5: Howse Geological Cross-section 696 with the Profile of the planned pit

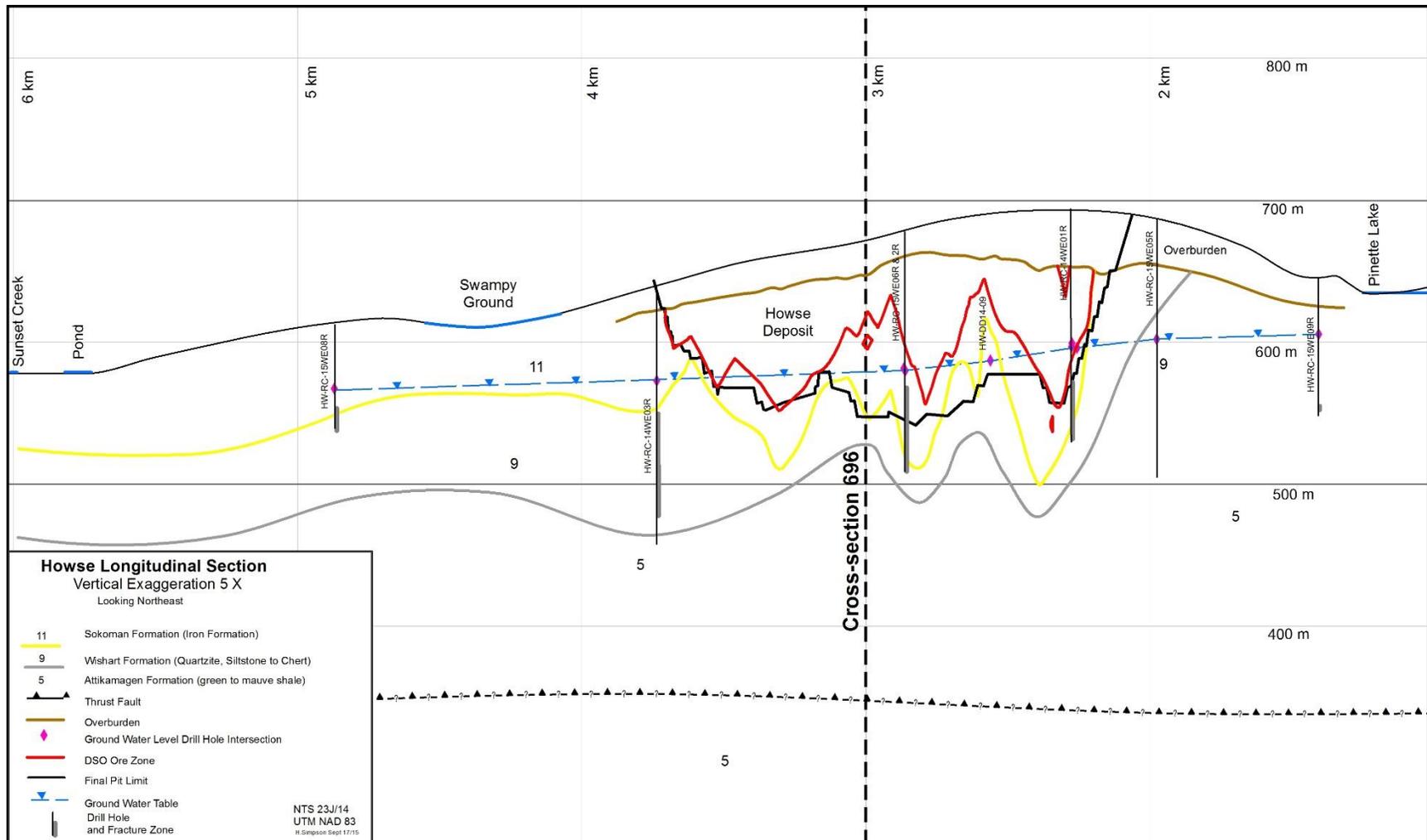


Figure 6: Howse Geological Longitudinal Section with the Profile of the Planned Pit

3.1.1 ASHUANIPI COMPLEX (MAP UNIT 1)

Archean basement in the area is dominated by a granodioritic gneiss that do not outcrop in the Howse area. To the west, the Wishart Formation lies unconformably on the Ashuanipi Gneiss.

3.1.2 KNOB LAKE GROUP

The Knob Lake Group is a Hudsonian age continental shelf sedimentary suite of rocks that are mapped from south of Labrador City to the west side of Ungava Bay. The group contains the major iron formations of the Labrador Trough. The formations are numbered based on Wardle 1982 (Table 3). The divisions of the upper, lower and middle members of Sokoman Formation are based on Klein 1972. The major formations within the Knob Lake Group are listed in Table 3 of formations and are described below.

3.1.2.1 Attikamagen Formation (map unit 5)

This formation is composed of inter-bedded argillaceous to shale material in thin beds ranging in colour from greyish-green, grey-black, black and reddish-grey. In outcrops, greyish-green and reddish-grey are the defining colours. Minor beds of chert and dolomite are noted in places.

In the Barney Deposit area the Denault Dolomite Formation (unit 6 on Wardle Map 85-5) was added to the Attikamagen as it is limited in the map area and not noted in the Howse horizon.

3.1.2.2 Wishart Formation (map unit 9)

To the west, along the margin of the Labrador Trough, the Wishart Formation starts with a basal conglomerate unconformably lying on the Ashuanipi Gneiss. In the Howse area the conglomerate is not noted. The common rocks of the formation are medium- to coarse-grained quartz sandstone to arkose and inter-bedded siltstone. Also noted are shale and chert beds. The Wishart Formation has a series of beds starting in coarse units and grading up to fine sediments in repeating cycles. In outcrop cross-bedding and ripples have been mapped.

In the Barney Deposit area the Flemming Chert Breccia Formation (unit 8 on Wardle Map 85-5) was added to the Wishart as it is limited in map area and not noted in the Howse horizon.

3.1.2.3 Sokoman Formation (map unit 11)

This formation comprises the major iron bearing units and is subdivided into four members, Ruth Formation (RF), Lower Iron Formation (LIF), Middle Iron Formation (MIF) and Upper Iron Formation (UIF). These members are further sub divided into several sub-members, as given below:

A) Ruth Member

- Ruth Formation: Unit 10 in the Wardle map. Some author put it as a separate formation since it has a limited exposure and association to DSO deposits. It has been included with the Sokoman for this mapping
- Black Chert (BC) : Massive black chert
- Ruth Shale (RS): This is a thin bedded to laminated carbonate shaley formation and is often black in color with some pyrite and graphite.
- Jasperlite (Jsp) : Bedded chert with major thick reddish (hematite rich) chert beds.

B) LIF Member

- Lower Iron Formation (LIF): Massive to layered green-grey silicate carbonate-magnetite-chert iron formation.
- Lower Red Green Cherty (LRGC): Layered silicate-magnetite-carbonate, magnetite-chert iron formation.

C) MIF Member

- Pink-Grey Cherty (PGC): Disseminated magnetite- chert iron formation.
- Upper Red Cherty (URC): Massive to layered, jasper-magnetite, hematite-chert iron formation.
- Lower Red Cherty (LRC): Layered magnetite-chert iron format

D) UIF Member

- Green Chert (GC): Silicate-rich green chert unit.
- Jasper Upper Iron Formation (JUIF) Layered to laminated, hematite, magnetite-chert iron formation. In Schefferville area old reports call JUIF as Green Upper Iron Formation (GUIF)
- Lean Chert (LC) Green, grey-green and pink-grey magnetite-chert iron formation.

3.1.2.4 Menihek Formation (map unit 12)

The Menihek is dominated by inter-bedded black to dark grey shale beds with lighter grey beds which have a tuff like nature in places. The unit has common graphitic slips and disseminated pyrite and occasional arsenopyrite. In places the black beds have a slaty cleavage.

3.1.2.5 Montagnais Intrusions (map unit 22)

These dibasic dykes are not noted in the Howse area but do cross-cut the Knob Lake Group on the LabMag Deposit and Schefferville areas. The dykes are late Precambrian aged.

3.2 METAMORPHISM

During the Hudsonian Orogeny the area experienced compression and metamorphism. The metamorphic grade increases across the Labrador Trough from west to east. In the map area the grade is lower green schist facies.

3.3 STRUCTURE

The main structural trend of the rock in the region is northwest-southeast. This is the same direction noted in the unfolded rocks west of the Howells River on the LabMag trend, which has shallow northeast dipping beds. The northeast-southwest direction is formed during the Hudsonian Orogeny as the continental marine sedimentary shelf was compressed from the northeast.

The rocks folded in a series of tight syncline/anticline structures with fold axis that strike northwest-southeast and dip steeply east. As the compression continued thrusting along the anticlinal axis occurred. This leave the area with a series of tight near vertical synclinal folds with east limb bedding overturned and separated by thrust faults. The main base thrust runs close to the current location of the Howells River and is often referred to as the Stakit Lake Fault. The rocks west of this fault show very little deformation.

Fracturing in the rock is controlled by the folding and tends to be best developed parallel to the fold axis. The highest concentration of fractures is close to the fold axis. In several areas the fracture are filled with quartz veining and crystal development. The best developed crystals in the Howse area are at the peak of Irony Mountain. Quartz veins can also be seen just east of the road to Schefferville from TSMC/DSO3 Mine across from the old Star Creek Mine. This quartz development is likely related to the fracture development period. Another set of fractures have been reported parallel to Cross Faults and perpendicular to main NW-SE fold axis, which also control ground water flow in the area.

3.4 MINERALIZATION

3.4.1 ORIGIN OF DSO DEPOSITS

The DSO mineralization is caused by Cretaceous weathering of the Knob Lake Group sediments. The deposits are controlled primarily by the Hudsonian northwest-southeast fracturing. This is one reason why much of the ground water flow is in a northwest-southeast trend. High water flow and the sub-tropical climate in Cretaceous period caused the leaching and breakdown of the carbonates and sulphides from iron formation. The leaching moves on to the silicate and iron oxides. The highest Cretaceous water flow was along the areas of highest fracture near the fold axis. Cavities in the bedding cause by the leaching were developed in the high water flow areas. The iron being leached from further out was deposited in the cavities as goethite and as cavities fill the iron starts to convert to hematite. Complete replacement by iron occurred in the centre of the Hudsonian folds.

The low ground, where greatest leaching occurred, became marshy and Cretaceous sediment bands were formed. These beds were preserved in two of the mines IOCC operated (Ruth and Redmond Mines). Here both clay layers and organic layer were found. Some fossils of plants and insects were recovered during mining.

During the Pleistocene glaciation most of the weathered regolith were removed by the ice sheet leaving only the deeply weather zones where low ground was protected by hard ridges in which the current DSO deposits are found.

3.4.2 ORE TYPES

3.4.2.1 Blue Ore

Usually the result of weathering of the MIF but can also be LRGC or JUIF. Has a steel metallic blue colour caused by the high specularitic hematite content. Forms the centre of many of the folds.

3.4.2.2 Yellow Ore

This ore was formed from the weathering of the LIF member. The carbonates give this unit the highest manganese content. Also the main iron mineral is often goethite and secondary limonite which give the yellow colour to the unit. The PGC occasionally bears bands of rich in iron silicates and these bands turn to yellow ore upon leaching.

3.4.2.3 Red Ore

This ore type is caused by the weathering of the RF. The red colour comes from the earthy red-brown of fine hematite. The unit is usually a mixture of goethite and hematite which can be hard and massive. The clays from the shales give this unit the historical highest aluminium values of the Schefferville area ores.

3.4.2.4 Rubble Ore

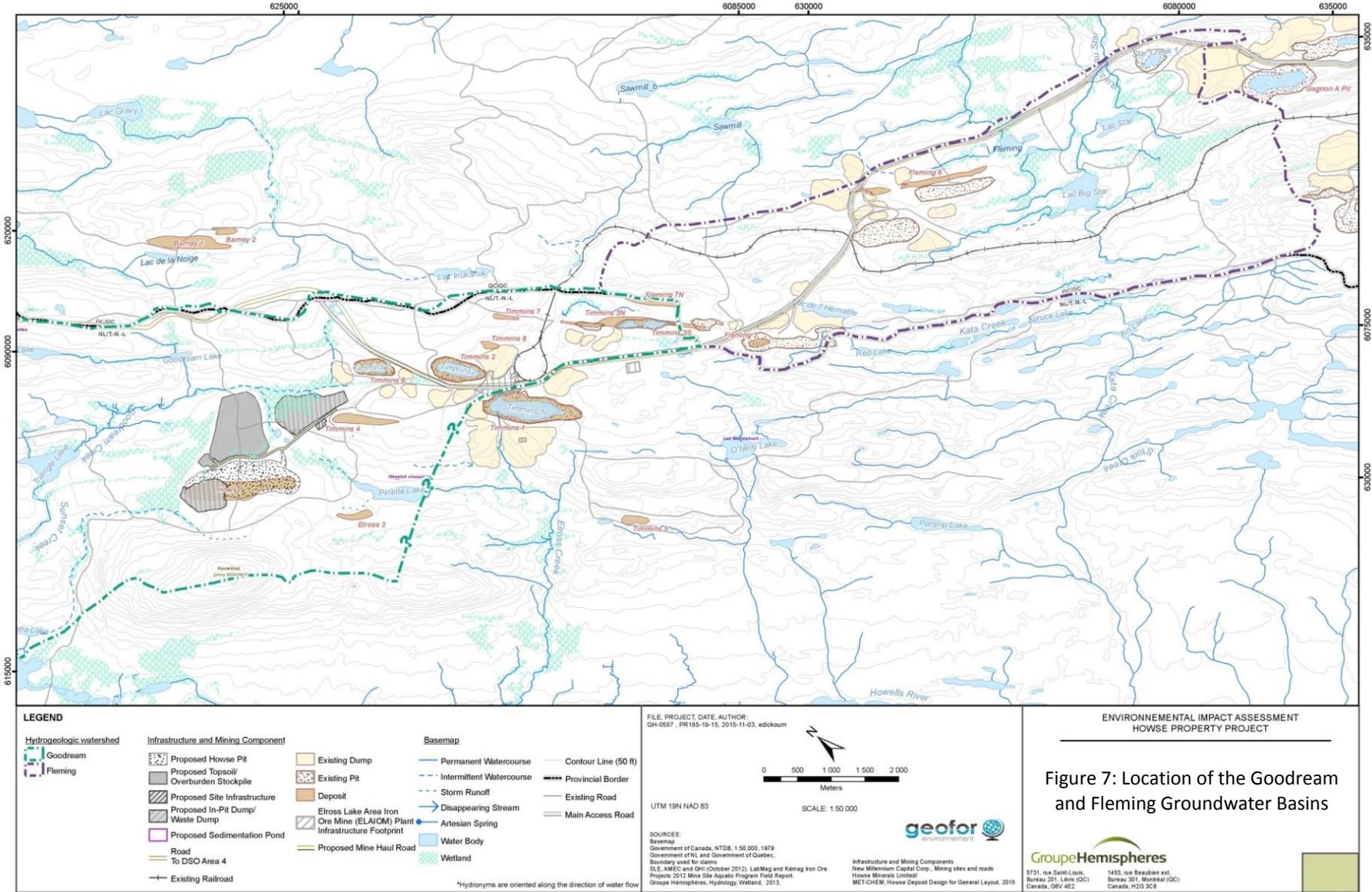
This was only found on the top of the large of the deposits. It was formed by side wall collapse during the Cretaceous were deep pits formed from the extensive leaching away of minerals in the centre of the folds. After the side walls fall into the pit it was replaced and sealed with iron oxides and hence has a conglomerate (rubble) appearance. In the Ruth and Redmond Mines this unit was underlain by Cretaceous age clay and carbon beds over the Blue, Red and Yellow Ores. Rubble Ore is not reported in the Howse Deposit.

4 REGIONAL GROUNDWATER

4.1 GROUNDWATER BASINS

The analysis of the data collected during the mining of a large number of DSO deposits located between the Gagnon pits near Schefferville and the Howse deposit and information gathered from exploration campaigns by TSMC and former companies allowed defining two main distinct groundwater basins. The groundwater flowing in both basins is primarily controlled by the Hudsonian northwest-southeast main fracturing system and to a lesser extent by perpendicular secondary fractures.

The Fleming 7 deposit is located on a groundwater basin divide which corresponds also to the Quebec-Labrador border. To the south-east of the Fleming 7, the groundwater is flowing entirely on the Quebec side from Fleming 7 area toward the Big Star lake area (Fleming Basin on the Figure 7) which is the a sector of discharge of a large part of groundwater of this basin.



On the northwest side of Fleming 7, the partial delimitation of the basin (Goodream Basin on Figure 7), which is entirely in Labrador, is based on groundwater elevations collected by TSMC during previous and recent hydrogeological studies (Groupe Hémisphères 2010, Groupe Hémisphères and Geofor 2011, 2012a, 2012b, Geofor 2015a). Much information is available in the area of TSMC/DSO3 deposits. Elsewhere, the information is mainly obtained from water elevations measured in the Howse deposit area from 2013 to 2015. The northwest and a part of the southeast limit of the basin cannot be defined or ascertained without supplementary hydrogeological data.

4.2 GROUNDWATER FLOW IN THE GOODREAM BASIN

As part of the modelling, SNC-Lavalin has drawn the piezometric map presented in Figures 8 from all available groundwater elevations measured in Howse and TSMC/DSO3 areas. Table 1 summarized the main specifications of wells or piezometers used. The piezometric map show the groundwater flow pattern in the Goodream basin. The groundwater recharge is occurring in the Fleming 7 deposit area where the highest groundwater elevations are found and from the high elevation terrains along the Quebec-Labrador boundary. Groundwater flows in a northwest direction more or less parallel to the geological and structural main trend with a mean gradient of about 0.15 m/m. At the level of Timmins 4, a part of the groundwater flow begins to focus toward an area located south of the Triangle Lake. The gradient is minimal in the vicinity of HW-RC15-08R with a value of 0.005 m/m. Recharge is also occurring close to the Howse deposit on the southwest side of the groundwater divide along Irony Mountain.

Without presuming of all mechanisms of discharge of groundwater to the surface water network, it can be assumed that the Burnetta Lake is one of the points of discharge of groundwater in the sector of Howse deposit. The discharge of groundwater should occur through a southwest system of thrust faults intersecting the main northwest southeast thrust faults following the southwest section of the Burnetta Creek. It is unlikely that the groundwater discharges before HW-RC15-WE08R because no obvious groundwater resurgence was observed into the slope between the deposit and the area southwest of Triangle Lake. This is coherent with the deep water table observed in the large area around the Howse deposit.

Henry Simpson, an experienced geologist involved in the mapping of the Schefferville area, outlines that the creeks often follows the surficial layout of thrust faults which are zones of soft and erodible material. He also believes that the Burnetta Creek layout can also be controlled by such a structure based on his mapping experience of this sector (personal communication). As can be seen in Figure 8, the Burnetta Creek flows, from its origin, along the surficial layout of a thrust fault to a certain point downgradient where it makes a sudden 90 degree turn to flow southwest toward the Burnetta Lake following very likely another thrust fault perpendicular to the structural main trend. The creek finally flows into the Burnetta Lake that discharges into the Howell River.

The area between the Burnetta Lake and the irony mountain is very disturbed from the geological and structural point of view. Two thrust faults oriented northeast-southwest and delimiting a northeast

geological Menihek unit are noted on each side of the Burnetta Creek upstream of the Burnetta Lake. In this area, this orientation is unusual for a thrust fault and more for a geological unit as can be seen on the Figure 4. Although incompletely mapped in the northeast direction, it can be supposed that the faults are continuous along the northeast section of the Burnetta Creek and intercept at some point the main northwest-southeast structural faults conveying the groundwater that will then be channelled toward the Burnetta Lake area where it will discharge.

As support to this hypothesis, Groupe Hémisphères observed a clear increase of the flow of the Burnetta creek close to its discharge into the Howell River (Groupe Hémisphère, 2014). For example, for the same day in August 2013, the specific runoff at the upstream was 4.1 L/s/km² while the downstream station near the mouth recorded 147 L/s/km². They concluded that the downstream section of the creek was largely fed by groundwater.

Table 4 compares the temperatures for Burnetta and Pinette Lakes. Recent drilling results have indicated that Pinette Lake, for which temperature in July is around 13 °C, is fed essentially by surface water. The temperature of the water of Burnetta Lake, which is a much smaller lake, is half of Pinette Lake. This can be explained by the supply of cold groundwater lowering the temperature of the lake.

Table 4: Lakes Temperatures

	Burnetta L.	Pinette L.
Date	°C	
June 2014		8.2
July 2014		13.0
July 2015	6.6	12.5
August 2015	6.9	
Sept. 2015	5.0	7.6

4.3 GROUNDWATER FLOW UNDER THE HOWSE DEPOSIT

The Figure 6 shows the cross-section drawn from the knowledge of the geology of the area and the drilling done along the northwest southeast Iron Formation axis passing through the deposit. The cross-section shows the profile of the deposit and of the planned pit with the geology intercepted by the wells with the position of the main fractured zones. The water table profile is also represented.

The cross-section covers 3.5 km between the 2 extreme wells. It shows that the overburden varies from a depth of 20 m at the northwest limit of the deposit to a maximum of over 50 m at the southeast limit. The groundwater has a constant downward slope passing from an elevation of 607 m at HW-RC15-WE09R to 569 m at HW-RC15-WE08R. The groundwater flow is then from the southeast to the northwest with a mean slope of 0.01 m/m. Under the deposit the depth of the water table is minimum at HW-RC15-WE03R with a value of 67 m below ground surface and maximum of 90 m at HW-RC15-WE06R. The groundwater in the section of the deposit is recharged in the high elevation of the groundwater divide of the Irony Mountain. It is not excluded that the Pinette Lake feeds the groundwater flowing toward the deposit. The groundwater will discharge into the Triangle Lake area as explained in the previous section.

4.4 RECHARGE OF GROUNDWATER AND SEASONAL BEHAVIOR OF THE PIEZOMETRY

The climatic data for the Schefferville area is based on the 1981–2010 monthly climate normals from the Schefferville A weather station (No. 7117825) and evaporation data from Churchill Falls weather station (No. 8501132). A gap in the temperature data was filled using the Fermont station (No. 704BC70).

Schefferville monthly temperature is above freezing point during the months of May to September. July is the warmest month with an average temperature of 12.7 °C and the coldest month is January with an average temperature of -23.3 °C.

Table 1 summarizes the water budget. The mean total precipitation is 790.8 mm per year, of which 373.5 mm represents snowfall expressed as rainfall equivalent. The water budget uses the evapotranspiration value calculated for a contiguous area by Fracflow (2006) using the Thornwaites equation. Fracflow evaluated the total evapotranspiration value taking place from May to November at 188.4 mm per year.

The sublimation of snow is estimated at 15 % of the total snowfall based on extensive studies conducted in the Wolf Creek Research Basin, Yukon (Pomeroy *et al.*, 1998). The actual study area is at similar latitude and experiences equivalent average temperatures throughout the year. The sublimation will therefore represent 56.2 mm, expressed as rainfall equivalent. As shown on water budget of Table 5, a total of 109 mm of water is available for groundwater recharge, representing 20 % of the water depth after evapotranspiration and sublimation.

A well supplying the workers camp (see figure 1 and 3), a few kilometers from Howse deposit, was equipped by Geofor with a level logger to monitor the variation of the groundwater level along the year. Although the behavior of an aquifer varies from a location to another depending, amongst others, of the dimension and nature of the recharge area, this can illustrate the general behavior of the aquifers of the area assuming that the amplitude of the variation is different from a place to another.

Table 5: Annual Water Budget

COMPONENT	DEPTH (mm)
Precipitation	790.8
Evapotranspiration (-)	188.4
Sublimation (-)	56.2
Net Water Depth	546.2
Surface flow (80 % of Net Water Depth)	437
Infiltration (20 % of Net Water Depth)	109

The graphics of Figure 9 shows the variation of the phreatic level along the period of observation. A first recharge of the aquifers happens at the snowmelt of spring. At this location, the groundwater rose 14 meters from end of April to mid-June. The water level stabilized and slightly decreased of few meters in the period from mid-June to around September 20th. From there, a recharge of groundwater begins with the important rainfalls of this season and continues till the end of October for a total rise of the groundwater level of 10 m. With the freezing of the ground and the arrival of solid precipitations, the curve shows that the drawdown of the aquifer is continuous till spring where the groundwater level reaches 74 m below the surface with a total drawdown of 25 m at the observed location.

A Groundwater level logger is installed in each of the wells HW-RC13-03 and HW-RC14-WE03R of the Howse deposit since end of June 2014. The curve of the water table variation for both loggers shown at figure 10 with the corresponding pluviometry for a part of the actual observed period is presented for information since it is only covering a short period of the year. For the equivalent period, the behavior of the two Howse monitoring logger is very different in shape and amplitude compared to the logger at the camp site.

The curves of both loggers (Figure 10) at Howse are showing an inverted behavior. HW-RC13-03 experienced a continuous drawdown of the phreatic level of 1.7 m since the installation of the logger in June 2015 to the last readings available at the beginning of October 2015. For the same period, HW-RC14-WE03R is showing a groundwater level rise of 1.7 m. In our opinion the drawdown in summer until the beginning of the heavy rains of October is a normal tendency. This tendency was observed by periodic manual readings at HW-RC-14-WE01R, HW-DD14-09 and HW-DD14-35 plotted on the figure 10. The possibly odd behavior at HW-RC14-WE03R, although real, cannot be confirmed in another neighboring well. For now, this behavior can be explained by heterogeneity of the terrain at the location of the well.

The relative stability of water table indicates a good equilibrium between the discharge and the recharge. The level loggers in the wells are still currently recording and the data will be analyzed after a year of recording in order to confirm and explain the behavior of both wells and have a better image of the seasonal variations of the water table

4.5 DISCONTINUOUS PERMAFROST

IOC has observed some areas of discontinuous permafrost in the TSMC/DSO3 area. In this sector characterized by series of elongated ridges flanking parallel valleys, the permafrost is found at the highest elevations under tundra sites poorly protected against the wind (Technical Department, IOC, 1974).

Figure 11, taken from J.J. Drake (1983) illustrates the conceptual model of groundwater flow in an area of discontinuous permafrost. Totally and permanently frost-free areas occur within a permafrost zone.

Those areas, called taliks, are found principally under some lakes and components of the surface water drainage network. The groundwater flows over the permafrost in the unfrozen superficial layer called active layer. The water infiltrates the regional aquifer when the water flowing through active layer reaches a talik. As illustrated in Figure 11, a deep mining pit can also feed the groundwater with surface water if it is dug under the regional groundwater level.

A study carried out by Journeaux Ass. (2015) about eventual presence of permafrost under the Howse deposit area has shown that discontinuous permafrost, if any, should occur in erratic and isolated small lenses or pockets but not in any extensive identifiable layers. Based on this study the Howse area will be considered permafrost free.

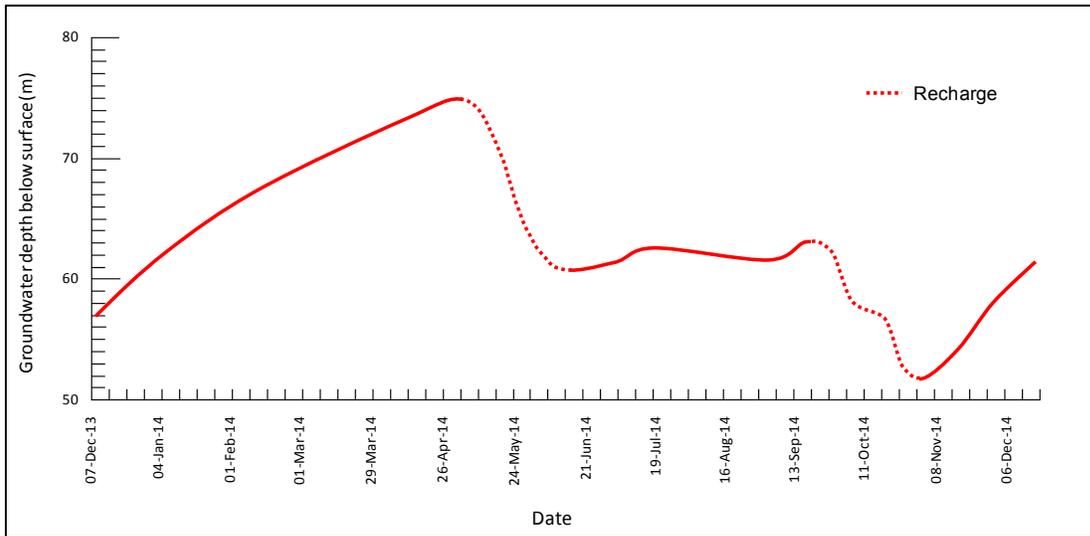


Figure 9: Seasonal Variation of the Groundwater Level at the Timmins Workers Camp

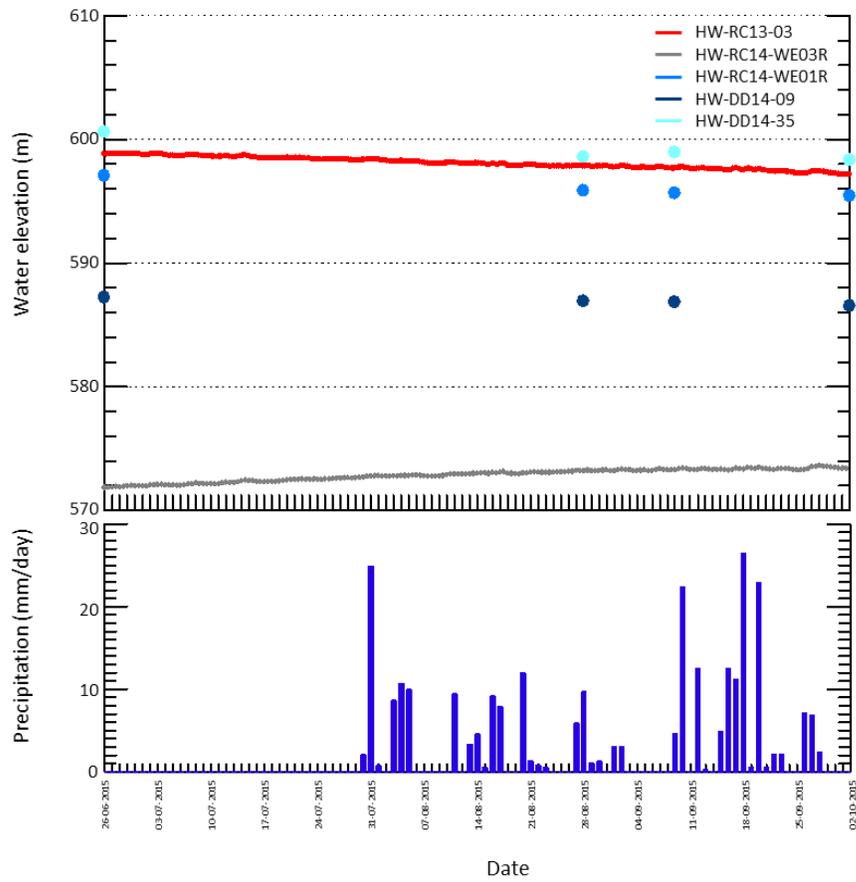


Figure 10: Variation of the Groundwater Level under the Howse Deposit Area

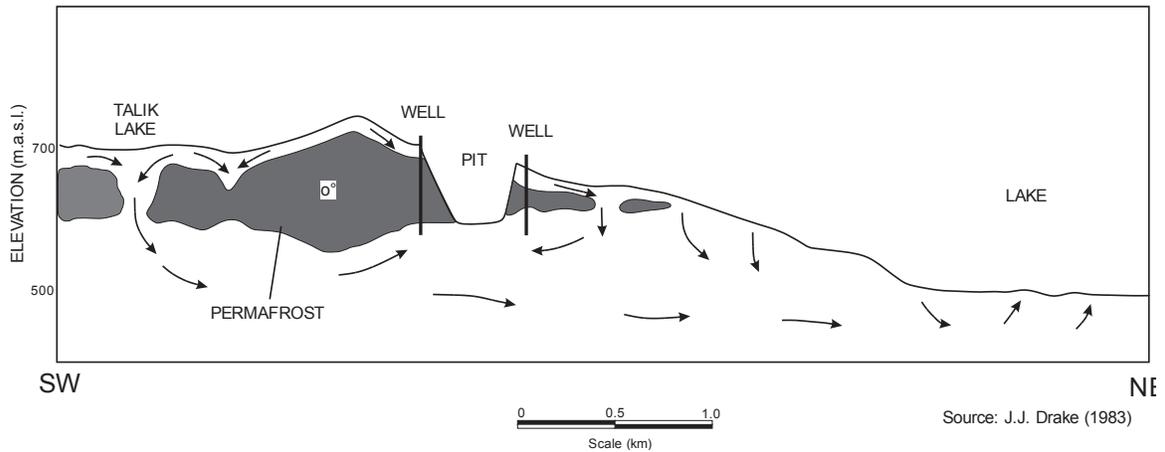


Figure 11: Groundwater Flow in a Region of Discontinuous Permafrost

5 RESULTS AND INTERPRETATION

5.1 TOPOGRAPHY AND SURFACE DRAINAGE

As can be seen on Figure 6, the deposit lies under a dome shape topographical element. From one side of the top of the dome culminating at 695 masl, the terrain drops 70 m toward the Pinette Lake with a mean slope of .065 m/m. On the other side the terrain shows a down slope of 0.035 m/m toward a swampy area southwest of the Triangle Lake. The area over the deposit is mainly forested.

Three lakes are visible in the Howse area. The small unnamed lake identified Lake X in Figure 2 has a small surface watershed. The lake bottom is clayey as the surrounding poorly drained swampy area. This lake is discharging for a large part of the year into the Goodream creek feeding the Triangle Lake. During high surface water the lake discharges at the same time into Pinette Lake.

Pinette Lake, a major water plan of the area located in a topographical low, is 820 m from the planned pit. It collects the surface water of a large area. It has a maximum depth of 4.5 m and a substrate dominated by silt and a few blocks (Groupe Hémisphère, 2014). The lake discharge into a creek routing the water to the Elross Creek which itself, discharges into the Howell River.

Triangle Lake is fed by the Goodream Creek and by runoff water of its watershed. The lake is located 1720 m downgradient of the future pit. It has a maximum depth of 12 m and a substrate dominated by silt and few blocks (Groupe Hémisphère, 2014). The lake discharges through a network of small creeks and swampy ponds into the Howells River.

The bed of Burnetta Creek, which is the closest creek to the Howse deposit, starts at the toe of Irony Mountain. A big part of the upstream of the Creek is generally dry, except for the spring period, till a swampy area where it begins to have a permanent flow. From there, the creek follows a northwest

direction until a certain point where it makes a ninety degree turn to follow a southwest direction to reach Burnetta Lake which effluent feeds the Howell River.

Wetlands of limited extent are mainly concentrated around the Lake X and along a short section of the upstream of Burnetta Creek. A more important wetland zone is observed southwest of Triangle Lake.

5.2 OVERBURDEN DRILLING

The logs of wells drilled in the Howse deposit shown in Appendix II indicate a thick mainly sandy overburden with sometime a mixture of sand, gravel and clay in variable proportion. The thickness of the cover varies between 20 and 30 m for the larger part of the Howse deposit, except for the most southeast part where it varies between 30 and 50 m (Figure 6). These fluvio-glacial sediments are rare in the region of the deposit where the bedrock is usually covered only by a thin layer of glacial till.

Some of the 2013-2014 drilling into the overburden for the assessment of the deposit was done with minimal drilling water for some holes. The majority of the samples collected in the overburden were dry. Two of the three holes specifically drilled in the overburden during the hydrogeological study were dry. A small flow rate of about 12 L/min was observed in the hole HW-RC14-WE01OB at about 38 m below the surface.

Based on all the available observations and on the 2013-2014 campaign, it appears that the overburden is generally dry except for the presence of scarce perched aquifer of limited extension. This can be explained by the infiltration of the surface water in the overburden and its fast evacuation along the slope of the terrain in permeable layers horizons in the overburden or of the rock interface. A part of the water can also migrate rapidly through the rock fractures.

5.3 ROCK DRILLING

Seven wells, identified HW-RC14-WE01R, HW-RC14-WE02R, HW-RC14-WE03R, HW-RC15-WE05R, HW-RC15-WE06R, HW-RC15-WE08R and HW-RC15-WE09R are distributed along the northwest-southeast dominant geological and structural axis of the large area of the Howse deposit. The longitudinal section presented in Figure 6 was drawn from the geological knowledge of the area and from the results of the drilling along the northwest-southeast axis. Appendix I of the report attached presents wells construction diagrams of each well with the corresponding simplified geology.

The section of Figure 6 shows the position of the water bearing fractured zones met by the drill in relation to the geology. Water bearing fractures were met deeply below the surface. The ground was dry till the interception of water bearing fractured zones. The observed Groundwater table shown on the figure is everywhere over the water bearing fractures indicating a confined aquifer in artesian condition.

All wells, except the HW-RC-15-05R and HW-RC-15-09R, have intercepted the Sokoman Formation (Iron Formation). For all wells in the Iron Formation, the most productive of the fractures shown on the cross-section were met close to or at the interface of the Sokoman and the Wishart Formations. This is the case for HW-RC15-WE07R and also for HW-RC14-WE03R where other productive factures were also met deeper in the Wishart Formation. Well HW-RC15-WE06R was entirely drilled in the Sokoman and was ended not far from the Wishart Formation. An important water bearing zones was met toward the end of

the hole probably not far from the Wishart Formation. Productive fractured zones for HW-RC15-WE07R which was drilled into another Iron Formation were met in the Sokoman between 60 and 98 m below ground surface. Any noticeable water bearing fractures were observed at wells HW-RC15-WE05. A small water bearing fracture was intersected at HW-RC15-WE09 toward the end of the hole. HW-RC15-WE05R and HW-RC15-WE09, drilled in the Attikamagen shale and HW-RC15-WE01 in a very muddy section of the Iron Formation show relatively low yield varying between 3 and 60 L/min. The yield of aquifer for all other wells varies from 200 to 800 L/min, the maximum occurring at HW-RC15-WE06R.

Those observations tend to show that the interface between the Sokoman and the Wishart is sometime a fractured sector providing important quantities of water. The Wishart Formation can also convey important quantities of water. The Attikamagen shales will supply minor quantities of groundwater. An important portion of the mining can be done without dewatering due to the deep location of the water table below the ground surface.

5.3.1 DESCRIPTION OF THE WELLS DRILLED IN 2014-2015

HW-RC14-WE01R was drilled through 44 m of overburden to a depth of 167 m. The iron formation was met from 44 m to a depth of 126.5 m where the Wishart quartzite was observed to the end of the hole. The rock samples had a muddy consistency along the entire length of the well but particularly till the depth of 110 m. Small water bearing zones were met from the contact with the Wishart formation to a depth of 160 m providing a total flow of about 109 m³/d. This interval was punched to allow the entrance of water into the well.

RC14-WE02R was drilled to 182 m below surface entirely in the iron formation met at 26 m under the overburden. Two water bearing zones estimated to a total of 109 m³/d by the driller were met at 155 m and 169 m below ground surface into the iron formation. The well caved in under the cased part at the end of drilling and was unusable for pumping test.

The geology of HW-RC14-WE03R, drilled at 180 m is comprised of 23 m of overburden, 81 m of the iron formation and 76 m of the Wishart formation (quartz rich sand). The well is cased on the entire length and screened between 88 m and 162 m where important water bearing zones were met in Wishart quartzite layers.

HW-RC-15WE05R - Hole intersected grey sandy-gravel overburden to 54.86 m. Wishart formation weathered sandstone to arkose from 54.86m to contact between 67.06 to 70.10m with Attikamagen greyish-green shale. Attikamagen shale to end of hole at 182.88m.

HW-RC-15WE06R - Hole intersected grey sandy-gravel overburden to 27.43 m. From 27.43 to 30.48m mixture of sandy-gravel and blue ore. High grade blue ore from 30.48 to 48.77m. From 30.48 to 134.11m leached & enriched Middle Iron Formation. Weathered Lower Iron Formation from 134.11 to the end of hole at 170.69m. The LIF shows weathering and minor enrichment but is not ore grade.

HW-RC-15WE07R - Hole intersected grey sandy-gravel overburden to 18.29 m. The remainder of the hole is middle iron formation. From 18.29 to 39.62 m leaching and minor iron enrichment occur. The section from 39.62 to 67.06 m shows leaching and surface weathering effects. From 67.06 to end of hole at 97.54 m the core is weathered Pink Grey Cherty units of (PGC) of the Middle Iron Formation.

HW-RC-15WE08R - Hole intersects large amounts of weathered iron formation chips to 6.10m which is possible minor overburden and badly weathered bedrock. From 6.10 to 15.24m drills claim intersection was overburden but chips are likely badly weathered and broken MIF. Weathered, leached and enriched MIF from 15.24 to 51.82m which is in the Treat Rock (TRX) range of IOCC just below the DSO grade. Lower Iron Formation is also leached and enriched between 51.82 and 57.91m with a TRX assay results. Weathered and leached Ruth Formation shale occurs from 57.91 to 64.01m with assays in the TRX range. Form 64.01 to the end of the hole at 73.15m leached Ruth Black Chert is intersected.

HW-RC-15WE09R - Hole intersected grey sandy-gravel overburden to 18.29m. From 18.29 to end of hole at 97.54m the hole intersects argillaceous to shale material with a dominate greyish-green and greyish-red colour of the Attikamagen Formation.

5.4 PUMPING TEST AND PACKER TESTS

The main specification of the steps and constant flow pumping tests on 2014 and 2015 wells are summarized in Table 2. The reports of analysis of 2014 and 2015 wells pumping tests using Aquifer Test Pro are shown in Appendix III with the pumping data. The Table 6 present a summary of the hydraulic testing carried out by Golder and Geofor.

Table 6: Summary of Hydraulic Testing Results

Reference	Test	Well tested	K (m/s)	K average (m/s)	Formation	
Golder, 2014	Packer test	HW-GT13-002	2E-07 - 6E-07	4.00E-07	Wishart	
			4E-08 - 6E-08		Attikamagen Shale	
		HW-GT13-001	4E-08 - 5E-08	5.00E-08		Chert/Shale/fault zone
			1E-07			Chert/Shale/fault zone
			1E-07	1.3E-07	Shale/fault zone	
Geofor, 2014	Pump test	HW-RC14-WE01*	2.13E-06		Sokoman (Iron ore)/Wishart	
		HW-RC14-WE03*	3.34E-05			
Geofor, 2015	Pump test	HW-RC15-WE06R*	1.1E-05 - 2.4E-05	9.40E-06	Sokoman	
		HW-RC14-WE02R**	1.2E-05 - 1.9E-05			
		HW-RC15-WE07R*	1.6E-06 - 1.1E-05			
		HW-RC15-WE08R*	1.10E-05			

*Pumping well; ** Observation well

5.4.1 PACKER TESTS

Golder Associates has conducted packer tests on inclined boreholes HW-GT13-01 and HW-GT13-02. Figure 12 from Golder Associates (2014) shows a geological section drawn from the drilling logs. Both holes intersect only partially the Sokoman and mainly the underlying formations where the packer tests

have been carried out. Figures A1-14 and A1-15 of Appendix I show the correlation between the geology and the estimated hydraulic conductivity on a projection of the inclined holes on the vertical axis. The tests cover a section comprised between 90 m below ground surface and the end of the hole. The tested depth intervals vary from 6 to 26 m. The hydraulic conductivity of both holes varies from 1E-07 m/s for the shallowest tested intervals to 5E-08 m/s for the deepest one. The tests seem to show that hydraulic conductivity is greater in the vicinity of the contact between the Sokoman and the underlying formations. The values of hydraulic conductivities of 4E-8 m/s measured by Golder in well HW-GT13-02 for the interval between 89 and 183.9 m seem underestimated in comparison with the value of 2.13E-6 m/s calculated from the pumping test at HW-RC14-WEO1R. This can confirm the warning of Golder, found in their technical memorandum of Appendix VI, stating that the presence of polymers in the holes can have blocked partially the fractures.

5.4.2 PUMPING TESTS

Generally, the recent results of hydraulic conductivity testing showed in Table 6 indicate that the hydraulic conductivity of the Sokoman Formation which is the main formation in the area was relatively higher, and ranging from 1.6E-6 m/s to 1.9E-5 m/s with an average of 9.4E-6 m/s. The shale of Attikamagen have the lowest permeability values with an average of 5E-8 m/s while the Wishart and fault zone recorded an intermediate conductivity values with an average of 1E-7 m/s. The fault zones tested by Golder were coated with mixed and less permeable materials according to borehole logs. This can explain their lower hydraulic conductivities values in comparison to the Sokoman.

The step-drawdown tests conducted by Geofor in 2015 at the three pumping wells (HW-RC15-WEO6R, HW-RC15-WEO7R and HW-RC15-WEO8R) showed a slight decrease in specific capacity of the wells with flow rate increase.

The well HW-RC15-WEO6R located within the proposed open pit was pumped to a maximum of 1.1 m³/min (291 usgpm) resulting in a 12.4 m final drawdown, and a specific capacity decreasing from 0.2 to 0.1 m³/min per meter.

The wells HW-RC15-WEO7R and HW-RC15-WEO8R located outside the proposed open pit were pumped to a maximum of 0.26 m³/min (75-85 usgpm) resulting in a 13.6 m final drawdown, and a specific capacity decreasing slightly from 0.04 to 0.02 m³/min per meter.

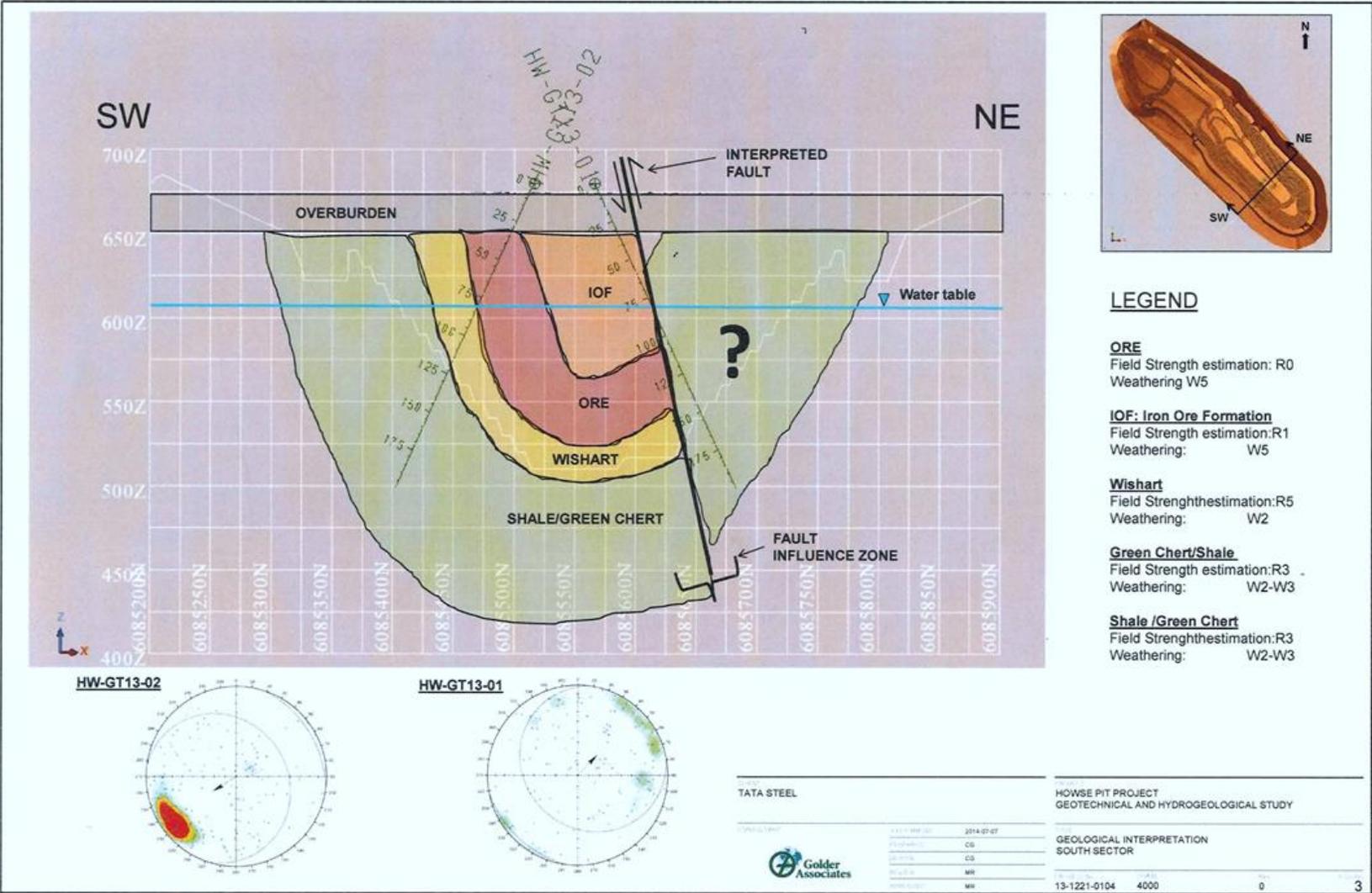


Figure 12: Packer Tests by Golder Associates

5.4.3 GROUNDWATER QUALITY

The pumped water was sampled at the time following the start of the pumping test indicated in Table 2. The certificates of analysis of the laboratory are collated in Appendix IV.

Table 7, shows the result of the physical property measured in the field. The measured parameters indicate that the water is slightly acidic for all wells except for HW-RC14-WE03R which is close to the neutrality. In all cases, the water is very weakly mineralized as indicated by the electrical conductivity and cold with values around 2 °C.

The results of analysis of water, presented in Table 8, show that, for all wells, except HW-RC14-WE01R, the analysed chemical parameters of this very soft water are generally under the detection limits of the laboratory method or, if not, well below the maximum acceptable concentration of the more stringent regulations, if appropriate. The maximum acceptable concentrations from Canadian *Metal Mining Effluent Regulations* (MMER) are shown the corresponding column of Table 8 for the deleterious elements concerned.

In contrast to all other wells, the physical properties of the water at HW-RC14-WE01R show values of total suspended solids exceeding the authorized limit of 30 mg/L of the MMER and high values of total dissolved solids and turbidity. The turbidity of all other wells is below 2 NTU with a real color below 4 UCV. Some water bearing muddy sections were met during the drilling of HW-RC14-WE01R. The muddy sections were releasing suspended solids in the pumped water causing an increase of the turbidity. The concentration of total suspended solids, as well as the turbidity and coloration, decreased significantly between the two sampling sessions indicating a cleaning of the water bearing structures with time. This decrease may continue in time but it has not been proven that it will go under the MMER limit. The suspended solids must be therefore taken into account in the dewatering process. The classical solution consists to settle the pumped water in pounds before releasing it in the drainage surface network. The Wells can also be designed with gravel pack around the pumping column in order to filter the groundwater at the pumping stage. The location of the dewatering wells can also be located in order to avoid muddy zones by drilling exploration holes.

Table 7: Physical Parameters Measured in the Field

WELL	HW-RC14-WE01R			HW-RC14-WE03R			RC15-WE07R	RC15-WE08R
	24 hours	36 hours	72 hours	24 hours	48 hours	72 hours	24 hours	72 hours
Time from the pump start								
pH	6.05	6.2	6.04	6.9	6.7	6.2	5.92	5.84
Electrical Conductivity ($\mu\sigma$)	11	12.3	14.5	21.2	20.7	21	21.9	22.9
Sp. Electrical Conductivity ($\mu\sigma$)	20	22	26.1	37.5	36.5	37.1	38.6	39.0
Temperature ($^{\circ}$ C)	2.1	1.8	1.8	2.3	2.3	2.3	2.1	2.0

Table 8: Results of Chemical Analysis

	Units	MMER LIMIT	HW-RC14 WE01R (24HRS)	HW-RC14 W01R (72H)	HW-RC14 WE03R (24HRS)	HW-RC14 WE03R (72HRS)	HW-RC15 WE06R (72HRS)	HW-RC15 WE07R (72 HRS)	HW-RC15 WE08R (24 HRS)
							2015-09-24	2015-09-17	2015-09-14
METALS									
Mercury (Hg)	mg/L		<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
P2O5			-	-	-	-	-	0.0	0.0
Total phosphorous	mg/L		<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
METALS ICP-MS									
Aluminum (Al)	ug/L		<30	<30	53	49	<10	<10	<10
Antimony (Sb)	ug/L		<3.0	<3.0	<3.0	<3.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L		<20	<20	<20	<20	2.6	2.7	<2.0
Silver (Ag)	ug/L		<0.3	<0.3	0.36	<0.3	<0.10	<0.10	<0.10
Boron (B)	ug/L		<50	<50	<50	<50	<20	<20	<20
Cadmium (Cd)	ug/L		<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20
Beryllium (Be)	ug/L		<2.0	<2.0	<2.0	<2.0	<0.40	<0.40	<0.40
Bismuth (Bi)	ug/L		<50	<50	<50	<50	<0.25	<0.25	<0.25

	Units	MMER LIMIT	HW-RC14 WE01R (24HRS)	HW-RC14 W01R (72H)	HW-RC14 WE03R (24HRS)	HW-RC14 WE03R (72HRS)	HW-RC15 WE06R (72HRS)	HW-RC15 WE07R (72 HRS)	HW-RC15 WE08R (24 HRS)
Chromium (Cr)	ug/L		<5.0	<5.0	<5.0	<5.0	<0.50	<0.50	<0.50
Calcium (Ca)	ug/L		1 400	1 600	2 400	2 400	1000	2300	<300
Cobalt (Co)	ug/L		<20	<20	<20	<20	<0.50	<0.50	<0.50
Copper (Cu)	ug/L	600	<3.0	<3.0	<3.0	<3.0	7.1	<0.50	<0.50
Total Hardness (CaCO3)	ug/L		9 900	1100	1500	1500	7200	14000	1600
Tin (Sn)	ug/L		<50	<50	<50	<50	<1.0	<1.0	<1.0
Iron (Fe)	ug/L		<100	<100	<100	<100	<100	<100	<100
Magnesium (Mg)	ug/L		1 600	1 700	2 200	2 200	1100	2000	220
Manganese (Mn)	ug/L		<3.0	<3.0	<3.0	<3.0	3.5	9.8	<0.40
Molybdenum (Mo)	ug/L		<10	<10	<10	<10	<0.50	<0.50	<0.50
Nickel (Ni)	ug/L		<10	<10	<10	<10	<10	<1.0	<1.0
Lead (Pb)	ug/L		<1.0	<1.0	<1.0	<1.0	0.53	0.31	<0.10
Potassium (K)	ug/L		290	210	340	360	200	360	<100
Selenium (Se)	ug/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium (Na)	ug/L		2 100	1 900	1 700	1 700	1700	920	<100
Strontium (Sr)	ug/L		<50	<50	<50	<50	3.1	5.4	<2.0
Thallium (Tl)	ug/L		<10	<10	<10	<10	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L		<50	<50	<50	<50	<10	<10	<10
Uranium (U)	ug/L		<2.0	<2.0	<2.0	<2.0	<1.0	<1.0	<1.0
Vanadium (V)	ug/L		<10	<10	<10	<10	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	1000	30	31	27	19	5.7	<5.0	<5.0
Mercury (Hg)	ug/L		-	-	-	-	1.5	<0.10	-
CONVENTIONALS									
Conductivity	mS/cm		0.029	0.028	0.037	0.038	0.022	0.034	0.041
Inorganic phosphorous	mg/L		0.04	0.03	<0.02	<0.02	-	-	-

	Units	MMER LIMIT	HW-RC14 WE01R (24HRS)	HW-RC14 W01R (72H)	HW-RC14 WE03R (24HRS)	HW-RC14 WE03R (72HRS)	HW-RC15 WE06R (72HRS)	HW-RC15 WE07R (72 HRS)	HW-RC15 WE08R (24 HRS)
Nitrogen ammonia (N-NH3)	mg/L		<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
Orthophosphate (P)	mg/L		0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols-4AAP	mg/L		<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Reactive silica (SiO2)	mg/L		9.8	11	7.0	7.1	10	6.2	6.7
Real Color	UCV		15	4	4	3	<2	<2	<2
Sulfides (S2-)	mg/L		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Cyanide (CN)	mg/L	2	<0.01	<0.01	<0.01	<0.01	-	-	-
Turbidity	NTU		180	99	1.9	1.6	1.8	1.4	0.2
Absorbance at 254nm	/cm		0.29	0.15	0.008	0.009	-	-	-
Alkalinity Total (as CaCO3) pH 4.5	mg/L		15	15	17	20	21	11	17
Bromide (Br-)	mg/L		<0.1	<0.1	<0.1	<0.1	-	-	-
Bicarbonates (HCO3 as CaCO3)	mg/L		15	15	17	20	21	11	17
Carbonate (CO3 as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1
Chloride (Cl)	mg/L		0.14	0.15	0.12	0.12	0.11	1.7	0.14
Nitrites (N-NO2-)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
Nitrates (N-NO3-)	mg/L		0.06	0.10	0.11	0.11	0.08	0.76	0.09
Sulfates (SO4)	mg/L		0.9	0.9	1.0	1.1	<0.5	1.0	0.8
Total Dissolved Solids	mg/L		37	37	45	39	15	20	28
Total suspended solids (TSS)	mg/L	30	210	180	2	<2	-	-	-
Dissolved organic carbon	mg/L		1.2	0.8	-	-	0.5	0.3	0.3
Total Organic Carbon	mg/L		-	-	<0.2	<0.2	-	-	-
Dissolved oxygen	mg/L		-	-	-	-	12	11	11
pH	pH		-	-	-	-	7.11	7.00	7.38
Nitrate (N) and Nitrite(N)	mg/L		-	-	-	-	0.08	0.76	0.09

6 MODELLING

The update of the 2014 modelling was subcontracted to SNC-LAVALIN by Geofor that provided the majority of the technical information. The simulations were made using the Visual Modflow 2011.1 Pro version. The SNC-Lavalin's technical memorandum, describing the methodology, the model and the results of the simulations are provided in Appendix V.

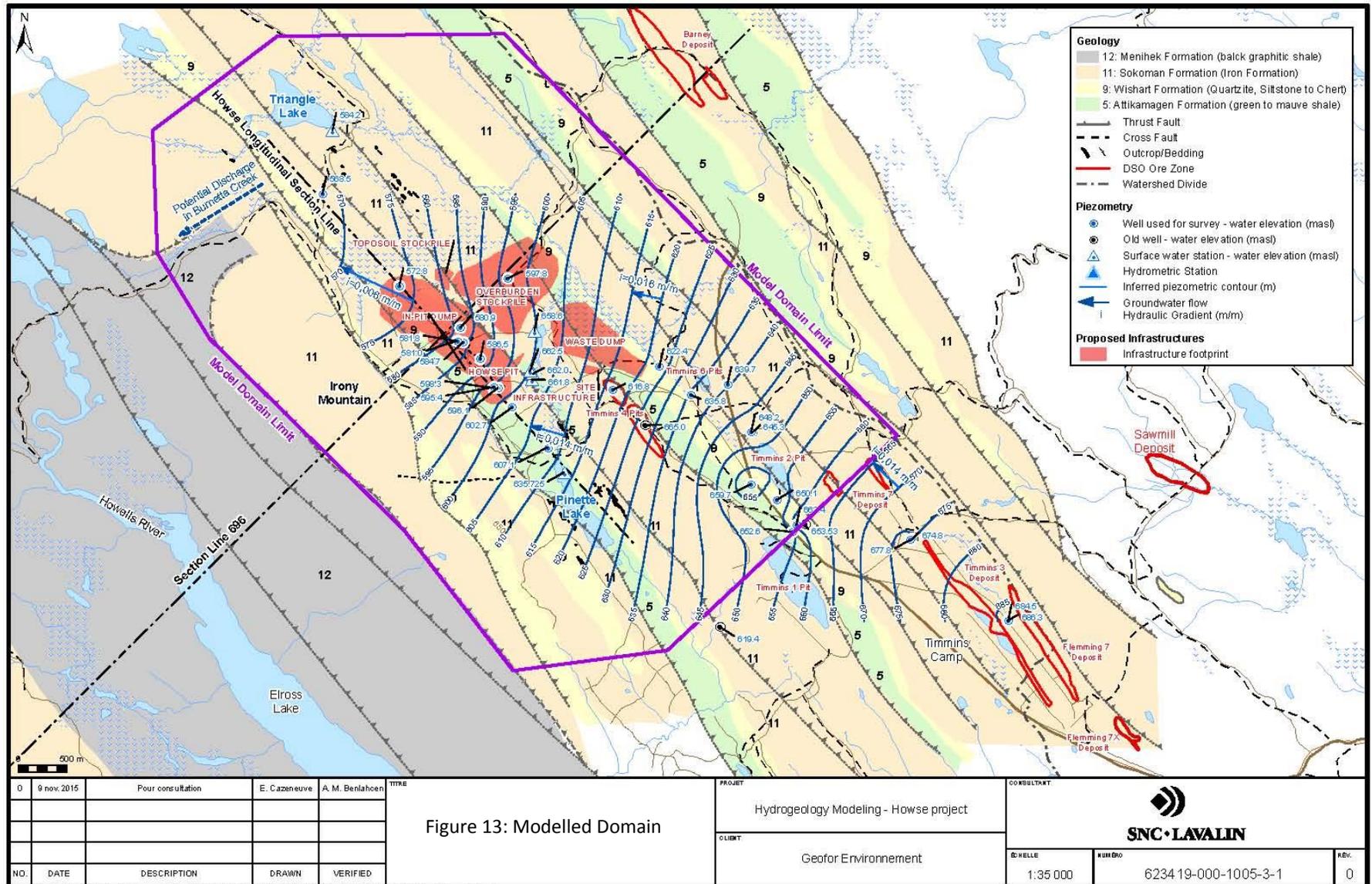
6.1 METHODOLOGY

In order to estimate the flow rate resulting from the dewatering of the Howse deposit, a conceptual model of the aquifer flowing through the deposit was built and transposed into a numerical model. The model of the natural groundwater flow of the aquifer was calibrated with hydrogeological parameters determined from field data collected at the site during actual and past campaigns. Following the calibration of the natural groundwater flow model, the open pit was introduced into the model to simulate the dewatering of the future mine pit at its final maximum depth of 160 m. The model considers a rectangular domain of about 5 km by 8 km as shown on Figure 13.

The model incorporates the basic assumptions of the groundwater flow developed in this report. In summary, the groundwater recharge is occurring in the Fleming 7 deposit area where the highest groundwater elevations are found and from the high elevation terrains along the Quebec-Labrador boundary. Groundwater flows in a northwest direction more or less parallel to the geological and structural main trend with a mean gradient of about 0.015 m/m. At the level of Timmins 4, part of the groundwater flow begins to focus toward an area located south of the Triangle Lake. The gradient is minimal in the vicinity of HW-RC15-08R with a value of 0.005 m/m (see figure). Recharge is also occurring close to the Howse deposit on the southwest side of the groundwater divide along Irony Mountain. Groundwater probably discharges through a southwest set of fractures southwest of Triangle Lake.

The hydraulic conductivities used are those shown in table 6. Simulations were carried out in steady state flow regime with the objective of evaluating the flow rates and extent of the influence of the dewatering activities at the final depth of the pit only. Direct precipitation over the area of the pit was not considered in the model.

In addition to the base case of the calibrated model, three sensitivity analyses were completed by increasing the hydraulic conductivities of hydrostratigraphic units to emphasize the flow along bedding planes and increasing the recharge rate for one of the scenarios.



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6.2 RESULTS

Table 9 summarizes the flow rate results, and shows the influence of permeability and recharge rate increase that can occur in case of possible heterogeneity of the formations and geological structures within the study area.

The base case scenario is evaluated to 9400 m³/d. The base case flow rate may reach higher values ranging from 12,000 to 19,000 m³/day with slightly higher hydraulic conductivities and increased recharge values.

Table 9: Dewatering simulation results including sensitivity analysis

Scenario	Flow rates (m ³ /day)			Pumping rate increase
	Model	Safety factor of 1.25		
Base case: Calibrated model	9393	11741	- Kx, Ky, Kz; - Recharge : 100 mm/y	
Sensitivity analysis Case 1	17382	21728	- Kx, Ky and Kz multiplied by 2 for OB and Sokoman, - Recharge increased to 200 mm/y	1,9
Sensitivity analysis Case 2	18752	23440	- Kx, Ky and Kz multiplied by 2 for all five units (OB, Sokoman, Wishart, Shale and Fault zones), - Recharge increased to 200 mm/y	2,0
Sensitivity analysis Case 3	11754	14693	- Kx, Ky, Kz; - Recharge increased to 200 mm/y	1,3

The sensitivity analyses results indicate that the hydraulic conductivity is the more influent parameter in the model. In deed when the recharge is doubled (case 3) the pumping rate increases by a factor of 1.3 while doubling the hydraulic conductivity and recharge results by a pumping rate increase by a factor of 2. Groundwater dewatering simulation results are presented in terms of piezometry and drawdown the in Figures 14 and 15 respectively.

It can be seen in figure 15 that larger drawdowns are observed in the vicinity of the pit. The regional drawdown resulting from the pumping activities is expected to be about 10 m towards the north-west limit of the domain (downgradient of the study area). This result implies that Burnetta Creek may be affected by the drawdown. In fact, Burnetta Creek is supposed to be a groundwater discharge zone according to the field observations and the structural geology (existence of a fault) along Burnetta Creek.

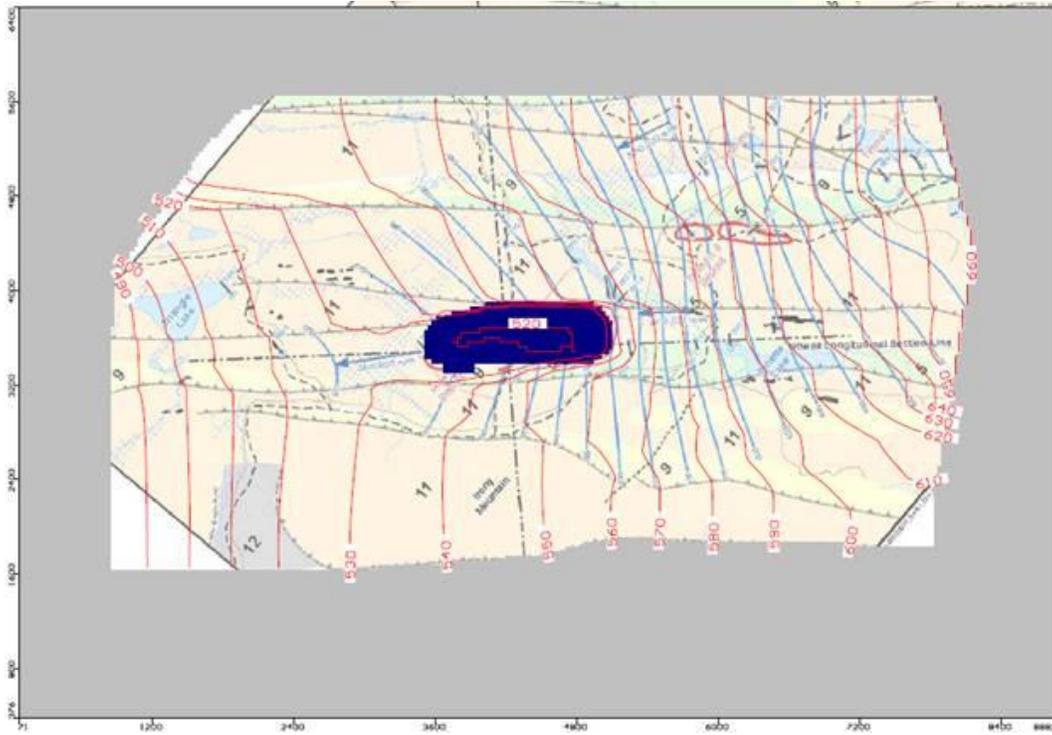


Figure 14: Piezometric map during pit dewatering (SNC-Lavalin, 2015)

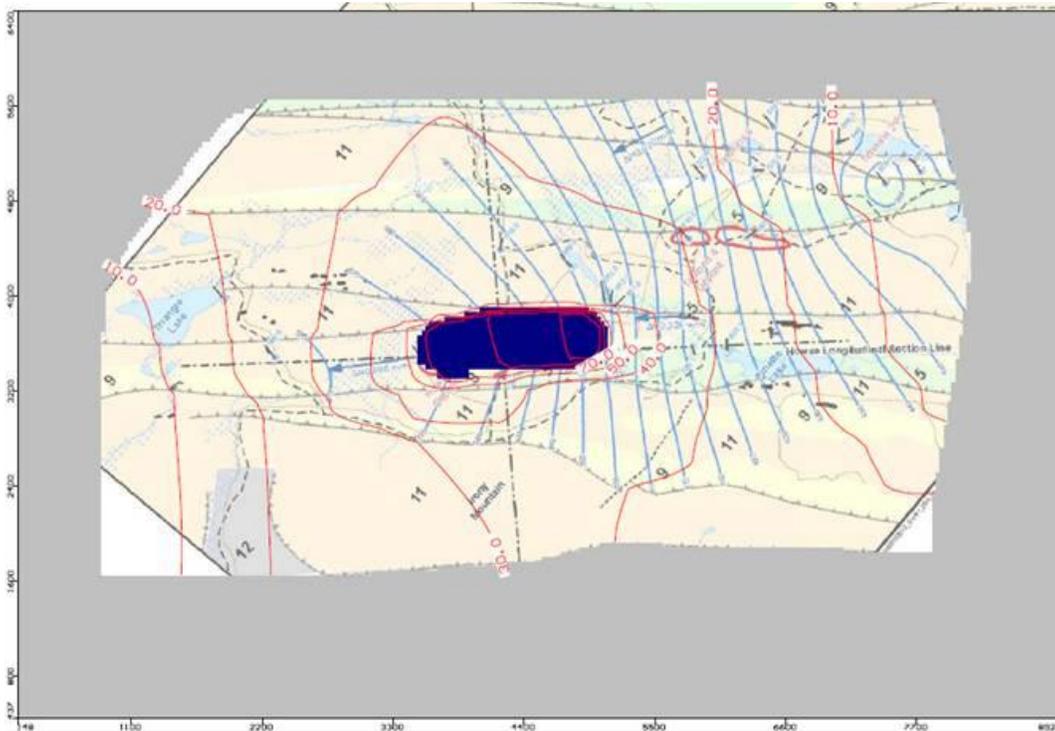


Figure 15: Groundwater drawdown during pit dewatering (SNC-Lavalin, 2015)

6.3 EFFECT OF THE DEWATERING ON DRAINAGE NETWORK AND WETLANDS

It will be expected during the first years of mining operations that the dewatering rate will be lower than the estimated rate for the final pit depth. The groundwater level at the Howse deposit is generally deep. During the first years, dewatering will be limited to water accumulated in the pit basically from direct precipitations and infiltration through the unsaturated geological units until pit floor reaches the water table. After, dewatering rate will increase gradually with pit floor depth and will reach maximum rate at its final depth.

In general, the impact of dewatering will be minimal because groundwater is deep below the surface and that the drainage network elements have an elevation greater than the corresponding water table. The drawdown generated by the dewatering is illustrated in Figure 14. This map indicates that the drawdown cone will extend under some elements of the hydrological network.

The lakes and creeks are briefly described in Chapter 5.1. Only 3 lakes of the area can be impacted by the dewatering if they have a relation with groundwater. The unnamed lake identified on Figure 2 as Lake X, has a clayey bottom like the surrounding wetlands. The elevation of the lake at 659 m is higher than the elevation of the groundwater for the corresponding section of the Howse deposit which is around 600 m. The lake bottom is likely impermeable and has then no relation with groundwater. No impact of the dewatering is expected.

Pinette Lake is located 820 m upgradient of the future pit. Lake's bottom elevation is around 631 masl what is 24 m higher than the groundwater elevation of the close well HW-RC15-WE09. This hydraulic head difference implies that the lake could contribute to recharge the groundwater if there is a link between them. In this eventual case, the dewatering will not impact significantly the lake. Without contact the impact will be null.

Triangle Lake is located 1720 m downgradient of the planned pit. It has a maximum depth of 12 m with a bottom elevation around 572 m. The groundwater elevation measured at the nearest well HW-RC15-WE08R, which is 675 from the lake, was 567 m. Considering a horizontal hydraulic gradient of 0.005 m/m the groundwater elevation would reach an elevation of 564 m at the lake location. Therefore, the hydraulic head difference between Triangle Lake and groundwater would be about 8 m. This implies that the lake would also contribute to groundwater recharge if there is a relation between them. The impact will be negligible if the lake has a link with groundwater and null if any link.

The wetlands of the area in the footprint of the drawdown cone are mainly located in the Triangle Lake area. Since the elevation of the water table is clearly below the surface, it can be deducted that the poorly drained ground is impermeable and that the wetland do not have a link with groundwater. The dewatering will have a null effect on those wetlands.

Figure 14 shows that larger drawdowns are observed in the vicinity of the pit. The regional drawdown resulting from the dewatering is expected to be about 10 m towards the northwest limit of the domain (downgradient of the study area). These results imply that Burnetta Creek can be affected by the drawdown, considering that Burnetta Creek is potentially a groundwater discharge zone based on the field observations and the presence of a fault.

7 CONCLUSIONS

The hydrogeological study started in 2013 by TSMC has allowed obtaining a network of wells and piezometers for the characterization and observation of the aquifer flowing under the Howse deposit. The actual piezometry has allowed defining partially the limits of the Goodream basin in which the Howse deposit is located. The piezometry indicates that the groundwater is flowing, for a large proportion, from the recharge area in the TSMC/DSO3 sector toward the northwest. From the Timmins 4 area the groundwater begins to focus gradually toward an area southwest of Triangle Lake. The aquifer is recharged at the high elevations of the Quebec-Labrador boundary and at the groundwater divide on Irony Mountain. It is possible that Pinette Lake participates to the recharge of groundwater flowing toward the deposit. Groundwater should discharge into the Burnetta Lake area through southwest thrust fault network parallel to a segment of Burnetta Creek.

The groundwater is flowing northwest between 65 m and 90 m under the Howse deposit and a thick overburden with a mean gradient of 0.02 m/m. The Sokoman and the Wishart aquifers have shown significant flow rates varying between 200 to 800 L/min. The Attikamagen Formation provides substantially lower flow rates.

For all wells, except for one exceeding the total suspended solids of the MMER norm, none of the analysed physico-chemical parameters was problematic. If necessary, the problem of the suspended solids in the pumped water can be easily fixed by sedimentation ponds. The groundwater is generally soft and free of coloration and turbidity.

Based on parameters obtained from hydraulic testing of wells, the dewatering rates will likely not exceed 12,000 m³/d including a safety factor of 1.25. The results represent the best estimate based on the actual knowledge of the area. The sensitivity analysis has shown that the hydraulic conductivity is the more influent parameter in the simulations. Increasing this value can theoretically raise the dewatering flow rate to a maximum of 23,000 m³/d including a safety factor of 1.25.

Burnetta Creek should be fed partly by groundwater. The drawdown induced by the dewatering of the deposit could possibly affect Burnetta Creek which is downgradient of the Howse deposit. The effect should be a decrease of the flow rate which is not expected to be significant.

Written by:



Gilles Fortin, ing. M.Sc.

