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 synthetizes 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 Tshiuetin 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 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).

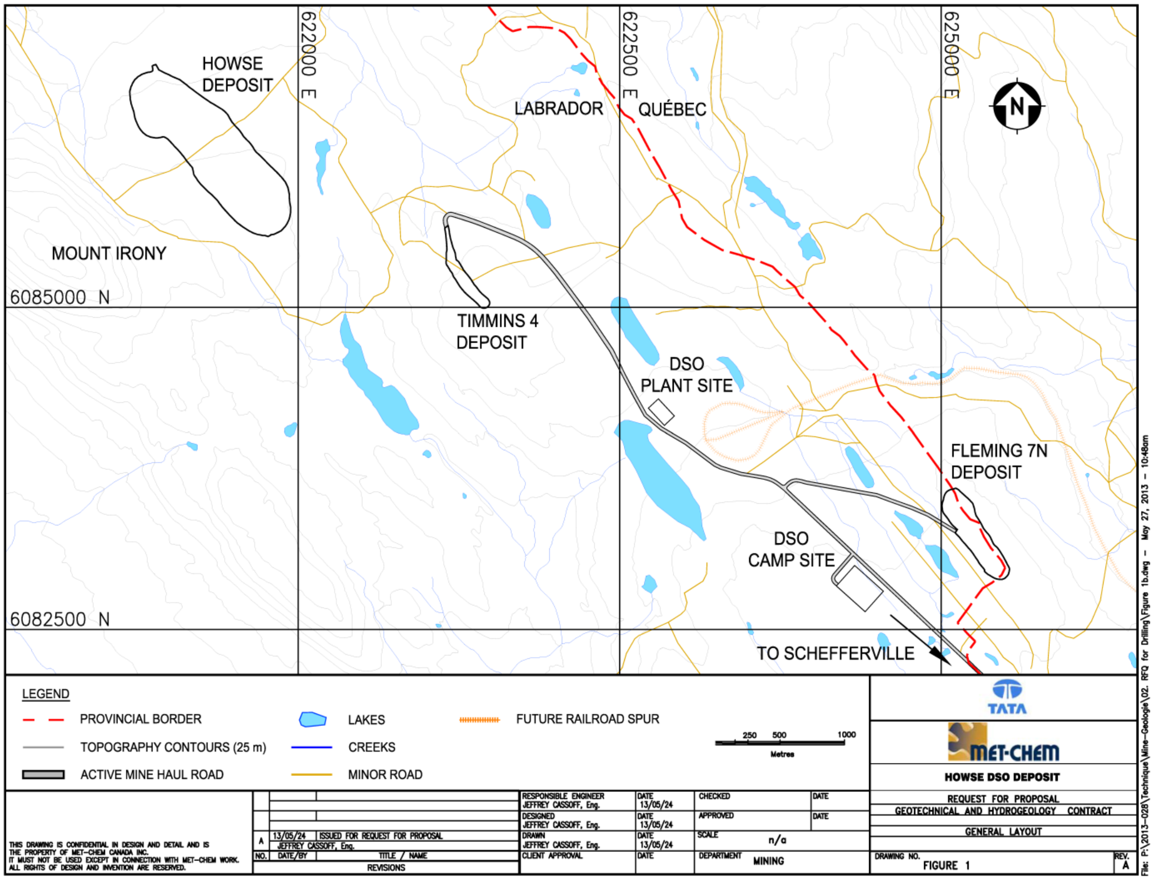


Figure 1: Location of the Howse Deposit (Figure from MET-CHEM)

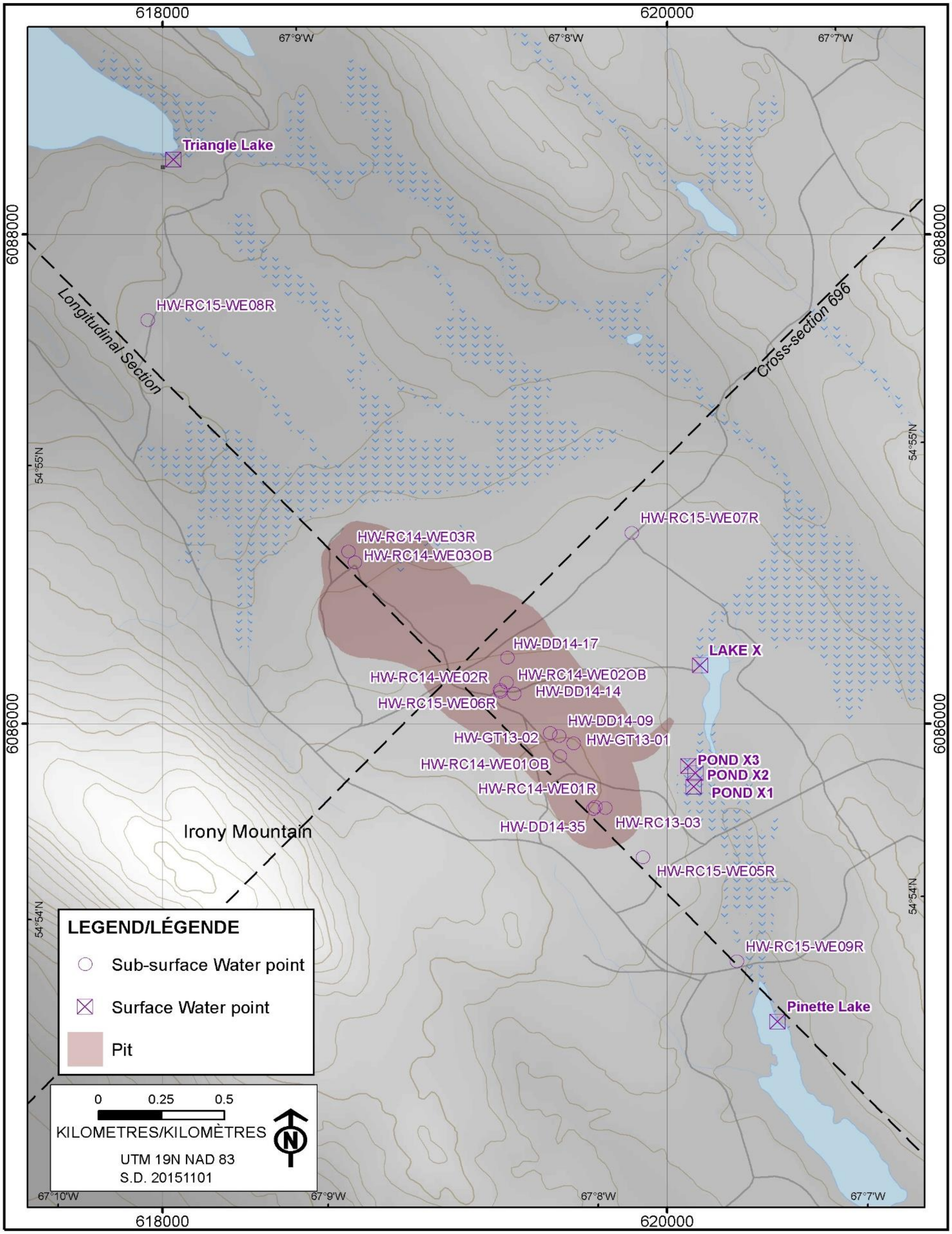


Figure 2: Location of Wells, Piezometers and Boreholes of the Howse Area

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 nortwest-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 equiped 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

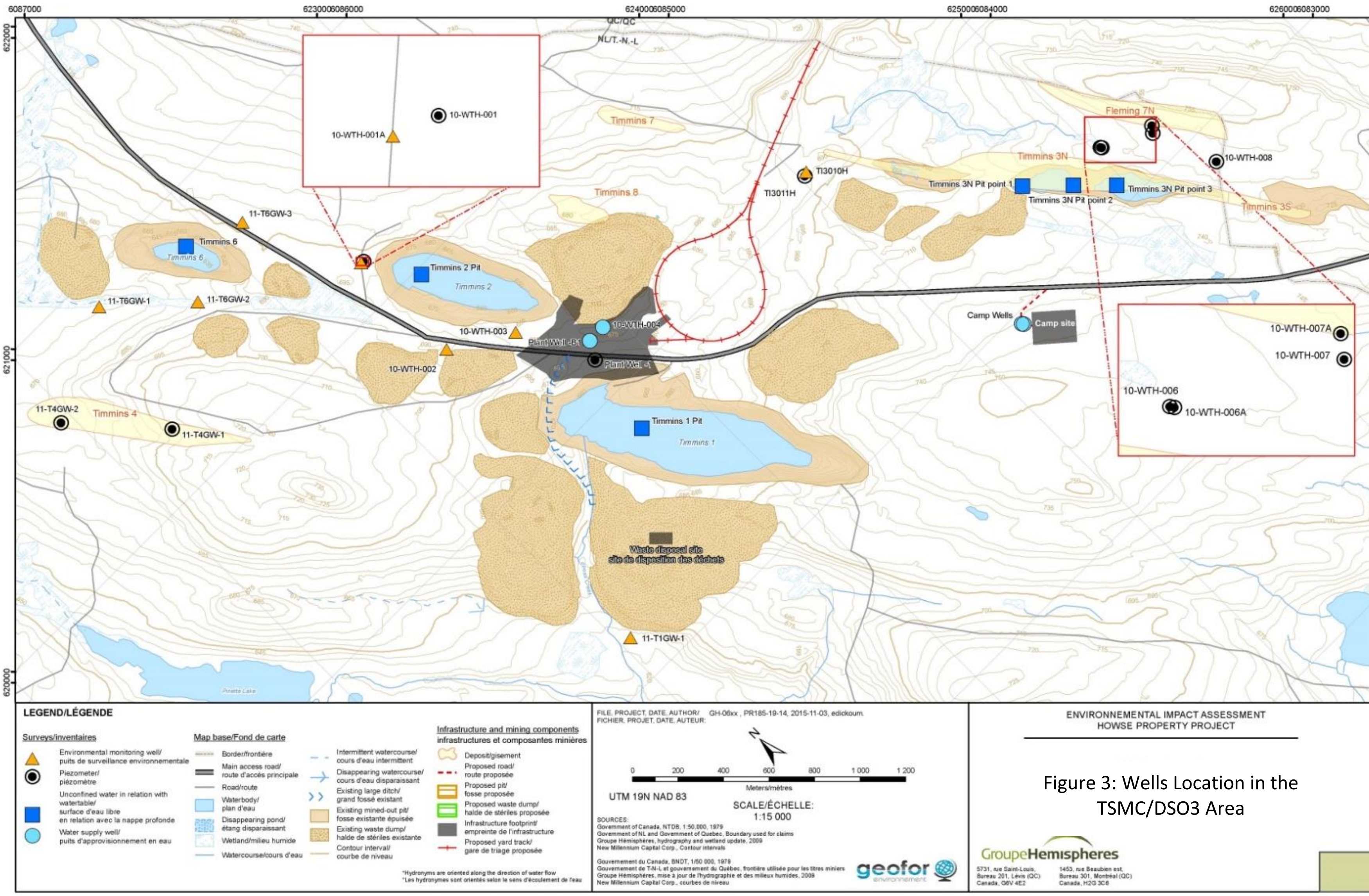


Figure 3: Wells Location in the TSMC/DSO3 Area

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^{o}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.

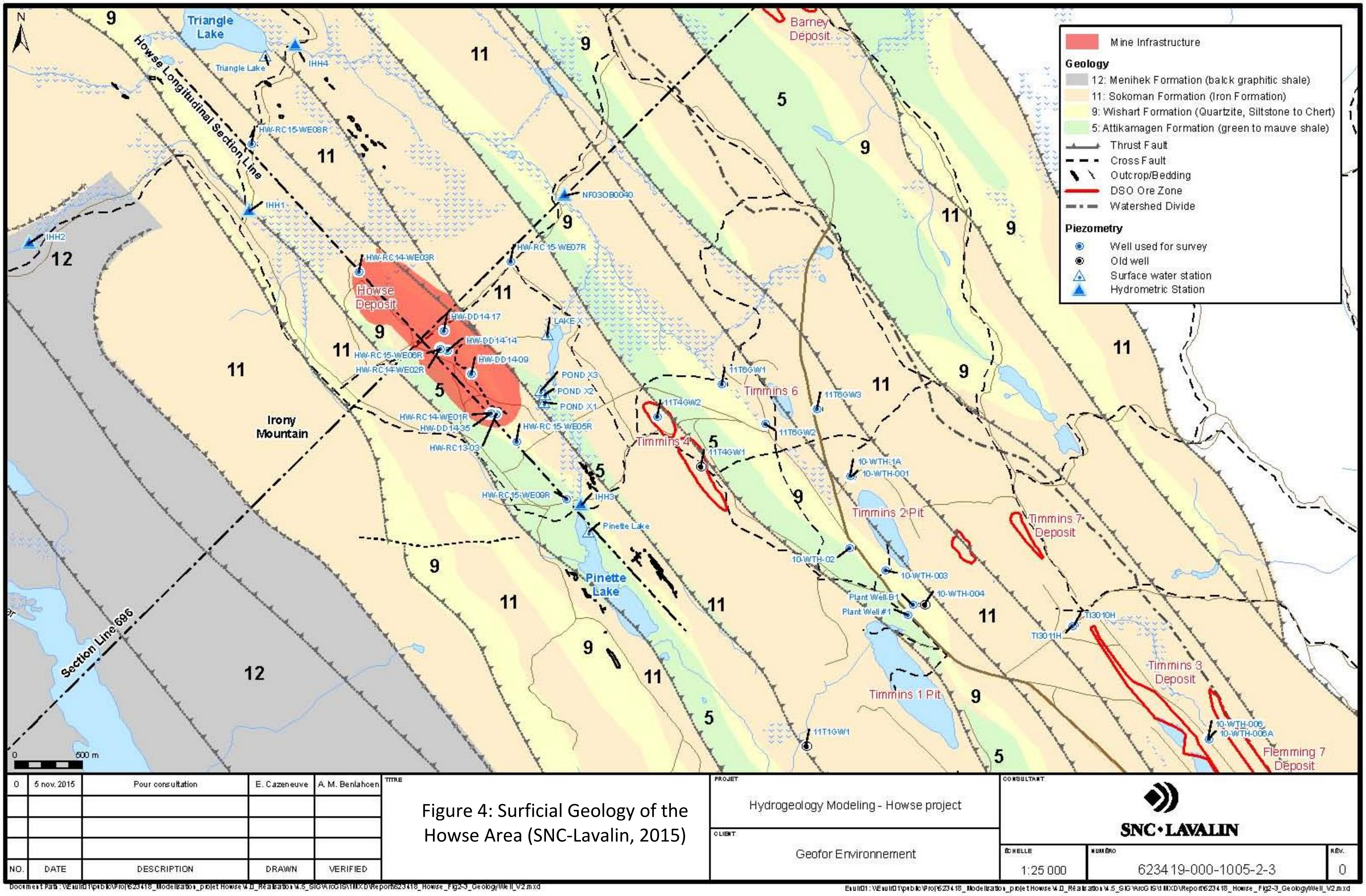


Figure 4: Surficial Geology of the Howse Area (SNC-Lavalin, 2015)

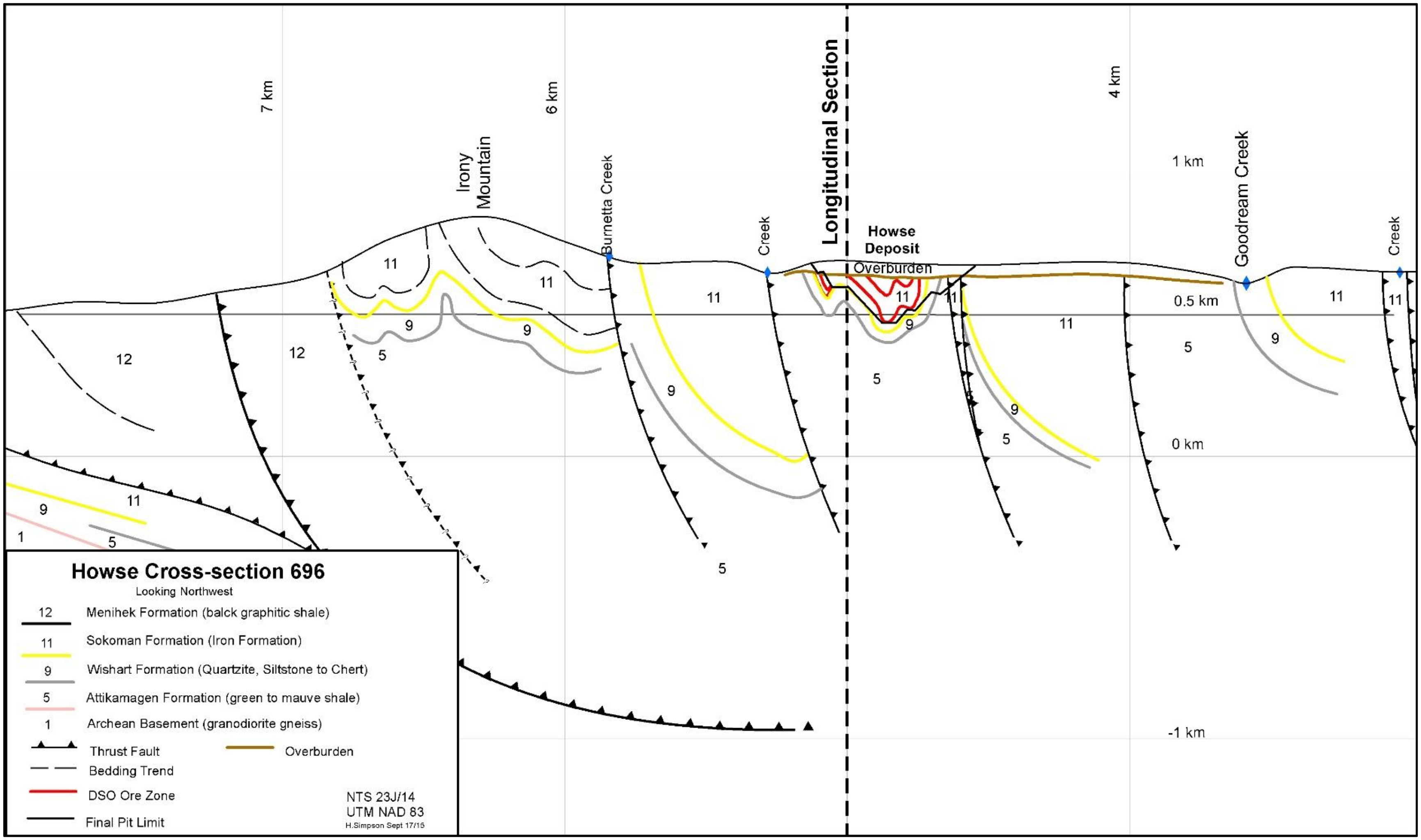


Figure 5: Howse Geological Cross-section 696 with the Profile of the planned pit

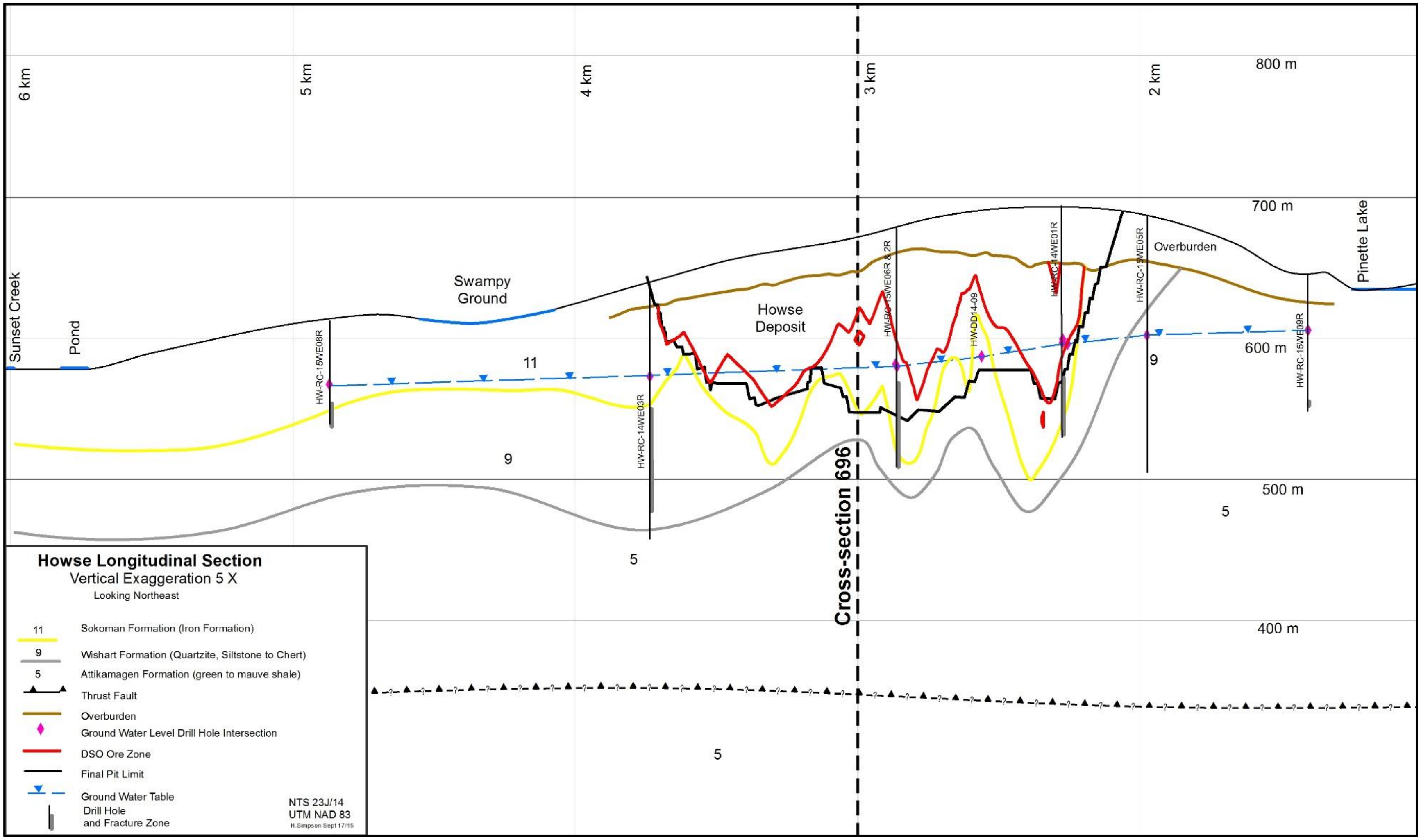


Figure 6: Howse Geological Longitudinal Section with the Profile of the Planned Pit

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 course 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 slatey 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 were 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.

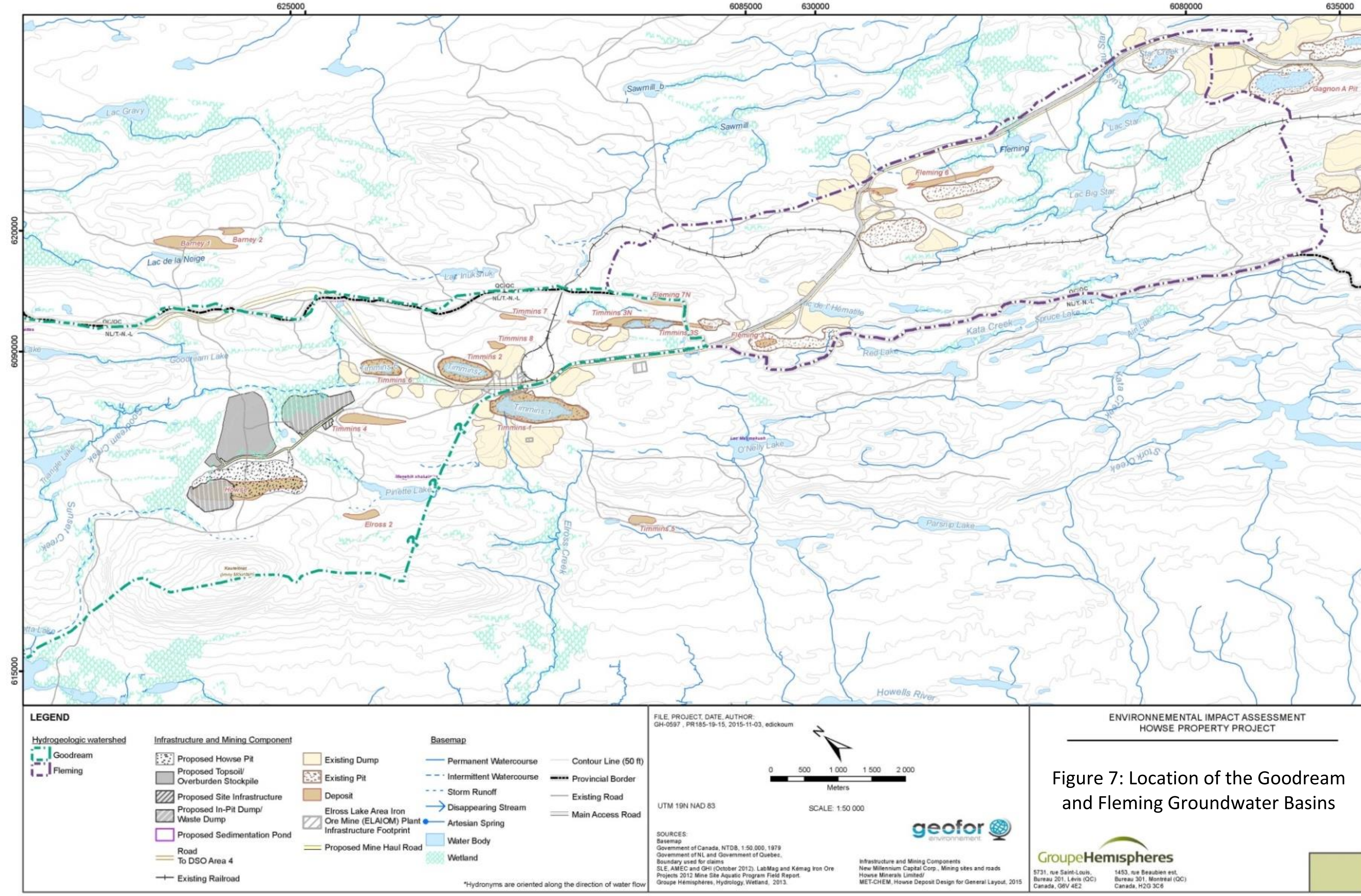


Figure 7: Location of the Goodream and Fleming Groundwater Basins

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.

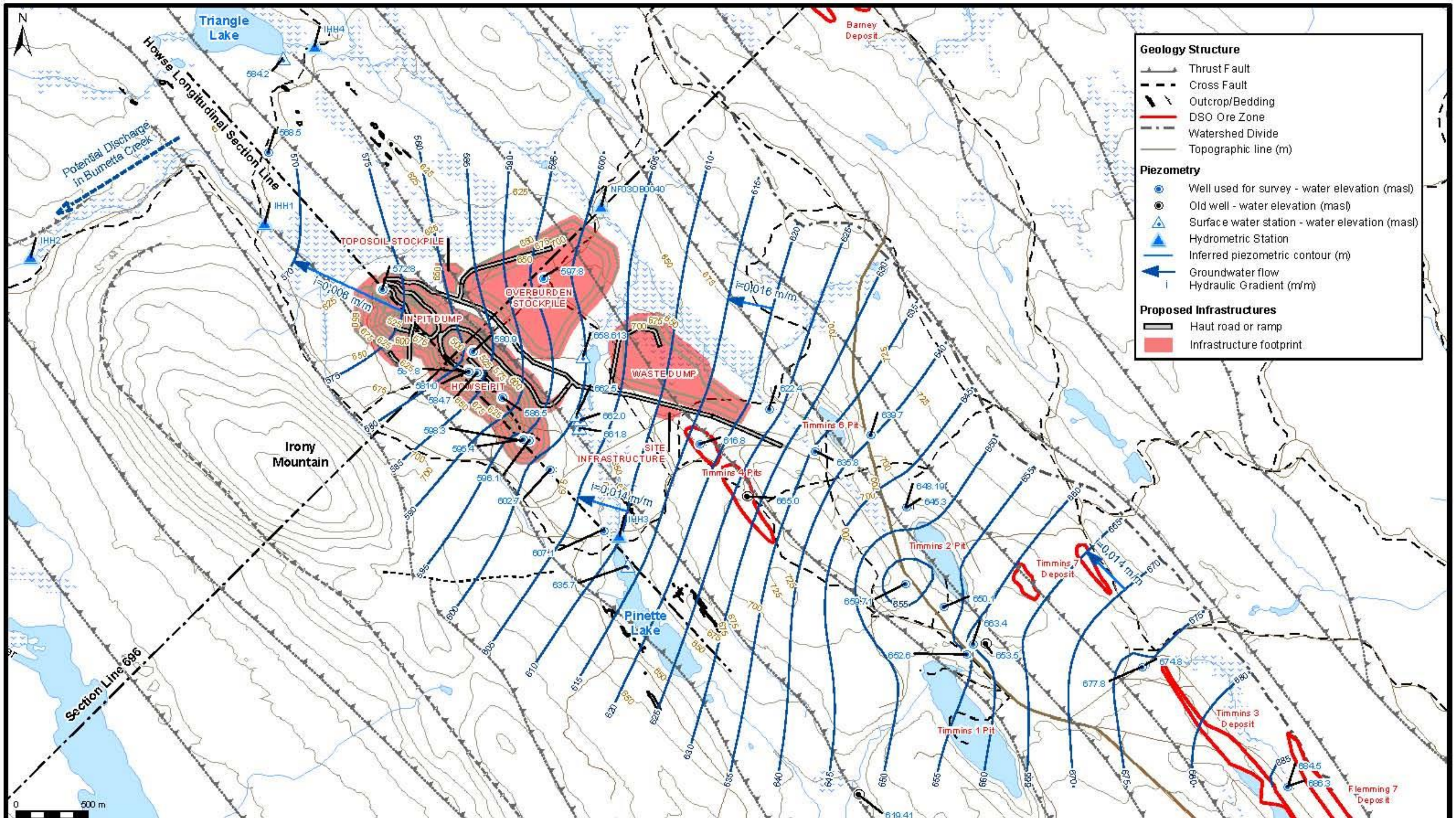
4.2 GROUNDWATER FLOW IN THE GOODREAM BASIN

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



NO.	DATE	DESCRIPTION	DRAWN	VERIFIED
0	9 nov. 2015	Pour consultation	E. Cazeneuve	A. M. Benlahcen

Figure 8: Piezometric Map of the Goodream Groundwater Basin (SNC-Lavalin, 2015)

PROJET: Hydrogeology Modeling - Howse project

CLIENT: Geofor Environnement

CONSULTANT: SNC•LAVALIN

ÉCHELLE: 1:25 000 | NUMÉRO: 623419-000-1005-2-6 | RÉV.: 0

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/km^2 while the downstream station near the mouth recorded 147 L/s/km^2. 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 ^oC, 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	^oC	
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 ^{o}C and the coldest month is January with an average temperature of -23.3 ^{o}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.