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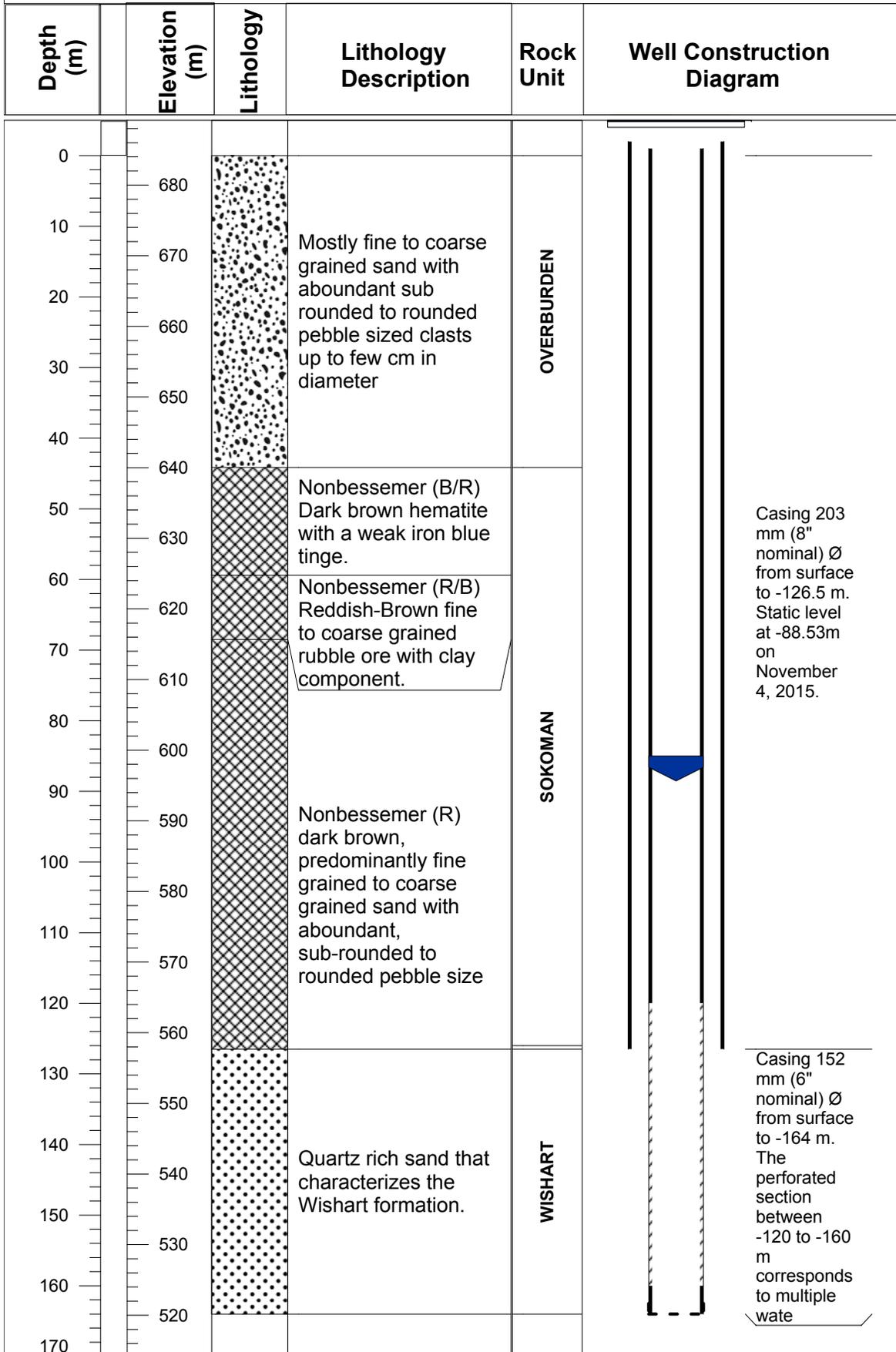
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APPENDICES

APPENDIX I

WELLS DIAGRAMS WITH SIMPLIFIED GEOLOGY



Drilling Date: September 13, 2014

Project Name: HOWSE

Easting (UTM zone 19): 619715

Drilling Company: Major Drilling

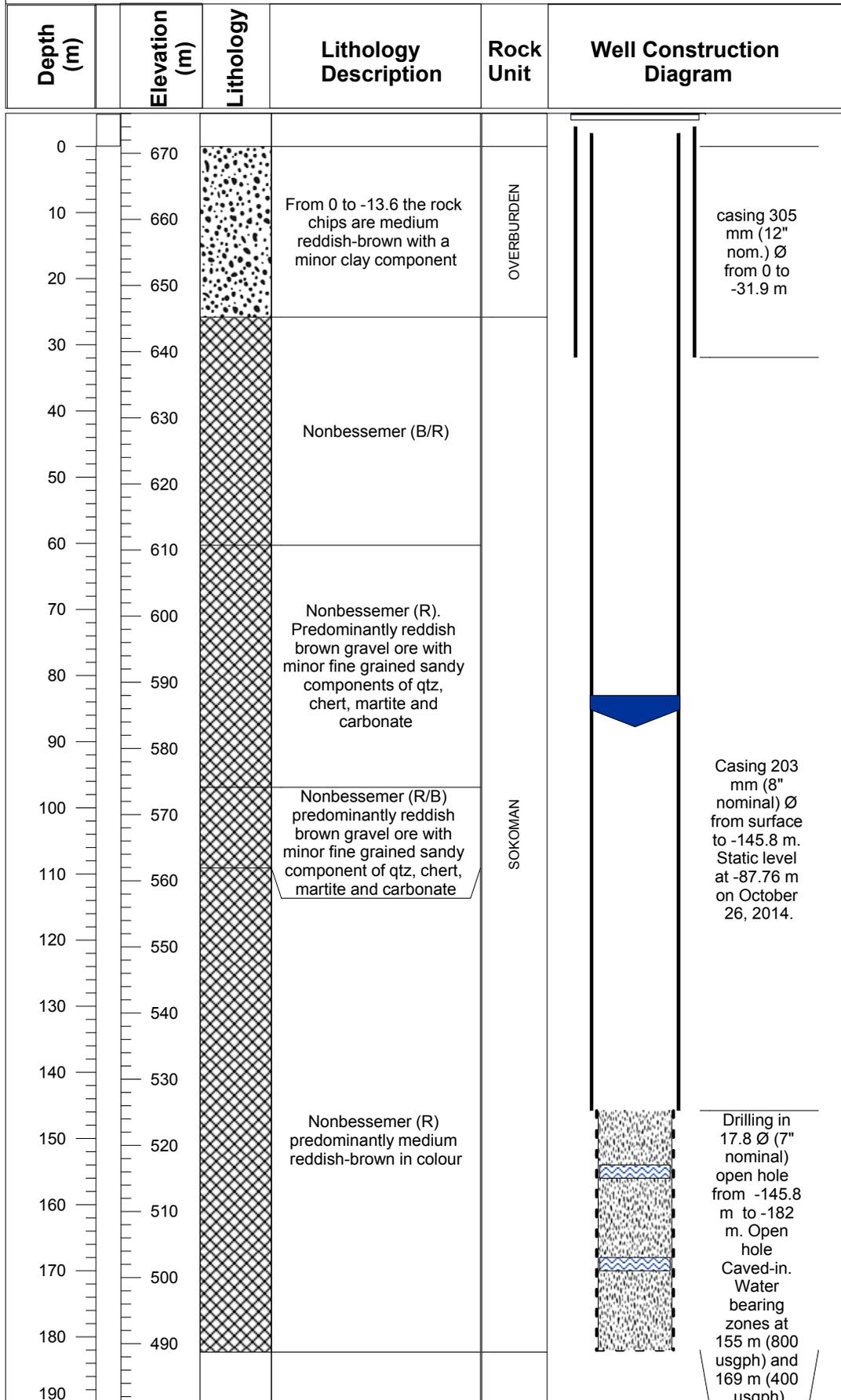
Company Name: Tata Steel Minerals

Northing (UTM zone 19): 6085660

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin



Drilling Date: September 24, 2014

Project Name: Howse

Easting (UTM zone 19): 619338

Drilling Company: Major Drilling

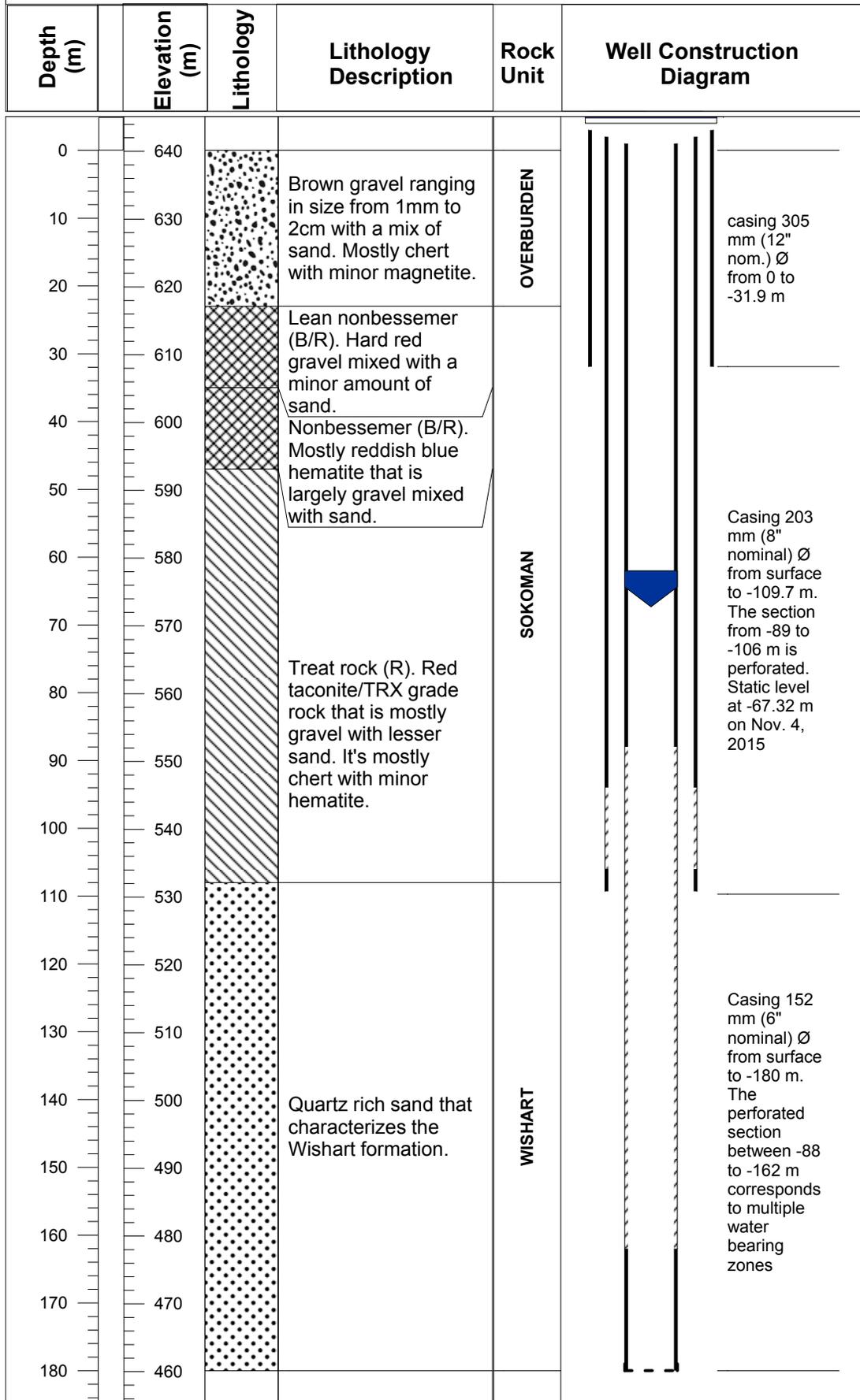
Company Name: TSMC

Northing (UTM zone 19): 6086138

Drilling Method: Major Drilling

Location: Schefferville

Hydrogeologist: Gilles Fortin



Drilling Date: November 19, 2014

Project Name: HOWSE

Easting (UTM zone 19): 618737

Drilling Company: Major Drilling

Company Name: Tata Steel Minerals

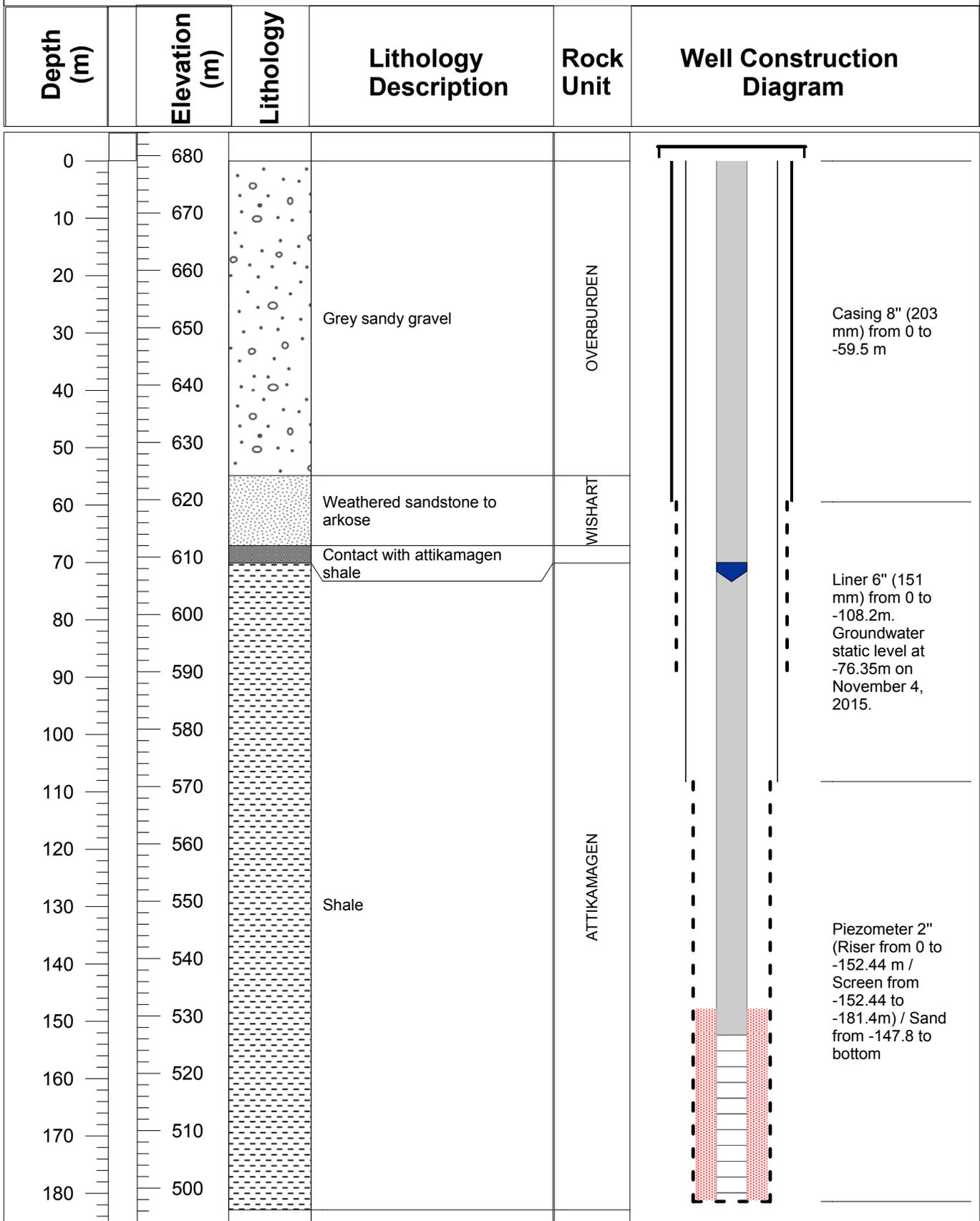
Northing (UTM zone 19): 6086703

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin

Fig. A1-4: HW-RC-15-WE05R



Drilling Date: August 28, 2015

Project Name: HOWSE

Easting (UTM zone 19): 619903

Drilling Company: Forage LBM

Company Name: Tata Steel Minerals

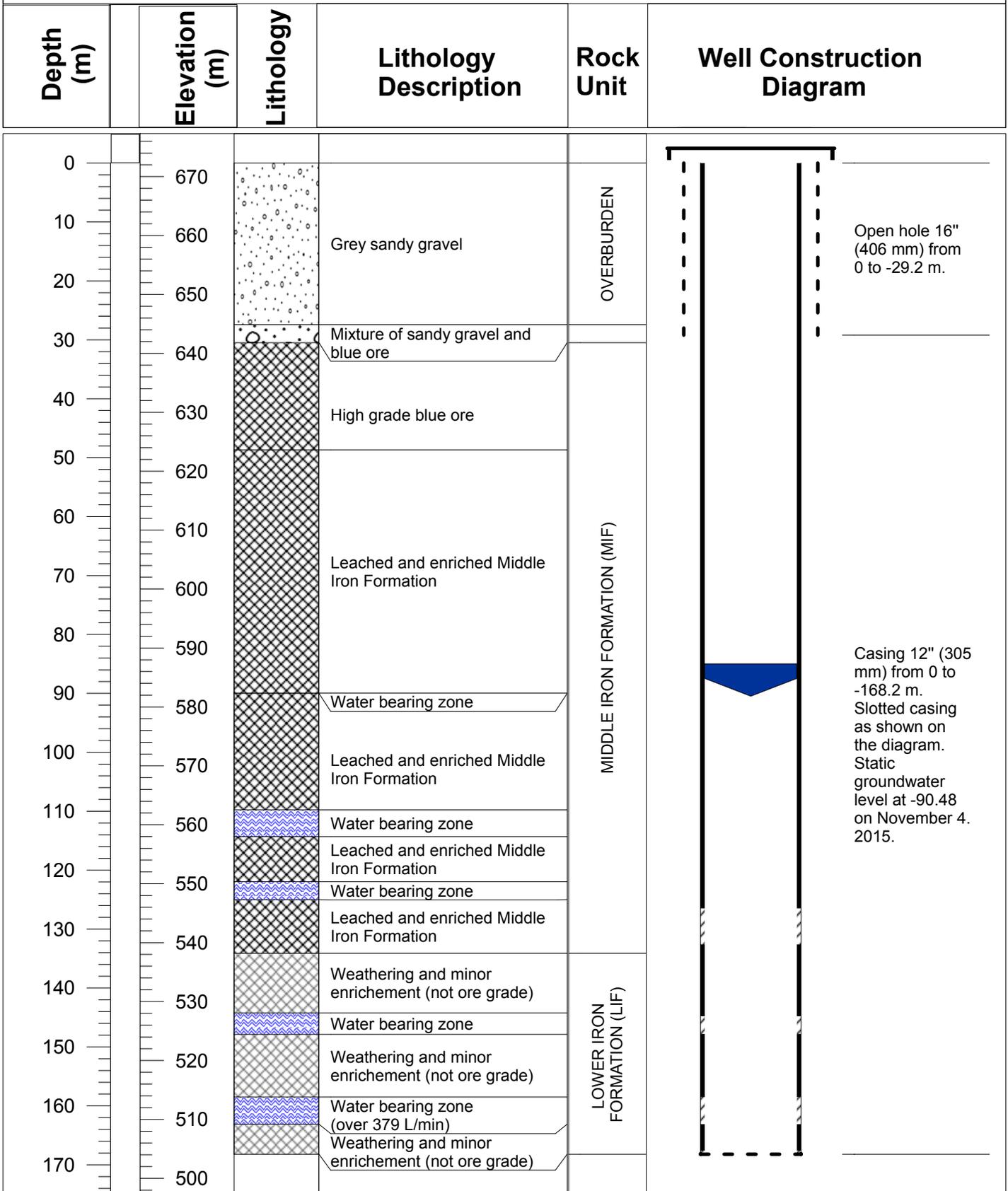
Northing (UTM zone 19): 6085454

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin

Fig. A1-5: HW-RC15-WE06R



Drilling Date: September 2, 2015

Project Name: Howse

Easting (UTM zone 19): 619339

Drilling Company: Les Forages LBM

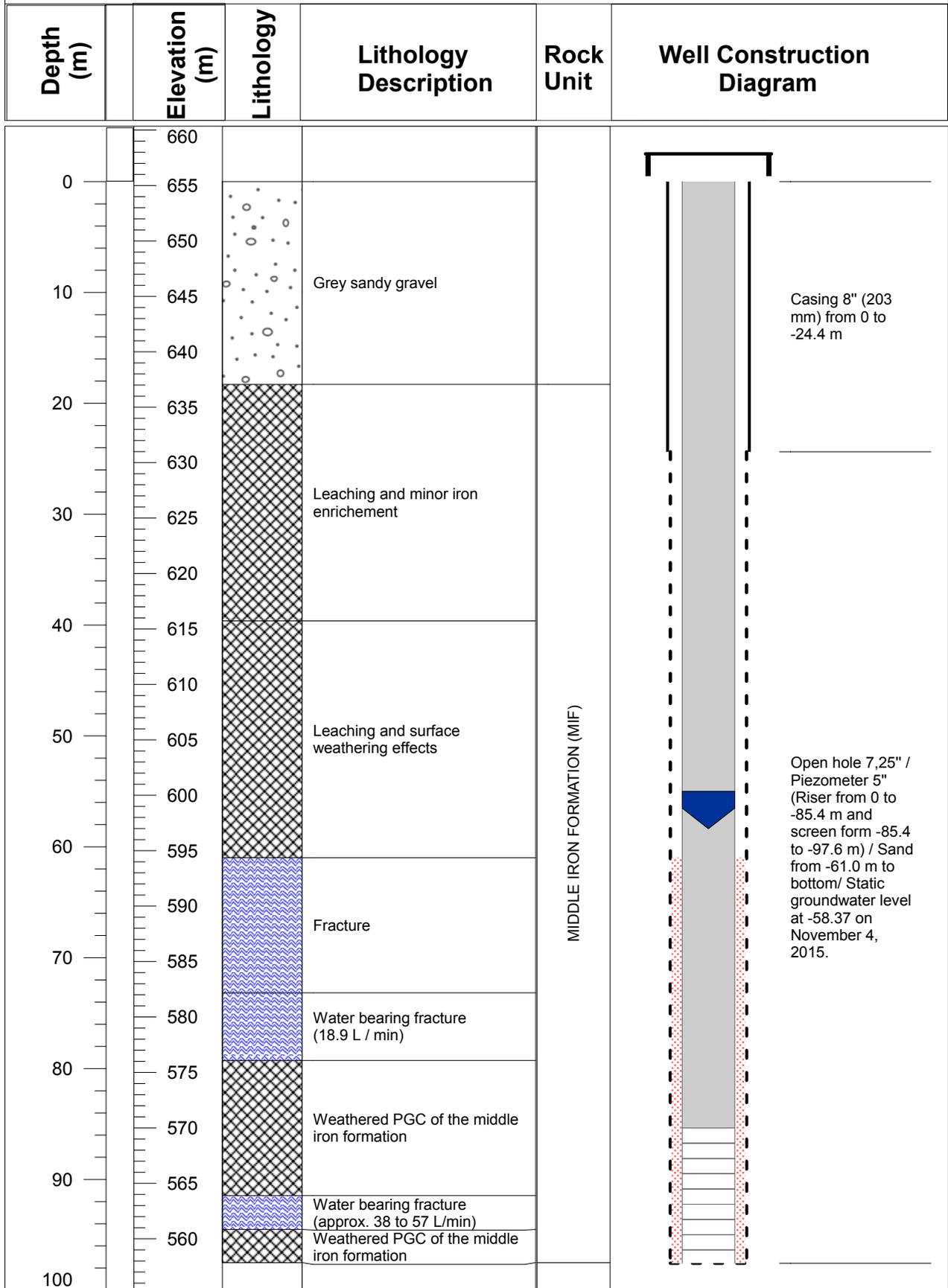
Company Name: Tata Steel Minerals

Northing (UTM zone 19): 6086132

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin



Drilling Date: September 11, 2015 Project Name: HOWSE

Easting (UTM zone 19): 620275

Drilling Company: Les Forages LBM Company Name: Tata Steel Minerals

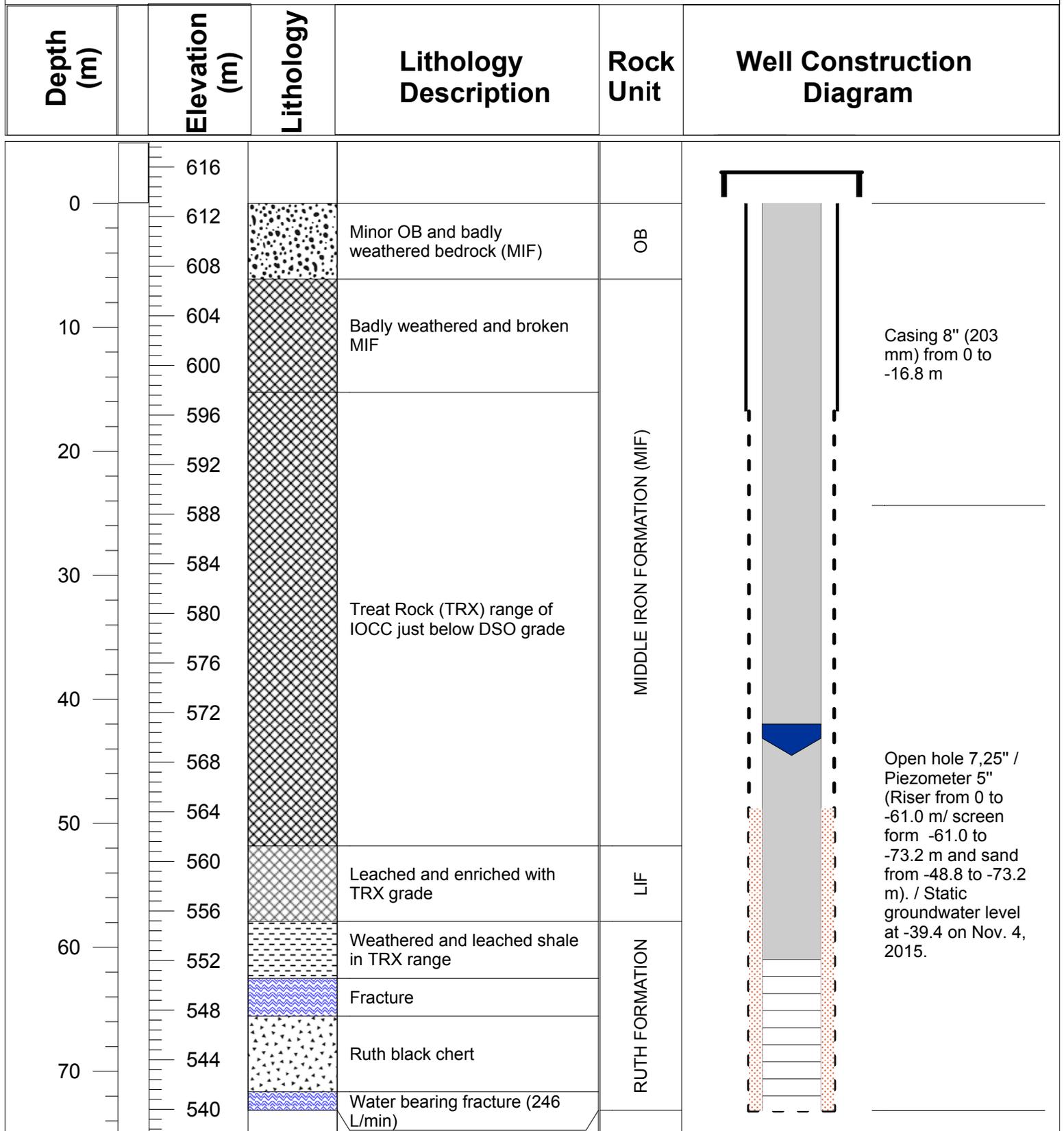
Northing (UTM zone 19): 6085028

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin

Fig A1-7: HW-RC-15-WE08R



Drilling Date: September 10, 2015

Project Name: HOWSE

Easting (UTM zone19): 617942

Drilling Company: Les Forages LBM

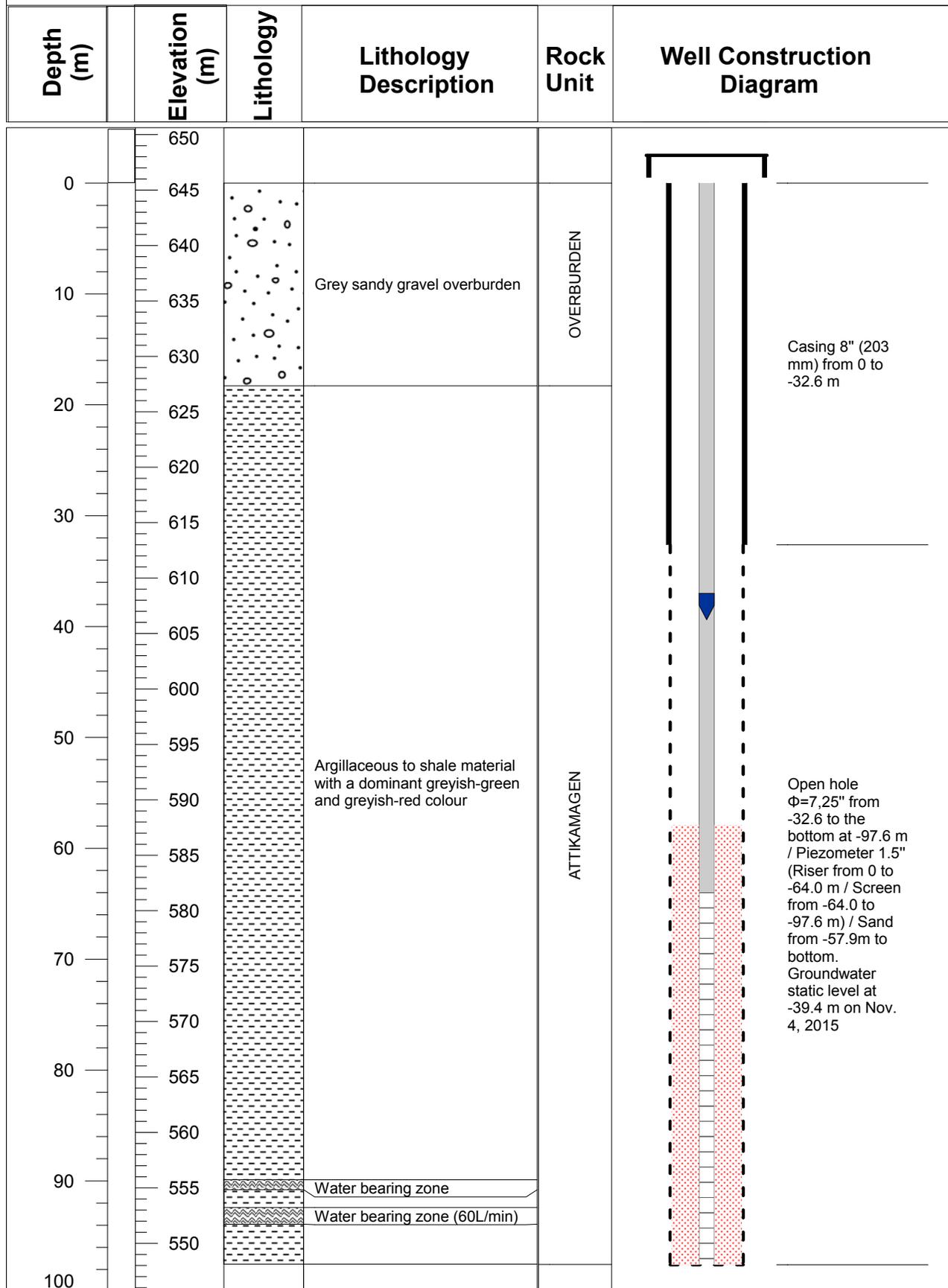
Company Name: Tata Steel Minerals

Northing (UTM zone 19): 6087650

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin



Drilling Date: September 8, 2015

Project Name: HOWSE

Easting (UTM zone 19): 619859

Drilling Company: Les Forages LBM

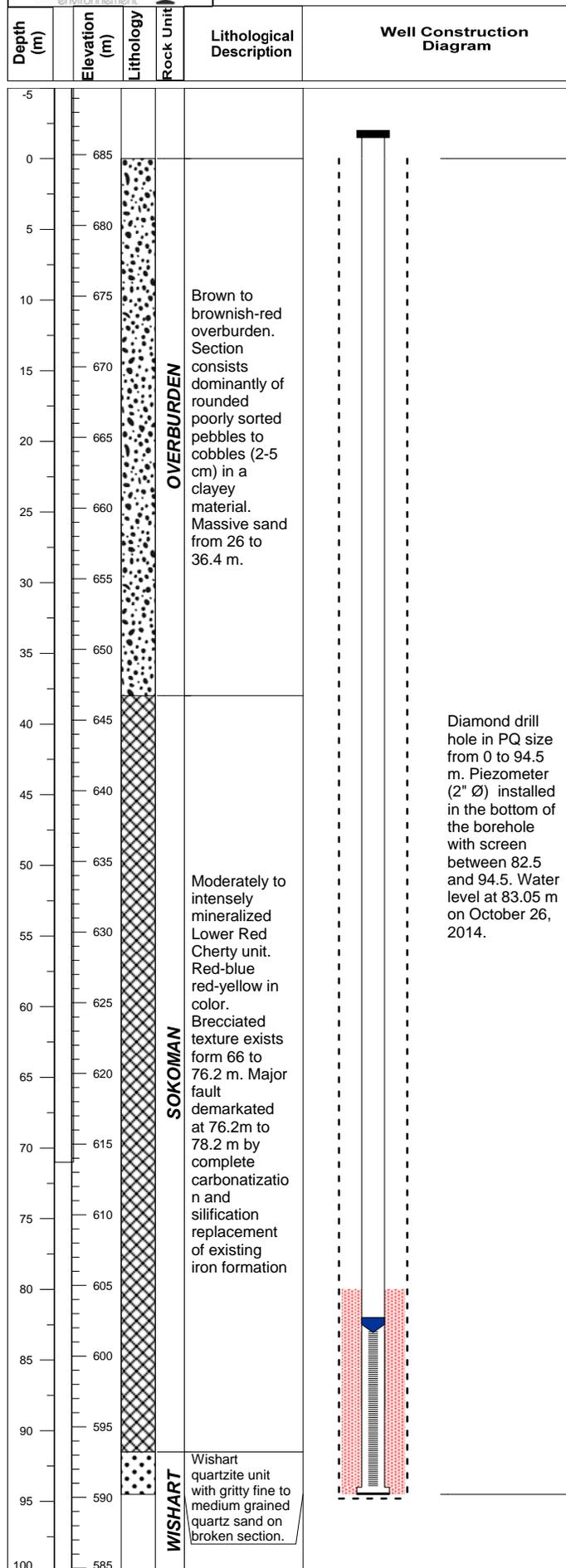
Company Name: Tata Steel Minerals

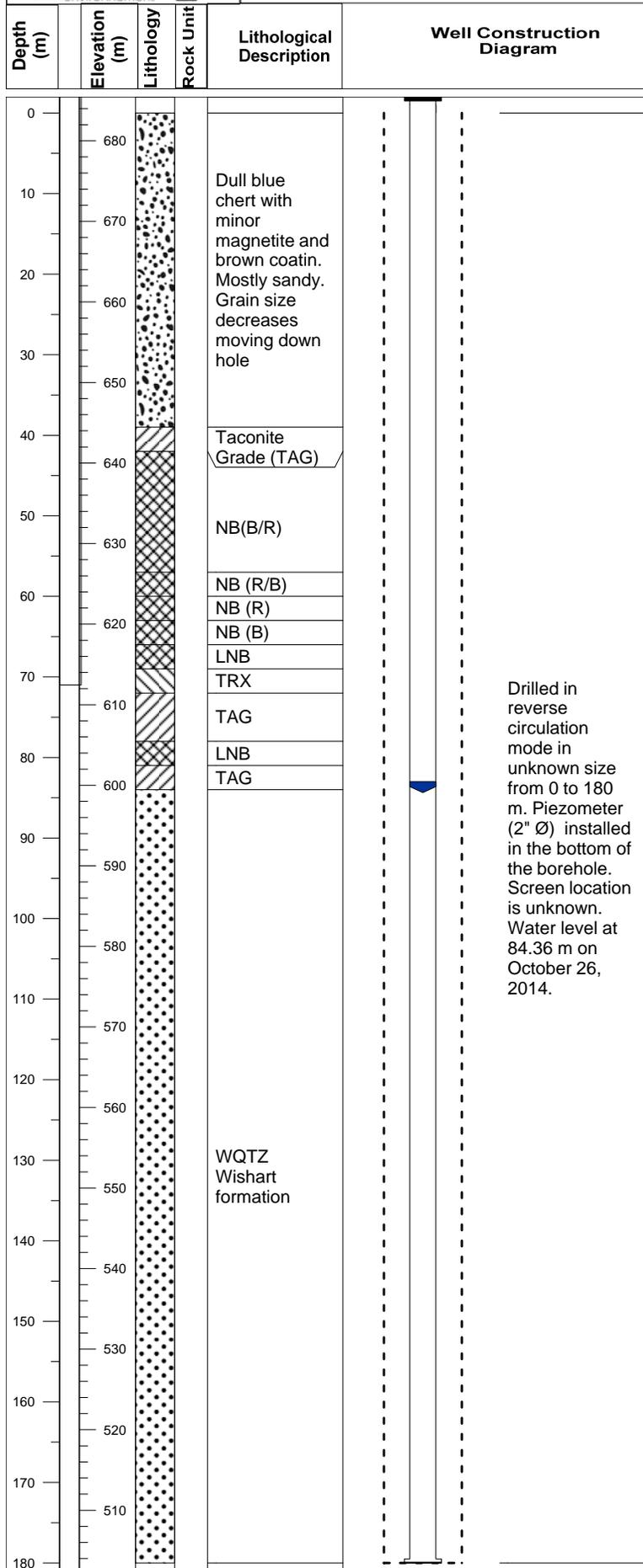
Northing (UTM zone 19): 6086780

Drilling Method: Double rotation

Location: Schefferville

Hydrogeologist: Gilles Fortin





Drilling End Date: July 12, 2013

Drilling Company: Major Drilling

Drilling Method: Rotary

Project Name: Howse

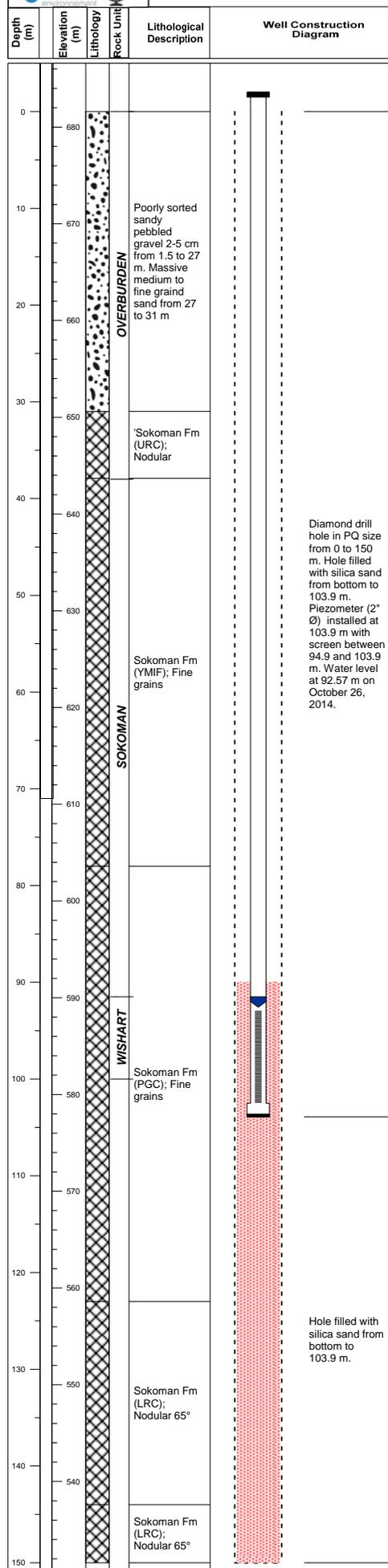
Company Name: TSMC

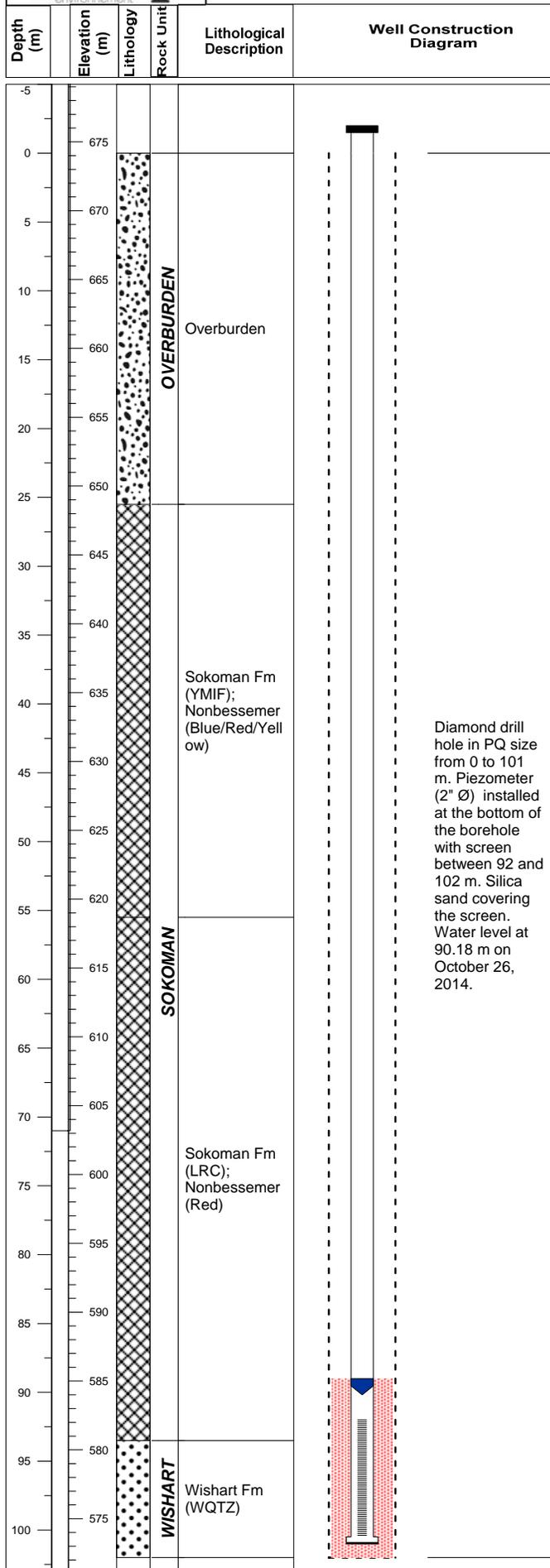
Location: Schefferville

Easting: 619755 (zone 19)

Northing: 6085655

Hydrogeologist: Golder





Drilling End Date August 27, 2014

Project Name: Howse

Easting: 619393 (zone 19)

Drilling Company: Major Drilling

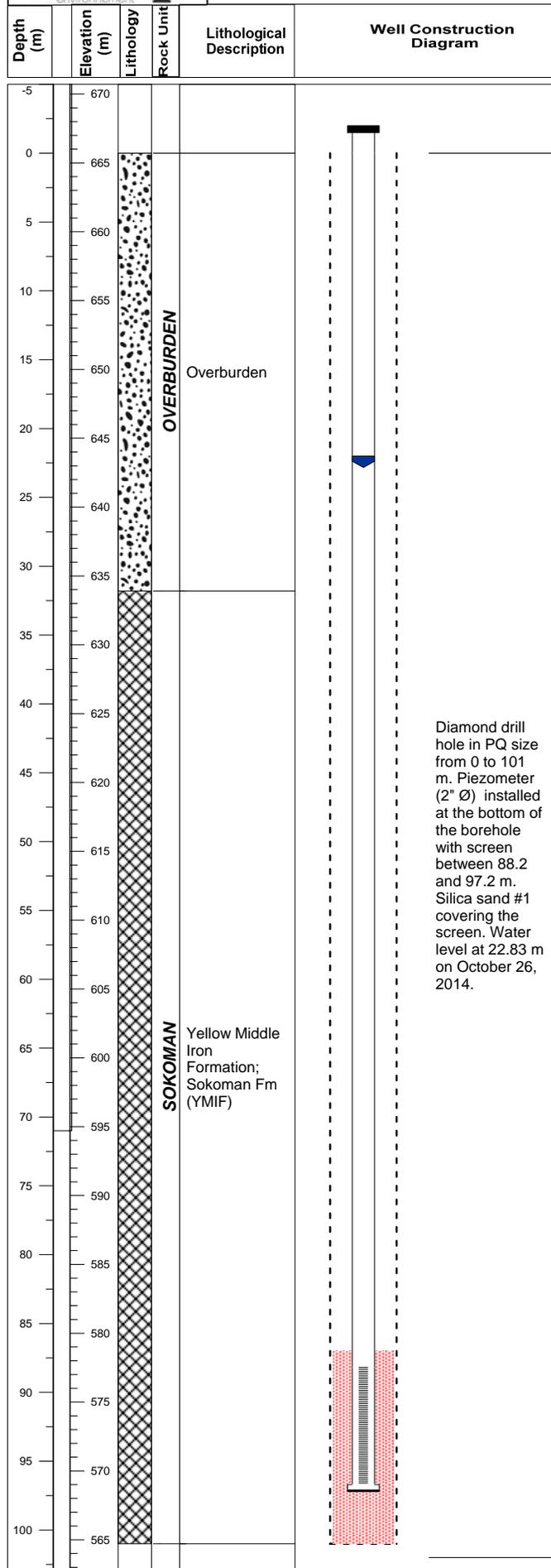
Company Name: TSMC

Northing: 6086123

Drilling Method: Rotary

Location: Schefferville

Hydrogeologist: Gilles Fortin



Drilling End Date August 27, 2014

Project Name: Howse

Easting: 619367 (zone 19)

Drilling Company: Major Drilling

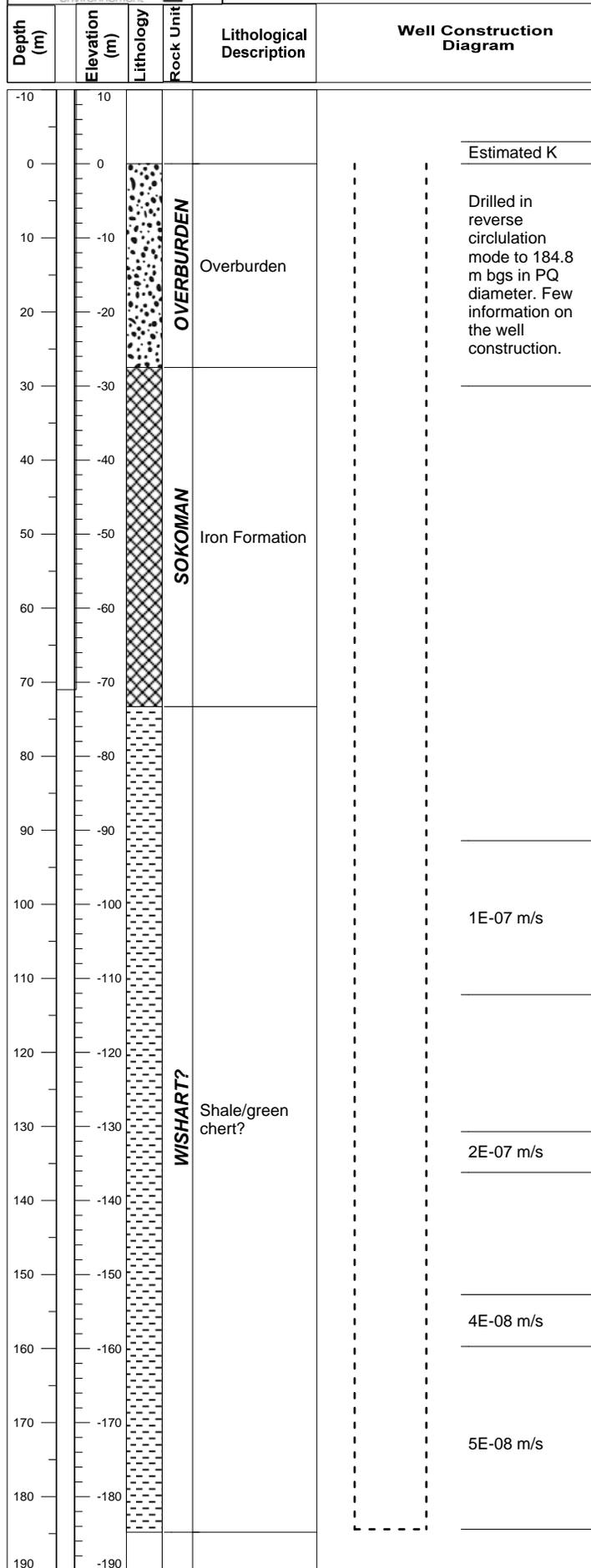
Company Name: TSMC

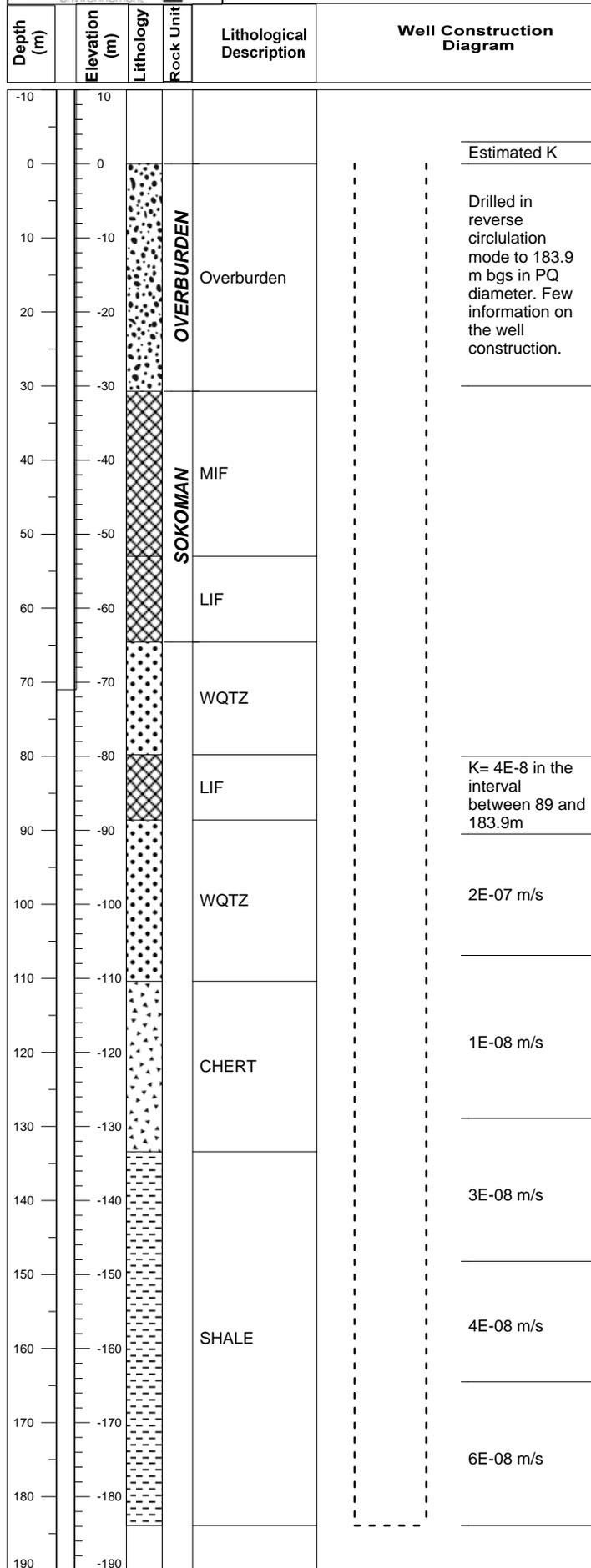
Northing: 6086270

Drilling Method: Rotary

Location: Schefferville

Hydrogeologist: Gilles Fortin





APPENDIX II

GEOLOGY OF OVERBURDEN WELLS

Geology HW-RC14-WE01OB

From	To	Summary	Description
0	4,5	OB	Light to medium brown sand sized material up to a few cm in diameter
4,5	6,5	OB	Light to medium brown sand sized to pebble sized material up to a few cm in diameter
6,5	9,5	OB	Light to medium brown sand sized material up to a few cm in diameter
9,5	12,5	OB	Light to medium brown sand sized material up to a few cm in diameter
12,5	15,5	OB	Light to medium brown in colour
15,5	18,5	OB	Medium to dark brown in colour with about 50/50 sand sized and pebble sized material up to a 5cm in diameter
18,5	21,5	OB	Medium brown sand sized material up to a few cm in diameter
21,5	24,5	OB	Light to medium brown sand sized material up to a few cm in diameter
24,5	27,5	OB	Medium brown in colour with about 50/50 sand sized and pebble sized material up to a few cm in diameter
27,5	30,5	OB	Medium to dark brown in colour with about 50/50 sand sized and pebble sized material up to a 5cm cm in diameter
30,5	33,55	OB	Medium to dark brown in colour with about 50/50 sand sized and pebble sized material up to a 5cm cm in diameter
33,55	36,6	OB	Reddish brown to Blueish red in colour
36,6	40	OB	Reddish brown in colour with rare pieces with a blueish stain

Geology HW-RC14-WE02OB

From	To	Summary	Description
0	4,5	OB	Light brown, fine to coarse grained sand sized material with rare pebble sized material up to a few cm in diameter
4,5	7,5	OB	Light brown, fine to coarse grained sand sized material with rare pebble sized material up to a few cm in diameter
7,5	10,6	OB	Light brown, very fine frained sandy material
10,6	13,65	OB	Light brown
13,65	16,7	OB	Light brown, fine to coarse grained sand sized material with rare pebble sized material up to a few cm in diameter
16,7	19,75	OB	Light brown, fine to coarse grained sand sized material with abundant pebble sized material up to a few cm in diameter
19,75	22,85	OB	Light brown, fine to coarse grained sand sized material with abundant pebble sized material up to a few cm in diameter
22,85	25,9	OB	Light to medium brown clay with rare sand sized material just a couple of mm in diameter
25,9	28,95	OB	Light to medium brown clay with rare sand sized material just a couple of mm in diameter

Geology HW-RC14-WE03OB

From	To	Summary	Description
0	4,5	OB	Medium-brown, Very fine to medium grain sand consisting of chert and other rock fragments
10,5	13,5	OB	Medium-reddish brown, Fine to medium grain sand consisting of chert and other rock fragments
16,5	19,5	OB	Medium-brown, clay-rich sand consisting of chert, qtz and other rock fragments
19,5	22,5	OB	Medium-brown, clay-rich sand consisting of chert, qtz and other rock fragments
22,5	25,5	OB	Medium-dark brown, clay-rich sand consisting of chert, qtz and other rock fragments
25,5	28,5	OB	Medium-brown, clay-rich sand consisting of chert, qtz and other rock fragments
28,5	31,95	OB	Red-Blue clay rich sandy rubble with fine qtz grains and other fine grained material
31,95	35,5	OB	Dark reddish-brown, sand consisting of chert, qtz and other rock fragments

APPENDIX III

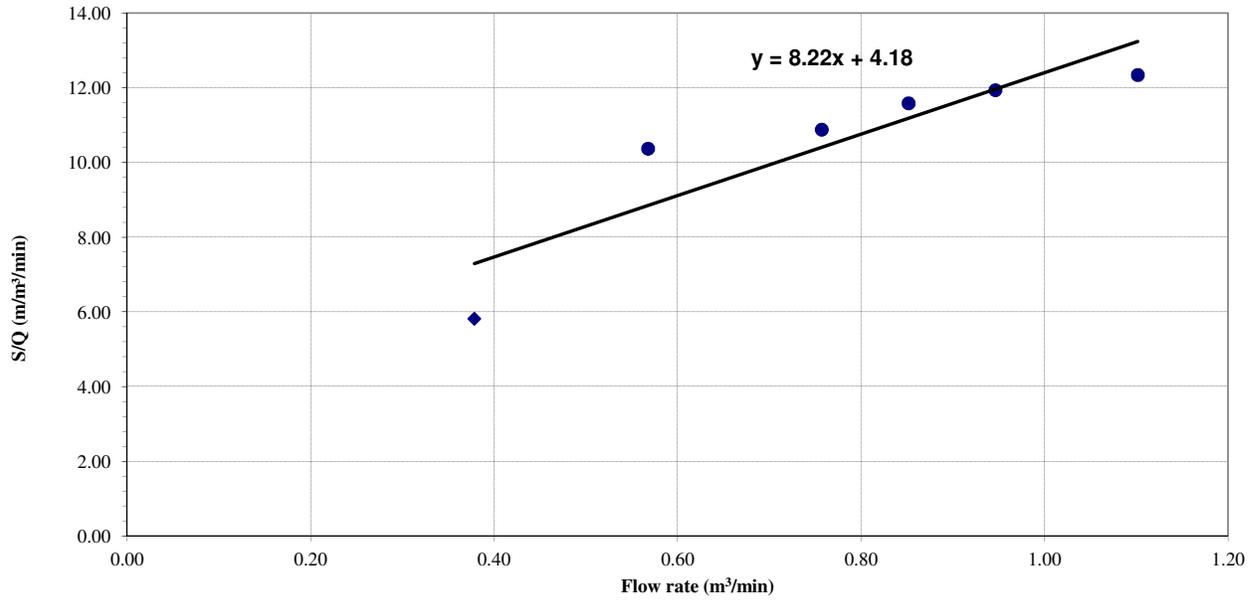
PUMPING TEST INTERPRETATION AND DATA

1) Step Test Results

WE06R

Step no.	Duration	Flow		Drawdown	Specific Drawdown		Specific Capacity	
		min	gpm		Q (m ³ /min)	s (m)	S/Q (m/m ³ /min)	Q/S (m ³ /min/m)
1	60	100		0.38	2.2	5.81		0.17
2	60	150		0.57	5.89	10.37		0.10
3	60	200		0.76	8.24	10.88		0.09
4	60	225		0.85	9.87	11.59		0.09
5	60	250		0.95	11.3	11.94		0.08
6	60	291		1.10	13.6	12.35		0.08

2. Graph of Specific Drawdown vs pumping flow rate

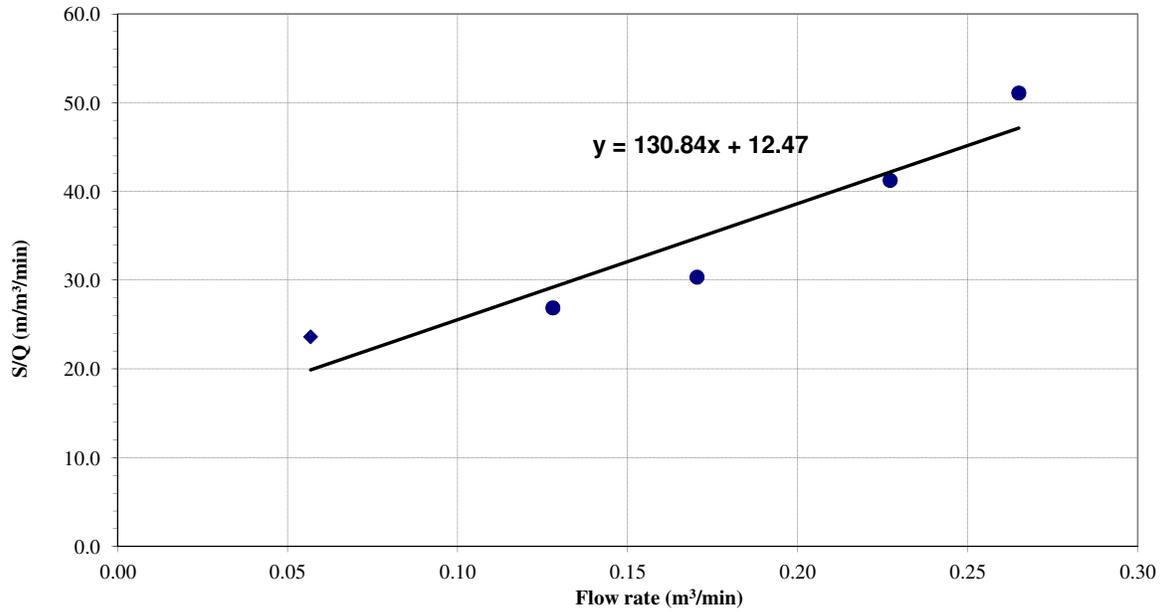


1) Step Test results

WE07R

Step no.	Duration min	Flow gpm	Flow	Drawdown	Specific Drawdown	Specific Capacity
			Q (m ³ /min)	s (m)	S/Q (m/m ³ /min)	Q/S (m ³ /min/m)
1	30	15	0.06	1.34	23.6	0.04
2	30	33.8	0.13	3.44	26.9	0.04
3	30	45	0.17	5.17	30.4	0.03
4	30	60	0.23	9.37	41.3	0.02
5	30	70	0.26	13.54	51.1	0.02

2. Graph of Specific Drawdown vs pumping flow rate

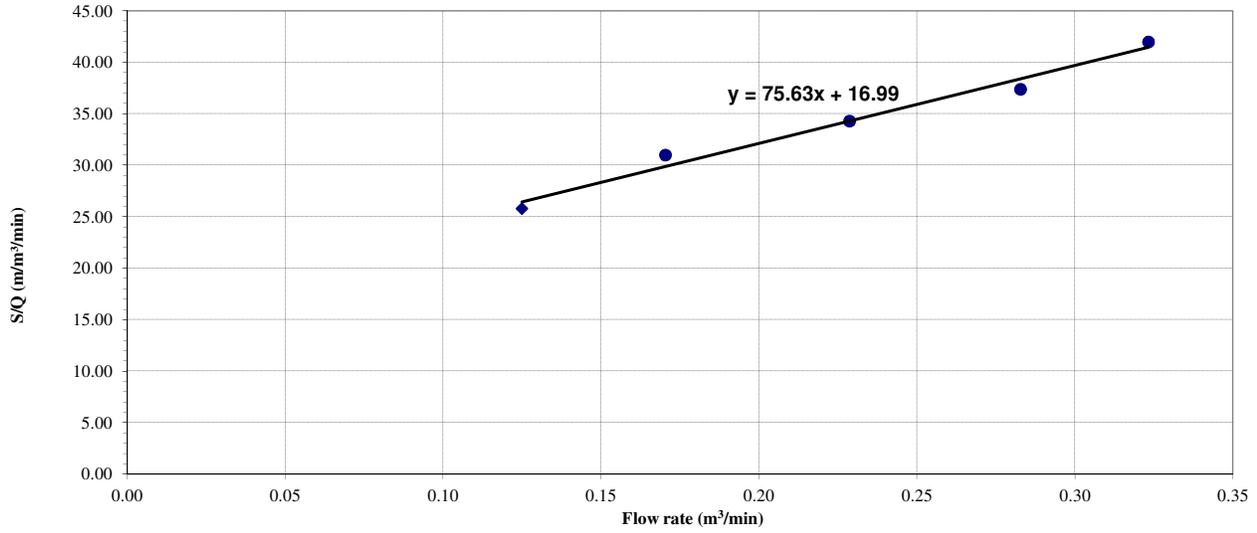


1) Step Test results

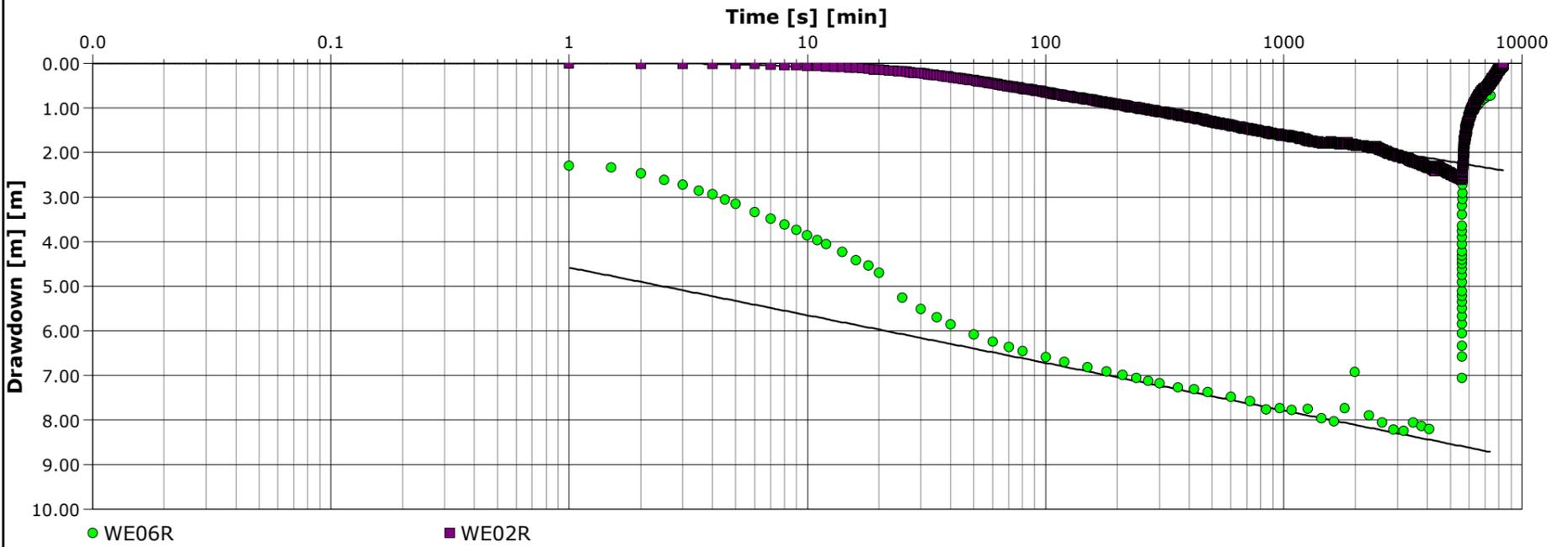
WE08R

Step no.	Duration	Flow	Flow	Flow	Flow	Drawdown	Specific Capacity	Specific Drawdown
	min	gpm	m ³ /d	Q (l/s)	Q (m ³ /min)	s (m)	S/Q (m/m ³ /min)	Q/S (m ³ /min/m)
1	30	33	180	2.1	0.12	3.22	25.78	0.04
2	30	45	245	2.8	0.17	5.28	31.00	0.03
3	30	60.4	329	3.8	0.23	7.84	34.29	0.03
4	30	74.7	407	4.7	0.28	10.57	37.38	0.03
5	30	85.4	466	5.4	0.32	13.57	41.98	0.02

2. Graph of Specific Drawdown vs pumping flow rate



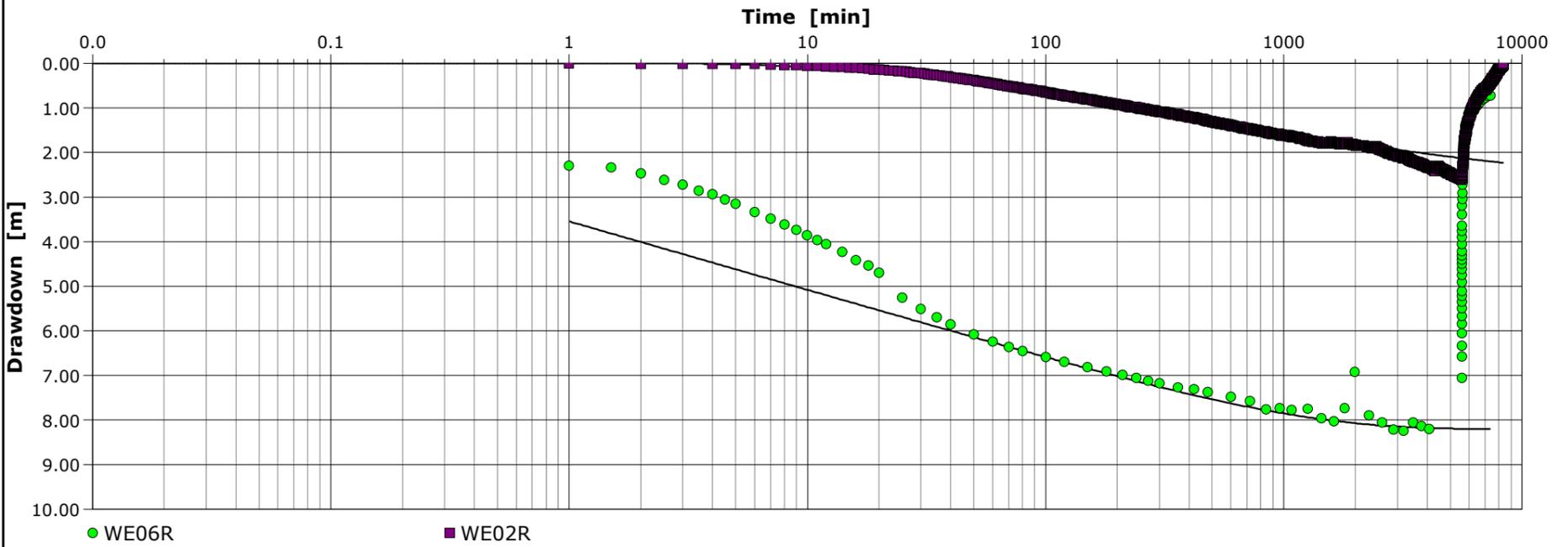
Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m ³ /d]	



Calculation after Theis

Observation well	Transmissivity [m ² /s]	K [m/s]	Storage coefficient	Radial distance to PW [m]
WE06R	1.26×10^{-3}	1.56×10^{-5}	3.86×10^{-4}	0.15
WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}	6.08
Average	1.38×10^{-3}	1.71×10^{-5}	4.95×10^{-2}	

Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Hantush	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m³/d]	

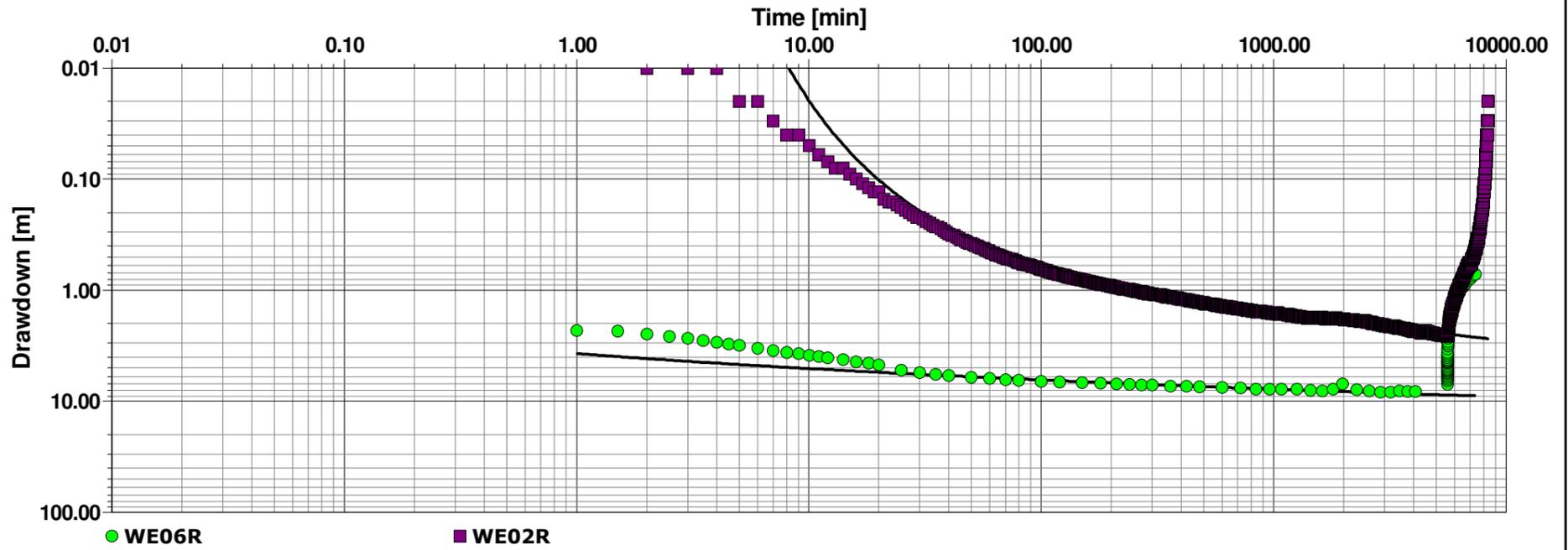


Calculation after Hantush

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Hydr. resistance [min]	Radial distance to PW [m]
WE06R	8.78×10^{-4}	1.08×10^{-5}	2.56×10^{-2}	7.41×10^4	0.15
WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}	1.67×10^5	6.08
Average	1.19×10^{-3}	1.47×10^{-5}	6.21×10^{-2}	1.20×10^5	

Le modèle Hantush ne juxtapose pas les données de descente avec la remontée

Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Double Porosité	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m ³ /d]	

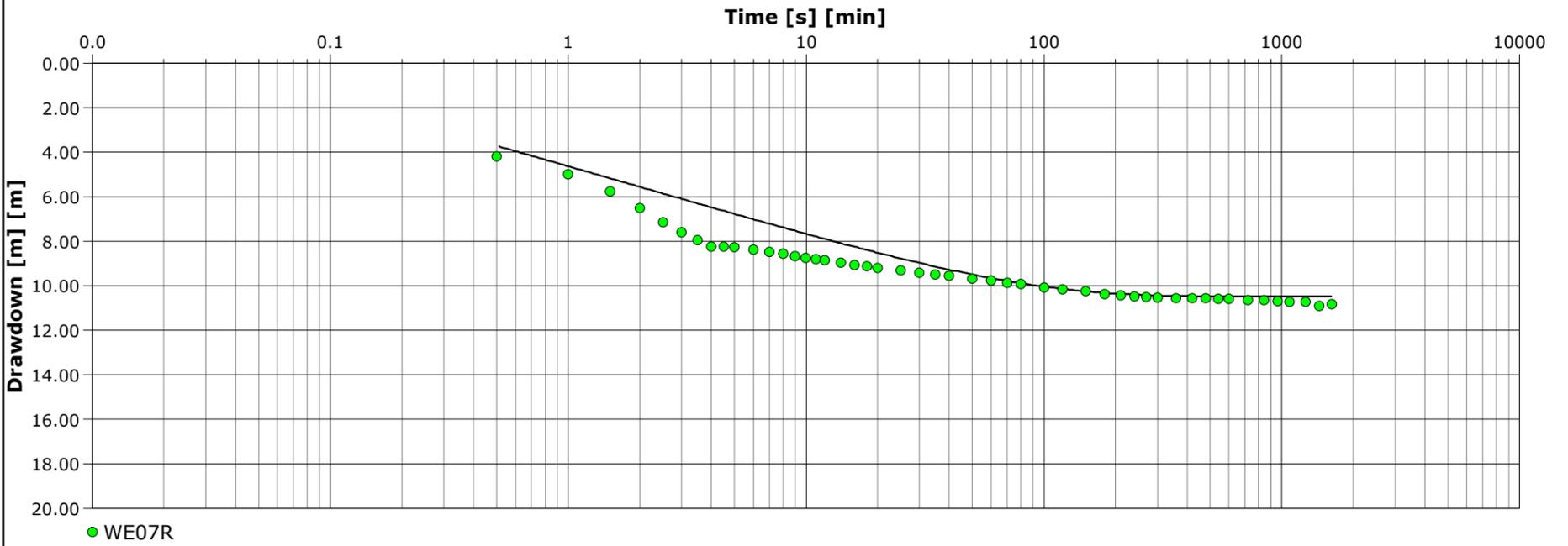


Calculation after Double Porosity

Observation well	Transmissivity [m ² /s]	K [m/s]	Specific storage	Sigma	Lambda	Radial distance to PW [m]
WE06R	1.00×10^{-3}	1.23×10^{-5}	3.38×10^{-4}	2.96×10^1	6.67×10^{-2}	0.15
WE02R	1.00×10^{-3}	1.23×10^{-5}	1.48×10^{-1}	1.00×10^0	6.67×10^{-2}	6.08
Average	1.00×10^{-3}	1.23×10^{-5}	7.41×10^{-2}	1.53×10^1	6.67×10^{-2}	

Location: Howse Deposit		Pumping Test: Pumping Test 2 (WE06R)			Pumping well: WE06R			
Test conducted by: Geofor					Test date: 22/09/2015			
Aquifer Thickness: 81.00 m			Discharge: variable, average rate 637.83 [m ³ /d]					
	Analysis Name	Analysis performed by	Date	Method name	Well	T [m ² /s]	K [m/s]	S
1	Theis	AB	21/09/2015	Theis	WE06R	1.26×10^{-3}	1.56×10^{-5}	3.86×10^{-4}
2	Theis	AB	21/09/2015	Theis	WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}
3	Hantush	AB	21/09/2015	Hantush	WE06R	8.78×10^{-4}	1.08×10^{-5}	2.56×10^{-2}
4	Hantush	AB	21/09/2015	Hantush	WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}
5	Double Porosité	AB	21/09/2015	Double Porosity	WE06R	1.00×10^{-3}	1.23×10^{-5}	3.38×10^{-4}
6	Double Porosité	AB	21/09/2015	Double Porosity	WE02R	1.00×10^{-3}	1.23×10^{-5}	1.48×10^{-1}
Average						1.19×10^{-3}	1.47×10^{-5}	6.19×10^{-2}

Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Hantush	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m³/d]	

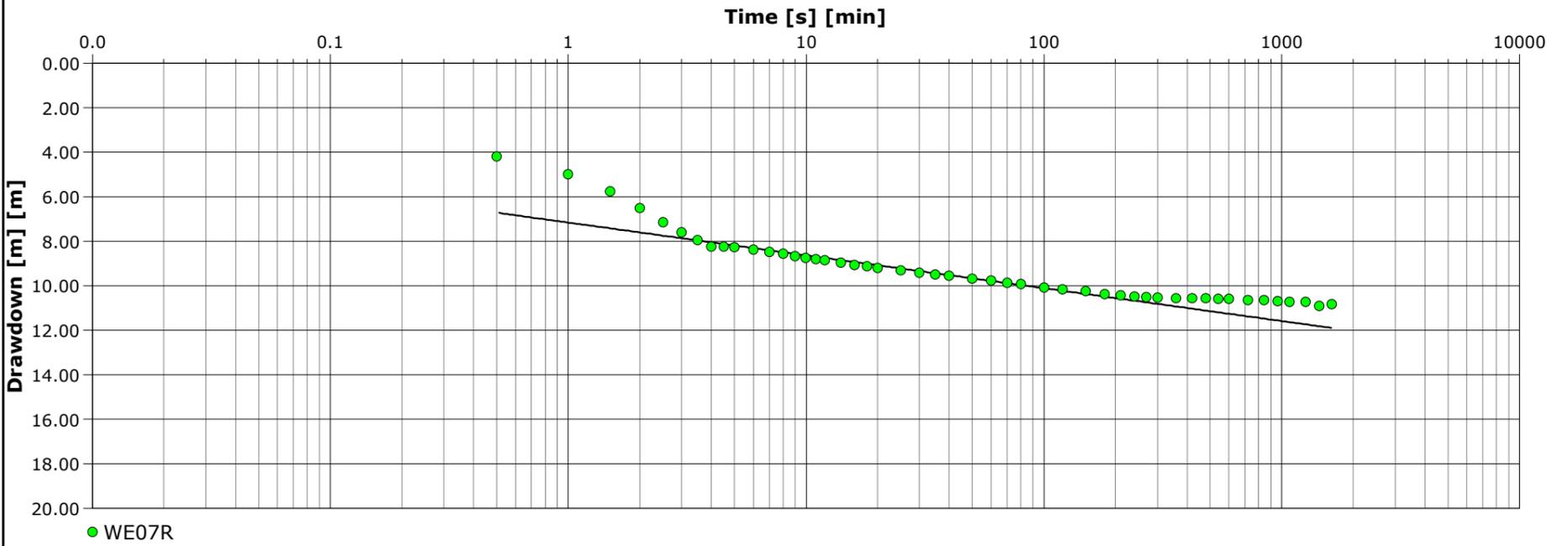


Calculation after Hantush

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Hydr. resistance [min]	Radial distance to PW [m]
WE07R	2.03×10^{-4}	5.34×10^{-6}	2.31×10^{-1}	5.58×10^2	0.06

Le modèle Hantush ne juxtapose pas les données de descente avec la remontée

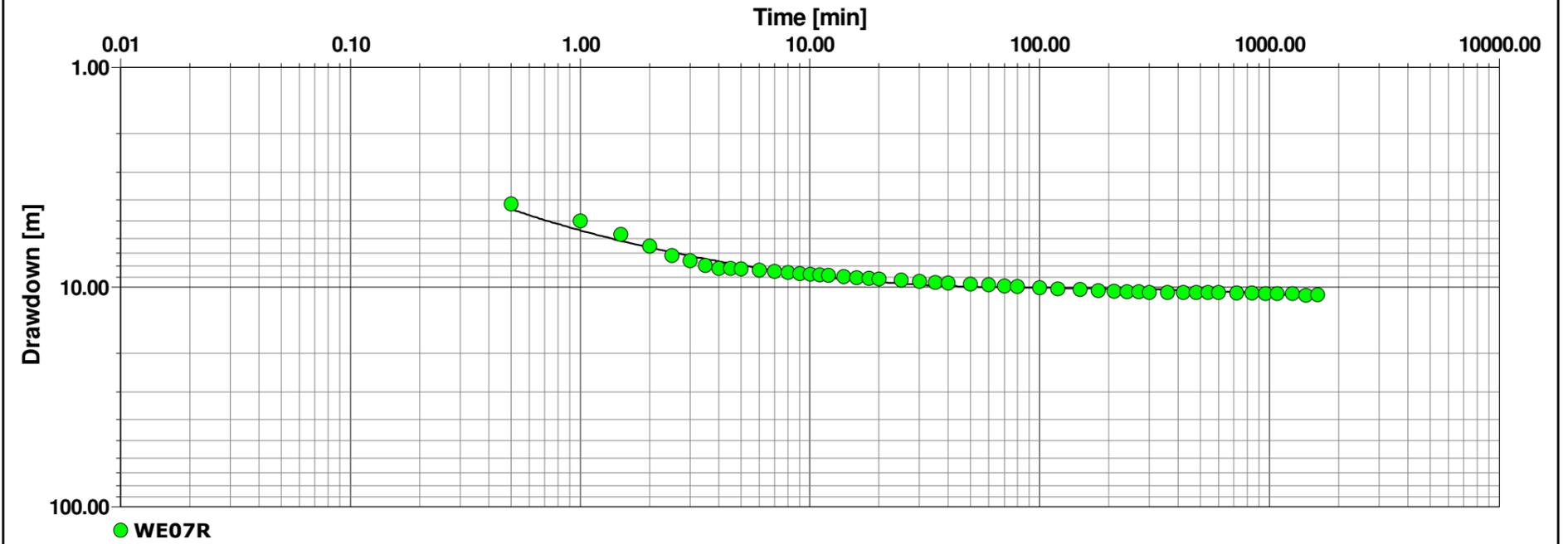
Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m ³ /d]	



Calculation after Theis

Observation well	Transmissivity [m ² /s]	K [m/s]	Storage coefficient	Radial distance to PW [m]
WE07R	4.34×10^{-4}	1.14×10^{-5}	2.01×10^{-4}	0.06

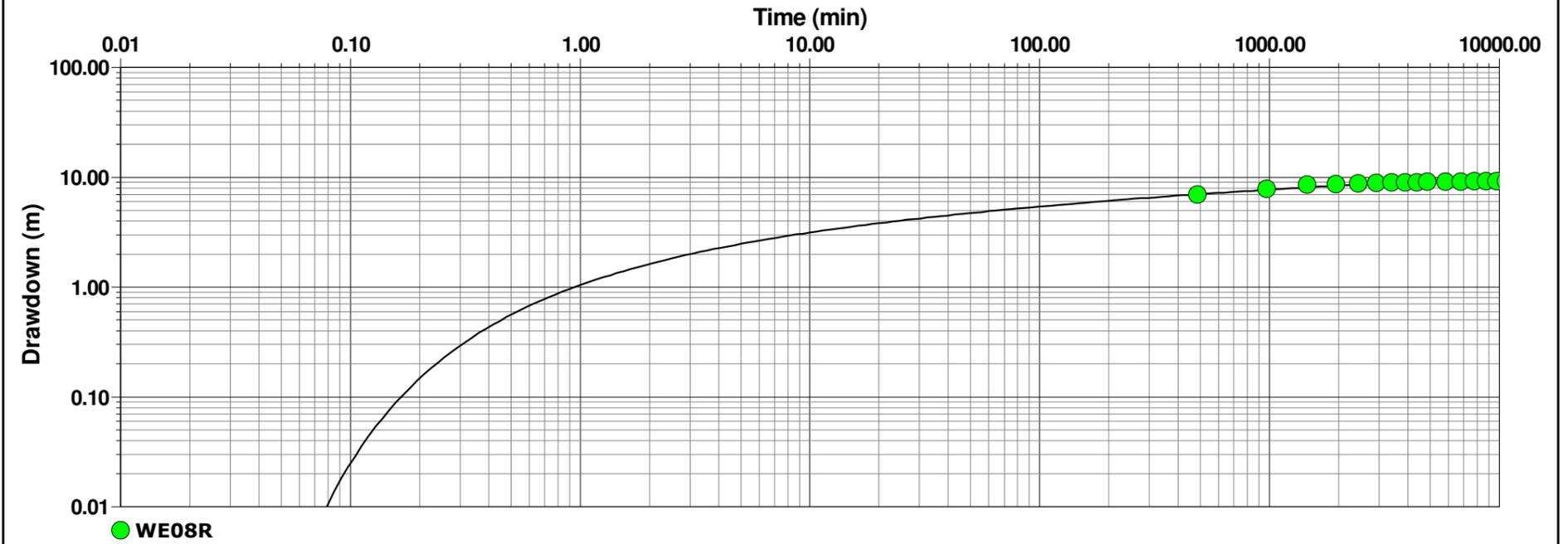
Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Double Porosit�	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m ³ /d]	



Calculation after Double Porosity						
Observation well	Transmissivity [m ² /s]	K [m/s]	Specific storage	Sigma	Lambda	Radial distance to PW [m]
WE07R	1.66×10^{-4}	4.36×10^{-6}	2.01×10^{-1}	7.74×10^1	3.25×10^{-3}	0.06

Location: Howse Deposit		Pumping Test: Pumping Test 2 without recovery(WE07R)			Pumping well: WE07R			
Test conducted by: Geofor				Test date: 15/09/2015				
Aquifer Thickness: 38.00 m		Discharge: variable, average rate 296.51 [m ³ /d]						
	Analysis Name	Analysis performed by	Date	Method name	Well	T [m ² /s]	K [m/s]	S
1	Theis	AB	21/09/2015	Theis	WE07R	4.34×10^{-4}	1.14×10^{-5}	2.01×10^{-4}
2	Hantush	AB	21/09/2015	Hantush	WE07R	2.03×10^{-4}	5.34×10^{-6}	2.31×10^{-1}
3	Double Porosité	AB	21/09/2015	Double Porosity	WE07R	1.66×10^{-4}	4.36×10^{-6}	2.01×10^{-1}
Average						2.68×10^{-4}	7.04×10^{-6}	1.44×10^{-1}

Location: Howse Deposit	Pumping Test: Pumping Test (without recovery) HW-RC15-WE08	Pumping well: WE08R
Test conducted by: Geofor		Test date: 13/09/2015
Analysis performed by: A.B.	Theis	Date: 17/09/2015
Aquifer Thickness: 28.00 m	Discharge: variable, average rate 318.6 [m ³ /d]	



Calculation after Theis

Observation well	Transmissivity [m ² /s]	K [m/s]	Storage coefficient	Radial distance to PW [m]
WE08R	3.11×10^{-4}	1.11×10^{-5}	4.70×10^{-3}	0.06



**19, Major
Gatineau
J8V 2K8**

Pumping Test Analysis Report

Project: Howse

Number: GEOF24

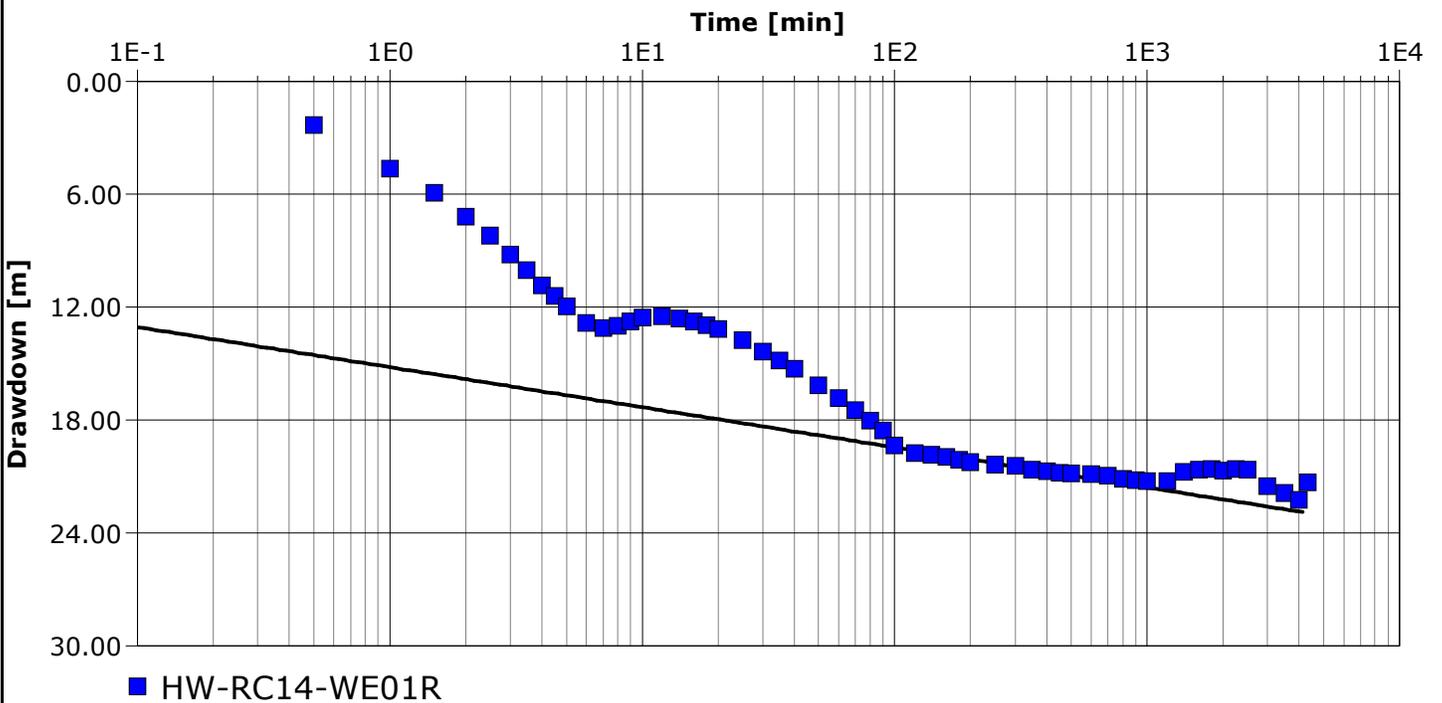
Client: TSMC

Location: Schefferville Pumping Test: HW-RC14-WE01R Pumping Well: HW-RC14-WE01R

Test Conducted by: Geofor Test Date: 2014-10-28

Analysis Performed by: Geofor HW-RC14-WE01R/72hrs Analysis Date: 2014-11-27

Aquifer Thickness: 40.00 m Discharge: variable, average rate 3.86 [m³/h]