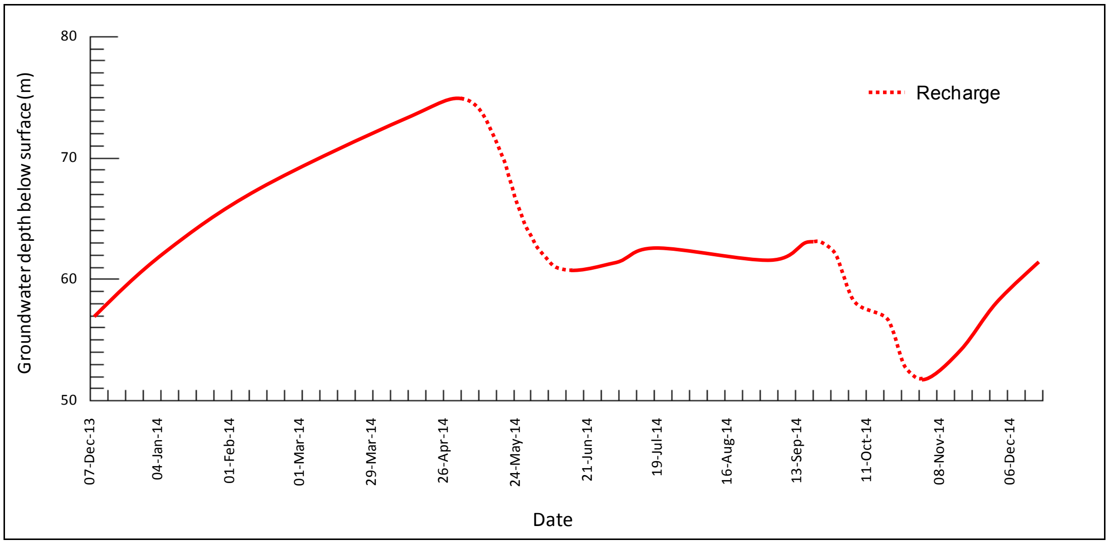


Figure 9: Seasonal Variation of the Groundwater Level at the Timmins Workers Camp

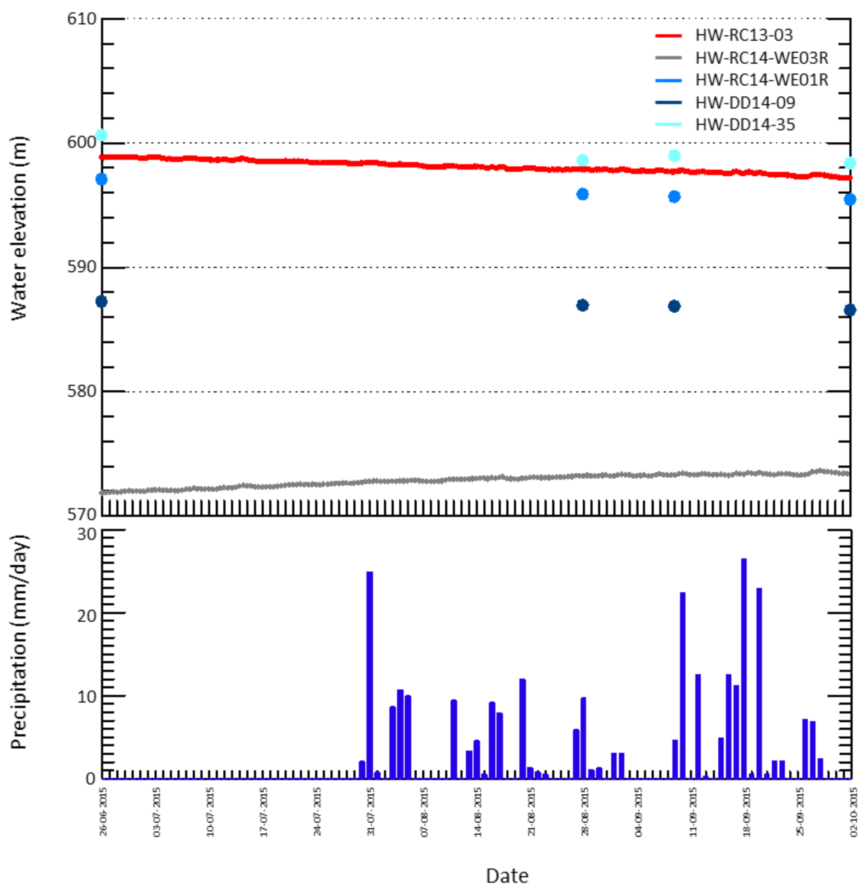


Figure 10: Variation of the Groundwater Level under the Howse Deposit Area

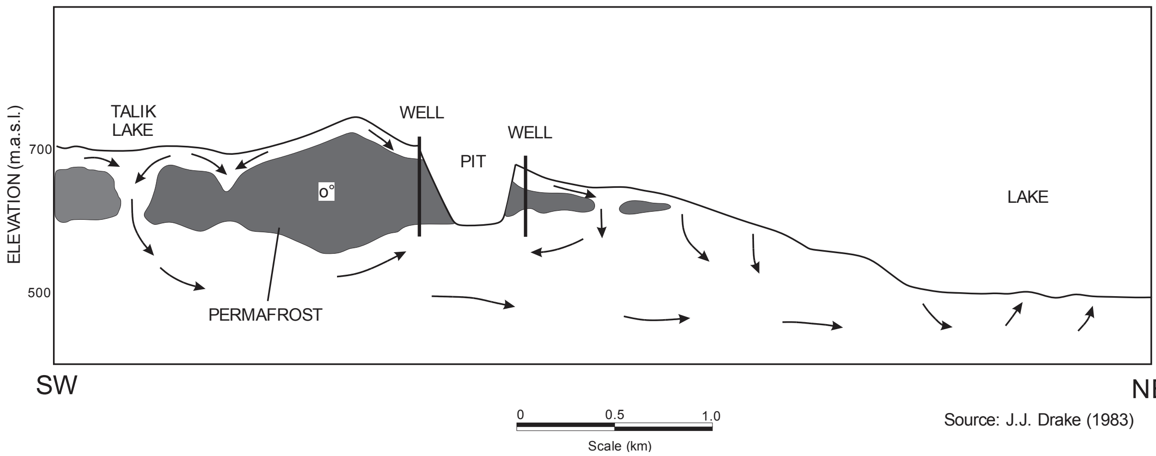


Figure 11: Groundwater Flow in a Region of Discontinuous Permafrost

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 m^3/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 m^3/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 form 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
			2E-07 - 6E-07	4.00E-07	Wishart
		HW-GT13-002	4E-08 - 6E-08		
			4E-08 - 5E-08	5.00E-08	Attikamagen Shale
			1E-07		Chert/Shale/fault zone
			1E-07		Chert/Shale/fault zone
Golder, 2014	Packer test	HW-GT13-001	2E-07	1.3E-07	Shale/fault zone
		HW-RC14-WE01*	2.13E-06		Sokoman (Iron ore)/Wishart
Geofor, 2014	Pump test	HW-RC14-WE03*	3.34E-05		
		HW-RC15-WEO6R*	1.1E-05 - 2.4E-05		
		HW-RC14-WEO2R**	1.2E-05 - 1.9E-05		Sokoman
		HW-RC15-WEO7R*	1.6E-06 - 1.1E-05		
Geofor, 2015	Pump test	HW-RC15-WEO8R*	1.10E-05	9.40E-06	

*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-WE01R. 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 m^3/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 m^3/min (75-85 usgpm) resulting in a 13.6 m final drawdown, and a specific capacity decreasing slightly from 0.04 to 0.02 m^3/min per meter.

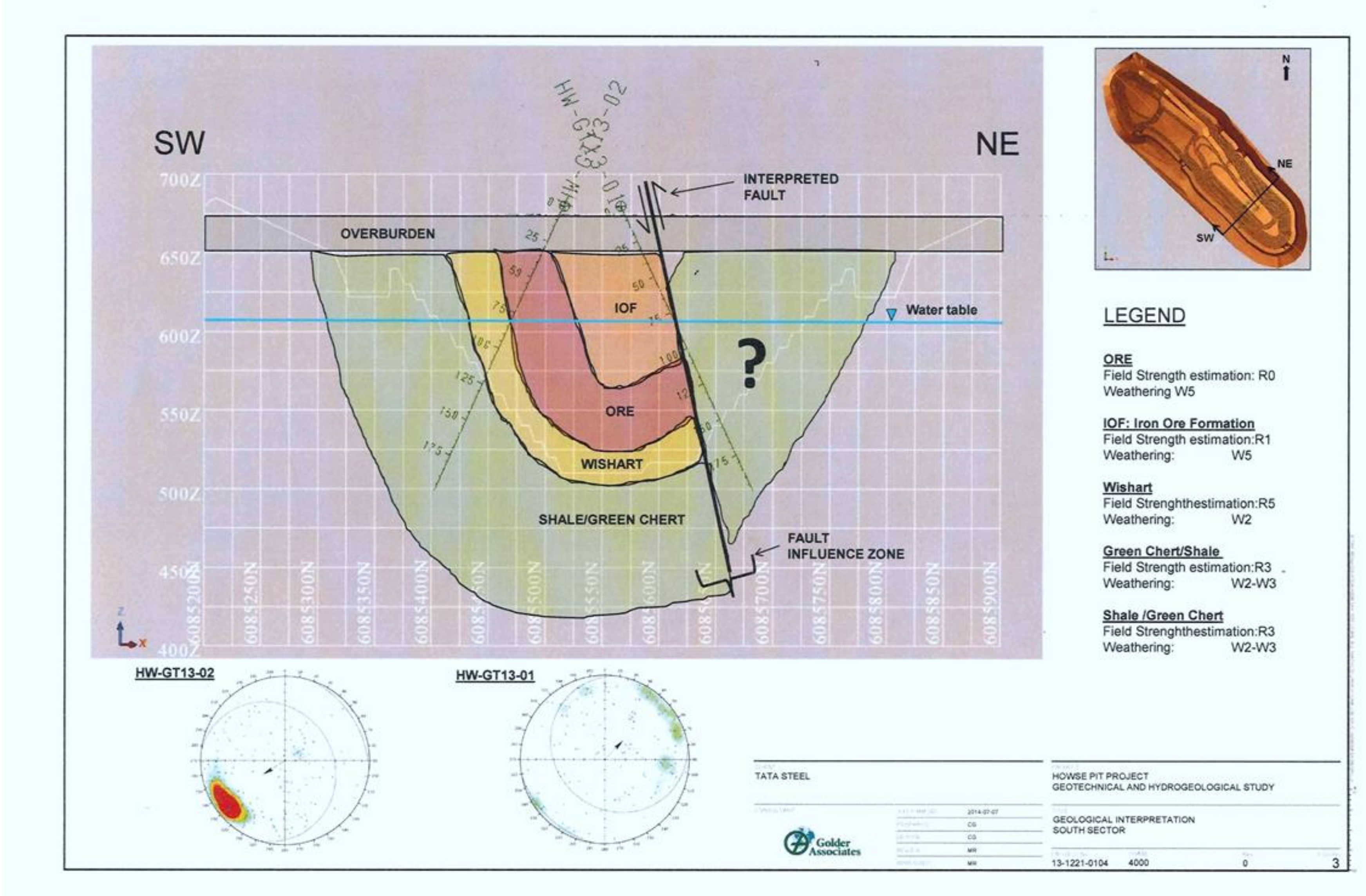


Figure 12: Packer Tests by Golder Associates

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 ^{o}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 where 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
Time from the pump start	24 hours	36 hours	72 hours	24 hours	48 hours	72 hours	24 hours	72 hours
pH	6.05	6.2	6.04	6.9	6.7	6.2	5.92	5.84
Electrical Conductivity (µσ)	11	12.3	14.5	21.2	20.7	21	21.9	22.9
Sp. Electrical Conductivity (µσ)	20	22	26.1	37.5	36.5	37.1	38.6	39.0
Temperature (^{o}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.

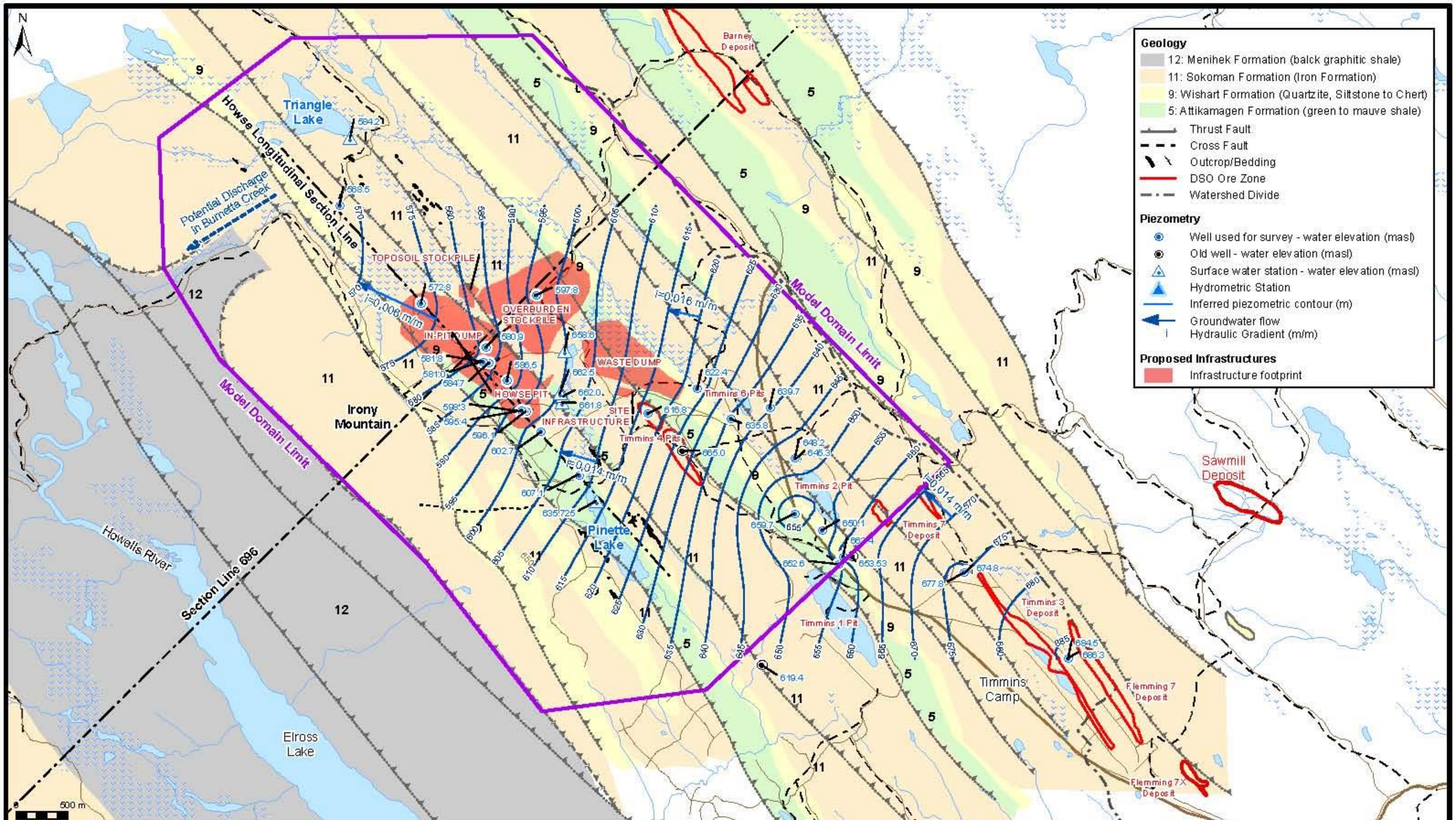
6.1 METHODOLOGY

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.



NO.	DATE	DESCRIPTION	DRAWN	VERIFIED
0	9 nov. 2015	Pour consultation	E. Cazeneuve	A. M. Benlahcen

TITRE: Figure 13: Modelled Domain

PROJET: Hydrogeology Modeling - Howse project

CLIENT: Geofor Environnement

CONSULTANT: SNC·LAVALIN

ÉCHELLE: 1:35 000 | NUMÉRO: 623419-000-1005-3-1 | RÉV.: 0

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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 m^3/d. The base case flow rate may reach higher values ranging from 12,000 to 19,000 m^3/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, Whishart, 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.

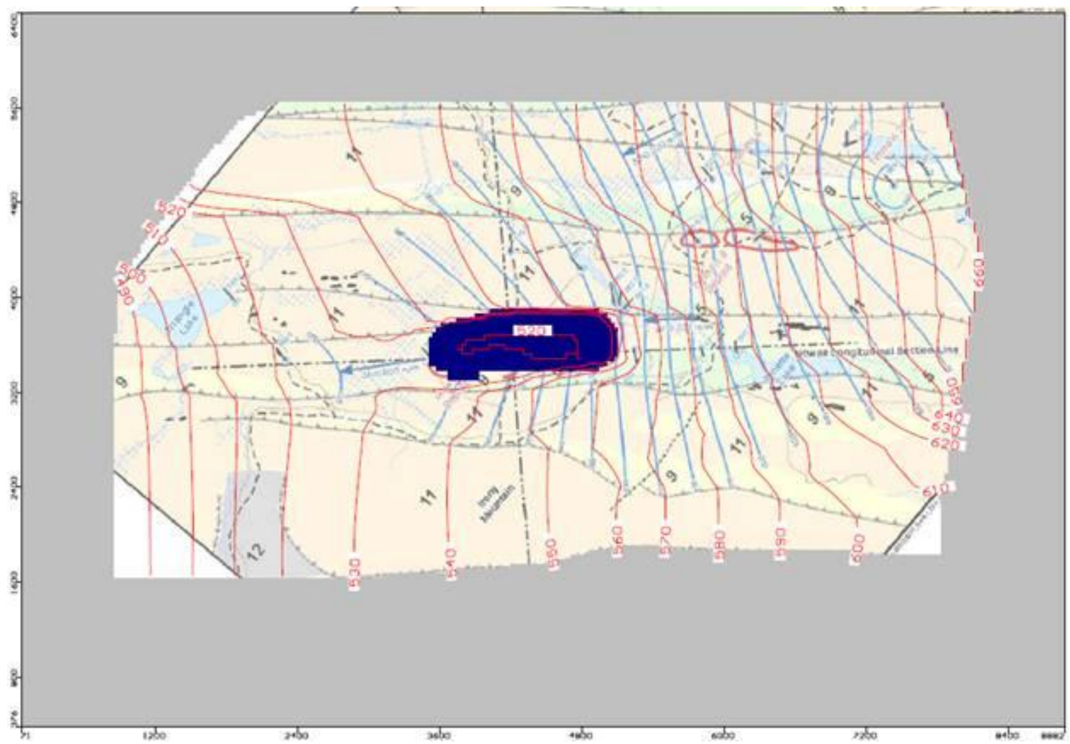

Figure 14: Piezometric map during pit dewatering (SNC-Lavalin, 2015)

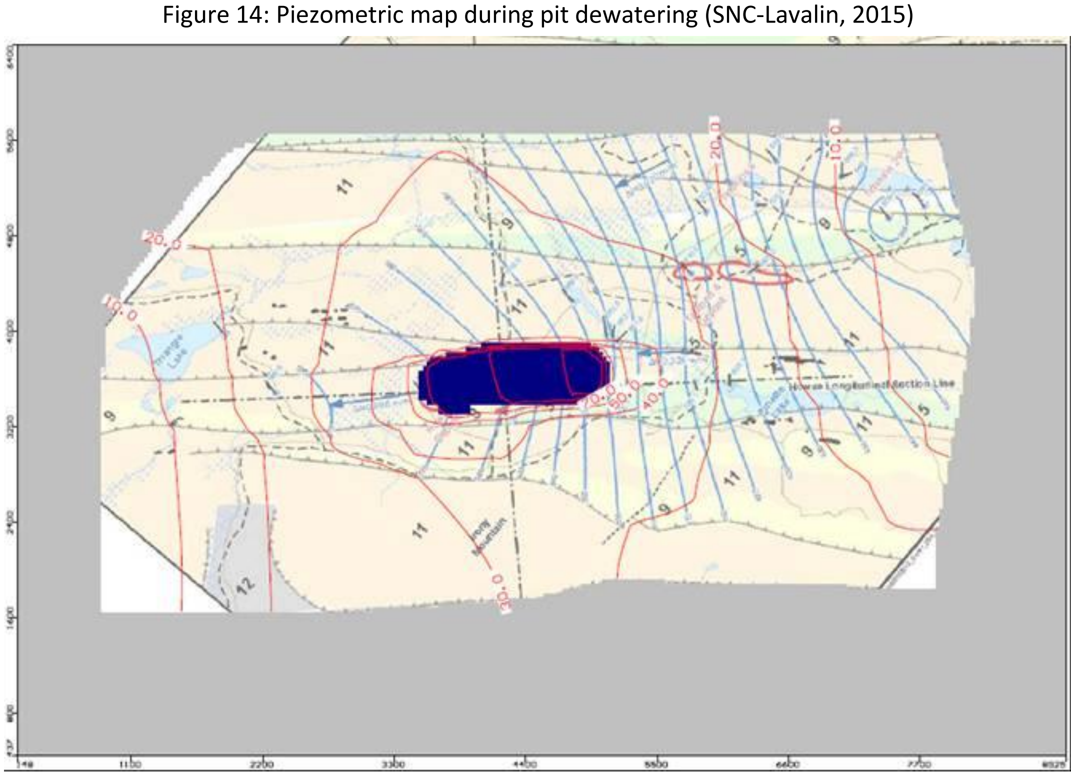

Figure 15: Groundwater drawdown during pit dewatering (SNC-Lavalin, 2015)

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 m^3/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 m^3/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:

<Original signed by>

Gilles Fortin, ing. M.Sc.

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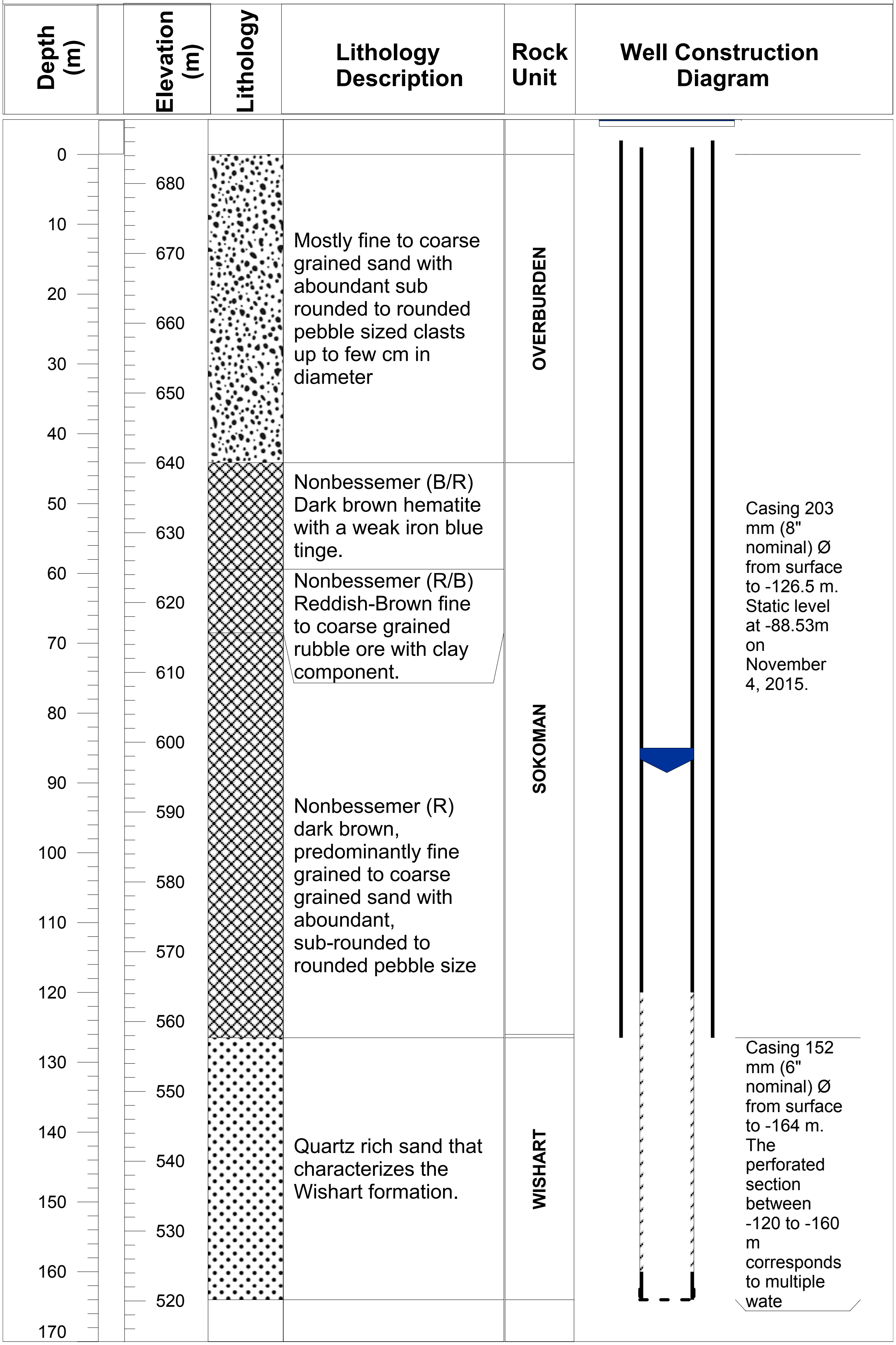
APPENDICES

APPENDIX I

WELLS DIAGRAMS WITH SIMPLIFIED GEOLOGY

Fig. A1-1: HW-RC-14-WE01R



Drilling Date: September 13, 2014

Drilling Company: Major Drilling

Drilling Method: Double rotation

Project Name: HOWSE

Company Name: Tata Steel Minerals

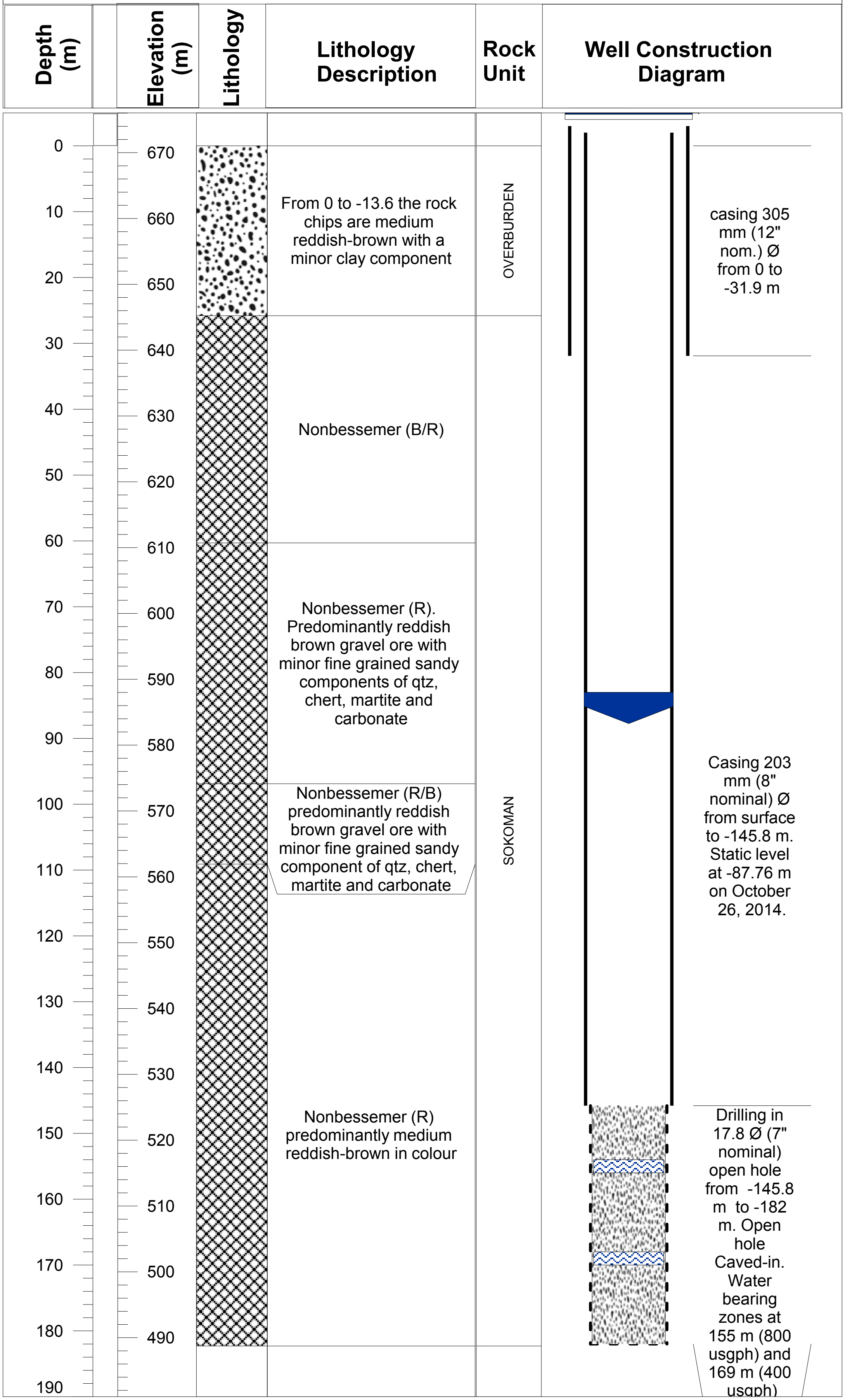
Location: Schefferville

Easting (UTM zone 19): 619715

Northing (UTM zone 19): 6085660

Hydrogeologist: Gilles Fortin

Fig. A1-2: HW-RC-14-WE02R

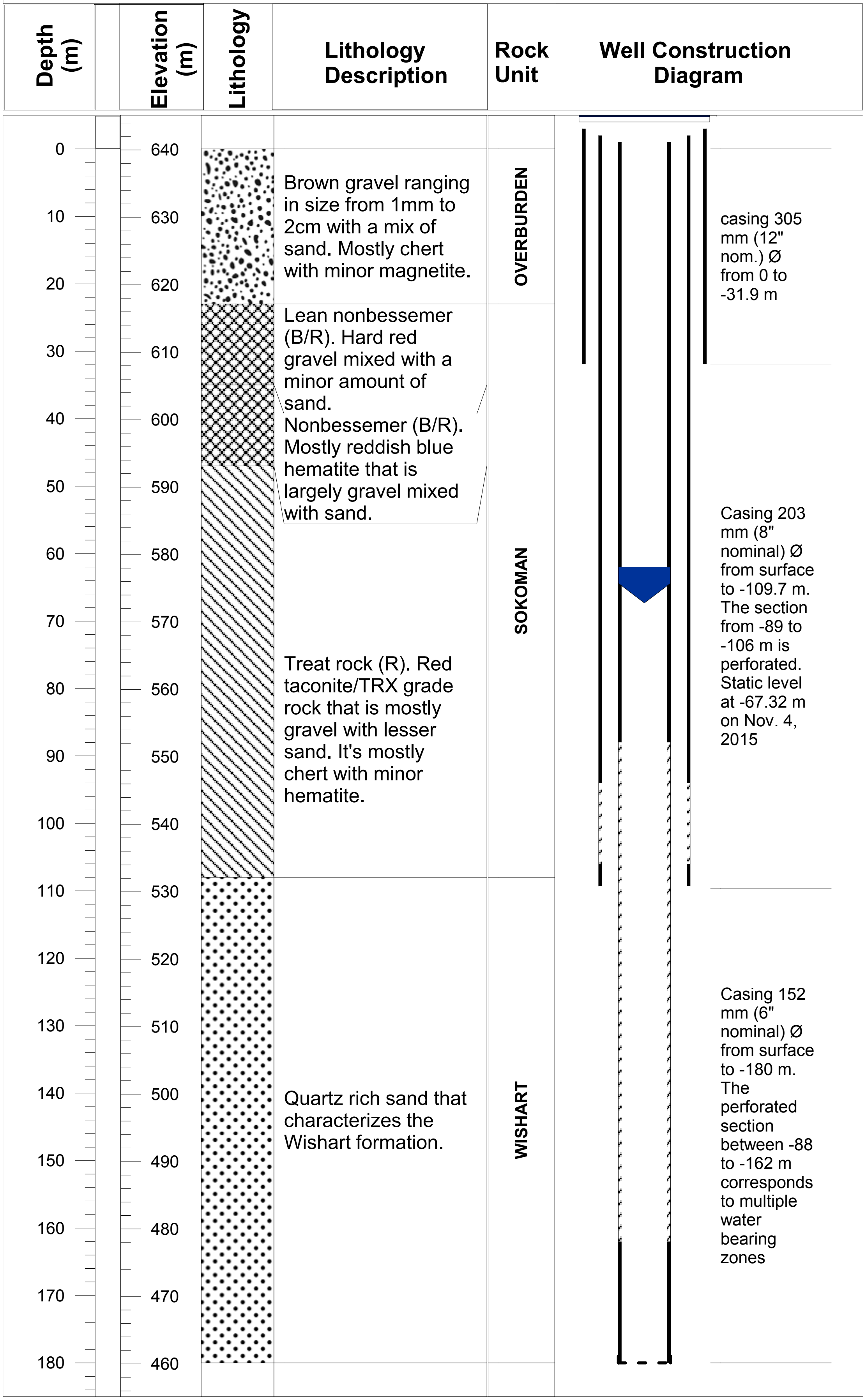


Drilling Date: September 24, 2014
Drilling Company: Major Drilling
Drilling Method: Major Drilling

Project Name: Howse
Company Name: TSMC
Location: Schefferville

Easting (UTM zone 19): 619338
Northing (UTM zone 19): 6086138
Hydrogeologist: Gilles Fortin

Fig. A1-3: HW-RC-14-WE03R



Drilling Date: November 19, 2014

Drilling Company: Major Drilling

Drilling Method: Double rotation

Project Name: HOWSE

Company Name: Tata Steel Minerals

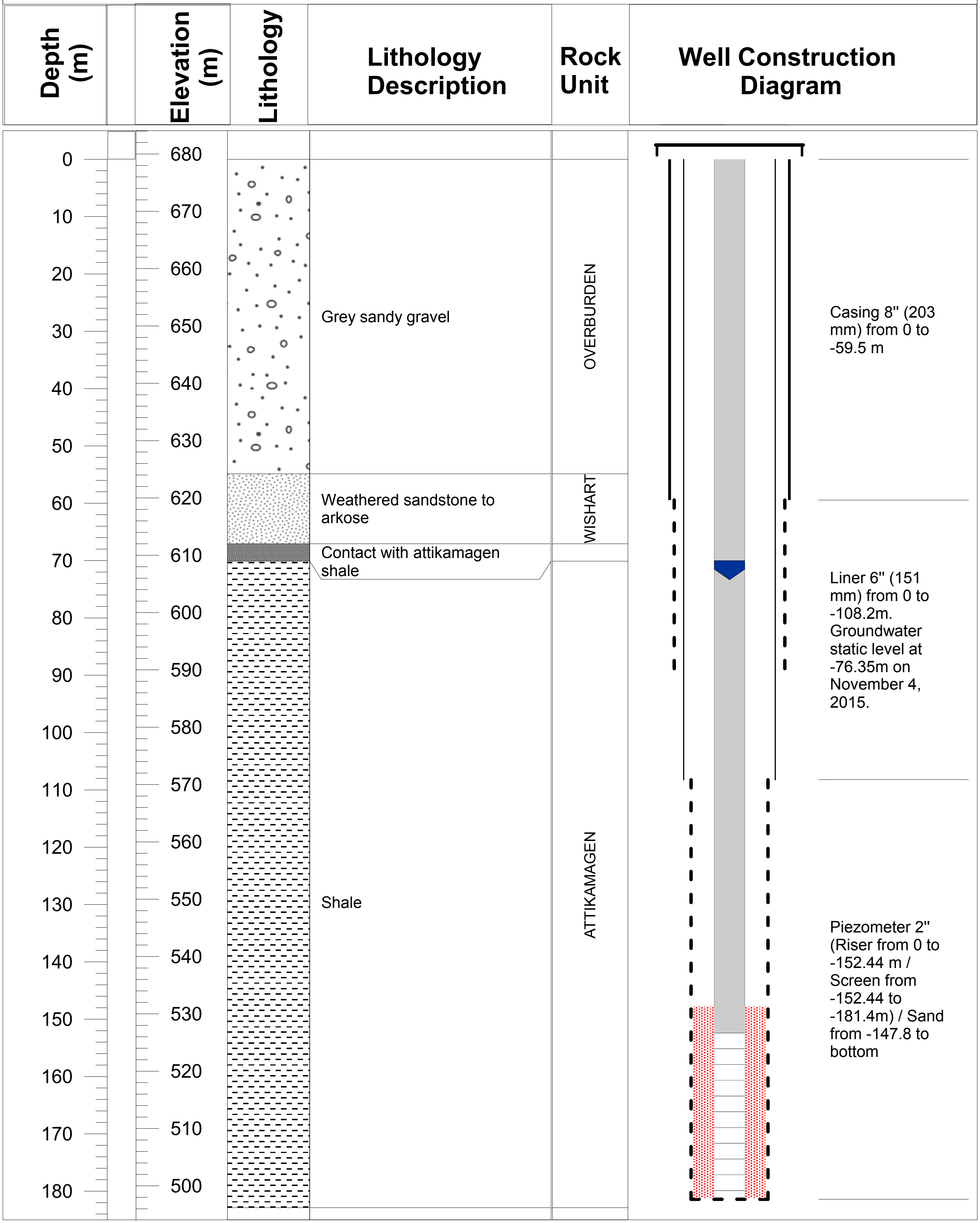
Location: Schefferville

Easting (UTM zone 19): 618737

Northing (UTM zone 19): 6086703

Hydrogeologist: Gilles Fortin

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



Drilling Date: August 28, 2015

Drilling Company: Forage LBM

Drilling Method: Double rotation

Project Name: HOWSE

Company Name: Tata Steel Minerals

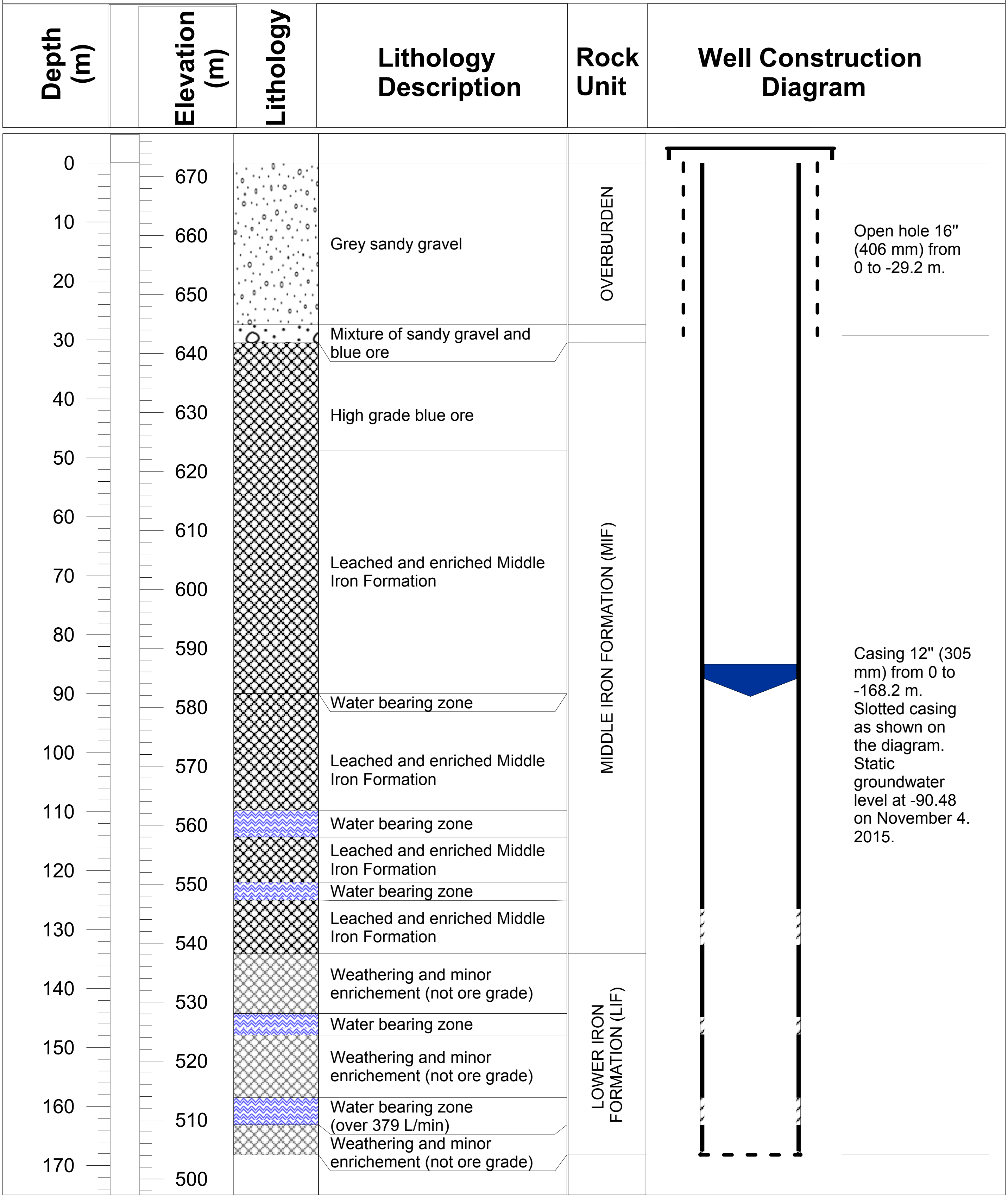
Location: Schefferville

Easting (UTM zone 19): 619903

Northing (UTM zone 19): 6085454

Hydrogeologist: Gilles Fortin

Fig. A1-5: HW-RC15-WE06R

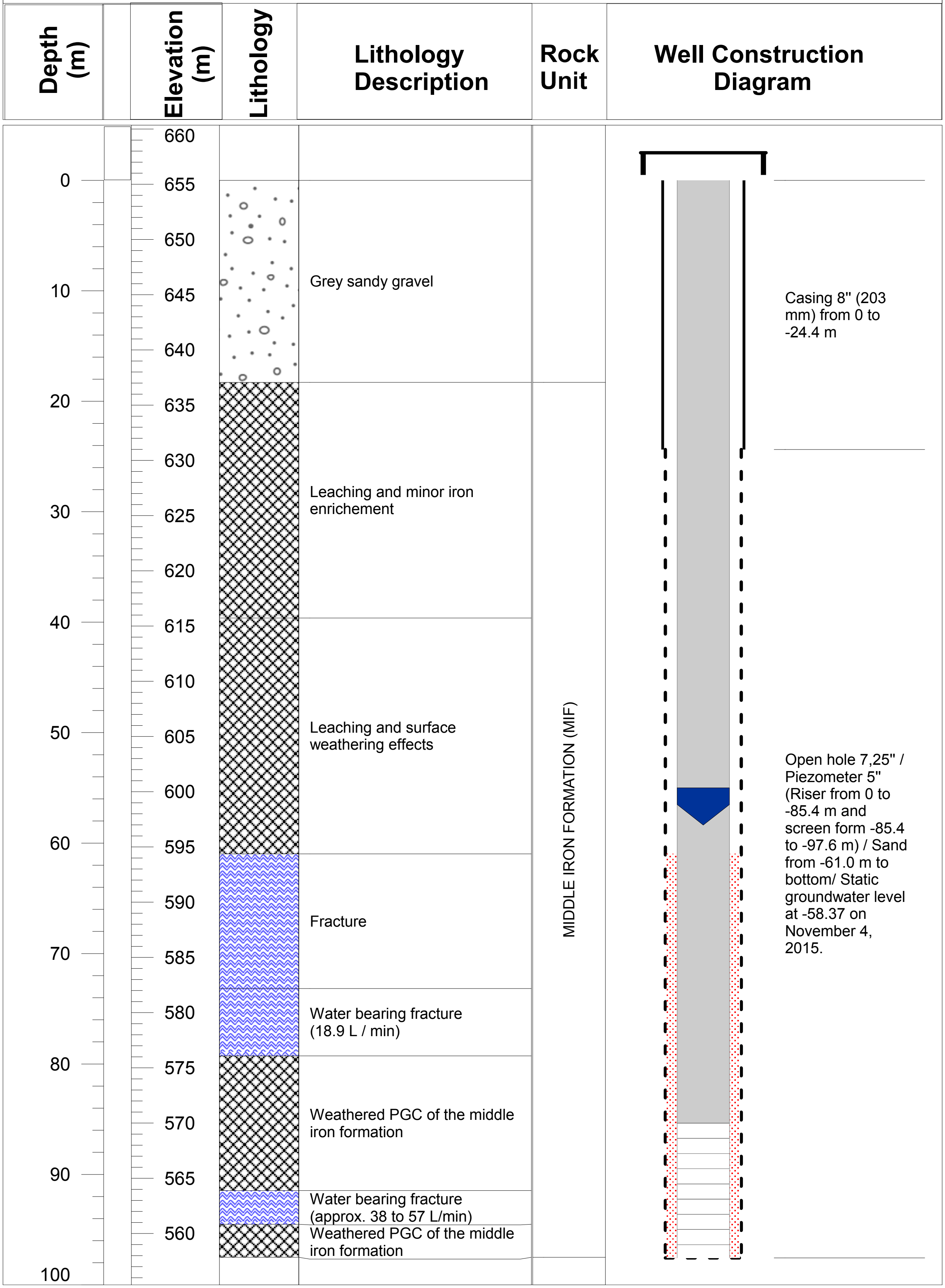


Drilling Date: September 2, 2015
Drilling Company: Les Forages LBM
Drilling Method: Double rotation

Project Name: Howse
Company Name: Tata Steel Minerals
Location: Schefferville

Easting (UTM zone 19): 619339
Northing (UTM zone 19): 6086132
Hydrogeologist: Gilles Fortin

Fig. A1-6: HW-RC-15-WE07R



Drilling Date: September 11, 2015

Drilling Company: Les Forages LBM

Drilling Method: Double rotation

Project Name: HOWSE

Company Name: Tata Steel Minerals

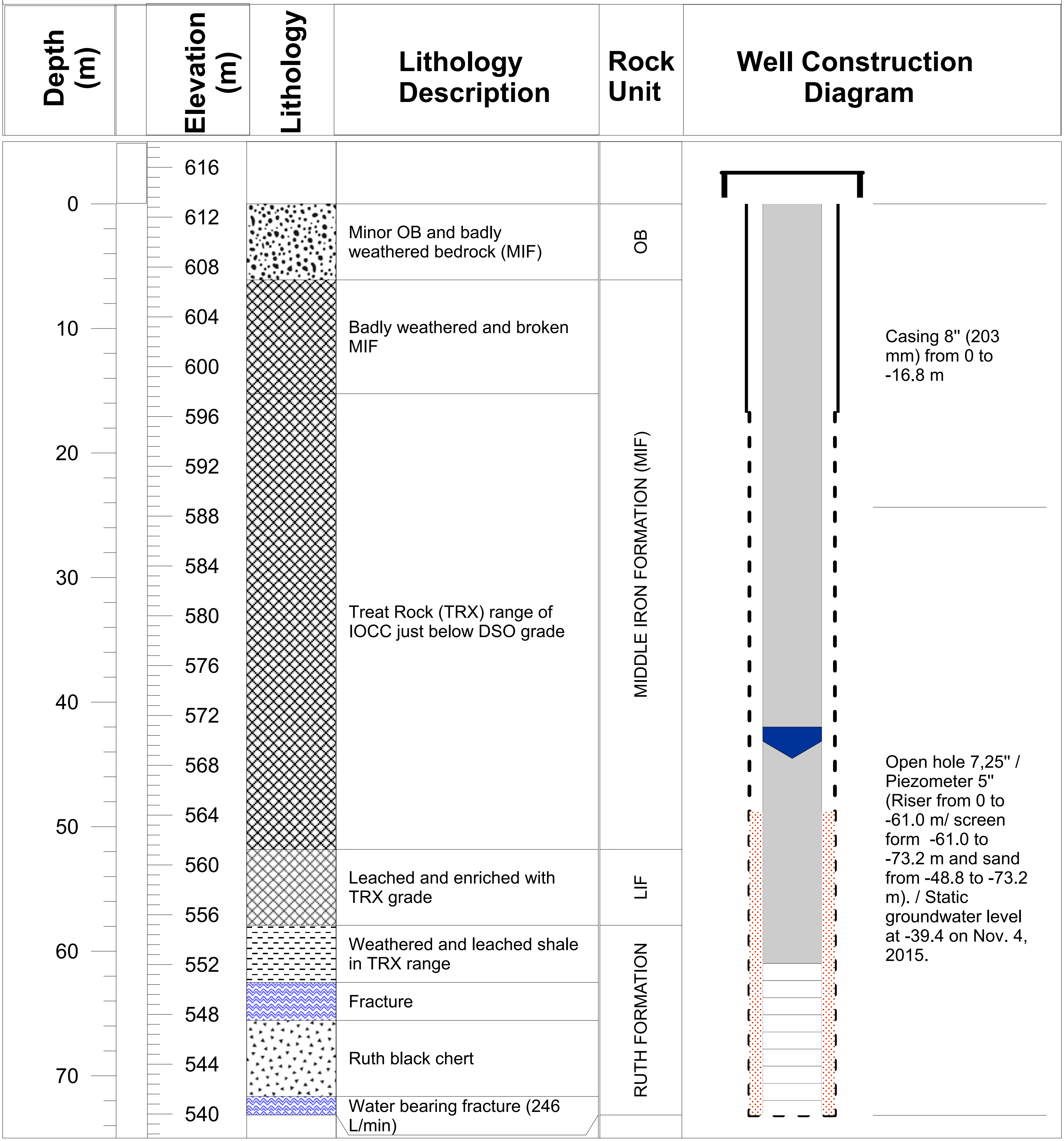
Location: Schefferville

Easting (UTM zone 19): 620275

Northing (UTM zone 19): 6085028

Hydrogeologist: Gilles Fortin

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



Drilling Date: September 10, 2015

Drilling Company: Les Forages LBM

Drilling Method: Double rotation

Project Name: HOWSE

Company Name: Tata Steel Minerals

Location: Schefferville

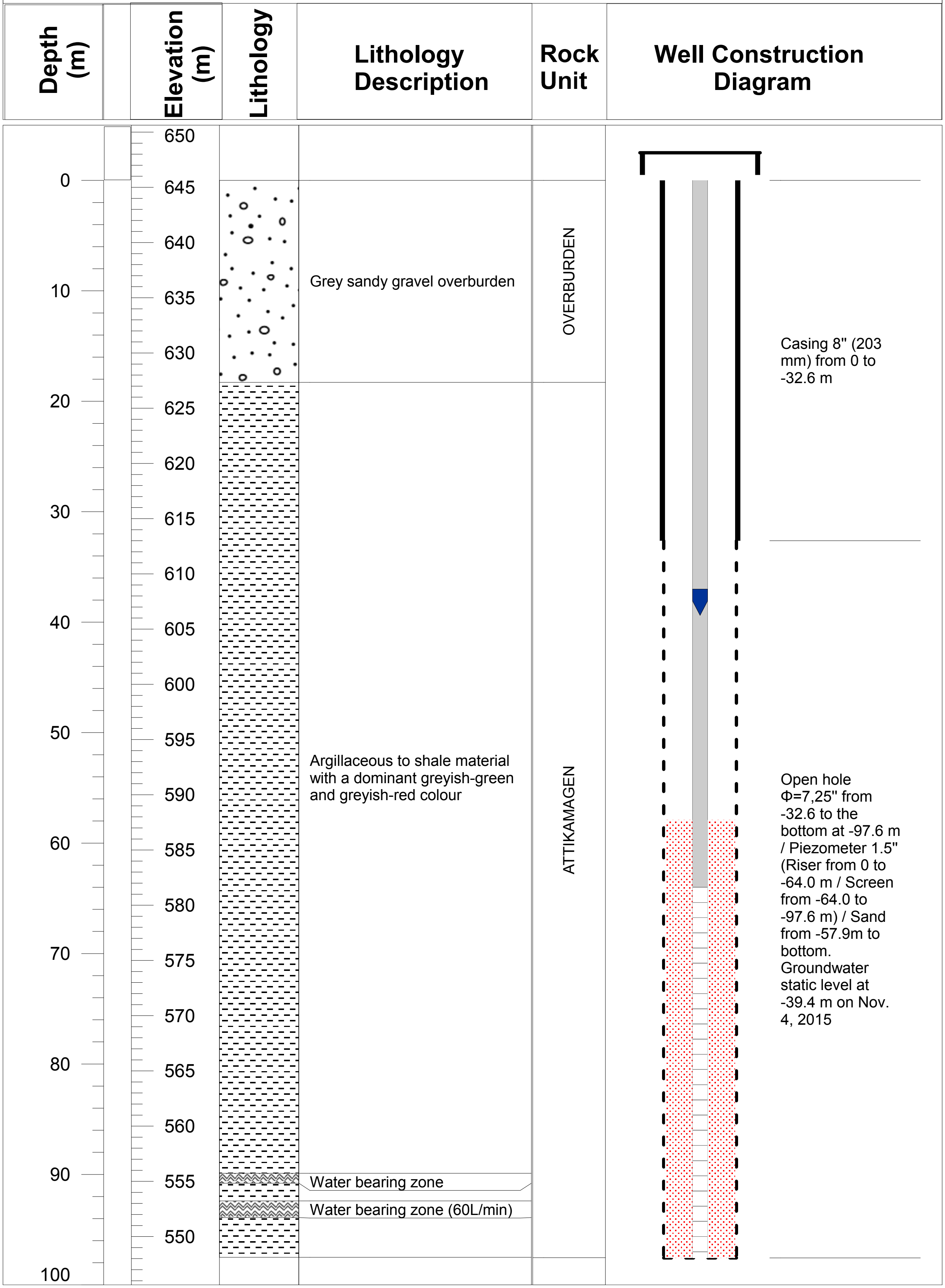
Easting (UTM zone19): 617942

Northing (UTM zone 19): 6087650

Hydrogeologist: Gilles Fortin

geofor environnement

Fig. A1-8: HW-RC-15-WE09R



Drilling Date: September 8, 2015

Drilling Company: Les Forages LBM

Drilling Method: Double rotation

Project Name: HOWSE

Company Name: Tata Steel Minerals

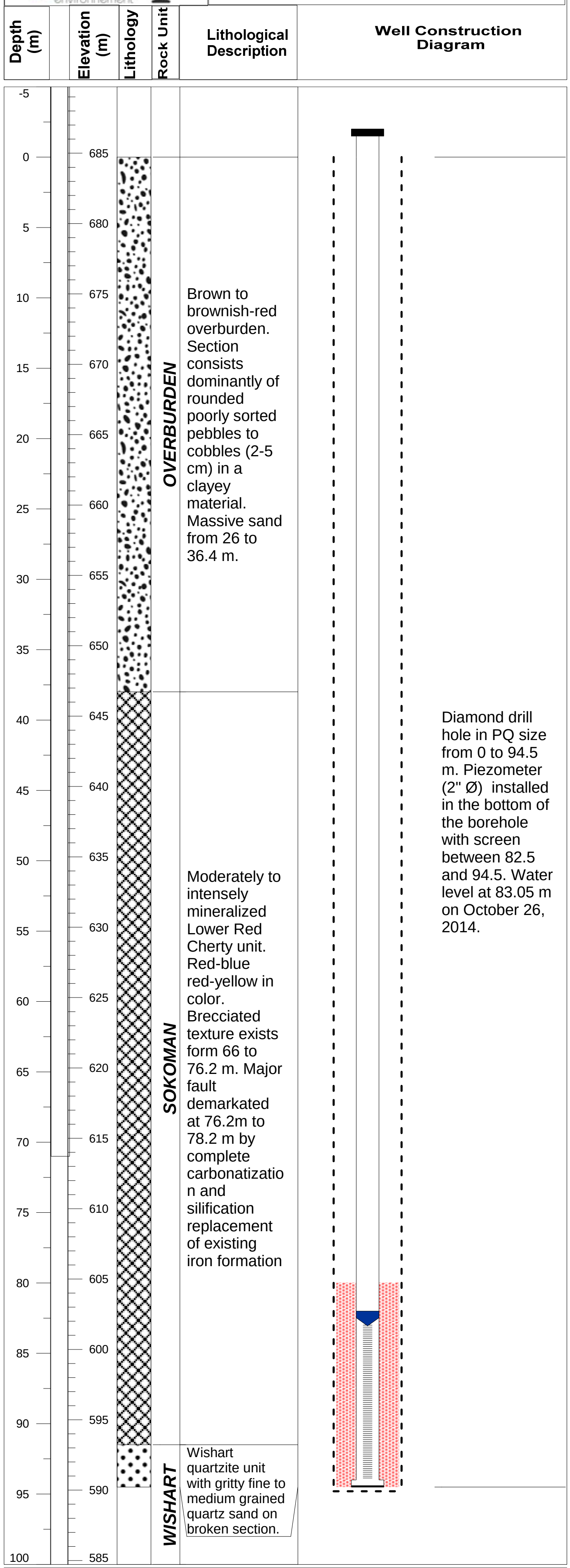
Location: Schefferville

Easting (UTM zone 19): 619859

Northing (UTM zone 19): 6086780

Hydrogeologist: Gilles Fortin

Fig. A1-9: HW-DD14-35



Drilling End Date: September 10, 2014

Drilling Company: Major Drilling

Drilling Method: Rotary

Project Name: Howse

Company Name: TSMC

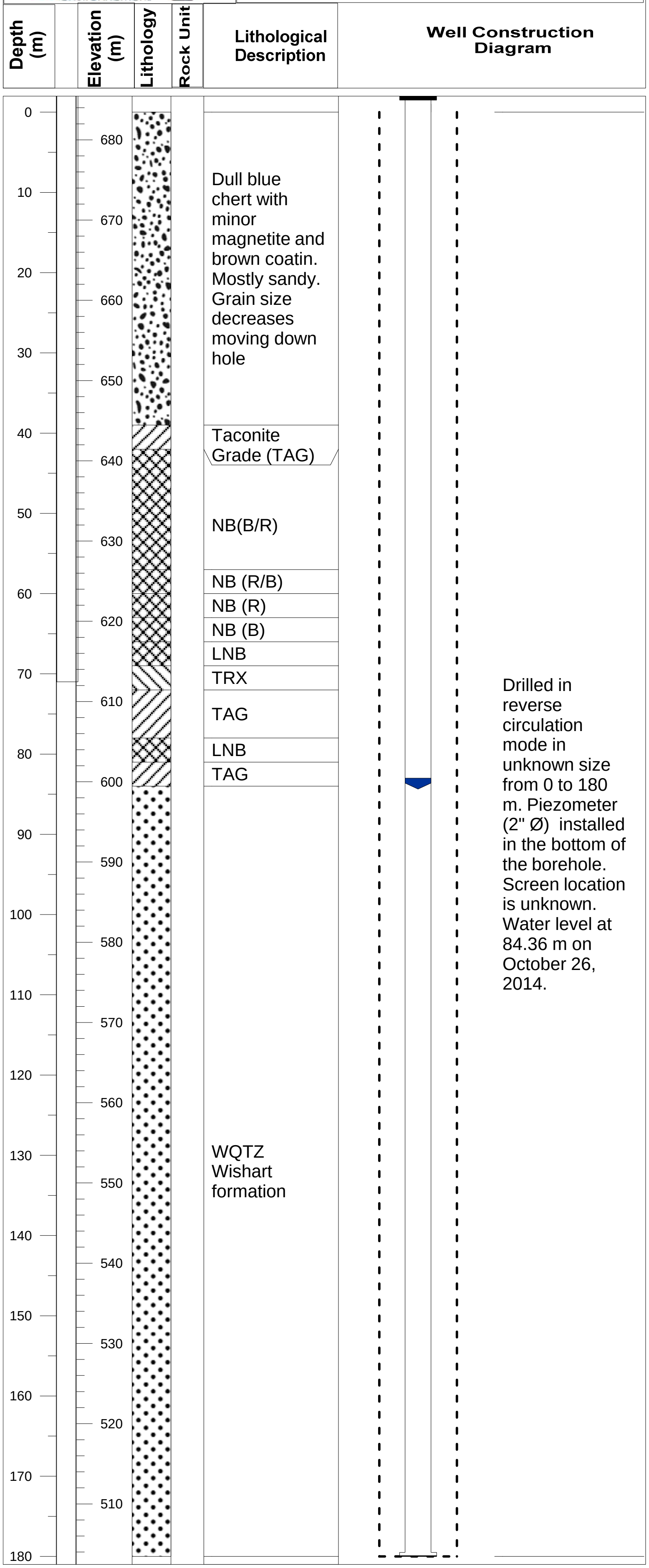
Location: Schefferville

Easting: 619706 (zone 19)

Northing: 6085652

Hydrogeologist: Gilles Fortin

Fig. A1-10: HW-RC13-03

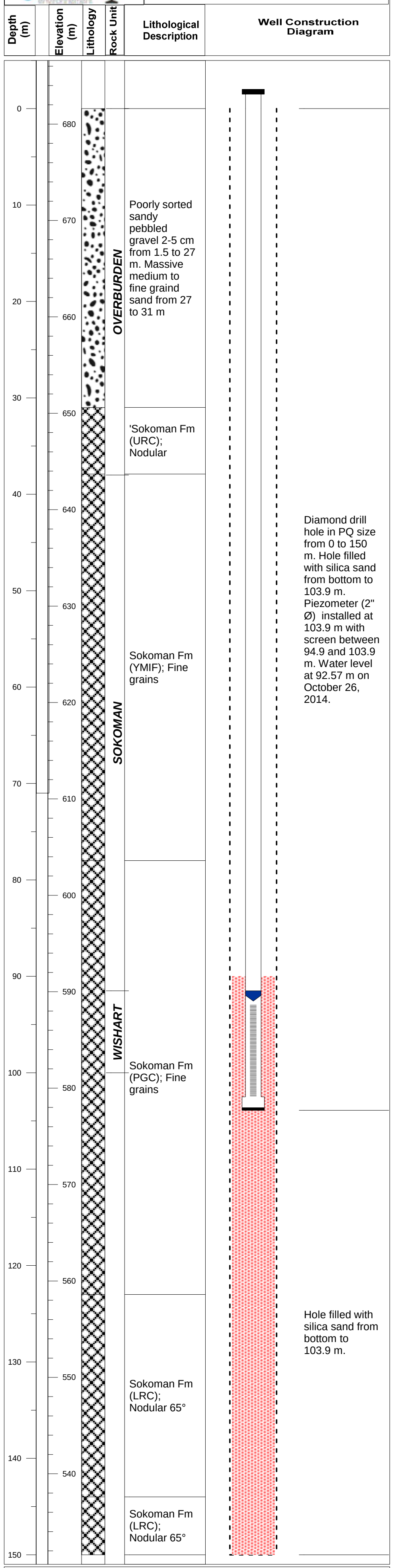


Drilling End Date: July12, 2013
Drilling Company: Major Drilling
Drilling Method: Rotary