Calculation using Theis

Observation Well	Transmissivity [m ² /d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]
HW-RC14-WE01R	7.35×10^0	1.84×10^{-1}	1.46×10^{-7}	0.08



19, Major
Gatineau
J8V 2K8

Pumping Test Analysis Report

Project: Howse

Number: GEOF24

Client: TSMC

Location: Schefferville

Pumping Test: HW-RC-14-WE03R

Pumping Well: HW-RC-14-WE03R

Test Conducted by: Geofor

Test Date: 2014-10-23

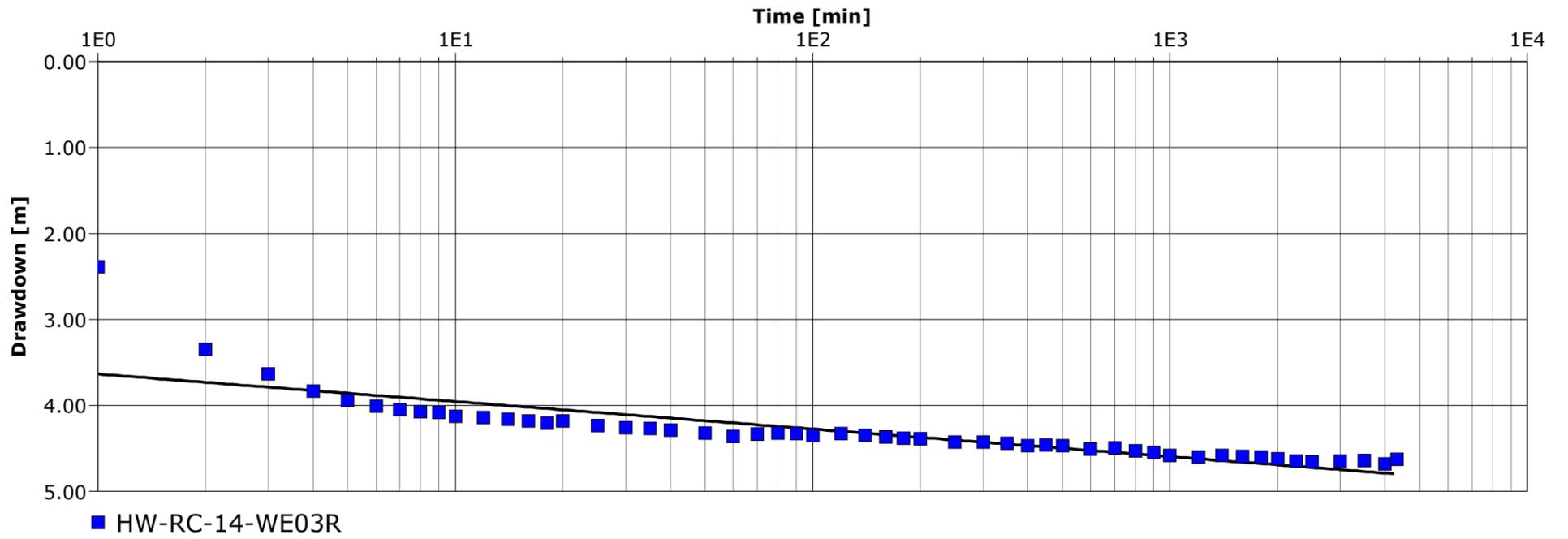
Analysis Performed by: Geofor

HW-RC-14-WE03/72 hours

Analysis Date: 2014-11-24

Aquifer Thickness: 40.00 m

Discharge: variable, average rate 436 [m³/d]



Calculation using Theis

Observation Well	Transmissivity [m ² /d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]
HW-RC-14-WE03R	2.14×10^2	5.35×10^0	2.46×10^{-10}	0.08

Pumping Test Data

HW-RC14-WE01R (1 hour steps)	
Time (min)	Drawdown (m)
0	0,00
0,5	0,01
1	0,02
1,5	0,02
2	0,04
2,5	0,06
3	0,17
3,5	0,16
4	0,12
4,5	0,10
5	0,08
6	0,05
7	0,06
8	0,08
9	0,10
10	0,16
12	0,22
14	0,28
15	0,33
18	0,49
20	0,62
25	0,90
30	1,17
35	1,41
40	1,66
45	1,92
50	2,17
55	2,36
56	4,15
56,5	4,30
57	4,46
57,5	4,60
58	4,75
58,5	4,88
59	5,00
59,5	5,11
60	5,21
60,5	5,32
61	5,43
62	5,62
63	5,85
64	6,01
65	6,17
66	6,34
68	6,64
70	6,96

72	7,21
74	7,38
76	7,56
81	7,98
86	8,35
91	8,72
96	10,05
101	10,93
106	11,57
111	12,32
112	11,87
112,5	12,09
113	12,32
113,5	12,52
114	12,73
114,5	13,17
115	13,61
115,5	13,97
116	14,34
116,5	14,67
117	15,01
118	15,62
119	16,13
120	16,58
121	17,02
122	17,36
124	17,99
126	18,22
128	18,84
130	19,54
132	20,10
137	20,99
142	22,21
147	22,85
152	23,54
162	24,91
172	25,21
182	8,12
192	1,64

HW-RC14-WE01R (72 hours)	
Time (min)	Drawdown (m)
0	0,00
0,5	2,32
1	4,64
1,5	5,92
2	7,19
2,5	8,20
3	9,21
3,5	10,03
4	10,85
4,5	11,40
5	11,94
6	12,83
7	13,12
8	13,01
9	12,77
10	12,57
12	12,48
14	12,59
16	12,77
18	12,96
20	13,17
25	13,77
30	14,35
35	14,84
40	15,29
50	16,14
60	16,85
70	17,49
80	18,06
90	18,58
100	19,34
120	19,74
140	19,82
160	19,94
180	20,13
200	20,24
250	20,36
300	20,44
350	20,62
400	20,70
450	20,81
500	20,82

600	20,89
700	20,94
800	21,13
900	21,19
1000	21,24
1200	21,24
1400	20,77
1600	20,65
1800	20,60
2000	20,68
2250	20,61
2500	20,65
3000	21,22
3500	21,26
4000	21,24
4320	21,30
4320,5	20,25
4321	19,29
4321,5	17,55
4322	15,80
4322,5	15,30
4323	14,80
4323,5	14,65
4324	14,51
4324,5	14,34
4325	14,17
4326	13,86
4327	13,57
4328	13,32
4329	13,09
4330	12,89
4331	12,69
4332	12,53
4333	12,39
4334	12,26
4335	12,12
4340	10,90
4345	10,02
4350	9,29
4355	8,73
4360	8,28
4365	7,89
4370	7,55
4375	7,25

4380	6,97
4410	5,86
4440	5,03
4470	4,34
4500	3,78
4530	3,32
4560	2,94
4590	2,61
4620	2,34
4680	1,93

HW-RC14-WE03R (1 hour steps)	
Time (min)	Drawdown (m)
0	0,00
1	2,32
2	2,13
3	2,22
4	2,26
5	2,28
6	2,31
7	2,32
8	2,34
9	2,34
10	2,36
11	2,35
12	2,36
13	2,38
14	2,38
15	2,38
16	2,37
17	2,39
18	2,37
19	2,39
20	2,39
21	2,39
22	2,38
23	2,40
24	2,39
25	2,40
26	2,38
27	2,38
28	2,37
29	2,39
30	2,39
31	2,38
32	2,38
33	2,39
34	2,39
35	2,39
36	2,40
37	2,38
38	2,39
39	2,40
40	2,40
41	2,39
42	2,40
43	2,40
44	2,40
45	2,39

46	2,40
47	2,41
48	2,40
49	2,40
50	2,42
51	2,39
52	2,42
53	2,41
54	2,40
55	2,41
56	2,41
57	2,41
58	2,40
59	2,41
60	2,41
61	2,42
62	2,42
63	2,72
64	2,85
65	3,03
66	3,08
67	3,14
68	3,17
69	3,16
70	3,16
71	3,18
72	3,19
73	3,18
74	3,19
75	3,20
76	3,21
77	3,19
78	3,20
79	3,20
80	3,21
81	3,20
82	3,20
83	3,22
84	3,19
85	3,21
86	3,20
87	3,19
88	3,21
89	3,19
90	3,22
91	3,20
92	3,19
93	3,21

94	3,21
95	3,22
96	3,21
97	3,21
98	3,20
99	3,20
100	3,22
101	3,21
102	3,22
103	3,22
104	3,22
105	3,22
106	3,23
107	3,21
108	3,21
109	3,22
110	3,22
111	3,23
112	3,22
113	3,23
114	3,24
115	3,23
116	3,24
117	3,23
118	3,24
119	3,24
120	3,24
121	3,25
122	3,26
123	3,23
124	3,26
125	3,61
126	3,89
127	3,99
128	4,01
129	4,06
130	4,07
131	4,09
132	4,11
133	4,09
134	4,07
135	4,10
136	4,08
137	4,10
138	4,13
139	4,11
140	4,13
141	4,14

(Continued)	
HW-RC14-WE03R (Steps)	
Time (min)	Drawdown (m)
142	4,13
143	4,15
144	4,15
145	4,15
146	4,14
147	4,15
148	4,14
149	4,12
150	4,14
151	4,16
152	4,15
153	4,16
154	4,16
155	4,18
156	4,18
157	4,17
158	4,16
159	4,18
160	4,17
161	4,19
162	4,18
163	4,18
164	4,17
165	4,18
166	4,20
167	4,20
168	4,19
169	4,19
170	4,19
171	4,18
172	4,19
173	4,18
174	4,22
175	4,21
176	4,21
177	4,20
178	4,20
179	4,21
180	4,19
181	4,22
182	4,20
183	4,51
184	4,54
185	4,66
186	4,69
187	4,73

188	4,78
189	4,71
190	4,73
191	4,77
192	4,77
193	4,80
194	4,82
195	4,83
196	4,83
197	4,84
198	4,82
199	4,83
200	4,83
201	4,83
202	4,82
203	4,83
204	4,84
205	4,85
206	4,84
207	4,86
208	4,87
209	4,87
210	4,88
211	4,88
212	4,89
213	4,90
214	4,89
215	4,90
216	4,89
217	4,91
218	4,91
219	4,89
220	4,90
221	4,90
222	4,91
223	4,91
224	4,92
225	4,92
226	4,92
227	4,90
228	4,91
229	4,91
230	4,91
231	4,91
232	4,87
233	4,91
234	4,89
235	4,90

236	4,90
237	4,89
238	4,90
239	4,90
240	4,89
241	4,91
242	4,88
243	4,71
244	4,65
245	4,49
246	4,46
247	2,58
248	0,53
249	0,53
250	0,43
251	0,36
252	0,30
253	0,26
254	0,23
255	0,20
256	0,18
257	0,16
258	0,15
259	0,13
260	0,12
261	0,11
262	0,10
263	0,09
264	0,08
265	0,07
266	0,06
267	0,06
268	0,05
269	0,05
270	0,04
271	0,03
272	0,03
273	0,02

HW-RC14-WE03R (72 hours)	
Time (min)	Drawdown (m)
0	0,00
1	2,39
2	3,34
3	3,63
4	3,83
5	3,94
6	4,00
7	4,05
8	4,07
9	4,08
10	4,13
11	4,13
12	4,14
13	4,14
14	4,16
15	4,17
20	4,18
25	4,23
30	4,26
35	4,27
40	4,29
45	4,32
50	4,32
60	4,36
70	4,34
80	4,32
90	4,33
100	4,35
150	4,39
200	4,39
250	4,42
300	4,43
350	4,44
400	4,47
450	4,46
500	4,46
600	4,51
700	4,49
800	4,53
900	4,52
1000	4,48
1200	4,50

1400	4,48
1600	4,45
1800	4,47
2000	4,45
2200	4,43
2400	4,36
2600	4,38
2800	4,35
3000	4,33
3200	4,33
3400	4,35
3600	4,38
3800	4,38
4000	4,40
4200	4,40
4356	4,34
4357	0,35
4358	0,51
4359	0,43
4360	0,35
4361	0,30
4362	0,25
4363	0,22
4364	0,19
4365	0,17
4366	0,15
4367	0,14
4368	0,13
4369	0,12
4370	0,11
4371	0,10
4372	0,09
4373	0,08
4374	0,07
4375	0,07
4376	0,06
4377	0,05
4378	0,05
4379	0,04
4380	0,04
4381	0,03
4382	0,03
4383	0,02
4384	0,02

4385	0,02
4386	0,01
4387	0,01
4388	0,01
4389	0,00
4390	0,00

HW-RC15-WE02R (72 hours) (Piezo of WE06R)	
Time (min)	DRAWDOWN (m)
0	0,00
1	0,00
2	0,01
3	0,01
4	0,01
5	0,02
6	0,02
7	0,03
8	0,04
9	0,04
10	0,05
11	0,06
12	0,07
14	0,08
16	0,10
18	0,12
20	0,13
25	0,18
30	0,22
35	0,27
40	0,31
50	0,38
60	0,45
70	0,51
80	0,56
100	0,65
120	0,72
150	0,81
180	0,88
210	0,94
240	0,99
270	1,04
300	1,08
360	1,16
420	1,22
480	1,29
540	1,34
600	1,39
720	1,47
840	1,54
960	1,60
1080	1,64
1260	1,72
1440	1,78
1620	1,78
2000	1,83
3000	2,08
4000	2,32

5000	2,48
5611	2,60
5612	2,57
5613	2,57
5614	2,56
5615	2,55
5616	2,55
5617	2,54
5618	2,53
5619	2,52
5620	2,51
5621	2,50
5623	2,49
5625	2,46
5627	2,44
5629	2,42
5631	2,39
5636	2,35
5641	2,29
5646	2,25
5651	2,20
5661	2,12
5671	2,05
5681	1,99
5691	1,93
5701	1,87
5711	1,83
5731	1,75
5761	1,65
5791	1,57
5821	1,50
5851	1,44
5881	1,38
5911	1,33
5971	1,24
6031	1,17
6091	1,10
6151	1,04
6211	0,98
6331	0,89
6451	0,81
6571	0,74
6691	0,68
6871	0,60
7051	0,57
7231	0,49
7411	0,41
7591	0,33
7891	0,19
8191	0,06
8340	0,00

HW-RC15-WE06R (1 hour step)		
Time (min)	DRAWDOWN (m)	Pumping Rate (m ³ /d)
0	0,00	545
1	0,51	
2	1,08	
3	0,91	
4	0,62	
5	0,97	
6	0,77	
7	1,56	
8	1,32	
9	1,48	
10	1,64	
11	1,84	
12	1,76	
13	1,57	
14	1,89	
15	1,82	
20	2,65	
25	2,80	
30	3,06	
35	3,10	
40	3,12	
50	3,53	
60	3,60	819
61	3,80	
62	3,71	
63	3,84	
64	4,04	
65	4,21	
66	4,37	
67	4,64	
68	4,66	
69	4,72	
70	4,73	
71	4,96	
72	4,82	
73	5,12	
74	4,99	
75	5,05	
80	5,50	
85	5,48	
90	5,54	
95	5,40	
100	5,70	
110	5,80	
120	5,90	1090

121	6,18	
122	6,50	
123	6,59	
124	6,77	
125	7,11	
126	6,90	
127	7,02	
128	7,19	
129	7,25	
130	7,14	
131	7,18	
132	7,36	
133	7,34	
134	7,39	
135	7,18	
140	7,40	
145	7,57	
150	7,65	
155	7,72	
160	7,78	
170	7,99	
180	8,23	1226
181	8,62	
182	8,90	
183	9,02	
184	8,69	
185	8,96	
186	8,88	
187	8,85	
188	9,03	
189	9,05	
190	9,20	
191	9,25	
192	9,18	
193	9,21	
194	9,22	
195	9,24	
200	9,44	
205	9,57	
210	9,54	
215	9,68	
220	9,65	
230	9,81	
240	9,96	1363
241	10,08	
242	10,21	
243	10,14	
244	10,33	

245	10,45	
246	10,40	
247	10,38	
248	10,41	
249	10,57	
250	10,60	
251	10,53	
252	10,77	
253	10,57	
254	10,69	
255	10,68	
260	10,87	
265	10,89	
270	11,01	
275	11,05	
280	11,01	
290	11,10	
300	11,43	1586
301	11,59	
302	11,57	
303	11,84	
304	11,89	
305	12,19	
306	12,27	
307	12,44	
308	12,49	
309	12,52	
310	12,61	
311	12,59	
312	12,73	
313	12,77	
314	12,78	
315	12,85	
320	12,93	
325	13,03	
330	13,07	
335	13,31	
340	13,37	
350	13,35	
360	13,58	Recovery
361	10,97	
362	8,88	
363	7,93	
364	7,28	
365	6,77	
366	6,34	
367	5,98	
368	5,68	

(Continued)		
HW-RC15-WE06R (1 hour step)		
Time (min)	DRAWDOWN (m)	Pumping Rate (m ³ /d)
370	5,19	
371	4,99	
372	4,79	
373	4,61	
374	4,43	
375	4,28	
380	3,61	
385	3,12	
390	2,75	
395	2,46	
400	2,24	
410	1,90	
420	1,67	
430	1,50	
440	1,38	
450	1,28	
500	0,97	
550	0,80	
600	0,69	
650	0,61	
700	0,54	
725	0,50	

HW-RC15-WE06R (93.5 Hours)	
Time (min)	Drawdown (m)
0	0,00
1	2,30
1,5	2,34
2	2,47
2,5	2,61
3	2,72
3,5	2,85
4	2,94
4,5	3,06
5	3,15
6	3,33
7	3,48
8	3,62
9	3,74
10	3,86
11	3,96
12	4,06
14	4,23
16	4,41
18	4,53
20	4,70
25	5,26
30	5,51
35	5,70
40	5,85
50	6,08
60	6,24
70	6,36
80	6,45
100	6,59
120	6,70
150	6,82
180	6,91
210	6,99
240	7,06
270	7,12
300	7,17
360	7,27
420	7,31
480	7,38
600	7,48
720	7,58
840	7,76
960	7,73
1080	7,77

1260	7,75
1440	7,96
1620	8,03
1800	7,74
1980	7,82
2280	7,89
2580	8,06
2880	8,22
3180	8,24
3480	8,06
3780	8,13
4080	8,20
4500	8,45
5000	8,58
5609	8,82
5609,5	7,06
5610	6,58
5610,5	6,34
5611	6,06
5611,5	5,84
5612	5,67
5612,5	5,49
5613	5,35
5613,5	5,22
5614	5,11
5615	4,91
5616	4,75
5617	4,61
5618	4,50
5619	4,40
5620	4,31
5621	4,22
5623	4,05
5625	3,89
5627	3,76
5629	3,64
5634	3,39
5639	3,19
5644	3,04
5649	2,91
5659	2,72
5669	2,57
5679	2,46
5689	2,37
5709	2,23
5729	2,12
5759	1,98
5789	1,88

5819	1,78
5849	1,70
5879	1,62
5909	1,56
5969	1,44
6029	1,34
6089	1,25
6149	1,18
6209	1,10
6329	1,05
6449	0,98
6569	0,93
6689	0,88
6869	0,82
7049	0,78
7229	0,74
7409	0,72

HW-RC15-WE07R (30 min steps)		
Time (min)	DRAWDOWN (m)	Pumping rate (m ³ /d)
0	0,00	82
1	2,79	
1,5	2,73	
2	2,61	
2,5	2,33	
3	2,04	
3,5	1,82	
4	1,69	
4,5	1,60	
5	1,53	
6	1,45	
7	1,37	
8	1,34	
9	1,33	
10	1,33	
12	1,32	
14	1,33	
16	1,33	
18	1,34	
20	1,34	
25	1,34	
30	1,34	184
30,5	2,59	
31	2,83	
31,5	2,96	
32	3,02	
32,5	3,14	
33	3,14	
33,5	3,16	
34	3,19	
34,5	3,22	
35	3,23	
36	3,27	
37	3,28	
38	3,30	
39	3,32	
40	3,33	
42	3,36	
44	3,36	
46	3,37	
48	3,39	
50	3,40	
55	3,42	

60	3,44	245
60,5	4,06	
61	4,30	
61,5	4,44	
62	4,53	
62,5	4,60	
63	4,67	
63,5	4,70	
64	4,75	
64,5	4,77	
65	4,80	
66	4,85	
67	4,88	
68	4,91	
69	4,94	
70	4,96	
72	5,00	
74	5,03	
76	5,06	
78	5,09	
80	5,11	
85	5,14	
90	5,17	327
91,5	6,34	
92	6,78	
92,5	7,10	
93	7,44	
93,5	7,69	
94	7,89	
94,5	8,05	
95	8,14	
96	8,26	
97	8,36	
98	8,45	
99	8,54	
100	8,62	
102	8,76	
104	8,85	
106	8,93	
108	9,00	
110	9,07	
115	9,26	
120	9,37	382
120,5	9,78	
121	10,06	
121,5	10,25	

122	10,56	
122,5	10,89	
123	11,06	
123,5	11,21	
124	11,34	
124,5	11,44	
125	11,53	
126	11,65	
127	11,81	
128	11,98	
129	12,16	
130	12,33	
132	12,64	
134	12,81	
136	12,91	
138	13,01	
140	13,17	
145	13,39	
150	13,54	Recovery
150,5	5,12	
151	7,11	
151,5	5,31	
152	4,12	
152,5	3,12	
153	2,20	
153,5	1,62	
154	1,18	
154,5	0,94	
155	0,74	
156	0,56	
157	0,45	
158	0,39	
159	0,35	
160	0,32	
162	0,29	
164	0,27	
166	0,25	
168	0,24	
170	0,22	
175	0,19	
180	0,18	

HW-RC15-WE07R (24 Hours)	
Time (min)	DRAWDOWN (m)
0	0,00
0,5	4,19
1	4,99
1,5	5,76
2	6,52
2,5	7,16
3	7,60
3,5	7,96
4	8,23
4,5	8,23
5	8,27
6	8,38
7	8,47
8	8,57
9	8,66
10	8,75
11	8,81
12	8,86
14	8,97
16	9,06
18	9,13
20	9,19
25	9,31
30	9,42
35	9,50
40	9,55
50	9,67
60	9,76
70	9,86
80	9,93
100	10,07
120	10,16
150	10,25
180	10,38
210	10,43
240	10,48
270	10,52
300	10,54
360	10,56
420	10,56
480	10,55
540	10,58
600	10,59
720	10,64
840	10,65
960	10,69
1080	10,73
1260	10,73

1440	10,91
1620	10,84
1620,5	7,11
1621	7,10
1621,5	5,30
1622	4,11
1622,5	3,11
1623	2,19
1623,5	1,61
1624	1,17
1624,5	0,93
1625	0,73
1626	0,55
1627	0,44
1628	0,38
1629	0,34
1630	0,31
1632	0,28
1634	0,26
1636	0,24
1638	0,23
1640	0,21
1645	0,18
1650	0,17

HW-RC15-WE08R (30 min steps)		
Temps (min)	DRAWDOWN (m)	Pumping rate (m ³ /d)
0	0,00	80
1	0,00	
2	5,49	
3	3,53	
4	3,33	
5	3,29	
7	3,29	
9	3,29	
10	3,29	
15	3,29	
20	3,29	
25	3,29	
30	3,31	245
31	5,11	
32	5,25	
33	5,29	
34	5,29	
35	5,31	
36	5,32	
37	5,32	
38	5,32	
39	5,33	
40	5,33	
42	5,34	
44	5,35	
46	5,35	
48	5,35	
50	5,35	
55	5,36	
60	5,36	329
61	7,02	
62	7,18	
63	7,67	
64	7,76	
65	7,79	
66	7,81	
67	7,83	
68	7,84	
69	7,85	
70	7,86	
72	7,86	
74	7,88	
76	7,89	
78	7,89	
80	7,90	
85	7,92	
90	7,93	407
91	9,83	

92	10,11	
93	10,22	
94	10,28	
95	10,34	
96	10,38	
97	10,41	
98	10,44	
99	10,47	
100	10,49	
102	10,52	
104	10,55	
106	10,57	
108	10,59	
110	10,62	
115	10,64	
120	10,66	466
121	12,58	
122	12,85	
123	12,99	
124	13,07	
125	13,13	
126	13,19	
127	13,24	
128	13,27	
129	13,30	
130	13,33	
132	13,39	
134	13,43	
136	13,47	
138	13,50	
140	13,53	
145	13,60	
150	13,66	Recovery
150,5	10,62	
151	0,93	
151,5	0,68	
152	0,42	
152,5	0,34	
153	0,28	
153,5	0,25	
154	0,23	
154,5	0,23	
156	0,20	
157	0,18	
158	0,20	
159	0,20	
160	0,20	

HW-RC15-WE08R (72 Hours)	
Temps (min)	DRAWDOWN (m)
0	0,00
0,5	6,55
1	7,46
1,5	8,08
2	8,24
2,5	8,34
3	8,41
3,5	8,47
4	8,51
4,5	8,54
5	8,57
6	8,62
7	8,64
8	8,67
9	8,69
10	8,71
11	8,72
12	8,74
14	8,76
16	8,78
18	8,79
20	8,81
25	8,84
30	8,86
35	8,89
40	8,96
50	8,94
60	8,97
70	8,99
80	9,02
100	9,06
120	9,10
150	8,81
180	8,86
210	8,89
240	8,91
270	8,94
300	8,97
360	9,01
420	9,06
480	9,10
600	9,16
720	9,23
840	9,26
960	9,30

1080	9,35
1260	9,36
1440	9,37
1620	9,40
1620,5	0,45
1621	0,46
1621,5	0,42
1622	0,36
1622,5	0,33
1623	0,33
1623,5	0,35
1624	0,38
1624,5	0,39
1625	0,40
1626	0,41
1627	0,44
1628	0,49
1629	0,51
1630	0,52
1631	0,52
1632	0,52
1634	0,52
1636	0,52
1638	0,51
1640	0,51
1645	0,48
1650	0,48
1655	0,48
1660	0,46
1670	0,45
1680	0,44
1690	0,42
1700	0,41
1720	0,38
1740	0,36
1770	0,34
1800	0,31

HW-DD14-35 (72 hours) (Piezo of HW-RC14-WE01R)	
Time (min)	Drawdown (m)
0	0,00
1	0,00
2	0,00
3	0,00
4	0,00
5	0,00
6	0,00
7	0,00
8	0,00
9	0,00
10	0,00
11	0,00
12	0,00
13	0,00
14	0,00
15	0,00
20	0,00
25	0,00
30	0,00
35	0,00
40	0,00
45	0,00
50	0,00
60	0,00
70	0,00
80	0,01
90	0,02
100	0,03
150	0,11
200	0,19
250	0,28
300	0,38
350	0,47
400	0,55
450	0,58
500	0,61
600	0,72
700	0,81
800	0,94
900	1,07
1000	1,16

1200	1,33
1400	1,43
1600	1,54
1800	1,71
2000	1,83
2200	1,98
2400	2,14
2600	2,29
2800	2,44
3000	2,59
3200	2,71
3400	2,83
3600	2,94
3800	3,06
4000	3,15
4200	3,27
4400	3,35
4494	3,39
4495	3,39
4496	3,39
4497	3,39
4498	3,38
4499	3,39
4500	3,38
4501	3,38
4502	3,38
4503	3,38
4504	3,38
4505	3,38
4506	3,38
4507	3,38
4508	3,38
4509	3,38
4514	3,38
4519	3,38
4524	3,38
4529	3,38
4534	3,38
4539	3,38
4544	3,38
4554	3,38
4564	3,38
4574	3,38
4584	3,38

4594	3,37
4644	3,35
4694	3,32
4744	3,28
4794	3,23
4844	3,16
4894	3,09
4944	3,03
4994	2,96
5094	2,85
5194	2,75
5294	2,65
5394	2,56
5494	2,48
5594	2,41
5694	2,34
5794	2,27
5894	2,21
5994	2,16
6094	2,16
6194	2,07
6294	1,99
6394	1,96
6494	1,90
6694	1,78
6894	1,72
7094	1,59
7292	1,52

HW-RC13-03 (72 hours) (Piezo of HW-RC14-WE01R)	
Time (min)	Drawdown (m)
0	0,00
1	0,00
2	0,00
3	0,00
4	0,00
5	0,00
6	0,00
7	0,00
8	0,00
9	0,00
10	0,00
11	0,00
12	0,00
13	0,00
14	0,00
15	0,00
20	0,00
25	0,00
30	0,00
35	0,00
40	0,00
45	0,00
50	0,00
60	0,00
70	0,00
80	0,00
90	0,01
100	0,02
150	0,05
200	0,10
250	0,13
300	0,17
350	0,21
400	0,25
450	0,29
500	0,33
600	0,39
700	0,43
800	0,47
900	0,51
1000	0,55
1200	0,63
1400	0,72
1600	0,80
1800	0,88
2000	0,96

2200	1,03
2400	1,10
2600	1,15
2800	1,21
3000	1,27
3200	1,33
3400	1,38
3600	1,44
3800	1,49
4000	1,54
4200	1,58
4400	1,62
4430	1,63
4431	1,63
4432	1,62
4433	1,63
4434	1,63
4435	1,63
4436	1,63
4437	1,63
4438	1,63
4439	1,63
4440	1,63
4441	1,63
4442	1,62
4443	1,62
4444	1,62
4445	1,62
4450	1,62
4455	1,62
4460	1,62
4465	1,62
4470	1,62
4475	1,62
4480	1,61
4490	1,61
4500	1,61
4510	1,60
4520	1,60
4530	1,59
4580	1,56
4630	1,52
4730	1,45
4830	1,39
4932	1,31
5032	1,26
5132	1,22
5232	1,18

5332	1,13
5432	1,09
5632	1,03
5832	0,98
6032	0,93
6232	0,87
6432	0,83
6632	0,79
6832	0,74
7032	0,69
7232	0,66
7274	0,66

APPENDIX IV
Laboratory Certificates of Analysis

Attention: Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Your P.O. #: 2200000001
Your Project #: HYDROLOGY
Site#: TSMC
Site Location: HOWSE
Your C.O.C. #: 112526-01-01

Report Date: 2014/11/07
Report #: R1940844
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B469200

Received: 2014/10/31, 09:00

Sample Matrix: GROUND WATER
Samples Received: 1

Analyses	Quantity	Date		Laboratory Method	Primary Reference
		Extracted	Analyzed		
Absorbance***	1	N/A	2014/10/31	QUE SOP-00139	MA.103 -%TUV 1.0
Total Alkalinity (pH end point 4.5)***	1	N/A	2014/10/31	QUE SOP-00142	MA.303-TitrAuto 2.1
Anions*	1	N/A	2014/10/31	QUE SOP-00141	MA. 300-Ions 1.3
Anions*	1	N/A	2014/10/31	QUE SOP-00141	MA. 300-Ions 1.3
Total Cyanide*	1	2014/10/31	2014/12/03	QUE SOP-00143	MA. 300 - CN 1.2
Real Color*	1	N/A	2014/10/31	QUE SOP-00115	MA. 103 - Col. 2.0
Conductivity*	1	N/A	2014/10/31	QUE SOP-00142	MA.303-TitrAuto 2.1
Dissolved Organic Carbon (1, 2)***	1	2014/11/01	2014/11/04	STL SOP-00243	SM 21 5310-B m
Total Extractable Mercury - Cold Vapour (1)***	1	2014/11/03	2014/11/04	STL SOP-00042	MA200-Hg 1.1 R1 m
Total Suspended Solids*	1	2014/10/31	2014/10/31	QUE SOP-00111	SM 2540 D
Acid Soluble Metals by ICP-MS (1)*	1	2014/11/05	2014/11/05	STL SOP-00006	MA200-Mét 1.2 R4 m
Total Extractable Metals by ICP (1)*	1	2014/11/03	2014/11/03	STL SOP-00006	MA200-Mét 1.2 R4 m
Ammonia Nitrogen (1)*	1	N/A	2014/11/04	STL SOP-00040	MA300-N 2.0 R1 m
pH*	1	N/A	2014/10/31	QUE SOP-00142	MA.303-TitrAuto 2.1
Total Phenols by 4-AAP (1)*	1	2014/11/06	2014/11/06	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Inorganic Phosphorus***	1	2014/11/06	2014/11/06	QUE SOP-00122	MA. 300 - P. Ino 1.1
Ortho Phosphate*	1	N/A	2014/10/31	QUE SOP-00121	MA.303 - P 1.1
Sulfides (S ₂ -)*	1	2014/11/03	2014/11/03	QUE SOP-00107	MA 300 - S 1.1
Reactive Silica (SiO ₂)***	1	N/A	2014/10/31	QUE SOP-00132	HACH, Method 8186
Total Dissolved Solids*	1	2014/11/04	2014/11/04	QUE SOP-00119	MA. 103 - S.T. 1.0
Turbidity*	1	N/A	2014/10/31	QUE SOP-00118	MA.103-TUR. 1.0

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) This test was performed by Maxxam -Ville St. Laurent
- (2) DOC present in the sample should be considered as non-purgeable DOC

* Maxxam is accredited as per the MDDELCC program.
*** This analysis is not subject to MDDELCC accreditation.

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Your P.O. #: 2200000001
Your Project #: HYDROLOGY
Site#: TSMC
Site Location: HOWSE
Your C.O.C. #: 112526-01-01

Report Date: 2014/11/07
Report #: R1940844
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B469200
Received: 2014/10/31, 09:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Mathieu Letourneau, B.Sc., chimist, Customer Service

Email: MLetourneau@maxxam.ca

Phone# (418) 658-5784

=====
This report has been generated and distributed using a secure automated process.

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

METALS (GROUND WATER)

Maxxam ID		AE6395		
Sampling Date		2014/10/30 08:00		
COC Number		112526-01-01		
	Units	HW-RC14 W01R	RDL	QC Batch

METALS				
Mercury (Hg)	mg/L	<0.00001	0.00001	1383686
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

TOTAL EXTRACTABLE METALS (GROUND WATER)

Maxxam ID		AE6395		
Sampling Date		2014/10/30 08:00		
COC Number		112526-01-01		
	Units	HW-RC14 W01R	RDL	QC Batch

METALS				
Total phosphorous	mg/L	<0.01	0.01	1383840
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

ACID SOLUBLE METALS (GROUND WATER)

Maxxam ID		AE6395		
Sampling Date		2014/10/30 08:00		
COC Number		112526-01-01		
	Units	HW-RC14 W01R	RDL	QC Batch
METALS				
Aluminum (Al)	mg/L	<0.030	0.030	1385112
Antimony (Sb)	mg/L	<0.0030	0.0030	1385112
Arsenic (As)	mg/L	<0.0010	0.0010	1385112
Barium (Ba)	mg/L	<0.020	0.020	1385112
Silver (Ag)	mg/L	<0.00030	0.00030	1385112
Boron (B)	mg/L	<0.050	0.050	1385112
Cadmium (Cd)	mg/L	<0.0010	0.0010	1385112
Beryllium (Be)	mg/L	<0.0020	0.0020	1385112
Bismuth (Bi)	mg/L	<0.050	0.050	1385112
Chromium (Cr)	mg/L	<0.0050	0.0050	1385112
Calcium (Ca)	mg/L	1.4	0.50	1385112
Cobalt (Co)	mg/L	<0.020	0.020	1385112
Copper (Cu)	mg/L	<0.0030	0.0030	1385112
Total Hardness (CaCO ₃)	mg/L	9.9	1.0	1385112
Tin (Sn)	mg/L	<0.050	0.050	1385112
Iron (Fe)	mg/L	<0.10	0.10	1385112
Magnesium (Mg)	mg/L	1.6	0.20	1385112
Manganese (Mn)	mg/L	<0.0030	0.0030	1385112
Molybdenum (Mo)	mg/L	<0.010	0.010	1385112
Nickel (Ni)	mg/L	<0.010	0.010	1385112
Lead (Pb)	mg/L	<0.0010	0.0010	1385112
Potassium (K)	mg/L	0.29	0.20	1385112
Selenium (Se)	mg/L	<0.0010	0.0010	1385112
Sodium (Na)	mg/L	2.1	0.20	1385112
Strontium (Sr)	mg/L	<0.050	0.050	1385112
Thallium (Tl)	mg/L	<0.010	0.010	1385112
Titanium (Ti)	mg/L	<0.050	0.050	1385112
Uranium (U)	mg/L	<0.0020	0.0020	1385112
Vanadium (V)	mg/L	<0.010	0.010	1385112
Zinc (Zn)	mg/L	0.030	0.0050	1385112
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

CONVENTIONAL PARAMETERS (GROUND WATER)

Maxxam ID		AE6395		
Sampling Date		2014/10/30 08:00		
COC Number		112526-01-01		
	Units	HW-RC14 W01R	RDL	QC Batch
CONVENTIONALS				
Conductivity	mS/cm	0.029	0.001	1383307
Dissolved organic carbon	mg/L	1.2	0.2	1383651
Inorganic phosphorous	mg/L	0.04	0.02	1385384
Nitrogen ammonia (N-NH3)	mg/L	<0.02	0.02	1384424
Orthophosphate (P)	mg/L	0.10	0.01	1383500
pH	pH	7.10	N/A	1383303
Phenols-4AAP	mg/L	<0.002	0.002	1385464
Reactive silica (SiO2)	mg/L	9.8	0.1	1383498
Real Color	UCV	15	2	1383313
Sulfides (S2-)	mg/L	<0.02	0.02	1384049
Total Cyanide (CN)	mg/L	<0.01	0.01	1383340
Turbidity	NTU	180	0.1	1383314
Absorbance at 254nm	/cm	0.29	0.005	1383308
Alkalinity Total (as CaCO3) pH 4.5	mg/L	15	1	1383304
Bromide (Br-)	mg/L	<0.1	0.1	1383002
Bicarbonates (HCO3 as CaCO3)	mg/L	15	1	1383304
Carbonate (CO3 as CaCO3)	mg/L	<1	1	1383304
Chloride (Cl)	mg/L	0.14	0.05	1383002
Nitrites (N-NO2-)	mg/L	<0.01	0.01	1383041
Nitrates (N-NO3-)	mg/L	0.06	0.01	1383041
Sulfates (SO4)	mg/L	0.9	0.5	1383002
Total Dissolved Solids	mg/L	37	10	1384216
Total suspended solids (TSS)	mg/L	210	2	1383241
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD

METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

TOTAL EXTRACTABLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

ACID SOLUBLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
	1383002	MCC	QC Standard	Bromide (Br-)	2014/10/31		97	%
				Chloride (Cl)	2014/10/31		105	%
				Sulfates (SO4)	2014/10/31		101	%
	1383002	MCC	Method Blank	Bromide (Br-)	2014/10/31	<0.1		mg/L
				Chloride (Cl)	2014/10/31	<0.05		mg/L
				Sulfates (SO4)	2014/10/31	<0.5		mg/L
	1383041	MCC	QC Standard	Nitrates (N-NO3-)	2014/10/31		98	%
	1383041	MCC	Spiked Blank	Nitrites (N-NO2-)	2014/10/31		103	%
	1383041	MCC	Method Blank	Nitrites (N-NO2-)	2014/10/31	<0.01		mg/L
				Nitrates (N-NO3-)	2014/10/31	<0.01		mg/L
	1383241	BD	Spiked Blank	Total suspended solids (TSS)	2014/10/31		110	%
	1383241	BD	Method Blank	Total suspended solids (TSS)	2014/10/31	<2		mg/L
	1383303	CG0	QC Standard	pH	2014/10/31		99	%
	1383304	CG0	QC Standard	Alkalinity Total (as CaCO3) pH 4.5	2014/10/31		108	%
	1383304	CG0	Method Blank	Alkalinity Total (as CaCO3) pH 4.5	2014/10/31	<1		mg/L
	1383307	CG0	QC Standard	Conductivity	2014/10/31		100	%
	1383307	CG0	Method Blank	Conductivity	2014/10/31	<0.001		mS/cm
	1383308	CG0	Spiked Blank	Absorbance at 254nm	2014/10/31		96	%
	1383308	CG0	Method Blank	Absorbance at 254nm	2014/10/31	<0.005		/cm
	1383313	CG0	Spiked Blank	Real Color	2014/10/31		104	%
	1383313	CG0	Method Blank	Real Color	2014/10/31	<2		UCV
	1383314	CG0	Spiked Blank	Turbidity	2014/10/31		101	%
	1383314	CG0	Method Blank	Turbidity	2014/10/31	<0.1		NTU
	1383340	CB8	QC Standard	Total Cyanide (CN)	2014/12/03		95	%
	1383340	CB8	Method Blank	Total Cyanide (CN)	2014/12/03	<0.01		mg/L
	1383498	FTN	QC Standard	Reactive silica (SiO2)	2014/10/31		91	%
	1383498	FTN	Method Blank	Reactive silica (SiO2)	2014/10/31	<0.1		mg/L
	1383500	FTN	QC Standard	Orthophosphate (P)	2014/10/31		94	%
	1383500	FTN	Method Blank	Orthophosphate (P)	2014/10/31	<0.01		mg/L
	1383651	JL1	QC Standard	Dissolved organic carbon	2014/11/04		101	%
	1383651	JL1	Spiked Blank	Dissolved organic carbon	2014/11/04		97	%
	1383651	JL1	Method Blank	Dissolved organic carbon	2014/11/04	0.3, RDL=0.2		mg/L
	1383686	OZP	QC Standard	Mercury (Hg)	2014/11/04		97	%
	1383686	OZP	Spiked Blank	Mercury (Hg)	2014/11/04		101	%
	1383686	OZP	Method Blank	Mercury (Hg)	2014/11/04	<0.00001		mg/L
	1383840	JF1	QC Standard	Total phosphorous	2014/11/03		105	%
	1383840	JF1	Spiked Blank	Total phosphorous	2014/11/03		102	%
	1383840	JF1	Method Blank	Total phosphorous	2014/11/03	<0.01		mg/L
	1384049	BD	QC Standard	Sulfides (S2-)	2014/11/03		93	%
	1384049	BD	Method Blank	Sulfides (S2-)	2014/11/03	<0.02		mg/L
	1384216	MCC	Spiked Blank	Total Dissolved Solids	2014/11/04		108	%
	1384216	MCC	Method Blank	Total Dissolved Solids	2014/11/04	<10		mg/L
	1384424	DKH	QC Standard	Nitrogen ammonia (N-NH3)	2014/11/04		101	%
	1384424	DKH	Spiked Blank	Nitrogen ammonia (N-NH3)	2014/11/04		104	%
	1384424	DKH	Method Blank	Nitrogen ammonia (N-NH3)	2014/11/04	<0.02		mg/L
	1385112	JF1	Spiked Blank	Aluminum (Al)	2014/11/05		97	%
				Antimony (Sb)	2014/11/05		110	%
				Arsenic (As)	2014/11/05		101	%
				Barium (Ba)	2014/11/05		100	%

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Silver (Ag)	2014/11/05		100	%
			Boron (B)	2014/11/05		98	%
			Cadmium (Cd)	2014/11/05		102	%
			Beryllium (Be)	2014/11/05		100	%
			Bismuth (Bi)	2014/11/05		94	%
			Chromium (Cr)	2014/11/05		95	%
			Calcium (Ca)	2014/11/05		99	%
			Cobalt (Co)	2014/11/05		95	%
			Copper (Cu)	2014/11/05		92	%
			Tin (Sn)	2014/11/05		111	%
			Iron (Fe)	2014/11/05		94	%
			Magnesium (Mg)	2014/11/05		95	%
			Manganese (Mn)	2014/11/05		99	%
			Molybdenum (Mo)	2014/11/05		112	%
			Nickel (Ni)	2014/11/05		95	%
			Lead (Pb)	2014/11/05		95	%
			Potassium (K)	2014/11/05		94	%
			Selenium (Se)	2014/11/05		99	%
			Sodium (Na)	2014/11/05		99	%
			Strontium (Sr)	2014/11/05		99	%
			Thallium (Tl)	2014/11/05		95	%
			Titanium (Ti)	2014/11/05		98	%
			Uranium (U)	2014/11/05		93	%
			Vanadium (V)	2014/11/05		98	%
			Zinc (Zn)	2014/11/05		94	%
1385112	JF1	Method Blank	Aluminum (Al)	2014/11/05	<0.030		mg/L
			Antimony (Sb)	2014/11/05	<0.0030		mg/L
			Arsenic (As)	2014/11/05	<0.0010		mg/L
			Barium (Ba)	2014/11/05	<0.020		mg/L
			Silver (Ag)	2014/11/05	<0.00030		mg/L
			Boron (B)	2014/11/05	<0.050		mg/L
			Cadmium (Cd)	2014/11/05	<0.0010		mg/L
			Beryllium (Be)	2014/11/05	<0.0020		mg/L
			Bismuth (Bi)	2014/11/05	<0.050		mg/L
			Chromium (Cr)	2014/11/05	<0.0050		mg/L
			Calcium (Ca)	2014/11/05	<0.50		mg/L
			Cobalt (Co)	2014/11/05	<0.020		mg/L
			Copper (Cu)	2014/11/05	<0.0030		mg/L
			Total Hardness (CaCO3)	2014/11/05	<1.0		mg/L
			Tin (Sn)	2014/11/05	<0.050		mg/L
			Iron (Fe)	2014/11/05	<0.10		mg/L
			Magnesium (Mg)	2014/11/05	<0.20		mg/L
			Manganese (Mn)	2014/11/05	<0.0030		mg/L
			Molybdenum (Mo)	2014/11/05	<0.010		mg/L
			Nickel (Ni)	2014/11/05	<0.010		mg/L
			Lead (Pb)	2014/11/05	<0.0010		mg/L
			Potassium (K)	2014/11/05	<0.20		mg/L
			Selenium (Se)	2014/11/05	<0.0010		mg/L
			Sodium (Na)	2014/11/05	<0.20		mg/L
			Strontium (Sr)	2014/11/05	<0.050		mg/L

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Thallium (Tl)	2014/11/05	<0.010		mg/L
			Titanium (Ti)	2014/11/05	<0.050		mg/L
			Uranium (U)	2014/11/05	<0.0020		mg/L
			Vanadium (V)	2014/11/05	<0.010		mg/L
			Zinc (Zn)	2014/11/05	<0.0050		mg/L
1385384	DP3	Spiked Blank	Inorganic phosphorous	2014/11/06		104	%
1385384	DP3	Method Blank	Inorganic phosphorous	2014/11/06	<0.02		mg/L
1385464	DB2	QC Standard	Phenols-4AAP	2014/11/06		95	%
1385464	DB2	Spiked Blank	Phenols-4AAP	2014/11/06		100	%
1385464	DB2	Method Blank	Phenols-4AAP	2014/11/06	<0.002		mg/L

RDL = Reportable Detection Limit

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

VALIDATION SIGNATURE PAGE

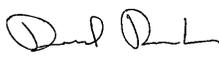
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).




Delia Barbul, B.Sc., Chemist




Dochka Koleva Hristova, B.Sc., Chemist



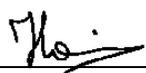

David Provencher, B.Sc., Chemist




Jonathan Fauvel, B.Sc, Chimiste, Analyste II




Maria Chrifi Alaoui, B.Sc., Chemist




Madina Hamrouni, B.Sc., Chemist




Steliana Calestru, B.Sc. Chemist

Maxxam Job #: B469200
Report Date: 2014/11/07

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

VALIDATION SIGNATURE PAGE(CONT'D)

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Attention: Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Your P.O. #: 2200000001
Your Project #: HYDROLOGY
Site#: TSMC
Site Location: HOWSE
Your C.O.C. #: 106829-06-01

Report Date: 2014/11/11
Report #: R1942757
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B469776

Received: 2014/11/04, 09:00

Sample Matrix: GROUND WATER
Samples Received: 1

Analyses	Quantity	Date		Laboratory Method	Primary Reference
		Extracted	Analyzed		
Absorbance***	1	N/A	2014/11/04	QUE SOP-00139	MA.103 -%TUV 1.0
Total Alkalinity (pH end point 4.5)***	1	N/A	2014/11/04	QUE SOP-00142	MA.303-TitrAuto 2.1
Anions*	1	N/A	2014/11/04	QUE SOP-00141	MA. 300-Ions 1.3
Anions*	1	N/A	2014/11/04	QUE SOP-00141	MA. 300-Ions 1.3
Total Cyanide*	1	2014/11/04	2014/11/05	QUE SOP-00143	MA. 300 - CN 1.2
Real Color*	1	N/A	2014/11/04	QUE SOP-00115	MA. 103 - Col. 2.0
Conductivity*	1	N/A	2014/11/04	QUE SOP-00142	MA.303-TitrAuto 2.1
Dissolved Organic Carbon (1, 2)***	1	2014/11/06	2014/11/07	STL SOP-00243	SM 21 5310-B m
Total Extractable Mercury - Cold Vapour (1)***	1	2014/11/10	2014/11/11	STL SOP-00042	MA200-Hg 1.1 R1 m
Total Suspended Solids*	1	2014/11/04	2014/11/04	QUE SOP-00111	SM 2540 D
Acid Soluble Metals by ICP-MS (1)*	1	2014/11/07	2014/11/07	STL SOP-00006	MA200-Mét 1.2 R4 m
Total Extractable Metals by ICP (1)*	1	2014/11/06	2014/11/06	STL SOP-00006	MA200-Mét 1.2 R4 m
Ammonia Nitrogen (1)*	1	N/A	2014/11/06	STL SOP-00040	MA300-N 2.0 R1 m
pH*	1	N/A	2014/11/04	QUE SOP-00142	MA.303-TitrAuto 2.1
Total Phenols by 4-AAP (1)*	1	2014/11/07	2014/11/07	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Inorganic Phosphorus***	1	2014/11/06	2014/11/06	QUE SOP-00122	MA. 300 - P. Ino 1.1
Ortho Phosphate*	1	N/A	2014/11/04	QUE SOP-00121	MA.303 - P 1.1
Sulfides (S ₂ -)*	1	2014/11/06	2014/11/07	QUE SOP-00107	MA 300 - S 1.1
Reactive Silica (SiO ₂)***	1	N/A	2014/11/05	QUE SOP-00132	HACH, Method 8186
Total Dissolved Solids*	1	2014/11/04	2014/11/04	QUE SOP-00119	MA. 103 - S.T. 1.0
Turbidity*	1	N/A	2014/11/04	QUE SOP-00118	MA.103-TUR. 1.0

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) This test was performed by Maxxam -Ville St. Laurent
- (2) DOC present in the sample should be considered as non-purgeable DOC

* Maxxam is accredited as per the MDDELCC program.
*** This analysis is not subject to MDDELCC accreditation.

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Your P.O. #: 2200000001
Your Project #: HYDROLOGY
Site#: TSMC
Site Location: HOWSE
Your C.O.C. #: 106829-06-01

Report Date: 2014/11/11
Report #: R1942757
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B469776
Received: 2014/11/04, 09:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Mathieu Letourneau, B.Sc., chimist, Customer Service
Email: MLetourneau@maxxam.ca
Phone# (418) 658-5784

=====
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

METALS (GROUND WATER)

Maxxam ID		AE9785		
Sampling Date		2014/11/01 08:00		
COC Number		106829-06-01		
	Units	HW-RC14-W01R (72H)	RDL	QC Batch

METALS				
Mercury (Hg)	mg/L	<0.00001	0.00001	1386779
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

TOTAL EXTRACTABLE METALS (GROUND WATER)

Maxxam ID		AE9785		
Sampling Date		2014/11/01 08:00		
COC Number		106829-06-01		
	Units	HW-RC14-W01R (72H)	RDL	QC Batch
METALS				
Total phosphorous	mg/L	<0.01	0.01	1385447
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

ACID SOLUBLE METALS (GROUND WATER)

Maxxam ID		AE9785		
Sampling Date		2014/11/01 08:00		
COC Number		106829-06-01		
	Units	HW-RC14-W01R (72H)	RDL	QC Batch

METALS				
Aluminum (Al)	mg/L	<0.030	0.030	1386296
Antimony (Sb)	mg/L	<0.0030	0.0030	1386296
Arsenic (As)	mg/L	<0.0010	0.0010	1386296
Barium (Ba)	mg/L	<0.020	0.020	1386296
Silver (Ag)	mg/L	<0.00030	0.00030	1386296
Boron (B)	mg/L	<0.050	0.050	1386296
Cadmium (Cd)	mg/L	<0.0010	0.0010	1386296
Beryllium (Be)	mg/L	<0.0020	0.0020	1386296
Bismuth (Bi)	mg/L	<0.050	0.050	1386296
Chromium (Cr)	mg/L	<0.0050	0.0050	1386296
Calcium (Ca)	mg/L	1.6	0.50	1386296
Cobalt (Co)	mg/L	<0.020	0.020	1386296
Copper (Cu)	mg/L	<0.0030	0.0030	1386296
Total Hardness (CaCO ₃)	mg/L	11	1.0	1386296
Tin (Sn)	mg/L	<0.050	0.050	1386296
Iron (Fe)	mg/L	<0.10	0.10	1386296
Magnesium (Mg)	mg/L	1.7	0.20	1386296
Manganese (Mn)	mg/L	0.0038	0.0030	1386296
Molybdenum (Mo)	mg/L	<0.010	0.010	1386296
Nickel (Ni)	mg/L	<0.010	0.010	1386296
Lead (Pb)	mg/L	<0.0010	0.0010	1386296
Potassium (K)	mg/L	0.21	0.20	1386296
Selenium (Se)	mg/L	<0.0010	0.0010	1386296
Sodium (Na)	mg/L	1.9	0.20	1386296
Strontium (Sr)	mg/L	<0.050	0.050	1386296
Thallium (Tl)	mg/L	<0.010	0.010	1386296
Titanium (Ti)	mg/L	<0.050	0.050	1386296
Uranium (U)	mg/L	<0.0020	0.0020	1386296
Vanadium (V)	mg/L	<0.010	0.010	1386296
Zinc (Zn)	mg/L	0.031	0.0050	1386296
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

CONVENTIONAL PARAMETERS (GROUND WATER)

Maxxam ID		AE9785		
Sampling Date		2014/11/01 08:00		
COC Number		106829-06-01		
	Units	HW-RC14-W01R (72H)	RDL	QC Batch
CONVENTIONALS				
Conductivity	mS/cm	0.028	0.001	1384598
Dissolved organic carbon	mg/L	0.8	0.2	1385882
Inorganic phosphorous	mg/L	0.03	0.02	1385384
Nitrogen ammonia (N-NH3)	mg/L	<0.02	0.02	1385407
Orthophosphate (P)	mg/L	<0.01	0.01	1384610
pH	pH	7.27	N/A	1384593
Phenols-4AAP	mg/L	<0.002	0.002	1386188
Reactive silica (SiO2)	mg/L	11	0.1	1385338
Real Color	UCV	4	2	1384609
Sulfides (S2-)	mg/L	<0.02	0.02	1385853
Total Cyanide (CN)	mg/L	<0.01	0.01	1384452
Turbidity	NTU	99	0.1	1384620
Absorbance at 254nm	/cm	0.15	0.005	1384608
Alkalinity Total (as CaCO3) pH 4.5	mg/L	15	1	1384595
Bromide (Br-)	mg/L	<0.1	0.1	1384199
Bicarbonates (HCO3 as CaCO3)	mg/L	15	1	1384595
Carbonate (CO3 as CaCO3)	mg/L	<1	1	1384595
Chloride (Cl)	mg/L	0.15	0.05	1384199
Nitrites (N-NO2-)	mg/L	<0.01	0.01	1384197
Nitrates (N-NO3-)	mg/L	0.10	0.01	1384197
Sulfates (SO4)	mg/L	0.9	0.5	1384199
Total Dissolved Solids	mg/L	37	10	1384216
Total suspended solids (TSS)	mg/L	180	2	1384332
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD except for the following:

Absorbance: Holding time already past.: AE9785

Anions: Holding time already past.: AE9785

Real Color: Holding time already past.: AE9785

pH: Holding time already past.: AE9785

Ortho Phosphate: Holding time already past.: AE9785

Turbidity: Holding time already past.: AE9785

Dissolved Organic Carbon: Holding time already past.: AE9785

échantillon AE9785-02R reçu après délais.

METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

TOTAL EXTRACTABLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

ACID SOLUBLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

pH: Holding time not respected.

Results relate only to the items tested.

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
	1384197	MCC	QC Standard	Nitrates (N-NO3-)	2014/11/04		100	%
	1384197	MCC	Spiked Blank	Nitrites (N-NO2-)	2014/11/04		97	%
	1384197	MCC	Method Blank	Nitrites (N-NO2-)	2014/11/04	<0.01		mg/L
				Nitrates (N-NO3-)	2014/11/04	<0.01		mg/L
	1384199	MCC	QC Standard	Bromide (Br-)	2014/11/04		99	%
				Chloride (Cl)	2014/11/04		105	%
				Sulfates (SO4)	2014/11/04		97	%
	1384199	MCC	Method Blank	Bromide (Br-)	2014/11/04	<0.1		mg/L
				Chloride (Cl)	2014/11/04	<0.05		mg/L
				Sulfates (SO4)	2014/11/04	<0.5		mg/L
	1384216	MCC	Spiked Blank	Total Dissolved Solids	2014/11/04		108	%
	1384216	MCC	Method Blank	Total Dissolved Solids	2014/11/04	<10		mg/L
	1384332	MCC	Spiked Blank	Total suspended solids (TSS)	2014/11/04		109	%
	1384332	MCC	Method Blank	Total suspended solids (TSS)	2014/11/04	<2		mg/L
	1384452	CB8	QC Standard	Total Cyanide (CN)	2014/11/05		108	%
	1384452	CB8	Method Blank	Total Cyanide (CN)	2014/11/05	<0.01		mg/L
	1384593	CG0	QC Standard	pH	2014/11/04		99	%
	1384595	CG0	QC Standard	Alkalinity Total (as CaCO3) pH 4.5	2014/11/04		104	%
	1384595	CG0	Method Blank	Alkalinity Total (as CaCO3) pH 4.5	2014/11/04	<1		mg/L
	1384598	CG0	QC Standard	Conductivity	2014/11/04		101	%
	1384598	CG0	Method Blank	Conductivity	2014/11/04	<0.001		mS/cm
	1384608	FTN	Spiked Blank	Absorbance at 254nm	2014/11/04		91	%
	1384608	FTN	Method Blank	Absorbance at 254nm	2014/11/04	<0.005		/cm
	1384609	FTN	Spiked Blank	Real Color	2014/11/04		99	%
	1384609	FTN	Method Blank	Real Color	2014/11/04	<2		UCV
	1384610	FTN	QC Standard	Orthophosphate (P)	2014/11/04		97	%
	1384610	FTN	Method Blank	Orthophosphate (P)	2014/11/04	<0.01		mg/L
	1384620	CG0	Spiked Blank	Turbidity	2014/11/04		99	%
	1384620	CG0	Method Blank	Turbidity	2014/11/04	<0.1		NTU
	1385338	FTN	QC Standard	Reactive silica (SiO2)	2014/11/05		88	%
	1385338	FTN	Method Blank	Reactive silica (SiO2)	2014/11/05	<0.1		mg/L
	1385384	DP3	Spiked Blank	Inorganic phosphorous	2014/11/06		104	%
	1385384	DP3	Method Blank	Inorganic phosphorous	2014/11/06	<0.02		mg/L
	1385407	DKH	QC Standard	Nitrogen ammonia (N-NH3)	2014/11/06		101	%
	1385407	DKH	Spiked Blank	Nitrogen ammonia (N-NH3)	2014/11/06		102	%
	1385407	DKH	Method Blank	Nitrogen ammonia (N-NH3)	2014/11/06	<0.02		mg/L
	1385447	AL5	Spiked Blank	Total phosphorous	2014/11/06		110	%
	1385447	AL5	Method Blank	Total phosphorous	2014/11/06	<0.01		mg/L
	1385853	CB8	QC Standard	Sulfides (S2-)	2014/11/07		86	%
	1385853	CB8	Method Blank	Sulfides (S2-)	2014/11/07	<0.02		mg/L
	1385882	JL1	Spiked Blank	Dissolved organic carbon	2014/11/07		103	%
	1385882	JL1	Method Blank	Dissolved organic carbon	2014/11/07	0.3, RDL=0.2		mg/L
	1386188	DB2	QC Standard	Phenols-4AAP	2014/11/07		97	%
	1386188	DB2	Spiked Blank	Phenols-4AAP	2014/11/07		97	%
	1386188	DB2	Method Blank	Phenols-4AAP	2014/11/07	<0.002		mg/L
	1386296	JF1	Spiked Blank	Aluminum (Al)	2014/11/07		101	%
				Antimony (Sb)	2014/11/07		104	%
				Arsenic (As)	2014/11/07		103	%
				Barium (Ba)	2014/11/07		99	%

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Silver (Ag)	2014/11/07		101	%
			Boron (B)	2014/11/07		103	%
			Cadmium (Cd)	2014/11/07		99	%
			Beryllium (Be)	2014/11/07		100	%
			Bismuth (Bi)	2014/11/07		95	%
			Chromium (Cr)	2014/11/07		99	%
			Calcium (Ca)	2014/11/07		99	%
			Cobalt (Co)	2014/11/07		99	%
			Copper (Cu)	2014/11/07		99	%
			Tin (Sn)	2014/11/07		105	%
			Iron (Fe)	2014/11/07		101	%
			Magnesium (Mg)	2014/11/07		102	%
			Manganese (Mn)	2014/11/07		104	%
			Molybdenum (Mo)	2014/11/07		108	%
			Nickel (Ni)	2014/11/07		97	%
			Lead (Pb)	2014/11/07		99	%
			Potassium (K)	2014/11/07		102	%
			Selenium (Se)	2014/11/07		108	%
			Sodium (Na)	2014/11/07		100	%
			Strontium (Sr)	2014/11/07		100	%
			Thallium (Tl)	2014/11/07		98	%
			Titanium (Ti)	2014/11/07		101	%
			Uranium (U)	2014/11/07		99	%
			Vanadium (V)	2014/11/07		100	%
			Zinc (Zn)	2014/11/07		97	%
1386296	JF1	Method Blank	Aluminum (Al)	2014/11/07	<0.030		mg/L
			Antimony (Sb)	2014/11/07	<0.0030		mg/L
			Arsenic (As)	2014/11/07	<0.0010		mg/L
			Barium (Ba)	2014/11/07	<0.020		mg/L
			Silver (Ag)	2014/11/07	<0.00030		mg/L
			Boron (B)	2014/11/07	<0.050		mg/L
			Cadmium (Cd)	2014/11/07	<0.0010		mg/L
			Beryllium (Be)	2014/11/07	<0.0020		mg/L
			Bismuth (Bi)	2014/11/07	<0.050		mg/L
			Chromium (Cr)	2014/11/07	<0.0050		mg/L
			Calcium (Ca)	2014/11/07	<0.50		mg/L
			Cobalt (Co)	2014/11/07	<0.020		mg/L
			Copper (Cu)	2014/11/07	<0.0030		mg/L
			Total Hardness (CaCO3)	2014/11/07	<1.0		mg/L
			Tin (Sn)	2014/11/07	<0.050		mg/L
			Iron (Fe)	2014/11/07	<0.10		mg/L
			Magnesium (Mg)	2014/11/07	<0.20		mg/L
			Manganese (Mn)	2014/11/07	<0.0030		mg/L
			Molybdenum (Mo)	2014/11/07	<0.010		mg/L
			Nickel (Ni)	2014/11/07	<0.010		mg/L
			Lead (Pb)	2014/11/07	<0.0010		mg/L
			Potassium (K)	2014/11/07	<0.20		mg/L
			Selenium (Se)	2014/11/07	<0.0010		mg/L
			Sodium (Na)	2014/11/07	<0.20		mg/L
			Strontium (Sr)	2014/11/07	<0.050		mg/L

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Thallium (Tl)	2014/11/07	<0.010		mg/L
			Titanium (Ti)	2014/11/07	<0.050		mg/L
			Uranium (U)	2014/11/07	<0.0020		mg/L
			Vanadium (V)	2014/11/07	<0.010		mg/L
			Zinc (Zn)	2014/11/07	<0.0050		mg/L
1386779	MCA	QC Standard	Mercury (Hg)	2014/11/11		107	%
1386779	MCA	Spiked Blank	Mercury (Hg)	2014/11/11		101	%
1386779	MCA	Method Blank	Mercury (Hg)	2014/11/11	<0.00001		mg/L

RDL = Reportable Detection Limit

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



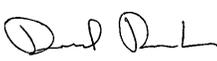

Alexandre Lemire, M.Sc., Analyst 2




Delia Barbul, B.Sc., Chemist




Dochka Koleva Hristova, B.Sc., Chemist



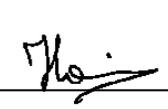

David Provencher, B.Sc., Chemist




Jonathan Fauvel, B.Sc, Chimiste, Analyste II




Maria Chrifi Alaoui, B.Sc., Chemist




Madina Hamrouni, B.Sc., Chemist

Maxxam Job #: B469776
Report Date: 2014/11/11

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

VALIDATION SIGNATURE PAGE(CONT'D)

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Attention: Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Your P.O. #: 2200000001
Your Project #: HYDROLOGY
Site#: TSMC
Site Location: HOWSE
Your C.O.C. #: 106829-05-01

Report Date: 2014/11/04
Report #: R1939486
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B468237

Received: 2014/10/28, 14:00

Sample Matrix: WATER
Samples Received: 2

Analyses	Quantity	Date		Laboratory Method	Primary Reference
		Extracted	Analyzed		
Absorbance***	2	N/A	2014/10/28	QUE SOP-00139	MA.103 -%TUV 1.0
Total Alkalinity (pH end point 4.5)***	2	N/A	2014/10/28	QUE SOP-00142	MA.303-TitrAuto 2.1
Anions*	2	N/A	2014/10/28	QUE SOP-00141	MA. 300-Ions 1.3
Anions*	2	N/A	2014/10/28	QUE SOP-00141	MA. 300-Ions 1.3
Total Cyanide*	2	2014/10/28	2014/10/29	QUE SOP-00143	MA. 300 - CN 1.2
Real Color*	2	N/A	2014/10/28	QUE SOP-00115	MA. 103 - Col. 2.0
Conductivity*	2	N/A	2014/10/28	QUE SOP-00142	MA.303-TitrAuto 2.1
Total Extractable Mercury - Cold Vapour (1)***	2	2014/11/03	2014/11/04	STL SOP-00042	MA200-Hg 1.1 R1 m
Total Suspended Solids*	2	2014/10/29	2014/10/29	QUE SOP-00111	SM 2540 D
Acid Soluble Metals by ICP-MS (1)*	2	2014/10/31	2014/10/31	STL SOP-00006	MA200-Mét 1.2 R4 m
Total Extractable Metals by ICP (1)*	2	2014/10/31	2014/10/31	STL SOP-00006	MA200-Mét 1.2 R4 m
Ammonia Nitrogen (1)*	2	N/A	2014/10/31	STL SOP-00040	MA300-N 2.0 R1 m
pH*	2	N/A	2014/10/28	QUE SOP-00142	MA.303-TitrAuto 2.1
Total Phenols by 4-AAP (1)*	2	2014/10/31	2014/10/31	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Inorganic Phosphorus***	2	2014/10/31	2014/10/31	QUE SOP-00122	MA. 300 - P. Ino 1.1
Ortho Phosphate*	2	N/A	2014/10/28	QUE SOP-00121	MA.303 - P 1.1
Sulfides (S2-)*	2	2014/10/30	2014/10/30	QUE SOP-00107	MA 300 - S 1.1
Reactive Silica (SiO2)***	2	N/A	2014/10/29	QUE SOP-00132	HACH, Method 8186
Total Dissolved Solids*	2	2014/10/31	2014/10/31	QUE SOP-00119	MA. 103 - S.T. 1.0
Total Organic Carbon (1, 2)*	2	N/A	2014/10/31	STL SOP-00243	SM 21 5310-B m
Turbidity*	2	N/A	2014/10/28	QUE SOP-00118	MA.103-TUR. 1.0

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam -Ville St. Laurent

(2) TOC present in the sample should be considered as non-purgeable TOC

* Maxxam is accredited as per the MDDELCC program.

*** This analysis is not subject to MDDELCC accreditation.

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Your P.O. #: 2200000001
Your Project #: HYDROLOGY
Site#: TSMC
Site Location: HOWSE
Your C.O.C. #: 106829-05-01

Report Date: 2014/11/04
Report #: R1939486
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B468237

Received: 2014/10/28, 14:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Mathieu Letourneau, B.Sc., chimist, Customer Service

Email: MLetourneau@maxxam.ca

Phone# (418) 658-5784

=====
This report has been generated and distributed using a secure automated process.

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

METALS (WATER)

Maxxam ID		AE1455	AE1566		
Sampling Date		2014/10/26	2014/10/26		
COC Number		106829-05-01	106829-05-01		
	Units	HW-RC-14W03R(24HRS)	HW-RC-14-W03R (72HRS)	RDL	QC Batch
METALS					
Mercury (Hg)	mg/L	<0.00001	<0.00001	0.00001	1383686
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

TOTAL EXTRACTABLE METALS (WATER)

Maxxam ID		AE1455	AE1566		
Sampling Date		2014/10/26	2014/10/26		
COC Number		106829-05-01	106829-05-01		
	Units	HW-RC-14W03R(24HRS)	HW-RC-14-W03R (72HRS)	RDL	QC Batch
METALS					
Total phosphorous	mg/L	<0.01	<0.01	0.01	1383048
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

ACID SOLUBLE METALS (WATER)

Maxxam ID		AE1455	AE1566		
Sampling Date		2014/10/26	2014/10/26		
COC Number		106829-05-01	106829-05-01		
	Units	HW-RC-14W03R(24HRS)	HW-RC-14-W03R (72HRS)	RDL	QC Batch
METALS					
Aluminum (Al)	mg/L	0.053	0.049	0.030	1383013
Antimony (Sb)	mg/L	<0.0030	<0.0030	0.0030	1383013
Arsenic (As)	mg/L	<0.0010	<0.0010	0.0010	1383013
Barium (Ba)	mg/L	<0.020	<0.020	0.020	1383013
Silver (Ag)	mg/L	0.00036	<0.00030	0.00030	1383013
Boron (B)	mg/L	<0.050	<0.050	0.050	1383013
Cadmium (Cd)	mg/L	<0.0010	<0.0010	0.0010	1383013
Beryllium (Be)	mg/L	<0.0020	<0.0020	0.0020	1383013
Bismuth (Bi)	mg/L	<0.050	<0.050	0.050	1383013
Chromium (Cr)	mg/L	<0.0050	<0.0050	0.0050	1383013
Calcium (Ca)	mg/L	2.4	2.4	0.50	1383013
Cobalt (Co)	mg/L	<0.020	<0.020	0.020	1383013
Copper (Cu)	mg/L	<0.0030	<0.0030	0.0030	1383013
Total Hardness (CaCO3)	mg/L	15	15	1.0	1383013
Tin (Sn)	mg/L	<0.050	<0.050	0.050	1383013
Iron (Fe)	mg/L	<0.10	<0.10	0.10	1383013
Magnesium (Mg)	mg/L	2.2	2.2	0.20	1383013
Manganese (Mn)	mg/L	<0.0030	<0.0030	0.0030	1383013
Molybdenum (Mo)	mg/L	<0.010	<0.010	0.010	1383013
Nickel (Ni)	mg/L	<0.010	<0.010	0.010	1383013
Lead (Pb)	mg/L	<0.0010	<0.0010	0.0010	1383013
Potassium (K)	mg/L	0.34	0.36	0.20	1383013
Selenium (Se)	mg/L	<0.0010	<0.0010	0.0010	1383013
Sodium (Na)	mg/L	1.7	1.7	0.20	1383013
Strontium (Sr)	mg/L	<0.050	<0.050	0.050	1383013
Thallium (Tl)	mg/L	<0.010	<0.010	0.010	1383013
Titanium (Ti)	mg/L	<0.050	<0.050	0.050	1383013
Uranium (U)	mg/L	<0.0020	<0.0020	0.0020	1383013
Vanadium (V)	mg/L	<0.010	<0.010	0.010	1383013
Zinc (Zn)	mg/L	0.027	0.019	0.0050	1383013
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

CONVENTIONAL PARAMETERS (WATER)

Maxxam ID		AE1455	AE1566	AE1566		
Sampling Date		2014/10/26	2014/10/26	2014/10/26		
COC Number		106829-05-01	106829-05-01	106829-05-01		
	Units	HW-RC-14W03R(24HRS)	HW-RC-14-W03R (72HRS)	HW-RC-14-W03R (72HRS) Lab-Dup	RDL	QC Batch

CONVENTIONALS						
Conductivity	mS/cm	0.037	0.038	N/A	0.001	1381402
Inorganic phosphorous	mg/L	<0.02	<0.02	N/A	0.02	1382931
Nitrogen ammonia (N-NH3)	mg/L	<0.02	<0.02	N/A	0.02	1382916
Orthophosphate (P)	mg/L	<0.01	<0.01	N/A	0.01	1381454
pH	pH	6.89	6.86	N/A	N/A	1381380
Phenols-4AAP	mg/L	0.002	<0.002	N/A	0.002	1383165
Reactive silica (SiO2)	mg/L	7.0	7.1	N/A	0.1	1382176
Real Color	UCV	4	3	N/A	2	1381453
Sulfides (S2-)	mg/L	<0.02	<0.02	N/A	0.02	1382299
Total Cyanide (CN)	mg/L	<0.01	<0.01	N/A	0.01	1381493
Total Organic Carbon	mg/L	<0.2	<0.2	N/A	0.2	1382660
Turbidity	NTU	1.9	1.6	N/A	0.1	1381456
Absorbance at 254nm	/cm	0.008	0.009	N/A	0.005	1381406
Alkalinity Total (as CaCO3) pH 4.5	mg/L	17	20	N/A	1	1381400
Bromide (Br-)	mg/L	<0.1	<0.1	<0.1	0.1	1380980
Bicarbonates (HCO3 as CaCO3)	mg/L	17	20	N/A	1	1381400
Carbonate (CO3 as CaCO3)	mg/L	<1	<1	N/A	1	1381400
Chloride (Cl)	mg/L	0.12	0.12	0.11	0.05	1380980
Nitrites (N-NO2-)	mg/L	<0.01	<0.01	N/A	0.01	1381302
Nitrates (N-NO3-)	mg/L	0.11	0.11	N/A	0.01	1381302
Sulfates (SO4)	mg/L	1.0	1.1	1.0	0.5	1380980
Total Dissolved Solids	mg/L	45	39	N/A	10	1382971
Total suspended solids (TSS)	mg/L	2	<2	N/A	2	1381888

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD except for the following:

Turbidity: Analyses requested past holding time: AE1455

Total Organic Carbon: Arrived unpreserved, preserved upon reception at the laboratory.: AE1455, AE1566

METALS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

TOTAL EXTRACTABLE METALS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

ACID SOLUBLE METALS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

pH: Holding time not respected.

Results relate only to the items tested.

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	
1380980	MCC	QC Standard	Bromide (Br-)	2014/10/28		99	%	
			Chloride (Cl)	2014/10/28		104	%	
			Sulfates (SO4)	2014/10/28		95	%	
1380980	MCC	Method Blank	Bromide (Br-)	2014/10/28	<0.1		mg/L	
			Chloride (Cl)	2014/10/28	<0.05		mg/L	
			Sulfates (SO4)	2014/10/28	<0.5		mg/L	
1381302	MCC	QC Standard	Nitrates (N-NO3-)	2014/10/28		99	%	
1381302	MCC	Spiked Blank	Nitrites (N-NO2-)	2014/10/28		105	%	
1381302	MCC	Method Blank	Nitrites (N-NO2-)	2014/10/28	<0.01		mg/L	
			Nitrates (N-NO3-)	2014/10/28	<0.01		mg/L	
1381380	CG0	QC Standard	pH	2014/10/28		99	%	
1381400	CG0	QC Standard	Alkalinity Total (as CaCO3) pH 4.5	2014/10/28		107	%	
1381400	CG0	Method Blank	Alkalinity Total (as CaCO3) pH 4.5	2014/10/28	<1		mg/L	
1381402	CG0	QC Standard	Conductivity	2014/10/28		102	%	
1381402	CG0	Method Blank	Conductivity	2014/10/28	<0.001		mS/cm	
1381406	CG0	Spiked Blank	Absorbance at 254nm	2014/10/28		98	%	
1381406	CG0	Method Blank	Absorbance at 254nm	2014/10/28	<0.005		/cm	
1381453	CG0	Spiked Blank	Real Color	2014/10/28		96	%	
1381453	CG0	Method Blank	Real Color	2014/10/28	<2		UCV	
1381454	FTN	QC Standard	Orthophosphate (P)	2014/10/28		105	%	
1381454	FTN	Method Blank	Orthophosphate (P)	2014/10/28	<0.01		mg/L	
1381456	FTN	Spiked Blank	Turbidity	2014/10/28		99	%	
1381456	FTN	Method Blank	Turbidity	2014/10/28	<0.1		NTU	
1381493	CB8	QC Standard	Total Cyanide (CN)	2014/10/29		99	%	
1381493	CB8	Method Blank	Total Cyanide (CN)	2014/10/29	<0.01		mg/L	
1381888	MCC	Spiked Blank	Total suspended solids (TSS)	2014/10/29		101	%	
1381888	MCC	Method Blank	Total suspended solids (TSS)	2014/10/29	<2		mg/L	
1382176	FTN	QC Standard	Reactive silica (SiO2)	2014/10/29		90	%	
1382176	FTN	Method Blank	Reactive silica (SiO2)	2014/10/29	<0.1		mg/L	
1382299	BD	QC Standard	Sulfides (S2-)	2014/10/30		82	%	
1382299	BD	Method Blank	Sulfides (S2-)	2014/10/30	<0.02		mg/L	
1382660	JL1	Spiked Blank	Total Organic Carbon	2014/10/31		102	%	
1382660	JL1	Method Blank	Total Organic Carbon	2014/10/31	<0.2		mg/L	
1382916	DKH	QC Standard	Nitrogen ammonia (N-NH3)	2014/10/31		102	%	
1382916	DKH	Spiked Blank	Nitrogen ammonia (N-NH3)	2014/10/31		104	%	
1382916	DKH	Method Blank	Nitrogen ammonia (N-NH3)	2014/10/31	<0.02		mg/L	
1382931	DP3	Spiked Blank	Inorganic phosphorous	2014/10/31		105	%	
1382931	DP3	Method Blank	Inorganic phosphorous	2014/10/31	<0.02		mg/L	
1382971	BD	Spiked Blank	Total Dissolved Solids	2014/10/31		112	%	
1382971	BD	Method Blank	Total Dissolved Solids	2014/10/31	18, RDL=10		mg/L	
1383013	JS2	Spiked Blank	Aluminum (Al)	2014/10/31		103	%	
			Antimony (Sb)	2014/10/31		109	%	
			Arsenic (As)	2014/10/31		96	%	
			Barium (Ba)	2014/10/31		102	%	
			Silver (Ag)	2014/10/31		87	%	
			Boron (B)	2014/10/31		97	%	
			Cadmium (Cd)	2014/10/31		100	%	
			Beryllium (Be)	2014/10/31		96	%	
			Bismuth (Bi)	2014/10/31		98	%	

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Chromium (Cr)	2014/10/31		90	%
			Calcium (Ca)	2014/10/31		103	%
			Cobalt (Co)	2014/10/31		90	%
			Copper (Cu)	2014/10/31		86	%
			Tin (Sn)	2014/10/31		110	%
			Iron (Fe)	2014/10/31		94	%
			Magnesium (Mg)	2014/10/31		93	%
			Manganese (Mn)	2014/10/31		96	%
			Molybdenum (Mo)	2014/10/31		105	%
			Nickel (Ni)	2014/10/31		90	%
			Lead (Pb)	2014/10/31		95	%
			Potassium (K)	2014/10/31		97	%
			Selenium (Se)	2014/10/31		91	%
			Sodium (Na)	2014/10/31		94	%
			Strontium (Sr)	2014/10/31		98	%
			Thallium (Tl)	2014/10/31		98	%
			Titanium (Ti)	2014/10/31		96	%
			Uranium (U)	2014/10/31		91	%
			Vanadium (V)	2014/10/31		94	%
			Zinc (Zn)	2014/10/31		90	%
1383013	JS2	Method Blank	Aluminum (Al)	2014/10/31	<0.030		mg/L
			Antimony (Sb)	2014/10/31	<0.0030		mg/L
			Arsenic (As)	2014/10/31	<0.0010		mg/L
			Barium (Ba)	2014/10/31	<0.020		mg/L
			Silver (Ag)	2014/10/31	<0.00030		mg/L
			Boron (B)	2014/10/31	<0.050		mg/L
			Cadmium (Cd)	2014/10/31	<0.0010		mg/L
			Beryllium (Be)	2014/10/31	<0.0020		mg/L
			Bismuth (Bi)	2014/10/31	<0.050		mg/L
			Chromium (Cr)	2014/10/31	<0.0050		mg/L
			Calcium (Ca)	2014/10/31	<0.50		mg/L
			Cobalt (Co)	2014/10/31	<0.020		mg/L
			Copper (Cu)	2014/10/31	<0.0030		mg/L
			Total Hardness (CaCO3)	2014/10/31	<1.0		mg/L
			Tin (Sn)	2014/10/31	<0.050		mg/L
			Iron (Fe)	2014/10/31	<0.10		mg/L
			Magnesium (Mg)	2014/10/31	<0.20		mg/L
			Manganese (Mn)	2014/10/31	<0.0030		mg/L
			Molybdenum (Mo)	2014/10/31	<0.010		mg/L
			Nickel (Ni)	2014/10/31	<0.010		mg/L
			Lead (Pb)	2014/10/31	<0.0010		mg/L
			Potassium (K)	2014/10/31	<0.20		mg/L
			Selenium (Se)	2014/10/31	<0.0010		mg/L
			Sodium (Na)	2014/10/31	<0.20		mg/L
			Strontium (Sr)	2014/10/31	<0.050		mg/L
			Thallium (Tl)	2014/10/31	<0.010		mg/L
			Titanium (Ti)	2014/10/31	<0.050		mg/L
			Uranium (U)	2014/10/31	<0.0020		mg/L
			Vanadium (V)	2014/10/31	<0.010		mg/L
			Zinc (Zn)	2014/10/31	<0.0050		mg/L

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
1383048	MCA	Spiked Blank	Total phosphorous	2014/10/31		95	%
1383048	MCA	Method Blank	Total phosphorous	2014/10/31	<0.01		mg/L
1383165	DB2	QC Standard	Phenols-4AAP	2014/10/31		101	%
1383165	DB2	Spiked Blank	Phenols-4AAP	2014/10/31		104	%
1383165	DB2	Method Blank	Phenols-4AAP	2014/10/31	<0.002		mg/L
1383686	OZP	QC Standard	Mercury (Hg)	2014/11/04		97	%
1383686	OZP	Spiked Blank	Mercury (Hg)	2014/11/04		101	%
1383686	OZP	Method Blank	Mercury (Hg)	2014/11/04	<0.00001		mg/L

RDL = Reportable Detection Limit

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Job #: B468237
Report Date: 2014/11/04

TATA STEEL MINERALS CANADA
Client Project #: HYDROLOGY
Site Location: HOWSE
Your P.O. #: 2200000001
Sampler Initials: GF

VALIDATION SIGNATURE PAGE

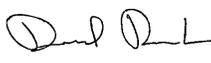
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).