Project Name: Howse
Company Name: TSMC
Location: Schefferville

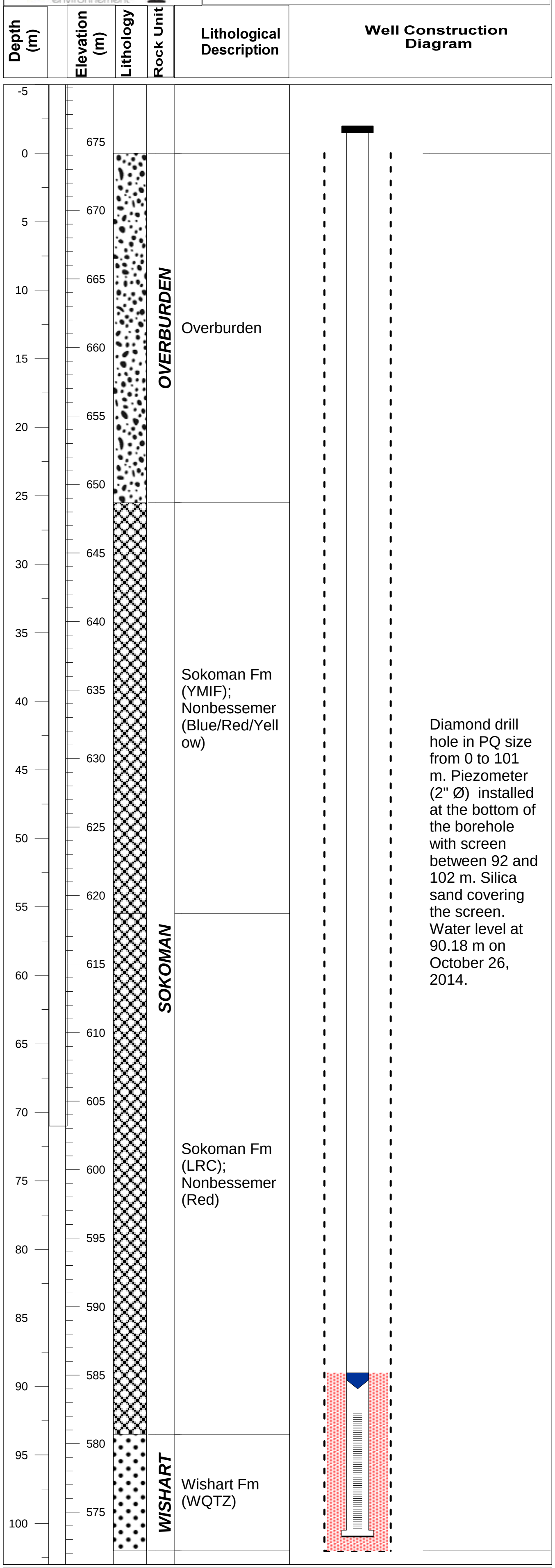
Easting: 619755 (zone 19)
Northing: 6085655
Hydrogeologist: Golder

Fig. A1-11: HW-DD14-09



Drilling End Date August 20, 2014
Drilling Company: Major Drilling
Drilling Method: Rotary
Project Name: Howse
Company Name: TSMC
Location: Schefferville
Easting: 619571 (zone 19)
Northing: 6085950
Hydrogeologist: Gilles Fortin

Fig. A1-12: HW-DD14-14



Drilling End Date August 27, 2014

Drilling Company: Major Drilling

Drilling Method: Rotary

Project Name: Howse

Company Name: TSMC

Location: Schefferville

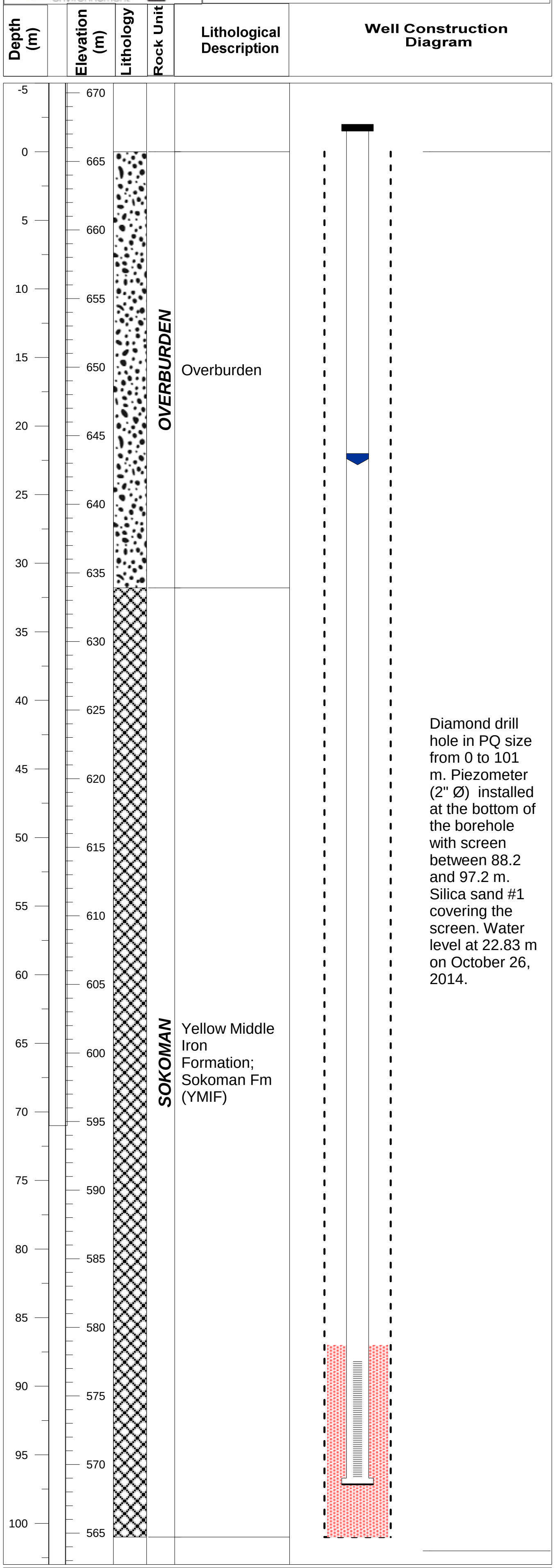
Easting: 619393 (zone 19)

Northing: 6086123

Hydrogeologist: Gilles Fortin

geofor environnement

Fig A1-13: HW-DD14-17



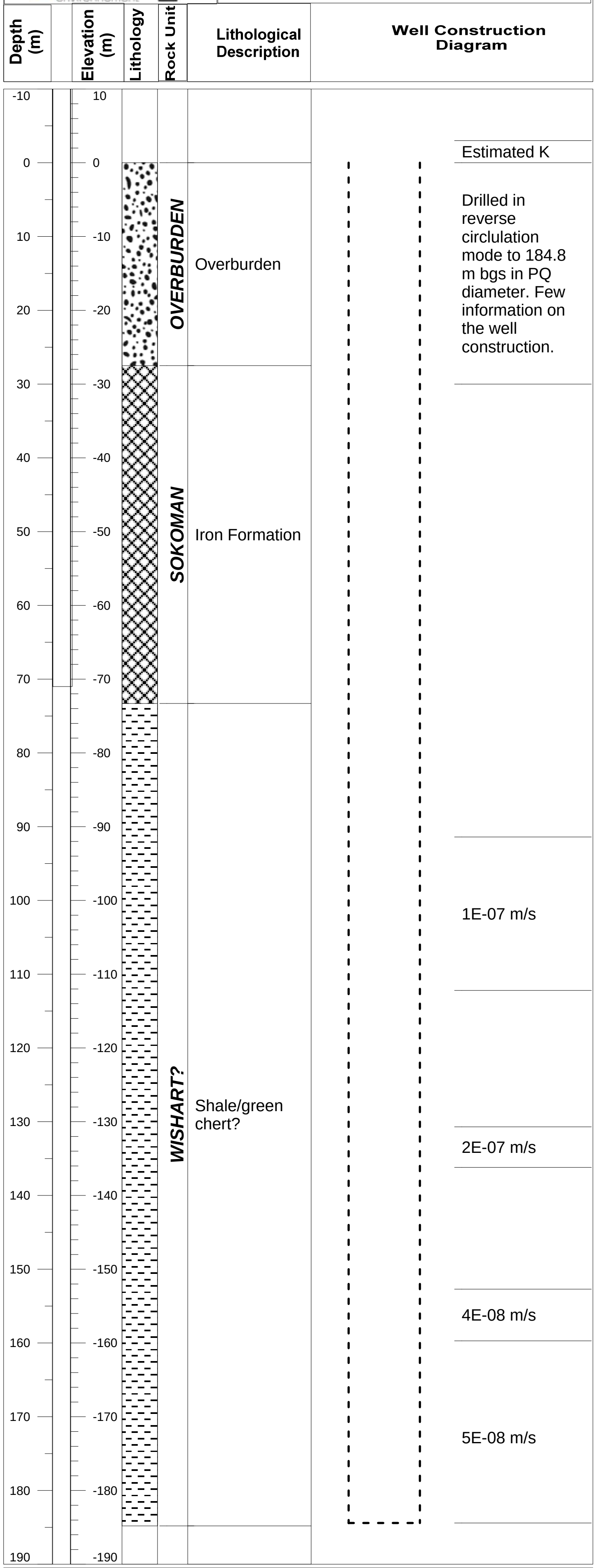
Drilling End Date August 27, 2014
Drilling Company: Major Drilling
Drilling Method: Rotary

Project Name: Howse
Company Name: TSMC
Location: Schefferville

Easting: 619367 (zone 19)
Northing: 6086270
Hydrogeologist: Gilles Fortin

geofor environnement

Fig. A1-14 : HW-GT13-01

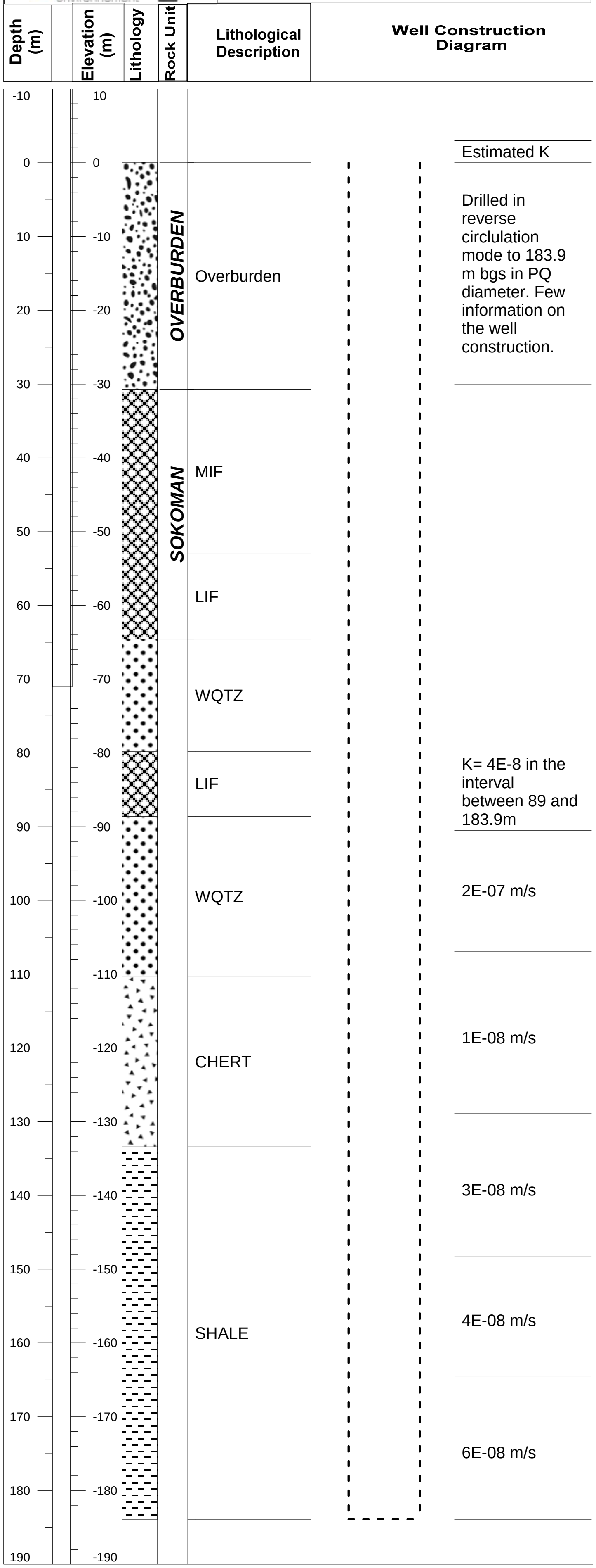


Drilling End Date: December 03, 2010
Drilling Company: Major Drilling
Drilling Method: Rotary

Project Name: Howse
Company Name: TSMC
Location: Schefferville

Easting: 619556 (zone 19)
Northing: 6085935
Hydrogeologist: Golder

Fig. A1-15: HW-GT13-02



Drilling End Date: December12, 2010
Drilling Company: Major Drilling
Drilling Method: Rotary

Project Name: Howse
Company Name: TSMC
Location: Schefferville

Easting: 619628 (zone 19)
Northing: 6085922
Hydrogeologist: Golder

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	Descritpion
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	Descritpion
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 graned material
31,95	35,5	OB	Dark reddish-brown, sand consisting of chert, qtz and other rock fragments

APPENDIX III

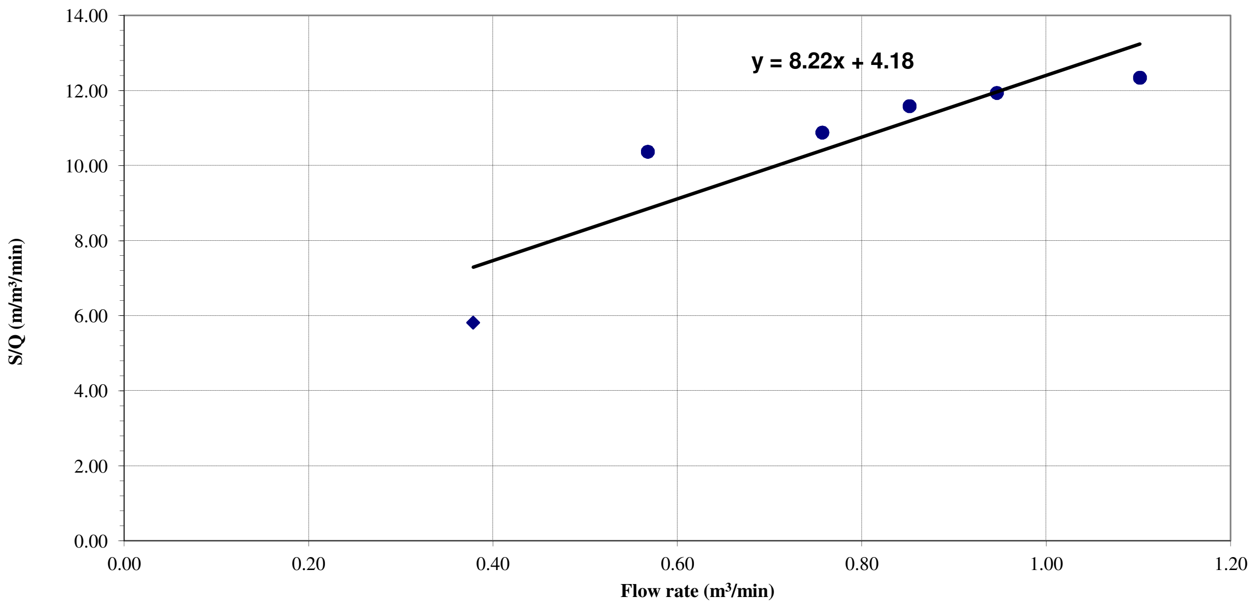
PUMPING TEST INTERPRETATION AND DATA

1) Step Test Results

WE06R

Step no.	Duration	Flow	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

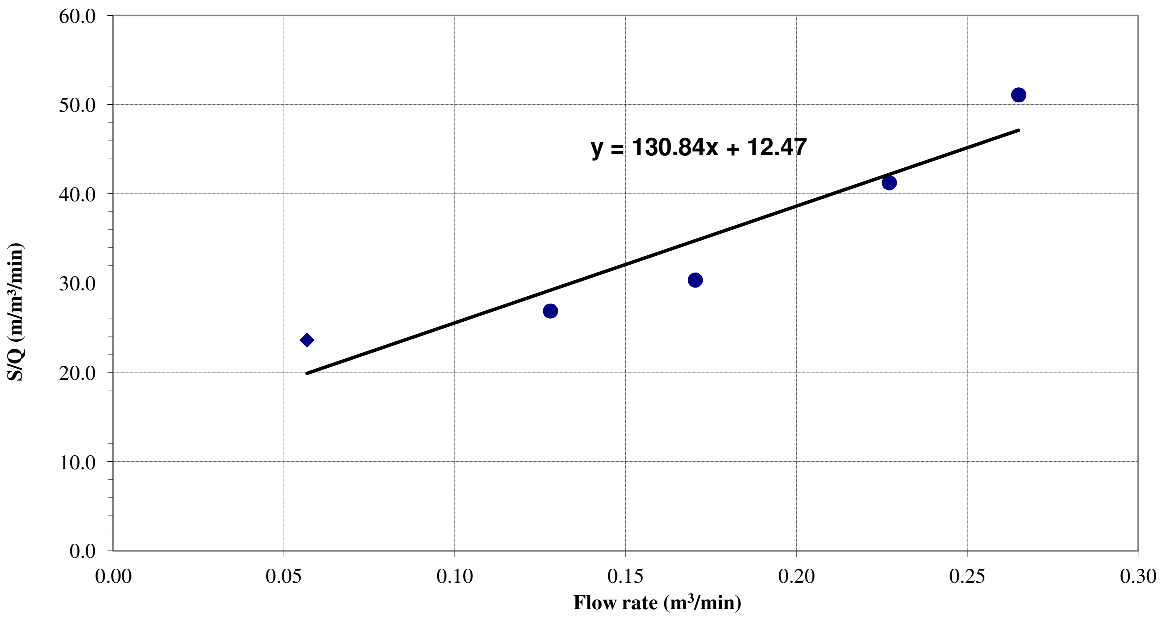


1) Step Test results

WE07R

Step no.	Duration	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

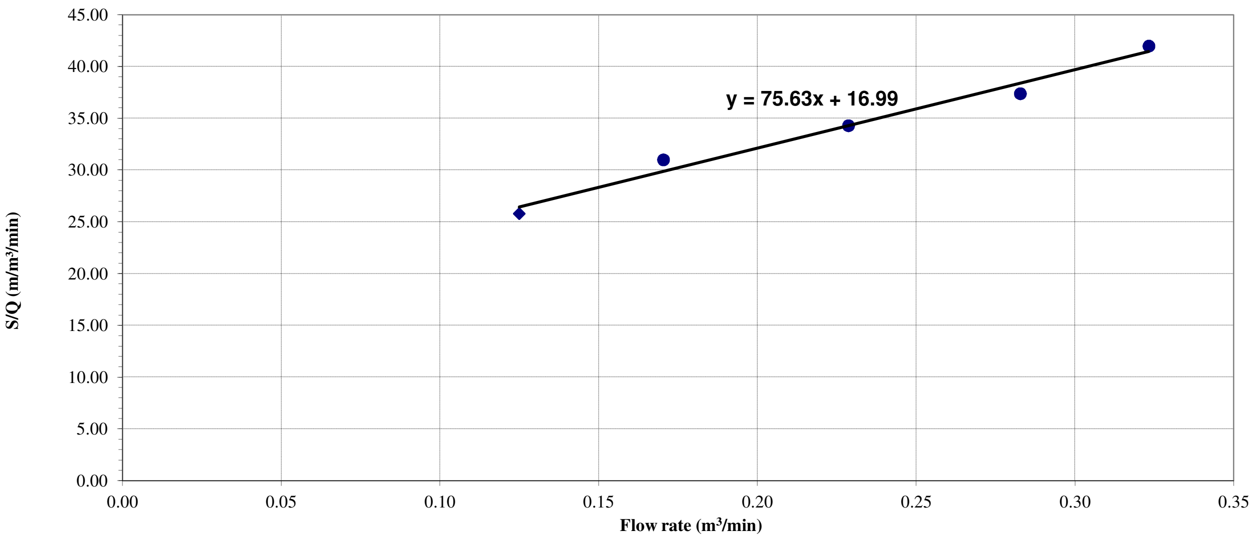


1) Step Test results

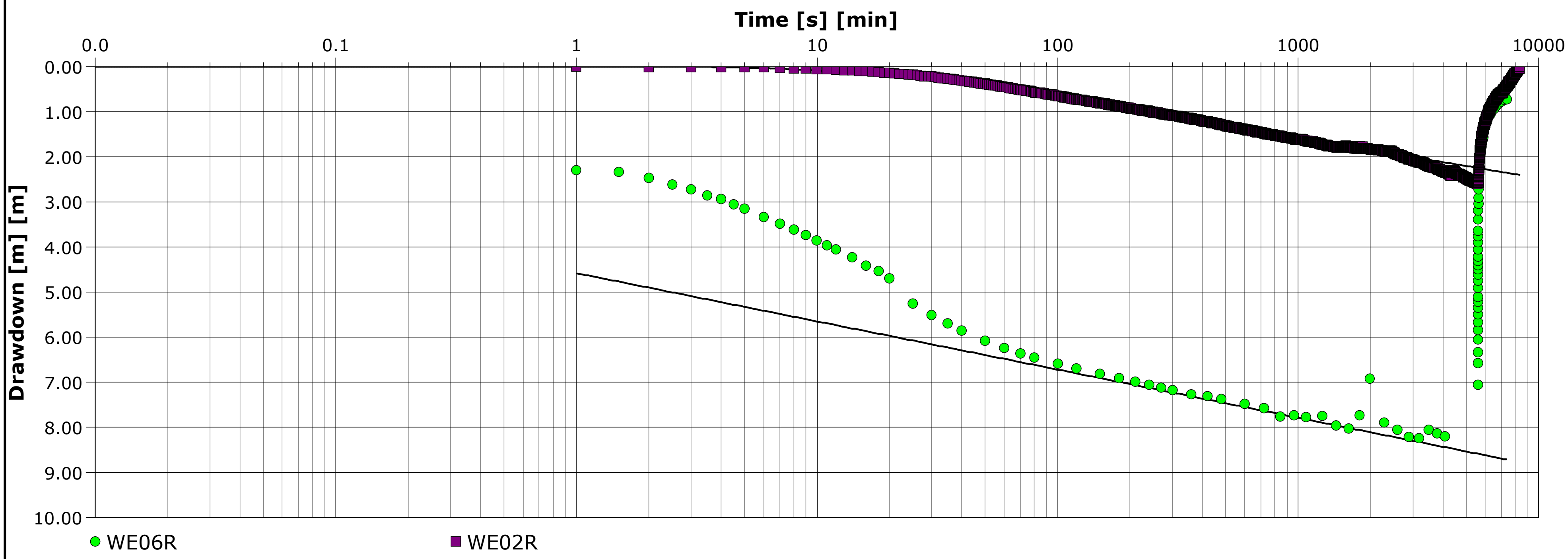
WE08R

Step no.	Duration	Flow	Flow	Flow	Flow	Drawdown	Specific Capacity	Specific Drawdown
	min	gpm	m3/d	Q (l/s)	Q (m^3/min)	s (m)	S/Q (m/m³/min)	Q/S (m³/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



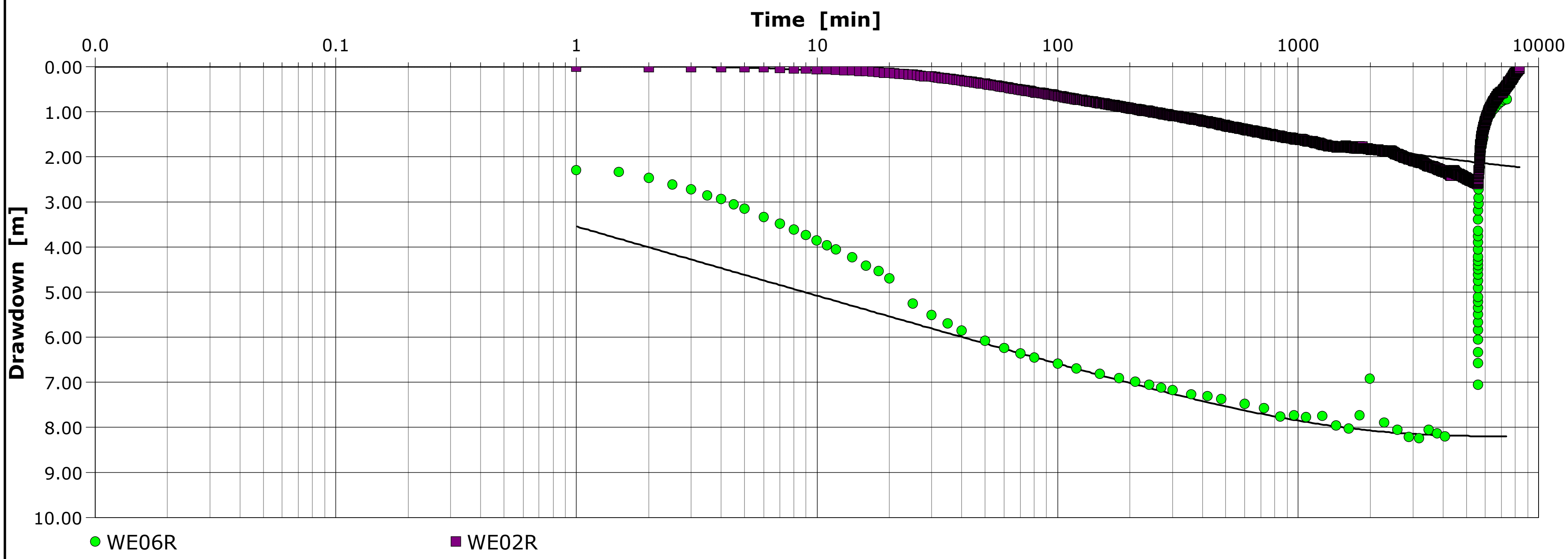
Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m³/d]	



Calculation after Theis

Observation well	Transmissivity [m²/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]	

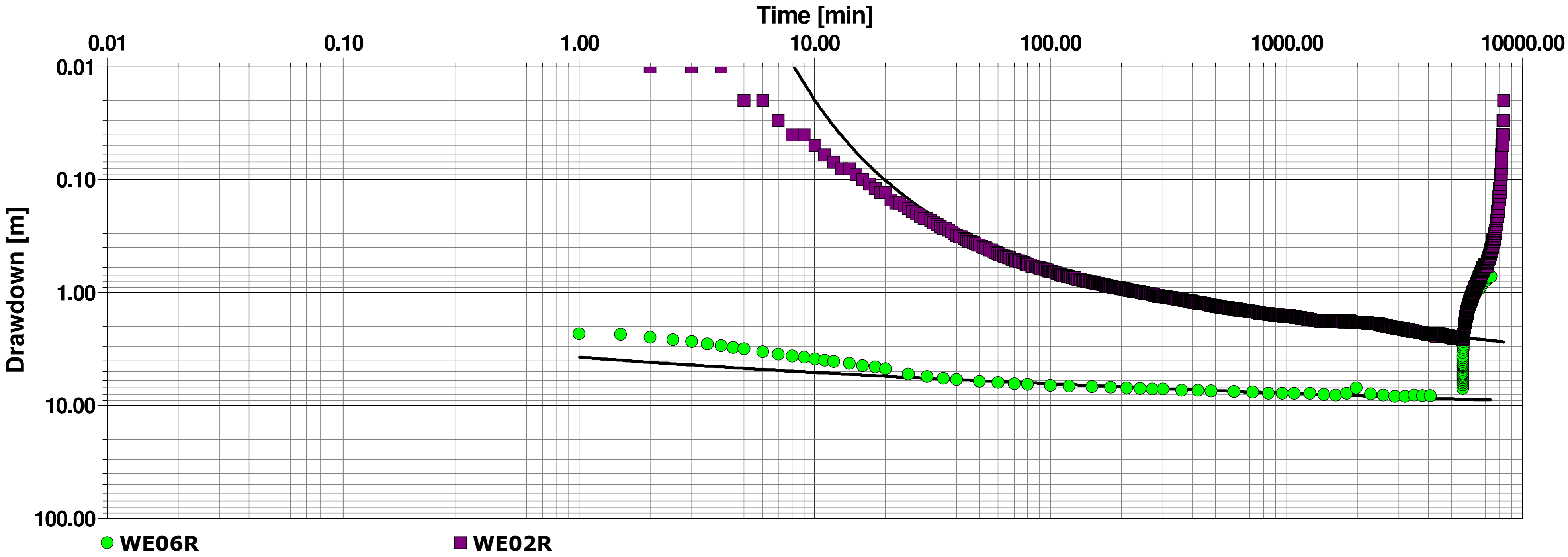


Calculation after Hantush

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 modèl Huntush ne juxtapore pas les données de descente aec la remonteé

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 [m³/d]	

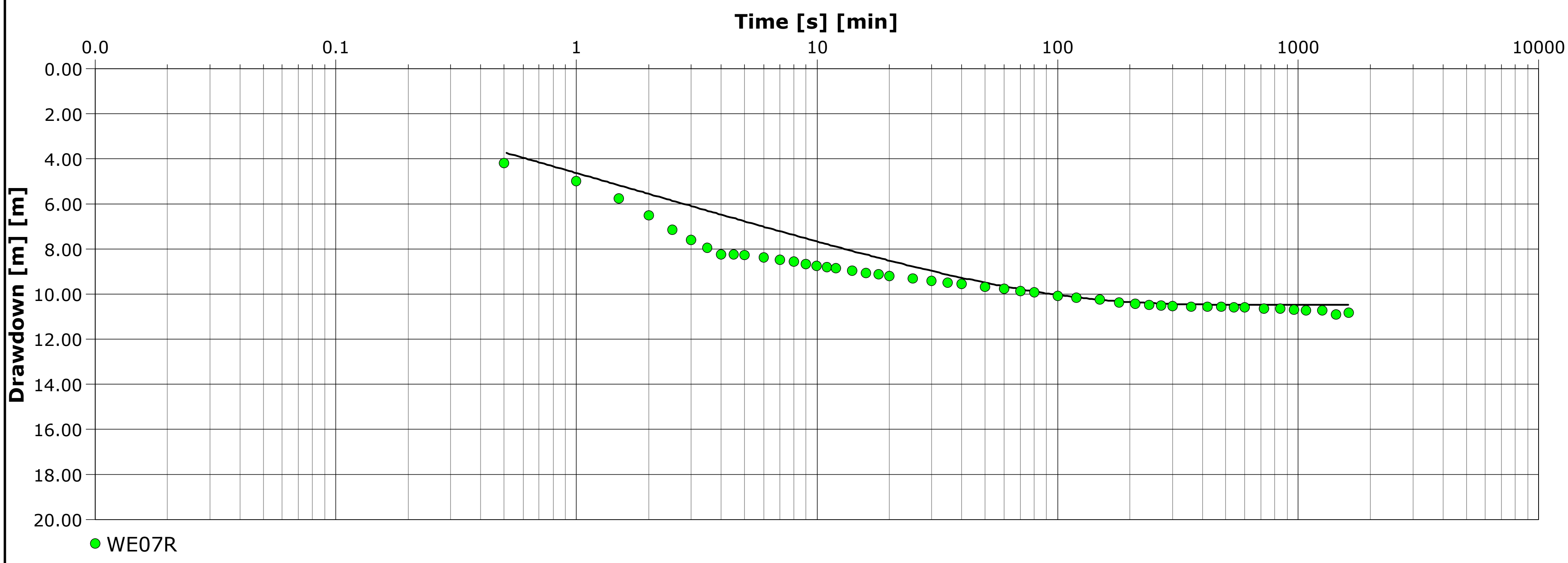


Calculation after Double Porosity

Observation well	Transmissivity [m²/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 [m³/d]					
	Analysis Name	Analysis performed by	Date	Method name	Well	T [m²/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]	

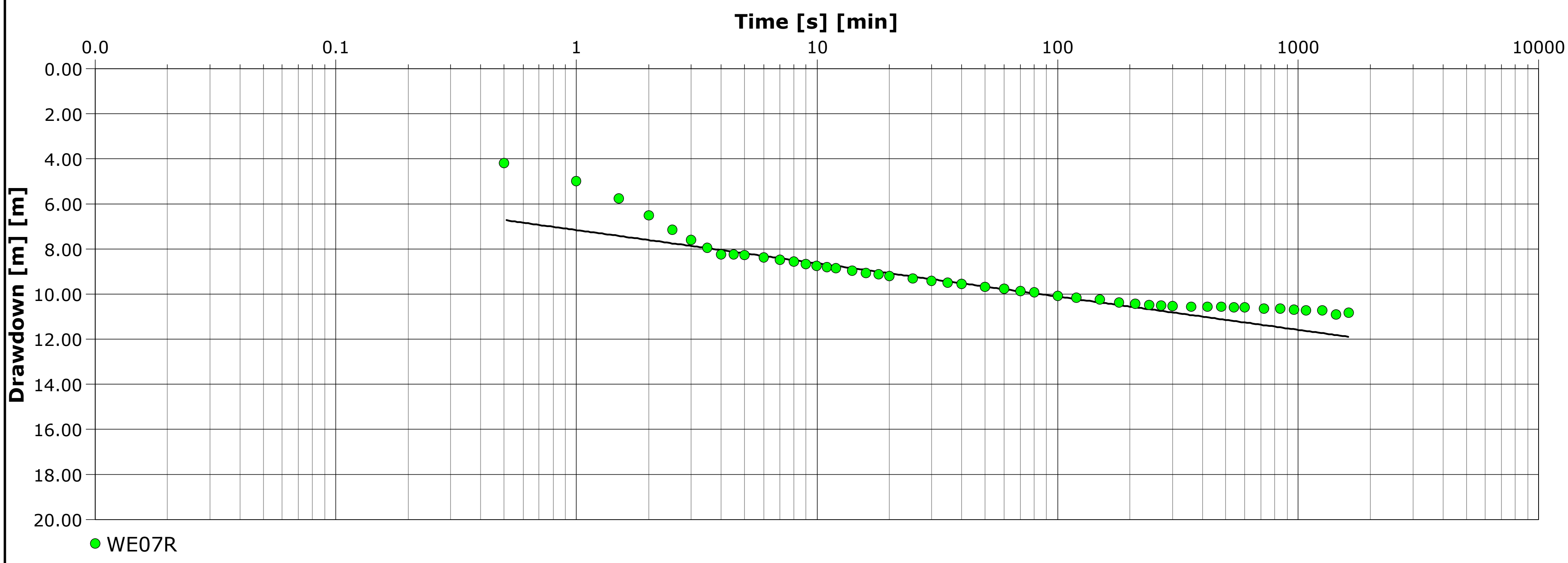


Calculation after Hantush

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 modèl Huntush ne juxtapore pas les données de descente aec la remonteé

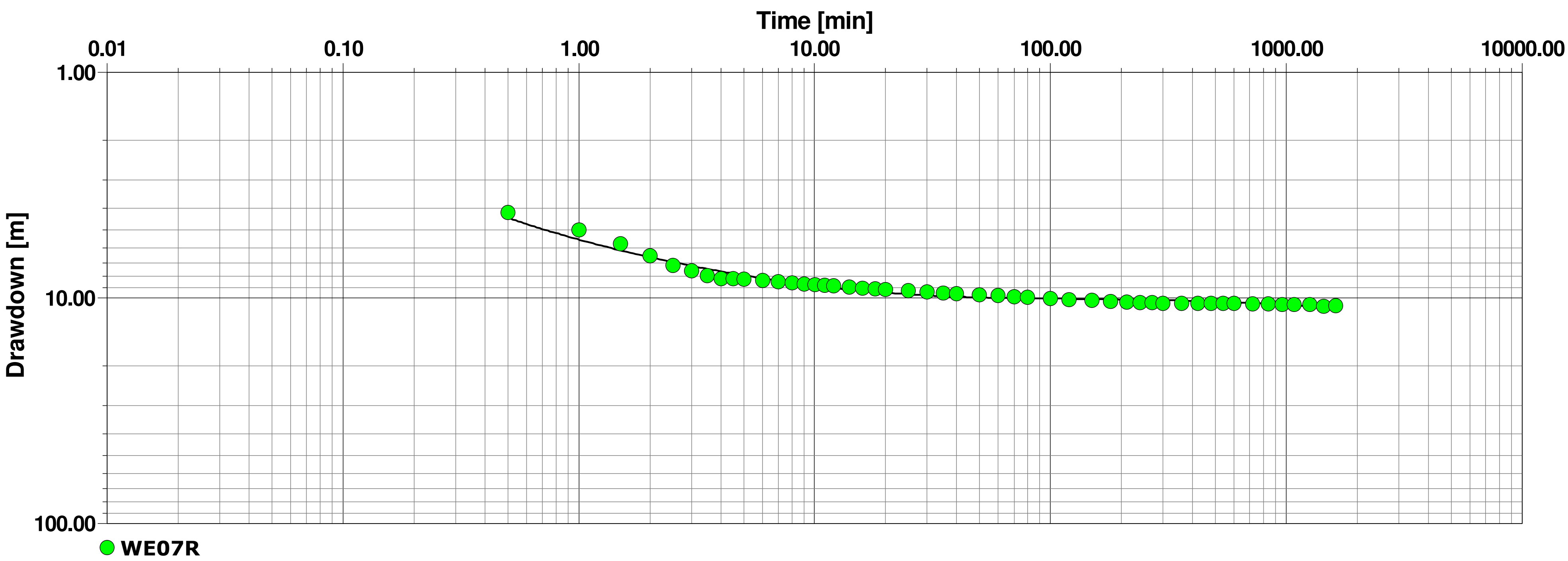
Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m³/d]	



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]	

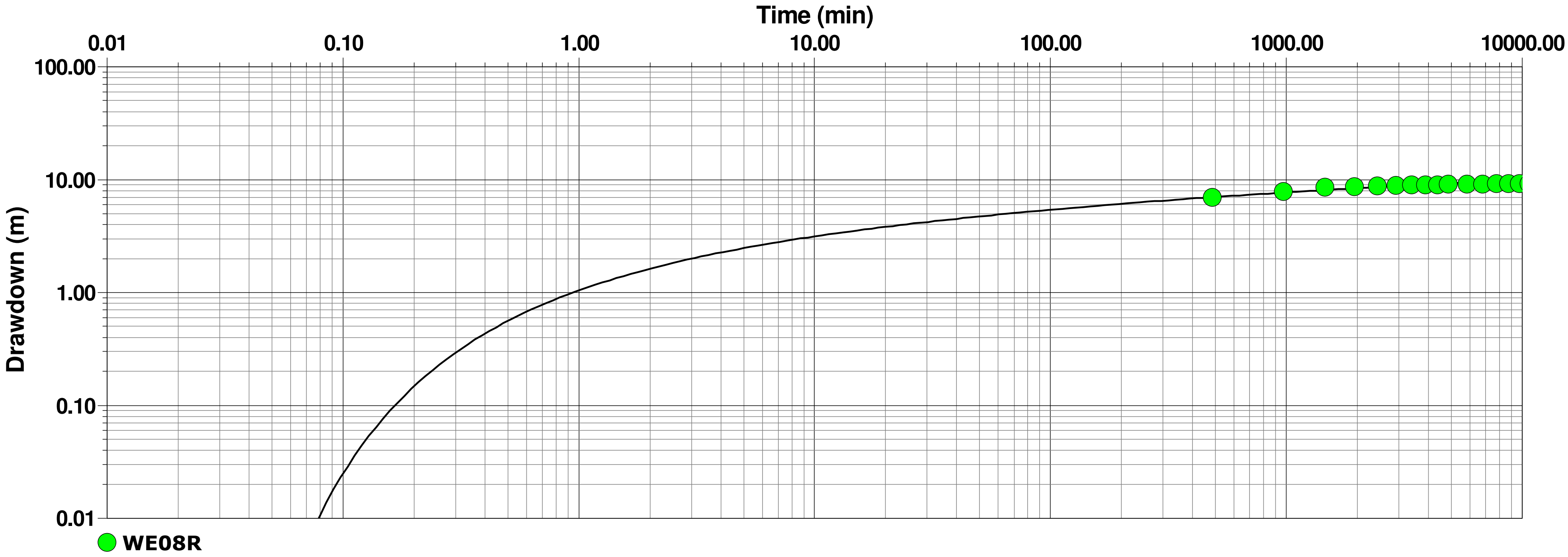


Calculation after Double Porosity

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 [m³/d]						
	Analysis Name	Analysis performed by	Date	Method name	Well		T [m²/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-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 [m³/d]	

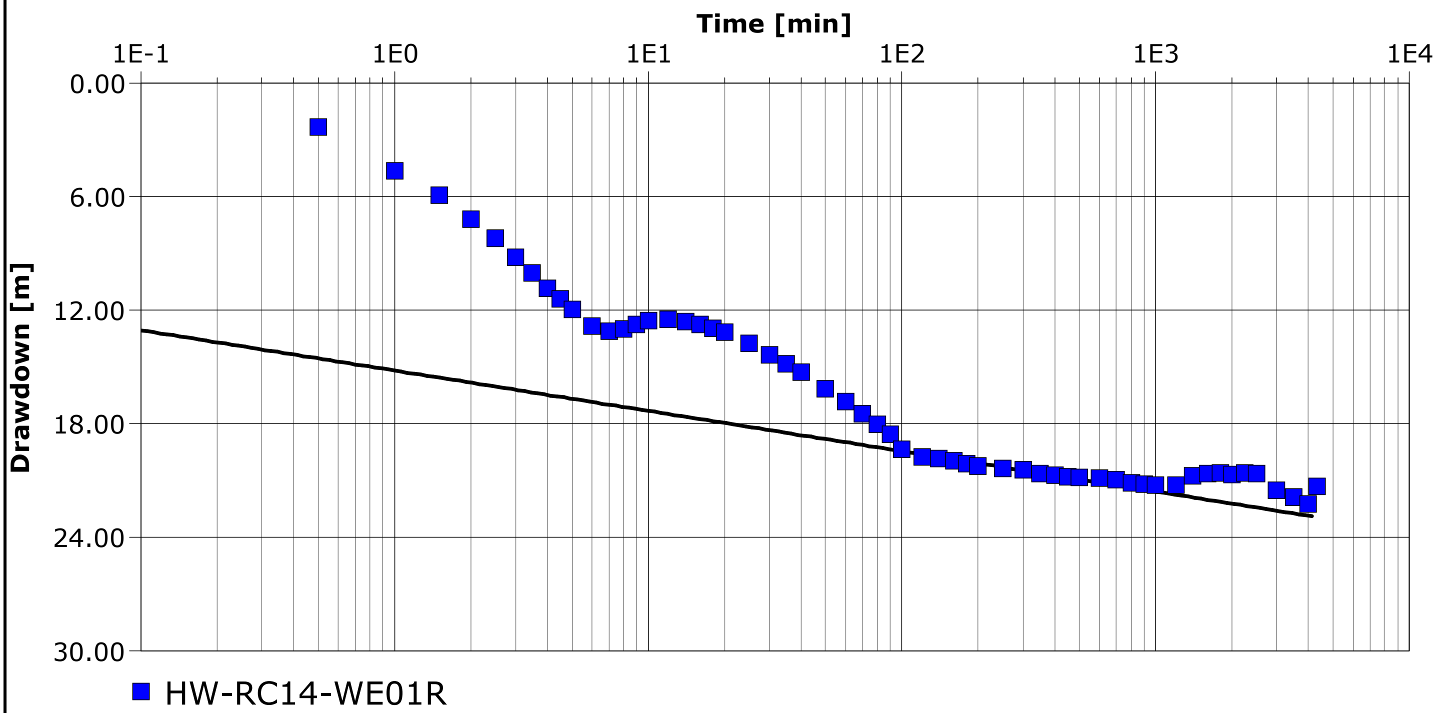


Calculation after Theis

Observation well	Transmissivity [m²/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-WEO1R/72hrs	Analysis Date: 2014-11-27
Aquifer Thickness: 40.00 m	Discharge: variable, average rate 3.86 [m³/h]	



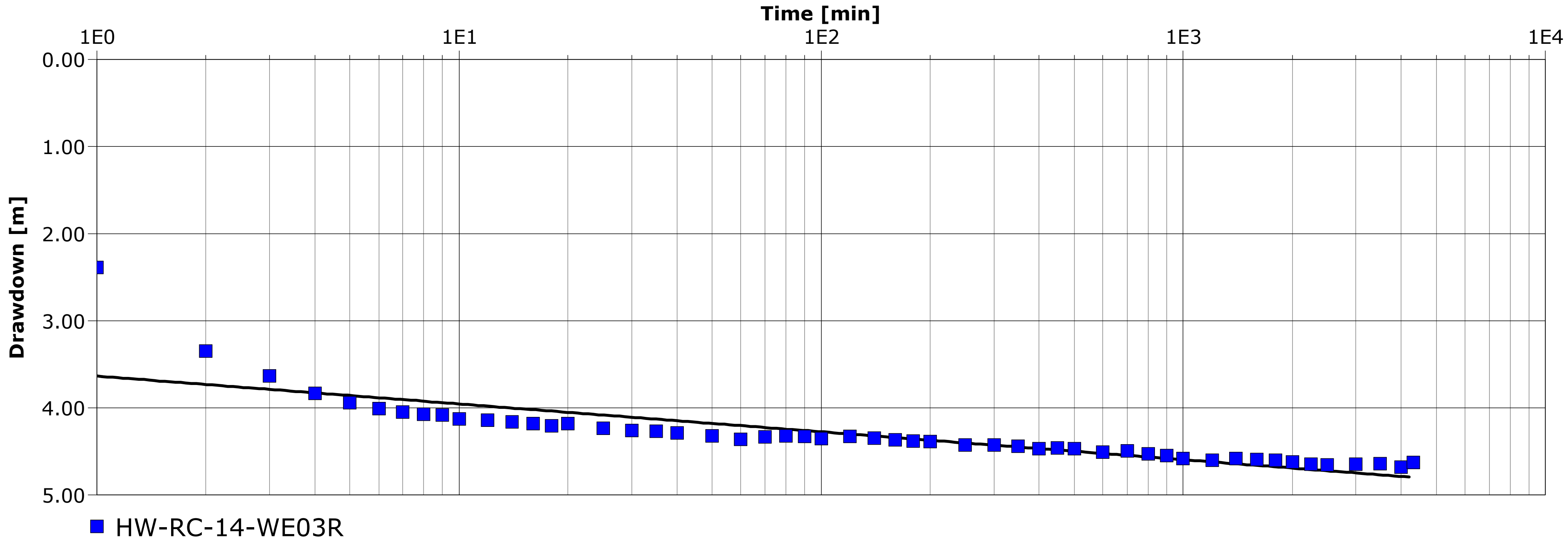
Calculation using Theis

Observation Well	Transmissivity [m²/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 [m²/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

Maxxam
A Bureau Veritas Group Company

Success Through Science®

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

Attention:Loic Didillon

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

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 Extracted	Date Analyzed	Laboratory Method	Primary Reference
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 (S2-)*	1	2014/11/03	2014/11/03	QUE SOP-00107	MA 300 - S 1.1
Reactive Silica (SiO2)***	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.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

Attention:Loic Didillon

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

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 (CaCO3)	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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

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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.

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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).

<Original signed by>

Chemist

<Original signed by>

Dochka Koleva Hristova, B.Sc., Chemist

<Original signed by>

David Provencher, B.Sc., Chemist

<Original signed by>

Jonathan Fauvel, B.Sc, Chimiste, Analyste II

<Original signed by>

Maria Chrifi Alaoui, B.Sc., Chemist

<Original signed by>

Madina Hamrouni, B.Sc., Chemist

<Original signed by>

Steliana Calestru, B.Sc. Chemist

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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.

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

Attention:Loic Didillon

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

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 Extracted	Date Analyzed	Laboratory Method	Primary Reference
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 (S2-)*	1	2014/11/06	2014/11/07	QUE SOP-00107	MA 300 - S 1.1
Reactive Silica (SiO2)***	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.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

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

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
==
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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

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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

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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 (CaCO3)	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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

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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).

<Original signed by>

Alexandre Lemire, M.Sc., Analyst 2

<Original signed by>

Delia Barbul, B.Sc., Chemist

<Original signed by>

Dochka Koleva Hristova, B.Sc., Chemist

<Original signed by>

David Provencher, B.Sc., Chemist

<Original signed by>

Jonathan Fauvel, B.Sc, Chimiste, Analyste II

<Original signed by>

Maria Chrifi Alaoui, B.Sc., Chemist

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Madina Hamrouni, B.Sc., Chemist

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VALIDATION SIGNATURE PAGE(CONT'D)

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

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

Attention:Loic Didillon

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

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 Extracted	Date Analyzed	Laboratory Method	Primary Reference
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.

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

Attention:Loic Didillon

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

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.
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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

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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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

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Maxxam
A Bureau Veritas Group Company

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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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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.

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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	%

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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

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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.

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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).

<Original signed by>

Delia Barbul, B.Sc., Chemist

<Original signed by>

Dochka Koleva Hristova, B.Sc., Chemist

<Original signed by>

David Provencher, B.Sc., Chemist

<Original signed by>

Jonathan Fauvel, B.Sc, Chimiste, Analyste II

<Original signed by>

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.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Extracted	Date Analyzed	Laboratory Method	Primary Reference
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.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 (CaCO3)	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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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	%

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units
			Zinc (Zn)	2015/09/28		106	%
1513738	NS	Method Blank	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	%

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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.

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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).

<Original signed by>

Anne-Marie Giroux, Analyste I

<Original signed by>

Dochka Koleva Hristova, B.Sc., Chemist

<Original signed by>

David Provencher, B.Sc., Chemist

<Original signed by>

Madina Hamrouni, B.Sc., Chemist

<Original signed by>

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.

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Maxxam
A Bureau Veritas Group Company

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 Extracted	Date Analyzed	Laboratory Method	Primary Reference
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 (S2-)*	1	2015/09/22	2015/09/23	QUE SOP-00107	SM 21 4500-S2- D m
Reactive Silica (SiO2)***	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.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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
==
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 #: 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

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

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

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 (CaCO3)	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

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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				
P2O5	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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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

2015/09/24 16:28

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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.

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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	%

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	%

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.

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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).

<Original signed by>

Anne-Marie Giroux, Analyste I

<Original signed by>

Dochka Koleva Hristova, B.Sc., Chemist

<Original signed by>

David Provencher, B.Sc., Chemist

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Steliana Calestru, B.Sc. Chemist

<Original signed by>

Veronic Beausejour, B.Sc., Chemist, Supervisor

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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 Extracted	Date Analyzed	Laboratory Method	Primary Reference
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
Phone# (418) 658-5784 Ext:6432

==

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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

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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				
P2O5	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

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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

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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.

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	%

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	%

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

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 Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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).

<Original signed by>

Anne-Marie Giroux, Analyste I

<Original signed by>

David Provencher, B.Sc., Chemist

<Original signed by>

Faouzi Sarsi, B.Sc. Chemist

<Original signed by>

Madina Hamrouni, B.Sc., Chemist

<Original signed by>

Steliana Calestru, B.Sc. Chemist

<Original signed by>

Veronic Beausejour, B.Sc., Chemist, Supervisor

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APPENDIX V
Numerical Modelling Report of SNC-Lavalin

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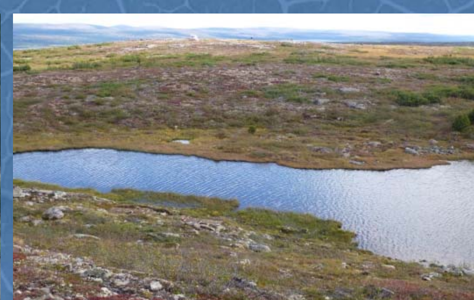
PRELIMINARY REPORT

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

SNC·LAVALIN

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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).

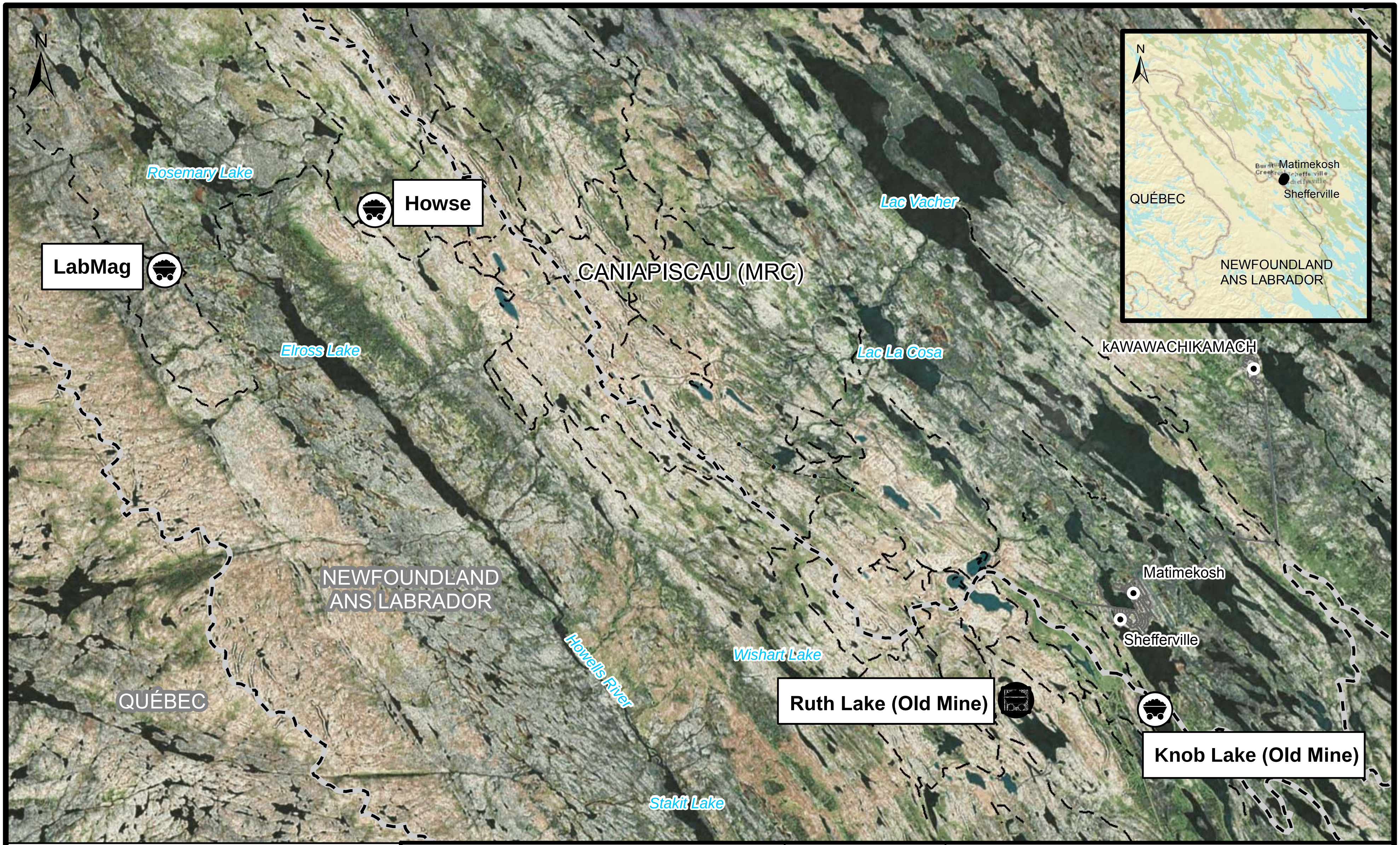
Drake (1983) describes the hydrogeological conditions prevailing in the iron formations, in the Schefferville area, where existing mines are located along the ridge sides and penetrate the permafrost zone when present. Permafrost is absent in the area of the Howse Deposit (Journeaux Assoc, 2015), but 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 underlaid 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

0 1 2 3 4 5 km

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

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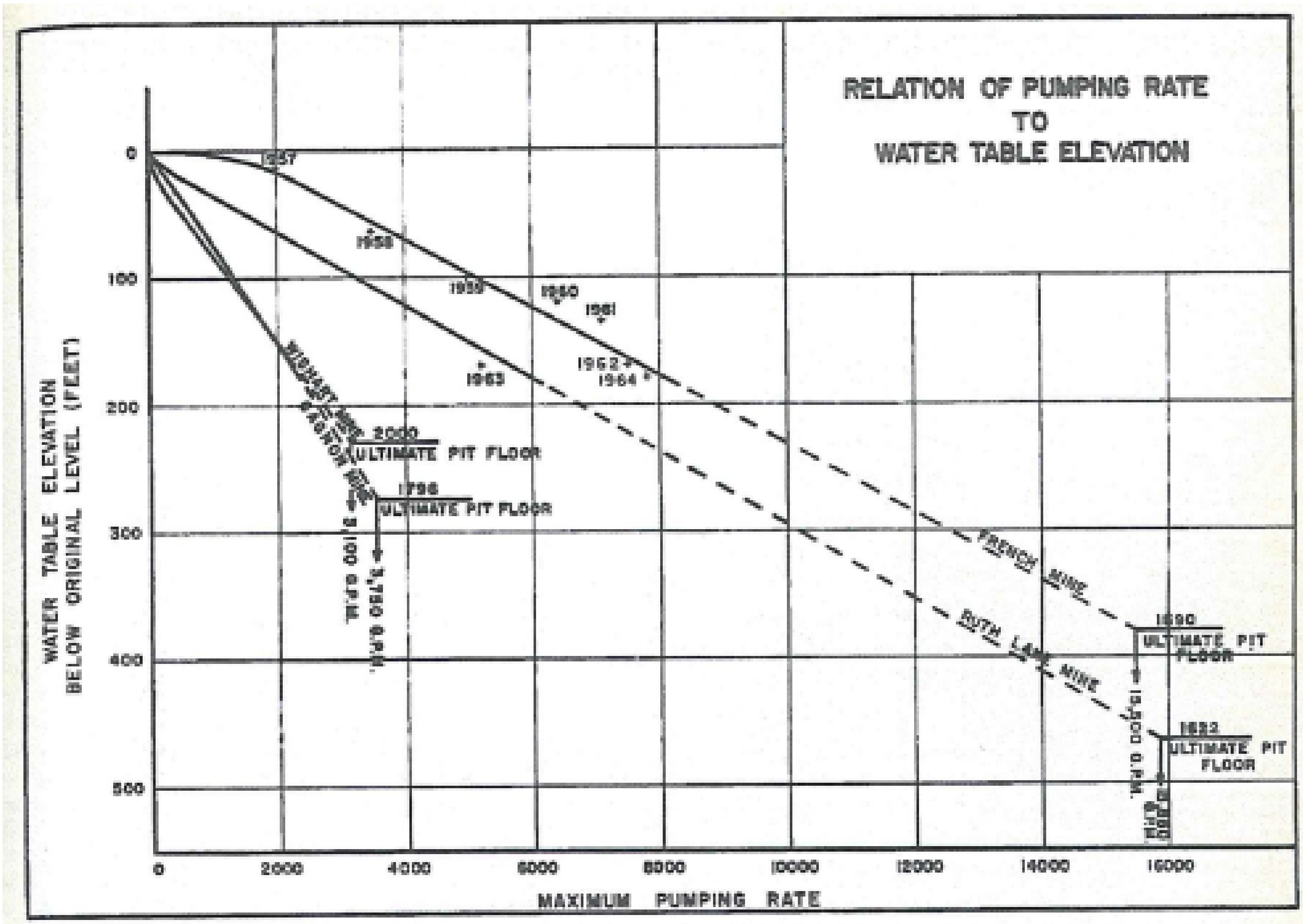
Stubbins and Munro (1965) provided an overview of the historical mine dewatering in the area of Knob Lake, located 25 km south-east of the Howse deposit. The studied mines included Wishart, Gagnon, French and Ruth mines, where the dewatering was very much depth correlated and increased with the mine 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 m^3/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.