Delia Barbul, B.Sc., Chemist




Dochka Koleva Hristova, B.Sc., Chemist




David Provencher, B.Sc., Chemist




Jonathan Fauvel, B.Sc, Chimiste, Analyste II




Maria Chrifi Alaoui, B.Sc., Chemist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your P.O. #: 2200000596
Your C.O.C. #: 122459-05-01

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Report Date: 2015/10/02
Report #: R2056873
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B557619

Received: 2015/09/25, 10:00

Sample Matrix: GROUND WATER
Samples Received: 1

Analyses	Quantity	Date		Laboratory Method	Primary Reference
		Extracted	Analyzed		
Total Alkalinity (pH end point 4.5)***	1	N/A	2015/09/25	QUE SOP-00142	MA.303-TitrAuto 2.1m
Anions*	1	N/A	2015/09/25	QUE SOP-00141	MA 300-Ions 1.3 R2 m
Anions*	1	N/A	2015/09/25	QUE SOP-00141	MA 300-Ions 1.3 R2 m
Real Color*	1	N/A	2015/09/25	QUE SOP-00115	MA 103-Col 2.0 R2m
Conductivity*	1	N/A	2015/09/25	QUE SOP-00142	MA.303-TitrAuto 2.1m
Dissolved Organic Carbon (1, 2)***	1	2015/09/28	2015/09/29	STL SOP-00243	SM 21 5310-B m
Total Extractable Mercury - Cold Vapour (1)***	1	2015/09/28	2015/09/29	STL SOP-00042	MA200-Hg 1.1 R1 m
Dissolved Metals by ICP-MS (Low Level)*	1	N/A	2015/09/28	QUE SOP-00132	MA 200-Met 1.2 R5 m
Ammonia Nitrogen (1)*	1	N/A	2015/09/29	STL SOP-00040	MA300-N 2.0 R2 m
Dissolved Oxygen***	1	N/A	2015/09/25	SM 421 F	MA315-DBO 1.1 R3 m
pH*	1	N/A	2015/09/25	QUE SOP-00142	MA.303-TitrAuto 2.1m
Total Phenols by 4-AAP (1)*	1	2015/09/30	2015/09/30	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Ortho Phosphate*	1	N/A	2015/09/25	QUE SOP-00121	MA.303 - P 1.1
Sulfides (S2-)*	1	2015/09/28	2015/09/28	QUE SOP-00107	SM 21 4500-S2- D m
Reactive Silica (SiO2)***	1	N/A	2015/09/30	QUE SOP-00132	HACH DR/890-8186m
Total Dissolved Solids*	1	2015/09/29	2015/09/30	QUE SOP-00119	MA115-S.D. 1.0 R4 m
Turbidity*	1	N/A	2015/09/25	QUE SOP-00118	MA 103-TUR. 1.0 R4m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam -Ville St. Laurent

(2) DOC present in the sample should be considered as non-purgeable DOC

* Maxxam is accredited as per the MDDELCC program.

*** This analysis is not subject to MDDELCC accreditation.

Your P.O. #: 2200000596
Your C.O.C. #: 122459-05-01

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Report Date: 2015/10/02
Report #: R2056873
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B557619
Received: 2015/09/25, 10:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Mathieu Letourneau, B. Sc., Chemist,
Email: MLetourneau@maxxam.ca
Phone# (418) 658-5784 Ext:6432

=====
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

METALS (GROUND WATER)

Maxxam ID		BK5459	BK5459		
Sampling Date		2015/09/24 10:00	2015/09/24 10:00		
COC Number		122459-05-01	122459-05-01		
	Units	HW-RC15-WE06R	HW-RC15-WE06R Lab-Dup	RDL	QC Batch
METALS					
Mercury (Hg)	mg/L	<0.00001	<0.00001	0.00001	1513675
RDL = Reportable Detection Limit QC Batch = Quality Control Batch					

DISSOLVED METALS (GROUND WATER)

Maxxam ID		BK5459		
Sampling Date		2015/09/24 10:00		
COC Number		122459-05-01		
	Units	HW-RC15-WE06R	RDL	QC Batch
METALS ICP-MS				
Aluminum (Al)	ug/L	<10	10	1513738
Antimony (Sb)	ug/L	<1.0	1.0	1513738
Silver (Ag)	ug/L	<0.10	0.10	1513738
Arsenic (As)	ug/L	<1.0	1.0	1513738
Barium (Ba)	ug/L	2.6	2.0	1513738
Beryllium (Be)	ug/L	<0.40	0.40	1513738
Bismuth (Bi)	ug/L	<0.25	0.25	1513738
Boron (B)	ug/L	<20	20	1513738
Cadmium (Cd)	ug/L	<0.20	0.20	1513738
Calcium (Ca)	ug/L	1000	300	1513738
Chromium (Cr)	ug/L	<0.50	0.50	1513738
Cobalt (Co)	ug/L	<0.50	0.50	1513738
Copper (Cu)	ug/L	7.1	0.50	1513738
Total Hardness (CaCO ₃)	ug/L	7200	1000	1513738
Tin (Sn)	ug/L	<1.0	1.0	1513738
Iron (Fe)	ug/L	<100	100	1513738
Magnesium (Mg)	ug/L	1100	100	1513738
Manganese (Mn)	ug/L	3.5	0.40	1513738
Molybdenum (Mo)	ug/L	<0.50	0.50	1513738
Nickel (Ni)	ug/L	1.5	1.0	1513738
Phosphorus	ug/L	<10	10	1513738
Lead (Pb)	ug/L	0.53	0.10	1513738
Potassium (K)	ug/L	200	100	1513738
Selenium (Se)	ug/L	<1.0	1.0	1513738
Strontium (Sr)	ug/L	3.1	2.0	1513738
Sodium (Na)	ug/L	1700	100	1513738
Thallium (Tl)	ug/L	<2.0	2.0	1513738
Uranium (U)	ug/L	<1.0	1.0	1513738
Titanium (Ti)	ug/L	<10	10	1513738
Vanadium (V)	ug/L	<2.0	2.0	1513738
Zinc (Zn)	ug/L	5.7	5.0	1513738
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

CONVENTIONAL PARAMETERS (GROUND WATER)

Maxxam ID		BK5459	BK5459		
Sampling Date		2015/09/24 10:00	2015/09/24 10:00		
COC Number		122459-05-01	122459-05-01		
	Units	HW-RC15-WE06R	HW-RC15-WE06R Lab-Dup	RDL	QC Batch

CONVENTIONALS					
Conductivity	mS/cm	0.022	N/A	0.001	1513164
Dissolved organic carbon	mg/L	0.5	N/A	0.2	1513770
Dissolved oxygen	mg/L	12	N/A	1.0	1513287
Nitrogen ammonia (N-NH3)	mg/L	<0.02	N/A	0.02	1514277
Orthophosphate (P)	mg/L	<0.01	N/A	0.01	1513350
pH	pH	7.11	N/A	N/A	1513143
Phenols-4AAP	mg/L	<0.002	<0.002	0.002	1514877
Reactive silica (SiO2)	mg/L	10	N/A	2	1514905
Real Color	UCV	<2	N/A	2	1513354
Sulfides (S2-)	mg/L	<0.02	N/A	0.02	1513888
Turbidity	NTU	1.8	N/A	0.1	1513360
Alkalinity Total (as CaCO3) pH 4.5	mg/L	21	N/A	1	1513145
Bicarbonates (HCO3 as CaCO3)	mg/L	21	N/A	1	1513145
Carbonate (CO3 as CaCO3)	mg/L	<1	N/A	1	1513145
Chloride (Cl)	mg/L	0.11	N/A	0.05	1513069
Nitrites (N-NO2-)	mg/L	<0.01	N/A	0.01	1513067
Nitrates (N-NO3-)	mg/L	0.08	N/A	0.01	1513067
Nitrate (N) and Nitrite(N)	mg/L	0.08	N/A	0.02	1513069
Sulfates (SO4)	mg/L	<0.5	N/A	0.5	1513069
Total Dissolved Solids	mg/L	15	N/A	10	1514200
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable					

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD

METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

DISSOLVED METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Reported detection limits are multiplied by dilution factors used for sample analysis.

Results relate only to the items tested.

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
1513067	MCC	QC Standard	Nitrates (N-NO3-)	2015/09/25		103	%
1513067	MCC	Spiked Blank	Nitrites (N-NO2-)	2015/09/25		105	%
1513067	MCC	Method Blank	Nitrites (N-NO2-)	2015/09/25	<0.01		mg/L
			Nitrates (N-NO3-)	2015/09/25	<0.01		mg/L
1513069	MCC	QC Standard	Chloride (Cl)	2015/09/25		107	%
			Nitrate (N) and Nitrite(N)	2015/09/25		103	%
			Sulfates (SO4)	2015/09/25		99	%
1513069	MCC	Spiked Blank	Nitrate (N) and Nitrite(N)	2015/09/25		105	%
1513069	MCC	Method Blank	Chloride (Cl)	2015/09/25	<0.05		mg/L
			Nitrate (N) and Nitrite(N)	2015/09/25	<0.02		mg/L
			Sulfates (SO4)	2015/09/25	<0.5		mg/L
1513143	CB8	QC Standard	pH	2015/09/25		100	%
1513145	CB8	Spiked Blank	Alkalinity Total (as CaCO3) pH 4.5	2015/09/25		86	%
1513145	CB8	Method Blank	Alkalinity Total (as CaCO3) pH 4.5	2015/09/25	<1		mg/L
1513164	CB8	QC Standard	Conductivity	2015/09/25		103	%
1513164	CB8	Method Blank	Conductivity	2015/09/25	<0.001		mS/cm
1513350	CB8	QC Standard	Orthophosphate (P)	2015/09/25		106	%
1513350	CB8	Method Blank	Orthophosphate (P)	2015/09/25	<0.01		mg/L
1513354	ARI	Spiked Blank	Real Color	2015/09/25		100	%
1513354	ARI	Method Blank	Real Color	2015/09/25	<2		UCV
1513360	ARI	Spiked Blank	Turbidity	2015/09/25		94	%
1513360	ARI	Method Blank	Turbidity	2015/09/25	<0.1		NTU
1513675	SDA	Spiked Blank	Mercury (Hg)	2015/09/29		98	%
1513675	SDA	Method Blank	Mercury (Hg)	2015/09/29	<0.00001		mg/L
1513738	NS	Spiked Blank	Aluminum (Al)	2015/09/28		108	%
			Antimony (Sb)	2015/09/28		92	%
			Silver (Ag)	2015/09/28		86	%
			Arsenic (As)	2015/09/28		100	%
			Barium (Ba)	2015/09/28		89	%
			Beryllium (Be)	2015/09/28		93	%
			Bismuth (Bi)	2015/09/28		89	%
			Boron (B)	2015/09/28		98	%
			Cadmium (Cd)	2015/09/28		98	%
			Calcium (Ca)	2015/09/28		95	%
			Chromium (Cr)	2015/09/28		100	%
			Cobalt (Co)	2015/09/28		98	%
			Copper (Cu)	2015/09/28		101	%
			Tin (Sn)	2015/09/28		97	%
			Iron (Fe)	2015/09/28		105	%
			Magnesium (Mg)	2015/09/28		106	%
			Manganese (Mn)	2015/09/28		104	%
			Molybdenum (Mo)	2015/09/28		102	%
			Nickel (Ni)	2015/09/28		99	%
			Phosphorus	2015/09/28		102	%
			Lead (Pb)	2015/09/28		98	%
			Potassium (K)	2015/09/28		102	%
			Selenium (Se)	2015/09/28		99	%
			Strontium (Sr)	2015/09/28		95	%
			Sodium (Na)	2015/09/28		110	%
			Thallium (Tl)	2015/09/28		88	%
			Uranium (U)	2015/09/28		88	%
			Titanium (Ti)	2015/09/28		102	%
			Vanadium (V)	2015/09/28		98	%

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
1513738	NS	Method Blank	Zinc (Zn)	2015/09/28		106	%
			Aluminum (Al)	2015/09/28	<10		ug/L
			Antimony (Sb)	2015/09/28	<1.0		ug/L
			Silver (Ag)	2015/09/28	<0.10		ug/L
			Arsenic (As)	2015/09/28	<1.0		ug/L
			Barium (Ba)	2015/09/28	<2.0		ug/L
			Beryllium (Be)	2015/09/28	<0.40		ug/L
			Bismuth (Bi)	2015/09/28	<0.25		ug/L
			Boron (B)	2015/09/28	<20		ug/L
			Cadmium (Cd)	2015/09/28	<0.017		ug/L
			Calcium (Ca)	2015/09/28	<300		ug/L
			Chromium (Cr)	2015/09/28	<0.50		ug/L
			Cobalt (Co)	2015/09/28	<0.50		ug/L
			Copper (Cu)	2015/09/28	<0.50		ug/L
			Total Hardness (CaCO3)	2015/09/28	<1000		ug/L
			Tin (Sn)	2015/09/28	<1.0		ug/L
			Iron (Fe)	2015/09/28	<100		ug/L
			Magnesium (Mg)	2015/09/28	<100		ug/L
			Manganese (Mn)	2015/09/28	<0.40		ug/L
			Molybdenum (Mo)	2015/09/28	<0.50		ug/L
			Nickel (Ni)	2015/09/28	<1.0		ug/L
			Phosphorus	2015/09/28	<10		ug/L
			Lead (Pb)	2015/09/28	<0.10		ug/L
			Potassium (K)	2015/09/28	<100		ug/L
			Selenium (Se)	2015/09/28	<1.0		ug/L
			Strontium (Sr)	2015/09/28	<2.0		ug/L
			Sodium (Na)	2015/09/28	<100		ug/L
Thallium (Tl)	2015/09/28	<2.0		ug/L			
Uranium (U)	2015/09/28	<1.0		ug/L			
Titanium (Ti)	2015/09/28	<10		ug/L			
Vanadium (V)	2015/09/28	<2.0		ug/L			
			Zinc (Zn)	2015/09/28	<5.0		ug/L
1513770	MR4	QC Standard	Dissolved organic carbon	2015/09/29		98	%
1513770	MR4	Spiked Blank	Dissolved organic carbon	2015/09/29		103	%
1513770	MR4	Method Blank	Dissolved organic carbon	2015/09/29	0.4, RDL=0.2		mg/L
1513888	DP3	QC Standard	Sulfides (S2-)	2015/09/28		114	%
1513888	DP3	Method Blank	Sulfides (S2-)	2015/09/28	<0.02		mg/L
1514200	AG5	Spiked Blank	Total Dissolved Solids	2015/09/30		98	%
1514200	AG5	Method Blank	Total Dissolved Solids	2015/09/30	<10		mg/L
1514277	DKH	Spiked Blank	Nitrogen ammonia (N-NH3)	2015/09/29		96	%
1514277	DKH	Method Blank	Nitrogen ammonia (N-NH3)	2015/09/29	<0.02		mg/L
1514877	JL1	QC Standard	Phenols-4AAP	2015/09/30		99	%
1514877	JL1	Spiked Blank	Phenols-4AAP	2015/09/30		100	%
1514877	JL1	Method Blank	Phenols-4AAP	2015/09/30	<0.002		mg/L
1514905	DP3	QC Standard	Reactive silica (SiO2)	2015/09/30		102	%

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC							
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
1514905	DP3	Method Blank	Reactive silica (SiO ₂)	2015/09/30	0.2, RDL=0.1		mg/L

RDL = Reportable Detection Limit

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Job #: B557619
Report Date: 2015/10/02

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

VALIDATION SIGNATURE PAGE

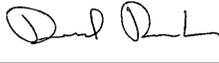
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

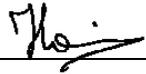
Anne-Marie Giroux, Analyste I

Dochka Koleva Hristova, B.Sc., Chemist

David Provencher, B.Sc., Chemist

Madina Hamrouni, B.Sc., Chemist

Steliana Calestru, B.Sc. Chemist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your P.O. #: 2200000596
Your C.O.C. #: 122459-01-01

Attention: Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Report Date: 2015/09/24
Report #: R2053368
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B555840

Received: 2015/09/18, 09:00

Sample Matrix: GROUND WATER
Samples Received: 2

Analyses	Quantity	Date		Laboratory Method	Primary Reference
		Extracted	Analyzed		
Total Alkalinity (pH end point 4.5)***	1	N/A	2015/09/18	QUE SOP-00142	MA.303-TitrAuto 2.1m
Anions*	1	N/A	2015/09/18	QUE SOP-00141	MA 300-Ions 1.3 R2 m
Anions*	1	N/A	2015/09/18	QUE SOP-00141	MA 300-Ions 1.3 R2 m
Real Color*	1	N/A	2015/09/18	QUE SOP-00115	MA 103-Col 2.0 R2m
Conductivity*	1	N/A	2015/09/18	QUE SOP-00142	MA.303-TitrAuto 2.1m
Dissolved Organic Carbon (1, 2)***	1	2015/09/19	2015/09/22	STL SOP-00243	SM 21 5310-B m
Total Extractable Mercury - Cold Vapour (1)***	1	2015/09/21	2015/09/23	STL SOP-00042	MA200-Hg 1.1 R1 m
Total Extractable Metals by ICP*	1	2015/09/21	2015/09/21	QUE SOP-00132	MA 200-Met 1.2 R5 m
Dissolved Metals by ICP-MS (Low Level)*	1	N/A	2015/09/22	QUE SOP-00132	MA 200-Met 1.2 R5 m
Ammonia Nitrogen (1)*	1	N/A	2015/09/23	STL SOP-00040	MA300-N 2.0 R2 m
Dissolved Oxygen***	1	N/A	2015/09/18	SM 421 F	MA315-DBO 1.1 R3 m
pH*	1	N/A	2015/09/18	QUE SOP-00142	MA.303-TitrAuto 2.1m
Total Phenols by 4-AAP (1)*	1	2015/09/24	2015/09/24	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Ortho Phosphate*	1	N/A	2015/09/18	QUE SOP-00121	MA.303 - P 1.1
Sulfides (S ₂ -)*	1	2015/09/22	2015/09/23	QUE SOP-00107	SM 21 4500-S2- D m
Reactive Silica (SiO ₂)***	1	N/A	2015/09/23	QUE SOP-00132	HACH DR/890-8186m
Total Dissolved Solids*	1	2015/09/18	2015/09/18	QUE SOP-00119	MA115-S.D. 1.0 R4 m
Turbidity*	1	N/A	2015/09/18	QUE SOP-00118	MA 103-TUR. 1.0 R4m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam -Ville St. Laurent

(2) DOC present in the sample should be considered as non-purgeable DOC

* Maxxam is accredited as per the MDDELCC program.

*** This analysis is not subject to MDDELCC accreditation.

Your P.O. #: 2200000596
Your C.O.C. #: 122459-01-01

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Report Date: 2015/09/24
Report #: R2053368
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B555840
Received: 2015/09/18, 09:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Mathieu Letourneau, B. Sc., Chemist,
Email: MLetourneau@maxxam.ca
Phone# (418) 658-5784 Ext:6432

=====
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Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

METALS (GROUND WATER)

Maxxam ID		BJ6498		
Sampling Date		2015/09/17 09:00		
COC Number		122459-01-01		
	Units	HW-RC15-WE07R	RDL	QC Batch
METALS				
Mercury (Hg)	mg/L	<0.00001	0.00001	1510505
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

DISSOLVED METALS (GROUND WATER)

Maxxam ID		BJ6498		
Sampling Date		2015/09/17 09:00		
COC Number		122459-01-01		
	Units	HW-RC15-WE07R	RDL	QC Batch
METALS ICP-MS				
Aluminum (Al)	ug/L	<10	10	1511062
Antimony (Sb)	ug/L	<1.0	1.0	1511062
Silver (Ag)	ug/L	<0.10	0.10	1511062
Arsenic (As)	ug/L	<1.0	1.0	1511062
Barium (Ba)	ug/L	2.7	2.0	1511062
Beryllium (Be)	ug/L	<0.40	0.40	1511062
Bismuth (Bi)	ug/L	<0.25	0.25	1511062
Boron (B)	ug/L	<20	20	1511062
Cadmium (Cd)	ug/L	<0.20	0.20	1511062
Calcium (Ca)	ug/L	2300	300	1511062
Chromium (Cr)	ug/L	<0.50	0.50	1511062
Cobalt (Co)	ug/L	<0.50	0.50	1511062
Copper (Cu)	ug/L	<0.50	0.50	1511062
Total Hardness (CaCO ₃)	ug/L	14000	1000	1511062
Tin (Sn)	ug/L	<1.0	1.0	1511062
Iron (Fe)	ug/L	<100	100	1511062
Magnesium (Mg)	ug/L	2000	100	1511062
Manganese (Mn)	ug/L	9.8	0.40	1511062
Molybdenum (Mo)	ug/L	<0.50	0.50	1511062
Mercury (Hg)	ug/L	<0.10	0.10	1511062
Nickel (Ni)	ug/L	<1.0	1.0	1511062
Lead (Pb)	ug/L	0.31	0.10	1511062
Potassium (K)	ug/L	360	100	1511062
Selenium (Se)	ug/L	<1.0	1.0	1511062
Strontium (Sr)	ug/L	5.4	2.0	1511062
Sodium (Na)	ug/L	920	100	1511062
Thallium (Tl)	ug/L	<2.0	2.0	1511062
Uranium (U)	ug/L	<1.0	1.0	1511062
Titanium (Ti)	ug/L	<10	10	1511062
Vanadium (V)	ug/L	<2.0	2.0	1511062
Zinc (Zn)	ug/L	<5.0	5.0	1511062
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

TOTAL EXTRACTABLE METALS (GROUND WATER)

Maxxam ID		BJ7517		
Sampling Date		2015/09/17 09:00		
COC Number		122459-01-01		
	Units	HW-RC15-WE07R	RDL	QC Batch
METALS				
P205	mg/L	0.0	N/A	1510582
Total phosphorous	mg/L	<0.01	0.01	1510582
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

CONVENTIONAL PARAMETERS (GROUND WATER)

Maxxam ID		BJ6498		
Sampling Date		2015/09/17 09:00		
COC Number		122459-01-01		
	Units	HW-RC15-WE07R	RDL	QC Batch

CONVENTIONALS				
Conductivity	mS/cm	0.034	0.001	1510120
Dissolved organic carbon	mg/L	0.3	0.2	1510365
Dissolved oxygen	mg/L	11	1.0	1509917
Nitrogen ammonia (N-NH3)	mg/L	0.02	0.02	1511713
Orthophosphate (P)	mg/L	<0.01	0.01	1510005
pH	pH	7.00	N/A	1510116
Phenols-4AAP	mg/L	<0.002	0.002	1512316
Reactive silica (SiO2)	mg/L	6.2	0.1	1511588
Real Color	UCV	<2	2	1510001
Sulfides (S2-)	mg/L	<0.02	0.02	1511603
Turbidity	NTU	1.4	0.1	1509938
Alkalinity Total (as CaCO3) pH 4.5	mg/L	11	1	1510118
Bicarbonates (HCO3 as CaCO3)	mg/L	11	1	1510118
Carbonate (CO3 as CaCO3)	mg/L	<1	1	1510118
Chloride (Cl)	mg/L	1.7	0.05	1509665
Nitrites (N-NO2-)	mg/L	<0.01	0.01	1509822
Nitrates (N-NO3-)	mg/L	0.76	0.01	1509822
Nitrate (N) and Nitrite(N)	mg/L	0.76	0.02	1509665
Sulfates (SO4)	mg/L	1.0	0.5	1509665
Total Dissolved Solids	mg/L	20	10	1509974
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD

METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

DISSOLVED METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

TOTAL EXTRACTABLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
1509665	MCC	QC Standard	Chloride (Cl)	2015/09/18		104	%
			Nitrate (N) and Nitrite(N)	2015/09/18		100	%
			Sulfates (SO4)	2015/09/18		93	%
1509665	MCC	Spiked Blank	Nitrate (N) and Nitrite(N)	2015/09/18		104	%
1509665	MCC	Method Blank	Chloride (Cl)	2015/09/18	<0.05		mg/L
			Nitrate (N) and Nitrite(N)	2015/09/18	<0.02		mg/L
			Sulfates (SO4)	2015/09/18	<0.5		mg/L
1509822	MCC	QC Standard	Nitrates (N-NO3-)	2015/09/18		100	%
1509822	MCC	Spiked Blank	Nitrites (N-NO2-)	2015/09/18		100	%
1509822	MCC	Method Blank	Nitrites (N-NO2-)	2015/09/18	<0.01		mg/L
			Nitrates (N-NO3-)	2015/09/18	<0.01		mg/L
1509938	MCC	Spiked Blank	Turbidity	2015/09/18		98	%
1509938	MCC	Method Blank	Turbidity	2015/09/18	<0.1		NTU
1509974	AG5	Spiked Blank	Total Dissolved Solids	2015/09/18		97	%
1509974	AG5	Method Blank	Total Dissolved Solids	2015/09/18	<10		mg/L
1510001	ARI	Spiked Blank	Real Color	2015/09/18		101	%
1510001	ARI	Method Blank	Real Color	2015/09/18	<2		UCV
1510005	MCC	QC Standard	Orthophosphate (P)	2015/09/18		99	%
1510005	MCC	Method Blank	Orthophosphate (P)	2015/09/18	<0.01		mg/L
1510116	CB8	QC Standard	pH	2015/09/18		100	%
1510118	CB8	Spiked Blank	Alkalinity Total (as CaCO3) pH 4.5	2015/09/18		89	%
1510118	CB8	Method Blank	Alkalinity Total (as CaCO3) pH 4.5	2015/09/18	<1		mg/L
1510120	CB8	QC Standard	Conductivity	2015/09/18		103	%
1510120	CB8	Method Blank	Conductivity	2015/09/18	<0.001		mS/cm
1510365	JL1	Spiked Blank	Dissolved organic carbon	2015/09/22		105	%
1510365	JL1	Method Blank	Dissolved organic carbon	2015/09/22	0.4, RDL=0.2		mg/L
1510505	SDA	Spiked Blank	Mercury (Hg)	2015/09/23		98	%
1510505	SDA	Method Blank	Mercury (Hg)	2015/09/23	<0.00001		mg/L
1510582	NS	QC Standard	Total phosphorous	2015/09/21		102	%
1510582	NS	Spiked Blank	Total phosphorous	2015/09/21		100	%
1510582	NS	Method Blank	P2O5	2015/09/21	0.0		mg/L
			Total phosphorous	2015/09/21	<0.01		mg/L
1511062	NS	Spiked Blank	Aluminum (Al)	2015/09/22		109	%
			Antimony (Sb)	2015/09/22		97	%
			Silver (Ag)	2015/09/22		98	%
			Arsenic (As)	2015/09/22		101	%
			Barium (Ba)	2015/09/22		97	%
			Beryllium (Be)	2015/09/22		103	%
			Bismuth (Bi)	2015/09/22		97	%
			Boron (B)	2015/09/22		107	%
			Cadmium (Cd)	2015/09/22		101	%
			Calcium (Ca)	2015/09/22		98	%
			Chromium (Cr)	2015/09/22		101	%
			Cobalt (Co)	2015/09/22		99	%
			Copper (Cu)	2015/09/22		98	%
			Tin (Sn)	2015/09/22		100	%
			Iron (Fe)	2015/09/22		105	%
			Magnesium (Mg)	2015/09/22		107	%
			Manganese (Mn)	2015/09/22		103	%
			Molybdenum (Mo)	2015/09/22		102	%
			Mercury (Hg)	2015/09/22		103	%
			Nickel (Ni)	2015/09/22		99	%

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Lead (Pb)	2015/09/22		101	%
			Potassium (K)	2015/09/22		105	%
			Selenium (Se)	2015/09/22		99	%
			Strontium (Sr)	2015/09/22		98	%
			Sodium (Na)	2015/09/22		108	%
			Thallium (Tl)	2015/09/22		96	%
			Uranium (U)	2015/09/22		98	%
			Titanium (Ti)	2015/09/22		100	%
			Vanadium (V)	2015/09/22		98	%
			Zinc (Zn)	2015/09/22		105	%
1511062	NS	Method Blank	Aluminum (Al)	2015/09/22	<10		ug/L
			Antimony (Sb)	2015/09/22	<1.0		ug/L
			Silver (Ag)	2015/09/22	<0.10		ug/L
			Arsenic (As)	2015/09/22	<1.0		ug/L
			Barium (Ba)	2015/09/22	<2.0		ug/L
			Beryllium (Be)	2015/09/22	<0.40		ug/L
			Bismuth (Bi)	2015/09/22	<0.25		ug/L
			Boron (B)	2015/09/22	<20		ug/L
			Cadmium (Cd)	2015/09/22	<0.20		ug/L
			Calcium (Ca)	2015/09/22	<300		ug/L
			Chromium (Cr)	2015/09/22	<0.50		ug/L
			Cobalt (Co)	2015/09/22	<0.50		ug/L
			Copper (Cu)	2015/09/22	<0.50		ug/L
			Total Hardness (CaCO3)	2015/09/22	<1000		ug/L
			Tin (Sn)	2015/09/22	<1.0		ug/L
			Iron (Fe)	2015/09/22	<100		ug/L
			Magnesium (Mg)	2015/09/22	<100		ug/L
			Manganese (Mn)	2015/09/22	<0.40		ug/L
			Molybdenum (Mo)	2015/09/22	<0.50		ug/L
			Mercury (Hg)	2015/09/22	<0.10		ug/L
			Nickel (Ni)	2015/09/22	<1.0		ug/L
			Lead (Pb)	2015/09/22	<0.10		ug/L
			Potassium (K)	2015/09/22	<100		ug/L
			Selenium (Se)	2015/09/22	<1.0		ug/L
			Strontium (Sr)	2015/09/22	<2.0		ug/L
			Sodium (Na)	2015/09/22	<100		ug/L
			Thallium (Tl)	2015/09/22	<2.0		ug/L
			Uranium (U)	2015/09/22	<1.0		ug/L
			Titanium (Ti)	2015/09/22	<10		ug/L
			Vanadium (V)	2015/09/22	<2.0		ug/L
			Zinc (Zn)	2015/09/22	<5.0		ug/L
1511588	DP3	QC Standard	Reactive silica (SiO2)	2015/09/23		96	%
1511588	DP3	Method Blank	Reactive silica (SiO2)	2015/09/23	0.1, RDL=0.1		mg/L
1511603	DP3	QC Standard	Sulfides (S2-)	2015/09/23		104	%
1511603	DP3	Method Blank	Sulfides (S2-)	2015/09/23	<0.02		mg/L
1511713	DKH	Spiked Blank	Nitrogen ammonia (N-NH3)	2015/09/23		108	%
1511713	DKH	Method Blank	Nitrogen ammonia (N-NH3)	2015/09/23	0.02, RDL=0.02		mg/L
1512316	JL1	QC Standard	Phenols-4AAP	2015/09/24		98	%
1512316	JL1	Spiked Blank	Phenols-4AAP	2015/09/24		99	%

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
	1512316	JL1	Method Blank	Phenols-4AAP	2015/09/24	<0.002		mg/L

RDL = Reportable Detection Limit

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Job #: B555840
Report Date: 2015/09/24

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000596

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anne-Marie Giroux, Analyste I

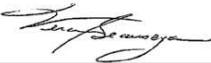
Dochka Koleva Hristova, B.Sc., Chemist

David Provencher, B.Sc., Chemist

Steliana Calestru, B.Sc. Chemist

Veronic Beausejour, B.Sc., Chemist, Supervisor

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your P.O. #: 2200000595
Your C.O.C. #: 122459-10-01

Attention: Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Report Date: 2015/09/23
Report #: R2052950
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B554504

Received: 2015/09/15, 09:00

Sample Matrix: GROUND WATER
Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Primary Reference
		Extracted	Analyzed		
Total Alkalinity (pH end point 4.5)***	1	N/A	2015/09/15	QUE SOP-00142	MA.303-TitrAuto 2.1m
Anions (1)*	1	N/A	2015/09/17	STL SOP-00014	MA300-Ions 1.3 R2 m
Real Color*	1	N/A	2015/09/15	QUE SOP-00115	MA 103-Col 2.0 R2m
Conductivity*	1	N/A	2015/09/15	QUE SOP-00142	MA.303-TitrAuto 2.1m
Dissolved Organic Carbon (1, 2)***	1	2015/09/16	2015/09/17	STL SOP-00243	SM 21 5310-B m
Total Extractable Mercury - Cold Vapour (1)***	1	2015/09/21	2015/09/23	STL SOP-00042	MA200-Hg 1.1 R1 m
Total Extractable Metals by ICP*	1	2015/09/16	2015/09/16	QUE SOP-00132	MA 200-Met 1.2 R5 m
Dissolved Metals by ICP-MS (Low Level)*	1	N/A	2015/09/17	QUE SOP-00132	MA 200-Met 1.2 R5 m
Ammonia Nitrogen (1)*	1	N/A	2015/09/21	STL SOP-00040	MA300-N 2.0 R2 m
Nitrate and/or Nitrite (1)*	1	N/A	2015/09/17	STL SOP-00014	MA300-Ions 1.3 R2 m
Dissolved Oxygen***	1	N/A	2015/09/15	SM 421 F	MA315-DBO 1.1 R3 m
pH*	1	N/A	2015/09/15	QUE SOP-00142	MA.303-TitrAuto 2.1m
Total Phenols by 4-AAP (1)*	1	2015/09/17	2015/09/17	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Ortho Phosphate*	1	N/A	2015/09/16	QUE SOP-00121	MA.303 - P 1.1
Sulfides (S2-)*	1	2015/09/16	2015/09/16	QUE SOP-00107	SM 21 4500-S2- D m
Reactive Silica (SiO2)***	1	N/A	2015/09/18	QUE SOP-00132	HACH DR/890-8186m
Total Dissolved Solids*	1	2015/09/15	2015/09/16	QUE SOP-00119	MA115-S.D. 1.0 R4 m
Turbidity*	1	N/A	2015/09/15	QUE SOP-00118	MA 103-TUR. 1.0 R4m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) This test was performed by Maxxam -Ville St. Laurent
- (2) DOC present in the sample should be considered as non-purgeable DOC

* Maxxam is accredited as per the MDDELCC program.
*** This analysis is not subject to MDDELCC accreditation.

Your P.O. #: 2200000595
Your C.O.C. #: 122459-10-01

Attention:Loic Didillon

TATA STEEL MINERALS CANADA
1000, RUE SHERBROOKE OUEST
BUREAU 1120
MONTRÉAL, QC
CANADA H3A 3G4

Report Date: 2015/09/23
Report #: R2052950
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B554504
Received: 2015/09/15, 09:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Mathieu Letourneau, B. Sc., Chemist,
Email: MLetourneau@maxxam.ca
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=====
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Maxxam Job #: B554504
Report Date: 2015/09/23

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

METALS (GROUND WATER)

Maxxam ID		BJ1016		
Sampling Date		2015/09/14 10:00		
COC Number		122459-10-01		
	Units	HW-RC15-WE08R	RDL	QC Batch
METALS				
Mercury (Hg)	mg/L	<0.00001	0.00001	1510492
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

DISSOLVED METALS (GROUND WATER)

Maxxam ID		BJ1016		
Sampling Date		2015/09/14 10:00		
COC Number		122459-10-01		
	Units	HW-RC15-WE08R	RDL	QC Batch
METALS ICP-MS				
Aluminum (Al)	ug/L	<10	10	1509159
Antimony (Sb)	ug/L	<1.0	1.0	1509159
Silver (Ag)	ug/L	<0.10	0.10	1509159
Arsenic (As)	ug/L	<1.0	1.0	1509159
Barium (Ba)	ug/L	<2.0	2.0	1509159
Beryllium (Be)	ug/L	<0.40	0.40	1509159
Bismuth (Bi)	ug/L	<0.25	0.25	1509159
Boron (B)	ug/L	<20	20	1509159
Cadmium (Cd)	ug/L	<0.20	0.20	1509159
Calcium (Ca)	ug/L	<300	300	1509159
Chromium (Cr)	ug/L	<0.50	0.50	1509159
Cobalt (Co)	ug/L	<0.50	0.50	1509159
Copper (Cu)	ug/L	<0.50	0.50	1509159
Total Hardness (CaCO3)	ug/L	1600	1000	1509159
Tin (Sn)	ug/L	<1.0	1.0	1509159
Iron (Fe)	ug/L	<100	100	1509159
Magnesium (Mg)	ug/L	220	100	1509159
Manganese (Mn)	ug/L	<0.40	0.40	1509159
Molybdenum (Mo)	ug/L	<0.50	0.50	1509159
Nickel (Ni)	ug/L	<1.0	1.0	1509159
Lead (Pb)	ug/L	<0.10	0.10	1509159
Potassium (K)	ug/L	<100	100	1509159
Selenium (Se)	ug/L	<1.0	1.0	1509159
Strontium (Sr)	ug/L	<2.0	2.0	1509159
Sodium (Na)	ug/L	<100	100	1509159
Thallium (Tl)	ug/L	<2.0	2.0	1509159
Uranium (U)	ug/L	<1.0	1.0	1509159
Titanium (Ti)	ug/L	<10	10	1509159
Vanadium (V)	ug/L	<2.0	2.0	1509159
Zinc (Zn)	ug/L	<5.0	5.0	1509159
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

Maxxam Job #: B554504
Report Date: 2015/09/23

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

TOTAL EXTRACTABLE METALS (GROUND WATER)

Maxxam ID		BJ1016		
Sampling Date		2015/09/14 10:00		
COC Number		122459-10-01		
	Units	HW-RC15-WE08R	RDL	QC Batch
METALS				
P205	mg/L	0.0	N/A	1508559
Total phosphorous	mg/L	<0.01	0.01	1508559
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				

Maxxam Job #: B554504
Report Date: 2015/09/23

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

CONVENTIONAL PARAMETERS (GROUND WATER)

Maxxam ID		BJ1016	BJ1016		
Sampling Date		2015/09/14 10:00	2015/09/14 10:00		
COC Number		122459-10-01	122459-10-01		
	Units	HW-RC15-WE08R	HW-RC15-WE08R Lab-Dup	RDL	QC Batch

CONVENTIONALS					
Conductivity	mS/cm	0.041	N/A	0.001	1508217
Dissolved organic carbon	mg/L	0.3	N/A	0.2	1508931
Dissolved oxygen	mg/L	11	N/A	1.0	1507915
Nitrates (N-NO3-)	mg/L	0.09	N/A	0.02	1508924
Nitrites (N-NO2-)	mg/L	<0.02	N/A	0.02	1508924
Nitrogen ammonia (N-NH3)	mg/L	<0.02	N/A	0.02	1509845
Orthophosphate (P)	mg/L	<0.01	N/A	0.01	1508593
pH	pH	7.38	N/A	N/A	1508220
Phenols-4AAP	mg/L	<0.002	N/A	0.002	1509171
Reactive silica (SiO2)	mg/L	6.7	N/A	0.1	1509782
Real Color	UCV	<2	N/A	2	1507956
Sulfides (S2-)	mg/L	<0.02	N/A	0.02	1508535
Turbidity	NTU	0.2	N/A	0.1	1507955
Alkalinity Total (as CaCO3) pH 4.5	mg/L	17	17	1	1508212
Bicarbonates (HCO3 as CaCO3)	mg/L	17	17	1	1508212
Carbonate (CO3 as CaCO3)	mg/L	<1	<1	1	1508212
Chloride (Cl)	mg/L	0.14	N/A	0.05	1508925
Nitrate (N) and Nitrite(N)	mg/L	0.09	N/A	0.02	1508925
Sulfates (SO4)	mg/L	0.8	N/A	0.5	1508925
Total Dissolved Solids	mg/L	28	N/A	10	1507845

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Job #: B554504
Report Date: 2015/09/23

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD

METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

DISSOLVED METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Sample BJ1016 was filtered in the laboratory prior to analyzing for metals.

TOTAL EXTRACTABLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

Maxxam Job #: B554504
Report Date: 2015/09/23

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
1507845	AG5	Spiked Blank	Total Dissolved Solids	2015/09/16		97	%
1507845	AG5	Method Blank	Total Dissolved Solids	2015/09/16	<10		mg/L
1507955	CA3	Spiked Blank	Turbidity	2015/09/15		92	%
1507955	CA3	Method Blank	Turbidity	2015/09/15	<0.1		NTU
1507956	CA3	Spiked Blank	Real Color	2015/09/15		98	%
1507956	CA3	Method Blank	Real Color	2015/09/15	<2		UCV
1508212	CB8	Spiked Blank	Alkalinity Total (as CaCO3) pH 4.5	2015/09/15		88	%
1508212	CB8	Method Blank	Alkalinity Total (as CaCO3) pH 4.5	2015/09/15	<1		mg/L
1508217	CB8	QC Standard	Conductivity	2015/09/15		102	%
1508217	CB8	Method Blank	Conductivity	2015/09/15	<0.001		mS/cm
1508220	CB8	QC Standard	pH	2015/09/15		100	%
1508535	DP3	QC Standard	Sulfides (S2-)	2015/09/16		100	%
1508535	DP3	Method Blank	Sulfides (S2-)	2015/09/16	<0.02		mg/L
1508559	NS	QC Standard	Total phosphorous	2015/09/16		102	%
1508559	NS	Spiked Blank	Total phosphorous	2015/09/16		100	%
1508559	NS	Method Blank	P2O5	2015/09/16	0.0		mg/L
			Total phosphorous	2015/09/16	<0.01		mg/L
1508593	DP3	QC Standard	Orthophosphate (P)	2015/09/16		104	%
1508593	DP3	Method Blank	Orthophosphate (P)	2015/09/16	<0.01		mg/L
1508924	JEM	Spiked Blank	Nitrates (N-NO3-)	2015/09/17		106	%
			Nitrites (N-NO2-)	2015/09/17		105	%
1508924	JEM	Method Blank	Nitrates (N-NO3-)	2015/09/17	<0.02		mg/L
			Nitrites (N-NO2-)	2015/09/17	<0.02		mg/L
1508925	JEM	Spiked Blank	Chloride (Cl)	2015/09/17		104	%
			Nitrate (N) and Nitrite(N)	2015/09/17		106	%
			Sulfates (SO4)	2015/09/17		103	%
1508925	JEM	Method Blank	Chloride (Cl)	2015/09/17	<0.05		mg/L
			Nitrate (N) and Nitrite(N)	2015/09/17	<0.02		mg/L
			Sulfates (SO4)	2015/09/17	<0.5		mg/L
1508931	JL1	QC Standard	Dissolved organic carbon	2015/09/17		98	%
1508931	JL1	Spiked Blank	Dissolved organic carbon	2015/09/17		98	%
1508931	JL1	Method Blank	Dissolved organic carbon	2015/09/17	0.4, RDL=0.2		mg/L
1509159	NS	Spiked Blank	Aluminum (Al)	2015/09/17		110	%
			Antimony (Sb)	2015/09/17		101	%
			Silver (Ag)	2015/09/17		94	%
			Arsenic (As)	2015/09/17		103	%
			Barium (Ba)	2015/09/17		102	%
			Beryllium (Be)	2015/09/17		92	%
			Bismuth (Bi)	2015/09/17		104	%
			Boron (B)	2015/09/17		88	%
			Cadmium (Cd)	2015/09/17		102	%
			Calcium (Ca)	2015/09/17		96	%
			Chromium (Cr)	2015/09/17		105	%
			Cobalt (Co)	2015/09/17		102	%
			Copper (Cu)	2015/09/17		104	%
			Tin (Sn)	2015/09/17		99	%
			Iron (Fe)	2015/09/17		107	%
			Magnesium (Mg)	2015/09/17		110	%
			Manganese (Mn)	2015/09/17		106	%
			Molybdenum (Mo)	2015/09/17		101	%
			Nickel (Ni)	2015/09/17		105	%
			Lead (Pb)	2015/09/17		101	%

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Potassium (K)	2015/09/17		107	%
			Selenium (Se)	2015/09/17		100	%
			Strontium (Sr)	2015/09/17		101	%
			Sodium (Na)	2015/09/17		108	%
			Thallium (Tl)	2015/09/17		106	%
			Uranium (U)	2015/09/17		106	%
			Titanium (Ti)	2015/09/17		102	%
			Vanadium (V)	2015/09/17		102	%
			Zinc (Zn)	2015/09/17		111	%
1509159	NS	Method Blank	Aluminum (Al)	2015/09/17	<10		ug/L
			Antimony (Sb)	2015/09/17	<1.0		ug/L
			Silver (Ag)	2015/09/17	<0.090		ug/L
			Arsenic (As)	2015/09/17	<1.0		ug/L
			Barium (Ba)	2015/09/17	<2.0		ug/L
			Beryllium (Be)	2015/09/17	<0.40		ug/L
			Bismuth (Bi)	2015/09/17	<0.25		ug/L
			Boron (B)	2015/09/17	<20		ug/L
			Cadmium (Cd)	2015/09/17	<0.017		ug/L
			Calcium (Ca)	2015/09/17	<300		ug/L
			Chromium (Cr)	2015/09/17	<0.50		ug/L
			Cobalt (Co)	2015/09/17	<0.50		ug/L
			Copper (Cu)	2015/09/17	<0.50		ug/L
			Total Hardness (CaCO3)	2015/09/17	<1000		ug/L
			Tin (Sn)	2015/09/17	<1.0		ug/L
			Iron (Fe)	2015/09/17	<100		ug/L
			Magnesium (Mg)	2015/09/17	<100		ug/L
			Manganese (Mn)	2015/09/17	<0.40		ug/L
			Molybdenum (Mo)	2015/09/17	<0.50		ug/L
			Nickel (Ni)	2015/09/17	<1.0		ug/L
			Lead (Pb)	2015/09/17	<0.10		ug/L
			Potassium (K)	2015/09/17	<100		ug/L
			Selenium (Se)	2015/09/17	<1.0		ug/L
			Strontium (Sr)	2015/09/17	<2.0		ug/L
			Sodium (Na)	2015/09/17	<100		ug/L
			Thallium (Tl)	2015/09/17	<0.80		ug/L
			Uranium (U)	2015/09/17	<1.0		ug/L
			Titanium (Ti)	2015/09/17	<10		ug/L
			Vanadium (V)	2015/09/17	<2.0		ug/L
			Zinc (Zn)	2015/09/17	<5.0		ug/L
1509171	MH1	QC Standard	Phenols-4AAP	2015/09/17		104	%
1509171	MH1	Spiked Blank	Phenols-4AAP	2015/09/17		102	%
1509171	MH1	Method Blank	Phenols-4AAP	2015/09/17	<0.002		mg/L
1509782	DP3	QC Standard	Reactive silica (SiO2)	2015/09/18		93	%
1509782	DP3	Method Blank	Reactive silica (SiO2)	2015/09/18	<0.1		mg/L
1509845	MR4	Spiked Blank	Nitrogen ammonia (N-NH3)	2015/09/21		105	%
1509845	MR4	Method Blank	Nitrogen ammonia (N-NH3)	2015/09/21	<0.02		mg/L
1510492	SDA	Spiked Blank	Mercury (Hg)	2015/09/23		103	%

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TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
	1510492	SDA	Method Blank	Mercury (Hg)	2015/09/23	<0.00001		mg/L
<p>RDL = Reportable Detection Limit</p> <p>QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p>								

Maxxam Job #: B554504
Report Date: 2015/09/23

TATA STEEL MINERALS CANADA
Your P.O. #: 2200000595

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

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David Provencher, B.Sc., Chemist

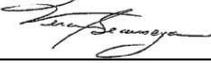
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Veronic Beausejour, B.Sc., Chemist, Supervisor

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APPENDIX V
Numerical Modelling Report of SNC-Lavalin



SNC • LAVALIN

PRELIMINARY REPORT

**Hydrogeology Numerical Modeling for the Howse
Deposit - Update**

Howse Property Project

Howse Minerals Limited

Geofor Environnement



SNC-LAVALIN INC.

November 2015
REPORT PRE00
Project n°623418

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Appendix A: Figures

Appendix B: Sensitivity Analysis

TEAM WORK

SNC-Lavalin Inc.

The modeling was conducted by Emmanuelle Millet, M.Sc. with the collaboration of Géraldine Cosset ing., M.Sc.A.

Data analysis and interpretation, conceptual model and report were achieved by Abdel Mounem Benlahcen geo, PhD.

Data, model and report were verified by Christian Bélanger, ing., M.Sc.A.

1 INTRODUCTION

In autumn of 2014, SNC-Lavalin conducted a hydrogeology numerical modeling for the Howse deposit dewatering. This first study was based on hydrogeological studies conducted by Golder (2014) and Geofor (2014). A complementary hydrogeological program was conducted in the fall of 2015 by Geofor in order to collect additional geological and hydrogeological data and, ultimately, refine the numerical model. The following sections present an overview of the data collected and the numerical model update for the Howse pit dewatering.

2 SUMMARY OF THE SITE HYDROGEOLOGY

2.1 REGIONAL SETTING AND SITE CONTEXT

The Howse deposit is located in Newfoundland and Labrador along the Labrador Trough, about 25 km to the northwest of Schefferville, Quebec, between Irony Mountain, Pinette Lake and the existing Tata Steel Minerals Canada Ltd. (TSMC) Timmins 4 mine. As other DSO deposits in the region, the Howse deposit is located on a ridge side, in this particular case on the Irony Mountain east ridge (Figure 2-1).

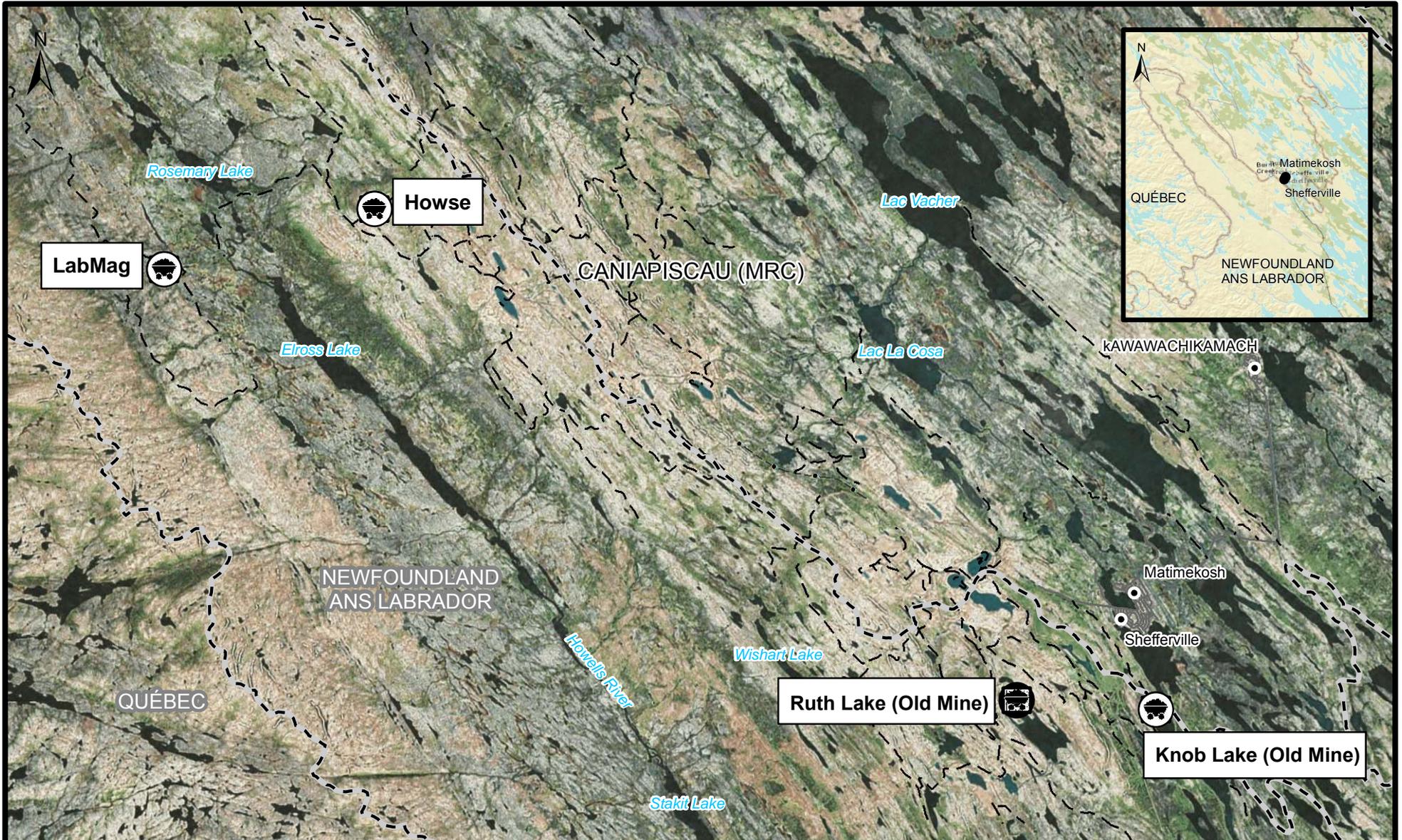
Drake (1983) describes the hydrogeological conditions prevailing in the iron formations, in the Schefferville area, where existing mines are located along the ridge sides and penetrate the permafrost zone when present. Permafrost is absent in the area of the Howse Deposit (Journeaux Assoc, 2015), but it is present sporadically in nearby valleys, such as in the vicinity of Flemings and Timmins 3N.

The piezometric surface beneath the ridges generally lies within 30 m of the surface and apparently follows the topography (Stubbins and Munro 1965). Ridges are associated with recharge zones, although on the sides of some ridges, small springs may be found at the base of the Sokoman formation. Valleys are occupied by lakes and swamps, and the groundwater level is near the surface in the valley bottom, which is considered as a groundwater discharge area. Water budgets of several lakes have shown that a considerable volume of groundwater discharges into them, especially where the water table is at the surface in the lower-lying areas (Drake 1983).

Large thrust faults that lie along the ridge sides are zones of locally higher permeability, which was in favor of local alteration within the Sokoman formation and ore deposit. The mines are consequently located on the ridges flanks close to the crest (Drake, 1983).

The lineaments are oriented in a northwest-southeast direction over the entire region and the iron formation structural is oriented in the same direction.

The regional groundwater flows mainly from southeast to northwest, and is controlled by the configuration of the regional hydrogeological setting, including natural boundaries. The region is underlain by synclinal layers affected by some geological structures. This configuration will influence greatly the groundwater flow.



Notes:

- 1- This drawing is to be read in conjunction with the accompanying report.
- 2- Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
- Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PROJECT

Hydrogeology Modeling - Howse project

TITLE

Figure 2-1
Aerial Photography
of the Project Region

DRAWN

E. Cazeneuve

VERIFIED

A. M. Benlahcen

DATE

3 nov. 2015

SCALE

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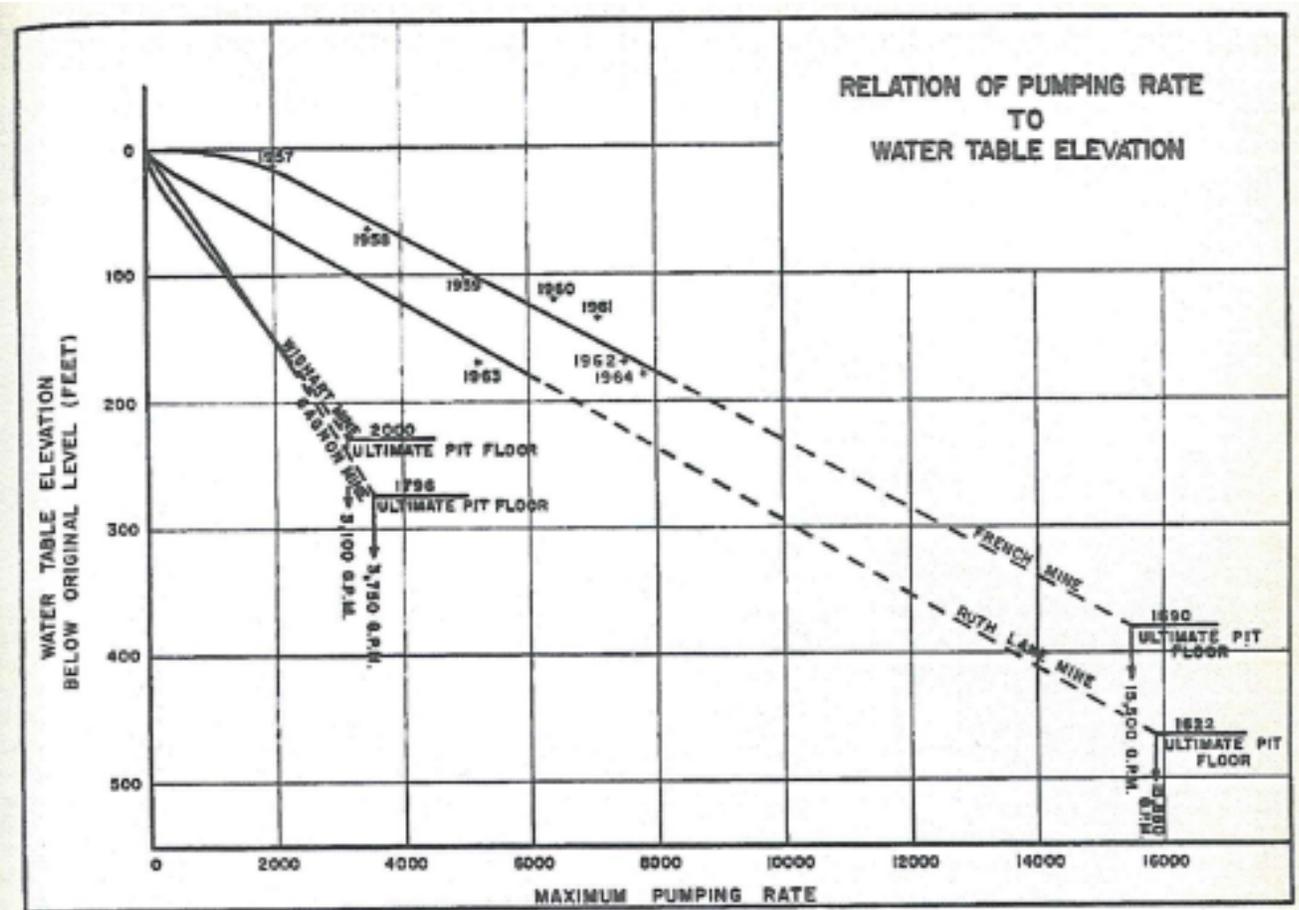
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Stubbins and Munro (1965) provided an overview of the historical mine dewatering in the area of Knob Lake, located 25 km south-east of the Howse deposit. The studied mines included Wishart, Gagnon, French and Ruth mines, where the dewatering was very much depth correlated and increased with the mine pit floor depth (Figure 2-2). Table 2-1 summarizes these results. The range of the dewatering rates varied from 16,874 to 86,547 m³/d for those old mines. Obviously, this wide range of dewatering rates is due to several factors for which data are unavailable, such as pit dimensions, hydraulic conductivities of the geological units, fault zones, proximity to the water bodies, permafrost presence, and mining and dewatering operations.

Table 2-1 Dewatering history for DSO mines

Type of Data	Mine Site	Floor Depth (m)	Dewatering (m ³ /d)	Data References
Historical data of DSO mines	Wishart	69	16,874	Stubbins, J. B. and P. Munro. 1965. Historical information on mine dewatering of DSO (Knob Lake). The Canadian Institute of Mining and Metallurgy Bulletin, 58:814-822.
	Gagnon	83	20,412	
	French	116	84,370	
	Ruth	144	86,547	

Figure 2-2 Relation of Pumping Rate to Water Table Elevation in Some Mines at Knob Lake Adapted from Stubbins and Munro (1965)



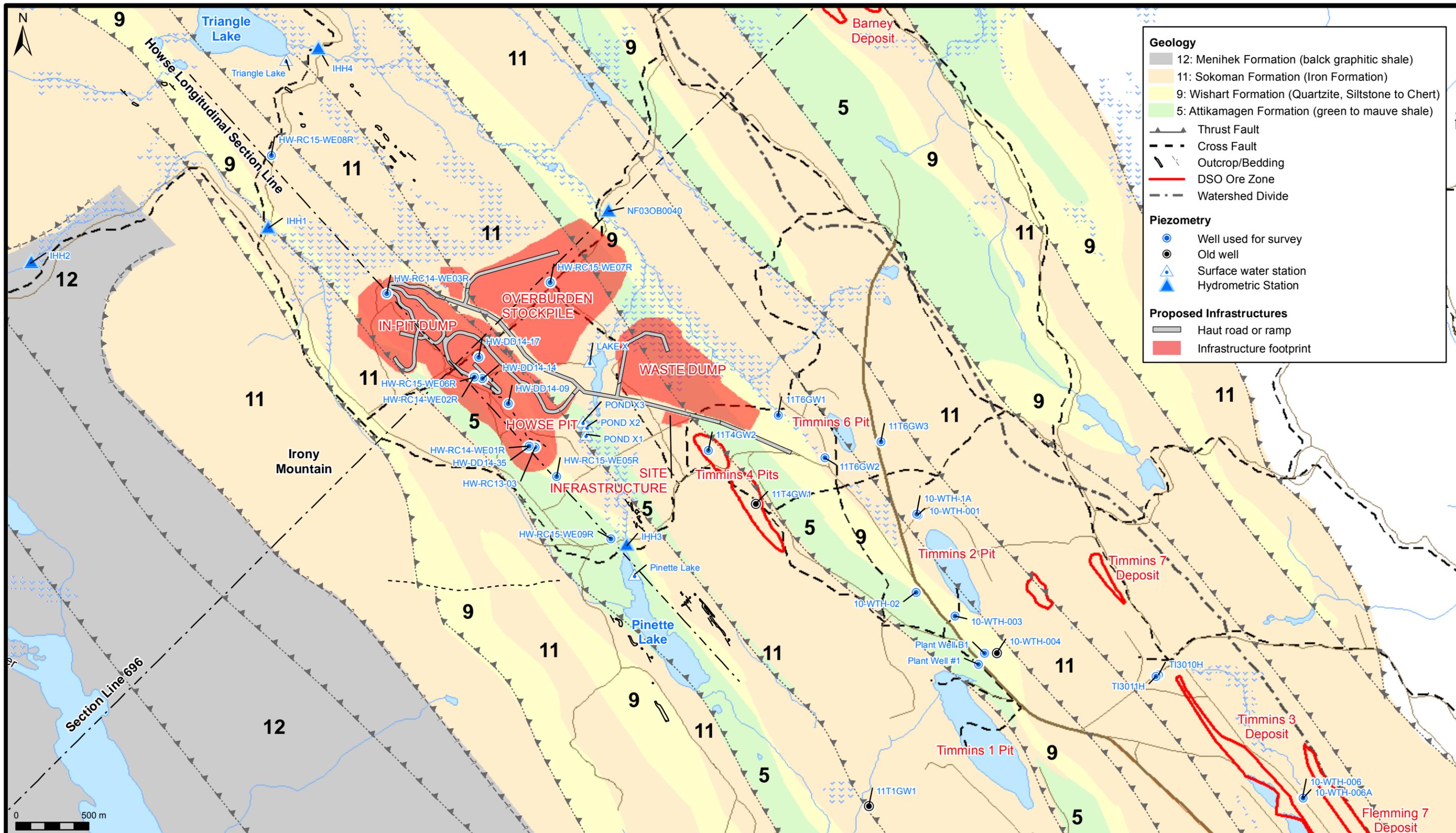
2.2 LOCAL GEOLOGY AND HYDROGEOLOGY

2.2.1 Hydrostratigraphic units

The project site is located in the Labrador geosynclinals which consist of geological formations that were compressed into a series of synclines and anticlines, cut by steep angle reverse faults that dip primarily to the east. The main geological formations encountered in the area of Howse deposit and their thickness ranges (source: Tata Steel's geologist) are:

- › Overburden: uniform cover of till overlying variable thickness of sand and gravel, and ranges over the Howse deposit from 20 to 50 m of thickness.
- › The Sokoman Formation (Cherty iron formation): the thickness ranges from 110 to 120 m: The Sokoman is subdivided in three units: the Lower Iron Formation (LIF), predominantly a carbonate-silicate facies iron formation, the Middle Iron Formation (MIF) which is the main Ore zone, and the Upper Iron Formation (UIF);
- › The Wishart Formation (Quartzite, Siltstone to Chert): estimate thickness from 15 to 20 m;
- › Attikamagen Formation (Shale): stated in all the literature as over 300 m thickness;
- › Archaean basement (granodiorite gneiss), not encountered in the boreholes.

The surface geology map is presented in Figure 2-3 and the two cross-sections (longitudinal and transversal) along the Howse deposit are shown on Figures 2-4 and 2-5.



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					Figure 2-3 Surface Geology of the Howse Deposit Area
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PROJET	Hydrogeology Modeling - Howse project
CLIENT	Geofor Environnement

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Figure 2-4 Longitudinal Cross-section of the geology at Howse deposit site (Source: TATA Steel, 2015)

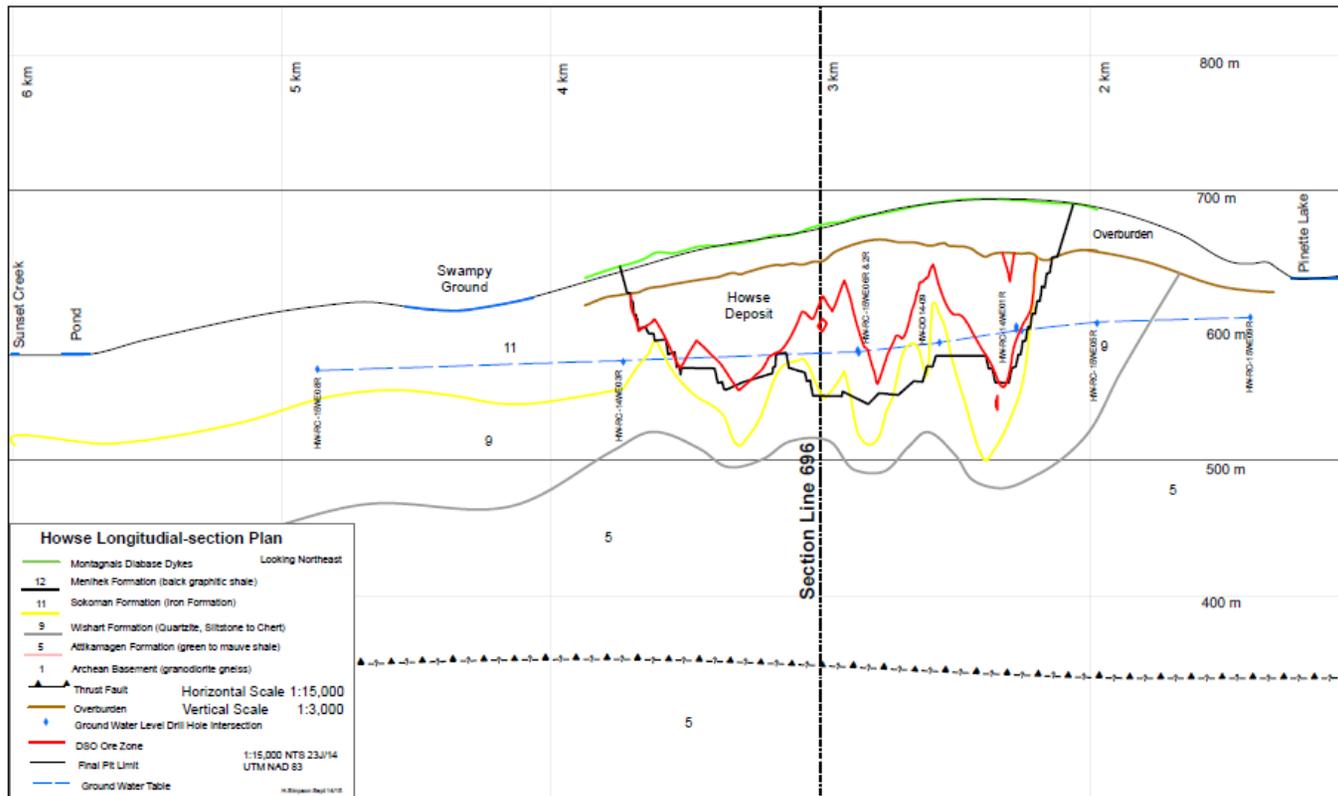
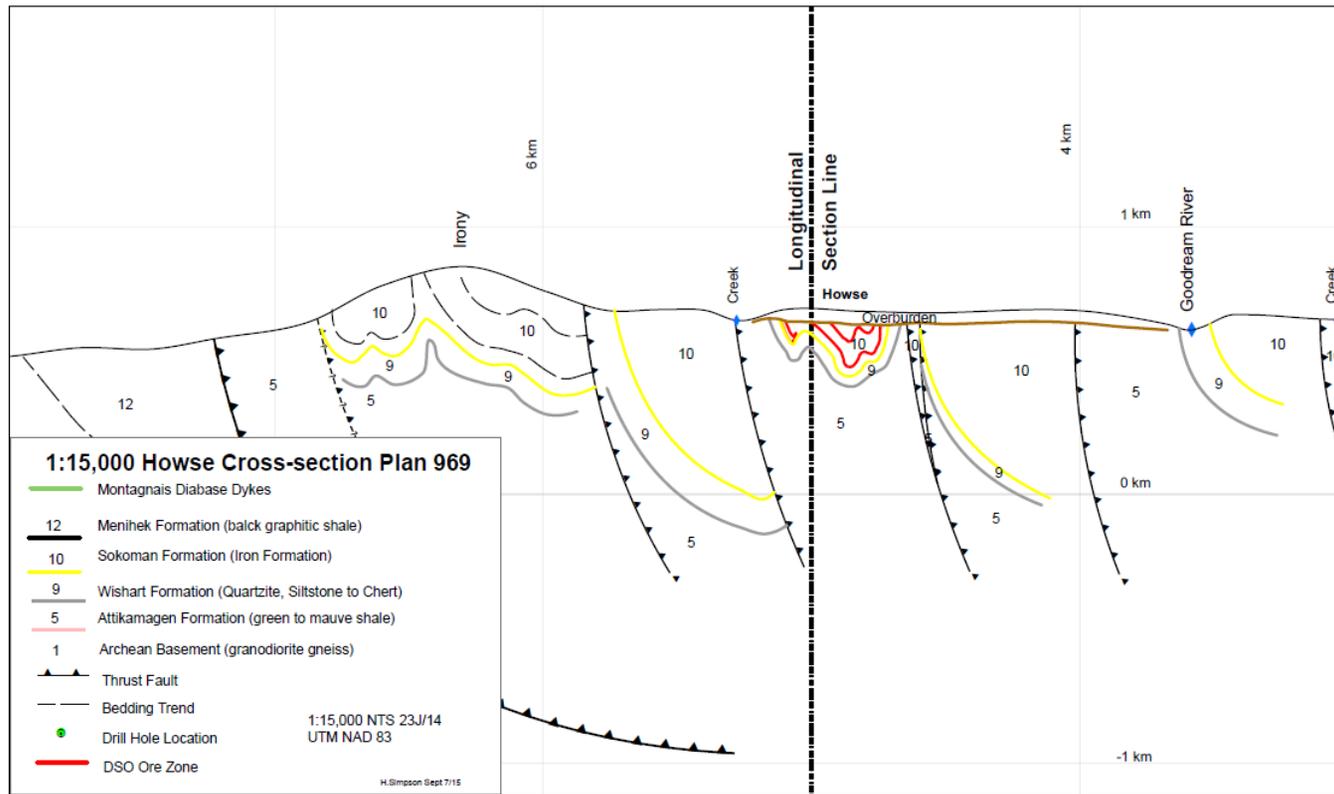


Figure 2-5 Transversal cross-section (Line 696) of the geology at Howse deposit site (Source: TATA Steel, 2015)



2.2.2 Aquifer hydraulic characteristics

Since 2014, many field investigations were conducted in the vicinity of the Howse deposits in order to assess the hydrogeological properties (hydraulic conductivity, storativity). The hydrogeologic testing includes mainly packer tests (Golder, 2014) and pumping tests (Geofor, 2014 and Geofor, 2015). The detailed methodology, data compilation and interpretation as well as results for all geological boreholes and hydrogeological tests are presented in previous enumerated reports.

Golder (2014) conducted packer tests in two boreholes located within the perimeter of the proposed pit. The permeability testing was conducted at varying depth intervals from 6 to 26 m, either in falling head mode or in constant head mode (Golder, 2014). The hydraulic conductivity results for each borehole were interpreted by SNC-Lavalin using the boreholes' logs in order to attribute the permeability values obtained to the corresponding units tested. These results are summarized in Table 2-2.

Geofor (2014) conducted a 72-hour constant flow pumping test in two boreholes (HW-RC14-WE01R and HW-RC14-WE03R), located at each end of the proposed open pit, and their results were interpreted by Geofor and summarized in Table 2-2.

Geofor (2015) conducted new pumping tests on three new boreholes, one within the perimeter of the proposed open pit (HW-RC15-WEO6R) and two located around this perimeter (HW-RC15-WEO7R and HW-RC15-WEO8R). The results interpreted by SNC-Lavalin are presented in Appendix A, and summarized in Table 2-2.

Generally, the recent results of hydraulic conductivity testing showed that the hydraulic conductivity of the Sokoman Formation which is the main formation in the area was relatively higher, and ranging from 1.6×10^{-6} m/s to 1.9×10^{-5} m/s with an average of 9.4×10^{-6} m/s. The shale of Attikamagen had the lowest permeability values with an average of 5×10^{-8} m/s while the Wishart and fault zone recorded an intermediate conductivity value with an average of 1×10^{-7} m/s. The low permeability of the fault zones (in borehole HW-GT13-001) may be due to the nature of the fault coating materials that were reported less permeable in borehole logs. However, this is not a general trend in others boreholes, such as in borehole HW-RC-14-WE03R, where a fault was reported within the Sokoman and the permeability estimate was the highest within the Howse deposit.

Aquifer and Well Productivity

The step-drawdown tests conducted by Geofor in 2015 at the three pumping wells (HW-RC15-WEO6R, HW-RC15-WEO7R and HW-RC15-WEO8R) showed a slight decrease in specific capacity of the wells with flow rate increase. The results are presented in Appendix A.

The well HW-RC15-WEO6R located within the proposed open pit was pumped to a maximum of 1.1 m³/min (291 gpm) resulting in a 12.4 m final drawdown, and a specific capacity decreasing from 0.2 to 0.1 m³/min per meter.

The wells HW-RC15-WEO7R and HW-RC15-WEO8R located outside the proposed open pit were pumped to a maximum of 0.26 m³/min (75-85 gpm) resulting in a 13.6 m final drawdown, and a slight specific capacity decrease from 0.04 to 0.02 m³/min per meter.

Table 2-2 Summary of Hydraulic Conductivities Obtained from Various Tests

Reference	Test	Well Tested	K (m/s)	K average (m/s)	Geologic Formation
Golder, 2014	Packer test	HW-GT13-002	2E-07 - 6E-07	4.00E-07	Wishart
			4E-08 - 6E-08	5.00E-08	Attikamagen Shale
		HW-GT13-001	4E-08 - 5E-08		1.3E-07
			1E-07	Chert/Shale/fault zone	
			2E-07	Shale/fault zone	
Geofor, 2014	Pumping test	HW-RC14-WE01*	2.13E-06	9.40E-06	Sokoman (faulted Iron ore) /Wishart)
		HW-RC14-WE03*	3.34E-05		
Geofor, 2015	Pumping test	HW-RC15-WEO6R*	1.1E-05 - 2.4E-05	9.40E-06	Sokoman
		HW-RC14-WEO2R**	1.2E-05 - 1.9E-05		
		HW-RC15-WEO7R*	1.6E-06 - 1.1E-05		
		HW-RC15-WEO8R*	1.10E-05		

*Pumping well; ** Observation well

2.2.3 Groundwater Flow and Elevation

A regional piezometric map was built based on recent data (fall 2015) collected in the project area and data from previous studies on other mine sites nearby (2010 to 2014). Although the last data are not very recent, they nevertheless confirm the regional groundwater flow direction prevailing in the area on a large scale. The piezometric results are presented in Table 2-3 and Figure 2-6. The general groundwater elevation is higher in ridge sides to the southeastern area, in Timmins 3N and Fleming 7N areas (between 672 m in 10WTH-007 and 687 m in 10WTH-006), and decreases gradually to the northwestern area, reaching lower values in the Howse deposit area, between 607 m and 569 m. The regional groundwater seems to flow in the longitudinal structures oriented parallel to the valley and recharged by the local groundwater flow. Abandoned mine pits may also be contributing to the groundwater recharge.



Table 2-3 Piezometric Results

Hole id	Northing	Easting	Well depth	Water depth (TOC)	Water elevation	Date
	(m) zone 19		(m)	(m)	(masl)	
New wells of 2015 in the Howse deposit area						
HW-RC15-WE05R	6085454	619903	181.4	76.4	602.7	28/08/2015
HW-RC15-WE06R	6086132	619339	168.2	90.5	581.8	02/09/2015
HW-RC15-WE09R	6085028	620275	97.6	39.4	607.1	08/09/2015
HW-RC15-WE08R	6087650	617942	73.2	44.5	568.5	10/09/2015
HW-RC15-WE07R	6086780	619859	97.6	58.4	597.8	11/09/2015
Existing wells in the Howse deposit						
HW-DD14-09	6085950	619571	150.0	95.1	586.5	20/08/2014
HW-DD14-14	6086123	619393	102.0	89.5	584.7	27/08/2014
HW-DD14-17	6086270	619367	101.0	84.8	580.9	27/08/2014
HW-DD14-35	6085652	619706	94.5	86.4	598.3	09/10/2014
HW-RC13-03	6085655	619755	180.0	87.4	596.1	07/12/2013
HW-RC14-WE01R	6085660	619715	164.0	88.8	595.4	13/09/2014
HW-RC14-WE02R	6086138	619338	182.0	90.1	581.0	24/09/2014
HW-RC14-WE03R	6086703	618737	180.0	67.3	572.8	19/10/2014
Surface water in the Howse deposit area						
LAKE X	6086239	620132	-	-	658.6	Oct-14
POND X1	6085741	620106	-	-	661.8	Oct-14
POND X2	6085797	620114	-	-	662.0	Oct-14
POND X3	6085827	620085	-	-	662.5	Oct-14
Pinette Lake	6084782	620439	-	-	635.7	Oct-14
Triangle Lake	6088305	618045	-	-	584.2	Oct-14
Boreholes at the neighbouring sites						
11T6GW1 (Timmins 6)	6085872	621425	92.4	42.7	622.4	10/09/2011
11T6GW2 (Timmins 6)	6085581	621746	103.7	48.8	635.8	Oct-15
11T6GW3 (Timmins 6)	6085690	622131	103.7	61.3	642.8	Oct-15
11T4GW2 (Timmins 4)	6085630	620945	97.6	61.1	616.8	11-Oct-11
Plant Well #1	6084167	622800	103.7	27.9	652.6	14-Oct-11
Plant Well B1	6084242	622843	97.6	18.4	663.4	30-Oct-11
10-WTH-02 (Timmins 2)	6084662	622372	140.2	33.3	659.7	5-Oct-10
10-WTH-1A (Timmins 2)	6085195	622376	79.3	51.1	648.2	29-Oct-10

Hydrogeology numerical modeling for the Howse property project

November 5th, 2015

623418

Geofor Environnement

Preliminary Report / V00



Hole id	Northing	Easting	Well depth	Water depth (TOC)	Water elevation	Date
	(m) zone 19		(m)	(m)	(masl)	
10-WTH-001 (Timmins 2)	6085191	622387	73.2	53.8	645.3	Oct-15
10-WTH-003 (Timmins 2)	6084499	622639	94.5	32.7	650.1	07/10/2010
10-WTH-004 (Timmins 2)	6084244	622926	61.0	20.9	653.5	26/10/2010
TI3010H (Timmins 3)	6084096	624039	74.0	19.3	674.8	27/10/2009
TI3011H (Timmins 3)	6084085	624021	110.0	16.7	677.8	31/10/2009
10-WTH-006 (Fleming 7)	6083256	625028	134.1	52.9	686.3	05/11/2010
10-WTH-006A (Fleming 7)	6083251	625032	140.2	54.8	684.5	12/11/2010

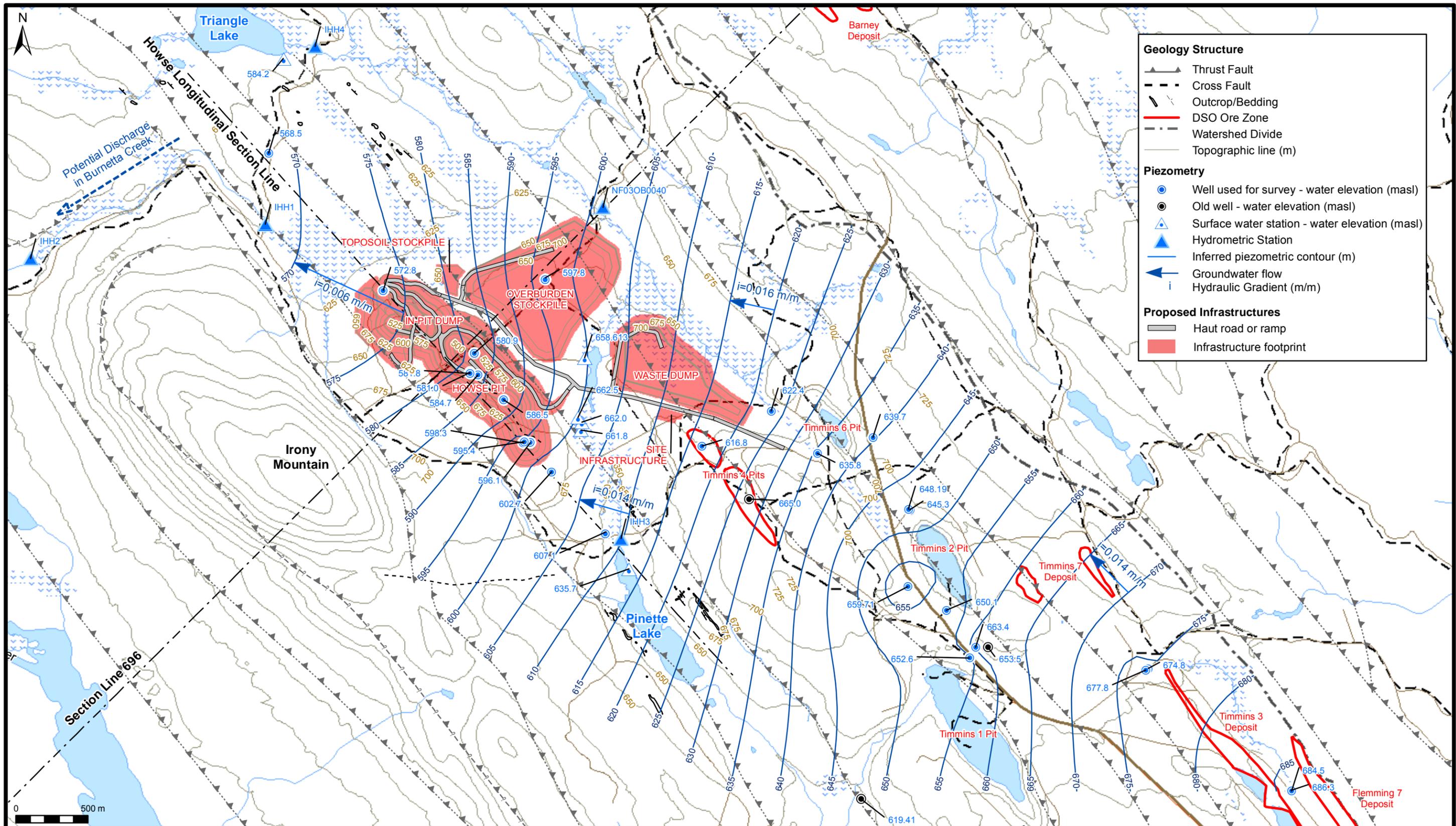
TOC: Top of casing

masl: meter above sea level

Source of 2015 piezometric data : Geofor, November 2015

Source of 2014 piezometric data : Geofor, January 2014

Source of 2010-2011 piezometric data : Groupe Hémisphères and Geofor Environnement, 2011



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					Figure 2-6 Piezometric Map of the Howse Deposit Area
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PROJET	Hydrogeology Modeling - Howse project
CLIENT	Geofor Environnement

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At the Howse deposit, the groundwater depth varied approximately from 39 m to 95 m below the ground surface. The local groundwater circulates in the fracture zones developed in some of the iron formations along the bedding plains and faults.