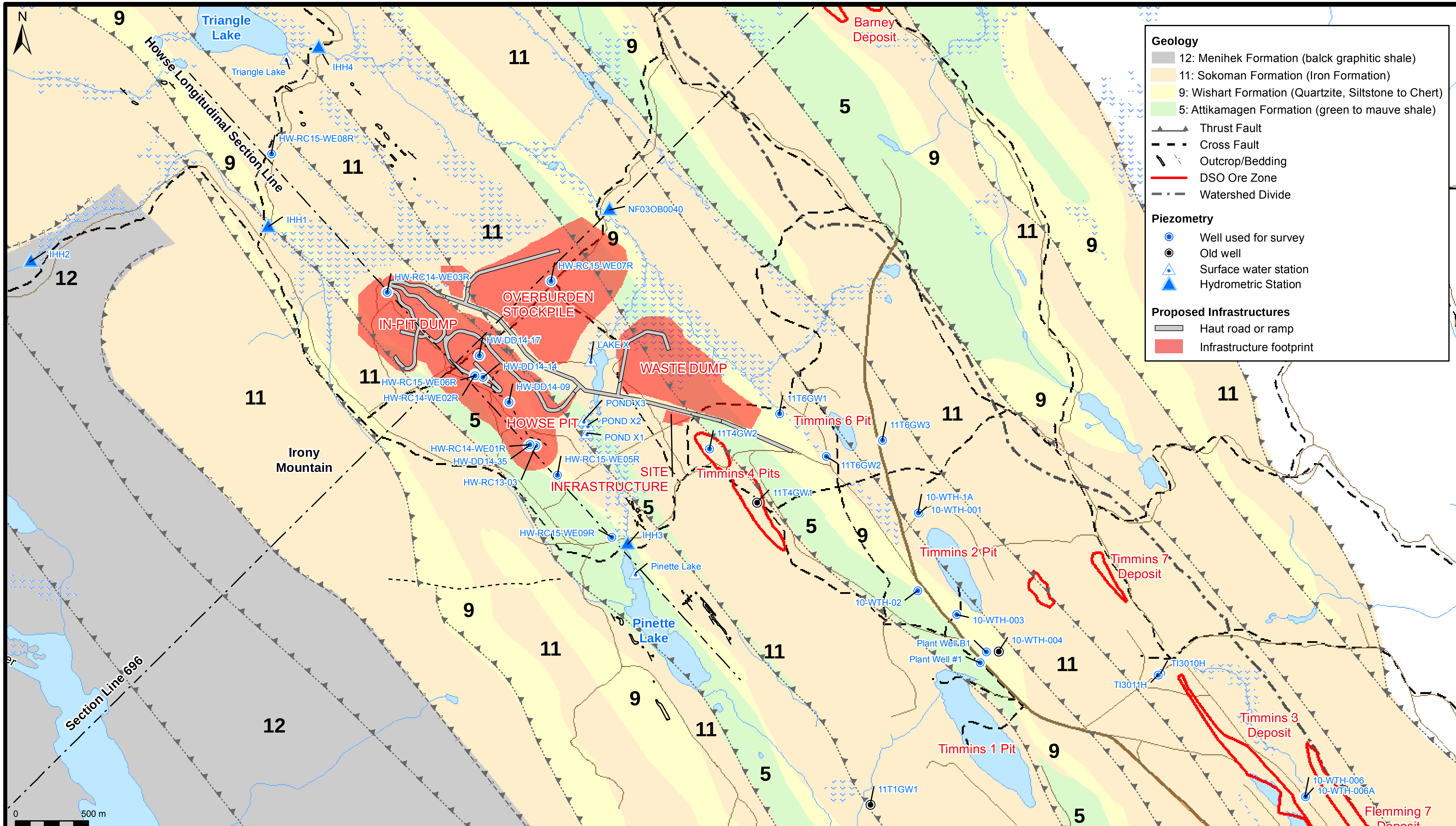


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Figure 2-3
Surface Geology
of the Howse Deposit Area

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Hydrogeology Modeling - Howse project

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

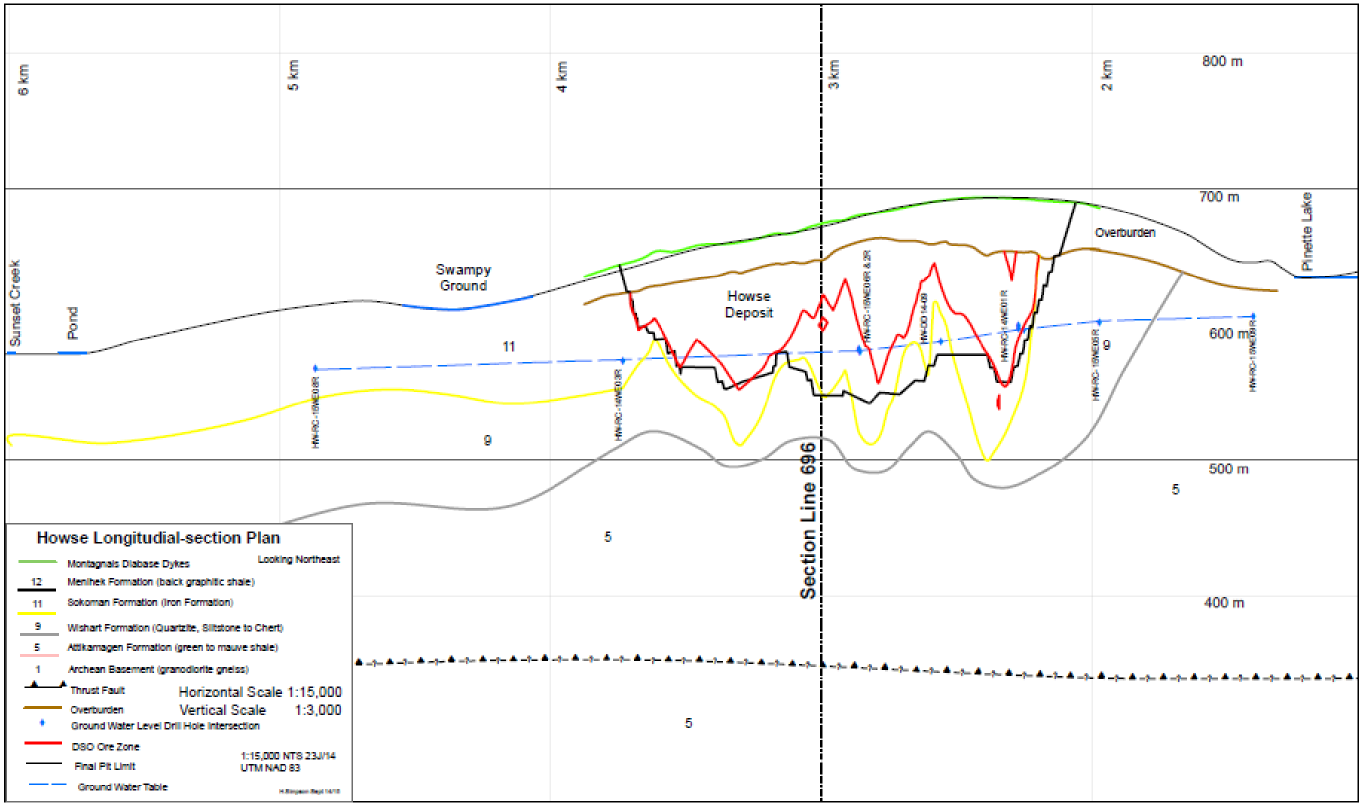
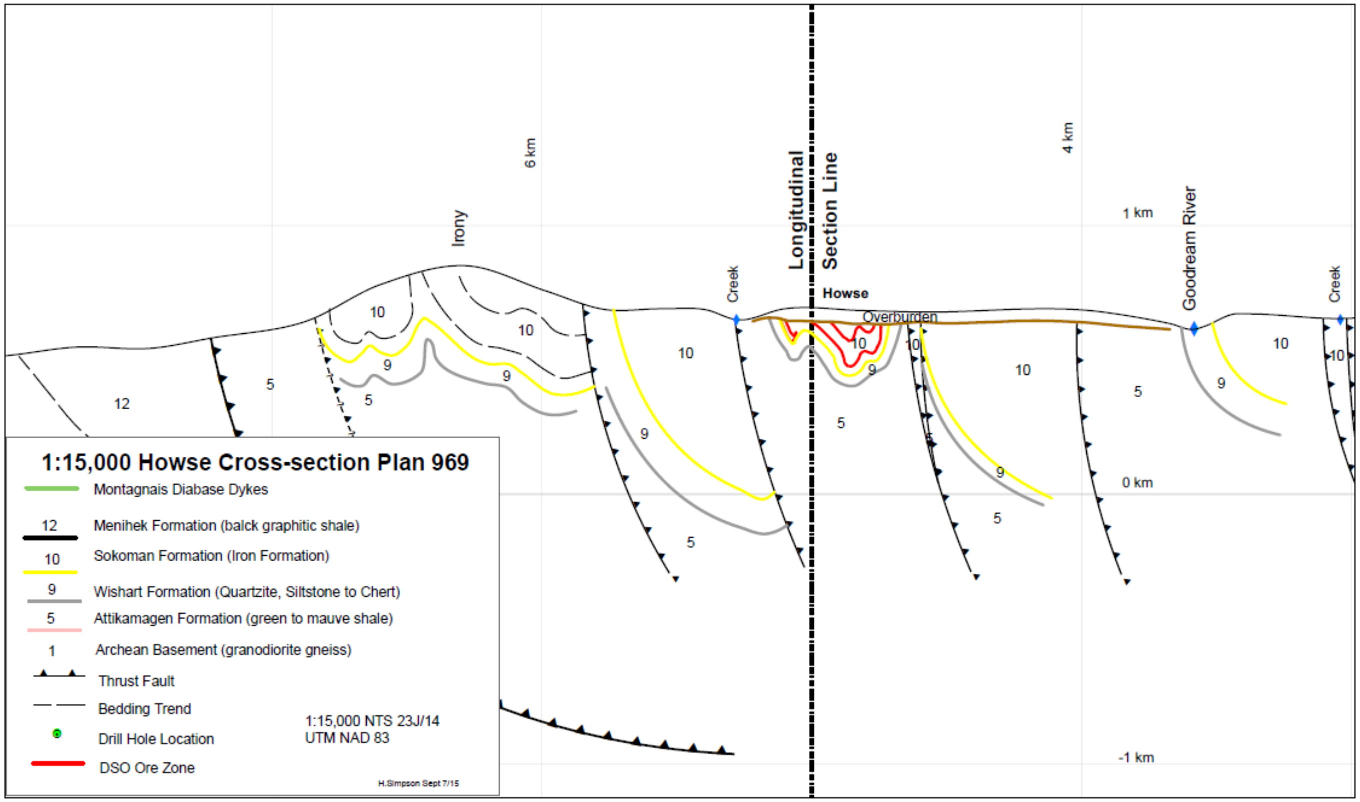


Figure 2-5 Transversal cross-section (Line 696) of the geology at Howse deposit site (Source: TATA Steel, 2015)



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 whereas 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 are 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 x 10^{-6} m/s to 1.9 x 10^{-5} m/s with an average of 9.4 x 10^{-6} m/s. The shale of Attikamagen had the lowest permeability values with an average of 5 x 10^{-8} m/s while the Wishart and fault zone recorded an intermediate conductivity value with an average of 1 x10^{-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.

<u>Aquifer and Well Productivity</u>

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 m^3/min (291 gpm) resulting in a 12.4 m final drawdown, and a specific capacity decreasing from 0.2 to 0.1 m^3/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 m^3/min (75-85 gpm) resulting in a 13.6 m final drawdown, and a slight specific capacity decrease from 0.04 to 0.02 m^3/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		
			1E-07	1.3E-07	Chert/Shale/fault zone
			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		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

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

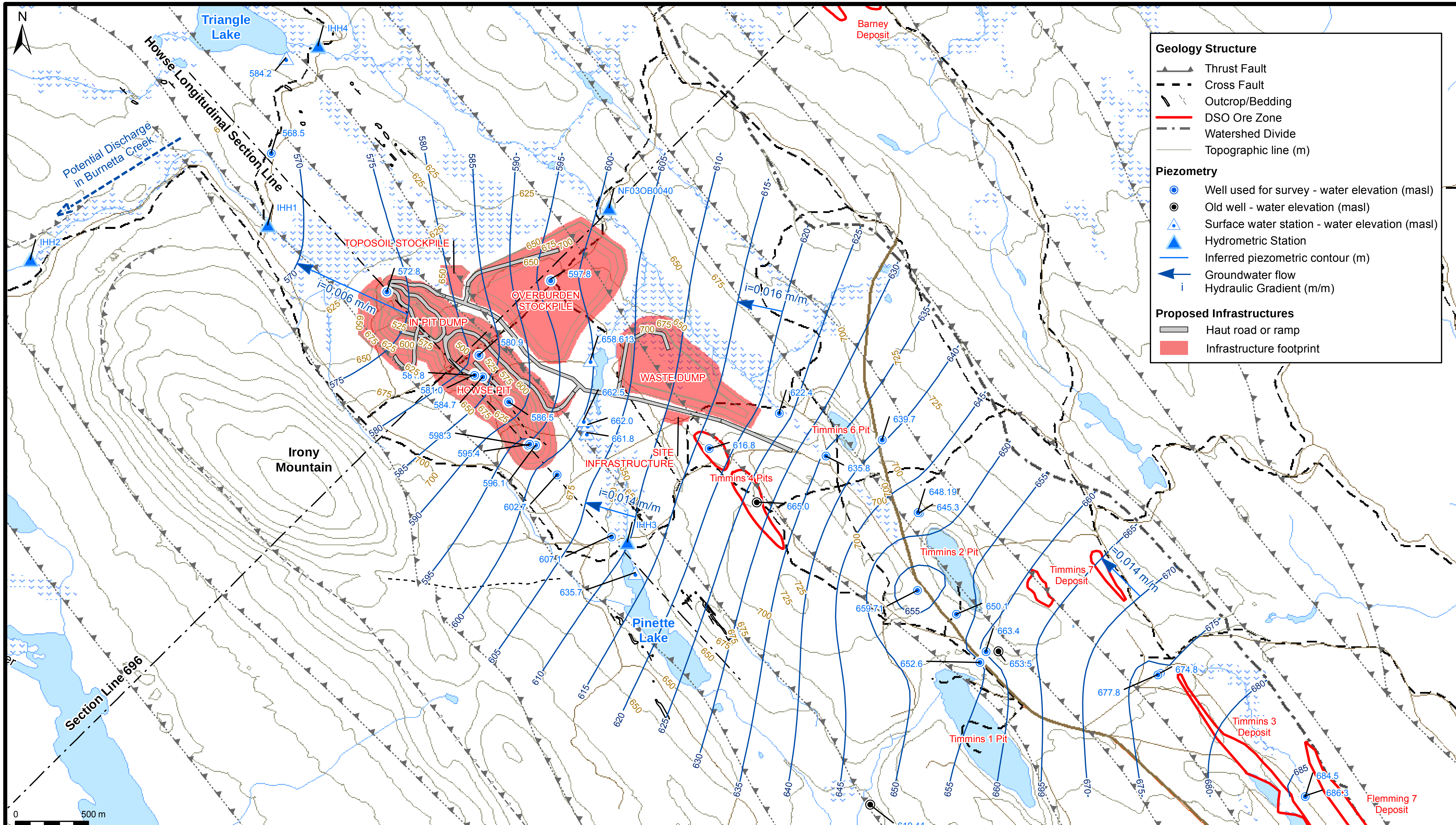


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Figure 2-6
Piezometric Map
of the Howse Deposit Area

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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.

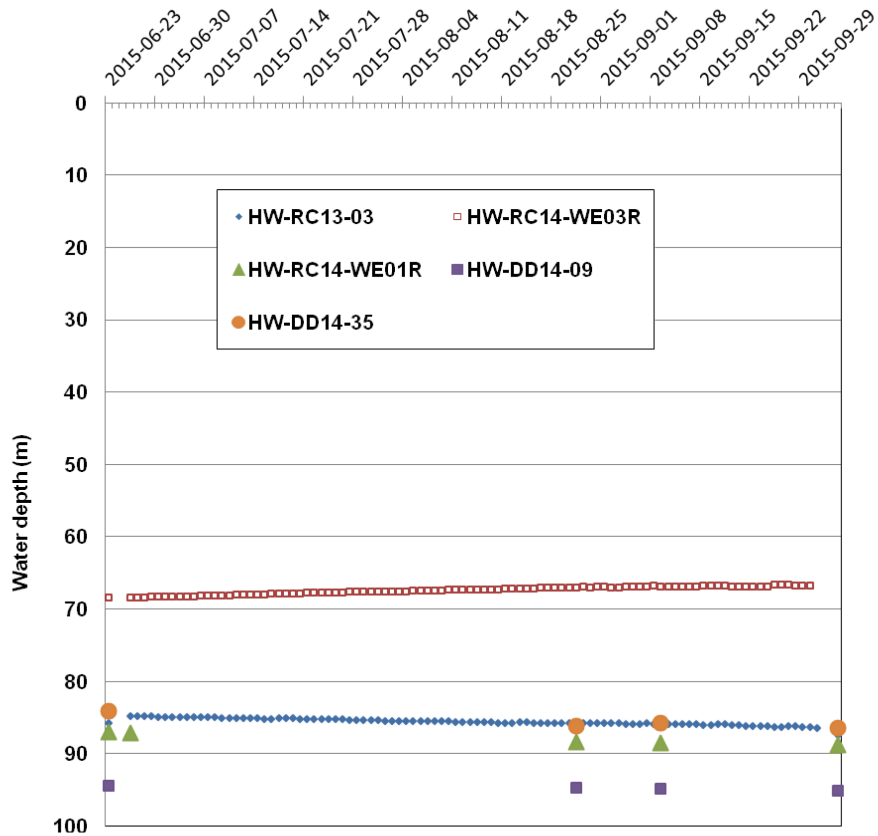
Table 2-4 Summary of Piezometric Monitoring

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.

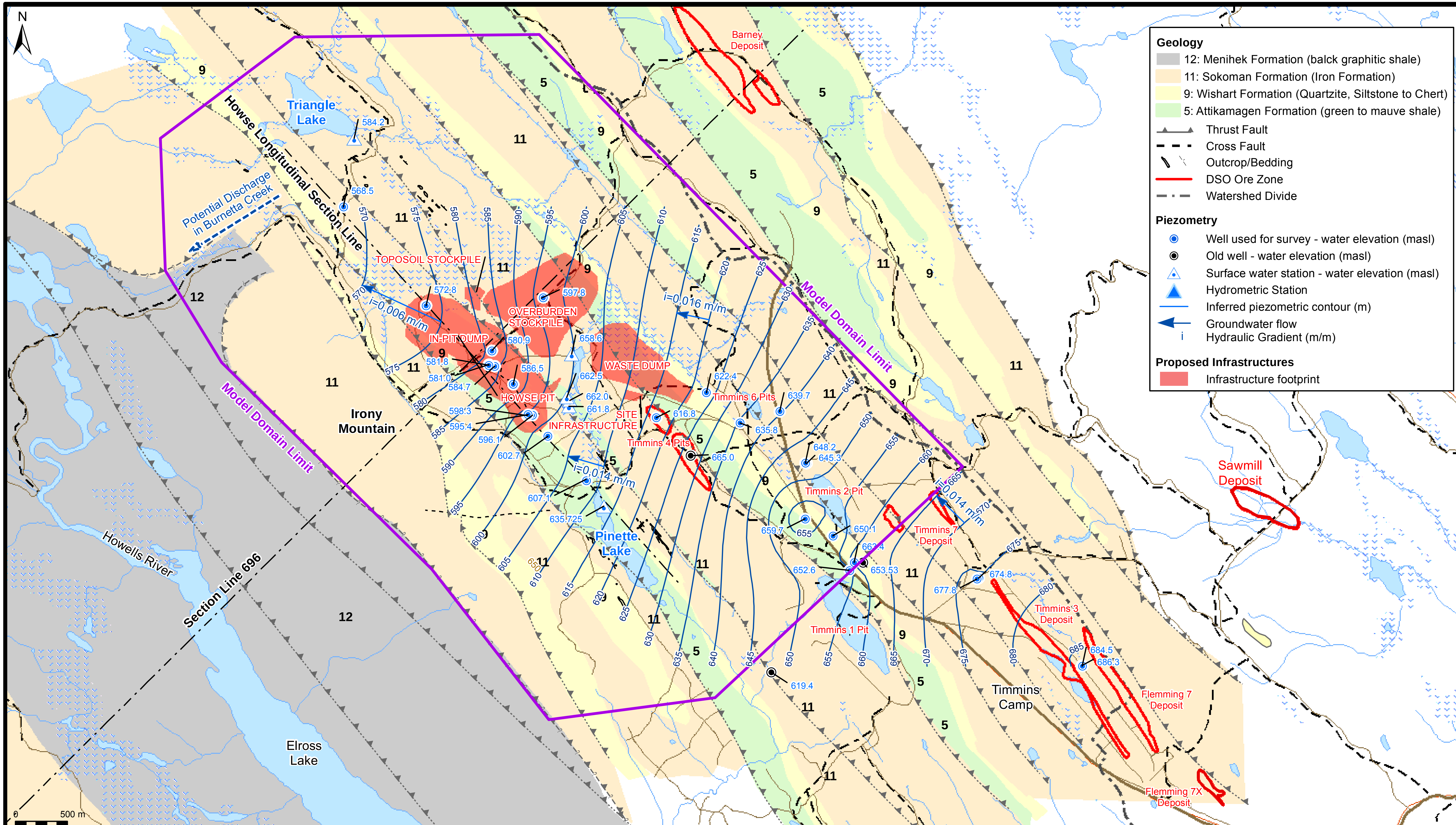


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Figure 3-1
Model Domain
of the Howse Deposit Area

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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)

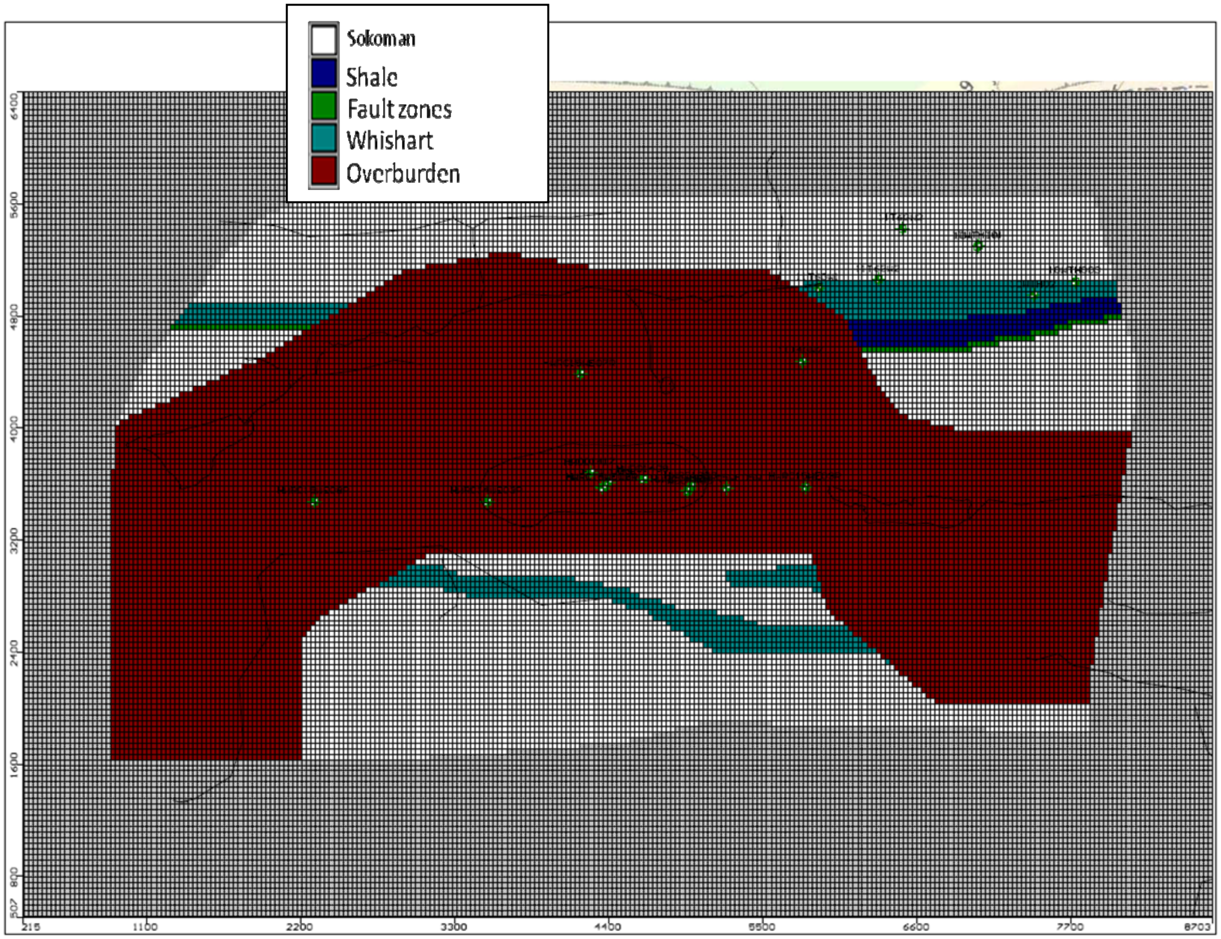


Figure 3-3 Geology of Layer 2 to 13.

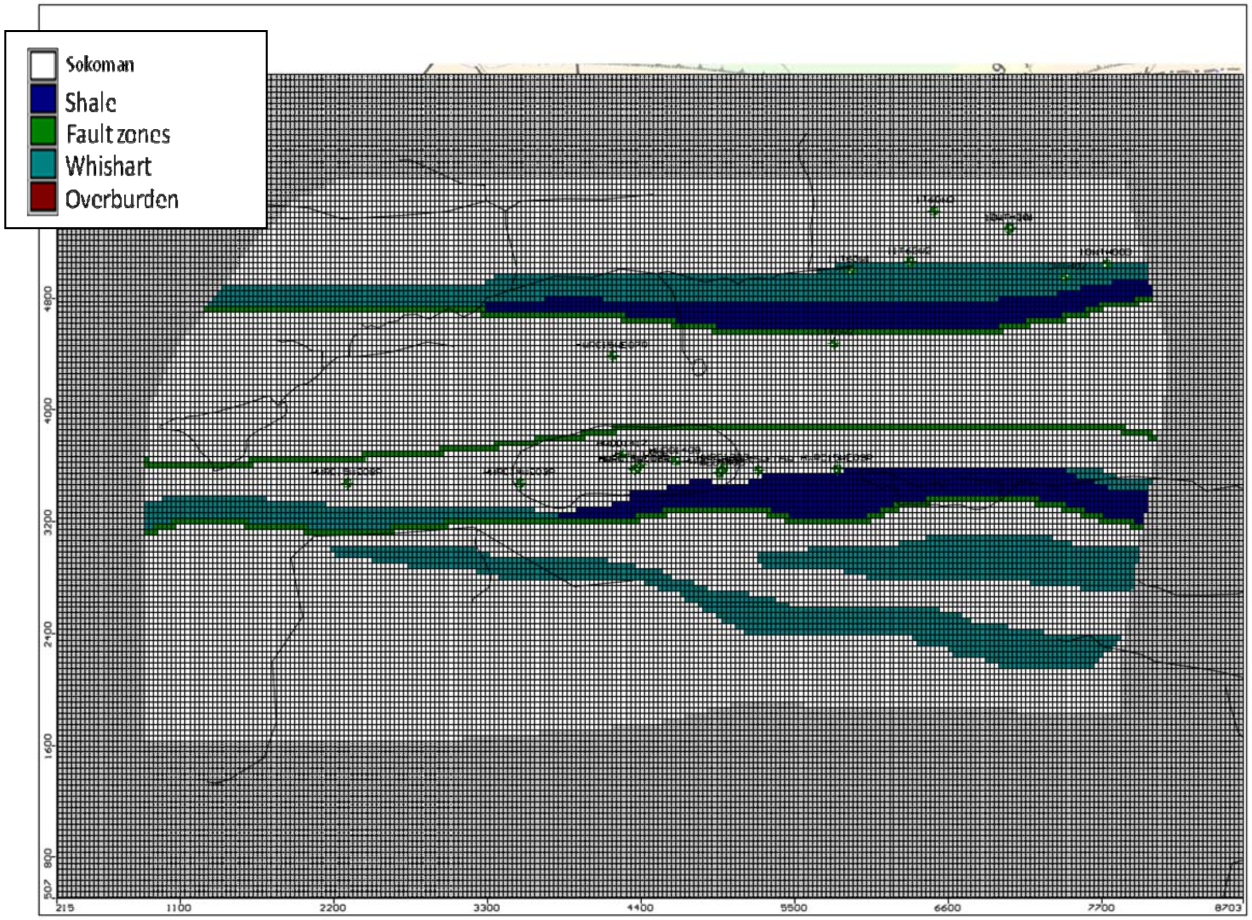


Figure 3-4 Vertical Model Grid –West-East Section

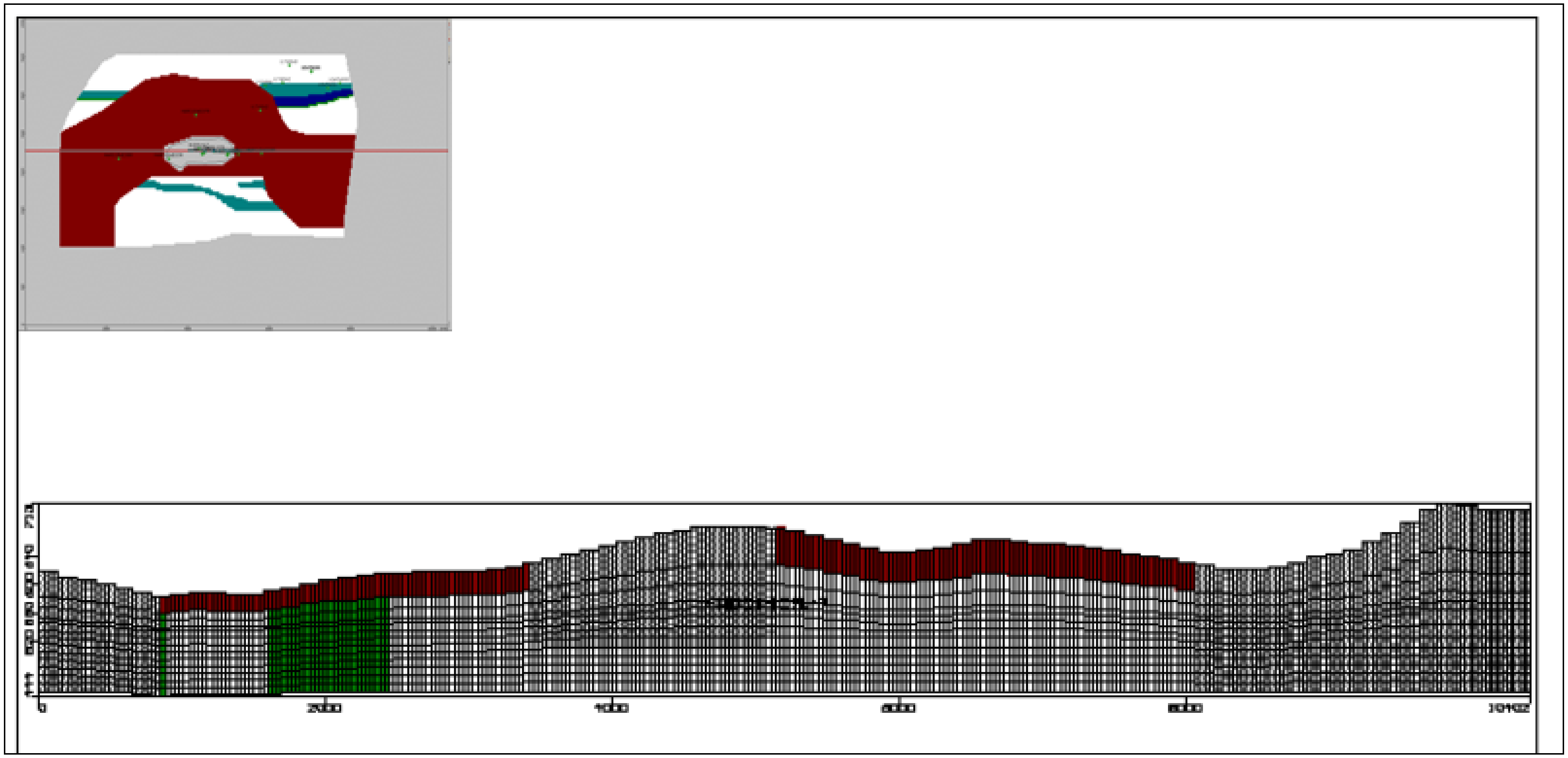
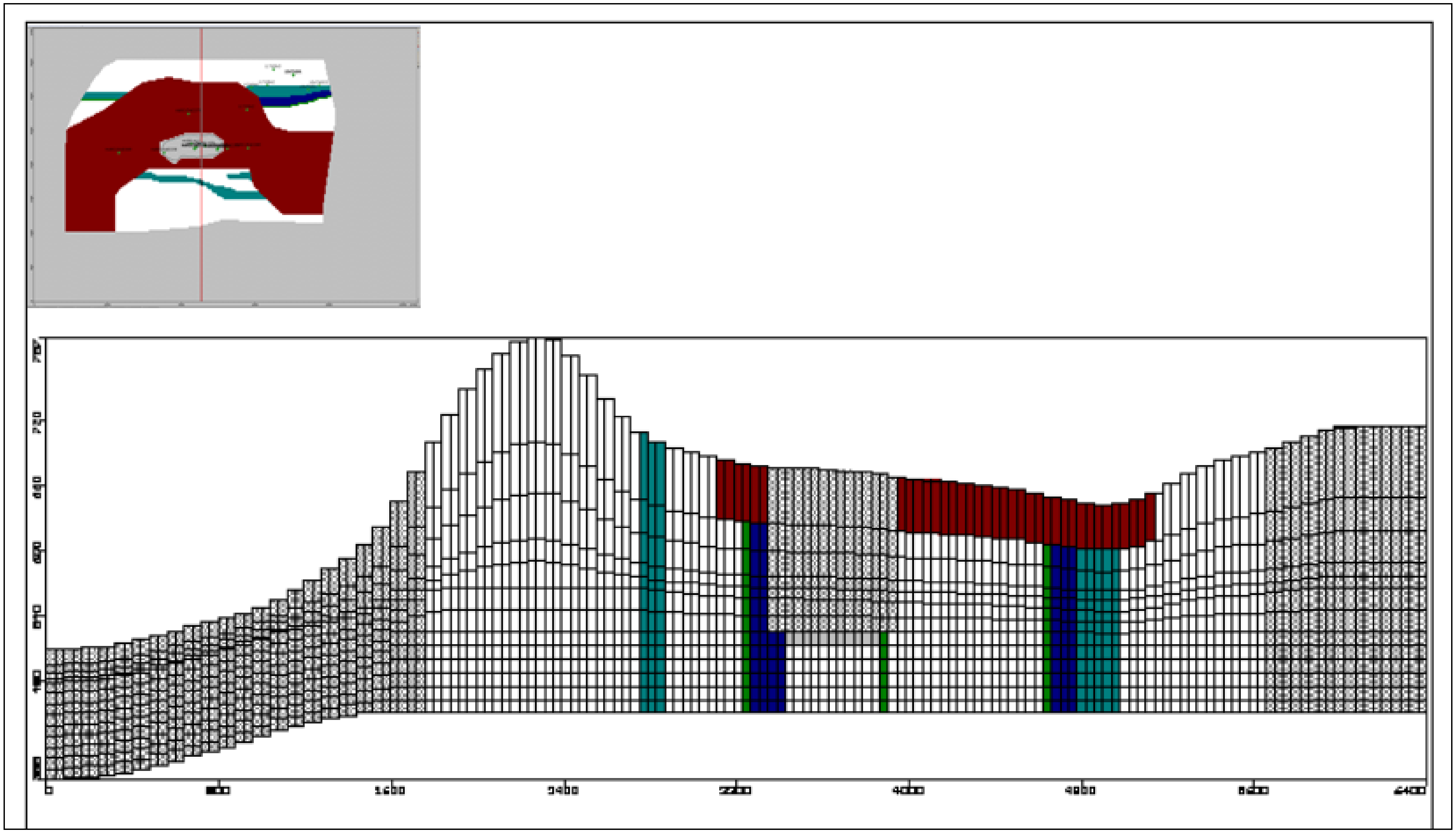


Figure 3-5 Vertical Model Grid –South-North Section



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 x 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).

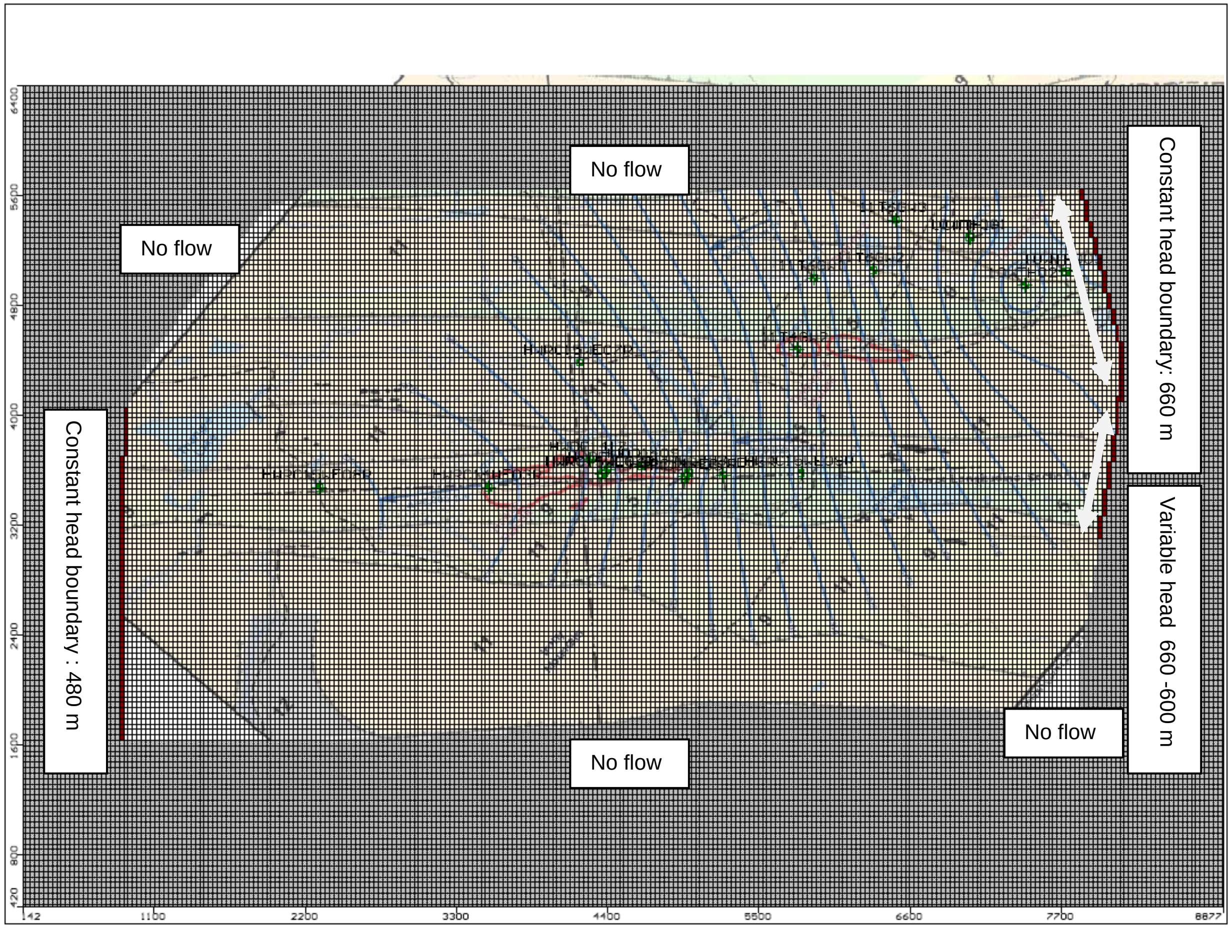
A constant hydraulic head of 480 m was set at the west boundary, representing the main discharge area of the aquifer.

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 access 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

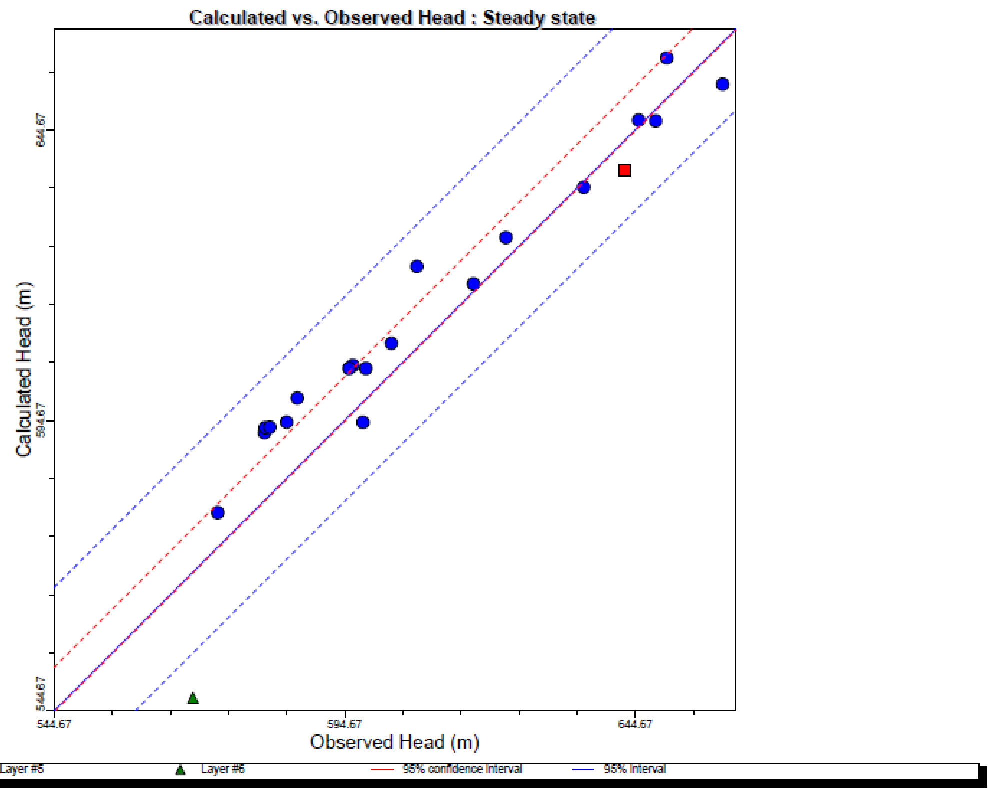
4.1 GROUNDWATER FLOW MODEL CALIBRATION

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



Max. Residual: -21.61 (m) at HWRC15WE08R/A
Min. Residual: -1.038 (m) at 11T6GW2/A
Residual Mean : 3.653 (m)
Abs. Residual Mean : 7.512 (m)

Num. of Data Points : 21
Standard Error of the Estimate : 1.846 (m)
Root Mean Squared : 9.027 (m)
Normalized RMS : 9.901 (%)
Correlation Coefficient : 0.955

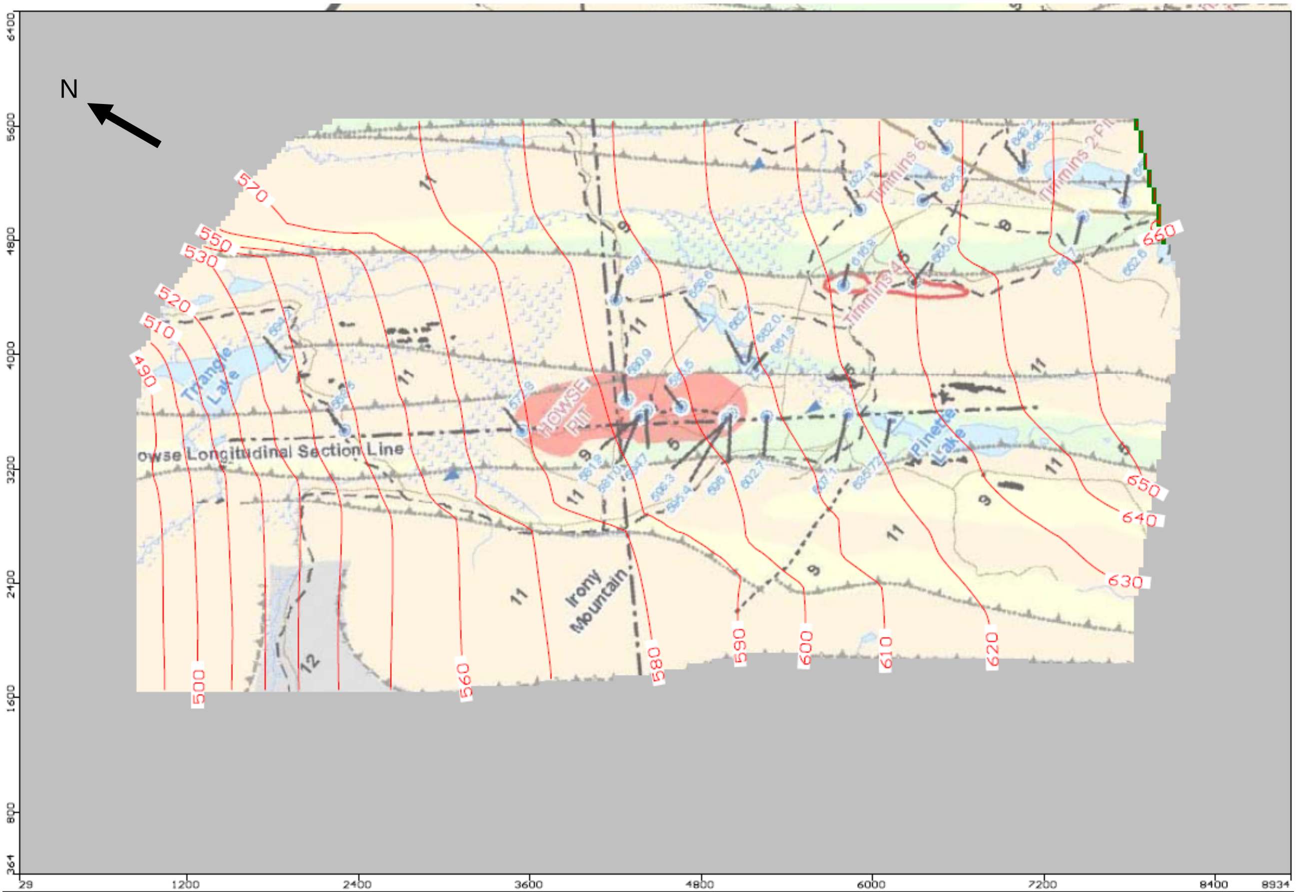
The initial conductivity values were increased to better represent the expected groundwater flow patterns of the area and to be able to incorporate a recharge of at least 100 mm/year without creating an overflow. Initial and calibrated hydraulic conductivities are given in Table 4-1.

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 m^3/day. This flow rate may reach higher values ranging from 12,000 to 19,000 m^3/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)

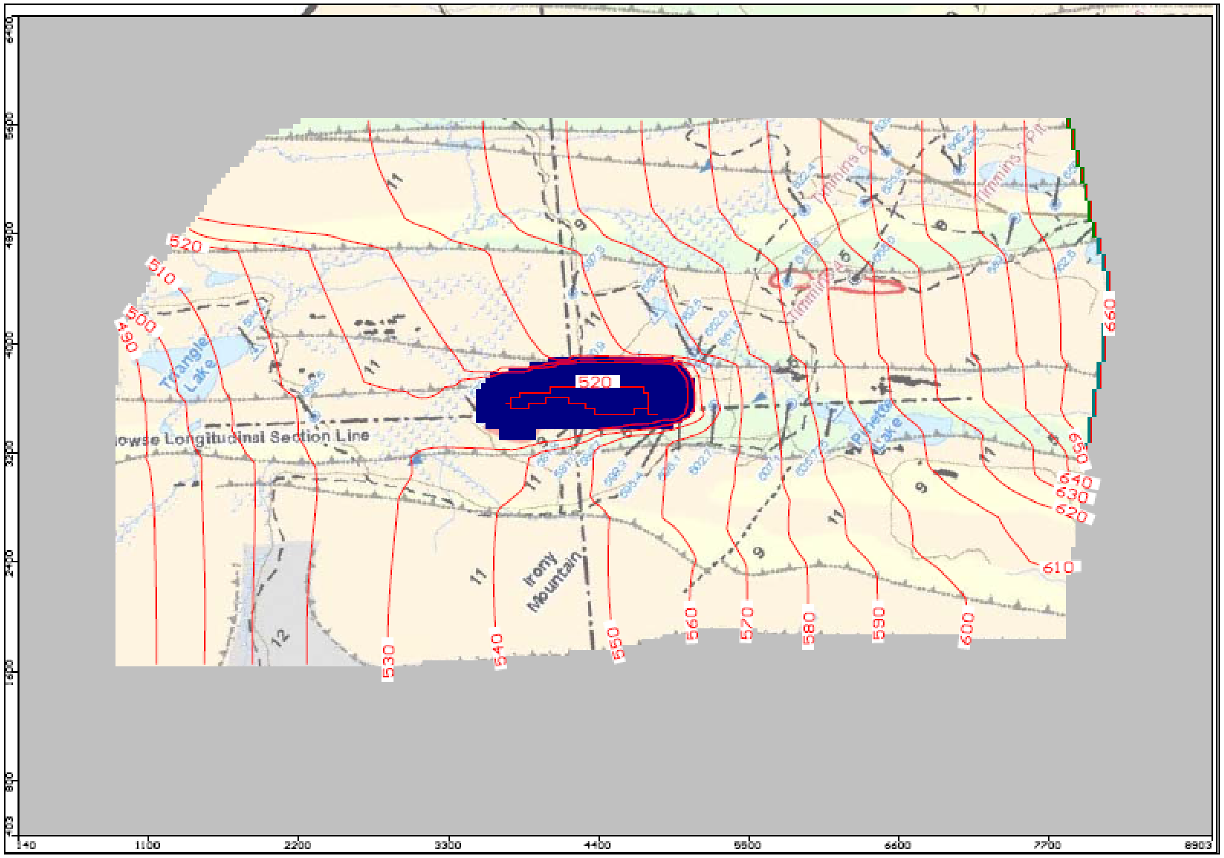


Figure 4-4 Groundwater Drawdown during Pit Dewatering (Final Depth)

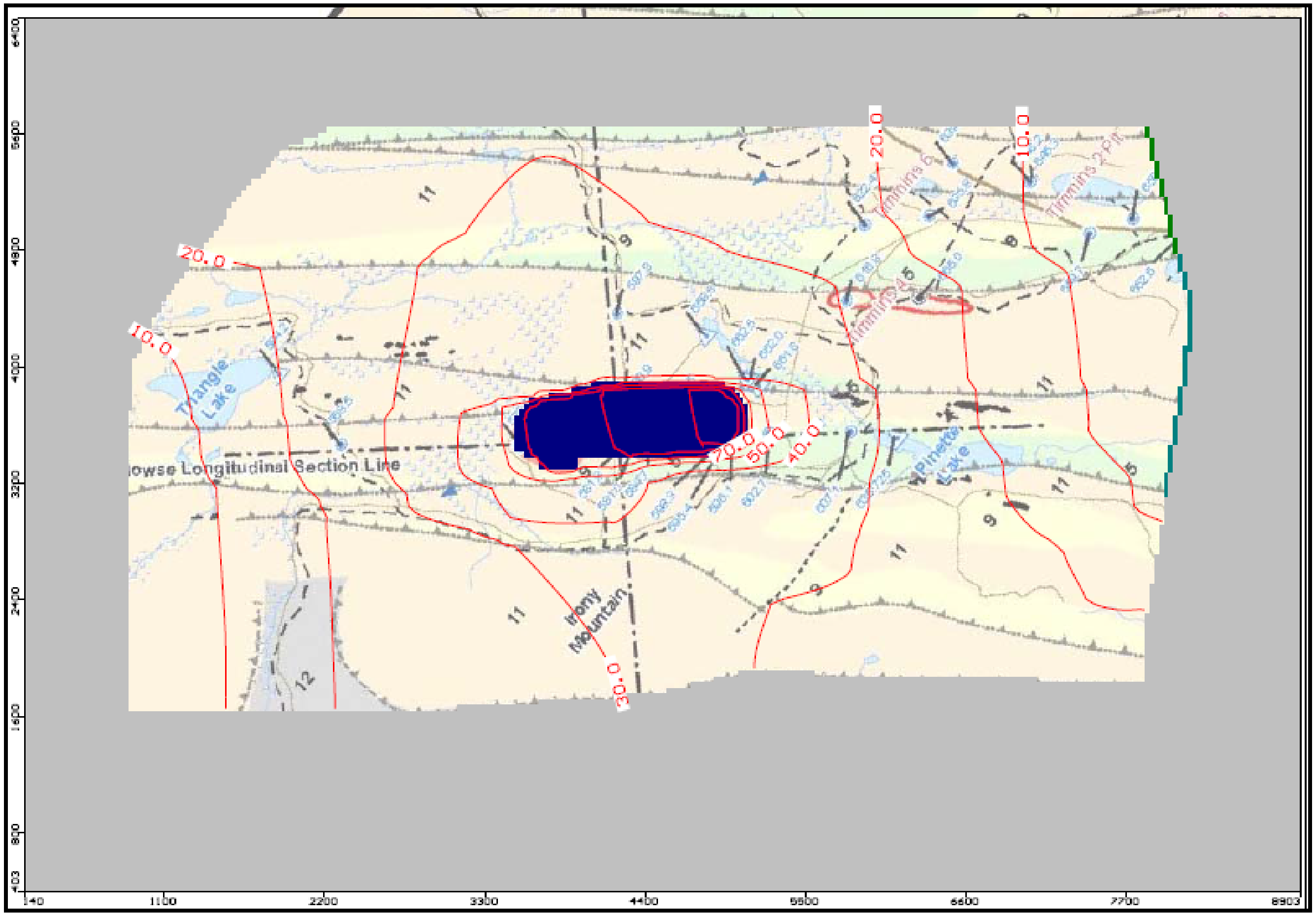


Table 4-3 Results of Drawdown versus Distance from the center of the pit for different scenarios

	Distance in meters from the center of the Pit to					
	2m isocontour drawdown		**5m isocontour drawdown**		**10m isocontour drawdown**	
	Downgradient	*Upgradient*	*Downgradient*	*Upgradient*	*Downgradient*	*Upgradient*
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 m^3/day;
  - This flow rate may reach higher values, ranging from 12,000 to 19,000 m^3/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.

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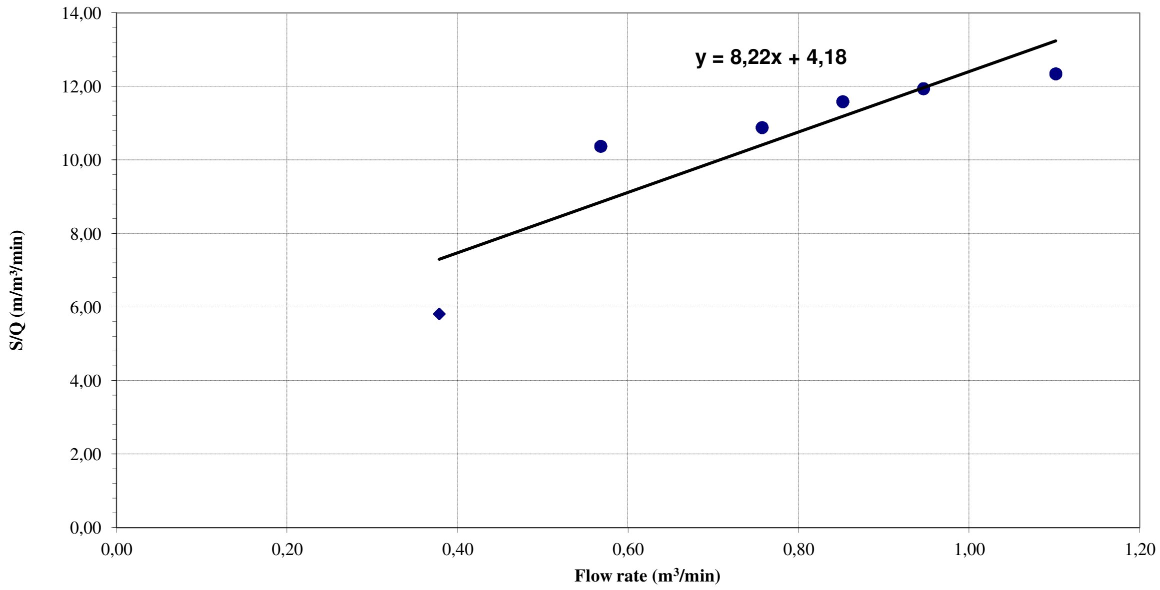
APPENDIX A

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)	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

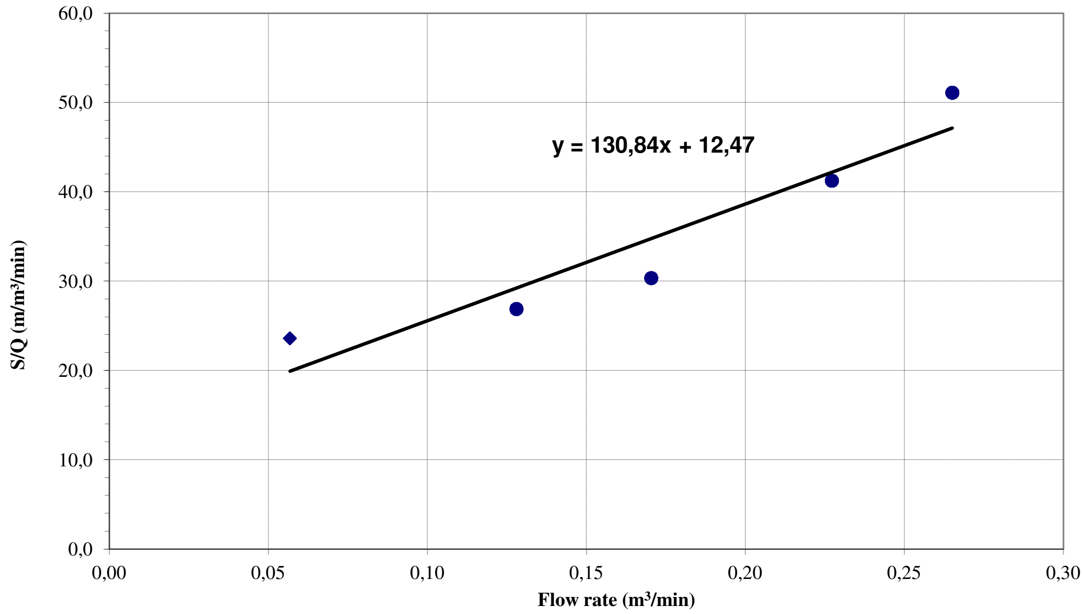
2. Graph of Specific Drawdown vs pumping flow rate



1. Step Test Results - 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/m³/min)	Q/S (m³/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

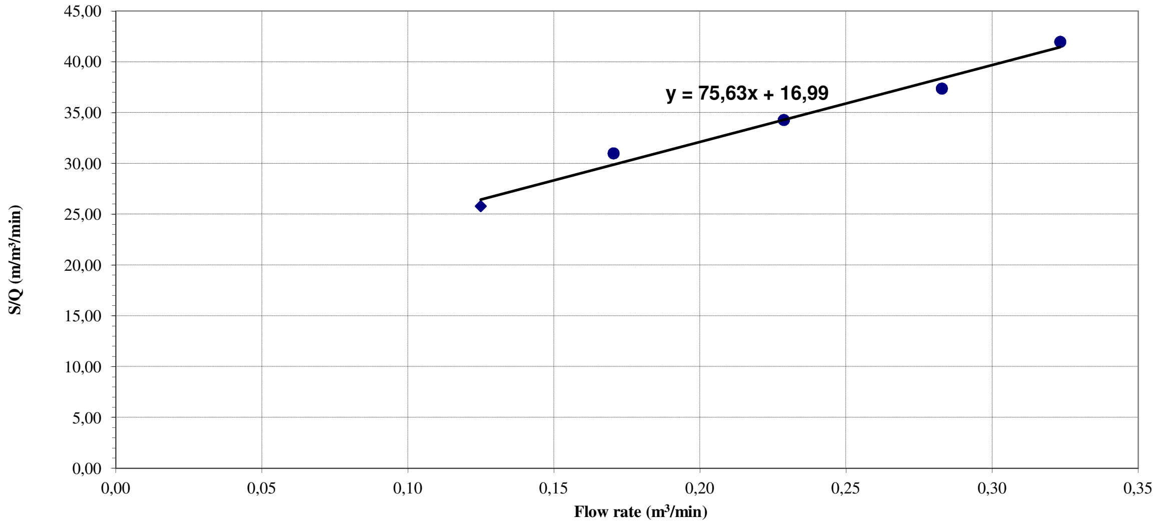
2. Graph of Specific Drawdown vs pumping flow rate



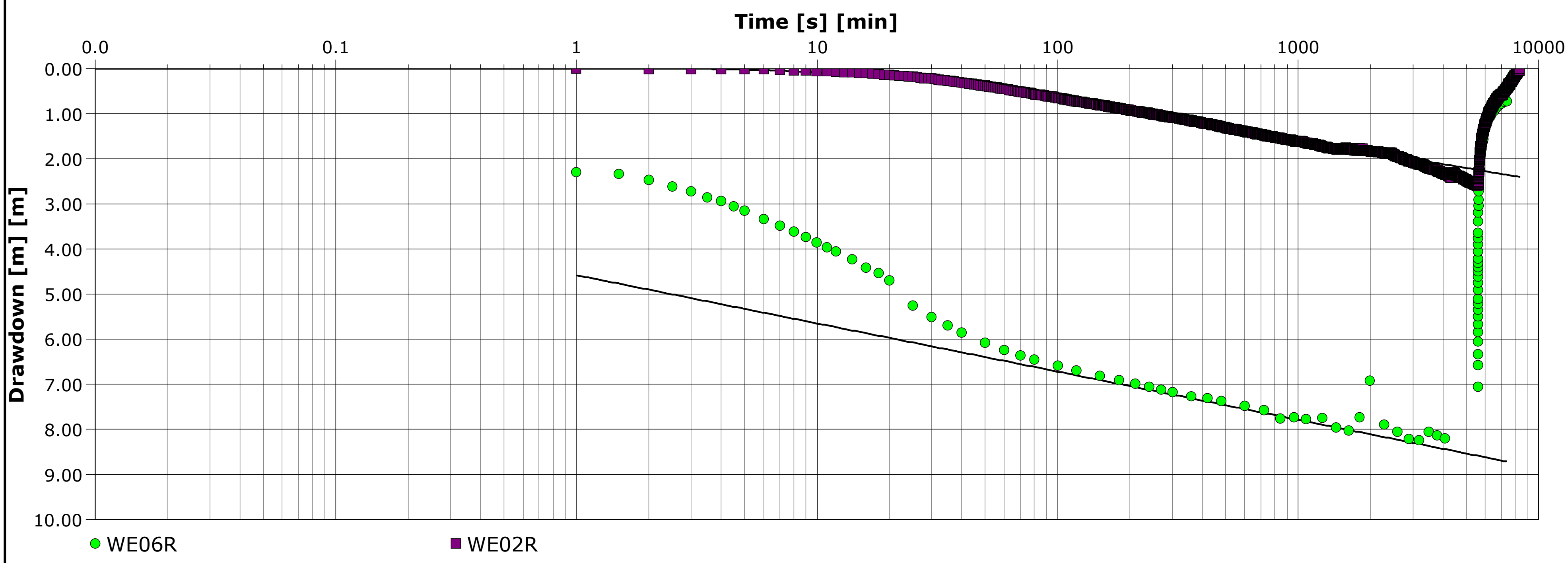
1. Step Test Results - Well HW-RC15-WEO8R

Step no.	Duration	Flow	Flow	Flow	Flow	Drawdown	Specific Capacity	Specific Drawdown
	min	gpm	m3/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



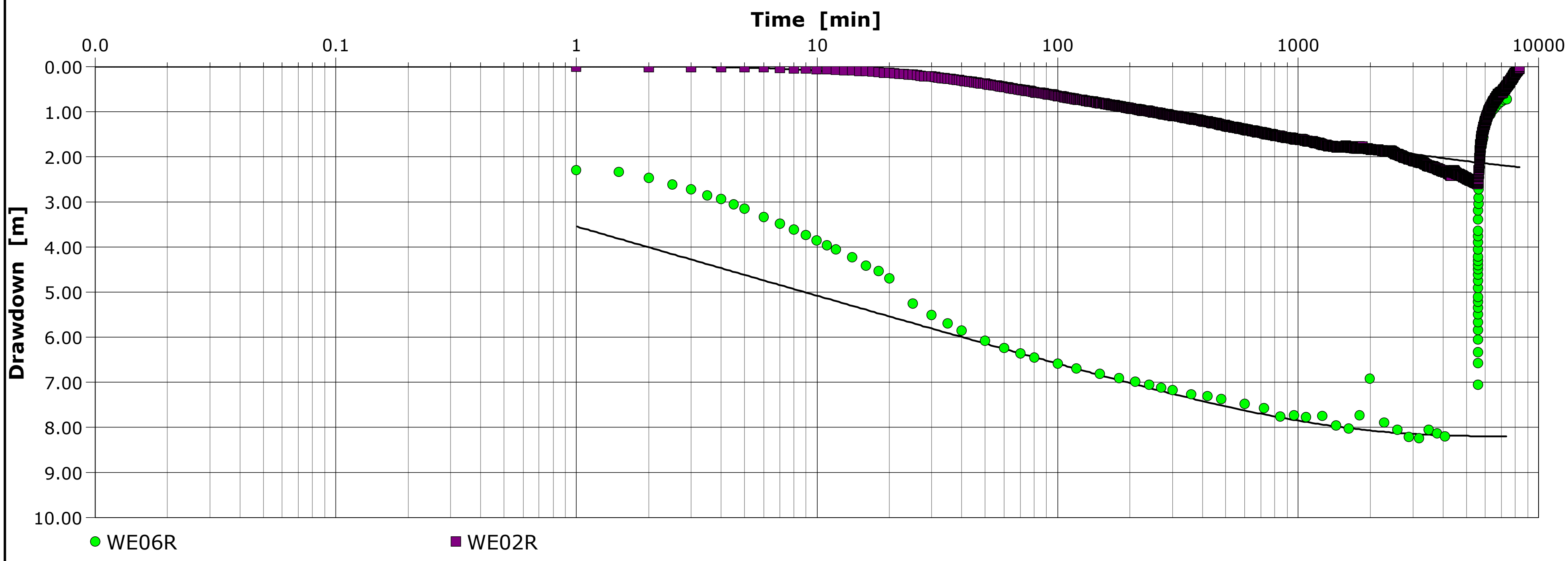
Location: Howse Deposit	Pumping Test: Pumping Test 2 (WE06R)	Pumping well: WE06R
Test conducted by: Geofor		Test date: 22/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 81.00 m	Discharge: variable, average rate 637.83 [m³/d]	