Groundwater flows are influenced by the topography with a horizontal hydraulic gradient of 0.006 m/m in the area of the Howse deposit, and varies regionally between 0.01 and 0.02 m/m upgradient, to the south-east of the project area;

Field observations by Geofor and Tata Steel's geologist pointed out the existence of a fault perpendicular to the main geological structures, along Burnetta Creek, through which the groundwater may be discharging and feeding the creek and Burnetta Lake downgradient. This condition may contribute to lowering the groundwater level at the Howse deposit.

Groundwater Monitoring

Two continuous and three discontinuous water level monitoring in boreholes were conducted within the perimeter of the future pit from July to September 2015. One of the monitored boreholes (HW-RC14-WE03R) is located downgradient at the northern extremity of the pit and the other boreholes are located upgradient at its southern extremity (HW-DD14-09, HW-RC14-WE01R, HW-DD14-35 and HW-RC13-03). The results for boreholes located at the southern extremity of the pit indicated a gradual decrease of groundwater level with time, reaching of magnitude of 2.3 m. At borehole HW-RC14-WE03R located downgradient, groundwater level increased by about 1.7 m. This water level increase is probably due to a direct response to local precipitation or surface runoff over an unconfined or semiconfined aquifer at this part of the Howse deposit. Recent findings on permafrost conditions at the Howse deposit area (Journeaux Assoc, 2015) confirmed that the permanent permafrost does not exist in the area, which favour local aquifer recharge. Table 2-4 summarizes the groundwater monitoring results in the five boreholes within the Howse. Figure 2-7 presents the groundwater level evolution in these boreholes during the monitoring.

Pinette Lake and Triangle Lake

Pinette Lake and Triangle Lake are both located within the footprint of the project area. The Pinette Lake is located 820 m upgradient from the future pit. It has a maximum depth of 4.5 m and a substrate dominated by silt and a few blocks (Groupe Hémisphère, 2014). Pinette Lake's bottom elevation (631 m approximately) is higher than the groundwater elevation at this location (617 m at HW-RC15-WE09R). The hydraulic head difference of about 14 m between Pinette Lake and the groundwater implies that this lake would contribute to groundwater recharge.

Triangle Lake is located 1720 m downgradient from the future pit. It has a maximum depth of 12 m and a substrate dominated by silt and a few blocks (Groupe Hémisphère, 2014). Triangle Lake's bottom elevation is at 572 m approximately. The groundwater elevation measured at nearest well

HW-RC15-WE08R (located 675 m from Triangle Lake), was 567 m. Considering a horizontal hydraulic gradient (i) of 0.005 m/m, groundwater elevation would reach an elevation of 564 m at the lake location (i: 4.1 m of hydraulic head per 675 m, distance from the HW-RC15-WE08R to the lake). Therefore, the hydraulic head difference between Triangle Lake and groundwater would be about 9 m, which implies that this lake would also contribute to groundwater recharge.

Piezometry seasonal fluctuations for longer period of time in boreholes nearby the pit and the lakes would lead to an evaluation of the effective recharge and discharge, and a better understanding of the groundwater/surface water interaction zones in this area.

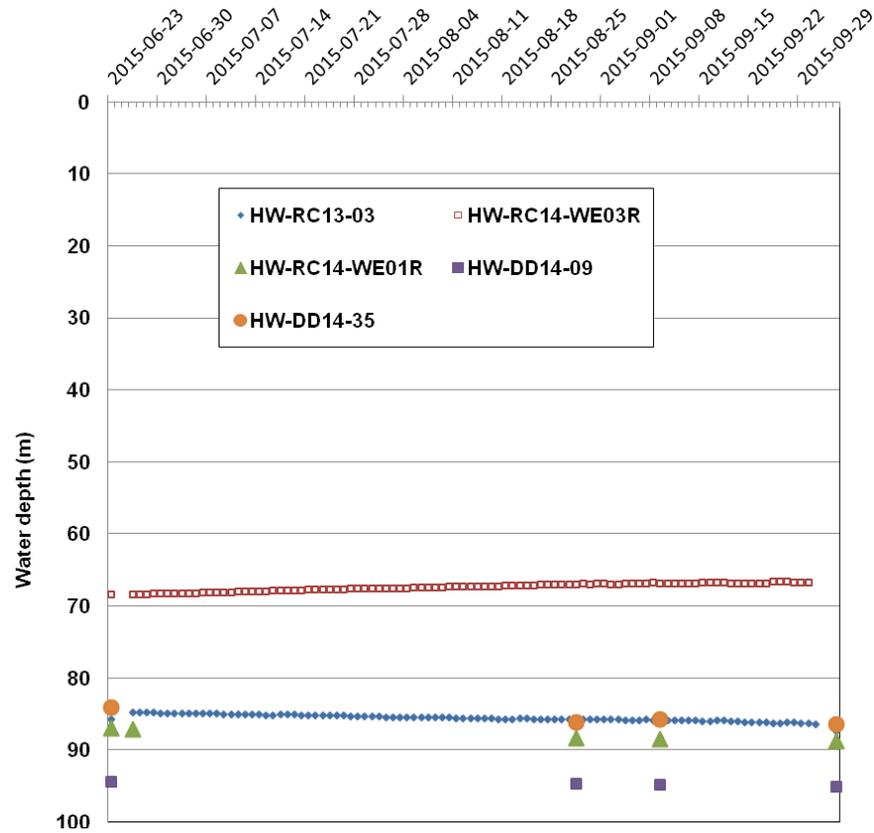
Table 2-4 Summary of Piezometric Monitoring

Borehole ID.	Initial depth (m)	Final depth (m)	Water level variation (m)
	June 23 2015	October 2/4 2015	
HW-RC14-WE03R*	68.40	66.74	+1.66
HW-RC13-03*	85.69	87.37	-1.68
HW-RC14-WE01R**	87.05	88.76	-1.71
HW-DD14-09**	94.40	95.08	-0.68
HW-DD14-35**	84.14	86.41	- 2.27

* Continuous measurements

** Instantaneous measurements

Figure 2-7 Groundwater Level Monitoring in Boreholes



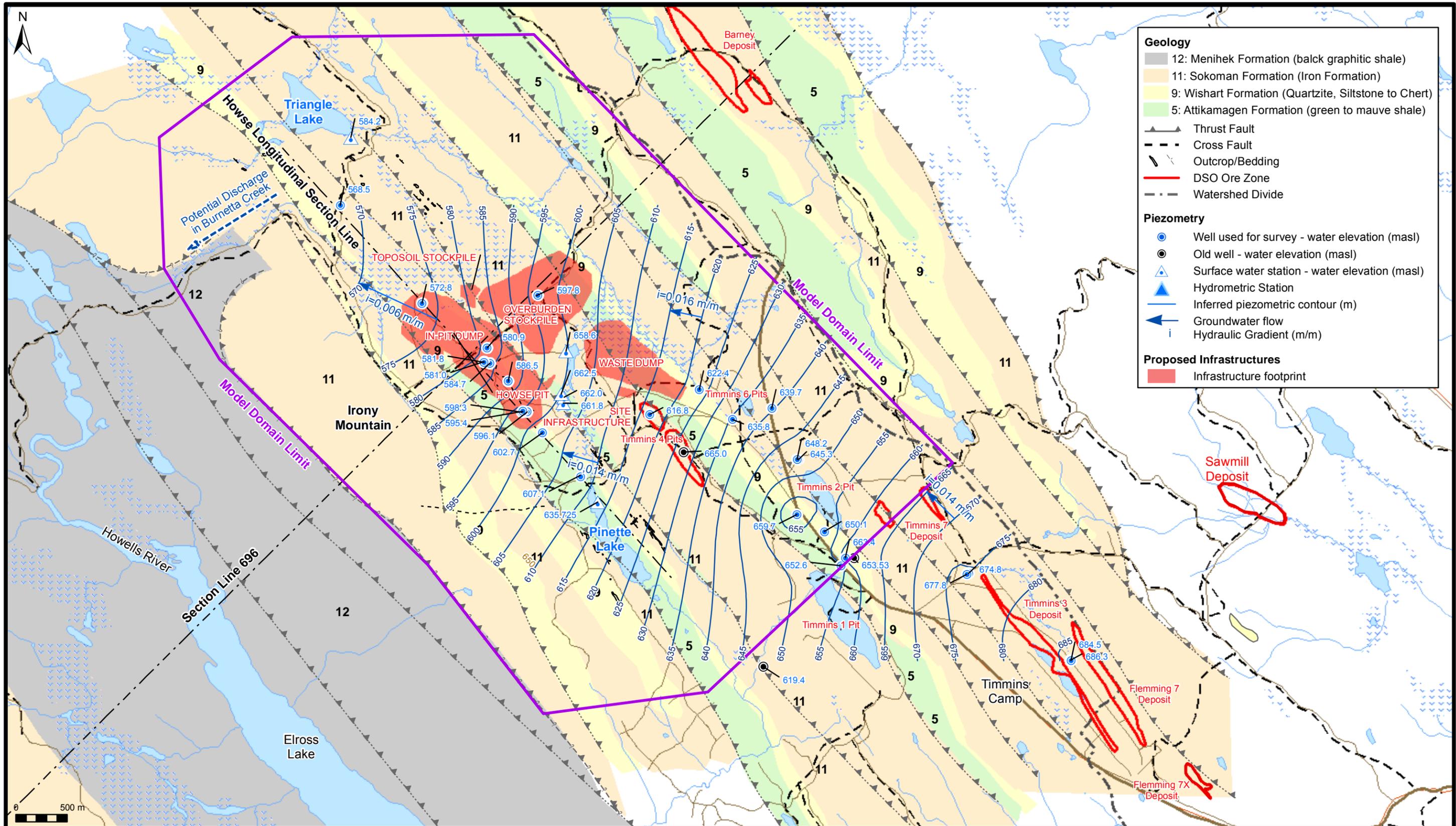
3 GROUNDWATER FLOW NUMERICAL MODEL

3.1 CONCEPTUAL MODEL

In order to estimate the flow rate resulting from the dewatering of the Howse deposit, a conceptual model of the aquifer flowing through the deposit was built and transposed into a numerical model. The model of the natural groundwater flow of the aquifer was calibrated with hydrogeological parameters determined with field data collected at the site. Following the calibration of the natural groundwater flow model, the open pit was introduced into the model to simulate the dewatering of the future mine pit at its final depth.

The purpose of building a conceptual model is to represent the field system with a simple model as close as possible to the field condition so that the numerical model will be more accurate. This conceptual model is based on the data collected on the hydrogeology conditions which are summarized in the following sections.

Figure 3-1 is at a larger scale to show the recharge zones to the southeast of the domain. The conceptual model of the groundwater system is described below.



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Figure 3-1
Model Domain
of the Howse Deposit Area

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3.1.1 Area of the Model

The area of interest was defined to include natural hydrogeological boundaries. The groundwater regional basin or watershed was delimited using some of the surface water watershed limits. These limits are considered as groundwater divides and are:

- › ridges along the provincial border to northeast;
- › ridge of Irony Mountain to the southwest;
- › ridges to the southeast, along Elross Creek's limit of the domain, is set along the ridges;
- › a limit to the northwest was set downstream of Triangle Lake.

The dimension of the model covers an area of about 5 km by 8 km.

3.1.2 Hydrostratigraphic units

The project site is located in the Labrador geosynclinals which consist of geological formations that were compressed into a series of synclines and anticlines, cut by steep angle reverse faults that dip primarily to the east. The main geological formations encountered in the area of interest are:

- › Overburden: ranges over the Howse deposit from 20 to 50 m of thickness
- › Sokoman Formation (Cherty iron formation) with Ruth Formation: thickness ranges from 110 to 120 m: includes the ore zone;
- › Wishart Formation: 15 to 20 m of thickness;
- › Attikamagen Formation (Shale): over 300 m thickness;

3.1.3 Groundwater Flow and Elevation

The regional groundwater flow is controlled by the lineaments that are oriented in a northwest-southeast direction. Also, the impermeable Attikamagen Formation (shale) acts as a barrier to groundwater flow. This configuration will influence greatly the groundwater flow which is mainly from southeast to northwest.

The groundwater level data on a large scale suggest that the groundwater flow originates from recharge areas located in the southwest. Locally, groundwater recharge is occurring from the watershed divide located to the southwest along Irony Mountain. The flow is towards Triangle Lake to the north and to Burnetta Creek to the south following the topography, geological structures and the permeable zones. In the area of the Howse deposit, the horizontal hydraulic gradient is about 0.006 m/m while it varies regionally from 0.01 to 0.02 m/m.

3.2 MODELING SOFTWARE

The 3D numerical groundwater flow model selected for the current study is Visual Modflow 2011.1 Pro version. The original Modflow code was developed by the U. S. Geological Survey in 1984. MODFLOW is considered an international standard for simulating and predicting groundwater conditions and groundwater/surface-water interactions. It is widely used within the groundwater modeling community, and well-documented. The model uses the finite-difference numerical technique for solving groundwater flow equations. All simulations were done in steady-state flow regime.

3.3 MODEL GEOMETRY AND GRID

3.3.1 Domain and Grid

The groundwater flow domain grid was built to include the regional groundwater domain. The presence of groundwater divides to the northeast and southwest of the study area were considered as natural boundaries in order to reduce the total number of cells and increase the calculation efficiency. The entire domain dimensions are around 5 km by 8 km.

The grid is composed of 100 rows and 224 columns, which represents 22,400 rectangular cells per layer.

Surface elevations have been extracted from 1: 50,000 scale topographic maps. The bottom limit of the model was set to a constant elevation of 450 m, which corresponds to the bottom of Cherty iron formation. Figure 3-2 shows the model limit and grid.

3.3.2 Model Layers

A simplified groundwater flow model for the study was developed based on recent regional surface geological map obtained from TATA Steel's geologist. The model is tri-dimensional, and is composed of five (5) main hydrogeostratigraphic zones (Figures 3-2 and 3-3)

- › Overburden;
- › Fault zones with intermediate permeable values assigned due to low permeability materials;
- › Sokoman formation representing the dominant hydrostratigraphic unit in the domain;
- › Wishart formation, represents the surrounding formation with intermediate permeable values assigned;
- › Shale formation with the lowest permeable values assigned.

The model is composed of 13 layers of variable thickness. The first layer is the overburden. The subsequent 12 layers are made of different hydraulic properties areas to represent the geological



units of the aquifer. The inclination of these different units was neglected in the study as it was considered to have little impact for the objective of the study. Figures 3-4 and 3-5 show the general configuration of the layers in the east-west and north-south axes respectively.

Figure 3-2 Surface Geology Layout (Layer 1, Top of the Model)

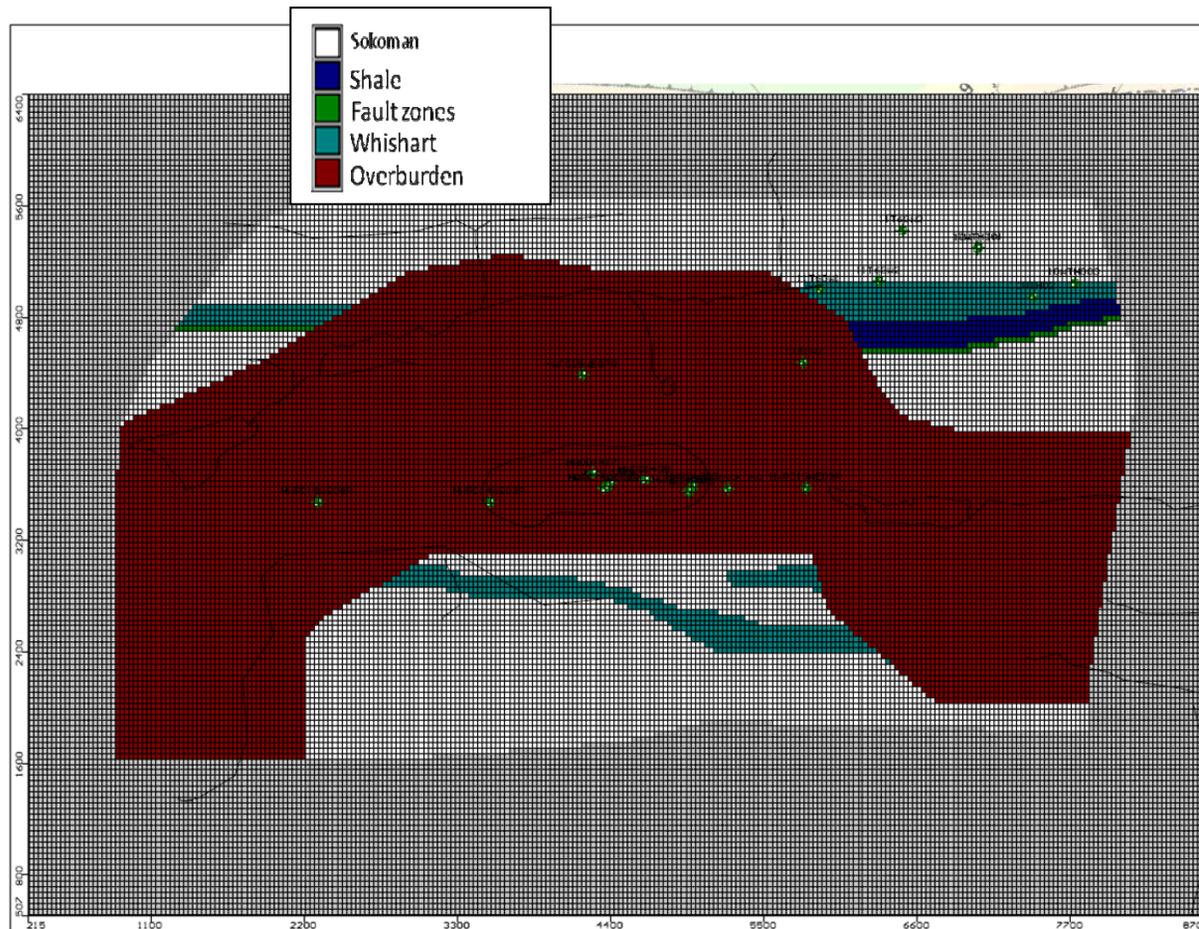


Figure 3-3 Geology of Layer 2 to 13.

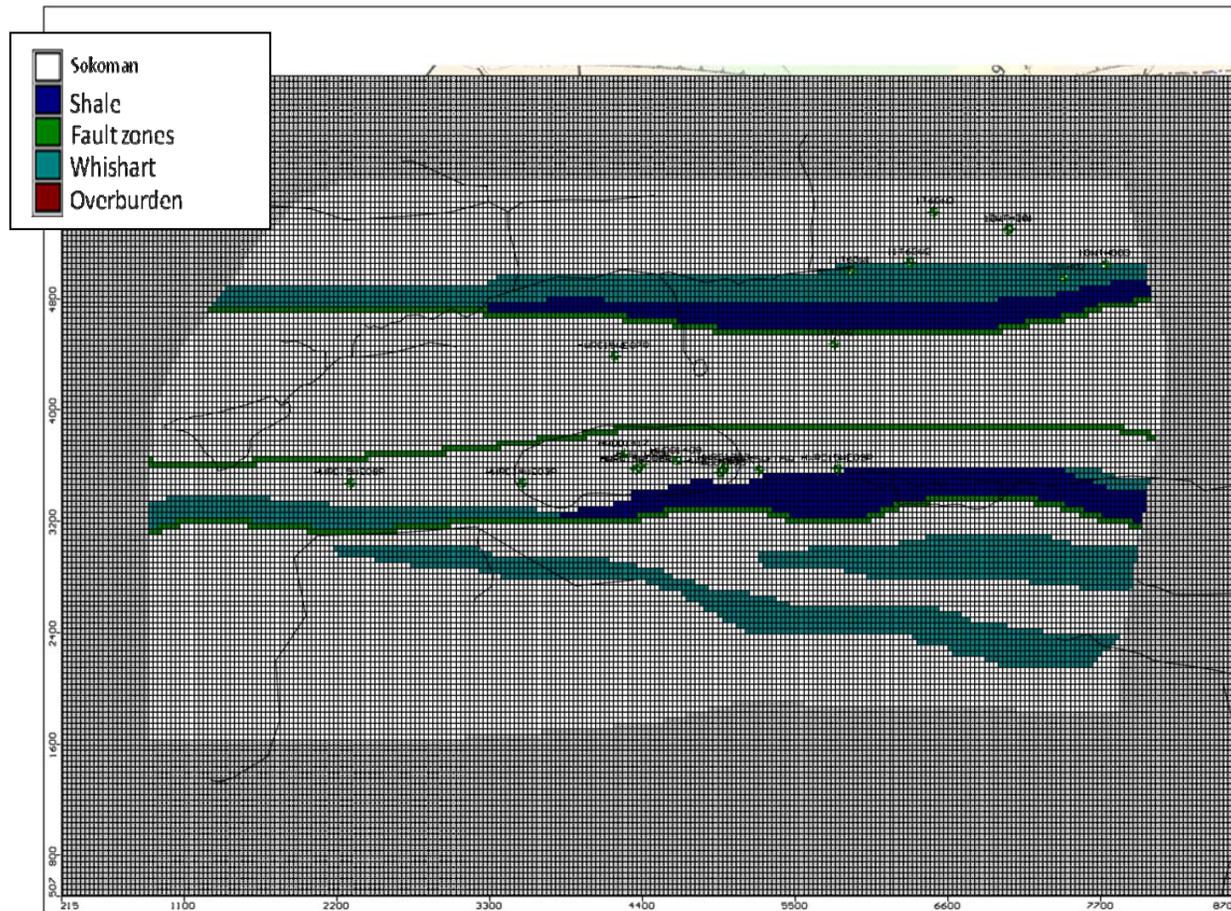


Figure 3-4 Vertical Model Grid –West-East Section

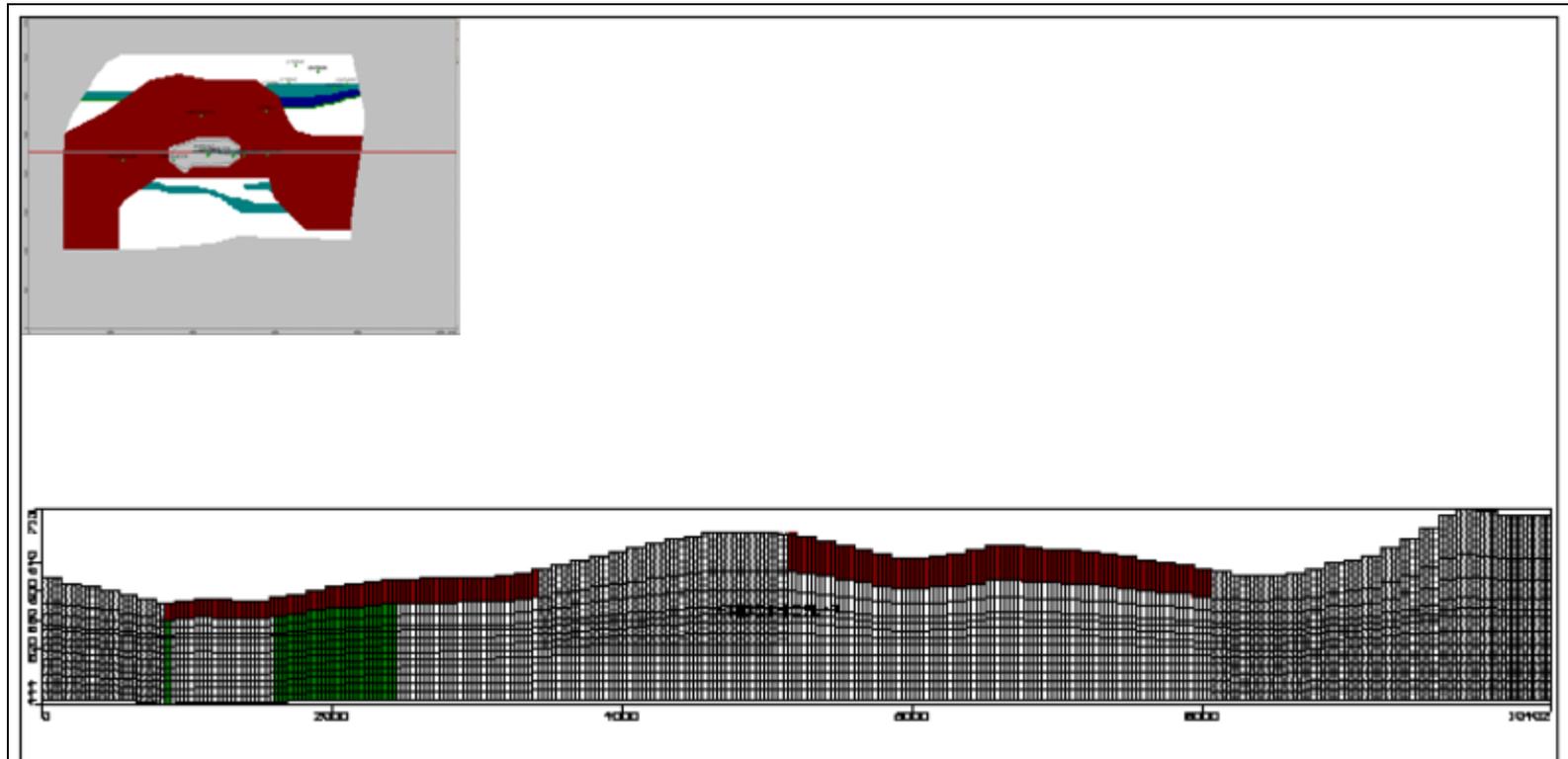
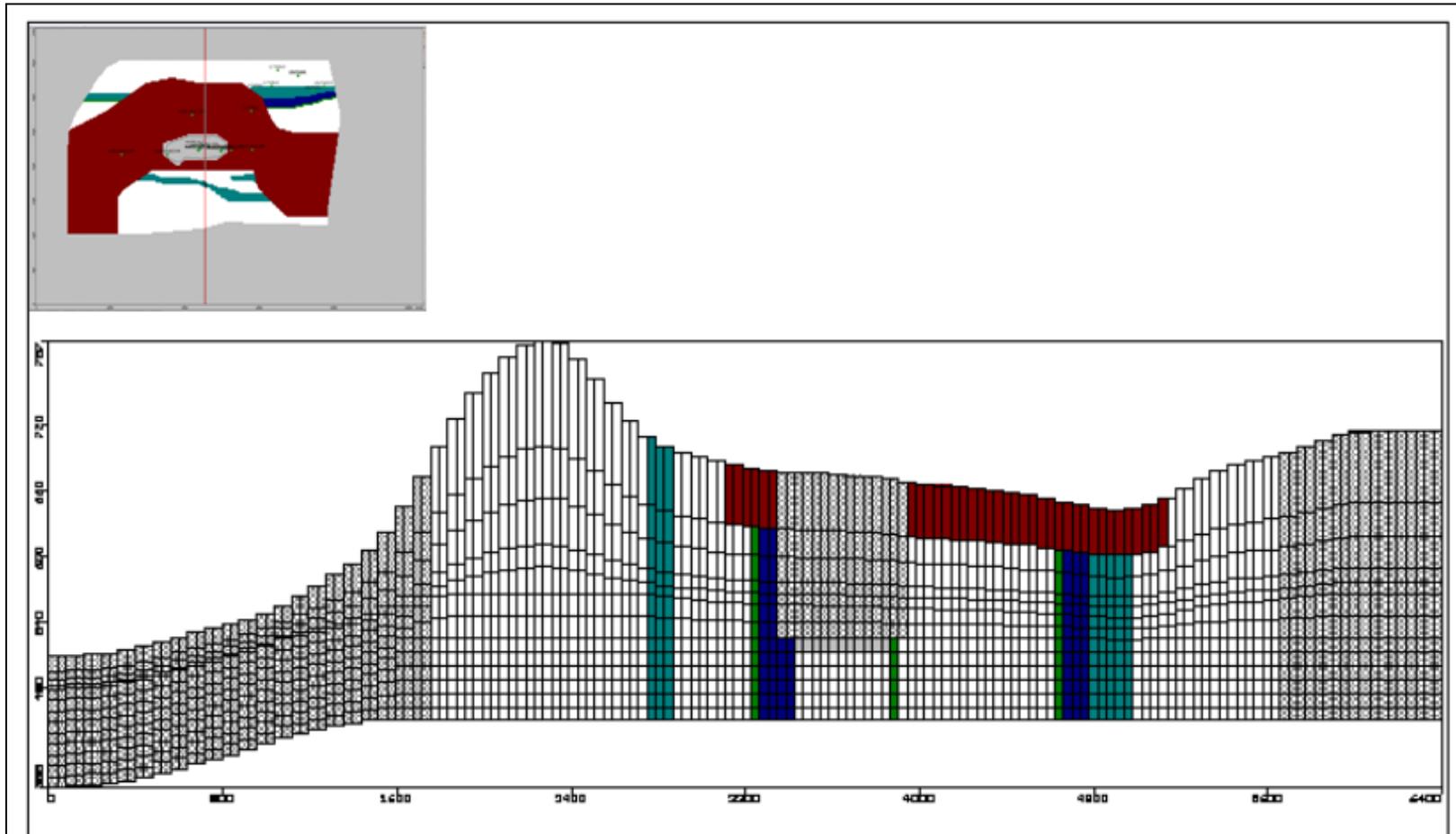


Figure 3-5 Vertical Model Grid –South-North Section



3.4 HYDRAULIC PROPERTIES AND BOUNDARY CONDITIONS

3.4.1 Hydraulic Properties

The hydraulic properties of the model's hydrostratigraphic units have been derived from the results of hydraulic testing, and borehole logs of the local hydrogeological studies on site (Golder, 2014; Geofor, 2014 and 2015) and on neighboring sites (Groupe Hémisphères and Geofor, April 2011).

The first layer of the model is composed of active cells with a uniform hydraulic conductivity for the overburden. A maximum value for fine sand of 1×10^{-5} m /s was considered based on literature (Sanders, 1998).

The distribution of the hydraulic conductivity of subsequent layers was assigned according to the regional surface geological map. The flow is governed by more permeable stratigraphic units aligned generally in the axis NW-SE.

The fault zones are represented by intermediate permeability values, while the Sokoman including the iron ore units is represented with a relatively higher permeability values.

For example, the spatial distribution of the iron formation units including the Cherty unit (Sokoman) which occupies most of the territory is presented in Figure 3-4 for the entire area of study. Table 3-1 gives the initial hydraulic conductivities used in the model.

Table 3-1 Initial Hydraulic Conductivities

Zone	Layer	Kx (m/s)	Ky (m/s)	Kz (m/s)
		Initial	Initial	Initial
Overburden	1	1.0E-05	1.0E-05	1.0E-05
Sokoman	1 to 13	9.4E-06	9.4E-06	9.4E-06
Wishart	1 to 13	4.0E-07	4.0E-07	2.0E-07
Shale	1 to 13	5.0E-08	5.0E-08	5.0E-08
Fault zones	1 to 13	1.3E-07	1.3E-07	6.5E-07

3.4.2 Boundary Conditions

The limits and characteristics of the groundwater flow domain were determined according to the regional hydrogeological settings. The groundwater regional basin or watershed was delimited using some of the surface water watershed limits, considered as groundwater divide, considered as no-flow boundaries.

Constant head boundary conditions were assigned on the discharge areas as well as inflow areas. In the northeastern corner of the domain, the Timmins area was identified as recharge areas in the previous studies (map of Hydrogeology Groundwater Flow, Groupe Hémisphères, EIA Howse

property project, 2014), and this is represented by a constant head boundary and variable head boundary in a small portion.

A constant head boundary of 660 m, based on water levels measured in the area of Timmins 1 and 2 (and variable head from 660 to 600 m in a small portion) was imposed to the eastern border of the model, representing the main water inflow into the domain (see Figure 3-6).

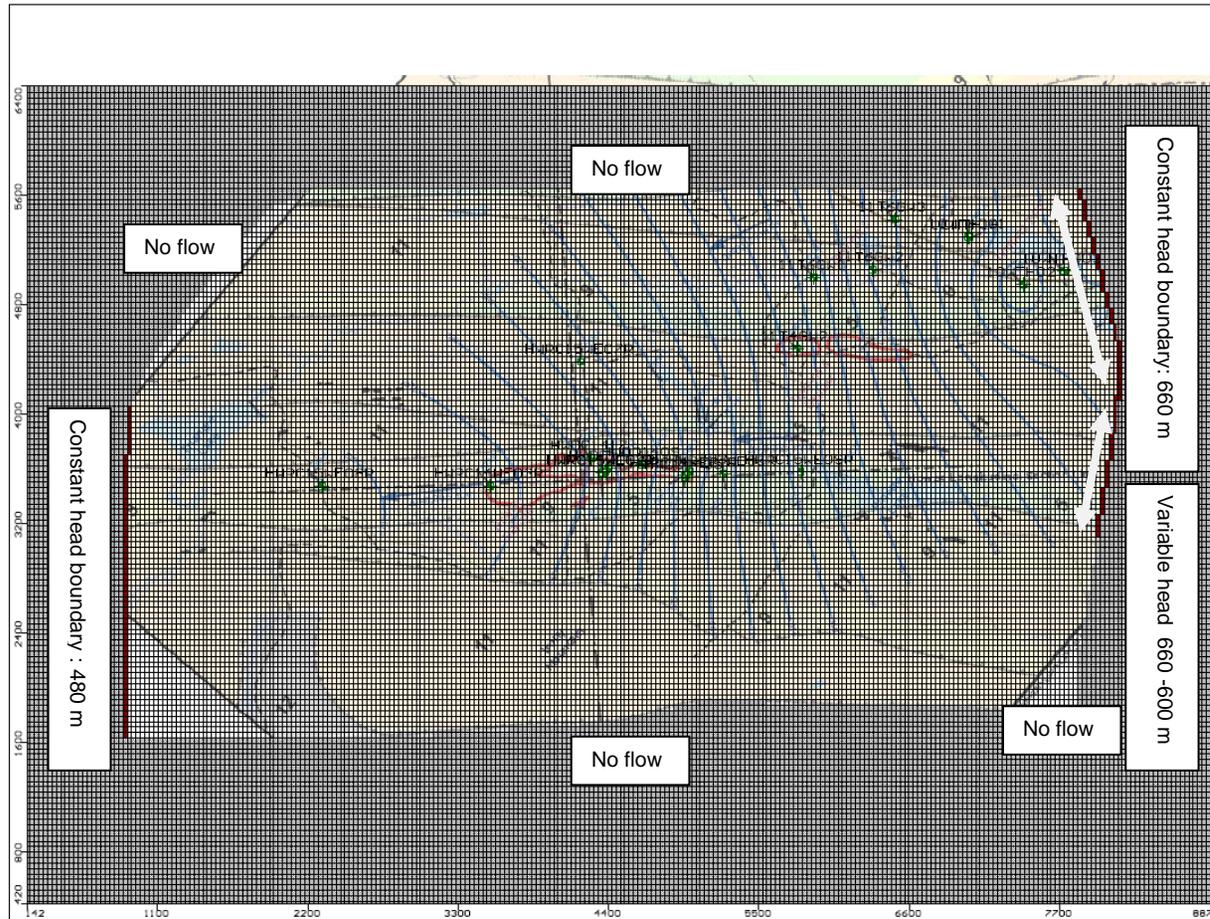
A constant hydraulic head of 480 m was set at the west boundary, representing the main discharge area of the aquifer.

Surface water bodies in the domain were not considered connected to the aquifer and were not represented in the model since it was considered that they have no impact on groundwater regional flow.

3.4.3 Recharge Rate

Geofor (November 2015) estimated a water budget for the Howse deposit based on literature review. The infiltration rate to groundwater would be 109 mm/year, representing 20 % of the net water depth available (546.2 mm) after deducting evapotranspiration and sublimation. Based on this estimate, an initial recharge rate of 100 mm/year was applied to the entire domain of the model and increased to 200 mm/year during the process of the sensitivity analysis of the model to assess the sensibility of this parameter variation on the dewatering.

Figure 3-6 Boundary Conditions Applied to the Model Indicated by Brown Cells



4 MODEL CALIBRATION AND RESULTS

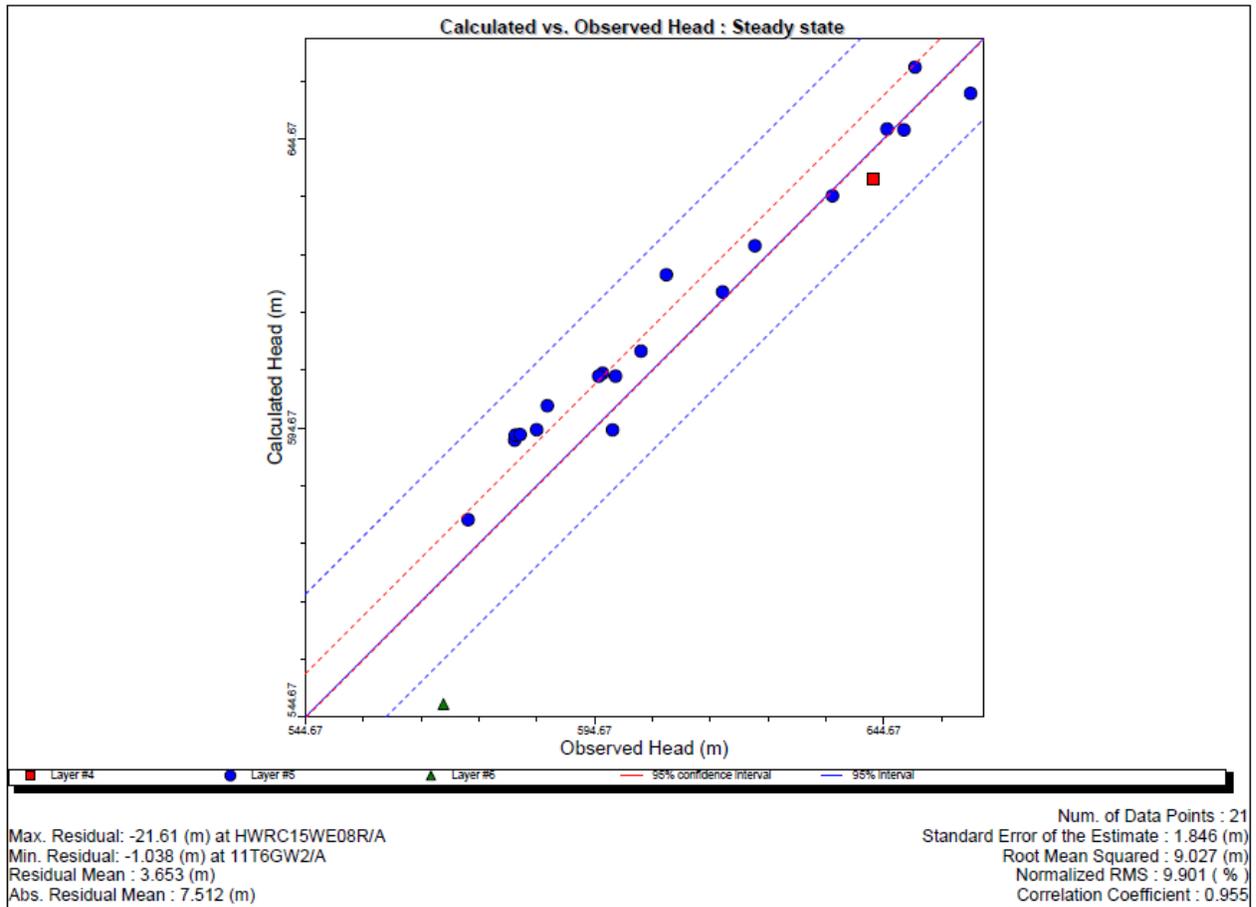
4.1 GROUNDWATER FLOW MODEL CALIBRATION

The model calibration process consists in adjusting hydraulic property values and boundary conditions in order to obtain a best possible fit of groundwater heads and flow directions observed in the field, within an acceptable error limit. Static groundwater heads were calibrated with piezometric data collected at different seasons.

First, a calibration was done by comparing piezometric map based on field data and simulated piezometric map. Simulated hydraulic heads were also compared to observed heads using a calibration curve. The results presented on Figure 4-1, showed a good fit between the simulated hydraulic heads to the observed hydraulic head on the field with an error percentage calculated by means of the normalized Root Mean Squared (RMS) lower than 10%. This RMS value indicates that the model calibration result is acceptable.

Figure 4-2 presents the calibrated piezometric contours and regional groundwater flow directions. As illustrated on Figure 3-6, the simulated main regional groundwater flow component is towards the northwest region of the domain which corresponds to the map flow of the piezometric map. The simulated hydraulic gradient over the domain was about 0.02 m/m and very close to the general values observed on a large scale (0.01-0.02 m/m).

Figure 4-1 Calculated Versus Observed Head at Steady State



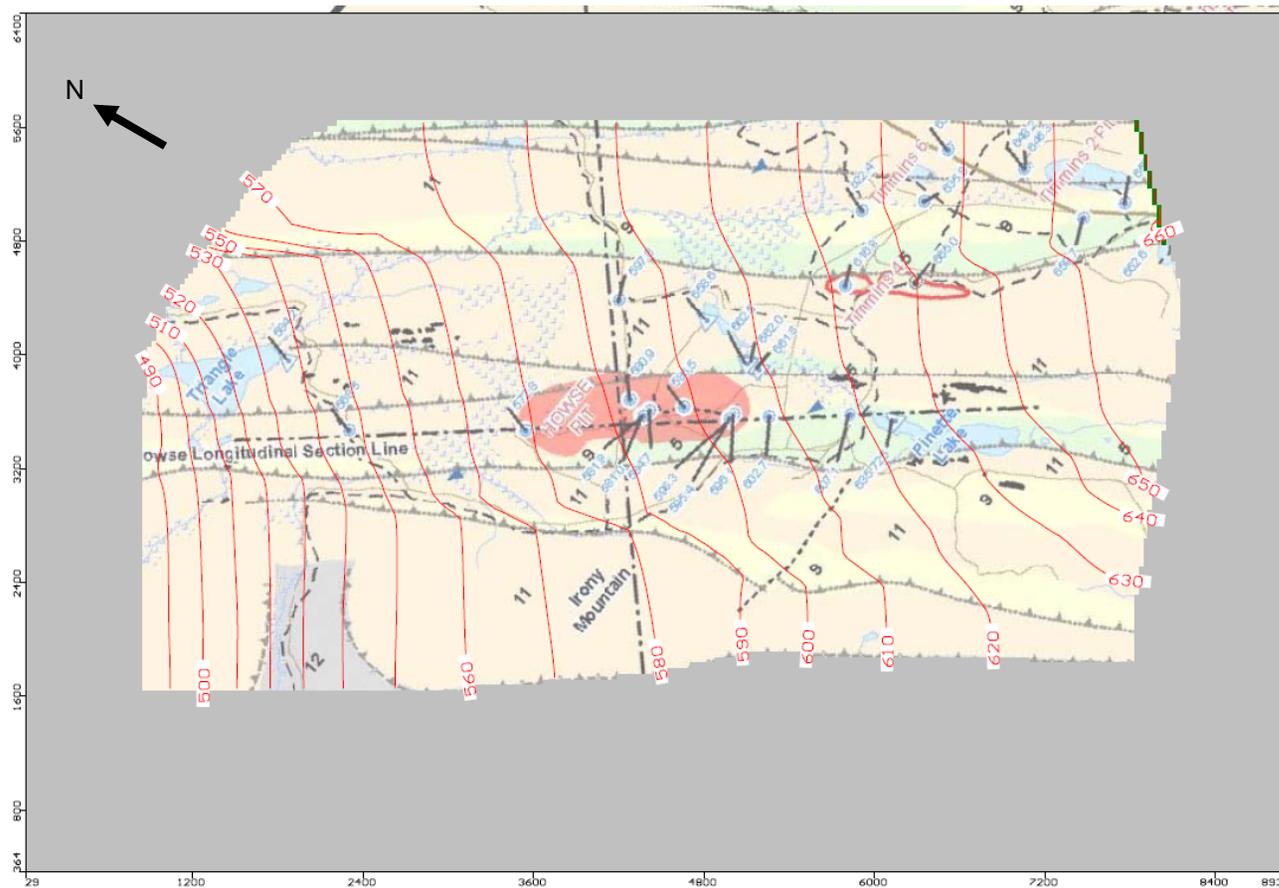
The initial conductivity values were increased to better represent the expected groundwater flow patterns of the area and to be able to incorporate a recharge of at least 100 mm/year without creating an overflow. Initial and calibrated hydraulic conductivities are given in Table 4-1.

Figure 4-2 presents simulated groundwater levels based on measured groundwater levels for steady-state groundwater regime prior to dewatering pumping activities.

Table 4-1 Initial and Calibrated Hydraulic Conductivities

Zone	Layer	Kx (m/s)		Ky (m/s)		Kz (m/s)	
		Initial	Calibrated	Initial	Calibrated	Initial	Calibrated
Overburden	1	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05
Sokoman	1 to 13	9.4E-06	9.4E-06	9.4E-06	9.4E-06	9.4E-06	9.4E-06
Wishart	1 to 13	4.0E-07	8.0E-07	4.0E-07	8.0E-07	2.0E-07	8.0E-07
Shale	1 to 13	5.0E-08	1.0E-07	5.0E-08	1.0E-07	5.0E-08	1.0E-07
Fault zones	1 to 13	1.3E-08	2.6E-07	1.3E-08	2.6E-07	6.5E-08	2.6E-07

Figure 4-2 Simulated Natural Piezometric Map



4.2 HOWSE DEPOSIT DEWATERING MODEL

After obtaining the calibrated natural groundwater flow model, the open pit was incorporated into the model to simulate the dewatering of the future mine pit at its final depth, which is 160 m. The drain package method of Modflow was used to simulate the drawdown at the final pit depth under pumping conditions.

Simulations were carried out in steady state flow regime with the objective of evaluating the flow rates and extent of the influence of the dewatering activities at the final depth of the pit only. Direct precipitation over the area of the pit was not considered in the model.

In addition to the base case of the calibrated model, three sensitivity analyses were completed by increasing the hydraulic conductivities of hydrostratigraphic units to emphasize the flow along bedding planes and increasing the recharge rate for one of the scenarios. More details on the sensitivity analyses are available in Appendix B.

The total pumping rate simulated for the base case dewatering scenario (final pit depth of 160 m) was 9,400 m³/day. This flow rate may reach higher values ranging from 12,000 to 19,000 m³/day with slightly higher hydraulic conductivities and increased recharge values. Table 4-2 summarizes the flow rate results taking into account these non negligible factors, and shows the influence of permeability and recharge rate increase (possibly due to the heterogeneity of the formations and geological structures within the study area).

Table 4-2 Dewatering Simulation Results including Sensitivity Analysis

Scenario	Flow rates (m ³ /day)		Note (see Appendix B on sensitivity analysis for more details)	Pumping rate increase
	Model	Safety factor of 1.25		
Base case: Calibrated model	9393	11741	- Kx, Ky, Kz; - Recharge : 100 mm/y	
Sensitivity analysis Case 1	17382	21728	- Kx, Ky and Kz multiplied by 2 for OB and Sokoman, - Recharge increased to 200 mm/y	1,9
Sensitivity analysis Case 2	18752	23440	- Kx, Ky and Kz multiplied by 2 for all five units (OB, Sokoman, Wishart, Shale and Fault zones), - Recharge increased to 200 mm/y	2,0
Sensitivity analysis Case 3	11754	14693	- Kx, Ky, Kz; - Recharge increased to 200 mm/y	1,3

The sensitivity analyses results indicate that the hydraulic conductivity is the more influent parameter in the model. Indeed, when the recharge is doubled (case 3) the pumping rate increases by a factor of 1.3 while doubling the hydraulic conductivity and recharge the pumping rate increases by a factor of 2.

Groundwater dewatering simulation results for the base case are presented in terms of piezometry and drawdown in Figures 4-3 and 4-4 respectively. Groundwater dewatering simulation results for the other scenarios are presented also in terms of drawdown in Appendix B.

It can be seen in Figure 4-3 that larger drawdowns are observed in the vicinity of the pit. The regional drawdown resulting from the pumping activities (base case scenario) is expected to be about 10 m at distance of about 3 km to towards the northwest limit of the domain (downgradient of the study area) and to 3.1 km upgradient of the study area (Table 4-3). In general, a 2m drawdown is expected at distance of about 3.5-3.6 km from the center of the pit (Table 4-3).

These results imply that the Burnetta Creek may be affected by the drawdown, considering the fact that Burnetta Creek is potentially a groundwater discharge zone (based on field observations and the presence of a fault in the area).

It will be expected during the first years of mining operations that the dewatering rate will be lower than the estimated rate for the final pit depth. The groundwater level at the Howse deposit is generally deep. During the first years, dewatering will be limited to water accumulated in the pit basically from direct precipitations and infiltration through the unsaturated geological units until the pit floor reaches the water table. After, dewatering rate will increase gradually with pit floor depth and reach its maximum rate at its final depth.

Figure 4-3 Piezometric Map during Pit Dewatering (Final Depth)

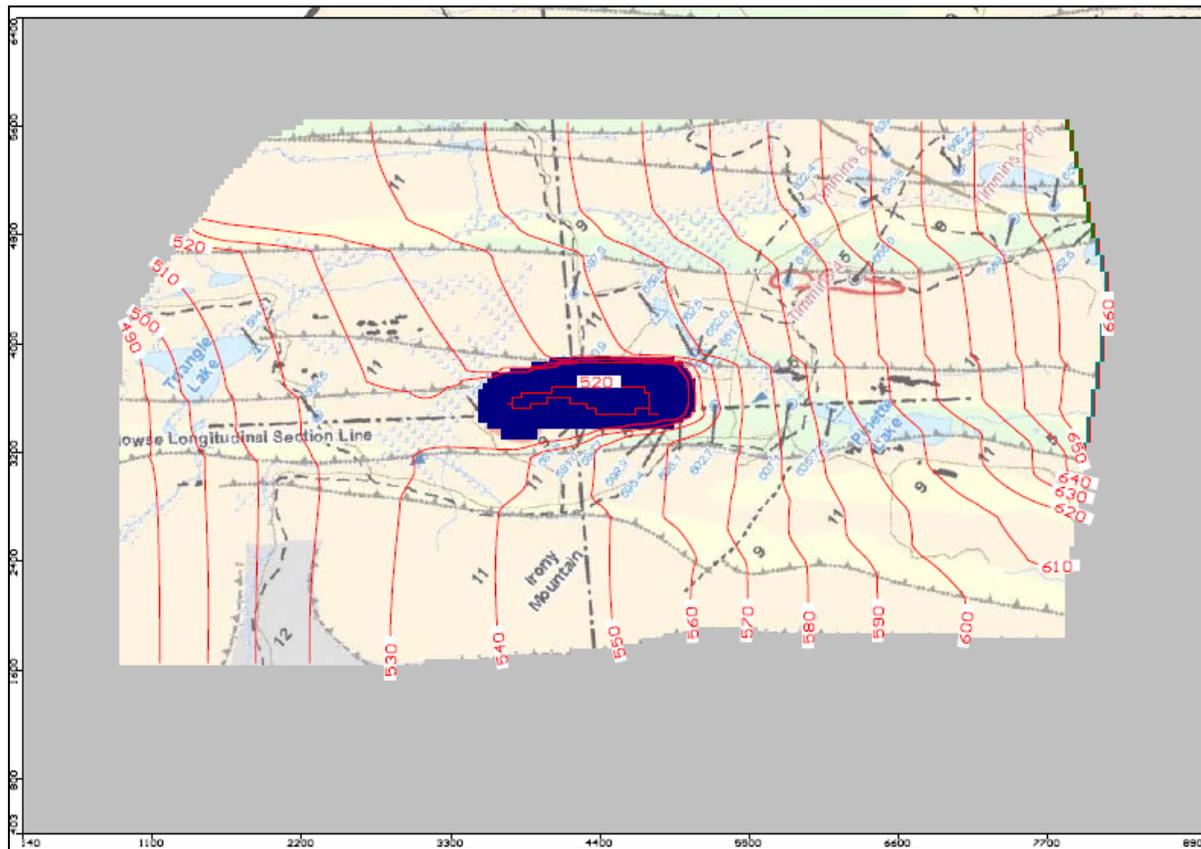


Figure 4-4 Groundwater Drawdown during Pit Dewatering (Final Depth)

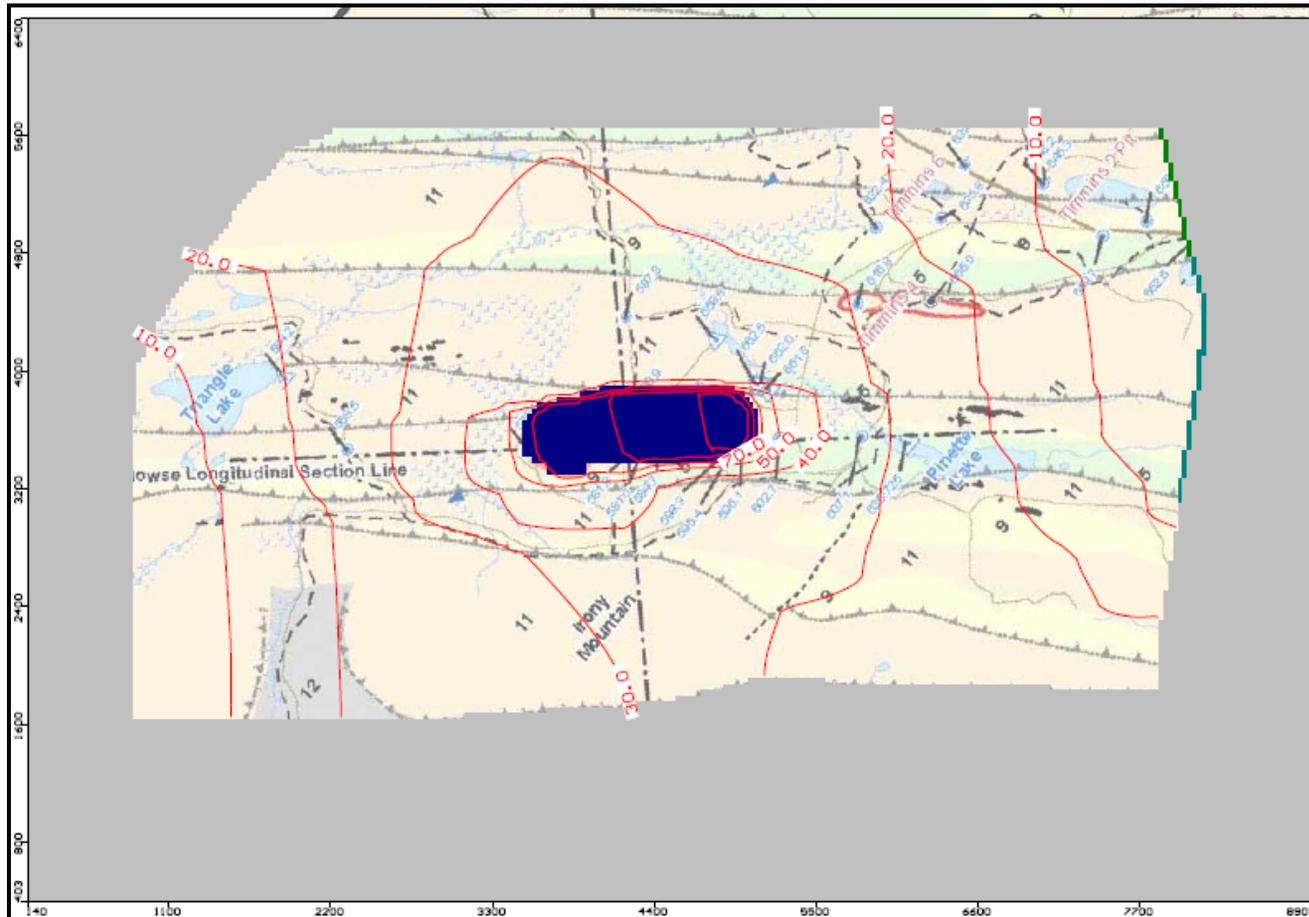


Table 4-3 Results of Drawdown versus Distance from the center of the pit for different scenarios

	Distance in meters from the center of the Pit to					
	2m isocontour drawdown		5m isocontour drawdown		10m isocontour drawdown	
	<i>Downgradient</i>	<i>Upgradient</i>	<i>Downgradient</i>	<i>Upgradient</i>	<i>Downgradient</i>	<i>Upgradient</i>
Calibrated Model	3475	3618	3303	3434	3036	3119
Scenario 1	3475	3618	3291	3428	3018	3077
Scenario 2	3481	3618	3291	3452	3053	3119
Scenario 3	3374	3523	3125	3196	2663	2663

Drawdown distances were measured in a cross-section parallel to faults zones (row 69 of the model)

4.3 GROUNDWATER FLOW MODEL LIMITATIONS

The groundwater model was constructed using several assumptions which have an influence on the results. While hydrogeological data was available in the immediate vicinity of the deposit, other areas of the groundwater domain were limitedly investigated, for which extrapolation of hydraulic characteristics had to be conducted. Therefore, the model domain had to be limited to the predetermined Goodream and Elross watersheds where the hydrogeological data could be determined. Beyond these watersheds no scientific references were available to further extend the model. Moreover, the groundwater model was built and calibrated with piezometric data collected during field campaigns from different years and seasons, and some surface water elevations close to the site. In fact, several pre-existing piezometers and wells in the area modeled were not available during recent hydrogeological investigations. They were either frozen due to permafrost, abandoned, in pumping conditions for water supply purposes, or destroyed by construction activities (Geofor, 2015).

5 CONCLUSIONS AND RECOMMENDATIONS

The current groundwater flow modeling study has allowed for the evaluation of dewatering flow rates of the Howse deposit. The main conclusions are:

- › The review of existing and new data allowed building a conceptual model of groundwater within the study area;
- › Groundwater model calibration has indicated that current hydrogeological conditions (before the start-up of the mining operations) can be simulated by increasing the hydraulic conductivities determined in previous studies (used as input data) and decreasing the recharge rate;
- › Groundwater flow simulations were performed for a base case and three sensitivity analyses, representing the dewatering of the final pit at a depth of 160 m;
- › The dewatering rates were estimated to :
 - 9,400 m³/day;
 - This flow rate may reach higher values, ranging from 12,000 to 19,000 m³/day, with the increase of the hydraulic conductivity of geological units surrounding the pit and of the recharge rate.
- › Some limitations have been identified in the groundwater flow model, notably uncertainties in hydraulic properties in some areas and the lack of recent groundwater elevations outside the deposit area.

Therefore, it is recommended to:

- › Continue the groundwater monitoring in observation wells around the proposed pit for longer a period of time (1 to 2 years) to better evaluate the effective recharge and discharge, and to allow for a better understanding of the groundwater/surface water interaction zones, in particular before and during the dewatering phases.
- › Monitor the flow and level of water continuously in the hydrometric stations upstream and downstream Burnetta Creek before and during the dewatering; to prevent and manage any eventual impact.
- › Compare the hydrogeological modeling results with the pumping records (data) during the course of the dewatering for an eventual update of the hydrogeological model.

6 REFERENCES

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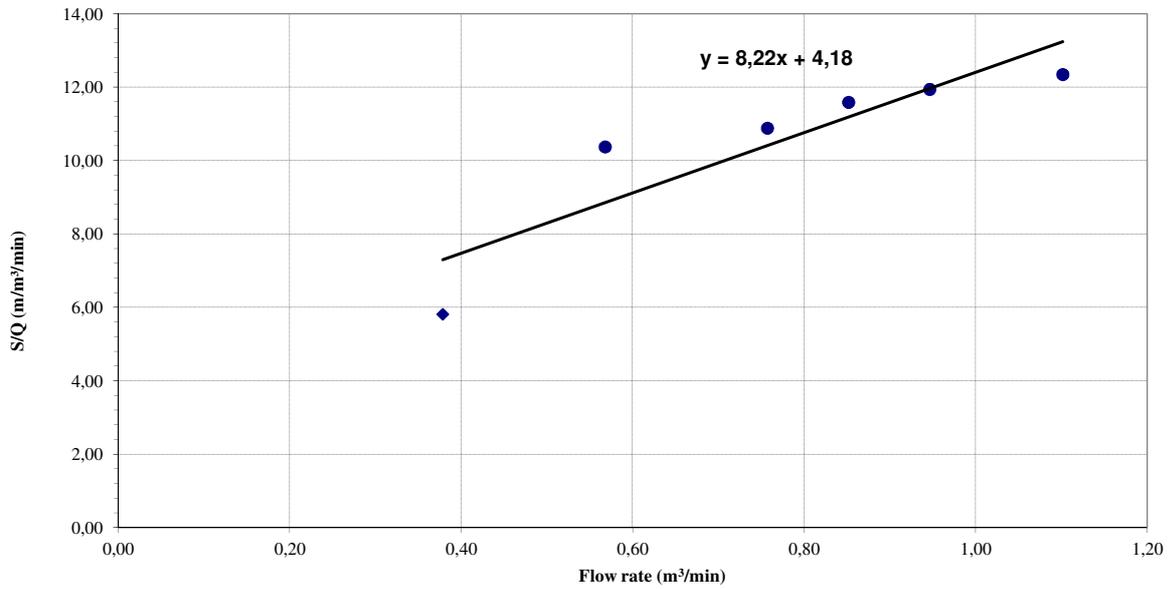
*Christian Bélanger ing., M.Sc.A.
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Environment & Water*

Pumping Test Results

1. Step Test Results - Well HW-RC15-WEO6R

Step no.	Duration	Flow	Flow	Drawdown	Specific Drawdown	Specific Capacity
			min	gpm	Q (m ³ /min)	s (m)
1	60	100	0,38	2,2	5,81	0,17
2	60	150	0,57	5,89	10,37	0,10
3	60	200	0,76	8,24	10,88	0,09
4	60	225	0,85	9,87	11,59	0,09
5	60	250	0,95	11,3	11,94	0,08
6	60	291	1,10	13,6	12,35	0,08

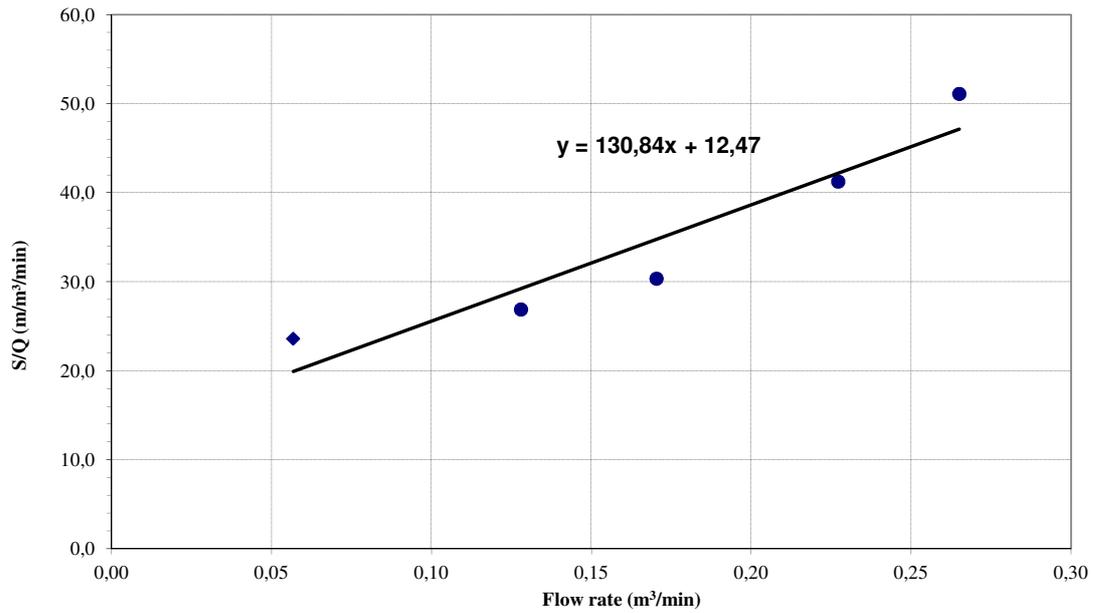
2. Graph of Specific Drawdown vs pumping flow rate



1. Step Test Results - Well HW-RC15-WEO7R

Step no.	Duration	Flow	Flow	Drawdown	Specific Drawdown	Specific Capacity
	min	gpm	Q (m ³ /min)	s (m)	S/Q (m/m ³ /min)	Q/S (m ³ /min/m)
1	30	15	0,06	1,34	23,6	0,04
2	30	33,8	0,13	3,44	26,9	0,04
3	30	45	0,17	5,17	30,4	0,03
4	30	60	0,23	9,37	41,3	0,02
5	30	70	0,26	13,54	51,1	0,02

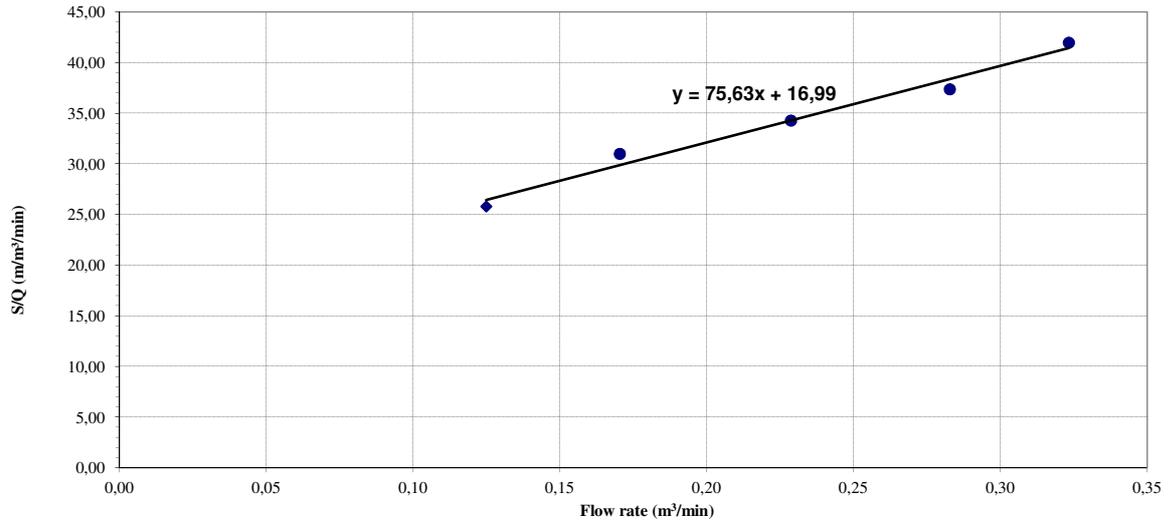
2. Graph of Specific Drawdown vs pumping flow rate



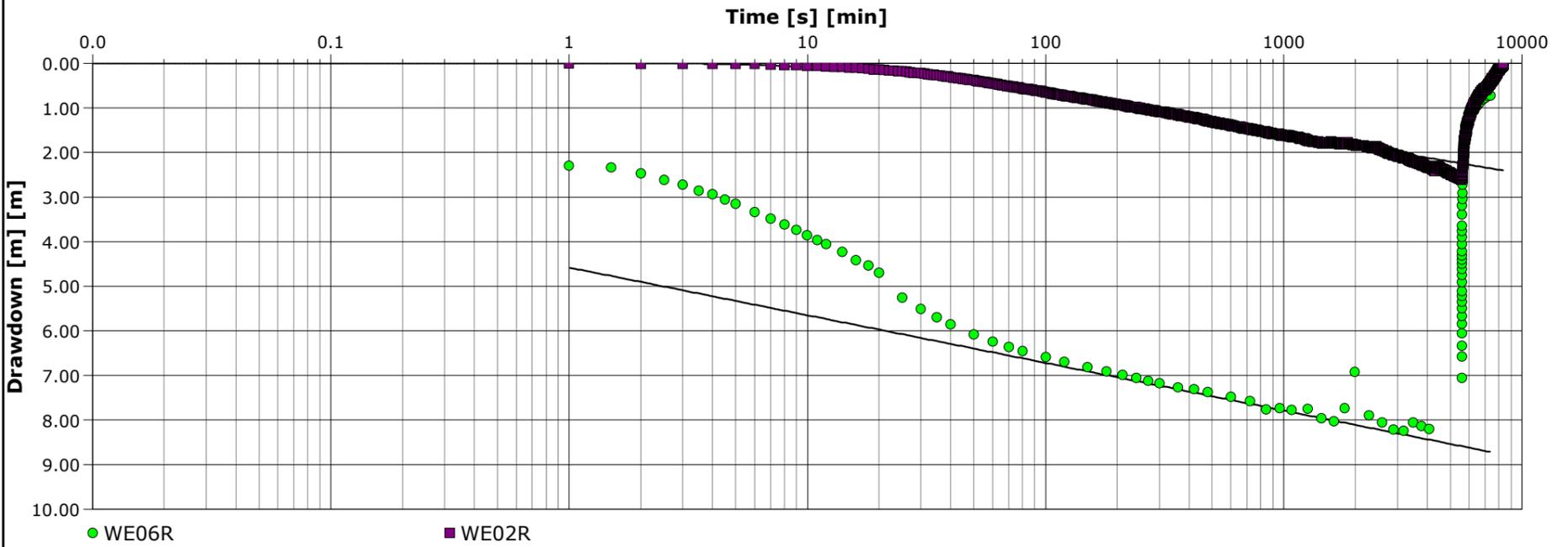
1. Step Test Results - Well HW-RC15-WEO8R

Step no.	Duration	Flow	Flow	Flow	Flow	Drawdown	Specific Capacity	Specific Drawdown
	min	gpm	m ³ /d	Q (l/s)	Q (m ³ /min)	s (m)	S/Q (m/m ³ /min)	Q/S (m ³ /min/m)
1	30	33	180	2,1	0,12	3,22	25,78	0,04
2	30	45	245	2,8	0,17	5,28	31,00	0,03
3	30	60,4	329	3,8	0,23	7,84	34,29	0,03
4	30	74,7	407	4,7	0,28	10,57	37,38	0,03
5	30	85,4	466	5,4	0,32	13,57	41,98	0,02

2. Graph of Specific Drawdown vs pumping flow rate



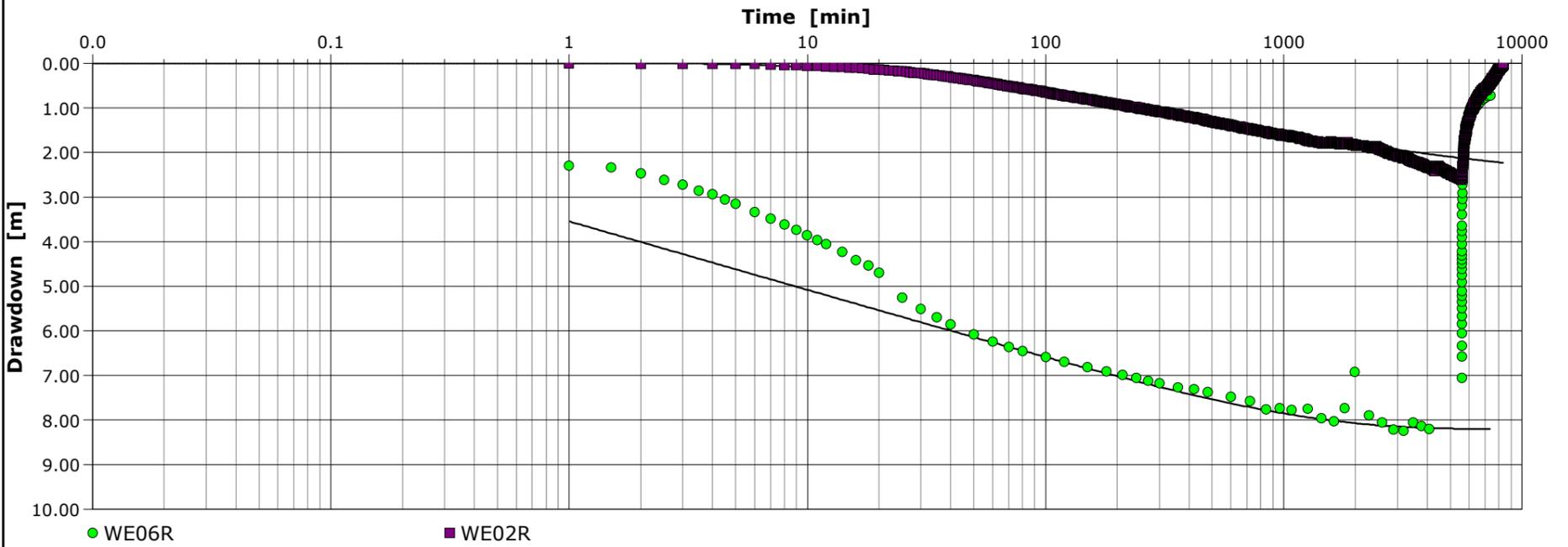
Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m ³ /d]	



Calculation after Theis

Observation well	Transmissivity [m ² /s]	K [m/s]	Storage coefficient	Radial distance to PW [m]
WE06R	1.26×10^{-3}	1.56×10^{-5}	3.86×10^{-4}	0.15
WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}	6.08
Average	1.38×10^{-3}	1.71×10^{-5}	4.95×10^{-2}	

Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Hantush	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m ³ /d]	

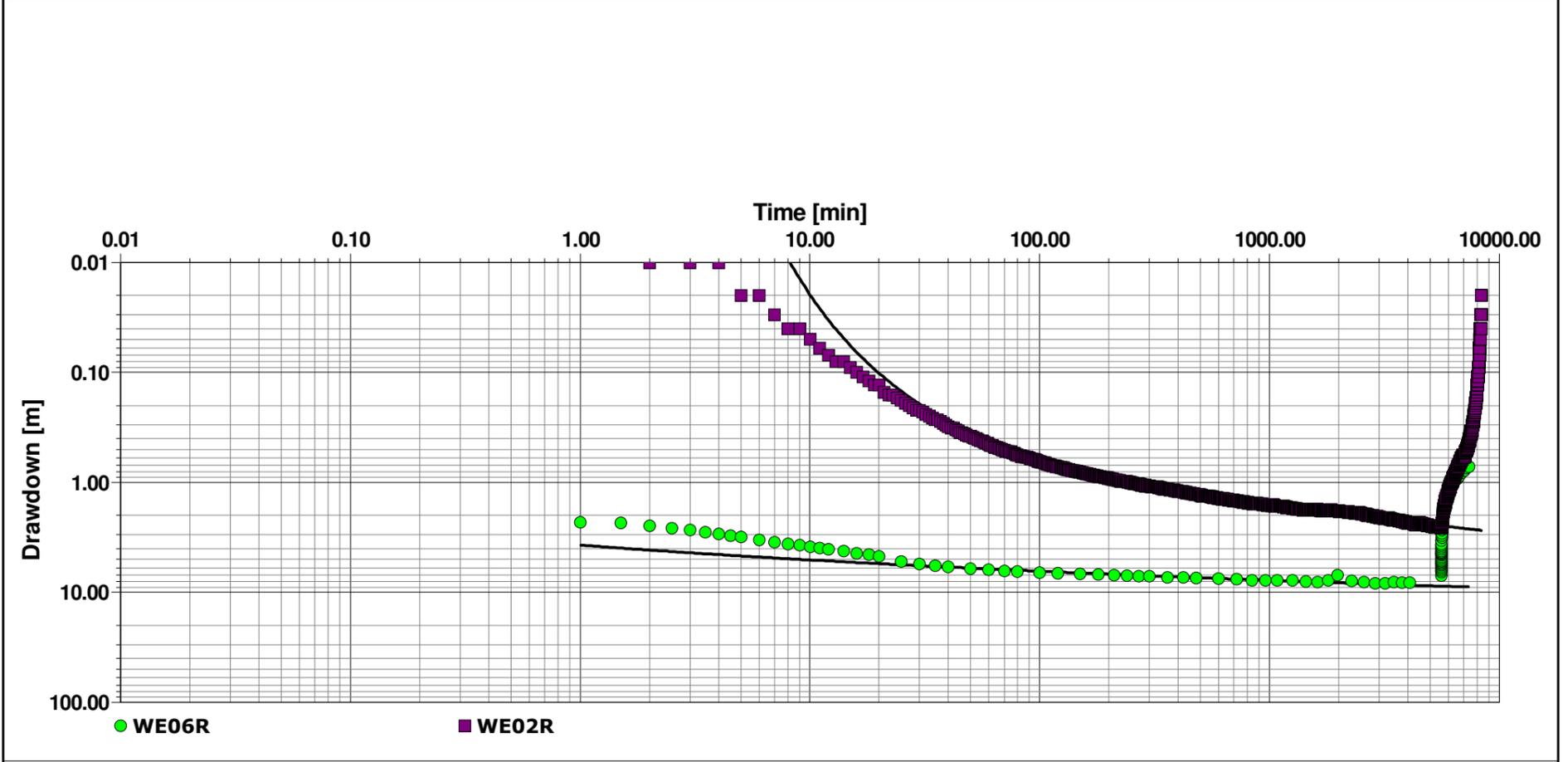


Calculation after Hantush

Observation well	Transmissivity [m ² /s]	K [m/s]	Storage coefficient	Hydr. resistance [min]	Radial distance to PW [m]
WE06R	8.78×10^{-4}	1.08×10^{-5}	2.56×10^{-2}	7.41×10^4	0.15
WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}	1.67×10^5	6.08
Average	1.19×10^{-3}	1.47×10^{-5}	6.21×10^{-2}	1.20×10^5	

Le modèle Hantush ne juxtapose pas les données de descente avec la remontée

Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Double Porosité	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m ³ /d]	

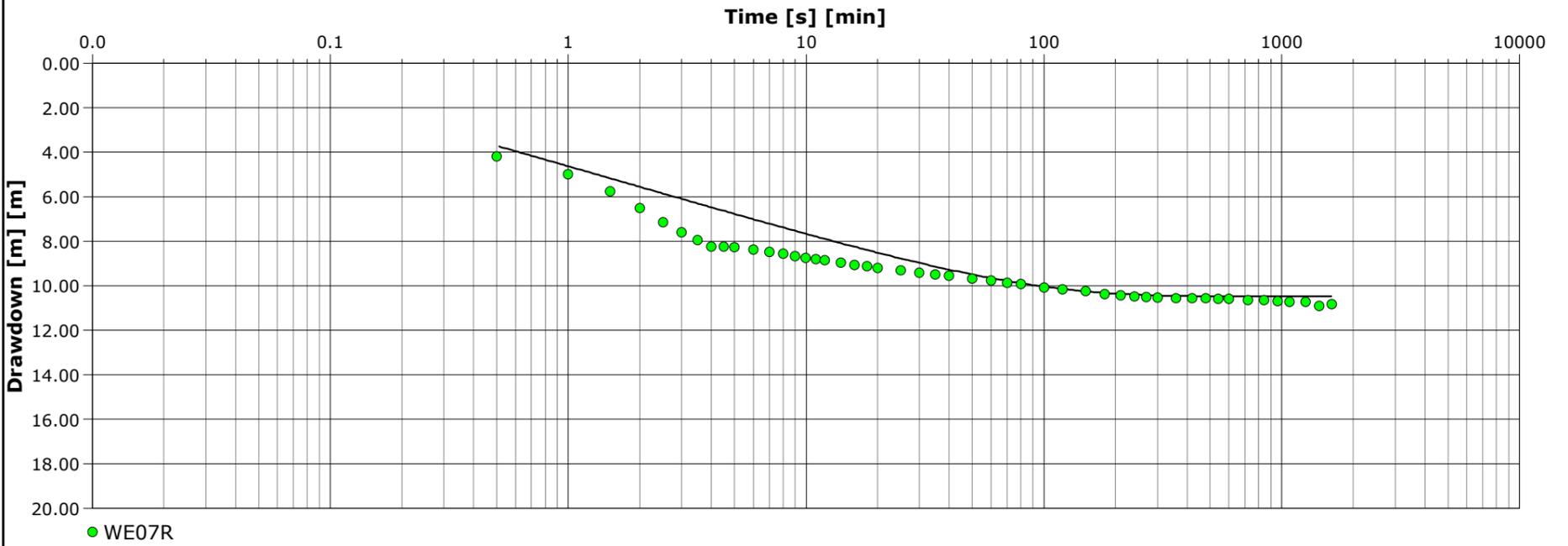


Calculation after Double Porosity

Observation well	Transmissivity [m ² /s]	K [m/s]	Specific storage	Sigma	Lambda	Radial distance to PW [m]
WE06R	1.00×10^{-3}	1.23×10^{-5}	3.38×10^{-4}	2.96×10^1	6.67×10^{-2}	0.15
WE02R	1.00×10^{-3}	1.23×10^{-5}	1.48×10^{-1}	1.00×10^0	6.67×10^{-2}	6.08
Average	1.00×10^{-3}	1.23×10^{-5}	7.41×10^{-2}	1.53×10^1	6.67×10^{-2}	

Location: Howse Deposit		Pumping Test: Pumping Test 2 (WE06R)			Pumping well: WE06R			
Test conducted by: Geofor					Test date: 22/09/2015			
Aquifer Thickness: 81.00 m			Discharge: variable, average rate 637.83 [m ³ /d]					
	Analysis Name	Analysis performed by	Date	Method name	Well	T [m ² /s]	K [m/s]	S
1	Theis	AB	21/09/2015	Theis	WE06R	1.26×10^{-3}	1.56×10^{-5}	3.86×10^{-4}
2	Theis	AB	21/09/2015	Theis	WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}
3	Hantush	AB	21/09/2015	Hantush	WE06R	8.78×10^{-4}	1.08×10^{-5}	2.56×10^{-2}
4	Hantush	AB	21/09/2015	Hantush	WE02R	1.50×10^{-3}	1.85×10^{-5}	9.85×10^{-2}
5	Double Porosit�	AB	21/09/2015	Double Porosity	WE06R	1.00×10^{-3}	1.23×10^{-5}	3.38×10^{-4}
6	Double Porosit�	AB	21/09/2015	Double Porosity	WE02R	1.00×10^{-3}	1.23×10^{-5}	1.48×10^{-1}
Average						1.19×10^{-3}	1.47×10^{-5}	6.19×10^{-2}

Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Hantush	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m³/d]	

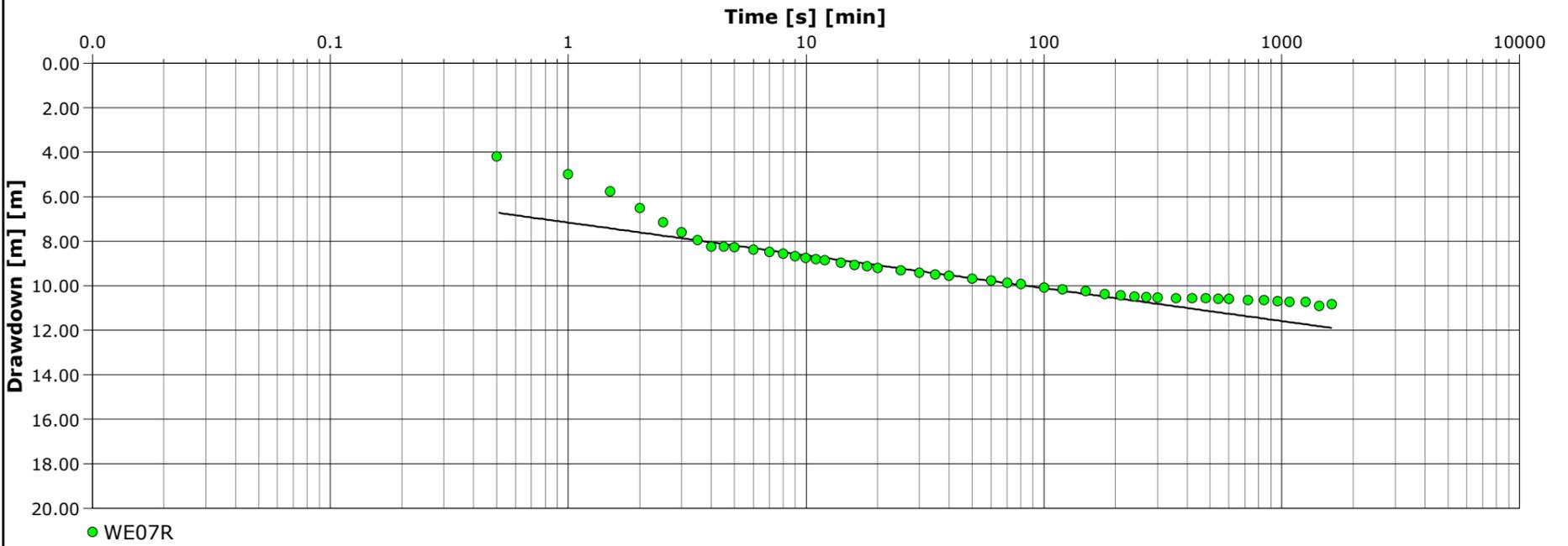


Calculation after Hantush

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Hydr. resistance [min]	Radial distance to PW [m]
WE07R	2.03×10^{-4}	5.34×10^{-6}	2.31×10^{-1}	5.58×10^2	0.06

Le modèle Hantush ne juxtapose pas les données de descente avec la remontée

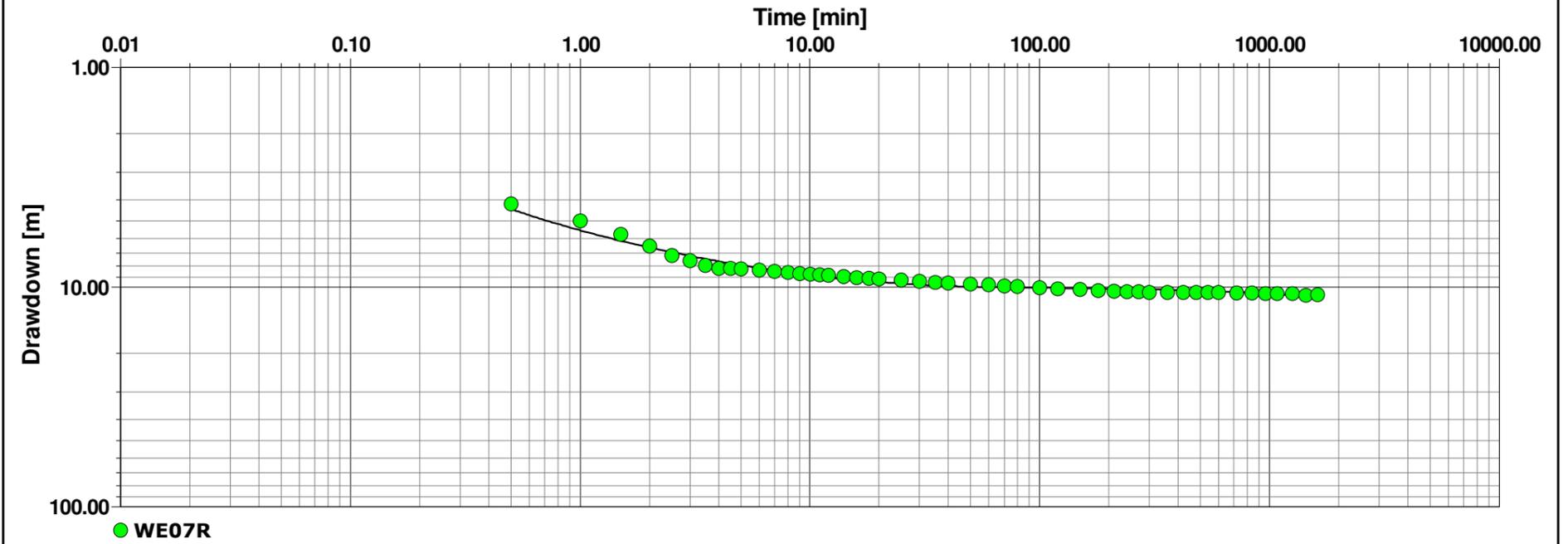
Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m³/d]	



Calculation after Theis

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Radial distance to PW [m]
WE07R	4.34×10^{-4}	1.14×10^{-5}	2.01×10^{-4}	0.06

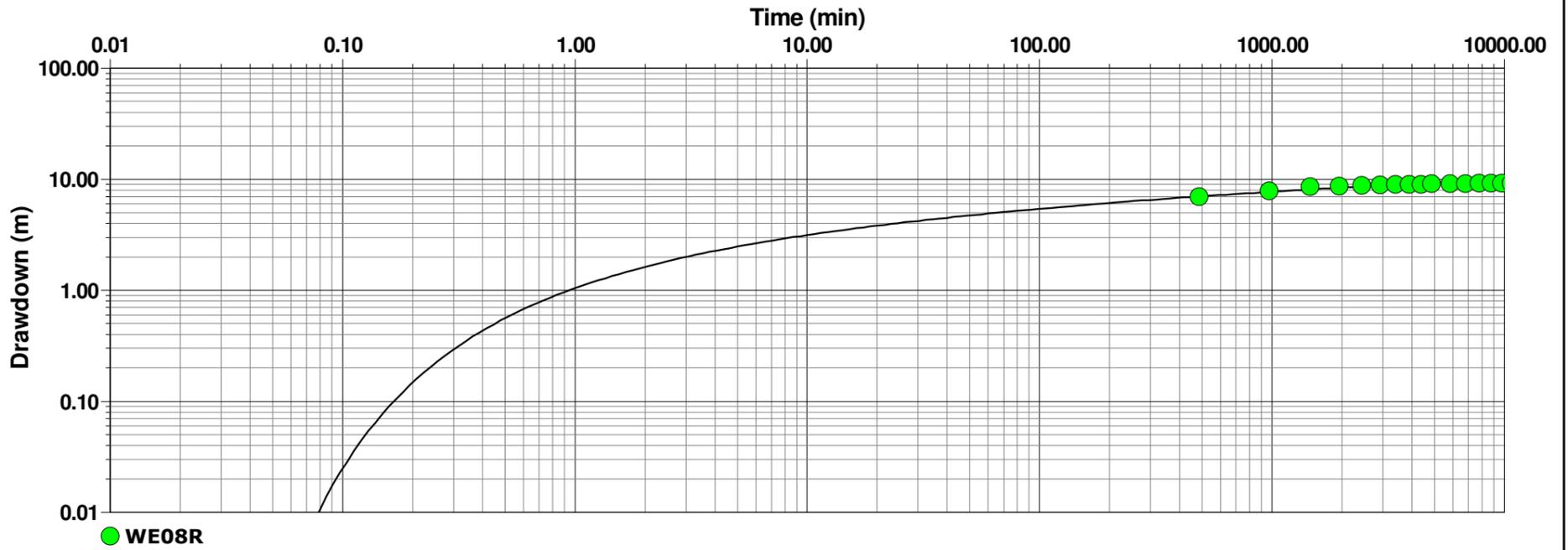
Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Double Porosité	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m³/d]	



Calculation after Double Porosity						
Observation well	Transmissivity [m²/s]	K [m/s]	Specific storage	Sigma	Lambda	Radial distance to PW [m]
WE07R	1.66×10^{-4}	4.36×10^{-6}	2.01×10^{-1}	7.74×10^1	3.25×10^{-3}	0.06

Location: Howse Deposit		Pumping Test: Pumping Test 2 without recovery(WE07R)			Pumping well: WE07R			
Test conducted by: Geofor				Test date: 15/09/2015				
Aquifer Thickness: 38.00 m			Discharge: variable, average rate 296.51 [m ³ /d]					
	Analysis Name	Analysis performed by	Date	Method name	Well	T [m ² /s]	K [m/s]	S
1	Theis	AB	21/09/2015	Theis	WE07R	4.34×10^{-4}	1.14×10^{-5}	2.01×10^{-4}
2	Hantush	AB	21/09/2015	Hantush	WE07R	2.03×10^{-4}	5.34×10^{-6}	2.31×10^{-1}
3	Double Porosit�	AB	21/09/2015	Double Porosity	WE07R	1.66×10^{-4}	4.36×10^{-6}	2.01×10^{-1}
Average						2.68×10^{-4}	7.04×10^{-6}	1.44×10^{-1}

Location: Howse Deposit	Pumping Test: Pumping Test (without recovery) HW-RC15-WEO8	Pumping well: WE08R
Test conducted by: Geofor		Test date: 13/09/2015
Analysis performed by: A.B.	Theis	Date: 17/09/2015
Aquifer Thickness: 28.00 m	Discharge: variable, average rate 318.6 [m ³ /d]	



Calculation after Theis

Observation well	Transmissivity [m ² /s]	K [m/s]	Storage coefficient	Radial distance to PW [m]
WE08R	3.11×10^{-4}	1.11×10^{-5}	4.70×10^{-3}	0.06

WEO6R

Recovery analysis

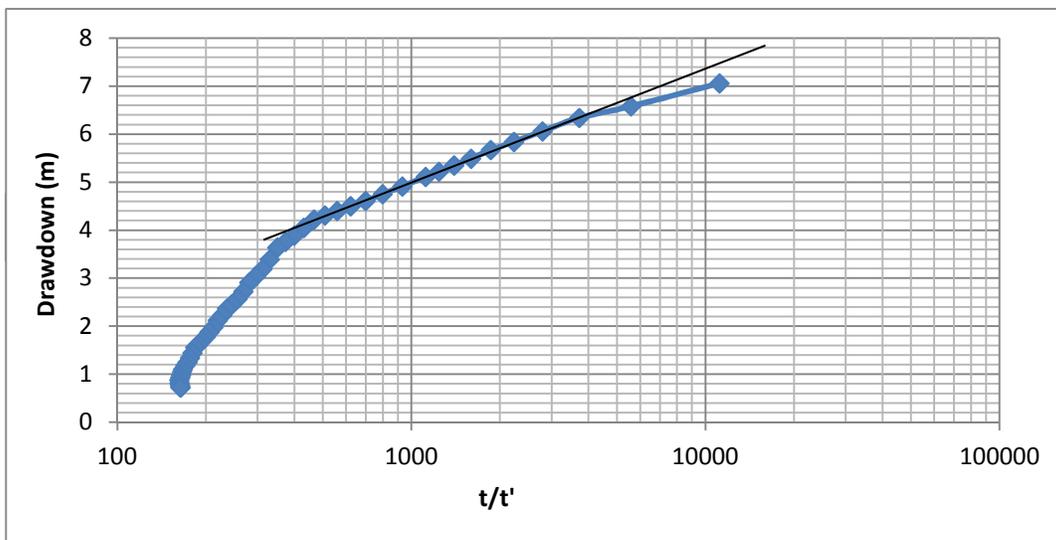
Thickness (m)	81
production time (min)	Well discharge (m3/d)
5576	954
8340	0

t/t'	Drawdown (m)
T1000	5
T10000	7
residual drawdown for a cycle of t/t'	2

t: time pumping started and t':time since pumping ceased

	0.06062809	m2/min
T	0.00101047	m2/s
K	1.2475E-05	m/s

Graph of residual drawdown vs t/t'



WEO7R

Recovery analysis

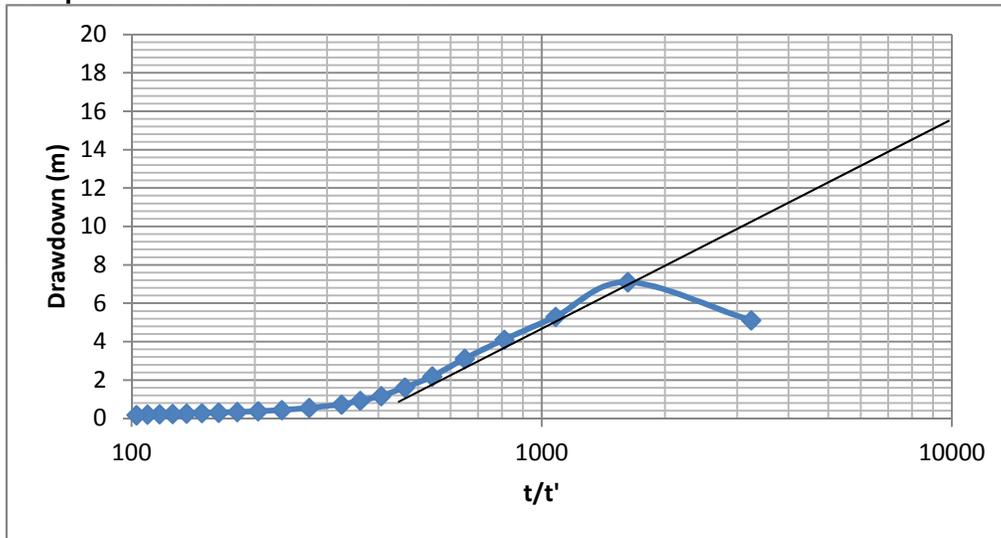
Thickness (m)	38
production time (min)	well discharge (m ³ /d)
1620	302
1650	0

t/t'	Drawdown (m)
T1000	5
T10000	15.8
residual drawdown for a cycle of t/t'	10.8

t: time pumping started and t':time since pumping ceased

	0.00355417	m ² /min
T	5.9236E-05	m ² /s
K	1.5588E-06	m/s

Graph of residual drawdown vs t/t'



WEO8R Recovery analysis

Thickness (m)	28
production time (min)	well discharge (m3/d)
1620	354
1800	0

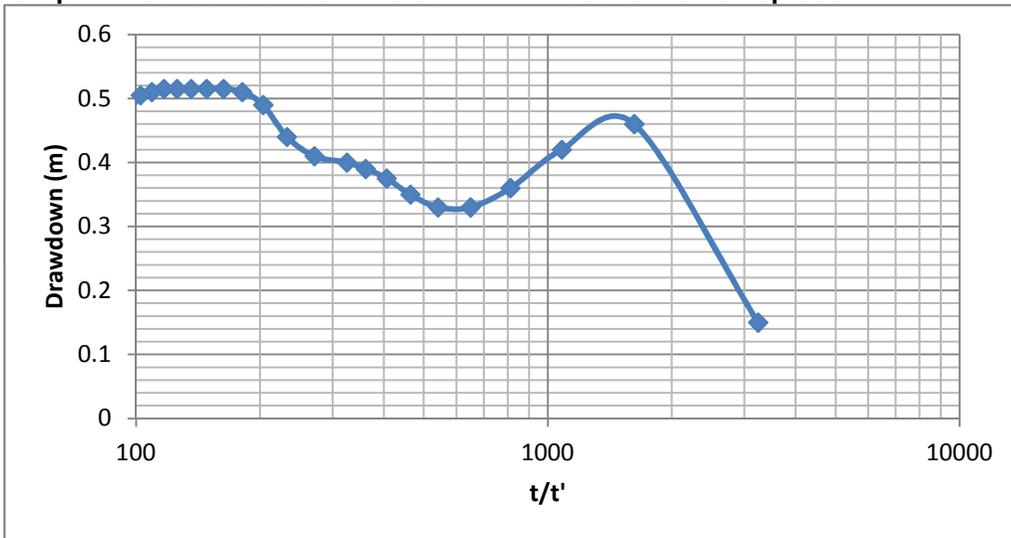
t/t'	Drawdowd (m)	
T1000	8.71	8.75
T10000	9.06	9.34
residual drawdown for a cycle of t/t'	0.35	0.59

t: time pumping started and t':time since pumping ceased

	0.12855551	m2/min
T	0.00214259	m2/s
K	7.6521E-05	m/s

Graph of residual drawdown vs t/t'

Results are not representative

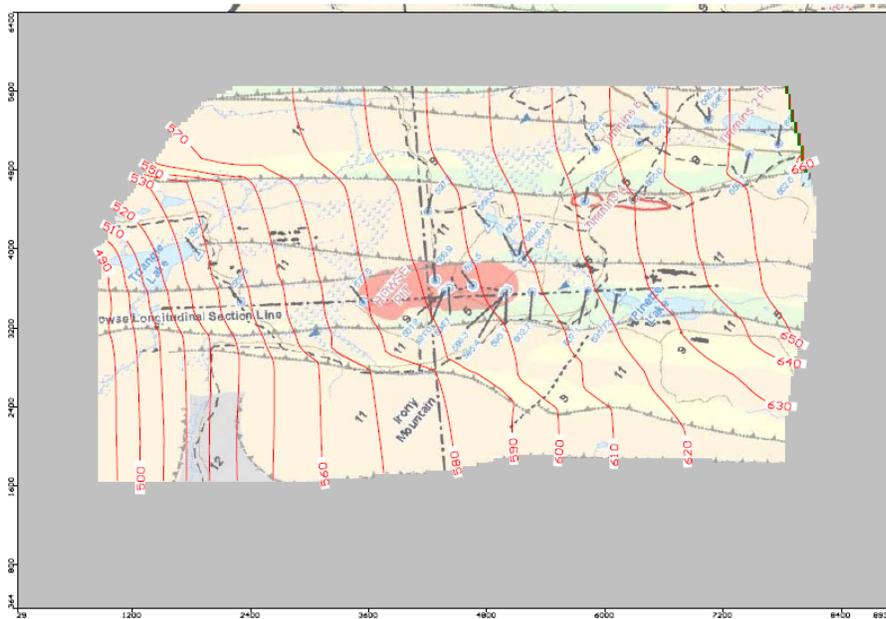


APPENDIX B

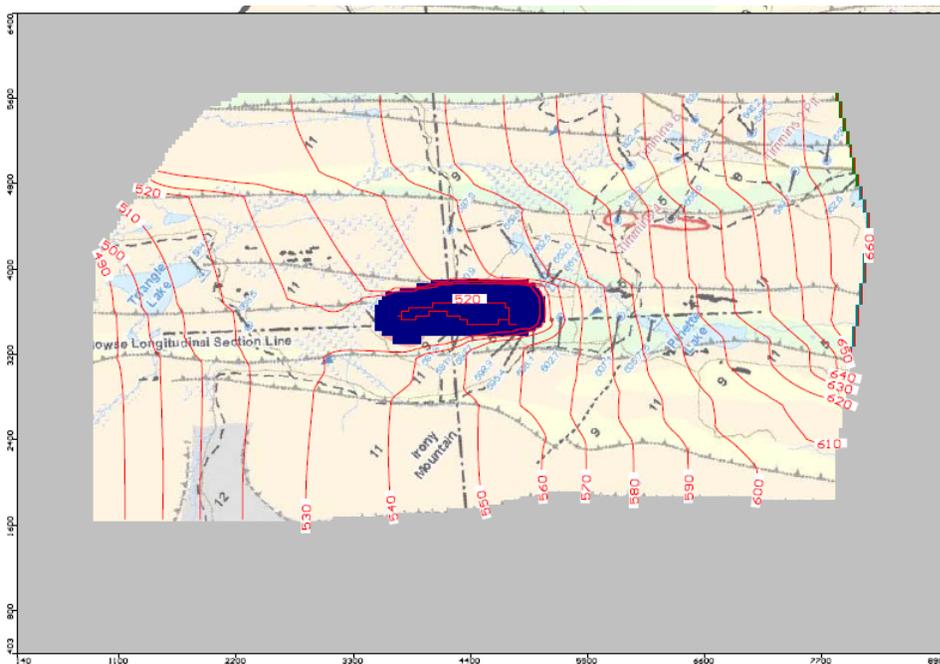
Modeling Results

Base Case Scenario Results

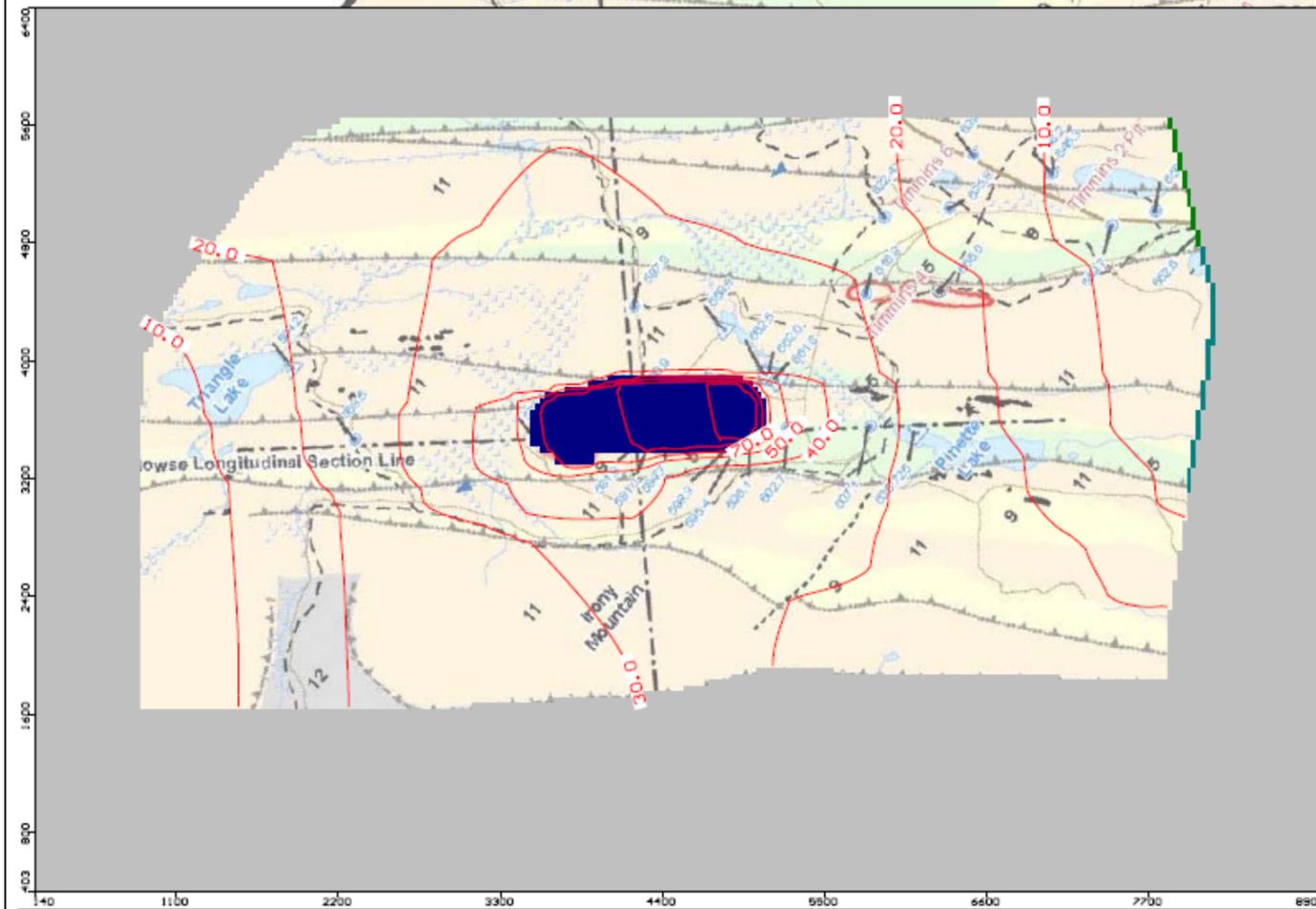
Simulated Natural Piezometric Map



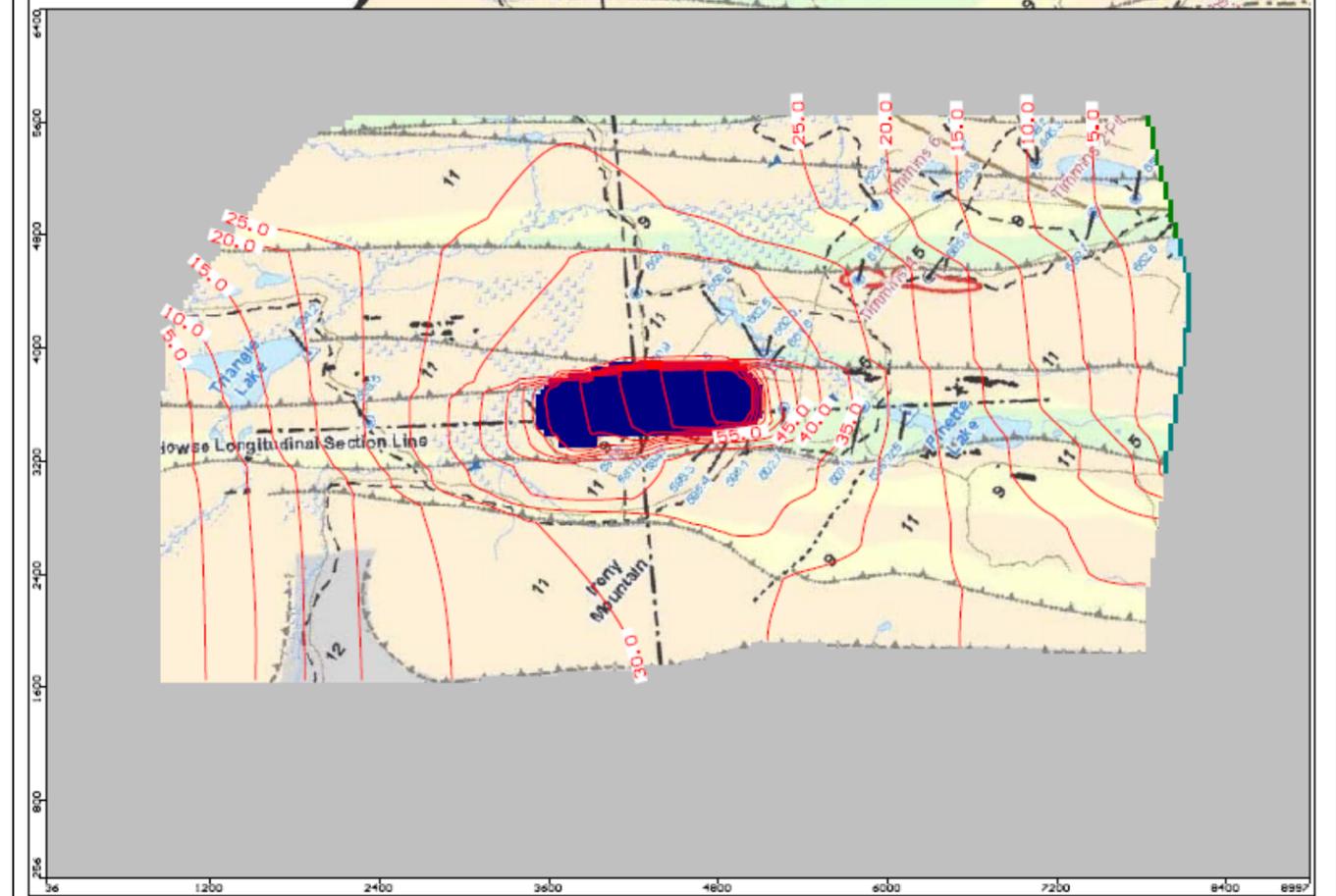
Piezometric Map during Pit Dewatering (Final Depth)



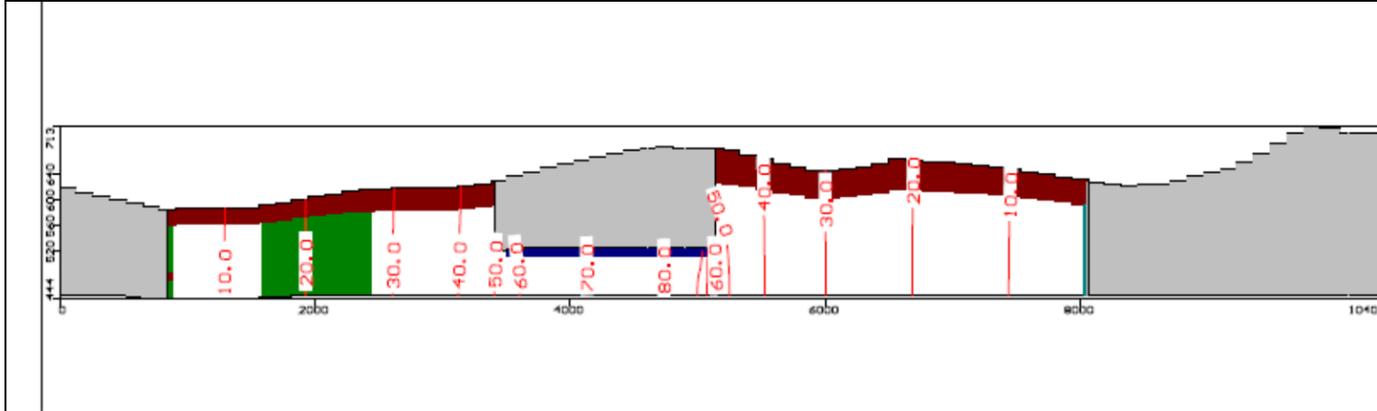
Groundwater Drawdown – 10 m drawdown isocontours



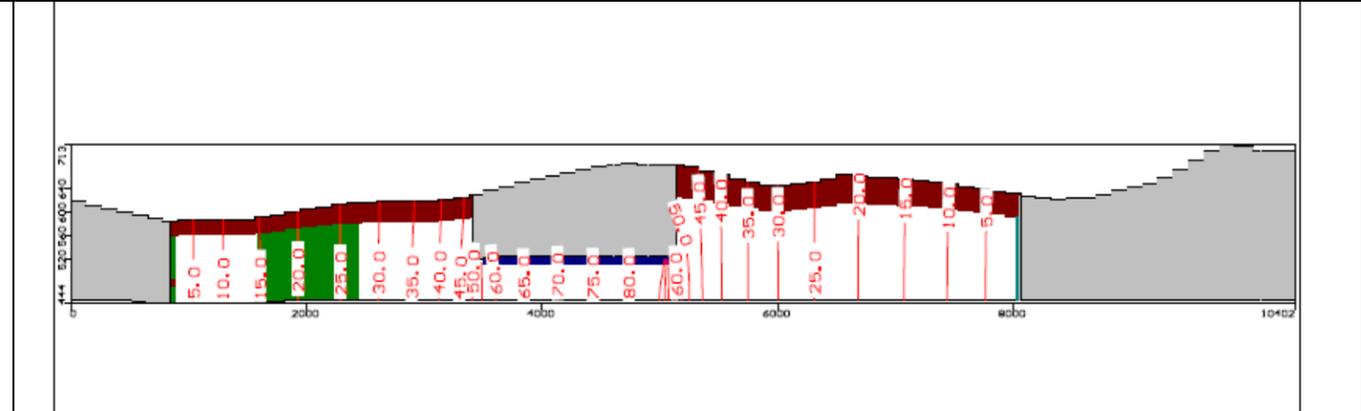
Groundwater Drawdown – 5 m drawdown isocontours



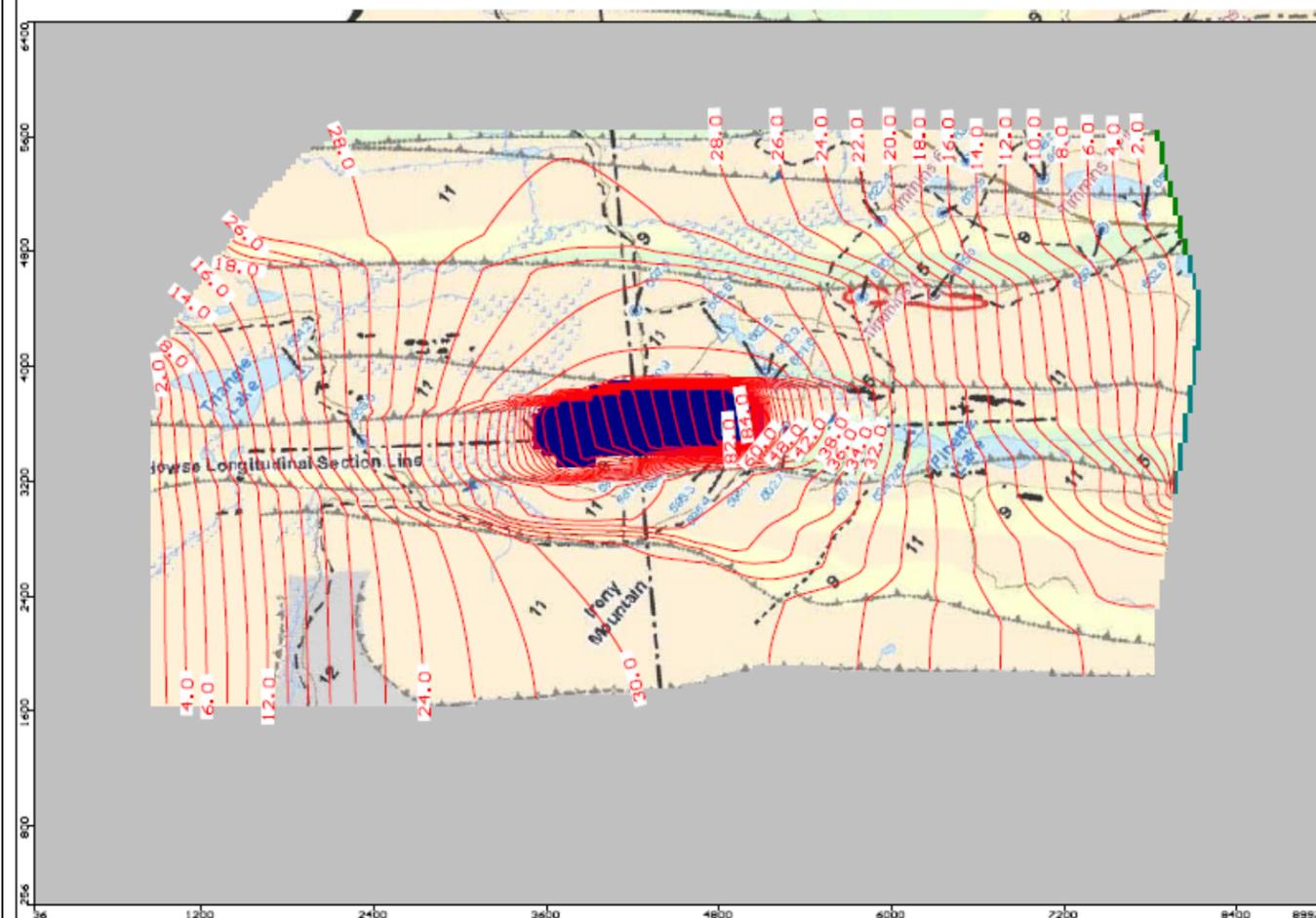
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



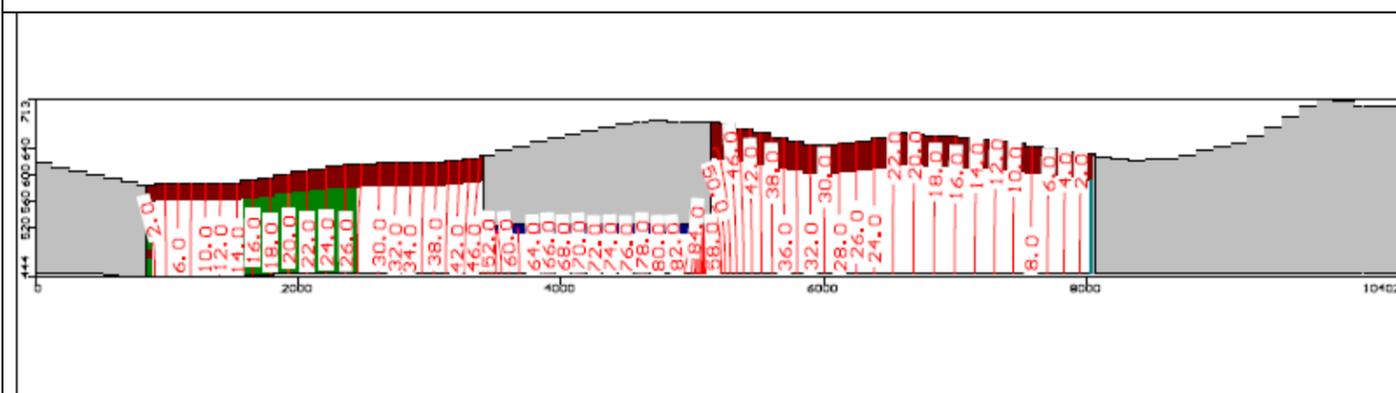
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



Groundwater Drawdown – 2 m drawdown isocontours



Groundwater Drawdown with 2 m drawdown isocontours - West-East Section



Sensitivity Analysis Results

1) **Case 1:** Increase Kxyz for the Sokoman (x2) and Overburden (x2) + Recharged doubled:

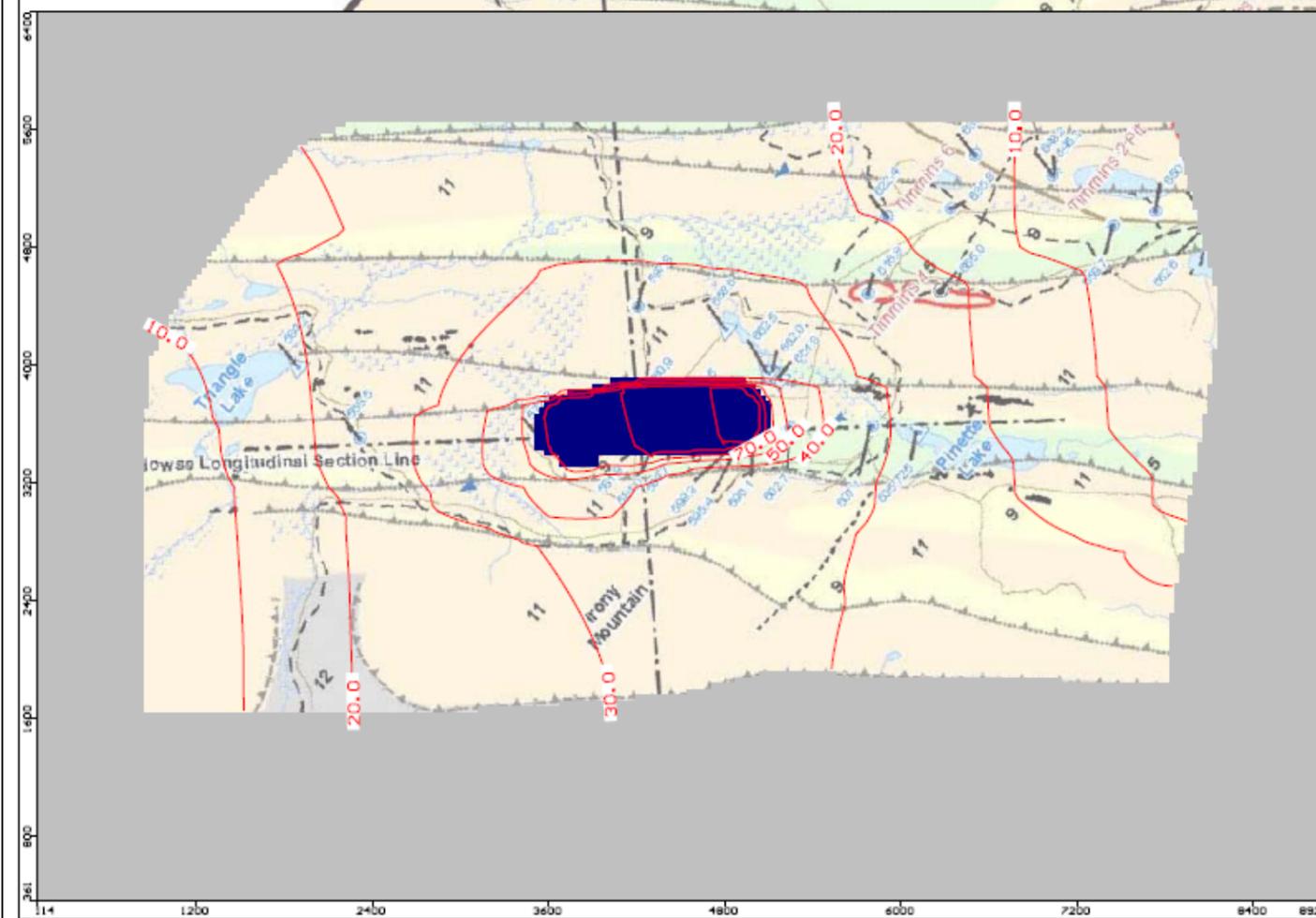
TableB1 Sensitivity analysis – Case 1

Zone	Kx (m/s)		Ky (m/s)		Kz (m/s)	
	Calibrated	Sensitivity analysis	Calibrated	Sensitivity analysis	Calibrated	Sensitivity analysis
Overburden	1,00E-05	2,00E-05	1,00E-05	2,00E-05	1,00E-05	2,00E-05
Sokoman	9,40E-06	1,88E-05	9,40E-06	1,88E-05	9,40E-06	1,88E-05
Wishart	8,00E-07	8,00E-07	8,00E-07	8,00E-07	8,00E-07	8,00E-07
Shale	1,00E-07	1,00E-07	1,00E-07	1,00E-07	1,00E-07	1,00E-07
Faults zones	2,60E-07	2,60E-07	2,60E-07	2,60E-07	2,60E-07	2,60E-07

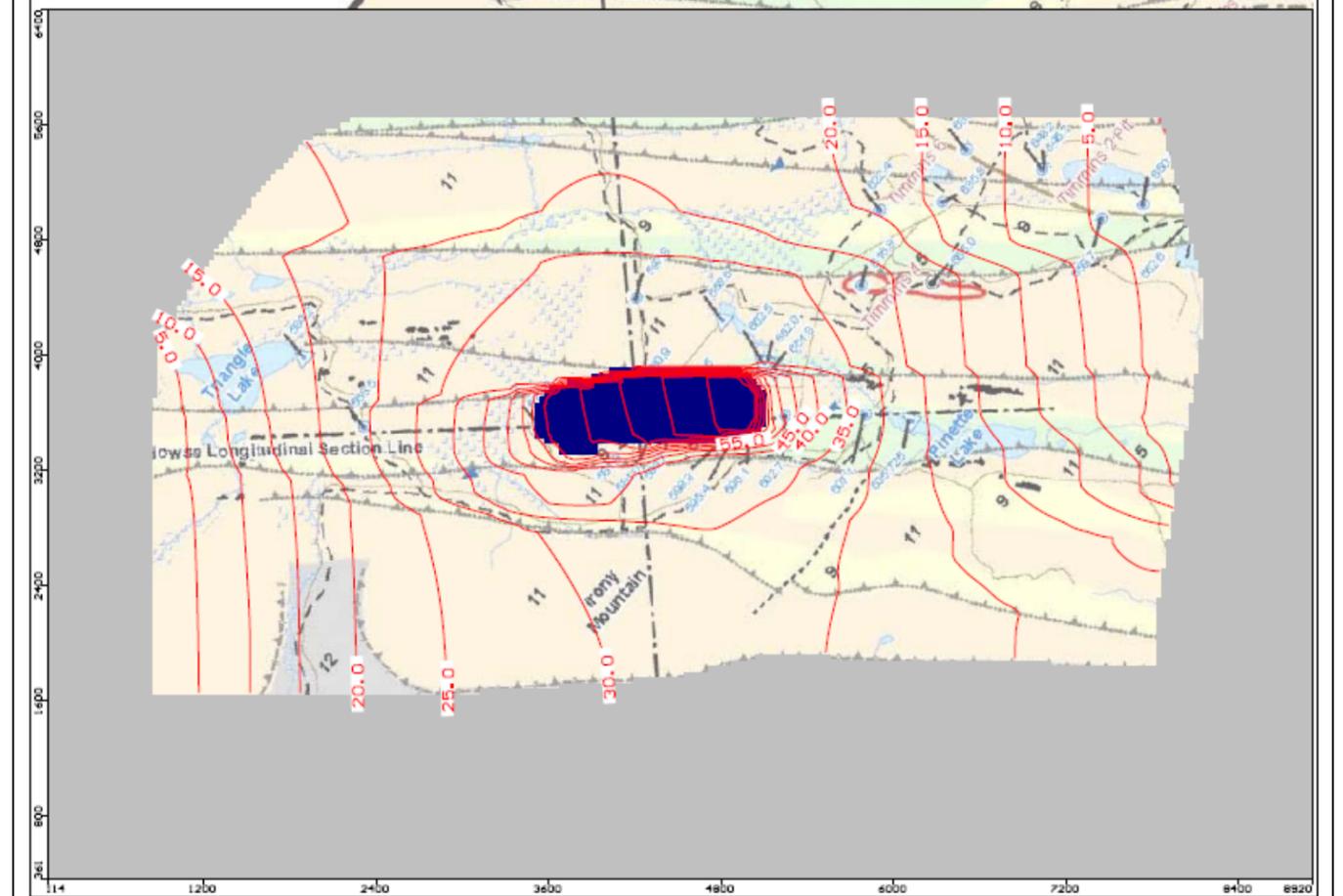
Recharge (mm/year)	Calibrated	Sensitivity analysis
R(1)	100	200

(Highlighted values were modified)

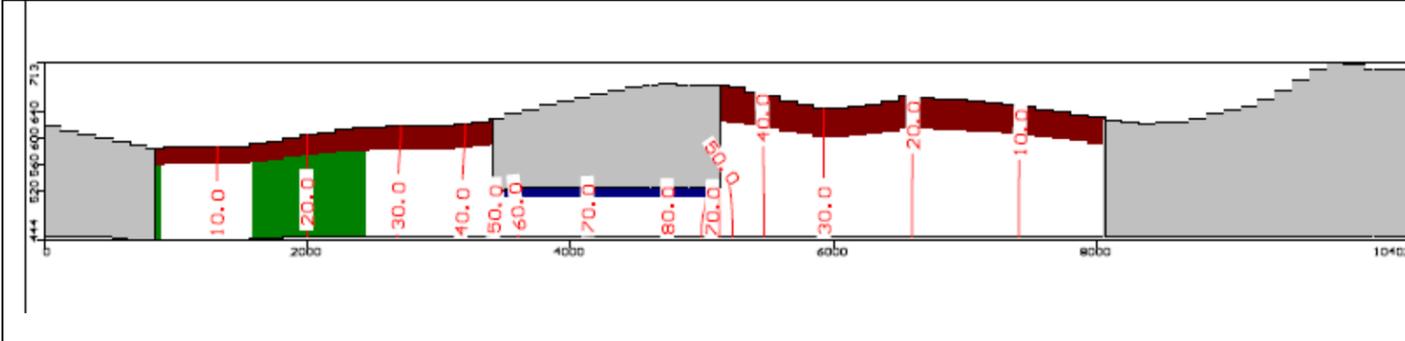
Groundwater Drawdown – 10 m drawdown isocontours



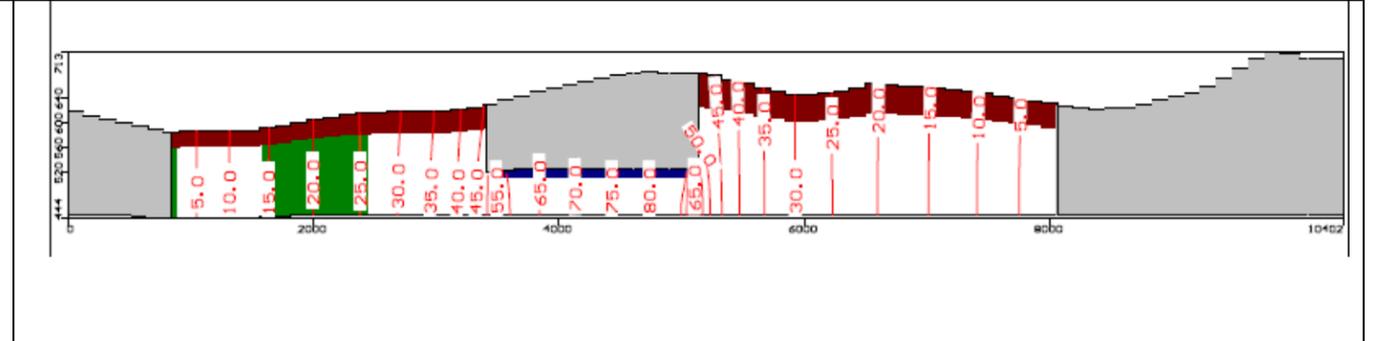
Groundwater Drawdown – 5 m drawdown isocontours



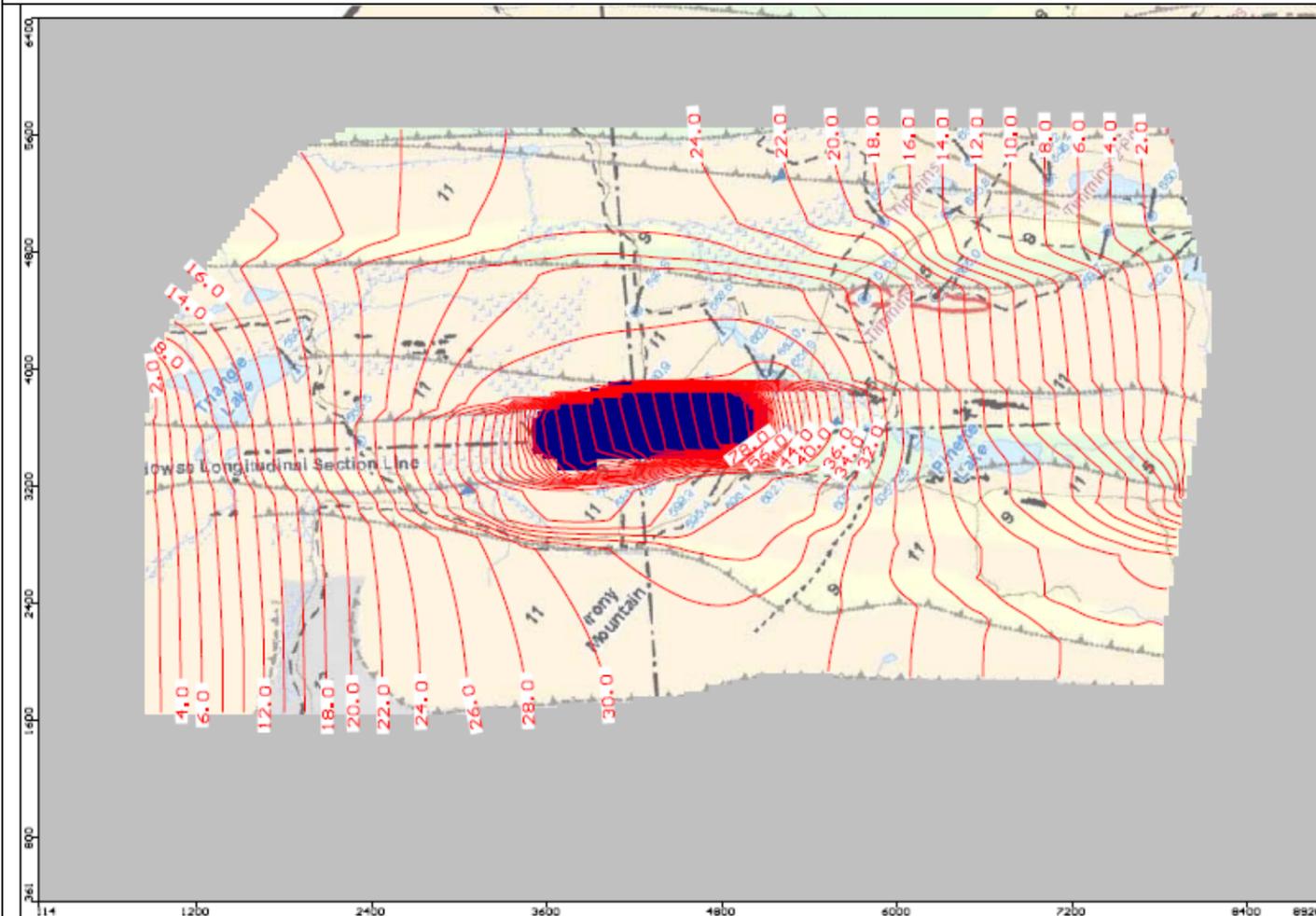
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



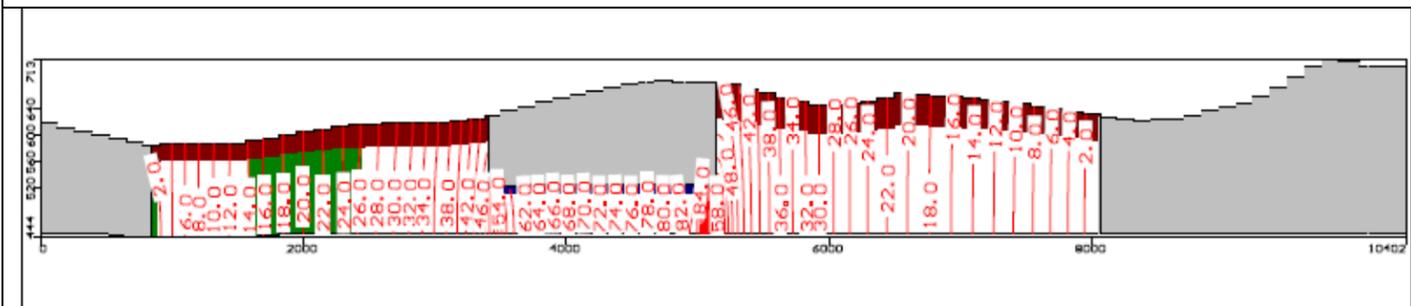
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



Groundwater Drawdown – 2 m drawdown isocontours



Groundwater Drawdown with 2 m drawdown isocontours - West-East Section



2) Case 2: Increase Kxyz of all formations (x2) + Recharged doubled:

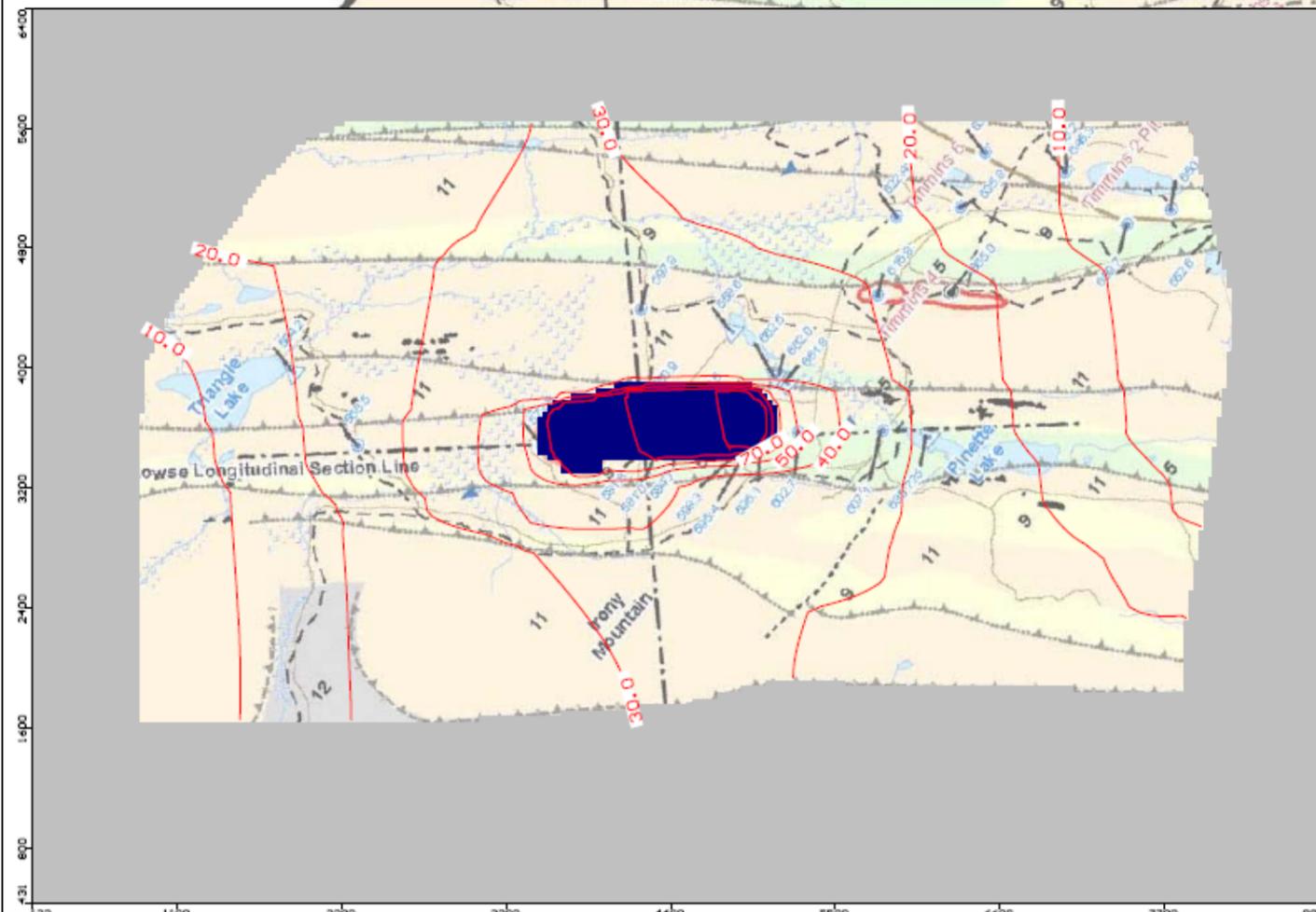
Table B2 Sensitivity analysis – Case 2

Zone	Kx (m/s)		Ky (m/s)		Kz (m/s)	
	Calibrated	Sensitivity analysis	Calibrated	Sensitivity analysis	Calibrated	Sensitivity analysis
Overburden	1,00E-05	2,00E-05	1,00E-05	2,00E-05	1,00E-05	2,00E-05
Sokoman	9,40E-06	1,88E-05	9,40E-06	1,88E-05	9,40E-06	1,88E-05
Wishart	8,00E-07	1,60E-06	8,00E-07	1,60E-06	8,00E-07	1,60E-06
Shale	1,00E-07	2,00E-07	1,00E-07	2,00E-07	1,00E-07	2,00E-07
Faults zones	2,60E-07	5,20E-07	2,60E-07	5,20E-07	2,60E-07	5,20E-07

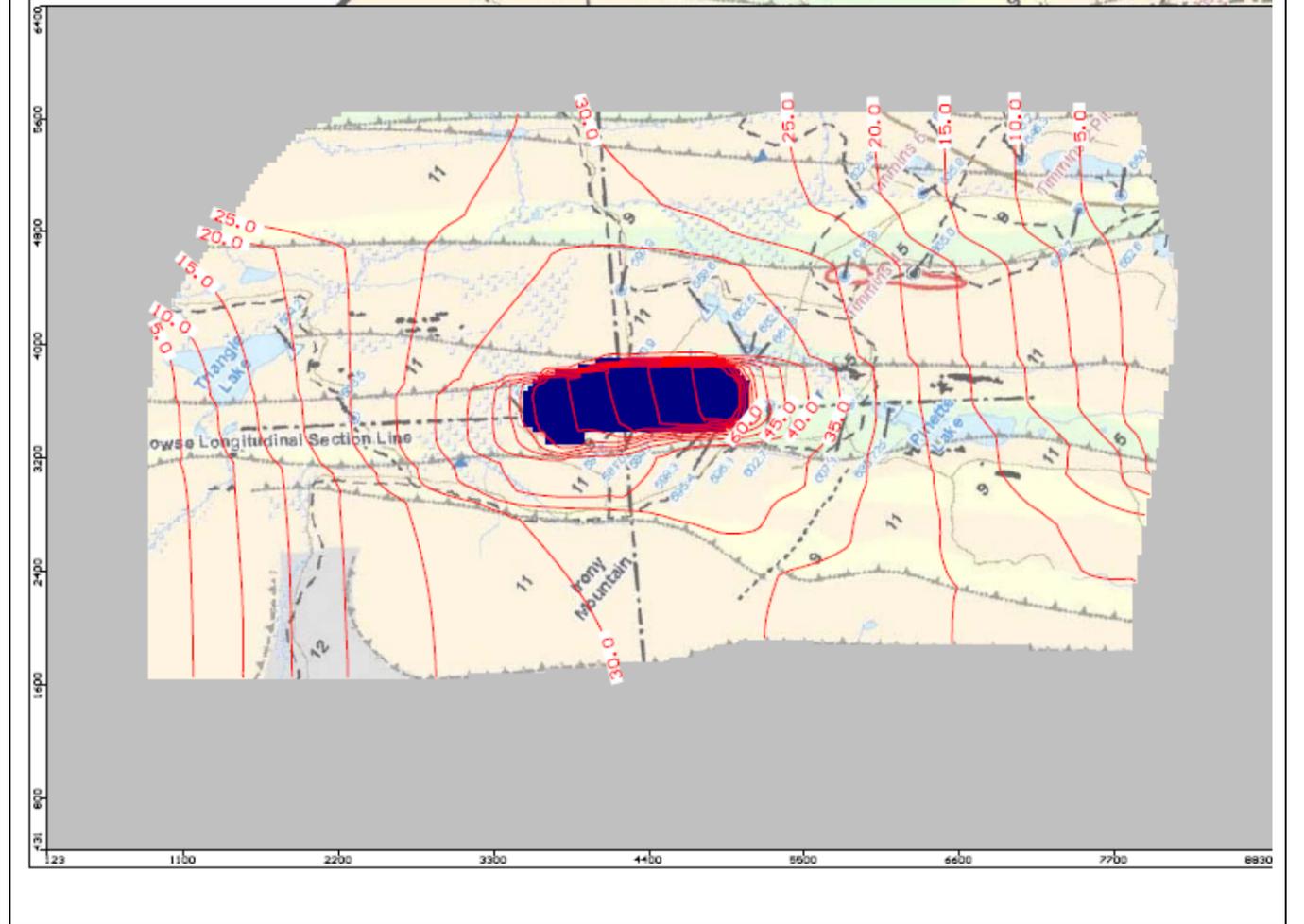
Recharge (mm/year)	Calibrated	Sensitivity analysis
R(1)	100	200

(Highlighted values were modified)

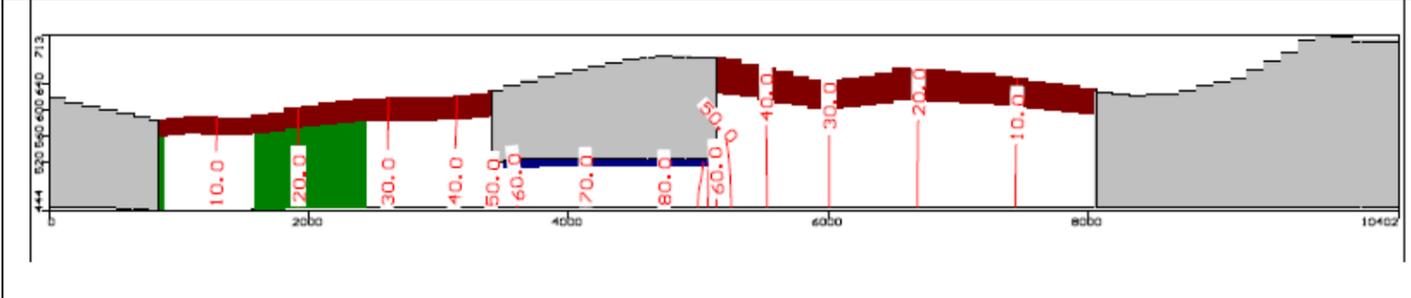
Groundwater Drawdown – 10 m drawdown isocontours



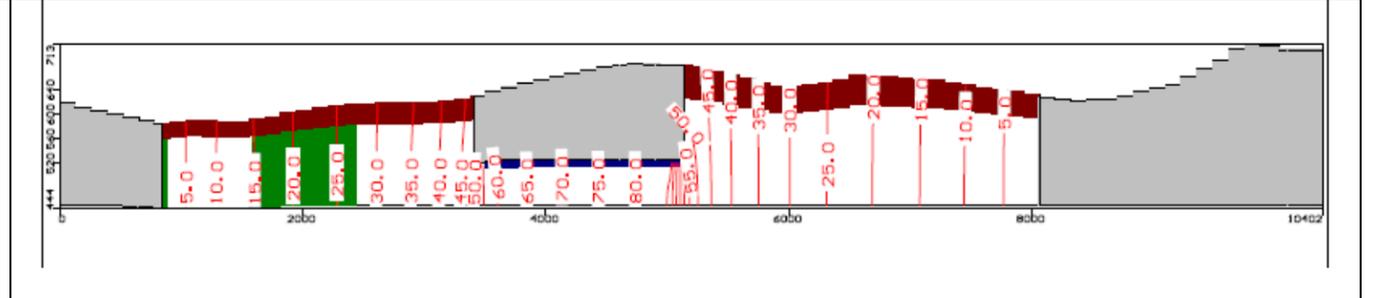
Groundwater Drawdown – 5 m drawdown isocontours



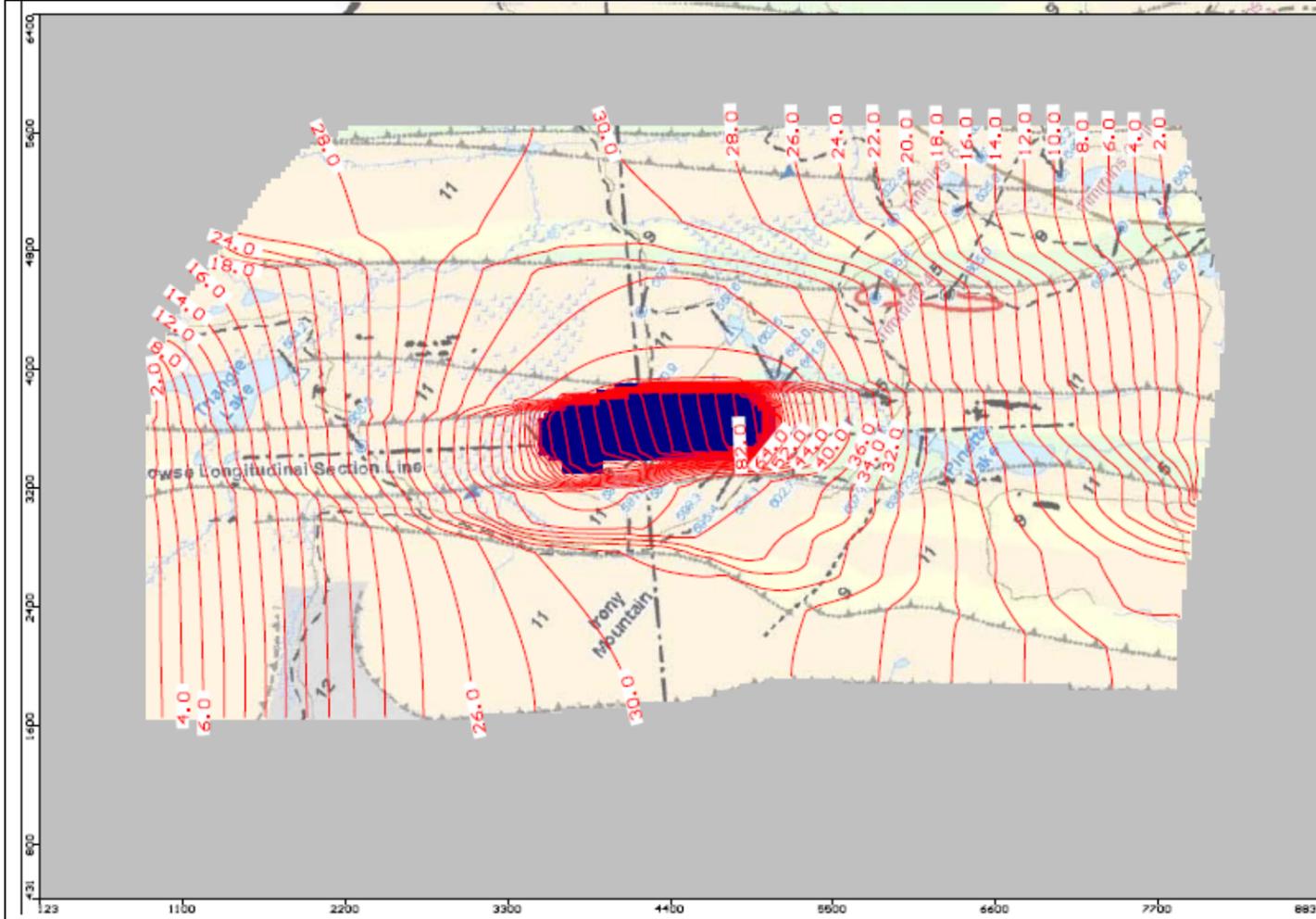
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



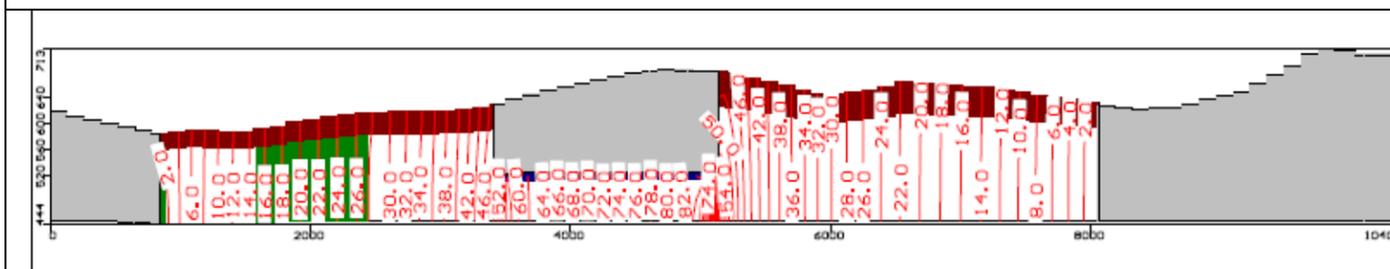
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



Groundwater Drawdown – 2 m drawdown isocontours



Groundwater Drawdown with 2 m drawdown isocontours - West-East Section



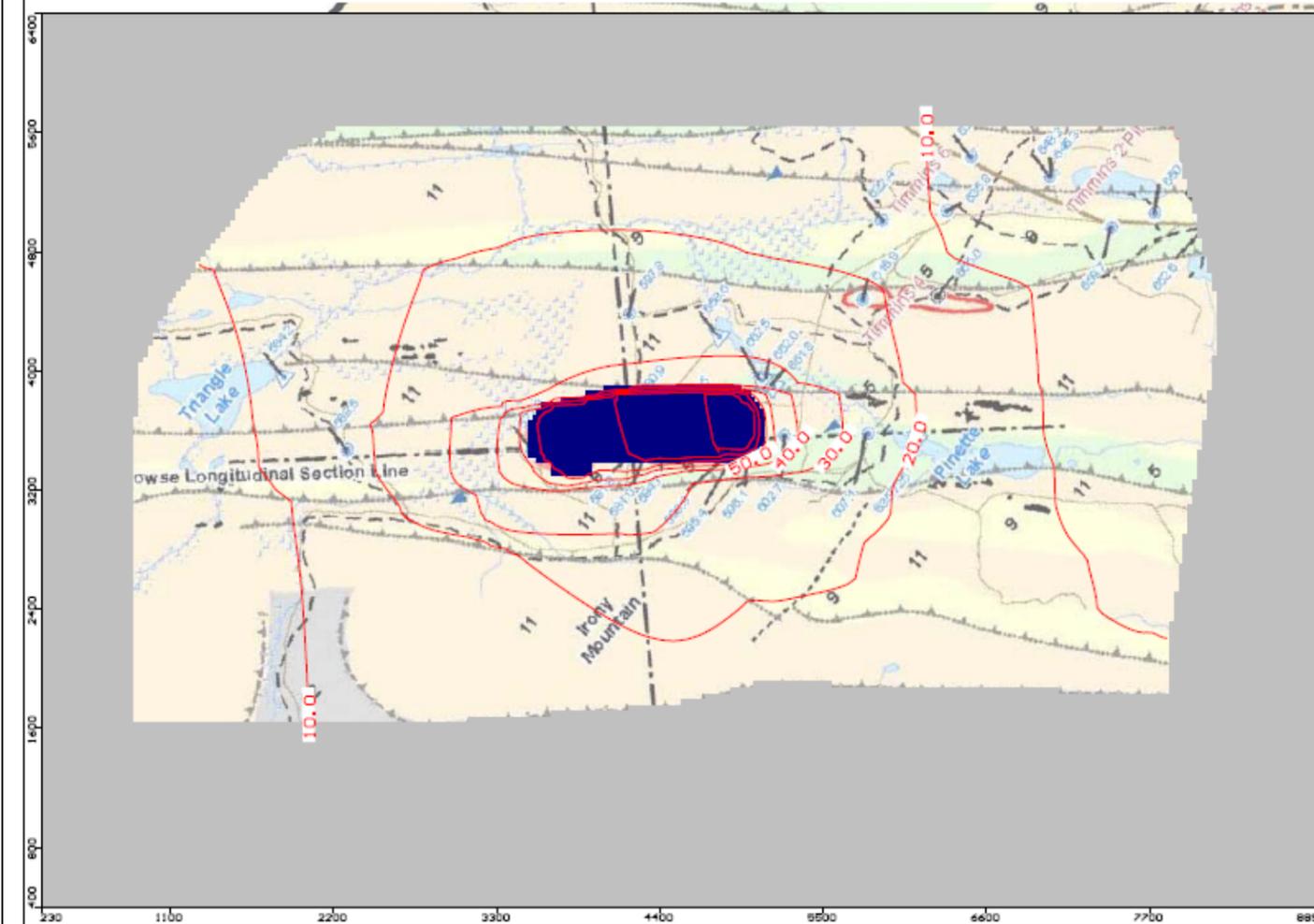
3) Case 3 Kxyz of initial calibration + Recharged doubled
Table B3 Sensitivity analysis – Case 3

Zone	Kx (m/s)		Ky (m/s)		Kz (m/s)	
	Calibrated	Sensitivity analysis	Calibrated	Sensitivity analysis	Calibrated	Sensitivity analysis
Overburden	1,00E-05	1,00E-05	1,00E-05	1,00E-05	1,00E-05	1,00E-05
Sokoman	9,40E-06	9,40E-06	9,40E-06	9,40E-06	9,40E-06	9,40E-06
Wishart	8,00E-07	8,00E-07	8,00E-07	8,00E-07	8,00E-07	8,00E-07
Shale	1,00E-07	1,00E-07	1,00E-07	1,00E-07	1,00E-07	1,00E-07
Faults zones	2,60E-07	2,60E-07	2,60E-07	2,60E-07	2,60E-07	2,60E-07

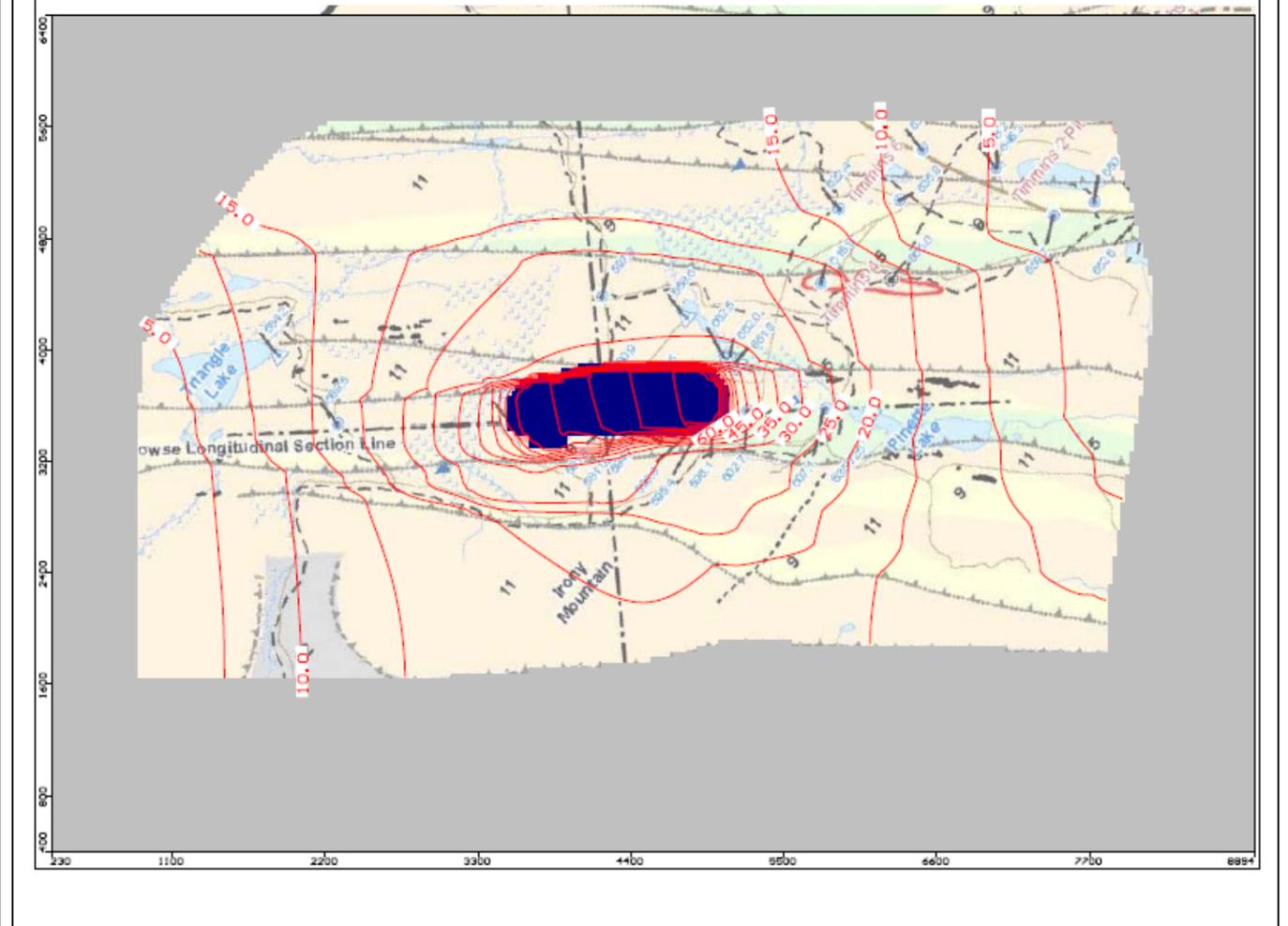
Recharge (mm/year)	Calibrated	Sensitivity analysis
R(1)	100	200

Highlighted values were modified)

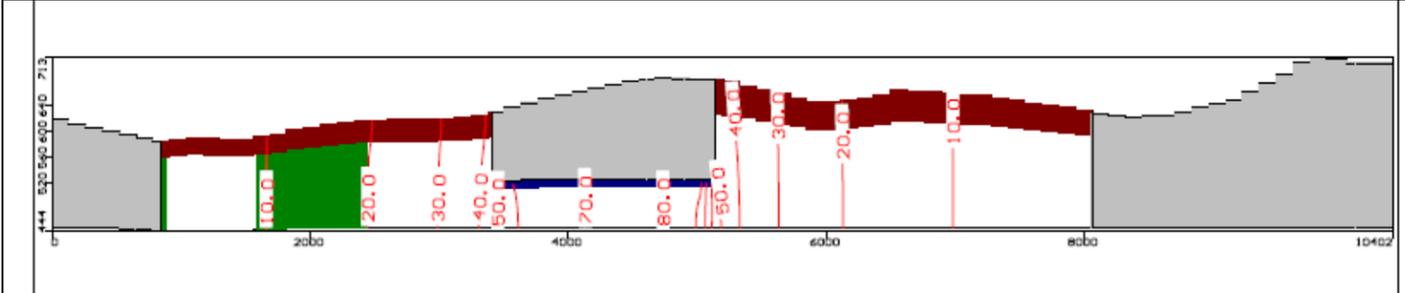
Groundwater Drawdown – 10 m drawdown isocontours



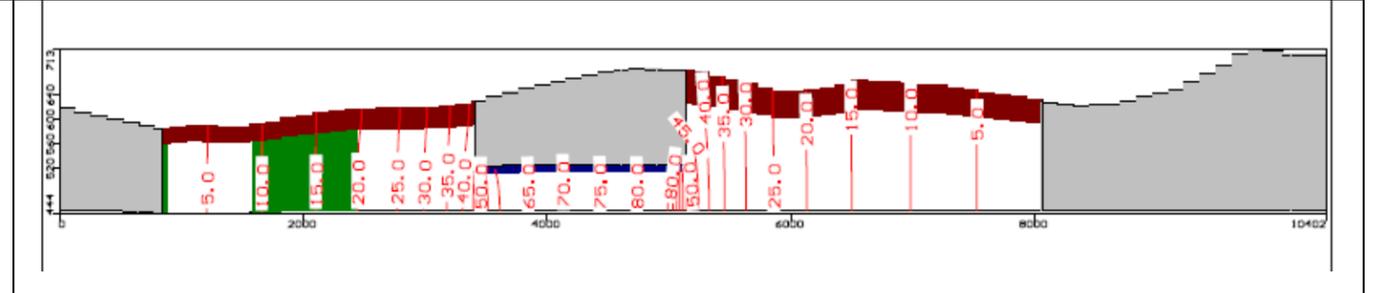
Groundwater Drawdown – 5 m drawdown isocontours



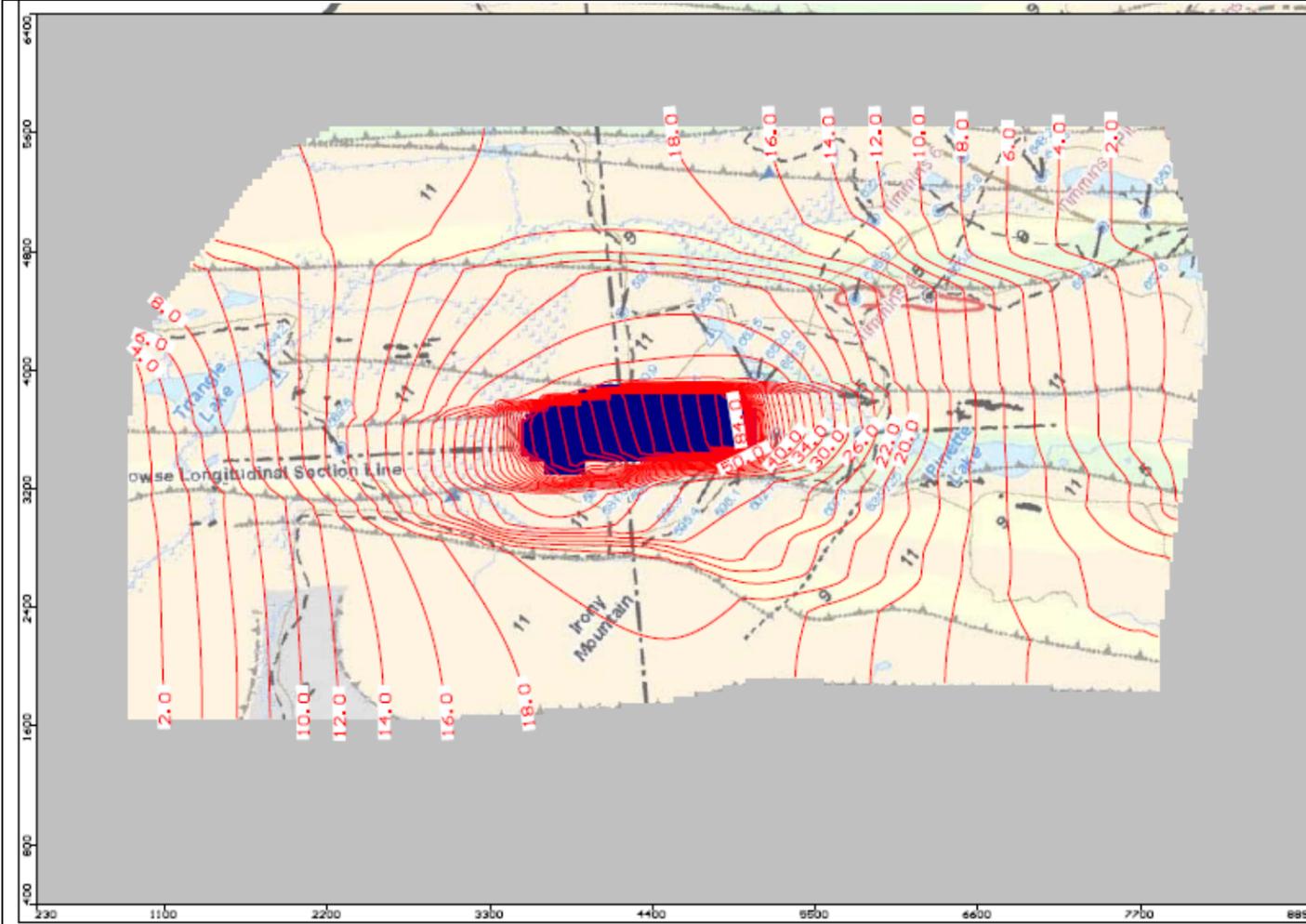
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



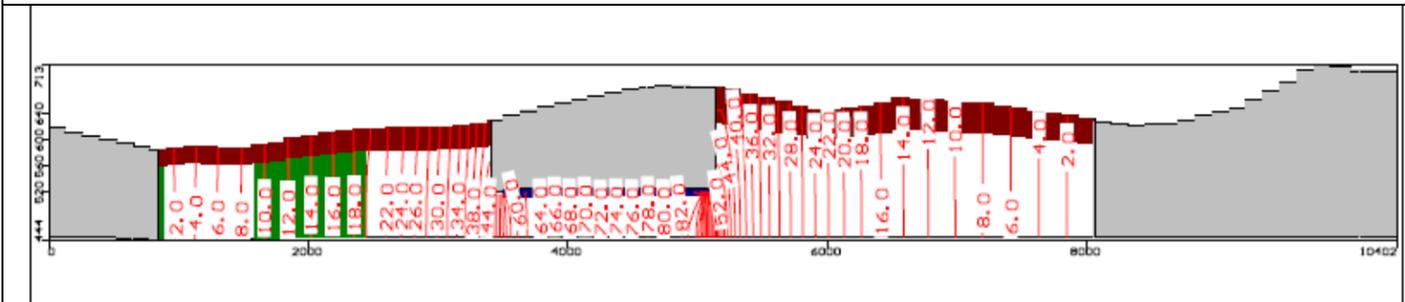
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



Groundwater Drawdown – 2 m drawdown isocontours



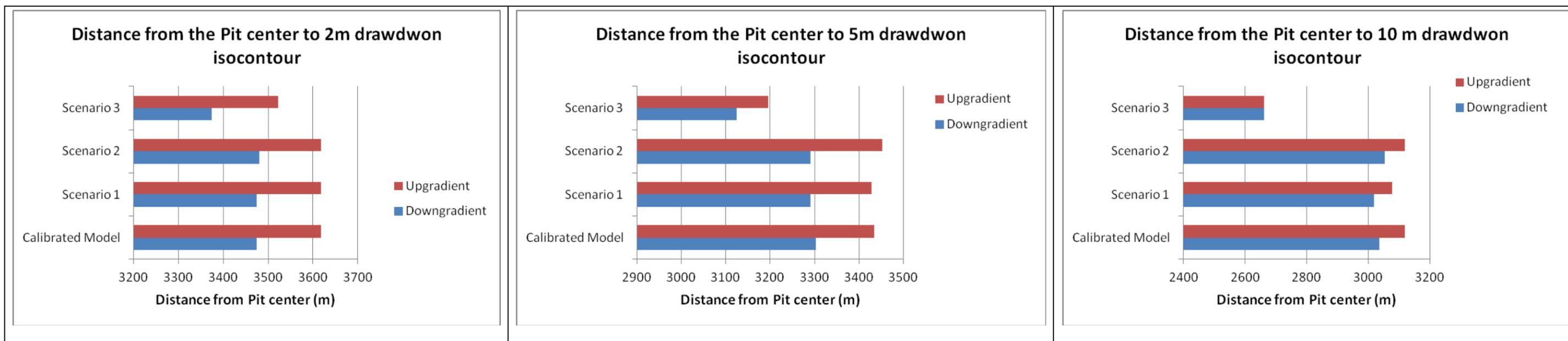
Groundwater Drawdown with 2 m drawdown isocontours - West-East Section



Model Results Summary

	Distance in meters from the center of the Pit to					
	2m isocontour drawdown		5m isocontour drawdown		10m isocontour drawdown	
	<i>Downgradient</i>	<i>Upgradient</i>	<i>Downgradient</i>	<i>Upgradient</i>	<i>Downgradient</i>	<i>Upgradient</i>
Calibrated Model	3475	3618	3303	3434	3036	3119
Scenario 1	3475	3618	3291	3428	3018	3077
Scenario 2	3481	3618	3291	3452	3053	3119
Scenario 3	3374	3523	3125	3196	2663	2663

Drawdown distances were measured in a cross-section parallel to faults zones (row 69 of the model)





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APPENDIX VI

TECHNICAL MEMORANDUM OF GOLDER ASSOCIATES

DATE February 28, 2014

REFERENCE No. 011-13-1221-0104 MTA Rev0

CONFIDENTIAL

TO Mr. Rodney Cooper
Labrador Iron Mines Ltd

CC Mr. Rabi Mohanty (TSMC), Normand D'Anjou (Golder)

FROM Pierre Fréchette

EMAIL pfrechette@golder.com

RE: HOWSE PIT HYDROGEOLOGICAL INVESTIGATION – SUMMARY OF FACTUAL DATA IN SUPPORT OF ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

Dear Mr. Cooper,

As per a request from Tata Steel (TSMC), Golder Associates is pleased to provide you with a summary of the hydrogeological data gathered during the course of the field investigation work conducted in November and December 2013.

Background

The 2013 drilling campaign started on November 14, 2013 and ended on December 17, 2013. During that period 6 boreholes were drilled:

- 3 boreholes drilled into bedrock with a reverse circulation (RC) drilling rig: HW-RC13-001, HW-RC13-002 and HW-RC13-003
- 2 boreholes drilled into bedrock with a diamond drilling (DD) drilling rig: HW-GT13-001 and HW-GT13-002
- 1 borehole drilled in overburden only with a DD rig: HW-BH-13-01

Groundwater levels were measured in the majority of these boreholes during or after drilling was completed as well as in seven existing boreholes present at the site. Permeability testing using a single packers set-up was conducted in the two diamond drill holes at various depths as the drilling progressed.

The current memorandum provides a summary of the factual hydrogeological data consisting of three main elements:

- i) Table 1: Groundwater Level Measurements
- ii) Table 2: Summary of Permeability Testing Results
- iii) Figure 1: Borehole Location Map

The following section presents the data and briefly discusses the limitations to the data.

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Factual Results

Groundwater Levels

The measured water levels are summarized in Table 1. It should be noted that in many cases for the boreholes drilled in 2013, the water levels were measured during or shortly after the end of drilling operations and thus they may not be entirely representative of the true static groundwater level.

For the water levels measured in the already existing boreholes, it could reasonably be assumed that equilibrium had been reached and that static conditions prevailed. On the other hand, since the condition of these boreholes is unknown, the provenance of the water in the boreholes could not be defined with certainty.

Hydraulic Conductivity Results

The values of hydraulic conductivity interpreted from the data of the packer tests, all conducted in bedrock, are summarized in Table 2. At each of the tested intervals, water was injected to conduct the permeability testing either in falling head mode (FHT) or in Constant Head mode (CHT) as appropriate.

It should be noted that polymers were used during drilling operation as the drilling company was concerned with the borehole stability. In spite of the efforts made to flush out these polymers from the tested intervals prior to testing, it is likely that residual presence of such polymers might have partly clogged the fractures in bedrock thus leading to an underestimation of the hydraulic conductivity. Also, the test interpretation method relies on an assessment of the position of the groundwater table which is inherently difficult to assess during diamond drilling operations.

Location Map

The attached Figure 1 shows the location, on a base map provided by TSMC, of the boreholes drilled in November and December 2013 as well as a few existing boreholes where Golder has measured groundwater levels.

It is to be noted that the borehole coordinates were established with a handheld GPS and are thus subject to a certain degree of uncertainty.

We trust the information provided herein meets your needs.

Best regards



Pierre Fréchette, Eng., M.Sc.
Project Director, Principal

PF/HT/kr

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Att.: Table 1 – Groundwater Level Measurements
Table 2 – Summary of Packer Test Results
Figure 1 – Location of Boreholes

Table 1 : Groundwater Level Measurements

Boreholes	Date	Handheld GPS Easting (m)	Handheld GPS Northing (m)	Database Coordinates Easting (m)	Database Coordinates Northing (m)	Borehole Depth (m)	Water Level Depth w/ir casing (m)	Casing Stick-up (m)	Water Level Depth (mbgs)	Notes
HW-RC13-001	17-nov-13	619764	6085682	619784	6085682	81.9	78.3	0.1	78.7	
	18-nov-13								97.0	2013-11-18: Rising water level during measurement (not static)
HW-RC13-002	21-nov-13	-	-	619736	6085637	161.5	-	-	65.9	2013-11-21: Water level measured when drilling was stand by
	22-nov-13								74.5	
	04-déc-13								75.7	
HW-RC13-003	05-déc-13	-	-	619757	6085658	180	-	-	77.7	2013-12-04/05: Water level measured when drilling was stand by
	08-déc-13								75.4	2013-12-08: Water level measured after lowering PVC tubing in borehole
HW-RC13-004C	09-déc-13	-	-	619125	6086146	162	-	-	58.6	2013-12-08/09: Water level measured after borehole cleaning
	10-déc-13								56.3 to 68.3	2013-12-10: Water level measured in PVC tubing
HW-1074 ¹	17-nov-13	619701	6085781	619685	6085801	94.4	88.3	1.1	87.2	
RC-HW003-2009	17-nov-13	619662	6085529	619683	6085527	90	89.1	0.8	88.3	
HW-1004CC	17-nov-13	619583	6085574	619590	6085578	>100	87.8	0.7	87.1	
HW-1008CC	19-nov-13	619328	6086124	619327	6086124	66	64.9	1.0	63.9	
HW-1018CC	19-nov-13	619092	6086323	619091	6086328	86.6	76.1	1.3	74.8	
HW-1030CC	20-nov-13	618722	6086595	618722	6086592	74.2	69.0	1.2	67.8	
HW-1022CC	20-nov-13	619018	6086241	619012	6086246	81.7	81.5	0.0	81.5	

Notes: All coordinates are in UTM Nord83 zone 19N. Collar not surveyed.

mbgs: meters below ground surface

1 : Uncertainty about the nomenclature of this existing borehole

Table 2 : Summary of Packer Test Results

Hole ID	Test	Hole information				Test date	Depth below ground surface (m)			Estimated K (m/s)	
		Azimuth	Dip	Collar Coordinates (m)			Inclined along hole axis		Vertical		
				Easting UTM NAD 83	Northing UTM NAD 83		Top (m)	Bottom (m)	Top	Bottom	
HW-GT13-001	1	43	66	619628	6085922	2013-11-27	100.1	122.8	91.4	112.2	1E-07
	2	43	66	619628	6085922	2013-11-30	143.1	149.1	130.7	136.2	2E-07
	3	43	66	619628	6085922	2013-12-01	167.1	174.8	152.7	159.7	4E-08
	4	43	66	619628	6085922	2013-12-02	173.1	201.8	158.1	184.4	5E-08
HW-GT13-002	1	238	66.3	619535	6085961	2013-12-08	98.8	116.8	90.5	106.9	2E-07
	2	238	66.3	619535	6085961	2013-12-08	109.3	116.8	100.0	106.9	6E-07
	3	238	66.3	619535	6085961	2013-12-09	115.3	140.8	105.5	128.9	1E-08
	4	238	66.3	619535	6085961	2013-12-10	139.3	161.8	127.5	148.2	3E-08
	5	238	66.3	619535	6085961	2013-12-11	160.6	179.6	147.1	164.5	4E-08
	6	238	66.3	619535	6085961	2013-12-12	178.3	200.8	163.2	183.9	6E-08
	7	238	66.3	619535	6085961	2013-12-12	97.2	200.8	89.0	183.9	4E-08

- LEGEND**
- HW-RC-13-001 REVERSE CIRCULATION BOREHOLE (GOLDER 2013)
 - HW-GT13-001 INCLINED ROCK DIAMOND DRILLHOLE (GOLDER 2013)
 - HW-BH-13-01 VERTICAL OVERBURDEN GEOTECHNICAL BOREHOLE (GOLDER 2013)
 - HW-1022CC EXISTING BOREHOLE (BY OTHERS)
 - TOPOGRAPHIC CONTOUR (m)
 - LAKE
 - WETLAND

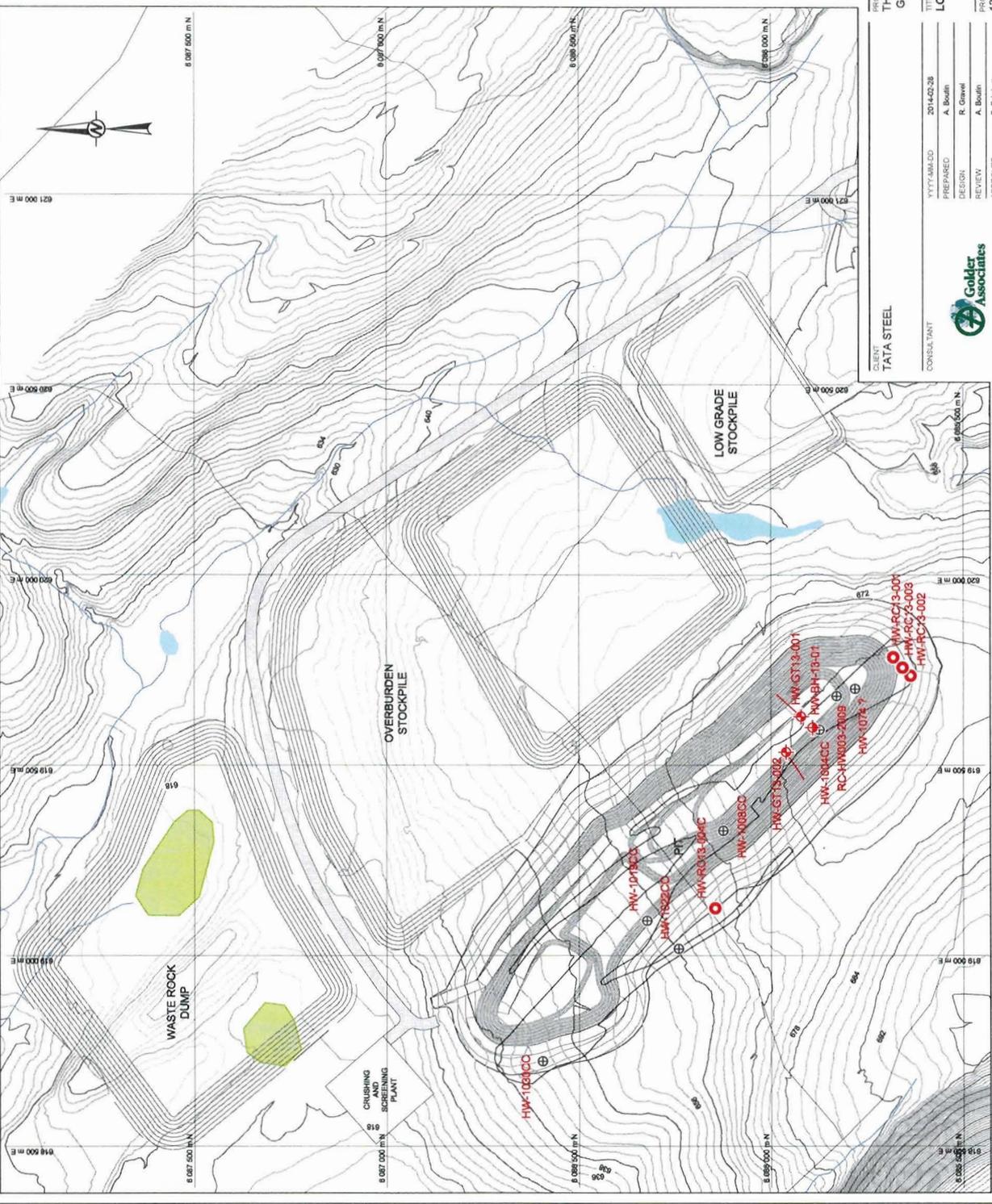
NOTES

COORDINATES SYSTEM: UTM AND 83_ZONE 19

REFERENCES

BASE PLAN PROVIDED BY TATA STEEL

CONFIDENTIAL



CLIENT	TATA STEEL
CONSULTANT	YITTYAMALDO
DATE	2014-02-28
PREPARED	A. Boudin
DESIGN	R. Girard
REVIEW	A. Boudin
APPROVED	P. Fichelle

PROJECT	THE HOWSE PIT GEOTECHNICAL AND HYDROGEOLOGY STUDY
TITLE	LOCATION OF BOREHOLES
PROJECT NO.	13-1221-0104
PHASE	1200
REV.	0
FIGURE	1



STUDY ON LAND AND RESOURCE USE BY THE INNU AND NASKAPI

HOWSE PROPERTY IRON ORE PROJECT

HOWSE MINERALS LIMITED

BY RAPHAEL PICARD

DECEMBER 2014

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1 INTRODUCTION

This study complies with the guidelines of the Canadian Environmental Assessment Agency (CEAA) for an environmental and social impact statement on the HOWSE Project iron ore deposit, which is located on the mineral properties of Howse Minerals Limited (HML) in Labrador. This study addresses the Proponent's obligation to integrate traditional knowledge into its analysis of social and environmental effects by collecting information and data on the use of land and resources in the study area. In addition, the study includes concerns voiced by land users regarding the construction of infrastructure and facilities and the use of the site's industrial operations in the interest of collecting information on the use of the study area and its resources.

The Project affects three groups in particular, namely the MATIMEKUSH–LAC JOHN, UASHAT MAK MANI-UTENAM and KAWAWACHIKAMACH First Nations, who are the primary holders of Aboriginal and treaty rights in the Howse Project study area. We have divided the main parts of this analysis according to the two nations, the Innu and the Naskapi. There is a sensitive area called KAUTEITNAT at the edge of the project area that is of particular interest to these groups.

A traditional knowledge approach requires the participation and collaboration of Aboriginal users in their capacity as providers of key information and observers influenced by their apprehension and their understanding of the mining project. Consequently, direct interviews with these informants are an essential element of our research methodology.

The current study is a necessary complement to the environmental impact statement and constitutes the primary source of knowledge about natural and cultural heritage, as well as the use of the project area and its resources for traditional purposes (ACEE, 2014) and the potential repercussions on the three groups involved.

1.1 PROJECT DESCRIPTION

HML plans to develop the iron ore deposit at the Howse Project. The deposit is located in Labrador, between Irony Mountain (Kauteitnat), Pinette Lake and Phase 1 of TSMC's Direct Shipping Ore (DSO) project (Figure 1). The Howse Project is located 25 km northwest of Schefferville, Quebec. The mine is centred at coordinates 67°8'19.07"W, 54°54'31.18"N; the property's mineral rights are registered to Labrador Iron Mines (LIM) (49%) and HML (51%) in the form of two mining concessions, 021314M and 021315M, which replace concession 0201430M (Figure 1).

The Proponent believes that mining can begin shortly, as the Project does not require many new installations and some of the necessary infrastructure is already available (e.g., railway tracks, access road, camp, mining equipment and explosives storage area) near TSMC'S Phase 1 complex, which is currently under construction for the DSO project. The Howse Mining Project was not part of TSMC'S initial plans, but had been part of LIM's plans (LIM, 2009). Due to a delay in the construction of the DSO project (haul road toward Project 2a – DSO 4, Goodwood and

Sunny deposits – and Project 2b – DSO 4 Kivivic deposits), TSMC reached an agreement with LIM, allowing it to mine the Howse deposit in order to maintain its annual production.

FACILITIES AND INFRASTRUCTURE REQUIRED TO MINE THE HOWSE DEPOSIT

Open pit mine: surface area of approximately 72 ha with a maximum depth of 160 m. The annual production capacity of raw ore is expected to be 1.3 million tonnes (Mt) for the first year and 2.2 Mt per year until the end of the mine's service life in 2027. Maximum production is expected to be 10,000 tonnes per day, which should be reached in 2017.

Stockpiles: surface areas of approximately 66 ha for the overburden and 4 ha for topsoil. Stockpiles will be surrounded by drainage ditches linked to a sedimentation pond.

Waste rock dumps: surface area of approximately 67 ha. The dumps will be surrounded by drainage ditches linked to a sedimentation pond.

Crushing and screening facility: surface area of approximately 3 ha. Powered by generators, this facility will be built on a platform that will be 100 m wide by about 150 m long.

Access and haul road: the existing road built by the Iron Ore Company of Canada (IOCC) for former mining activities will be used (1.3 km) and an additional 2.0 km will be constructed to link the Howse Project to the current road network of TSMC'S DSO project. This road will be used by mining trucks and light vehicles.

Water management facilities: peripheral wells will be installed on the mine's perimeter to lower the water table below the level of the pit. Whenever necessary, dewatering will be carried out using diesel-powered pumps. Water from rainfall and melted snow will be collected in drainage ditches and sent to a sedimentation pond before being released into the environment.

1.2 STUDY OBJECTIVES AND CONSTRAINTS

Overall, the study will:

- 1) Identify current and past parameters relating to the land and use of the study area and its resources by the two Innu groups (Matimekush–Lac John and Uashat mak Mani-Utenam) and the Kawawachikamach group.
- 2) Compile a range of data on aspects such as toponymy, ecology, hunting and fishing, as they are named and assessed by the groups.
AND FINALLY,
- 3) Understand the concerns of Innu and Naskapi users with respect to the components of the Howse Project and their potential effects on traditional activities and community life.

Certain limitations or constraints became apparent when conducting this study. The most important of these is the Project's location, which is an area with several other former or current mining projects. This leads to confusion between the cumulative effects and the specific effects expected to result from the Howse Project. The impact of earlier projects is currently being considered with respect to the Howse Project and gives rise to the same concerns for the stakeholders we met with.

The other constraint applies to traditional activities practiced by elder informants who do not go to the study area frequently, but have perceptual knowledge of its current use and can share their prior knowledge of the area, which spans several decades. These elders recommended that we meet with younger users of the study area as they are more active there.

The segmentation of user groups into three categories (trapline holders, those affected by projects effects on a daily basis and the Naskapi who hold treaty rights) makes it very difficult to standardize the interviews into a single, uniform user profile and to draw different conclusions than those reached by previous studies conducted for other projects. Each user segment has its own interests: the people of Matimekush–Lac John claim that mining project effects affect their daily lives: those from Uashat mak Mani-Utenam are concerned about their traplines and the Naskapi worry about the joining of government-regulated interests with the non-government regulated lands of Labrador.

A number of studies (two Aboriginal traditional knowledge (ATK) studies linked to two impact statements) have been conducted in recent years and, although in high demand, ended up indicating similar concerns in the same areas. Stakeholder fatigue has proved to be a significant constraint. The length of the interviews, considering the amount of information being sought, also proved problematic, undoubtedly due to limited time and available manpower.

2 METHODOLOGY

2.1 STUDY AREA

The study area was designed to cover some of the Project's peripheral areas in order to identify lands and water bodies used by the Innu and Naskapi. It includes some of the facilities and infrastructure from TSMC's DSO-Phase 1 complex and the Timmins pits, as well as a series of lakes: Lac des Neiges, Morley Lake, Goodream Lake, Triangle Lake, Curlingstone Lake, Lone Lake, Burnetta Lake, Rosemary Lake, Elross Lake and a section of the Howells River shoreline. These water bodies surround Irony Mountain in all directions. The study area includes several trails that provide direct access to the numerous land use sites. Two traplines (207 and 211) from the Saguenay beaver reserve are within the limits of the study area, and their owners are from Uashat mak Mani-Utenam (Figure 2).

2.2 ABORIGINAL TRADITIONAL KNOWLEDGE (ATK)

ATK is defined as: "knowledge that is held by, and unique to, Aboriginal peoples. [It] is a body of knowledge built up by a group of people through generations of living in close contact with nature. ATK is cumulative and dynamic. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual and political change. [ATK] must be understood to form a part of a larger body of knowledge which encompasses knowledge about cultural, environmental, economic, political and spiritual inter-relationships" (ACEE, 2012). The term ETK

(Ecological Traditional Knowledge) refers to an ATK subset which is “the sum of the ideas and conceptions that Aboriginals possess about their natural habitat¹” (Pouliot, 2014), meaning that it analyzes various aspects of the environment. In this case, ATK is an essential component in the analysis of the potential environmental effects of the Howse Project.

In addition, “ATK is a cumulative body of knowledge, know-how, practices and portrayals maintained and developed by a people whose history is interlinked with the natural environment” (Pouliot, 2014). ATK thus requires participation from the holders of such traditional knowledge. This is why it was necessary to conduct direct interviews with ATK holders.

2.3 IDENTIFICATION OF INFORMANTS

The informant selection process was achieved with the collaboration of Mr. David André of Matimekush–Lac John and Mr. George Guanish of Kawawachikamach. In the case of Uashat, the process was facilitated by Mr. André Michel. The selected informants were split into several subgroups. It should be noted that few women were able to take part in the interviews.

- Matimekush–Lac John
 - Six elders
 - Six young users
- Kawawachikamach
 - Two elders (including a woman)
 - Three young users
- Uashat mak Mani-Utenam
 - Two groups of families who hold traplines 207 (one woman was present) and 211 (two women were present)

All of the interviews were conducted in the meeting rooms of each community’s band council. Only one meeting took place in a Mani-Utenam residence (trapline 207).

2.4 DATA COLLECTION TOOLS

2.4.1 Interview Planning

One of the key tasks was to create a questionnaire that took the study objectives into account. We used the sample questionnaire in Clément’s study (2009 I, 2009 II) for TSMC’s DSO project and adapted it to this study’s requirements (Appendix 1).

The questionnaire considered the following items:

- Names of important areas and sites (toponyms)
- General use of lands and camps
- Annual cycle of activities (species harvested, length of outings, transportation)

¹ All of the quotations written in a language other than English were translated.

- Revenues from activities and land use costs
- Other users
- Wildlife (mammals, fish, birds, etc.)
- Flora
- Kauteitnat
- Potential effects of the Project on the use of the land and its resources

As previously mentioned, in light of the length of the meetings and the number of informants present, it was not possible to discuss each item in detail. The following report is therefore limited to the information collected during these interviews. Furthermore, as mentioned below, for the last five years, mining operations have been taking place in the study area, which is primarily used as a passageway to other locations. As a result, some informants simply did not answer some of our questions about the study area in particular because they do not linger there. This is not due to a lack of interest for the study area, but because there was some redundancy in the consultation process.

Moreover, an interview consent form was signed by each of the elder informants from Matimekush–Lac John and Kawawachikamach to meet the ethical requirements of our study and to prove that their decision to take part in the interview process was free and informed. However, the form was not signed by young users and Uashat mak Mani-Utenam informants (Appendix 2). As a result, the names of the informants were kept anonymous in the following report.

2.4.2 Documentary Research

Over the years, multiple investigations and studies have been carried out in the Schefferville area. Many of them focused on the same subject, used the same methodological approach and reached specific conclusions relating to their particular issues.

- Government guidelines on impact statements for mining projects:

All of the Project's narrative reports proved useful in understanding the scope and scale of construction and development in the study area. The CEEA guidelines (ACEE, 2014) for an impact statement provided the regulatory framework and the ATK consideration requirements for the impact statement process. References to the conclusions of previous project impact studies, notably for the New Millennium Iron (NML) DSO project, revealed the Canadian Government's growing concern for the place of Aboriginals in the assessment process.

- Land use studies for impact statement purposes:

The "legendary" reference for the systematic evaluation of traditional land use was produced by Richard Laforest under the guidance of the Atikamekw and Montagnais Council; it is entitled *Recherche sur l'occupation et l'utilisation du territoire de Schefferville* (1983) and has always remained confidential. No equivalent study has been conducted

since. Recent ATK studies on the history of Matimekush–Lac John land use were largely inspired by it, using the ethnography, toponymy and geopolitical parameters from the 1983 study and integrating them into their land use reports and impact statements. Here we are talking about the two land use studies conducted by Daniel Clément for the New Millennium DSO 1 and 2 project impact statements (January and December 2009).

A confidential land use study of family traplines was also conducted in 1998 for the Innu Takuaikan Uashat mak Mani-Utenam (ITUM). While it could prove extremely useful to land relations between the Matimekush–Lac John and Uashat mak Mani-Utenam groups, special permission is required to examine it and we were unable to access it.

With respect to the Naskapi, Allan Cooke's historical study (1976) focuses on the great Naskapi migrations in northern Quebec until their definitive settlement in Schefferville, during the 1950s. In addition, Michael H. Weiler (January and December 2009) carried out two land use studies on the Naskapi for the same NML DSO 1 and 2 projects for which Clément conducted his own studies, as previously mentioned. These studies are of interest because they describe three land use surveys covering three different periods: 1983, 1993 and 2006.

Special Research Studies on Toponyms

The works of St-Onge (1979) and Paré (1990) relating to toponymy studies on the Schefferville Innu and Naskapi, respectively, were briefly reviewed. Moreover, Laforest's 1983 research on land use contains an unpublished list of regional toponyms, as does the 1998 ITUM family trapline study.

2.4.3 Interviews and Participatory Mapping

- The first interview sessions were carried out in Matimekush on September 25 and in Kawawachikamach on September 26, 2014. We used **focus groups or discussion groups** in both cases. The groups were composed of elders from the two communities who had access to a topographic map (scale of 1:50,000) of the study area. A presentation of the Project and the main issues took place prior to the discussions. The sequence of the meetings was as follows: analysis of the area and understanding of the study, identification of the main toponyms and camp locations, travel routes and means of transportation, activity cycles, area resources, importance of Kauteitnat, current and past project activity constraints, and future effects of the Howse Project. Note-taking was the means used to document the conversations with translation of Innu and Naskapi into English and French and of map data. The group interviews were driven by direct participation for the identification of areas, roads, water bodies and information relevant to project constraints on the map of the study area.
- The second interview sessions took place during the last week of October in Matimekush–Lac John and Kawawachikamach and involved discussion groups composed of young Innu and Naskapi users. The interview process was nearly identical to the one used for

the elders, but the results were slightly different. The discussions with young users had been suggested by the group of elders.

- The interviews with the holders of traplines 207 and 211 were conducted individually (with each family) and followed the same approach and the same sequence of questions. The information was documented with written notes and on the same map of the study area as the one used during the meetings with the other groups. These interviews took place at Uashat mak Mani-Utenam during the first week of November 2014.

2.5 DATA ANALYSIS

The process of gathering ATK data from the three groups on the impact of the Howse Project on their traditional activities encountered a number of information biases caused by past or ongoing mining projects, notably the DSO and IOCC projects. Several of the comments were made spontaneously by our informants and focused on the current and cumulative damages and effects of these projects. We tried to find a way to analyze the effects of the other projects in their context and thus make it possible to assess the true potential effects of the Howse Project in its own unique context.

The following approach allowed for an appropriate assessment of the extent of the data collected to meet the initial objectives:

- Structuring the factual data from the last five years on the use of the study area for traditional activity purposes by identifying the outings, camp sites and resources harvested during the outing;
- Documenting any and all information about Kauteitnat;
- Identifying the cumulative effects of other projects that have constrained traditional activities to date (roads, dust, infrastructure, etc.) on the periphery of the study area and on resources;
- Identifying user concerns with respect to the Howse Project and their questions about mitigation measures.

An overall analysis was carried out by compiling data from the two discussion groups held with the elders, the two discussion groups held with the younger representatives and the meetings with the two trapline holders in relation to the main items depending on the type of questionnaire (land use data, Kauteitnat, cumulative effects, impact of the Howse Project). The participatory mapping information facilitated the grouping of land use and other data on the study area. The information on cumulative effects and the impact of the Howse Project was grouped according to the results of the interview sessions.

3 HISTORY OF LAND USE IN THE STUDY AREA

3.1 HISTORIC PERIOD

According to Laforest (1983) and Clément (2009), **the first proof of land use** in the Quebec/Labrador peninsula and south-central region (Schefferville) dates back to 7000 BP and the first contacts. A number of populations were leaving maritime areas (end of the Maritime Archaic tradition, 3000 BP and the first contacts) and migrating inland via watersheds. The purpose of these migrations was to hunt caribou and fish at certain times of the year, before returning to the coast. The tradition of moving inland and returning to the coast began during this period, known as the Shield Archaic period, and was transmitted over time. These populations are the ancestors of the Montagnais-Naskapi (Laforest, 1983). Up until the first contacts, the region's use had improved on the economic, technological and spatial organization levels.

The first contacts with European groups took place in the late 15th century and the early 16th century when they reached the main Quebec-Labrador entry routes. Norman, Breton and Basque fishermen were therefore present on the St. Lawrence River at that time. As part of an effort to find a route to India, explorers reached Labrador or Newfoundland (Caboto, Gaspard Corte-Real and Jacques Cartier). Further expeditions were organized and revealed the potential for fur destined for the European market: Frobisher for Baffin Island and the Hudson Strait, Henry Hudson for Ungava Bay and the Labrador coast. Other explorers also established contacts with Amerindian groups to facilitate the acquisition of pelts. These Amerindians would play a role in the relations between European merchants and fur producers from inland areas (Laforest, 1983) and it was at that time that the trading post at Tadoussac was created. (Figure 3).

The colonization of land that occurred in the 17th and 18th centuries was caused by fierce competition between merchants involved in the fur trade (Clément: 2009). The Council of Québec created the Tadoussac Trade or King's Domain (*Domaine du Roi*), which extended from Murray Bay to Cap du Cormoran, including inlands up to the watershed delineation. This competition took place between tenants of the King's lands and the Hudson's Bay Company. Numerous trading posts were thus created both inland and on the coast, the most well-known being the *Seigneurie de l'Isle aux Oeufs* and *Seigneurie Mingan*, which developed outposts in Sept-Îles, Moisie and Mingan. Hamilton Inlet also proved highly important for relations with the area's Amerindians and its numerous concessions, which included the *Lac des Naskapis* (Ashuanipi Lake), Winokapau, North West and Fort Nascope trading posts. The Hudson's Bay Company managed Rupert's Land, with trading posts in Neoskweskau and Nemiscau (Laforest, 1983). This network of sites led to the migration of Amerindians toward the south-central region, where they became the main fur suppliers (Figure 4).

According to the first writings of missionaries and approximate interpretations by chroniclers of the period, the following seven **Amerindian populations migrated toward the south-central region (in the 17th and 18th centuries)** and were spread out between the coast and the region's inland areas:

- The **Montagnais** between Québec and Tadoussac;
- The Montagnais and the **Papinachois** around Betsiamites;
- The **Chisebec** and the **Oumamiouek** in the Moisie and Sept-Îles region;
- The **Cuneskapi** on Ashuanipi Lake;
- The **Ouchestigouetch** east of the latter;
- The Nitschikirinouets on Nichicun Lake (Figure 5).

These groups were composed of bands of families with 10 to 40 people (Laforest, 1983).

At the end of the 18th century, the monopoly of large merchant companies grew very rapidly over the northern and south-central regions, with fierce competition between the new North West Company, the Hudson's Bay Company and concession holders of the King's Domain. This led to the establishment of a number of trading posts in the Ungava region (Laforest, 1983). Despite the proliferation in trade, the abundance of caribou allowed Amerindian groups to operate independently from trade merchants. Two herds of caribou indeed migrated in the area and were sufficient to meet the bands' needs. The first "spent the summer on the western shore of Ungava Bay, but migrated in the autumn farther south to spend the winter as far away as Caniapiscou Lake. That herd corresponds to the current Herd of Caniapiscou, Delorme and Opiscotéo lakes. The second herd spent time on the Atlantic coast and in the autumn migrated west, crossing the George River. The George River herd still exists today" (Clément, 2009, p. 30). Caribou hunting became the source of a family-based social organization and of a land use system governed by the hunters' movements. An abundance of caribou affected relations with traders, because the Montagnais-Naskapi devoted all their energy to the hunt. However, fur-bearing animals were found elsewhere, mainly south of the caribou hunting grounds. Caribou was therefore the primary source of subsistence, and when groups turned to the trapping of fur-bearing animals, there was a risk of famine, because they moved away from their usual diet and from caribou migration areas (Laforest, 1983). In addition, as there were only a few beavers in the central plateau, this entailed the shortage of another means of subsistence.

In the mid-19th century, **the number of caribou in the central plateau declined**, and other species, most notably the beaver, also diminished significantly or disappeared entirely. Several forest fires decimated the region's caribou herds and affected natural migrations. Other causes could also be responsible for the scarcity of animal resources, such as natural phenomena or improvements in harvesting technologies. Cases of families suffering from famine were reported in Fort Chimo, Fort Rupert, Nichicun, Caniapiscou and near Koksoak River (Cooke, 1979). Dozens of families starved to death as a direct result of changes in caribou migration. On the other hand, trading posts were having a hard time supplying hunters with ammunition, which they demanded be traded in exchange for furs. However, the hunters were faced with a problem: they had no furs and consequently no ammunition to hunt the rare caribou (Laforest, 1983). Fort Nascopie also faced great difficulties because the Innu were unable to conduct their usual trades. Because of the scarce resources and food shortages, the Innu tried to find other means of ensuring their survival. They either turned to the fur trade or migrated toward the coasts of the St. Lawrence and of Hamilton Inlet in Labrador, toward the sea. Those who headed in the direction of the St. Lawrence travelled via the Manicouagan, Trinité, Sainte-Marguerite and Moisie rivers.

The distribution of Amerindian groups in the 19th Century in the south-central region was reconfigured according to watersheds, ecological regions and groups of migrating caribou:

- **Petesekapau Unnut:** Band from Petesekapau Lake, in the north
- Meneyik Unnut: Menihék Lake
- Kaniapeshkau Unnut: Caniapiscau Lake
- **Tshemanipistuk Unnut:** Sainte-Marguerite River, to the south
- **Mista Shipu Unnut:** East of Sainte-Marguerite River, now commonly known as Moisie River
- **Mishikamau Unnut:** To the northeast, Mishikamau Lake, a crossing point toward Labrador
- Wesakwopetan Unnut: Near Shelter Bay (Figure 6)

Other Innu bands settled along Mingan River, North West River, Davis Inlet, George River and Nichicun Lake. The bonds between these bands were tight due to the migration of game, weddings, trade and kinships (Laforest, 1983). For their part, the Naskapi could be found near Fort Chimo and Fort Nascope (Cooke, 1976).

3.2 MODERN PERIOD 1900-1950

The land use system described above was to be the subject of adjustments in the 20th century because of new development factors, the establishment of Indian reserves and the creation of beaver reserves.

The closing of the Fort Nascope trading post in 1868 due to long-term supply problems was a major event that would lead to changes in the land use habits of the above-mentioned groups in the central plateau. One group turned toward Fort Chimo (probably Naskapi-Montagnais people north of Fort Nascope), which had re-opened in 1866. Other families headed to the Sept-Îles, Mingan and North West River posts (Laforest, 1983). Families from the Caniapiscau, Petitsikapau and Nichicun bands joined the Sainte-Marguerite group, while those from the Michikamau and Ashuanipi bands settled with the Moisie families. The latter spent their summers at the Moisie and Sept-Îles trading posts and at the Uashat mission.

The Sept-Îles reserve was created in 1909. Families continued to set up their summer camps in Moisie and Uashat. In 1926, there were an estimated 60 Innu families in Uashat and 200 Innu in Moisie, but they had administrative ties with the Sept-Îles band. There were more than 800 individuals in 1950 (Laforest, 1983). The grouping of Innu from this reserve into two different locations was the result of migration areas and the position of the Sept-Îles trading post. The designation of their identities is quite revealing of their allegiances. The explanations provided by Mailhot and de Vincent (Laforest, 1983) reveal the following identity trends based on migration routes and summer camps: the Innu from the Sept-Îles reserve are called UASHAUNNUT and originally lived near Sept-Îles Bay. Those who went up Sainte-Marguerite River are known as the TSHEMANIPISTUK UNNUT and migrated toward Caniapiscau Lake. The Moisie Innu, for their part, are called MISTA SHIPU UNNUT, meaning the Innu who use the “Great River”; they went as far as the George River. The Innu who lived on the reserve could use either the Sainte-Marguerite or Moisie rivers to reach their lands. Part of the Mista Shipu Unnut was split into

families and had lands around Menihék Lake. They maintained relations with nearby bands, most notably those from North West River in the Michikamau region. This is significant because Michikamau Lake is a commercial buffer zone.

The period covering the first half of the 20th century gave a considerable boost to the trapping of fur-bearing animals, an activity that relied heavily on trading posts for the supply of domestic goods and products. New land use strategies were developed and the upper parts of watersheds and of the central plateau were once again occupied (Laforest, 1983). The Innu continued their traditional activities and the territory was divided according to the abundance of resources. There was an increase in both the dependence on trapping activities and in competition between traders (Hudson's Bay Company and other private companies) due to the opening of new inland trading posts. One such post, Fort McKenzie (1916-1948), opened at the source of Swampy River and drew families from Ungava, the Gulf of St. Lawrence and Hudson's Bay. This competition encouraged the Innu to take part in the fur trade. However, a new phenomenon occurred, namely the appearance of white trappers who ventured inland as a way to earn money, especially in the North West River region of Labrador. As a result, traditional land use was modified. The first government subsidies, which were handed out in 1910, as well as seasonal job offers were also crucial events in the lives of the Uashat Innu.

Another defining moment was the 1949 creation of the Mani-Utenam Reserve, established to relocate both the bands living in Sept-Îles and the Innu living in Moisie to this site in order to facilitate their integration in the agglomeration of the city of Sept-Îles. The Saguenay beaver reserve was also created in 1954 and included Matimekush and John Lake, but the landowners were all from Uashat at the time the reserve was established. Before Schefferville was founded, only people from Uashat mak Mani-Utenam (Mista Shipu Unnut) used to migrate to the area. The new Indian Act (1952) forced the federal government to implement housing, health, education and social security programs, thus providing incentives for the Innu to leave their land and move away from their traditional activities (Figure 7).

In the early 1950s, mining development took off in Schefferville with the mining of iron ore. This development would require the building of transport (railway) and port facilities in Sept-Îles. These mining operations led to the creation of the city of Schefferville, near Knob Lake, in order to house workers, as well as the industrial and commercial facilities required to meet IOCC's needs. This offered appealing opportunities for the Innu, who could take part in the building of the railway and find employment. Knob Lake thus welcomed a large number of Innu when operations began, which indisposed the company and its workers due to pollution, and the Innu were given land at John Lake in 1956. That same year, 175 Naskapi from Fort Chimo settled near the railway installations. The company then demanded that the Naskapi be moved to the John Lake site with the Innu, which was a very strange request considering the migration habits of the two bands and their different origins. At the time, the status of these Innu linking them to their original bands of Uashat mak Mani-Utenam was not recognized by the federal government. It was only in 1968 that the Schefferville Innu were officially recognized as an autonomous band. They were relocated to a site at Pearce Point, but several families chose to stay behind in John Lake. Today, they can

be found at the Matimekush Reserve (Laforest, 1983). The Naskapi were also relocated to the edges of that reserve until they obtained their own village in Kawawachikamach.

Before the advent of mining, **land use from 1900 to 1950** was characterized by the movement patterns of the various Innu groups. The region of Schefferville was used by the Mista Shipu Unnut group, which is a Moisie subgroup of the Uashau-Innuat, a band formally recognized by the federal government. In June, they travelled from the north to the south to reach the different summer camps, and then from the south to the north for the great fall migration. This route led from the mouth of the Moisie River up to Menihék Lake and was punctuated by long portages. Throughout the migration, the large group was divided into smaller family groups according to the location of their lands. At Menihék Lake, a number of secondary routes were used to reach the different destinations. This lake was the main centre for migrations to other destinations that started at the mouth of the Mista Shipu (Moisie) (Laforest, 1983). The lake is located a few kilometers south of Schefferville, a city that was a thriving at the time. It is no accident that the Innu were present when the iron ore was discovered.

The annual cycle was the following:

- The summer ascent: The Mista Shipu migrated toward Menihék Lake with breaks to hunt for small game and fish and headed from there to other destinations.
- The fall hunt: Camps were set up near water bodies to hunt caribou.
- Wintering: Trapping of fur-bearing animals and small game, as well as caribou hunting depending on abundance.
- The spring descent: In April, they descended toward the spring meeting sites, hunting otters along the way to Menihék and Ashuanipi. Migratory bird hunting was the primary spring activity before travelling on the Mista Shipu river.
- Navigating the sea: Toward the Moisie, Sainte-Marguerite and Uashat sites.

3.3 LAND USE BY THE INNU SINCE 1950

Numerous changes occurred when the IOCC established itself in Schefferville. It brought about a shift to a sedentary lifestyle for part of the Mista Shipu Unnut in Knob Lake, along with the possibility of being closer to sites where they could conduct their traditional activities. The industrial facility provided the company with an opportunity to group the Innu together at John Lake. Government interventions and the presence of other Canadians nearby would also have a strong influence on the social model being established in terms of land use. These new changes would alter the traditional land use model that had been in use for decades.

3.3.1 Constraining Changes

As stated by Clément (2009), who echoed the argument made by Laforest (1983), political, economic and social factors accounted for the changes in the land use habits of the Matimekush–Lac John Innu.

The creation of the Saguenay beaver reserve in 1954 and the splitting of the territory into individual traplines were considered a direct repudiation of the Mista Shipu Unnut's land management system by the State. The policy, which was ostensibly to protect resources, effectively meant that the State took control of their land and resource management. This territorial configuration went against their consensual right to share and belong to the land.

Another important event was the signing of the James Bay and Northern Quebec Agreement and the Northeastern Quebec Agreement, which had the effect of imposing a legal and administrative framework to third party Uashat mak Mani-Utenam and Matimekush–Lac John, who were not signatories to the agreements. This meant that families and their descendants no longer had control over the traditional management of these lands and had to follow someone else's rules.

A significant portion of the ancestral lands of Matimekush–Lac John and Uashat mak Mani-Utenam families is located in Labrador and is thus subject to the legislation of the Province of Newfoundland and Labrador. Until 1968, the Innu from both communities were considered residents of Labrador. However, the Province of Newfoundland and Labrador changed its position in 1968 and they have been considered residents of Quebec ever since. This change made it illegal to practice traditional activities in Labrador, even though the beaver reserve traplines are located in Labrador. This has been an ongoing contentious issue. The Innu were also subjected to new rules, such as the necessity to hold permits to hunt certain game. Caribou hunting has also been closely monitored.

In both Quebec and Labrador, the Innu must comply with laws and regulations pertaining to the management of land and wildlife resources. The governments have allowed the creation of recreational sites and outfitting businesses, and have imposed multiple economic measures that have altered Innu land use. The invasion of this area has altered the traditional nature of the land use. As a result, the Innu occupy a significantly smaller territory than during the period from 1900 to 1950.

It should be mentioned that, originally, all the individual traplines of the Saguenay beaver reserve of the Naplekunnu (Innu living in Schefferville) were part of a single spatial unit that represented their land. However, the Matimekush–Lac John and Uashat mak Mani-Utenam Innu have now been combined into a single beaver reserve management unit. When the reserve was created, the Naplekunnu were listed as part of the Sept-Îles band. Naplekunnu traplines tend to be located north of Ashuanipi Lake. This is the result of the settlement of some users in Schefferville for mining development. Several Uashaunnut Innu have traplines near Schefferville, while those of the Matimekush–Lac John Innu are located far outside this area. It may seem confusing to determine why the Uashaunnut have their traplines near Schefferville or in Labrador while those of the Naplekunnu are located well outside the boundaries of the mining area. The answer lies in how land use was traditionally structured and individual choices made to remain close to employment opportunities. Many Innu did not move to the site of their trapping ground, choosing instead to remain in Uashat mak Mani-Utenam.

3.3.2 Travel Routes

At the time, land use by the Matimekush–Lac John Innu takes place from a fixed point, namely Schefferville. The migration movement no longer follows the former traditional annual cycle of ascending and descending for long periods of time, but has become a process of going back and forth to supply sites some distance away. The routes contain few camps; the Innu reach their sites in one day. The previous transportation network changed once settlement occurred, but now contains additional transport options, such as trains and roads built by the company, or snowmobiles and motorized canoes. Traffic near Schefferville is dense, but gradually eases as you move away from the city. According to Laforest (1983), there are many travel routes, but they are poorly documented, unlike in earlier times.

3.3.3 Annual Cycle

The economic, political and social changes disrupted the Innu's way of life and transformed the ways in which the land was used, as well as the annual cycle of activities. Nevertheless, hunting and trapping still remained important for the economy of the Matimekush–Lac John people. The annual cycle was as follows:

- Fall prior to the freeze-up: Caribou hunting both north and south of Schefferville
- Fall after the freeze-up: Trapping of fur-bearing animals nearby and in remote areas
- Wintering: Few activities, the main preoccupation being the status of caribou migration
- End of winter: Caribou hunting and trapping resume
- Spring: Waterfowl hunting and net fishing during the spring break-up
- Summer: Fishing on the numerous lakes and rivers nearby and farther away

3.4 LAND USE BY THE NASKAPI SINCE 1956

As previously mentioned, in 1956 the Naskapi arrived in Schefferville from Fort Chimo to profit from mining opportunities and because, according to Cooke (1976), government officials had forced their hand. For several decades, the federal government had provided them with supplies while they lived in the Fort McKenzie and Fort Chimo settlements. When they arrived in Schefferville, the federal government and the IOCC decided to group them together, with the Innu at John Lake and subsequently at Matimekush, when it became a reserve. As of 1956, land and resource use was shared between the two groups according to internal sharing arrangements. This period of sharing would last nearly 20 years. However, the Northeastern Quebec Agreement slightly destabilized this harmony by imposing priority interests regarding land and resource management in a way that benefitted the Naskapi, at the expense of the Innu (Laforest, 1983, Clément, 2006). Nevertheless, the traditional cohabitation and use of ancestral lands and resources remained well-established and stable. Michael H. Weiler conducted three land use studies of the region by the Naskapi, and we will reproduce the key information gathered here. The author divided his analysis into categories: caribou hunting, fishing, waterfowl hunting, small game hunting, trapping, access routes and camps.

3.4.1 1954 to 1982

During this period, the Naskapi were first located at John Lake (1956 to 1972) and later at Matimekush (1972 to 1984). Caribou were the Naskapi's primary means of subsistence. The George River herd was being replenished after having nearly disappeared at the turn of the century. The Naskapi had some difficulty adapting to their new sedentary way of life; some of them participated in the local mining economy while others tried to survive through wildlife harvesting and government subsidies (Weiler, 2009).

Caribou Hunting

Although the presence of caribou fluctuated and was unpredictable at the beginning of the period, hunting was still a significant source of the Naskapi food supply (Weiler, 2009) and the meat was shared with other community members. The hunt required the building of camps, even though it took place in the vicinity of Schefferville. Several hunters used trucks and snowmobiles to carry hunting products. Caribou hunting was conducted in three areas of the broader Schefferville area:

- On parts of the ridge between Schefferville and Howells River, including the northern part of Sunny Mountain and Greenbush and the western side descending into the Howells River valley;
- In the area west of Howells River, including the western part of the valley and the wooded section of the adjacent plateau;
- In the Attikamagen Lake area and the series of lakes to the north of it.

Of these three areas, the largest density of caribou was recorded further north, on Sunny Mountain/Greenbush, which is used primarily in the fall. When the herd increased, the two other areas were used during winter if the herd had dispersed. According to Weiler (2009), no hunting data is available for sites near mining operations and facilities.

Fishing

Fishing was an extremely important source of food during the first years following the Naskapi relocation, in light of the decrease in the number of caribou. Fishing nets were used and the frequency at which catches were verified was quite demanding. Camps had to be set up to check the nets and stay near fishing areas for periods of time. Fishing areas were located in water bodies upstream from the Swampy Bay basin and Attikamagen Lake. The Elross, Fleming and Kivivic lakes in the Howells River valley were also popular locations. Despite its proximity, Howells River was not used frequently because of traffic and the security gate.

Small Game Hunting

Small game was harvested in addition to the other activities of fishing, berry picking and trapping. This type of hunting could also be conducted in areas near the community. The most productive season was winter, because of the presence of the Willow Ptarmigan. Small game hunting activities were carried out in the areas northwest, south and southwest of Attikamagen Lake.

Waterfowl

Migratory bird hunting was an important part of the food supply chain at the time: spring lakes were not yet secure, and caribou were less mobile and absent from the area. Migratory birds were appreciated in the spring and provided an opportunity to fill food caches. They were easy to kill as they migrated and landed in sites that were easily accessible. In the fall, during their return journey, they stopped to eat wild fruits on the shores of water bodies or on mountain ridges. The areas most frequently used were Attikamagen Lake, the upstream section of Swampy Lake and the Ferrum River basins near the Annabel, Gillard and Rouллоis lakes, and Harris Lake near the Howells and Goodwood rivers.

Trapping

Trapping did not play a major role in the way of life of the Naskapi until this period because of their mobility and preference for caribou. However, its importance in Innu activities grew whenever a source of income was urgently needed. Several trapping sites are well-known: one is the upper and central part of the Howells River basin, and another is around Baussac Lake and in the area northeast of the Basseau and Matemace lakes. Others are located in the area of the Swampy Bay and Ferrum rivers around the Gillard, Rouллоis and Grouvel lakes, and at Attikamagen Lake.

Camp Sites

Only two camp sites were identified during this period: one in Vacher Lake and the other in an area between the Peter and Matemace lakes, which would eventually become the site of the Kawawachikamach village.

Travel Routes

There were two main travel routes:

- From Howells River toward Ungava Bay with the Ashuanipi region, via the lower part of the Koksoak, Caniapiscau and Goodwood rivers in the north, and the Menihék and Ashuanipi lakes in the south;
- From Swampy Bay and its links to the Ungava region, via the lower Koksoak and Caniapiscau rivers with the Attikamagen and Petitsikapau lake plateau, and ultimately Michikamau Lake.

3.4.2 1982 to 1993

Several factors led to changes in the Naskapi's way of life. The building of the Kawawachikamach village during this period and the move to that location caused profound changes in the community's social, cultural and economic vision, as well as in its values and aspirations. The closing of the IOCC mine in 1982 disturbed the economic, physical, human and social environment of the new community. A number of constraints and benefits suddenly vanished. The caribou of the George River herd grew in size and could now easily cross the ridge during its fall migration. Such factors would change land use habits and the harvesting of species.

Caribou Hunting

With the great abundance of caribou and its migration through the ridge (Howells and Schefferville) in the fall, this area became the preferred hunting ground. The proximity of the caribou to the city and the fact that it could be reached through a number of IOCC routes attracted local hunters to this particular type of hunting, which did not require excessive costs or camps. The part of the ridge that included the Swampy Bay River basin to the east and a western section of the Howells River valley constituted the caribou hunting areas.

Fishing

Fishing activities are concentrated east of the Attikamagen Lake area and in the upper basin of Ferrum River where the Tait, Hayot, Roulois and Pluton lakes are located. Fishing activities were also recorded on both sides of the ridge, along the upper basin of Swampy Lake River and in lakes surrounding Howells River. Several lakes located near mining operations were avoided through fear of contamination.

Small Game Hunting

It has already been mentioned that this type of hunting was of secondary importance when there was an abundance of other harvesting activities. Little information was provided about this period.

Waterfowl

The only indication of migratory bird being harvested was along the water bodies of the Swampy Bay River basin, such as the Vacher, Guisot, La Miltière and De Miley lakes. This activity did not take place exclusively in the spring.

Trapping

There were two main preferred trapping areas. One is located in a part of the Swampy Bay River basin and the other is on the eastern shore of the Howells River valley. Most of the fur-bearing animals of interest were trapped in these locations and in the forest: marten, weasel, ermine, wolverine, lynx, squirrel, beaver, muskrat, mink and otter. The Red Fox, Arctic Fox and wolf could also be harvested.

Travel Routes

The previously described travel routes continued to be used.

3.4.3 2006 Survey

This survey only gathered data on the Howells River basin, not on other areas of interest to the Naskapi. It is worth mentioning that this part of the territory, which is near Schefferville, is a widely-used area (Weiler, 2009).

Caribou Hunting

The survey showed intense caribou hunting activities in the Howells River basin, with the exception of the vicinity of Schefferville. The densest concentration of caribou hunting activities was recorded along the ridge between DSO 2 and the Goodwood crushing facility. Another dense

area is located in the Howells River basin, between the Kivivic and Stakit lakes. During the fall migration, it is along these areas that the largest amount of hunting activities takes place when the caribou arrive in very large numbers via the numerous hills from which they can be observed. After the migration, several small groups of caribou remain behind, wintering and dispersed throughout the Howells River valley and in wooded areas west of the plateau. Hunting occurs long after the migration, during winter. After the decrease in the caribou population in the 1990s and its reappearance in large numbers in the area following the end of mining operations, hunting once again became accessible, and the Howells River area was considered a hunting ground. Given the proximity of the hunting area, this activity is inexpensive and does not require much time.

Big Game Hunting – Bear and Moose

The Black Bear was included in the hunting activities of the Naskapi and is an important part of their subsistence. It is only recently that moose appeared in the Schefferville area. They can live in the wooded section of the territory and most notably in the Howells River valley. The Black Bear population is very large in the valley and the Swampy Bay River basin.

Fishing

The survey revealed that Howells River and the lakes in its valley were the Naskapi users' favourite spots to fish the large quantities of Brook Trout and chub. Lake Trout, Northern Pike, Lake Whitefish and ouananiche are also found in several lakes. The informants stated that fish no longer existed in the lakes located near the former mining pits.

Small Game Hunting

The wooded area of the Howells River valley is conducive to the harvesting of ptarmigan, grouse, porcupine and the Snowshoe Hare. Porcupines nearly disappeared from the area, but returned a decade ago. The partridge, hare and porcupine are the three most harvested species around the Swampy Bay River.

Waterfowl

There are three ecological regions for waterfowl: the Howells River valley, the ridge and the Swampy Bay River. There is also Attikamagen Lake, which is the most well-known and most popular area; it is where activities are the most intense and productive. During the spring migration, the Canada Goose and duck are harvested in large numbers in Howells River and its surrounding lakes, where there are several Ashkui. During the summer, several Canada Geese and species of duck can be found in the valley. During the fall, the hills and the ridge host flocks of Canada Geese drawn by wild fruits, and shot by hunters.

Trapping

Trapping activities take place mainly in the Howells River valley, but also in other areas. The combination of the dense forest and water bodies provides natural conditions that are conducive to the proliferation of fur-bearing animals. The marten, weasel, squirrel and lynx are all present in these silvicultural areas. Conditions in these wetlands are also favourable for otter, mink and muskrat. On the other hand, the number of beavers is moderate, but is on the rise. There are

large quantities of wolves and Red Foxes in the valley and they are harvested in great numbers. Wolves are very active during the caribou migration. Moose also seem to be present in the area, but none were killed by informants. The situation is similar in the Swampy Bay River basin.

Wild Fruit Picking

The valley's microclimate is prone to a type of vegetation that encourages the growth of plants and fruits. Blueberries, bilberries, lingonberries, cloudberry and crowberries are all fruits that have proliferated, as have the tamarack, Labrador tea, birch, moss and special woods used to make tools and crafts. Several plants are also used for their medicinal properties. The fruit varieties all grow abundantly and are gathered in the Swampy Bay River basin.

Travel Routes

Howells River is one of the traditional north-south routes. There are also trails along the river that are used for snowmobile transportation. There is one such trail north of Rosemary Lake and another at Stakit Lake.

Camps

Several camps are located in areas containing animal and plant resources, notably at the Kivivic, Elross and Fleming lakes in the Howells River basin, as well as at the entrance to the central part of Stakit Lake.

These three surveys show that the areas favoured by the Naskapi between 1956 and 2006 are largely located around the Howells River valley and the Swampy Bay River basin. The Naskapi are also fond of the area that includes the ridge, which is located between the city and the other watersheds near Howells River. Harvesting activities seem to fluctuate as a result of the decrease in the number of caribou when the Naskapi first settled in Schefferville until herd numbers rose again after the IOCC closure. These activities are also facilitated by the presence of the road network.

4 TOPONYMY AND DESIGNATION OF TERRESTRIAL/AQUATIC SPECIES AND EDIBLE BERRIES IN THE STUDY AREA

This section will provide a list of toponymic elements identified during informant interviews, as well as the designation of species in the study area. For a number of reasons, we did not subdivide this content into the two languages. A Naskapi elder confirmed that:

- the majority of locations (sites, lakes, rivers and access routes) in the area were named by the Innu;
- the names of species are similar in both languages;
- the Naskapi use some watershed names that were given by English or French speakers instead of using Innu names in certain cases and the Naskapi language is mainly used for a number of toponyms outside of the study area and the region.

It is likely that the Naskapi named spaces, watersheds and sites in the Fort McKenzie, Fort Chimo and Ungava areas when they used these areas. However, the informants seemed comfortable with the linguistic mix (Innu/Naskapi) in the Schefferville area. The young Innu and Naskapi also use allophone names for roads, watersheds and operating sites. In the course of our interviews, the elders often used Innu toponyms while also referring to the allophone toponyms to be more specific and to clearly express their views. The influence associated with the naming of sites and the replacement of toponyms by those from allophone languages are always very clear during the development of a territory and is a recurring phenomenon in Quebec. The study area thus shows signs of external influence. We will only list the names of the locations, as well as the animal, fish and wild fruit species that were mentioned during the interviews.

Geographic Locations:

- **Kauteitnat:** Heart-shaped mountain (Irony Mountain)
- Menihek Shakainiss: Pinette Lake
- Messeku Nipi: Peat lake
- **Papateu Shipu:** Howells River
- **Kapashekuauiaass:** Small wooded area (toward Goodwood)
- **Tekutaut Meshkenu:** Mountain ridge road, company road
- Tshitshitua Mani Meshekenu: Virgin Mary road

Names of Land Animal Species:

- **Atik(u):** Caribou
- Amishk(u): Beaver
- Atshakash: Mink
- Matsheshu: Fox
- Nitshik(u): Otter
- Uapistan: Marten
- **Kak(u):** Porcupine
- Uapush: Hare

Fish:

- **Matamek:** Brook Trout
- **Uanan:** Ouananiche
- **Kukamess:** Lake Trout
- Tshinusheu: Pike

Migratory Birds:

- **Nishk:** Canada Goose
- **Muak:** Loon
- **Kuaikan:** Black Scoter

- **Auiu:** Long-tailed Duck
- **Inniship:** American Black Duck

Partridges:

- Innineu: Grouse
- **Uapineu:** Snow Partridge (Willow Ptarmigan)

Wild Berries:

- Inniminanakashi: Blueberry
- **Shikuteu:** Crowberry
- Uitshiminanakashi: Cloudberry
- Nissiminanakashi: Bog Bilberry

5 USE OF THE STUDY AREA BY THE INNU

The current use of land and Innu-Aitun (Innu traditional knowledge) reflect the economic factors of the period since the opening and closing of the IOCC mine, the development of Schefferville and the recent renewal of mining activities. Many of the Innu elders have stopped their traditional activities, but do not deny that they sometimes head to their more distant lands for journeys of various durations. They claimed that they have not been involved in recent activities conducted in the study area, but mentioned that the young users were very active there. The latter provided us with good information on the various uses of the sites in the study area for short seasonal activities, as well as for specific harvests. They view the area near Matimekush–Lac John as an alternative for the practice of Innu-Aitun and inexpensive harvesting activities.

The other informants that we met were the holders of traplines 207 and 211 from Uashat mak Mani-Utenam, next to the study area. While far away from mining areas, they clearly belong to the study area even though they do not maintain a sustained presence or carry out daily activities there. The informants provided us with information on the area's new structure of land use by family members, which attempts to harmonize everyone's rights and interests. The elder who owns trapline 207 came up with a new way to distribute the land from Menihek Lake to Ushkuass Lake into four or five territorial sectors shared among the children of brothers and brothers-in-law, to better reconcile trapline use by those who also live in Matimekush–Lac John.

It is important to understand that people living in Matimekush–Lac John are the most frequent users of the study area, which is located near the communities and can easily be accessed through the existing road network. By comparison, the users of Uashat mak Mani-Utenam come by train when temporarily staying at their traplines. Proximity to the study area is a factor that predisposes some users to the more regular practice of Innu-Aitun; those who live further away may have a more restricted presence, but nevertheless retain their land use rights (Figure 8).

5.1 TRAVEL ROUTES

The study area contains a series of roads built by the IOCC. These roads, some slightly altered and others upgraded for the current TSMC and LIM operations, are used by the Innu for their traditional activities. Two major gravel roads cross the study area. The first and most northern is called the Tshitshitua Mani Meshkenu, or Virgin Mary road; it begins in Schefferville and leads up to the Annabelle and Leroy lakes. The other, known as Teketaut Meshkenu, mountain road or Greenbush Meshekenu, runs parallel to the other road and also begins in Schefferville. It leads up to Le Fer Lake and crosses the mountain ridge where the main IOCC iron ore sites were located. Once it reaches KAUTEITNAT, which it borders on its eastern side, it is divided into two segments that lead toward Greenbush in the northeast and toward the Howells River valley in the west. The latter segment, which goes to Papateu Shipu (Howells River), is frequently used by the Innu for a number of traditional activities. A side trail unites these two roads (Tshitshitua Mani Meshkenu and Teketaut Meshkenu) and crosses the planned Howse mine site up to Kauteitnat. There is also another existing road that originates from Schefferville and heads in a southwest direction to Wishart Lake. From that location, the Innu use ATVs or snowmobiles to reach Papatau Shakaikan (Stakit Lake) in the west. Informants also use small access roads such as the small Pinette Lake road or other abandoned trails to reach the gravel road that leads to Elross Creek. On the road used by TSMC for the DSO project, there is a security gate and a security escort to take users past the mining operations. A bypass road had been planned by TSMC, but it is not yet operational.

5.2 MEANS OF TRANSPORTATION

The configuration of roadways, as shown on the general reference map, makes pick-up trucks the preferred mode of transportation. Other means of transportation are also used according to the season, harvest or lack of roads:

- Four-wheel drive pick-up trucks: are the main means of transportation, suited to the existing gravel roads, with the capacity to carry people, food, harvests, and other supplies and equipment (ATV, canoe).
- ATV: is the most appropriate alternative for offroad travel and for getting to harvest sites that are not easily accessible (e.g., Pinette Lake) in late spring, summer and fall. Some use them the entire way for small excursions originating in Matimekush–Lac John.
- Snowmobile: is the preferred transportation method in winter. It is used for long excursions outside of the area, but it is also very useful for trips closer to the community and on certain lakes in the study area (Figure 8). It is also appropriate for ice fishing, winter trapping and caribou hunting.
- Motorized canoe: is useful for excursions to distant places that cannot be reached by truck. It is used for trapping and fishing.
- Traditional canoe: is useful as auxiliary equipment for trapping and fishing.

5.3 CAMPS

As previously mentioned, mining and community/municipality development factors have changed habits of mobility and land use for Innu-Aitun purposes. The setting-up of a long-term camp in the study area is no longer routine, as most users now pass through it for specific, short-term harvesting purposes, depending on the season and the sites visited. The distances covered between the site visited and their homes in Matimekush–Lac John are quite small (10 to 30 km). The accessibility provided by the gravel roads allows them to make daily return trips using their own means of motorized transportation. The study area is a place where animal, fish and plant species are relatively abundant and can be harvested easily. According to the elders interviewed, permanent wooden camps are located farther away, on lands where they used to practice traditional activities. The elders also stated that several permanent camps existed well before the company's arrival in the area. Many of these former camp sites can still be used today for daily fishing or hunting purposes, or for short journeys.

A few permanent camps still remain around Rosemary Lake and are used by several people for temporary and short-term stays; this seems to be the case for people from Uashat mak Mani-Utenam. Depending on the purpose of the activity and the season, users can remain there for longer periods of time. The use of tents is common, with white-cloth Innu tents made by Matimekush–Lac John artisans. The informants mentioned the presence of camp sites where tents can be installed, but where other types of shelters (basic cloth shelters supported by wooden stakes) can be built temporarily.

The general reference map shows the camps/tents mentioned by informants, but it is not comprehensive because of the numerous uses throughout the sector. Users do not assign fixed locations for themselves, with the exception of certain camps. Each camp site identified is used for one or more Innu-Aitun practices.

- 1) The Rosemary Lake area has been mentioned as a site containing both permanent and temporary camps. It is at the boundary of Papateu Shipu and close to other watersheds.
- 2) On the road from Kauteitnat leading to the shore of Papateu Shipu.
- 3) In the Papateu Shipu valley.
- 4) In the Triangle Lake area.
- 5) At Lac des Neiges.
- 6) At Inukshuk Lake.
- 7) A number of former camp sites identified at Goodream Lake, Dizzie Lake, Pinette Lake and between Inukshuk Lake and the company road.
- 8) A former camp next to the current security gate.

It can be assumed that if the caribou proliferate, the number of temporary camp sites in the study area will increase. However, the study area is not in an area where the practice of Innu-Aitun requires the building of permanent camps; tents are sufficient. This absence of permanent camps is due to the area's proximity to the community and the possibility of a quick trip by truck (or other means) to return home once the activities have been conducted.

5.4 ANNUAL ACTIVITY CYCLE

The organization of yearly activities reflected a major change in the annual cycle after 1982, namely the lack of a major source of subsistence in the area: caribou. Caribou hunting was a key element of the annual activity cycle following the creation of the city and the adoption of a more sedentary lifestyle by the Matimekush–Lac John community. This major change put certain activities on the same level in terms of their practice and priority, and resulted in a rebalancing of activities. As a result, the hunting of migratory birds and small game and fishing and trapping acquired importance based on time invested, interest and yield in terms of subsistence, while at the same time these activities were balanced according to season and opportunity. Young informants claimed that a lot of their time was being devoted to the search for employment once mining activities resumed, or that they held full-time jobs. They allocated their time among their jobs and hunting or fishing activities. The availability of these users therefore has an effect on the annual cycle.

In the fall, the activities of fishing and the hunting of small game (hare or partridge) and migratory birds returning south and spread throughout the area are balanced with the practice of Innu-Aitun activities in terms of time and interest, given the absence of caribou in the area. Some users can travel farther, outside the area (100 km and more to the west), if they are told that caribou were spotted. Trapping also takes place during the fall, but the furs of some riparian and silvicultural species are not yet ready to be sold because they are not sufficiently mature (according to the elders). However, beavers are harvested more for their meat than for the sale of their fur. The picking of lingonberries, which are also food for the Canada Goose, is very important for numerous families during that time of the year. A new species of big game, the moose, recently appeared in the area, but the Innu do not hunt it.

The same system used to balance activities also takes place **in winter**: small game hunting, fishing and trapping. Considering that employment activities typically decrease during this period, users say they practice these activities fully. Fishing is conducted on frozen lakes or on the shores of some rivers at the same time as trapping, especially for lynx. Small game hunting takes place frequently, usually whenever the opportunity arises.

In the spring, the return of the Canada Goose takes precedence over other activities and keeps the majority of the community occupied. Other duck species are also hunted and most activities are temporarily set aside until the Canada Goose has moved on.

Fishing starts again **in summer**, after the dangers associated with the thaw have passed. Waterfowl remain in the area. The picking of wild fruits is also important for some families.

This overview of annual cycle activities was not quantified by our informants with respect to the number of catches or time spent because of the opportunistic and often unplanned nature of such activities. As we will see, harvesting areas were only defined in the mind of each informant.

5.5 CARIBOU HUNTING

The Labrador and Quebec Innu hunt caribou from a group commonly known as the George River herd, but our informants told us that this herd has been decimated. According to them, after the closing of the IOCC mine some 20 years ago, there were so many caribou that they wandered freely throughout the Schefferville area. Caribou hunting was the main activity of the Innu in the fall, as the herd's northern migration passed through the area. During that time, caribou proliferated in the study area, and many sites were dedicated to this hunting activity. Hunted caribou were an essential constituent of the Innu food supply in Matimekush–Lac John and in Uashat mak Mani-Utenam. An informant told us that the herd was estimated at 800,000 heads.

Over the last five years (according to an average estimate of all the data collected), caribou have gradually disappeared from the region. Based on informant estimates, the George River herd now contains between 15,000 and 18,000 heads. The Innu are no longer familiar with the details of caribou migration routes. Some said that small groups had been spotted west of the region, but they did not specify if any animals had been killed. This phenomenon is intriguing for the Innu, who speculate on the reasons for its decline. Today, the important Innu-Aitun practice of hunting caribou no longer exists in the study area, which has undermined not only the Innu food base, but also the traditions associated with this type of hunting. It is now necessary to go farther in order to hunt caribou, and additional user costs are required given the absence of roads.

5.6 CANADA GOOSE AND WATERFOWL HUNTING

Canada Goose hunting is the primary spring activity. The hunt is organized by Innu groups who are related, and who occupy different water bodies waiting for flocks of Canada Geese. The latter are frequently found in three areas: all around Rosemary Lake, Triangle Lake and Pinette lake. Howells River is also an appropriate site, but as it is harder to reach in spring because of the thaw, the young do not make the extra effort and prefer Rosemary Lake instead. The young make return trips between the sites and the village, or sleep one night under a tent or in an available wooden camp. This hunting activity also starts again in the fall, when Canada Geese are spread out and easily caught because they land frequently. Canada Geese are also an essential part of Innu food subsistence. In the study area, the preferred site is primarily Rosemary Lake. In fact, informants stated that they actually preferred to go farther away in order to avoid mining activities.

Waterfowl is also hunted during nearly three seasons (spring, summer and fall). The goose, loon (spring), American Black Duck and Long-tailed Duck are the most harvested species. According to one of the elders, numerous sites are used by ducks to lay their eggs. Another elder said that the Innu do not collect eggs out of respect for reproduction; this was only done in the past when survival was at stake.

5.7 TRAPPING

According to the elders, numerous trapping activities are carried out around Matimekush–Lac John, but trapping is not as common as it once was. In the study area, beaver trapping is carried out late in the spring and some riparian (mink) and silvicultural (marten, fox) animals are harvested. The lynx is also present, but is difficult to trap.

Trapping seems to have lost some of its importance in the study area even if, from the elders' point of view, resources remain available. However, the daily back and forth to monitor traps is rather demanding and requires a lot of time, which is especially problematic for those with full-time jobs. Other elders said that the lack of caribou encourages people to resort to trapping, but outside the study area and farther down the Greenbush road and in its vicinity. The reasons given include the presence of permanent camps outside of the study area for longer journeys and the fear of contamination near mining sites. Beaver meat is prized by the Innu and is part of their regular diet. Furthermore, the animal trade is quite complex and, ultimately, the provider loses a lot of money when selling furs to an intermediary. An elder stated that this type of activity was practically a full-time job and that large quantities of furs were necessary in order to ship them to a place in Ontario where auctions (markets) were held. This was done some 20 years ago.

5.8 FISHING

Numerous water bodies are located in the study area and they contain a variety of fish resources. Fishing nets and rods are used to catch the different fish in summer and fall: a variety of salmonids as char, whitefish, Lake Trout and ouananiche. There are a number of fishing sites in the study area, notably in Rosemary Lake, Triangle Lake and lac des Trois Épinettes. Ice fishing is also conducted using a very special technique. Brook Trout (matamek) are the target of this type of fishing. Several groups of fishermen gather at the same time to do this type of fishing, which provides an additional element to their food supply.

5.9 SMALL GAME

Partridge, hare and porcupine are the most hunted small animals during fall and winter. Hunting techniques are specific to each species: the rifle for partridges, the use of sticks to knock out porcupines and the snare for hares. This type of hunting takes places when the opportunity arises during the harvesting of other species. These small animals can be found throughout the entire study area. The Innu really appreciate them, and they vary their food supply.

5.10 BERRY PICKING

Blueberries and cloudberry (in peatland areas) are the most-picked wild berries in summer. Raspberries can also be found in some locations. Lingonberries proliferate, but only in the fall. It is mainly women who do the picking while men carry the fruits back to the harvest sites. Informants

clearly stated that they still picked fruit in the study area, but more often in the vicinity of Rosemary Lake.

5.11 IRONY MOUNTAIN OR KAUTEITNAT

Kauteitnat, or “heart-shaped mountain”, is an important topographic centre for the Matimekush–Lac John and Uashat mak Mani-Utenam Innu. This mountain and its surroundings contain all of the attributes and advantages required for Innu-Aitun practices. The mountain itself constitutes **an ecosystem** that protects all its elements (Innu elder). Its morphology and the fact that it is elevated are signs of importance for the Innu and the elders in particular. It reaches an elevation of 3,000 feet, which is rather modest when compared to other mountains, and users can easily reach its peak. It is located in relatively flat terrain and is surrounded by water bodies with abundant resources. Kauteitnat used to be a part of the caribou migration route. Herds that originated from the southwest would stop there in the fall, and some small, scattered groups of caribou even stayed near the site until late winter. The Kauteitnat-caribou relationship is very revealing of Innu hunting habits and constitutes a survival myth, which is the necessity of such a relationship as a major cultural symbol for this Innu group. Kauteitnat belongs to all Innu and inspires the practice of rites of thanks for the benefits it provides. This makes it a sacred mountain that must be appreciated and protected.

Historically, the mountain was used as an observation promontory to locate caribou and, to a lesser extent, other species. Innu would head toward the summit to get a better view of the approaching caribou in the fall or spot the dispersed groups in winter. A Mani-Utenam elder said: “We were able to see steam from the breath of caribou as it dispersed into the cold air, even if they were very far away.” This observation post was so effective that it was used to gather information about this resource. Kauteitnat was also used as a point of orientation for hunters, who relied on this mountain to find their routes and their way. Kauteitnat is considered as an area that is sensitive to the integrity of the surrounding biodiversity.

The renewal of mining activities in the study area over the last five years has had an effect on the Matimekush–Lac John Innu, who are its primary users. This area is serviced by old roads from mining that took place between 1950 and 1980. The Innu are required to abide by the security gate for the DSO project and stricter security standards. The above portrayal of the use of the study area and the harvesting of resources is clouded by the absence of caribou, which is the primary resource for Innu-Aitun practices. Furthermore, this depiction shows that the resource is being replaced by a more active harvesting of other resources. Employment has also diluted the level of use by users. The situation varies, but users still show their interest in using this area, even in a fragmented manner, and in practicing their traditional activities. Informants have stated that there are sites where young students are brought to learn about traditional life and learn basic practices and harvesting techniques. This shows a concern about the necessity of transmitting this way of life and its characteristics. It is also worth noting that the elders are no longer active in the study area; they go farther afield and spend longer periods of time on their lands. The study area is thus used as a passageway to other harvesting areas.

6 USE OF THE STUDY AREA BY THE NASKAPI

The land use model used by the Naskapi in the study area is similar to the portrait established for the Innu, but comprises specific political, economic and social factors. Unlike the Innu, whose group is split between users originating from two communities, the Naskapi are a single entity living in a single community and constituting one Aboriginal nation. Their use of the region's harvesting areas is rather recent, dating back to the 1950s, when they were relocated to Schefferville. As the study area is located in Labrador, the provisions of the Northeastern Quebec Agreement do not apply. Their relations with other Innu users are courteous and friendly, and there are no cases where the use of the area has created conflicts. The area is shared in an informal manner and on a goodwill basis, without specific guidelines. According to the informants, a significant part of their activities take place in the Attikamagen Lake and Swampy Bay areas, but the Kauteitnat, Goodwood and Greenbush areas are also used and harvested.

6.1 TRAVEL ROUTES

With Kawawachikamach as their starting point, the Naskapi use the same existing travel routes as the Innu to access the various water bodies and sites located in the study area. They take the mountain road (Teketaut Meshkenu), which leads northeast up to Goodwood and Greenbush. This road crosses the mountain ridge where the IOCC's main iron mine sites were located. It then follows the eastern side of Kauteitnat, where it becomes two separate roads leading to Greenbush and the Howells River valley in the west. The part of the road leading to Papateu Shipu (Howells River) is used very frequently by the Naskapi. Another mining road crosses the planned Howse mine site and leads to Kauteitnat. There is also another existing road that leads southwest from Schefferville toward Wishart Lake and, from there, up to Papatau Shakaikan (Stakit Lake) in the west; it is accessed by snowmobile in winter.

6.2 MEANS OF TRANSPORTATION

The Naskapi are forced to use means of transportation adapted to the topographic configuration of sites and roadways, as shown on the map. There are four ways to travel in the study area: The four-wheel drive pick-up truck is the main means of transportation. It is suited to the existing gravel roads and can carry both people and the various equipment required for expeditions. The ATV is the most appropriate alternative for offroad travel and for getting to harvest sites that are not easily accessible in late spring, summer and fall. The snowmobile is used as a transportation method in winter, including on certain lakes in the study area (Figure 8). It is also appropriate for ice fishing, winter trapping and caribou hunting. The traditional canoe is very useful as auxiliary equipment for fishing and trapping.

6.3 CAMPS

Based on the data gathered, the Naskapi only have a few permanent camps in this area. They mainly use the study area as a means of getting to camps that are farther north or in the vicinity

of Attikamagen Lake and Swampy Bay, which was confirmed by Weiler's 2009 survey. The Naskapi claim that there are temporary camps on the road to Greenbush/Goodwood, in Kanishekemat and in Kapashekuiass (small woods), but they are located outside of the area. There is a zone where tents were erected on the eastern side of Kauteitnat several years ago, for the purposes of hunting caribou and Canada Geese. There is also a cluster of camps sites used to set up tents near Rosemary Lake. Other camps that the informants were familiar with are located on the eastern side of the Howells River basin. Some Naskapi apparently also used the Boot Lake area to erect tents.

Another interesting factor is that even if the principle of Innu traplines are respected by the Naskapi, the agreements provide the legal protection of these traplines. Based on the comments of some informants, the Naskapi harvest and practice their activities more easily in areas that they previously occupied or that they have been given since their arrival in Schefferville. Despite a longer Innu historical presence, the Kauteitnat area is well known to both Aboriginal communities.

6.4 ANNUAL ACTIVITY CYCLE

Our Naskapi informants did not explicitly refer to an annual activity cycle, but their situation and harvesting obligations force them to practice traditional activities throughout the seasons, according to the arrival, passing, migration context, location and presence of game.

- **In the fall:** As the main activity is no longer possible (there are no caribou), the hunting of the Canada Goose is important during the southward migration. There is also fishing and the hunting of partridges (grouse/Innineu). Some Naskapi also make incursions in the Kuujuaq area to hunt caribou from the Leaf River herd, according to the season.
- **In the winter:** The hunt for the Willow Ptarmigan (uapeneu) and trapping are important activities, but ice fishing also takes place. One elder mentioned that wooded areas and the mountain were favourable locations for partridges and hares.
- **In the spring:** The hunting of the Canada Goose and waterfowl resumes. It is an important occupation for the Naskapi, both within and outside the study area. Informants also mentioned that they went to different locations to avoid areas near mining activities.
- **In the summer:** Fishing, wild-berry picking and waterfowl hunting are the primary activities.

6.5 CARIBOU HUNTING

The Naskapi hunt caribou from the George River herd. They can also, on some occasions, hunt caribou from the Leaf River herd in the government-regulated lands of Ungava. Informants claimed that there had not been any caribou in the area for a few years. The rarity of the species has impacted their way of life. They had hunting grounds on the western side of Kauteitnat and used to hunt in groups. They must now find other ways to hunt caribou, but these are costly and require long journeys northward.

6.6 CANADA GOOSE AND WATERFOWL HUNTING

The hunting of Canada Geese is an important activity in the spring, when they arrive in large flocks. This hunt primarily takes place outside the study area. However, several groups did shoot Canada Geese along both sides of the Howells River basin, which seems to be a favourable location, according to informants.

The hunting of other waterfowl, such as the loon, the American Black Duck (Inniship), the Black Scoter (Kuaikan) or the Long-tailed Duck, is also much appreciated. It is done on certain lakes in the area.

6.7 SMALL GAME

The grouse is highly prized in the fall, as is the Willow Ptarmigan in winter. Needless to say, this type of hunting serves as a complement to other activities that are conducted at the same time. The study area is conducive to the presence of these species. Grouse are hunted along access routes in the fall and Willow Ptarmigans are hunted on small plateaus in the winter.

6.8 TRAPPING

Trapping activities are less common in the study area. Some Naskapi may lay traps here and there in wooded areas to catch martens, but they do so as they pass through the area to conduct a different activity. This is also true of the mink when they are fishing in riparian areas.

6.9 FISHING

The Naskapi head to the Curlingstone and Rosemary lakes and Howells River to fish salmonids such as Lake Trout and ouananiche. In the winter, ice fishing is conducted to catch Brook Trout. These activities are also carried out in Goodwood as well as in the Attikamagen and Swampy bay lake areas, outside of the study area.

6.10 BERRY PICKING

The Naskapi head to the edges of Kauteitnat to pick wild berries such as blueberries, raspberries and bilberries. Lingonberries are the main fruit collected there in the fall. Blackberries are also in high demand, and cloudberries are collected in peatland areas. These picking activities are mainly conducted in the summer, but lingonberries are inevitably collected intensively in the fall, at the same time that the Canada Geese and waterfowl pass through on their way south.

6.11 IRONY MOUNTAIN OR KAUTEITNAT

The heart-shaped mountain, or Irony Mountain (Kauteitnat), does not have the same symbolic or ritual signification for the Naskapi, who have only lived in the region for about 50 years. According

to an elder, Kauteitnat is a strategic site for the hunting of caribou and a repository of food resources for wildlife. It is well located and convenient, as well as being an excellent, very easily accessible observation site. This mountain is part of Naskapi heritage for the practice of traditional activities, and is unique not only in how it is used, but also for the concentration of wildlife that feeds, stops, mates and rests there.

As previously mentioned, the Naskapi share the study area with the Innu for their traditional activities, but these activities are not only conducted in this area (according to a young informant). The Naskapi have a steady presence in the area. They have the same attitude toward the harvesting of resources and use the same access routes as the Innu, but tend to go farther north, toward Greenbush. The Naskapi also use the same parameters as the Innu for their resource management system, but have fewer resting places, land-use sites and harvest sites. This is perhaps due to their propensity to occupy the same sites they used when they first arrived in the area. While the number of informants was smaller, the information received can only be taken as a general, albeit well-established, indicator.

7 INFORMANT CONCERNS – HOWSE PROJECT

The following is a list of Innu and Naskapi concerns and apprehensions as expressed by the informants. We have summarized the effects anticipated by participants, while trying to separate out the cumulative effects of other mining projects. Few measures were suggested by the participants to mitigate the potential effects.

7.1 CONCERNS

- The contamination of surface and underground water bodies: the study area is composed of numerous lakes, rivers and streams that are interlinked through the natural tributary flow process. According to informants, this aquatic network is lively and dynamic and its constituents are all connected. The planned project site is near this network, at the side of a mountain (Kauteitnat) with very particular winds and wind directions. The iron-bearing substances and particles carried by flows and generalized runoff can cause negative effects. In addition, there are a number of underground water sources in the area that could be contaminated through the infiltration of polluted runoff water into the groundwater. The contamination of this water would affect fish and riparian fur-bearing animals, as well as the aquatic ecosystem.
- The project's site and its waste areas are very close to Kauteitnat. The pit that will be dug could have an impact on the stability of the soils and sub-soils that support the eastern side of the mountain. One of the fears is that this side of the mountain could partially collapse, mainly as a result of vibrations and blasting.
- The dispersal of dust into the air can also cause pollution for users, as well as for animal and plant species. This aspect was a key topic of the discussions, as it can affect human health, species' appearance (such as the Willow Ptarmigan or White Partridge becoming orange), wild fruits, medicinal plants and the general landscape.

- Waste and tailings stored in fixed locations will be harmful in the long term if not handled appropriately.
- As a result of experiences with other mining pits, the informants stated that they would prefer if the pit was filled with solid matter once mining has ended.
- The stretch of road that links Tshitshitua Mani Meshkenu with the Tekutaut Meshkenu road and leads to Kauteitnat will disappear between Goodream Creek and the mountain. This hinders the movements of users who head to the mountain and, from there, use part of this road to reach Rosemary Lake and Howells River. If this stretch is eliminated, users will no longer be able to move between certain sites in a direct, efficient manner.
- The landscape surrounding Kauteitnat will be modified and as a result, the mountain, with its numerous symbols deeply rooted in Innu culture, will no longer be the same.
- The project will also modify caribou migration as soon as the herd returns. The informants claimed that they were convinced that caribou herds would no longer use these areas because of the noise and traffic. Other species will also be affected by these factors, and their behaviour and habits will change.
- The project will add new control and security measures to the existing ones, and they will restrict freedom of movement. The DSO security gate and road escort already restrict travel, which the informants dislike. The bypass road is not functional and has yet to be completed.
- The fly-in/fly-out system is also a significant concern. The informants do not know where people are coming from, and they worry that they could carry diseases and contaminate the local population.
- The positive benefits associated with the employment of Aboriginals are of little value if the company does not provide them with meaningful jobs or discriminates against them by giving them low-status jobs.

7.2 MITIGATION MEASURES

The concept of mitigation measures for the potential effects described above is poorly understood by the Innu and the Naskapi. They say that it is impossible to reduce effects to such a degree that they will be able to live comfortably with their daily presence and find them bearable (Innu elder). The effects are damaging and cause prejudice to community members and their activities and to the habitats of species (Innu elder). The Howse Project will surely have an impact because activities such as pit development, production, crushing and transportation will take place. An Innu elder stated: "We have already lived with mining activities in the past and now it feels like an old wound is being opened." Nothing was done to mitigate the effects of earlier activities on people and on nature. They therefore wonder whether it is possible to reduce the pit, waste, dust, contamination, traffic, noise and disappearance of species. They also mentioned that they were not engineers, so they cannot give advice on how to achieve this. They did, however, ask questions about how to reduce the impact of the above-mentioned effects:

- How can toxic spills in water bodies and underground water be stopped?
- How can dust be prevented from spreading throughout the landscape and in nature, threatening species and bothering people?

- How can we ensure that drilling and dynamiting will not affect the mountain's stability?
- How can we reduce ore transportation in the area, which occurs in various proportions?
- How can we ensure that production activities will not restrict the freedom of movement of local users?
- What can be done to prevent security from taking charge of users when they move through the area?
- At the time of the mine's closure, will the company fill up the pit?
- In the event that caribou no longer want to migrate toward these areas, what does the company intend to do?
- Will the economic benefits in terms of employment be more positive for outsiders than for people from the two communities?
- Why did the TSMC company not apply impact mitigation measures for the DSO project?

These questions can be taken as guidelines for mitigation measures or, at the very least, for analysis and clarification.

7.3 CUMULATIVE EFFECTS

Informants say that the effects of previous projects conducted between 1950 and 1980 continue to have an impact on their quality of life: the multiple, very deep pits that were not restored, the dangers associated with such pits, the impossibility of using these mining areas for their other activities, land degradation (it is no longer as it used to be) and the impact of iron concentrations all around water bodies are all residual effects that continue to affect the Innu and the Naskapi. These projects had an impact on the traditional life of the elders that we met, and younger community members also view them as a nuisance.

In terms of the TSMC/LIM DSO project associated with the Howse Project:

- The company told us that there would be no effects on air quality, but we are currently experiencing them;
- Truck traffic and dust emissions continue;
- The road has been blocked and security hinders people's freedom of movement;
- Species are endangered, such as certain fish and partridges that are turning orange;
- The same impact in its various forms will be transferred to the Howse Project;
- Near the old pits, there is no more life, and no possibility of reusing the land, except for roadways.

According to the informants, the cumulative effects have an ongoing impact on people and their environment. They say that the effects of the Howse Project will go on after the mine's closure.

7.4 FUTURE INVOLVEMENT IN THE PROJECT

Informants said that there has to be a greater interaction in the dissemination of information between the company's management and community members with regard to impact mitigation

measures and the creation of a group to monitor the actions to be taken, assess them and keep the population informed on their status. Financial agreements are not sufficient to offset the impact of such projects.

7.5 ADDITIONAL COMMENTS

A number of Innu informants say that this project must be the last one to take place in the region of Schefferville or on the traplines held by members of Uashat mak Mani-Utenam. They have been summoned to answer the same questions for many years now. The companies only want their consent. The Howse Project must be the last time that iron is removed from the region; it has already cost the environment too much. Despite past projects, a Naskapi elder said that “animals, fish and migratory birds have managed to survive even if there have been cycles, but we are now faced with great season, climate and wind changes. Snow falls later, the cold is less intense and wind directions are abnormal when they should be blowing in a specific direction during a given season.” This comment leads us to believe that major climate changes have now reached abnormal proportions in the area and have an impact on biodiversity. This may be the reason why there are no more caribou (Innu elder) and the behaviour of other species is changing.

8 CONCLUSION

This ATK study concerning land use in the study area has led to a certain number of findings. The Innu and Naskapi both know the study area very well and use it continuously, even though their attitude toward traditional activities has changed somewhat as a consequence of modernity, the constraints of sedentary activities and mining activities. This knowledge allows us to deduce that the cultural and land integrity of the study area has historically remained relatively unchanged, despite the jolts of industrial encroachment, modern life and globalization.

It is also worth noting that the Innu and the Naskapi have experienced the effects of former mining projects and seem to have found some kind of balance between the uncertainties of such projects and their ancestral ways of life. However, and in terms of the current projects, they are able to fully understand the issues affecting their lands and the activities, habitats and behaviours of certain species of game animals and birds in relation to the project’s main components. They can also ask informed questions and demand appropriate answers.

The Howse Project is located next to a sensitive area, namely KAUTEITNAT, which is viewed as an important symbol of Innu culture. The informants seemed to agree that if this mountain retains its natural integrity, the project can go forward, provided the company can provide assurances to that effect. In light of the comments collected, the safeguarding of the mountain’s integrity must also be accompanied by a series of other actions that aim to reduce the impact on water, air, soil and species. The elders were very clear about these matters.

The consultation process was conducted in a way that disseminated all of the information about the project. For our part, we wished to reflect the information we received on land use in the study

area as accurately as possible. We believe that this text accurately echoes the various comments made and that the interpretations made are true to the spirit of such comments.

LIST OF FIGURES

Figure 1: Location

Figure 2: Land Use Study Area

Figure 3: Quebec-Labrador Peninsula/South Centre

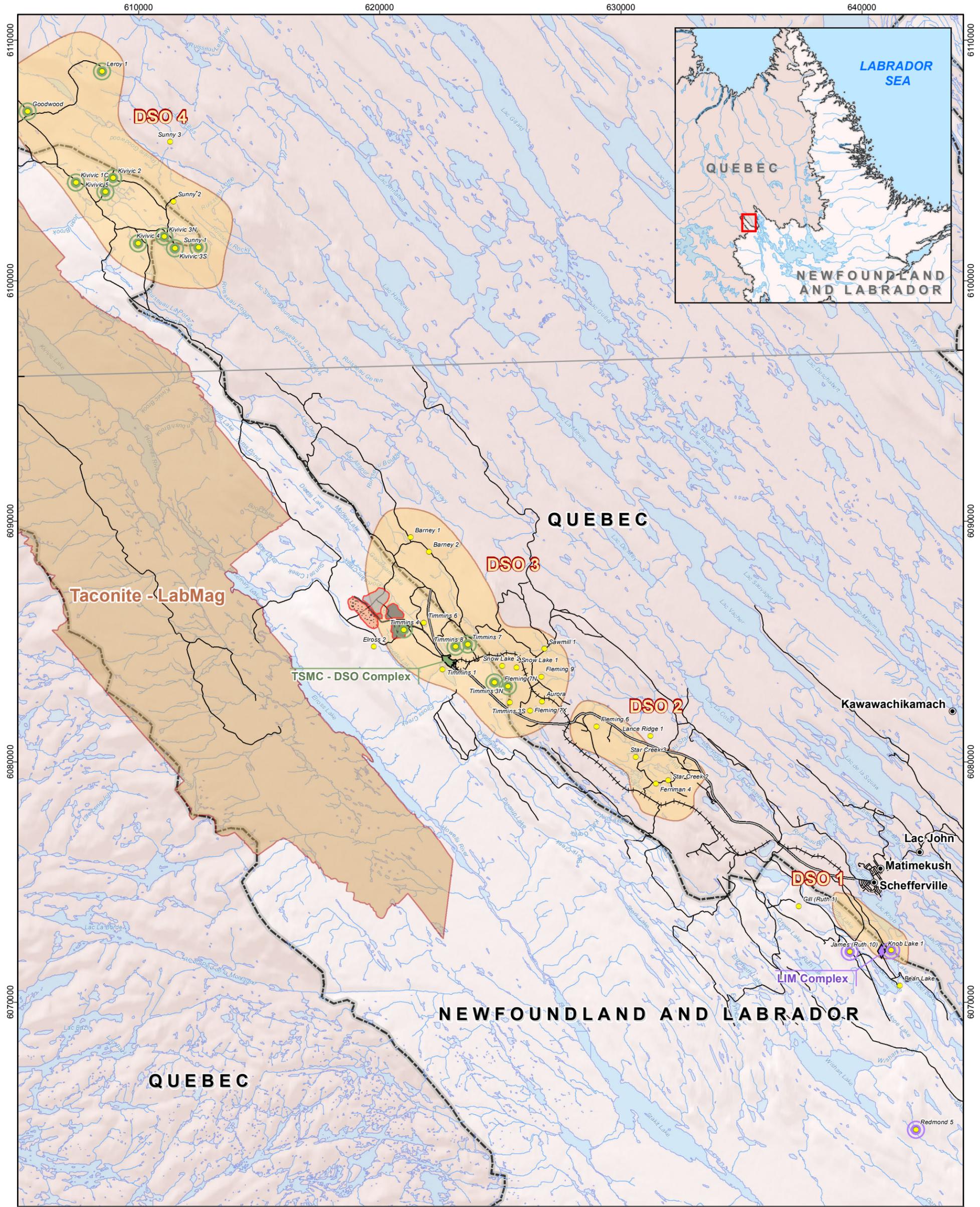
Figure 4: Trading Posts, Seigneuries and Concessions (17th and 18th century)

Figure 5: Amerindian Populations in the 17th and 18th Centuries

Figure 6: Indian Bands – 1850

Figure 7: Innu Families in Schefferville – 1960

Figure 8: Land Use and Traditional Aboriginal Knowledge



LEGEND

Infrastructure and Mining Components

- DSO - Deposit
- LIM Actual or Planned Deposit Operation
- LIM Complex
- TSMC Actual or Planned Deposit Operation
- DSO Complex - TSMC
- DSO - Other Site
- Taconite - LabMag

Howse Infrastructures

- Proposed Howse Pit
- Proposed Low Grade/Overburden Stockpile
- Proposed Crushing/Screening Facility
- Proposed Waste Rock Dump

Basemap

- Town
- Railroad
- Road
- Watercourse
- Water body
- Provincial Boundary

FILE VERSION, DATE, AUTHOR:
GH-0571.00, 2015-01-13, E.D.

0 2 4 6 8 10
Kilometers
UTM 19N NAD 83

SCALE: 1:150 000

SOURCES:

Basemap
Government of Canada, NTDB, 1:50,000, 1979
SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013.

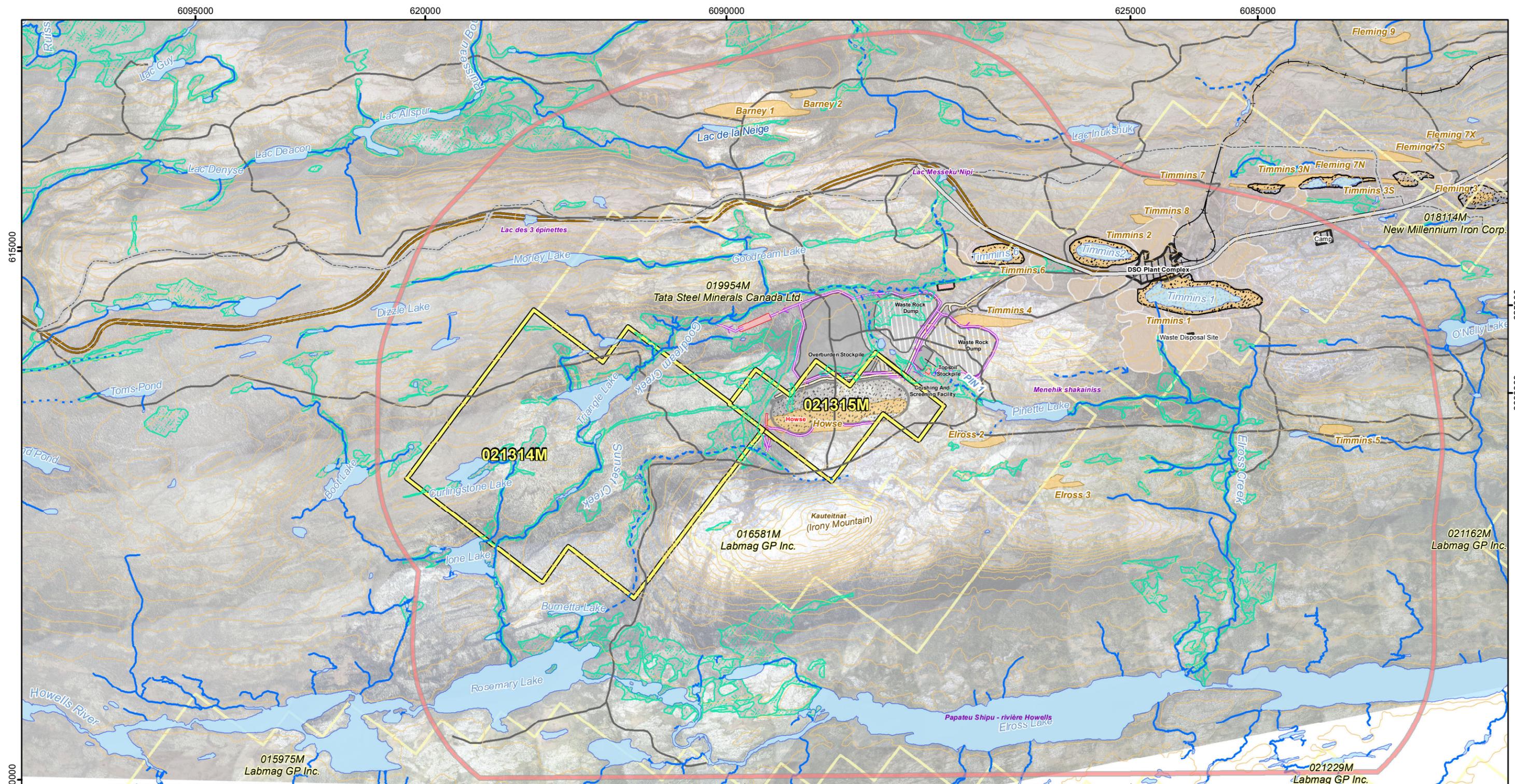
Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
TATA Steel Minerals Canada Limited/ MET-CHEM, Howse Deposit
Design for General Layout., 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Location
Howse Minerals Limited

Groupe Hémisphères
13, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 1



LEGEND

Infrastructure and Mining Components

- Proposed Infrastructures**
- Proposed Howse Pit
 - Proposed Low Grade/Overburden Stockpile
 - Proposed Crushing/Screening Facility
 - Proposed Waste Rock Dump
 - Proposed Sedimentation Pond
 - Proposed Ditch and Outlet
 - Road to DSO Area 4
 - Proposed Mine Haul Road

- Existing Components**
- Existing Railroad
 - Existing Sedimentation Pond
 - DSO Howse - Claim
 - Labrador Iron Mines Limited (49%) / Howse Minerals Ltd. (51%)
 - Other Claim
 - Elross Lake Area Iron Ore Mine (ELAIO) Plant Infrastructure Footprint
 - Existing Dump
 - Existing Pit
 - Deposit

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water body
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road
- Wetland
- Local Study Area

*Hydronyms are oriented along the direction of water flow

FILE, VERSION, DATE, AUTHOR:
GH-0572a-00, 2015-02-02, E.D.

UTM 19N NAD 83
SCALE: 1:44 000

SOURCES:
 Basemap
 Government of Canada, NTDB, 1:50,000, 1979 Government of NL and government of Quebec, Boundary used for claims
 SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013
 Infrastructure and Mining Components
 New Millennium Capital Corp., Mining sites and roads
 TATA Steel Minerals Canada Limited/ MET-CHEM Howse Deposit Design for General Layout, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Land Use Study Area
Howse Minerals Limited

GroupeHemispheres
 13, rue Saint-Louis,
 Bureau 201, Lévis (QC)
 Canada, G6V 4E2

1453, rue Beaubien est,
 Bureau 301, Montréal (QC)
 Canada, H2G 3C6

Figure 2

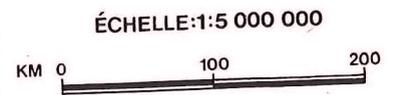
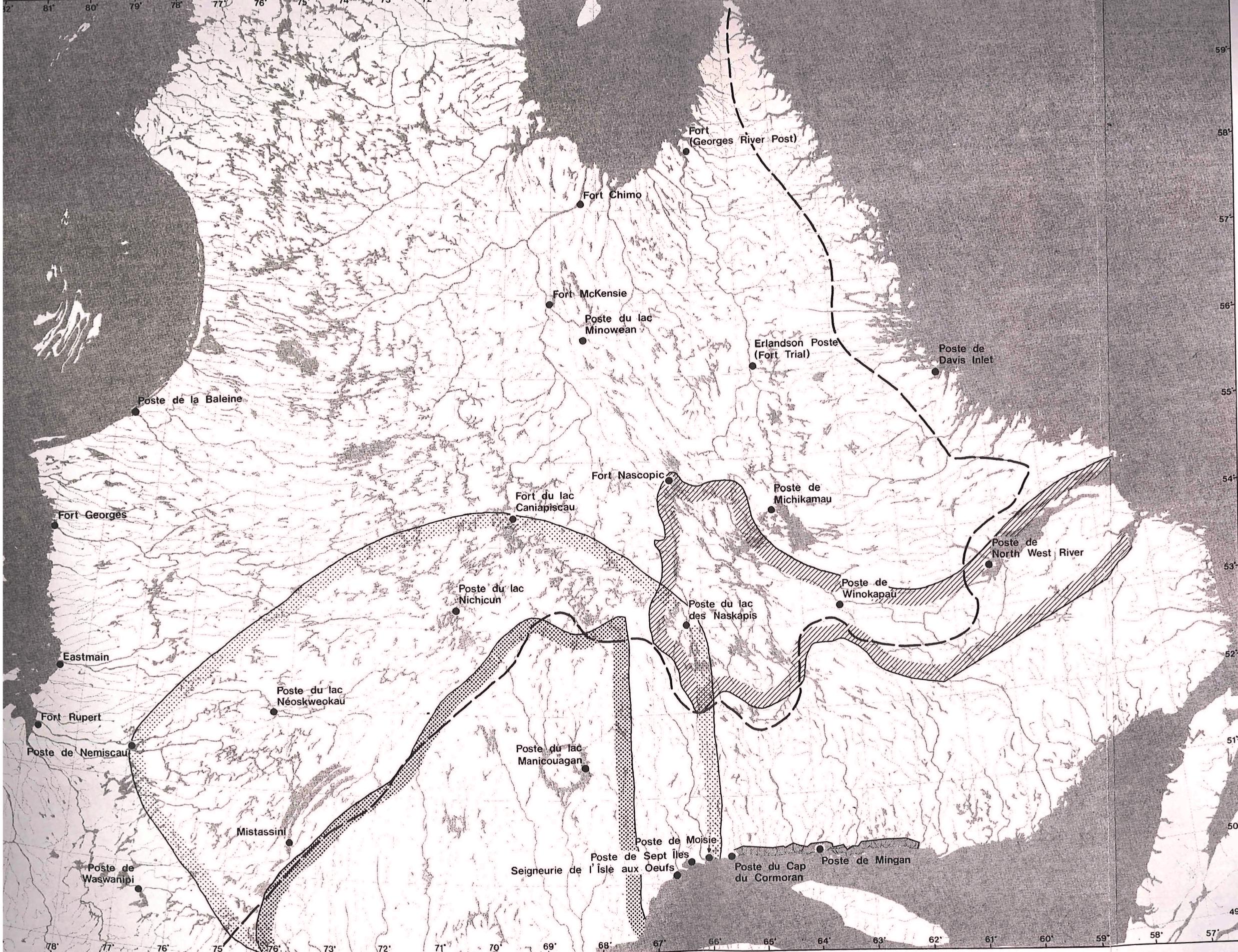
SCHEFFERVILLE

CARTE NO: 3

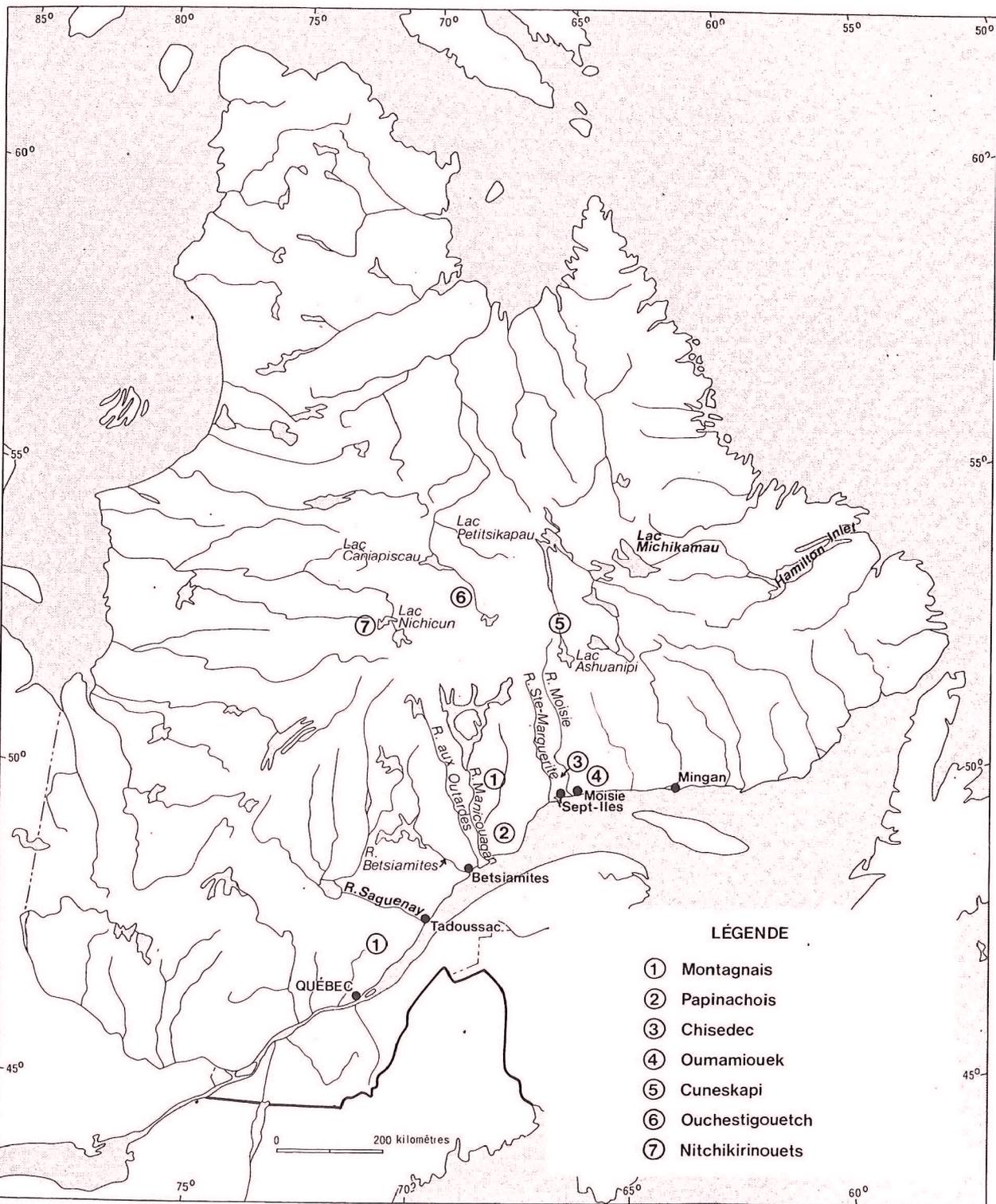
POSTES DE TRAITE, SEIGNEURIES ET CONCESSIONS AU QUÉBEC - LABRADOR

LÉGENDE

- Poste de traite
- Limite approximative de la terre de Rupert
- ▨ Limite approximative de la seigneurie de la terre ferme de Mingan
- ▧ Limite approximative de la concession faite à la veuve Formel à Hamilton Inlet
- ▩ Limite approximative du Domaine du Roi (1652)
- Limite approximative du Domaine du Roi (1733)



IDENTIFICATION DES POPULATIONS AMÉRINDIENNES RÉGIONALES AUX XVIIÈME ET XVIIIÈME SIÈCLES



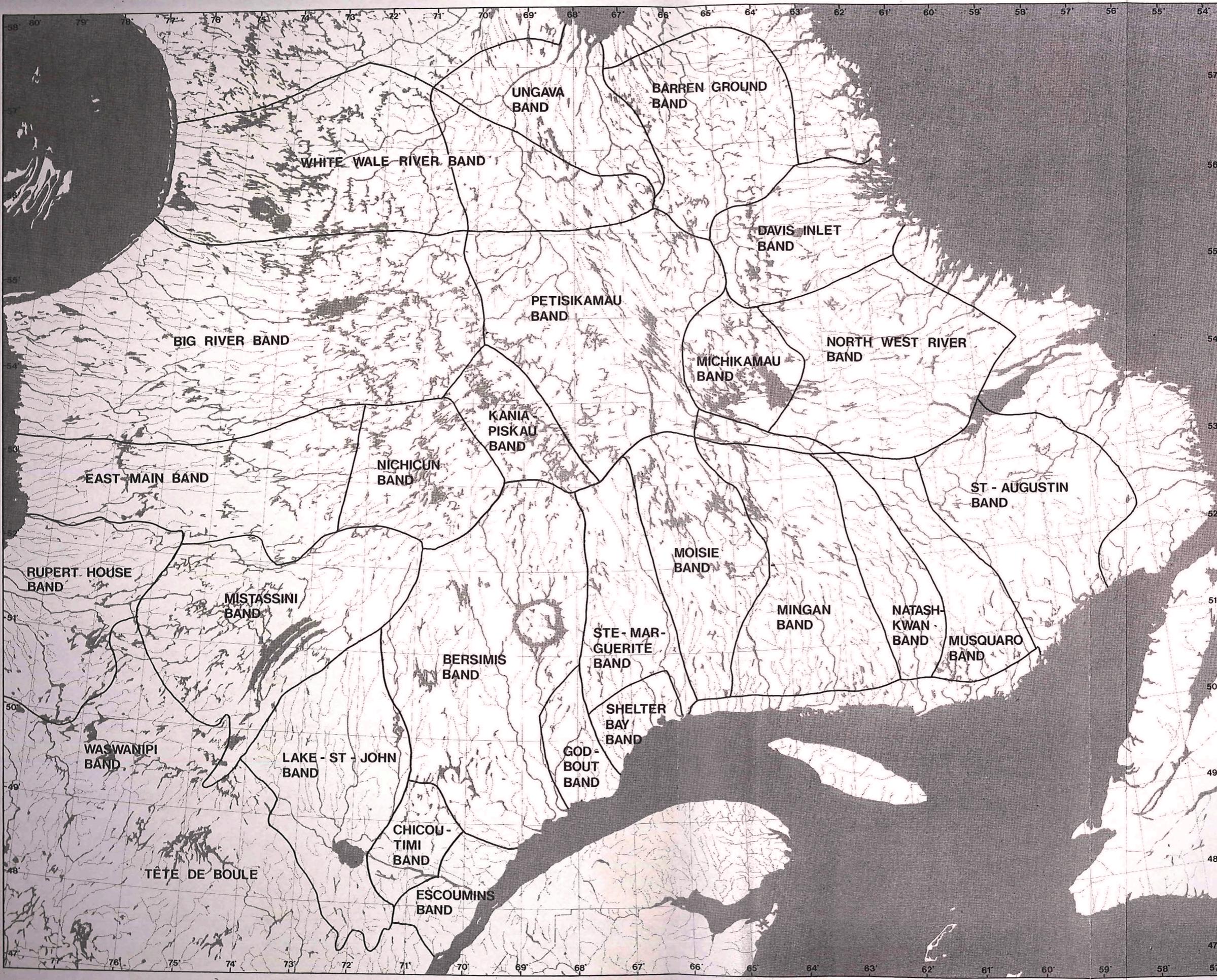
SCHEFFERVILLE

CARTE NO: 5

TERRITOIRES DES
BANDES INDIENNES
DE LA PÉNINSULE
QUÉBEC LABRADOR
VERS 1850

LÉGENDE

— Limite approxi-
mative des territoires
des bandes indiennes



ÉCHELLE: 1:5 000 000

KM 0 100 200

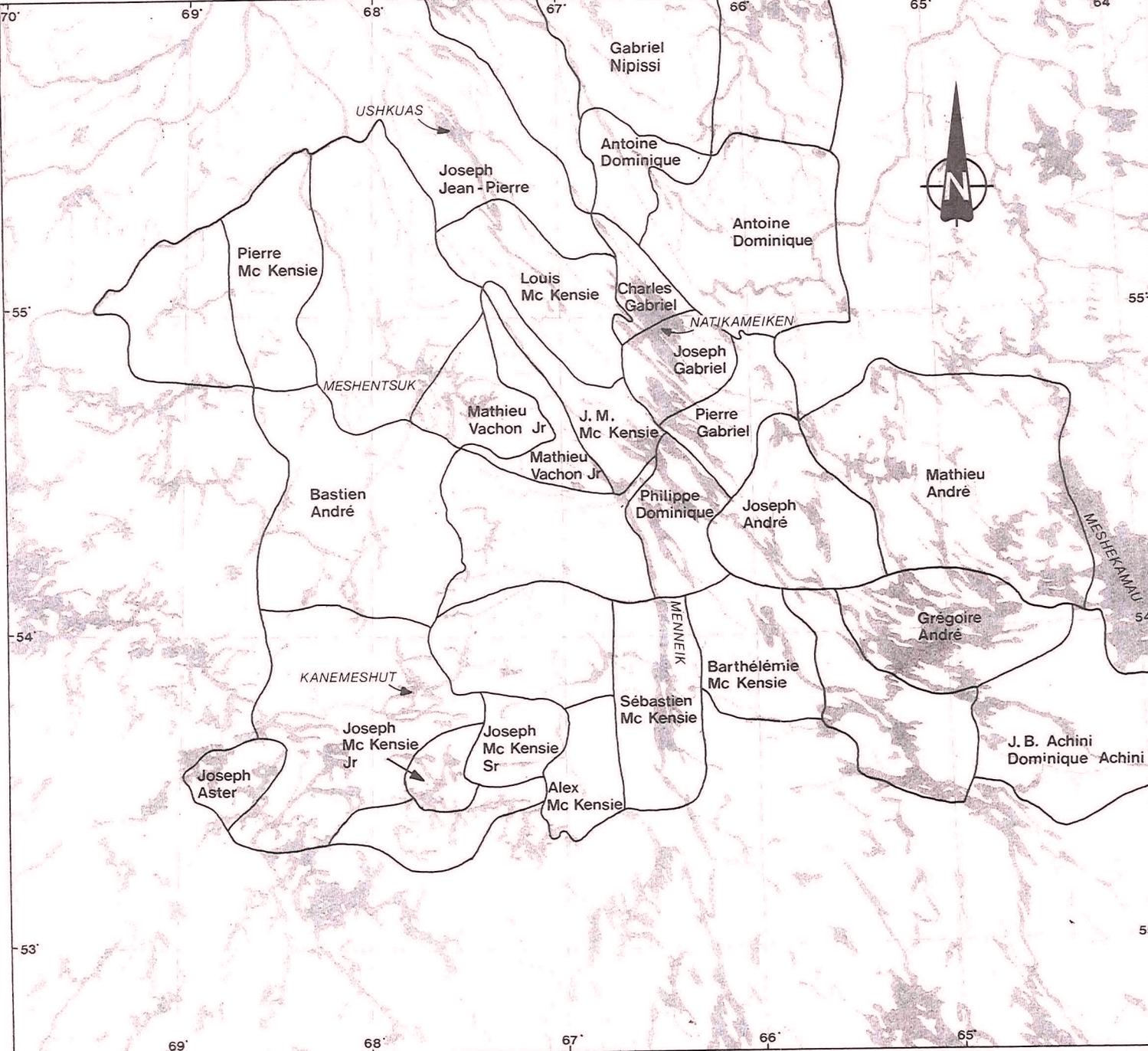
SCHEFFERVILLE

CARTE NO:14

TERRITOIRE DES FAMILLES MONTAGNAISES DE SCHEFFERVILLE EN 1960

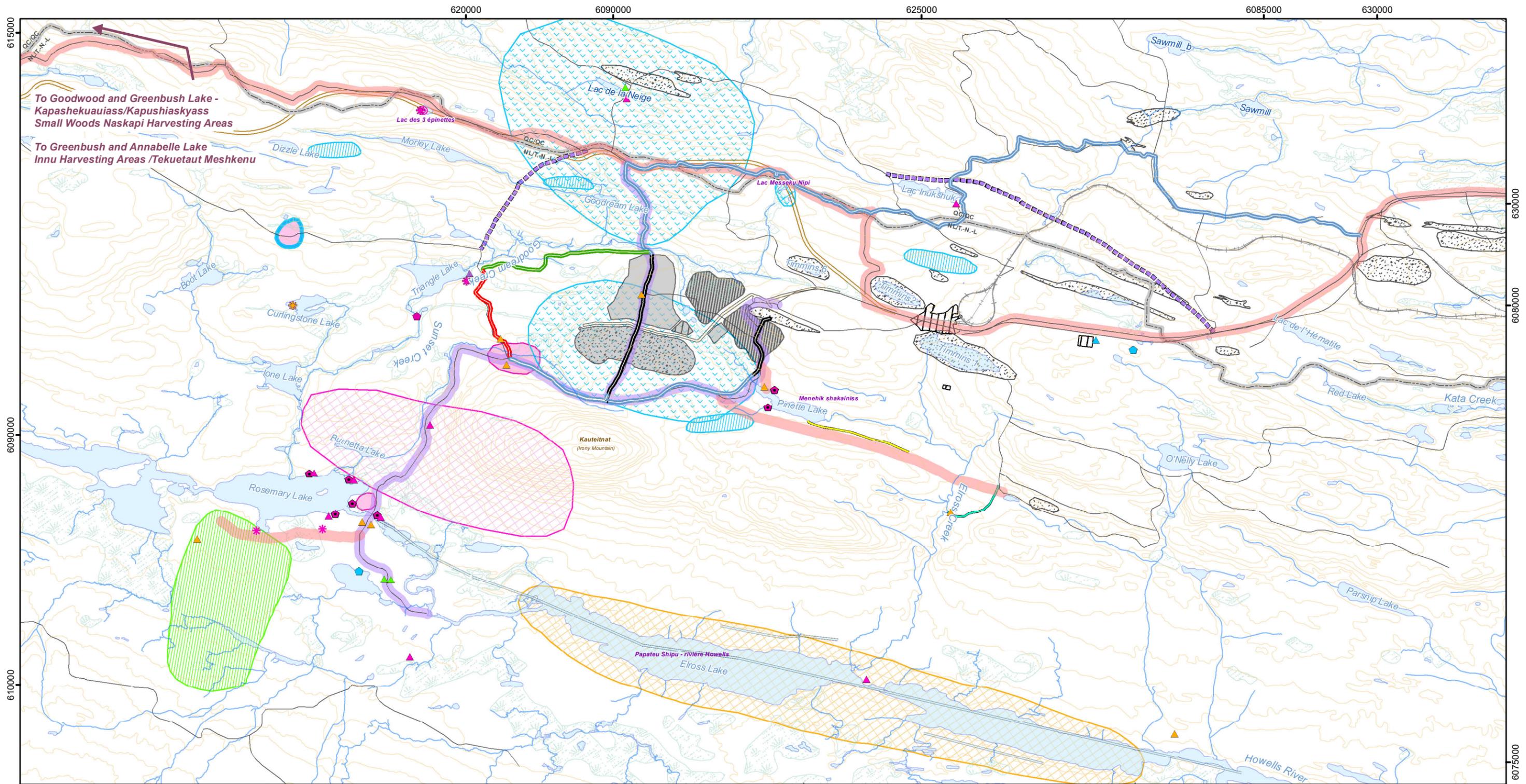
LÉGENDE

— Limite approximative
d'un territoire
familial



ÉCHELLE: 1:2 000 000

KM 0 20 40 60 80



LEGEND

Camps/ Tents

- ▲ Naskapi
- ▲ Innu
- ▲ Unknow Owner
- ▲ Naskapi - Old
- ▲ Innu - Old

Innu Harvesting Areas

- Hunting Area
- Camp Area

Naskapi Harvesting Area

- Goose Hunting

Innu Harvesting Locations

- ◆ Beaver Hunting
- ◆ Goose Hunting
- ◆ Fishing
- ◆ Trout Fishing
- ◆ Canoe
- ◆ Trout Fishing

Naskapi Harvesting Spot

- ◆ Trout Fishing

Access Roads

- To remove
- Access Road - Itinerary
- Winter Skidoo Trail
- Partridge Harvesting Road - Itinerary
- Proposed ByPass Road
- Old Access Road
- ATV Road - Skidoo Trail

Old Innu Harvesting Site

- ◆ Caribou Killing Site
- Old Partridge Area
- Old Goose Hunting
- Old Berry Picking Area
- Old Camp Area
- Old Naskapi Harvesting Area
- Old Camp Area

Infrastructure and Mining Components

- Road to DSO Area 4
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Crushing/Screening Facility
- Proposed Waste
- Rock Dump
- Proposed Mine Haul Road
- Eloss Lake Area Iron Ore Mine
- Plant Infrastructure Footprint

Basemap

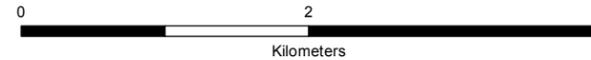
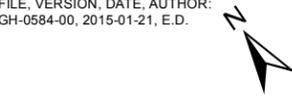
- Existing Road
- Contour Line (15 m)
- Provincial Border
- Watercourse
- Waterbody
- Wetland

Final Bypass Road

- Existing
- To Build
- To Improve

*Hydronyms are oriented along the direction of water flow

FILE VERSION, DATE, AUTHOR:
GH-0584-00, 2015-01-21, E.D.



UTM 19N NAD 83

SCALE: 1:50 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,
Mining Components
TATA Steel Minerals Canada Limited/
MET-CHEM Howse Deposit Design
for General Layout, 2013
Groupe Hémisphères, Hydrology and update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

**Land Use and
Traditional Aboriginal Knowledge**

Howse Minerals Limited

GroupeHemispheres
13, rue Saint-Louis,
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1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

**Figure
8**

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Weiler H. Michael *Naskapi Land Use in the Schefferville, Quebec Region Report II*, NMC Corp, December 2009, 55 pages

APPENDICES

APPENDIX I
Interview Questionnaire

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun**GUIDE D'ENTREVUE****Introduction**

Le formulaire de consentement doit être signé avant le début de l'entrevue.

- a) Présentation de l'équipe
- b) Brève description du projet
- c) Portée et objectifs du processus de l'étude d'impact environnemental et social
- d) Objectifs de cette entrevue concernant l'utilisation du territoire et des ressources, ainsi que le savoir traditionnel autochtone:
 - 1 Information générale sur l'utilisation du territoire et des ressources dans la zone d'étude;
 - 2 Identification et localisation des sites d'importance pour les activités traditionnelles, mais aussi des sites culturels et spirituels dans l'aire d'étude;
 - 3 Discussion concernant les perceptions, préoccupations et attentes liées au projet et à ses effets anticipés sur le territoire et les ressources dans l'aire d'étude.
- e) Questions / commentaires avant de débiter l'entrevue?

** Cette entrevue sera réalisée à l'aide de la carte de la zone d'étude

La plupart des questions doivent être répondues selon l'année de référence – août 2013 à juillet 2014 – et selon l'aire d'étude. Les exceptions sont mentionnées dans le questionnaire.

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

1. Identification des participants

Date: _____ **Heure début:** _____ **Heure fin:** _____

#Lot de piégeage : _____ **Titulaire actuel :** _____

Nom des participants	Liens (s)	Âge	Genre

Intervieweur: _____

Traducteur: _____

Lieu: _____

Enregistrée? _____

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun**GUIDE D'ENTREVUE****3. Utilisation générale du territoire et camps (avec la carte)**Titulaire du lot de piégeage

- 3.1. Quel est le rôle du titulaire du lot de piégeage?
- 3.2. Dans quelles circonstances avez-vous fréquenté l'aire d'étude au cours de l'année de référence?
- 3.3. Généralement, combien de personnes utilisent le lot de piégeage /aire d'étude?
- 3.4. Est-ce que l'utilisation du lot de piégeage / aire d'étude se limite à certains types d'activités?
- 3.5. Combien de personnes utilisent le lot de piégeage / aire d'étude en réalité?
- 3.6. Quel est le niveau d'effort que vous allouez aux activités traditionnelles? Temps plein, temps partiel, autre)?
- 3.7. Si on regarde la carte, pouvez-vous y inscrire l'endroit où se situent vos camps?
- 3.8. De quel(s) type(s) de camp s'agit-il?
- 3.9. S'agit-il de camps temporaires ou permanents?
- 3.10. Où se situent les sources d'eau potable à proximité de ces camps?
- 3.11. Comment vous rendez-vous à ces camps? (SVP, dessinez la route sur la carte. Si cela s'applique, distinguer selon les saisons).
- 3.12. Combien de temps vous faut-il pour vous rendre à vos camps? (pour chaque saison)
- 3.13. Quand vous allez à vos camps, combien de temps y restez-vous en général? (pour chaque saison)
- 3.14. Vous arrive-t-il de pratiquer des activités traditionnelles sans rester à votre camp (un aller-retour dans la même journée)? (pour chaque saison)
- 3.15. Y a-t-il des camps que vous avez abandonnés au cours des dernières années? Où? Pourquoi? (par exemple, le vieux camp près du lac Triangle, au sud du ruisseau Goodream?)

Autres utilisateurs

- 3.16. Dans quelles circonstances avez-vous fréquenté l'aire d'étude au cours de l'année de référence?
- 3.17. Quel est le niveau d'effort que vous allouez aux activités traditionnelles? Temps plein, temps partiel, autre)?
- 3.18. Si on regarde la carte, pouvez-vous y inscrire l'endroit où se situent vos camps?
- 3.19. De quel(s) type(s) de camp s'agit-il?
- 3.20. S'agit-il de camps temporaires ou permanents?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun**GUIDE D'ENTREVUE**

- 3.21. Où se trouvent les sources d'eau potable situées près de ces camps?
- 3.22. Comment vous rendez-vous à ces camps? (SVP, dessinez la route sur la carte. Si cela s'applique, distinguer selon les saisons).
- 3.23. Combien de temps vous faut-il pour vous rendre à vos camps? (pour chaque saison)
- 3.24. Quand vous allez à vos camps, combien de temps y restez-vous en général? (pour chaque saison)
- 3.25. Vous arrive-t-il de pratiquer des activités traditionnelles sans rester à votre camp (un aller-retour dans la même journée)? (pour chaque saison)
- 3.26. Y a-t-il des camps que vous avez abandonnés au cours des dernières années? Où? Pourquoi? (par exemple, le vieux camp près du lac Triangle, au sud du ruisseau Goodream?)

4. Cycle annuel des activités

- 4.1. **À l'aide de la carte et du tableau ci-dessous:** Quelles ont été vos principales activités au cours de l'année entre les mois d'août 2013 et juillet 2014? SVP indiquez quels sont les éléments marqueurs saisonniers (gel, dégel, etc.).

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

CYCLE ANNUEL DES ACTIVITÉS
 Année de référence : août 2013 à juillet 2014
 (Section en gris: les questions seront posées plus tard dans l'entrevue)

# sur carte	Quand (mois)	Activité	Espèces récoltées	a) Combien de fois? b) Durée des séjours? c) Nombre de personnes?	Modes de transport	Le projet aura-t-il un impact sur cette activité? Comment?	Si oui, mesures de bonification / évitement / mitigation proposées?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

# sur carte	Quand (mois)	Activité	Espèces récoltées	a) Combien de fois? b) Durée des séjours? c) Nombre de personnes?	Modes de transport	Le projet aura-t-il un impact sur cette activité? Comment?	Si oui, mesures de bonification / évitement / mitigation proposées?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

- 4.2. Au cours des 5 dernières années, avez-vous noté des changements concernant les ressources que vous récoltez dans l'aire d'étude?
- Leur présence?
 - Leur distribution?
 - Leur abondance?
 - Leur qualité?
- 4.3. Selon vous, quelle(s) est/sont la/les cause(s) de ces changements et pourquoi?
- 4.4. Ces changements ont-ils affecté vos activités dans l'aire d'étude? Si oui, comment?
- 4.5. Y a-t-il des zones qui sont particulièrement sensibles dans l'aire d'étude? (ex : aire de reproduction, aire de mise-bas, aire de mue, etc.) Si oui, svp les indiquer sur la carte.
- 4.6. Quels sont les principaux facteurs qui déterminent le temps que vous passez à pratiquer des activités traditionnelles dans l'aire d'étude?

5. Revenus et coûts (pour l'année de référence, août 2013 à juillet 2014)

- 5.1. Avez-vous vendu certaines des fourrures que vous avez récoltées dans l'aire d'étude?
- 5.2. Si oui, combien la vente des ces fourrures vous a-t-il rapporté?
- 5.3. Quelle proportion des ressources que vous récoltez dans l'aire d'étude sert à la consommation familiale?
- 5.4. Avez-vous estimé les coûts liés à la poursuite des activités traditionnelles durant l'année de référence (véhicules, équipement, essence, autre)?
- 5.5. Avez-vous reçu du soutien financier d'un programme en particulier pour vos activités de récolte?

6. Autres utilisateurs du territoire

- 6.1. (Si applicable) Est-ce qu'il y a d'autres autochtones qui ont utilisé l'aire d'étude durant l'année de référence?
- 6.2. Si oui, comment décririez-vous vos relations avec les autochtones dans l'aire d'étude durant l'année de référence?
- 6.3. (Si applicable) Est-ce qu'il y a des non-autochtones qui ont utilisé l'aire d'étude durant l'année de référence (pourvoiries, chasseurs, trappeurs, pêcheurs, tourisme d'aventure)?
- 6.4. Si oui, comment décririez-vous vos relations avec les non-autochtones dans l'aire d'étude durant l'année de référence?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

7. Faune présente dans l'aire d'étude

7.1. En utilisant la carte de l'aire d'étude, svp identifier les ressources qui y sont présentes selon votre connaissance, durant l'année de référence.

Espèces		O/N	# sur carte	# Récoltées?	Abondance (abondante, modérée, rare)	Commentaire
Mammifères						
Caribou sédentaire	Minashkuau-atik ^u					
Caribou migrateur	Mushuau-atik ^u					
Renard roux	Matsheshu					
Vison	Atshakash					
Martre	Uapishtan					
Orignal	Mush					
Ours noir et tanières	Mashk ^u					
Loup	Maikan					
Castor	Amishk ^u					
Lynx du Canada	Pishu					
Loutre	Nitshik ^u					
Rat musqué	Utshashk ^u					
Lièvre	Uapush					
Porc-épic	Kak ^u					
autres ?						
Poissons						
Ombre chevalier	Shushashui					
Ombre de fontaine	Matamek ^u					
Touladi	Kukamess					
Grand brochet	Tshinusheu					
Grand corégone	Atikamek ^u					
Ménomini rond	?					
Meunier noir	Makatsheu					
Ouananiche	Uanan					
Meunier rouge	Mikuashai					
Méné de lac	?					

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

Espèces		O/N	# sur carte	# Récoltées?	Abondance (abondante, modérée, rare)	Commentaire
Chabot tacheté	?					
Lotte	Minei					
Autres ?						
Faune aviaire						
Canard arlequin	Nutshipaushtikue-shish					
Garrot à œil d'or	Tshitshue mishikushk ^u					
Bernache du Canada	Nishk					
Oie des neiges	Uapishk					
Garrot (général)	Mishikushk ^a					
Plongeon catmarin	Ashu-muak ^u					
Cormoran (général)	Uapitukuan					
Garrot d'Islande	Mamatau-mishikushk					
Autres ?						
Autres						
Tétras du Canada	Innineu					
Gélinotte hupée	Pashpashtshu					
Lagopède des saules	Innapineu					
Lagopède des rochers	Kashkanatshish					
Grenouille	Umatshashkuk					
Salamandre	Utshishkatakak ^v Ushitshinauish					
Couleuvre	Atshinepuku					
Campagnol						
Souris	Apikushish					
Musaraigne						
Autres ?						

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

- 7.2. Est-ce que le caribou migre actuellement à travers l'aire d'étude ? Si oui, durant quelle(s) saison(s) ?
- 7.3. Avez-vous vu un troupeau de caribou de plus de 100 individus au cours des 5 dernières années dans l'aire d'étude ?
- 7.4. Si oui, à quelle fréquence et à quel(s) endroit(s) avez-vous observé ces troupeaux ?
- 7.5. Connaissez-vous des lieux de mise bas du caribou dans l'aire d'étude ou à proximité ?
- 7.6. Nous savons que le troupeau de caribous de la rivière George est en déclin dans l'aire d'étude. Avez-vous observé ce déclin ? Si oui, depuis quand ?
- 7.7. Selon vous, quelles en est/sont la/les cause(s) ? Pourquoi pensez-vous que ce/ces facteur(s) en est/sont la/les cause(s) ?
- 7.8. Est-ce que ce déclin a affecté vos activités de chasse au caribou ?
- 7.9. Connaissez-vous des endroits où se trouvent des tanières d'ours dans l'aire d'étude ou à proximité ?
- 7.10. Est-ce que les canards migrent dans l'aire d'étude ?
- 7.11. Est-ce que les oies migrent dans l'aire d'étude ?
- 7.12. Où s'arrêtent-ils/elles dans l'aire d'étude ? Quand ?
- 7.13. Avez-vous aperçu les espèces suivantes, rares ou en voie de disparition, au cours des 5 dernières années dans l'aire d'étude ? Si oui, à quelle fréquence ? À quel(s) endroit(s) ?
- Carcajou (Kuekuatsheu)
 - Renard arctique (?)
 - Coyote (Shitaikan)
 - Raton laveur (?)
 - Pékan (Utshek)
 - Caribou sédentaire (Minashkuau-atik^u)
 - Lièvre arctique (?)
 - Mouflon (Shakak^u)
 - Oiseaux de proie
 - Pygargue à tête blanche (Kauapishtikuanit-missu)
 - Aigle royal (Mitshishu ou missu)
 - Faucon pèlerin (?)
 - Hibou des marais (Kukuku)
- 7.14. Considérez-vous que d'autres espèces, mis à part celles mentionnées ci-dessus, sont en voie de disparition ou devenues rares dans l'aire d'étude ?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

9. Kauteitnat

- 9.1. À quand remonte vos premiers souvenirs de Kauteitnat?
- 9.2. Quels types d'activités étaient alors pratiquées à Kauteitnat et où (svp, indiquez le lieu sur la carte)?
- 9.3. Qui vous accompagnait?
- 9.4. À quelle fréquence visitiez-vous ce site?
- 9.5. Et maintenant? Allez-vous toujours à Kauteitnat? Si oui, à quelle(s) occasion(s)?
- 9.6. Quelles sont les activités (récoltes ou autre) que vous pratiquez à Kauteitnat? Où (svp indiquez le lieu sur la carte)?
- 9.7. Qui vous accompagne?
- 9.8. Comment décririez-vous l'importance et la signification (culturelle, spirituelle, rituelle et symbolique) de Kauteitnat?
- 9.9. Est-ce que la communauté a mis en place des mesures de conservation pour le site de Kauteitnat?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

10. Effets potentiels du projet sur l'utilisation du territoire et des ressources

10.1. Vous avez écouté une brève présentation du projet. Comment pensez-vous que le projet pourrait affecter négativement ou positivement les activités traditionnelles que vous poursuivez ?

(Note : les sources d'impacts pour les deux phases du projet seront brièvement rappelées aux participants par l'équipe)

Effets potentiels anticipés	
CONSTRUCTION	OPÉRATION

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

- 10.2. Quelles espèces sont plus susceptibles d'être affectées par le projet dans la zone d'étude et comment (utiliser le tableau du cycle annuel des activités)?
- 10.3. Quels sont les enjeux principaux qui devraient être abordés dans l'étude d'impact environnemental et social concernant l'utilisation du territoire et des ressources dans l'aire d'étude ?
- 10.4. Avez-vous des préoccupations concernant les effets cumulatifs des différents projets miniers actuellement en développement sur l'utilisation du territoire et des ressources? Si oui, lesquels?

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

11. Mesures de mitigation

11.1. Quelles sont vos suggestions pour éviter les effets négatifs potentiels que vous avez identifiés?

11.2. Quelles sont vos suggestions pour atténuer les effets négatifs potentiels que vous avez identifiés?

11.3. Quelles sont vos suggestions pour maximiser les effets positifs du projet?

Mesures d'évitement et d'atténuation proposées	
CONSTRUCTION	OPÉRATION

Utilisation du territoire et savoir traditionnel autochtone (STA) – Innu Aitun

GUIDE D'ENTREVUE

11.4. Quelles sont vos attentes par rapport à la fermeture des sites miniers et de leur réhabilitation/remise en état?

12. Prochaines étapes

12.1. Aimeriez-vous être informé de l'avancement du projet? Si oui, comment ?

12.2. Aimeriez-vous être impliqué dans les prochaines étapes de la planification du projet ? Si oui, comment ?

13. Questions

13.1. Avez-vous d'autres commentaires, questions ou préoccupations concernant le projet?

Merci pour votre participation.

Land-use and Aboriginal Traditional Knowledge (ATK) INTERVIEW GUIDE
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Introduction

The Consent Form must be signed before the interview begins.

- a) Presentation of team
- b) Brief project description
- c) Scope and objectives of the environmental and social impact assessment process
- d) Objectives of this land- and resource-use / aboriginal traditional knowledge (ATK) interview:
 - 1. General information regarding land- and resource-use in the study area;
 - 2. Identify and localize sites of importance for traditional activities but also cultural and spiritual sites in the study area;
 - 3. Discuss perceptions, concerns and expectations related to the Project and its anticipated effects on the land and on resources in the study area.
- e) Questions/comments before we start?

** This interview will be carried out using a map of the study area

Some questions should be answered according to the reference year - August 2013 to July 2014 – and to the study area. Exceptions are specified in the questionnaire.

**Land-use and Aboriginal Traditional Knowledge (ATK)
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1. Identification of participants

Date: _____ Starting time: _____ Ending time: _____

Name of Participants	Relationship(s)	Age	Gender

Interviewer: _____ Translator: _____

Location: _____ Recorded? _____

Land-use and Aboriginal Traditional Knowledge (ATK) INTERVIEW GUIDE
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3. General land-use and camp locations

- 3.1. In what circumstances did you carry out activities in the study area during the reference year?
- 3.2. How many people use the study area?
- 3.3. Is the study area restricted to certain types of activities?
- 3.4. What is the level of effort that you devote to traditional activities (e.g. full-time, part-time, other)?
- 3.5. If we look at the map, can you indicate where camps are located in the study area and the place name?
- 3.6. What types of camps are they?
- 3.7. Are these temporary or permanent camps?
- 3.8. Where are the sources of potable water located near each camp?
- 3.9. How do you get to your camps? (Please draw routes on map – if applicable, differentiate between seasons.)
- 3.10. How long does it take you to get there? (differentiate by season)
- 3.11. When you go to these camps, how long do you generally stay? (differentiate by season)
- 3.12. Do you sometimes harvest resources without staying at a camp (day trips)? (differentiate by season)
- 3.13. Are there camp sites that were abandoned in the past few years? Where? Why? (for example, the old camp around Triangle Lake, south of Goodream Creek?)

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4. Annual cycle of activities

- 4.1. **With map and inventory table below:** What were the main activities that you conducted in the study area during the year between the months of August 2013 and July 2014? Please indicate the markers of seasonal change (e.g. freeze up, open water, etc.).

Land-use and Aboriginal Traditional Knowledge (ATK)

ANNUAL CYCLE OF ACTIVITIES
 Reference year: August 2013 to July 2014
(Section in grey = questions will be asked later during interview)

# on map	when (month)	Activity	Species harvested	(a) How many times? (b) How long do you stay? (c) How many people go?	Modes of Transportation	Will Project have an impact on activity? How so?	If yes, proposed enhancement / avoidance / mitigation measures?

Land-use and Aboriginal Traditional Knowledge (ATK)

# on map	when (month)	Activity	Species harvested	(a) How many times? (b) How long do you stay? (c) How many people go?	Modes of Transportation	Will Project have an impact on activity? How so?	If yes, proposed enhancement / avoidance / mitigation measures?

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- 4.2. During the past 5 years, have you noted any changes in the resources that you harvest in the study area:
 - Their presence?
 - Their distribution?
 - Their abundance?
 - Their quality?
- 4.3. According to you, what is/are the cause(s) of these changes and why?
- 4.4. Have these changes affected your activities in the study area? If yes, how?
- 4.5. Are there particularly sensitive zones in the study area (e.g., calving areas, reproduction areas, spawning areas, moulting areas, etc.) If yes, please mark them on the map and indicate their names.
- 4.6. What are the main factors that determine how much time you spend practicing traditional activities in the study area?

5. Revenues/costs (Reference year: August 2013 to July 2014)

- 5.1. Did you sell any of the furs that you trapped in the study area?
- 5.2. If yes, how much income did you derive from selling them?
- 5.3. What proportion of the resources harvested in the study area is for family consumption?
- 5.4. Have you estimated the costs related to the pursuit of traditional activities during the reference year? (Vehicles? Equipment? Fuel? Other?)
- 5.5. Have you received support from the Hunting, Fishing and Trapping Support Programme or from other programmes? If yes, how so?

6. Other land-users

- 6.1. (If applicable) Did other aboriginal people use the study area during the reference year?
- 6.2. If yes, how would you describe your relations with aboriginal people in the study area during the reference year?
- 6.3. (If applicable) Did non-aboriginal people use the study area during the reference year? (outfitters, hunters, fishermen, adventure tourism)?
- 6.4. If yes, how would you describe your relations with non-aboriginal people in the study area during the reference year?

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7. Fauna present in study area

7.1. Using the study area map, please identify the resources that are present to your knowledge, during the reference year.

Species	Y/N	# on map	# Harvested	Abundance (abundant, moderately abundant, rare)	Comment
Game					
Sedentary caribou					
Migratory caribou					
Red fox					
Mink					
Marten					
Moose					
Black bear and dens					
Wolf					
Beaver					
Canada lynx					
Otter					
Muskrat					
Hare					
Porcupine					
Others ?					
Fish					
Arctic char					
Brook trout					
Lake trout					
Northern pike					
Lake whitefish					
Round whitefish					
White sucker					
Landlocked salmon					
Longnose sucker					
Lake chub					
Mottled sculpin					
Burbot					
Others ?					

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Species	Y/N	# on map	# Harvested	Abundance (abundant, moderately abundant, rare)	Comment
Waterfowl					
Harlequin duck					
Goldeneye					
Canada goose					
Snow goose					
Common loon					
Red-throated loon					
Cormorant					
Iceland gull					
Others ?					
Others					
Spruce grouse					
Ruffed grouse					
Rock ptarmigan					
Willow ptarmigan					
Frog					
Salamander					
Snake					
Woodland vole					
Mouse					
Shrew					
Others ?					

- 7.2. Do caribou migrate through the study area? If so, at what season(s)?
- 7.3. Have you seen a caribou herd of more than 100 in the past five years in the study area?
- 7.4. If yes, how often have you seen such a herd and where?
- 7.5. Are you aware of caribou calving sites in or near the study area?
- 7.6. We know that the George River caribou herd is declining in the study area. Have you noticed this decline? If so, since when?
- 7.7. According to you, what is/are the cause(s) of this decline? Why do you believe that this/these factor(s) is/are the cause(s)?
- 7.8. Has this decline affected your caribou harvest?
- 7.9. Are you aware of the presence of bear dens in or near the study area?

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- 7.10. Do ducks migrate through the study area?
- 7.11. Do geese migrate through the study area?
- 7.12. Where do they stop in the study area? When?
- 7.13. Have you seen the following rare or endangered species in the past five years in the study area? If yes, how often? Where?
 - Wolverine
 - Arctic fox
 - Coyote
 - Raccoon
 - Fisher
 - Sedentary caribou
 - Arctic hare
 - Skunk
 - Birds of prey
 - Bald eagle
 - Golden eagle
 - Peregrine falcon
 - Short-eared owl
- 7.14. Do you consider that other species, other than those mentioned above, are rare or endangered in the study area?

8. Flora

8.1. Please identify the plants that you harvested (berries, medicinal plants, firewood etc.) during the reference year and where in the study area you harvested them.

Species	Amount Harvested (small, medium, large)?	# on map	Comments

**Land-use and Aboriginal Traditional Knowledge (ATK)
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Land-use and Aboriginal Traditional Knowledge (ATK)**9. Kauteitnat**

- 9.1. How far back in your memory do you remember Kauteitnat?
- 9.2. Back then, what were the types of activities that were carried out at Kauteitnat and where (please indicate location on map)?
- 9.3. Who accompanied you?
- 9.4. How often did you go?
- 9.5. What about nowadays? Do you still go to Kauteitnat? If so, on what occasion?
- 9.6. What are the activities (harvesting or orther) that you carry out at Kauteitnat? Where (please indicate location on map)?
- 9.7. Who accompanies you?
- 9.8. How would you describe the importance and significance (cultural, spriritual, ritual and symbolic) of Kauteitnat (Irony Mountain)?
- 9.9. Has the community put in place some site conservation measures for Kauteitnat?

Land-use and Aboriginal Traditional Knowledge (ATK)

10. Potential project effects on land- and resource-use

10.1. You have listened to a brief presentation of the Project. How do you think the Project may affect negatively or positively the traditional activities that you carry out?

(Note: sources of effects for both phases will be briefly reminded to the participants by the team)

Anticipated Potential Effects	
CONSTRUCTION	EXPLOITATION

Land-use and Aboriginal Traditional Knowledge (ATK)

- 10.2. Which species are most likely to be affected by the Project in the study area and how (use annual cycle table)?
- 10.3. What are the main issues that should be addressed in the impact study concerning land- and resource-use in the study area?
- 10.4. What are your views regarding the cumulative effects of the various projects currently being developed on land- and resource-use in or near the study area? If yes, which ones?

Land-use and Aboriginal Traditional Knowledge (ATK)

11. Mitigation Measures

11.1. What are your suggestions for avoiding the potential negative impacts that you have identified?

11.2. What are your suggestions for mitigating the potential negative impacts that you have identified?

11.3. What are your suggestions to maximise the positive effects of the project?

Suggested avoidance and mitigation measures	
CONSTRUCTION	EXPLOITATION

Land-use and Aboriginal Traditional Knowledge (ATK)
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11.4. What are your expectations in terms of site closure and site restoration/rehabilitation?

12. Next Steps

12.1. Would you like to be informed of the future stages of the Project? If so, how?

12.2. Would you like to be involved in the next steps of the Project planning? If so, how?

13. Questions

13.1. Do you have other comments, questions or concerns regarding the Project?

Thank you for your participation.

APPENDIX II
Consent Form

Étude d'utilisation du territoire et du savoir traditionnel autochtone (STA)

ÉNONCÉ DU PROJET ET DE L'ÉTUDE

Howse Minerals Limited (HML) (une filiale en propriété exclusive de Tata Steel Minerals Canada Ltd (TSMC) signataire d'une entente de co-entreprise non-constituée avec TSMC et Labrador Iron Mines (LIM)) propose le développement du *Projet de minerai de fer Howse* situé dans la Chaîne ferrifère Millennium au Labrador. Le site se trouve à environ 25 km au nord-ouest de Schefferville, Québec.

TSMC construit et opère déjà le *Projet de minerai de fer à enfournement direct DSO* à proximité du site du projet Howse. La construction et l'opération de la mine Howse s'appuiera sur des installations et infrastructures existantes qui ont été construites, ou qui le seront sous peu, dans le cadre du projet DSO. L'infrastructure déjà en place inclut :

- le camp de travailleurs;
- le concentrateur;
- la voie ferrée;
- l'équipement minier;
- une aire d'entreposage des explosifs.

La réalisation de ce projet entraînera des changements à l'environnement. Le projet comprend la construction d'une mine à ciel ouvert ainsi que des installations connexes telles que des piles de mort-terrain et de stériles, et nécessitera la construction d'une nouvelle route entre le site Timmins 4 et le site minier Howse. Le projet inclura les éléments suivants :

- 2 km de nouvelle route;
- Une mine à ciel ouvert;
- Piles de stockage de mort-terrain / dépôt meubles;
- Haldes de stériles;
- Installations de concassage et tamisage.

En même temps, le projet apportera des bénéfices économiques à la région en créant des emplois et des occasions d'affaires pour les membres des communautés avoisinantes, puisqu'il permettra la continuité des projets miniers mis de l'avant par TSMC et LIM respectivement.

Le projet a été inscrit conformément à la *Loi canadienne sur l'évaluation environnementale 2012* et à l'*Environmental Protection Act* de Terre-Neuve-et-Labrador.

Le Groupe Hémisphères s'est vu confié le mandat par HML pour la réalisation de l'étude des impacts environnementaux et sociaux (EIES) requise.

La Nation Naskapi de Kawawachikamach (NNK), la Nation Innu de Matimekush-Lac John (NIMLJ), l'Innu Takuaihan Uashat mak Mani-Utenam (ITUM), Innu Nation (IN), ainsi que le Conseil de la communauté NunatuKavut (NCC – anciennement la Nation Métis du Labrador) ont été informés de l'intention de HML d'entreprendre le projet Howse.

Selon notre mandat, nous devons prendre en considération les préoccupations et les attentes des communautés potentiellement affectées.

Vous êtes invité à participer à une entrevue avec les représentants de notre équipe. L'objectif de cette entrevue est de recueillir vos connaissances et vos opinions concernant :

- l'utilisation du territoire et des ressources, y compris de l'état actuel du territoire et des ressources qui s'y trouvent ;
- la manière dont le projet Howse pourrait transformer le territoire et les ressources, et plus particulièrement les conséquences de cette transformation sur les utilisateurs du territoire ;
- l'importance de Kauteitnat et la manière dont le projet Howse pourrait affecter l'endroit;
- les effets anticipés du projet sur le savoir traditionnel, les communautés et sur les membres des communautés (les impacts socioéconomiques);
- comment les effets anticipés pourraient être atténués ou gérés;
- les mesures de suivi environnementales et sociales en vue d'identifier les effets réels du projet.

L'entrevue prendra de 1 à 4 heures. Des cartes et d'autres supports seront utilisés pour colliger l'information. Avec votre consentement, l'entrevue sera enregistrée.

Votre participation à l'entrevue est volontaire. Vous n'avez pas à répondre à des questions si vous ne voulez pas. *Votre nom ne figurera dans aucun rapport.* Les seuls participants qui pourront être identifiés sont ceux qui œuvrent dans le secteur public et qui auront participé à l'entrevue dans le cadre de leur fonction.

HML a besoin de votre consentement pour utiliser l'information que vous fournirez dans le contexte de l'EIES. Si vous êtes d'accord pour participer à l'entrevue, veuillez lire et signer le formulaire de consentement ci-joint. Votre signature confirme que vous donnez le droit à HML d'utiliser l'information que vous fournirez strictement pour les fins de l'étude d'impact environnementale du projet. Veuillez en conserver une copie pour vos dossiers personnels.

Merci.

HML et le Groupe Hémisphères

Pitama tshe natu
tshissenitakanit eshk^u eka tapuetakanit tshetshi takuak ne
atusseun mak tshe minu
uitakanit aimun
CONSENTEMENT PRÉALABLE ET INFORMÉ

**Tshetshipannanut tshe natu-tshissenitakanit eshpaniuet uashka assi mak anite mamu ka
tananut
Tshe natu-tshissenitakanit tshe ishpish apashtakanit assi mak Innuat utshissenitamunnuau
Howse Minerals Limited (HML) * Kanutashinenanut atusseun Howse**

ÉTUDE D'IMPACT ENVIRONNEMENTALE ET SOCIALE (EIES)

ÉTUDE D'UTILISATION DU TERRITOIRE ET DE SAVOIR TRADITIONNEL AUTOCHTONE (STA)

HOWSE MINERALS LIMITED (HML) – PROJET DE MINÉRAI DE FER HOWSE

- Niminu-uaitamakuti tshe ishinakuak ne atusseun mak ne kanatu-tshissenitakanit ute ianishkushtakanit (kie tshissinuatshitakan), iapit ute tekuaq Howse atusseun. / J'ai reçu l'énoncé du projet et de l'étude ci-joint (lequel j'ai paraphé), qui inclut la description du projet Howse.
- Nimishta-minu-uaitamakuti ne ua utitaikanit ne kanatu-tshissenitakanit, kie niminu-tshiuenamakuti kueshte aimun. / J'ai été pleinement informé des objectifs de l'étude, et j'ai obtenu des réponses satisfaisantes à mes questions.
- Ninishtuten nin eka ui kueshte patshitinamani kueshte aimun, kie muk^u ishpish ui punian ne e uaitaman. / Je comprends que je peux refuser de répondre à toute question, et que je peux terminer la discussion à tout moment.
- Ninishtuten nika tshi natueniten passe aimuna ianimatshenitakuaki tshetshi uitakaniti tshetshi eka mishituepanitakaniti mak tshetshi miniu-kanuenitakaniti. / Je comprends que je peux demander à ce que certaines informations sensibles soient protégées et traitées de façon confidentielle.
- Ninishtuten tshe eka uiesh mashinaikana nukuak nitishinikashun. / Je comprends que mon nom ne figurera dans aucun rapport.

Eshi-natuenitakanit ute ish pimit ka-mashinateua, nitapueten tshetshi apashtakanit nitaimun ka patshitinaman ka natshishkakuiian ume ut ua aieshkuitishunanut *kanatu-tshissenitakanit tshe ishi-ishpish apashtakanit assi mak Innuat utshissenitamunnuau* tshe utinakanit tshetshi ut ueuetashtakanit kanatu-tshisenitakanit tshe ishpaniuet uashka assi mak anite mamu ka tananut ne e tshitapajtakanit kanutashinenanut Howse, ne atusseun e tshitapaitakanit, aimun tshe mishituepanitakanit.

Sous réserve des conditions ci-dessus, je consens à l'utilisation de l'information que j'ai fournie durant l'entrevue strictement aux fins de la préparation de l'étude d'utilisation du territoire et du savoir traditionnel autochtone qui sera utilisée pour la préparation de l'étude d'impact environnementale et sociale pour le projet de minerai de fer Howse, qui sera rendue publique en vertu de la *Loi canadienne sur l'évaluation environnementale (2012)*.

Tshitishinikashun e mamikashtet / Nom (majuscules):

Ute mashinatautishu / Signature :

Utishinikashun ka uauitshiuet e mamikashtenit / Nom du coordonnateur (majuscules):

Ute tshe mashinatautishut / Signature :

Eshpish tshishtuakanit / Date :

Tanite ka mashinatautisihueik^u / Lieu :

Land Use Study and Aboriginal Traditional Knowledge (ATK)

PROJECT AND STUDY STATEMENT

Howse Minerals Limited (HML) (a wholly-owned subsidiary of Tata Steel Minerals Canada Ltd (TSMC), signatory to an unincorporated joint venture with TSMC and Labrador Iron Mines (LIM)) proposes to develop the Howse Property Project in the Millennium Iron Range, western Labrador. The deposit is located 25 km northwest of Schefferville, Québec.

TSMC is already building and operating the Direct Shipping Ore Project in the vicinity of the planned Howse Property Project. The construction and exploitation of the Howse Deposit will rely on existing infrastructure and facilities that were built (or that will soon be built) for the purpose of the DSO Project. Infrastructure already in place includes:

- workers' camp;
- crusher;
- railways;
- mining equipment;
- explosive storage area.

Undertaking the Howse Property Project will bring changes to the environment. It will create one open pit and its related overburden stockpile and waste rock dump and will require the construction of a new road between Timmins 4 pit and the planned Howse deposit. The Project will include the following:

- 2 km of new road;
- Open pit;
- Overburden/ topsoil stockpiles;
- Waste rock dump;
- Crusher facilities.

At the same time, the Project will bring economic benefits to the region and will create employment and business opportunities for community members, as it will secure continuity of mining projects undertaken by TSMC and LIM, respectively.

The Project has been registered pursuant to the *Canadian Environmental Assessment Act 2012* and the Newfoundland and Labrador *Environmental Protection Act*.

Groupe Hémisphères has been awarded a contract by HML to conduct the required environmental and social impact assessments (ESIAs).

The Naskapi Nation of Kawawachikamach (NNK), the Nation Innu Matimekush-Lac John (NIMLJ), the Innu Takuaikan Uashat mak Mani-Utenam (ITUM), Innu Nation of Labrador (IN), and the NunatuKavut Community Council (NCC - formerly Labrador Metis Nation) have been informed of HML intention to develop the Howse Project.

As part of our mandate, we must take into account the concerns and expectations of the potentially affected communities.

You are invited to participate in an interview with representatives of our study team. The objective of the interview is to gather your knowledge and opinions concerning:

- Land- and resource-use, including the current condition of the land and its resources;
- How the land and resources may be affected by the Howse Property Project, particularly the consequences of those changes on land- and resource-users;
- The importance of Irony Mountain and how it could potentially be affected by the project;
- The anticipated effects of the Project on the ATK, on communities and community members (socioeconomic impacts);
- How the anticipated effects may be alleviated or managed;
- Social and environmental monitoring measures, to identify what the actual impacts of the Project are.

The interview will last between 1 and 4 hours. Maps and other media will be used to collect information. If you agree, the interview will be recorded.

Your participation in the interview is voluntary. You do not have to answer any questions that you do not want to answer. *Your name will not be used in any reports.* The only informants who may be identified are those who work in the public sector, when they speak in an official capacity.

HML needs your consent to use the information that you provide for the purposes of the ESIA. If you agree to participate in this interview, please read and sign the following consent form. Your signature confirms that you give HML permission to use the information provided strictly for the purposes of the Project's environmental assessment. Please keep a copy of the form for your records.

Thank you.

HML and Groupe Hémisphères