Calculation after Theis

Observation well	Transmissivity [m²/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]	

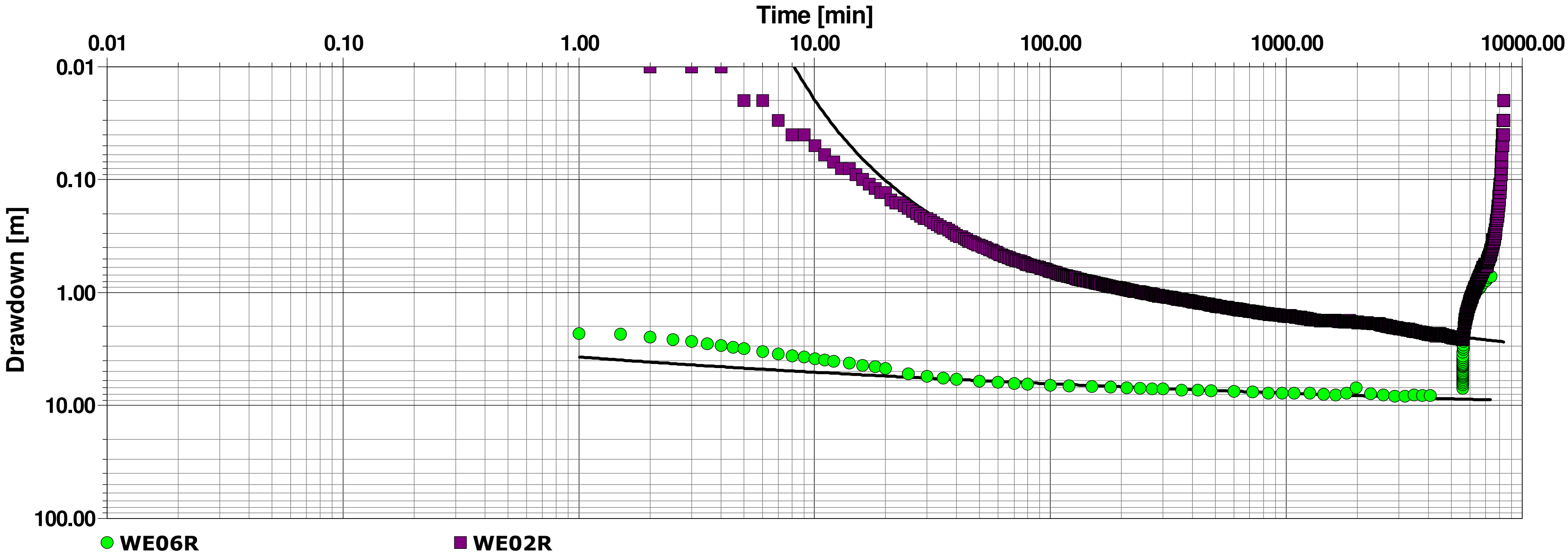


Calculation after Hantush

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 modèl Huntush ne juxtapore pas les données de descente aec la remonteé

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 [m³/d]	

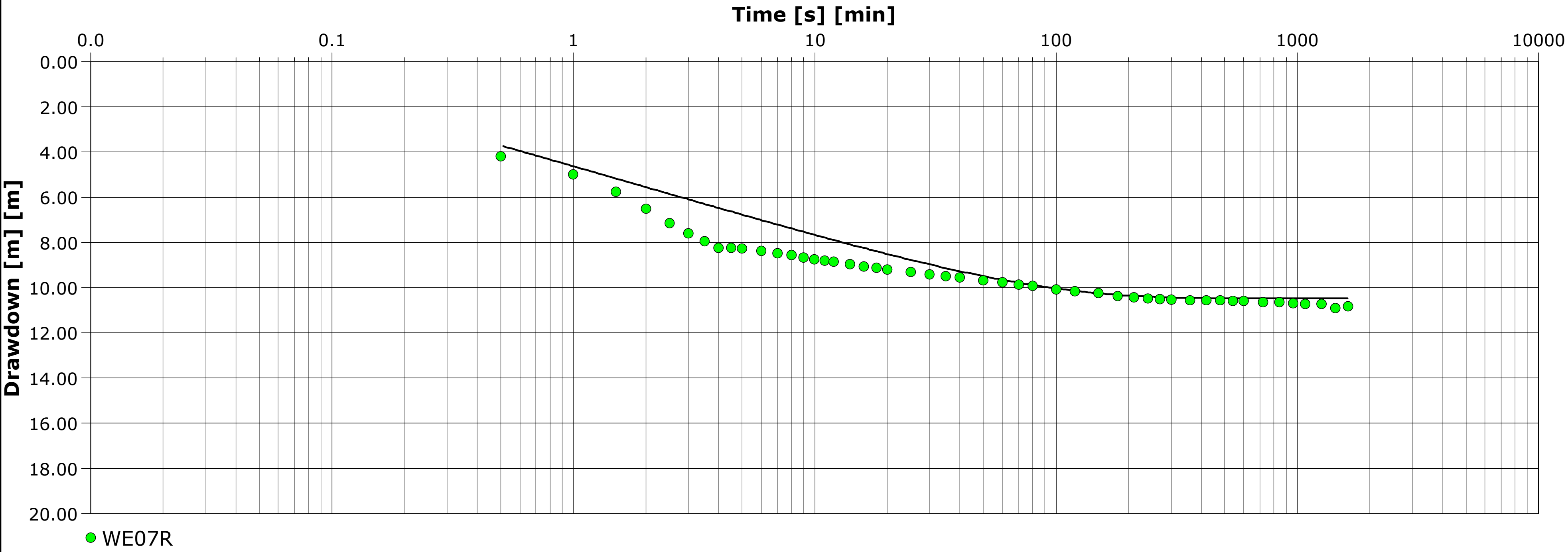


Calculation after Double Porosity

Observation well	Transmissivity [m²/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 [m³/d]					
	Analysis Name	Analysis performed by	Date	Method name	Well	T [m²/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]	

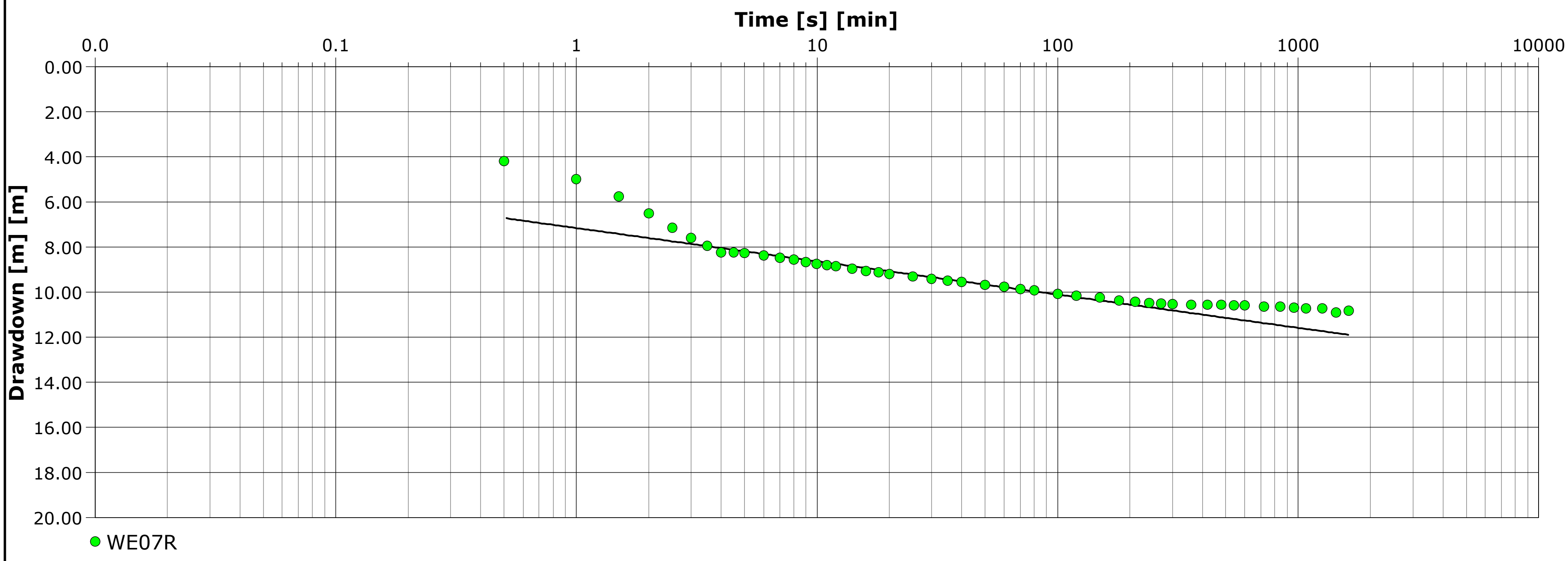


Calculation after Hantush

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 modèl Huntush ne juxtapore pas les données de descente aec la remonteé

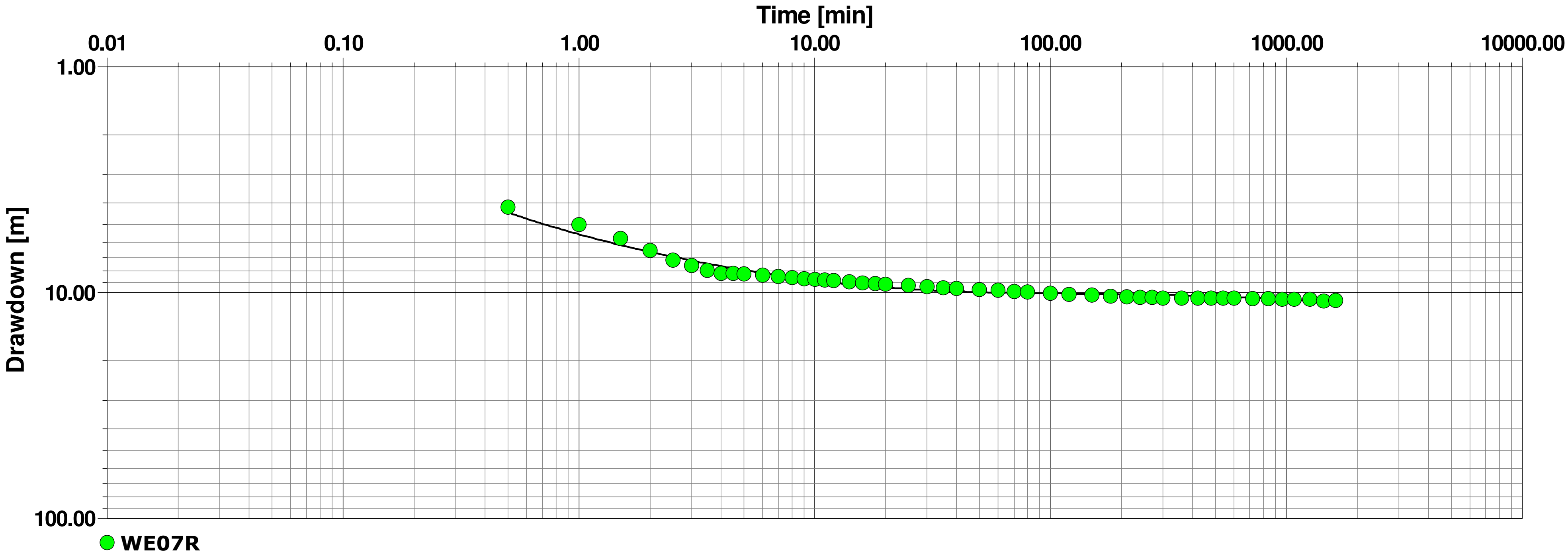
Location: Howse Deposit	Pumping Test: Pumping Test 2 without recovery(WE07R)	Pumping well: WE07R
Test conducted by: Geofor		Test date: 15/09/2015
Analysis performed by: AB	Theis	Date: 21/09/2015
Aquifer Thickness: 38.00 m	Discharge: variable, average rate 296.51 [m³/d]	



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]	

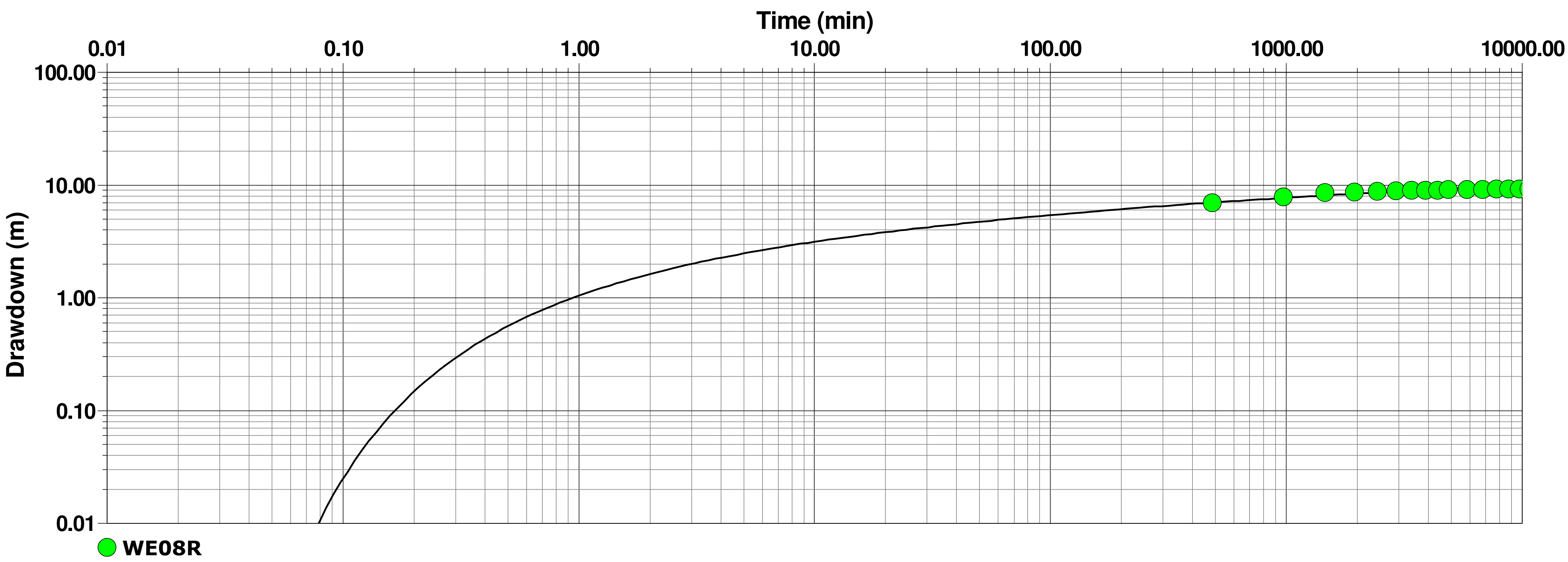


Calculation after Double Porosity

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 [m³/d]						
	Analysis Name	Analysis performed by	Date	Method name	Well		T [m²/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-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 [m³/d]	



Calculation after Theis

Observation well	Transmissivity [m²/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

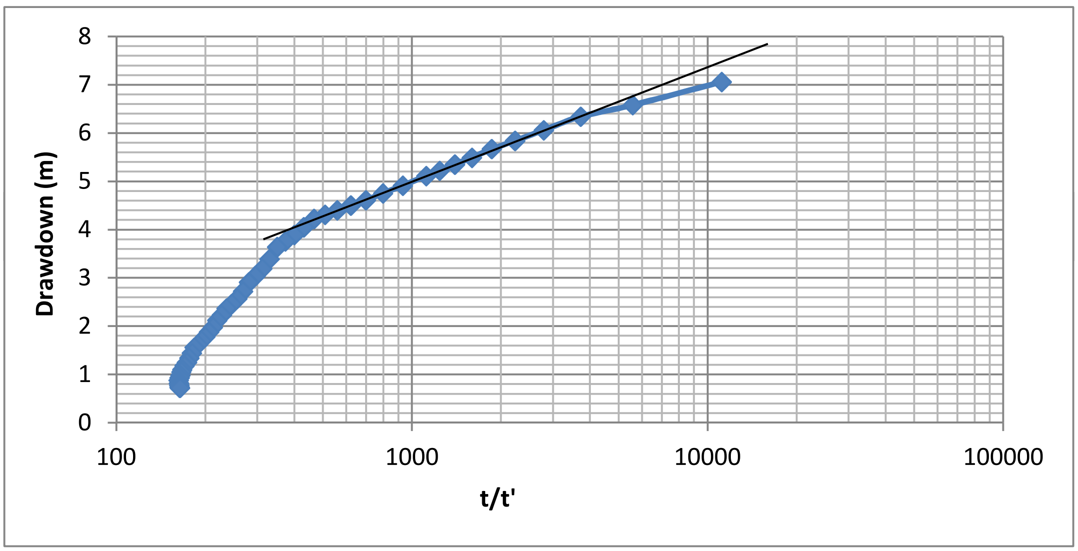
Thickness (m)	81
production time (min)	Well discharge (m3/d)
5576	954
8340	0

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

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

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

Graph of residual drawdown vs t/t'



WEO7R **Recovery analysis**

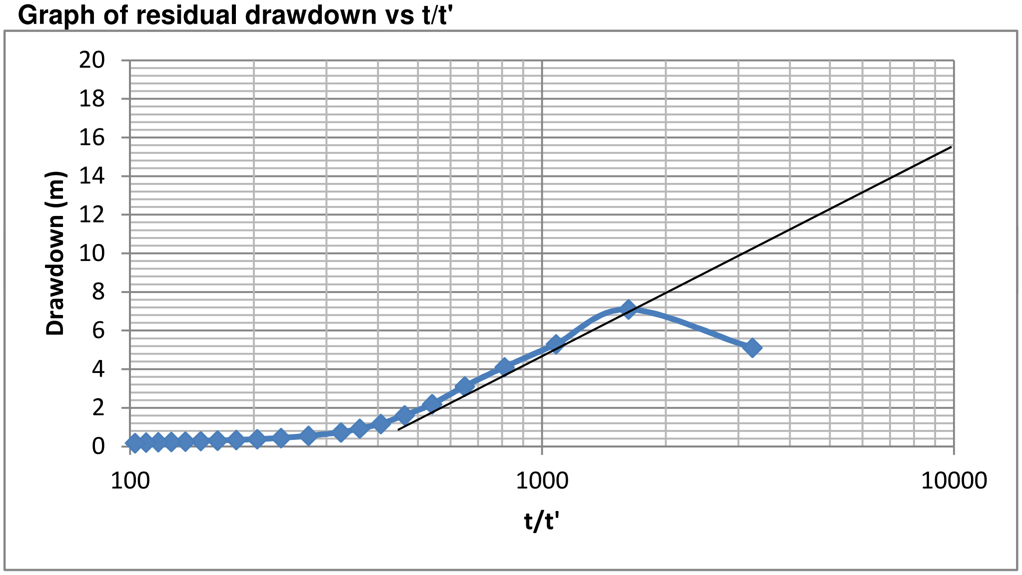
Thickness (m)	38
production time (min)	well discharge (m3/d)
1620	302
1650	0

t/t'	Drawdowd (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

T	0.00355417	m2/min
	5.9236E-05	m2/s
K	1.5588E-06	m/s

Graph of residual drawdown vs t/t'



WEO8R **Recovery analysis**

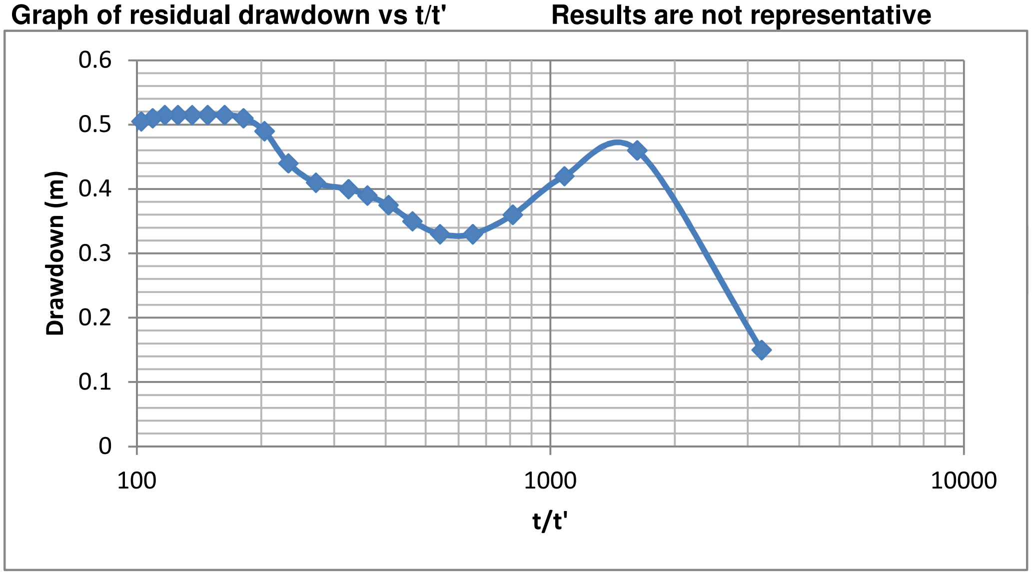
Thickness (m)	28
production time (min)	well discharge (m3/d)
1620	354
1800	0

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

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

Graph of residual drawdown vs t/t' **Results are not representative**



Summary of 2015 Pumping Test Results

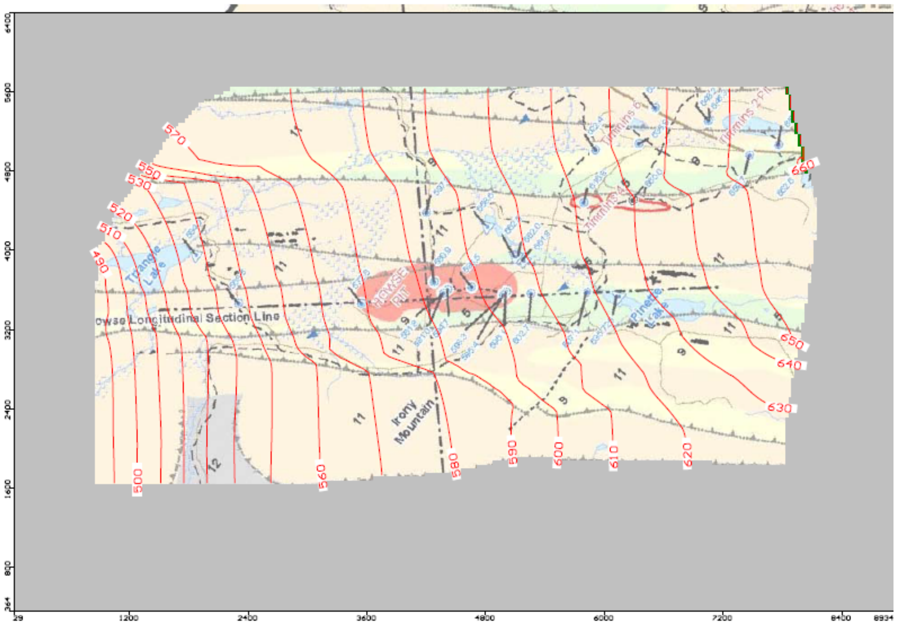
	Drawdown			Recovery								
Well ID.	**T**	**K**	**S**	**T**	**K**	**Method of analysis**	**pumping test date**	**Pumped well**	**Duration**	**Flow rate**	**Final drawndown**	**Formation tested / depth (m)**
	(m^2/s)	**(m/s)**	**(-)**	**(m^2/s)**	**(m/s)**				**(min)**	**(L/min)**	**(m)**	
HW-RC15-WEO6R	1,26E-03	1,56E-05	-	1,01E-03	1,25E-05	Theis	22-sept-15	HW-RC15-WEO6R	4080	662	8,2	Iron Ore (Sokoman) / 170
	8,78E-04	1,08E-05	-	-	-	Hantush						
	1,00E-03	1,23E-05	-	-	-	Double Porosity						
HW-RC14-WEO2R (10 m distant from pump well)	1,50E-03	1,85E-05	9,85E-02	-	-	Theis					2,6	
	1,50E-03	1,85E-05	9,85E-02	-	-	Hantush						
	1,00E-03	1,23E-05	1,48E-01	-	-	Double Porosity						
HW-RC15-WEO7R	4,34E-04	1,14E-05	-	5,92E-05	1,56E-06	Theis	15-sept-15	**HW-RC15-WEO7R**	1620	210	10,8	Iron Ore (Sokoman)/ 97.4
	2,03E-04	5,34E-06	-	-	-	Hantush						
	1,66E-04	4,36E-06	-	-	-	Double Porosity						
HW-RC15-WEO8R	3,11E-04	1,11E-05	-	-	-	Theis	13-sept-15	**HW-RC15-WEO8R**	1620	246	9,4	Iron Ore (Sokoman)/ 73,2
Minimum	5,92E-05	1,56E-06	9,85E-02									
Maximum	1,50E-03	1,85E-05	1,48E-01									
Moyenne géométrique	5,44E-04	9,44E-06	1,13E-01									

APPENDIX B

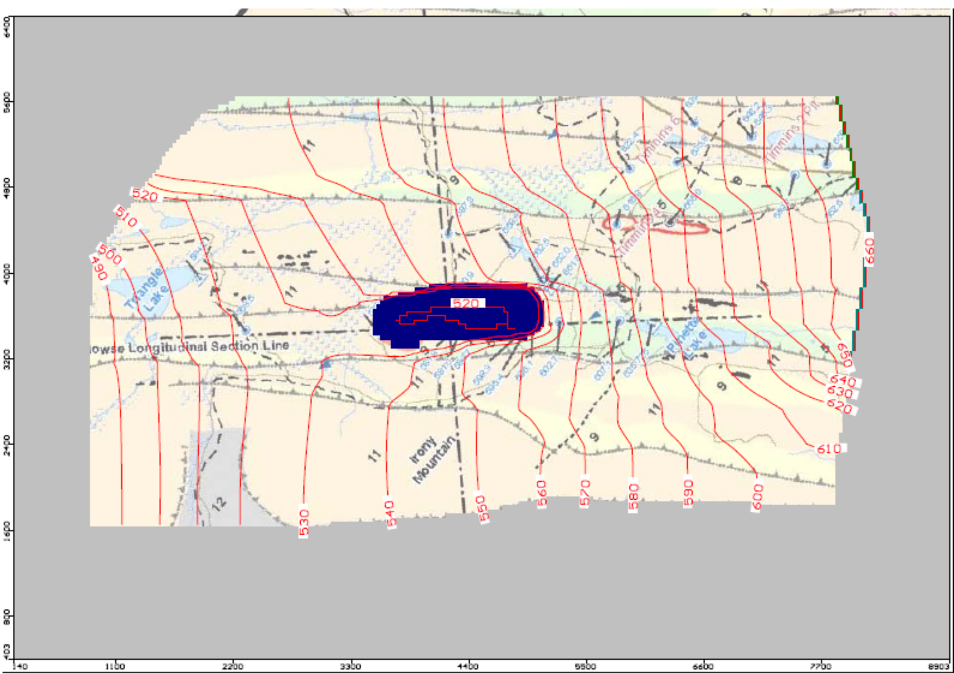
Modeling Results

Base Case Scenario Results

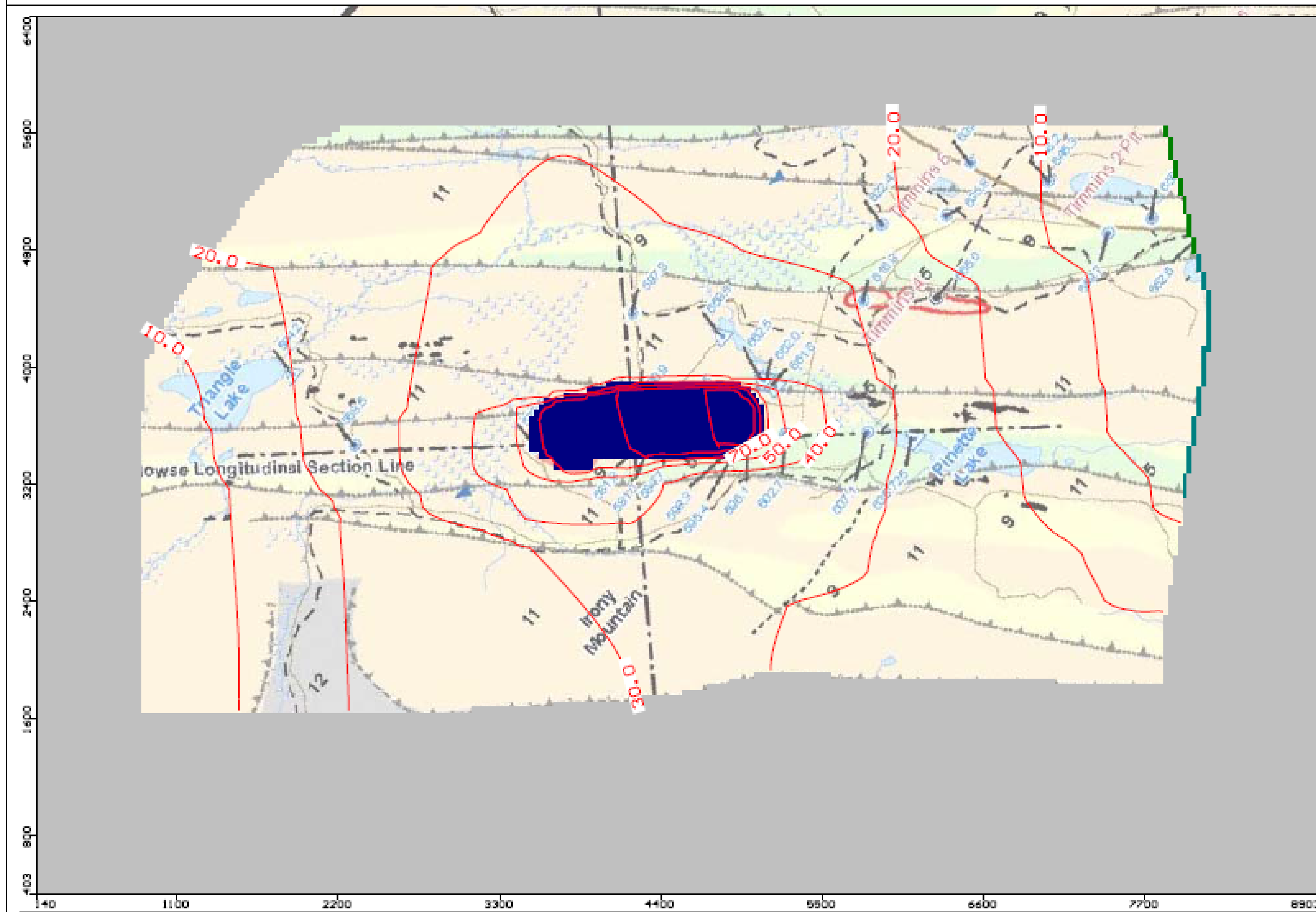
Simulated Natural Piezometric Map



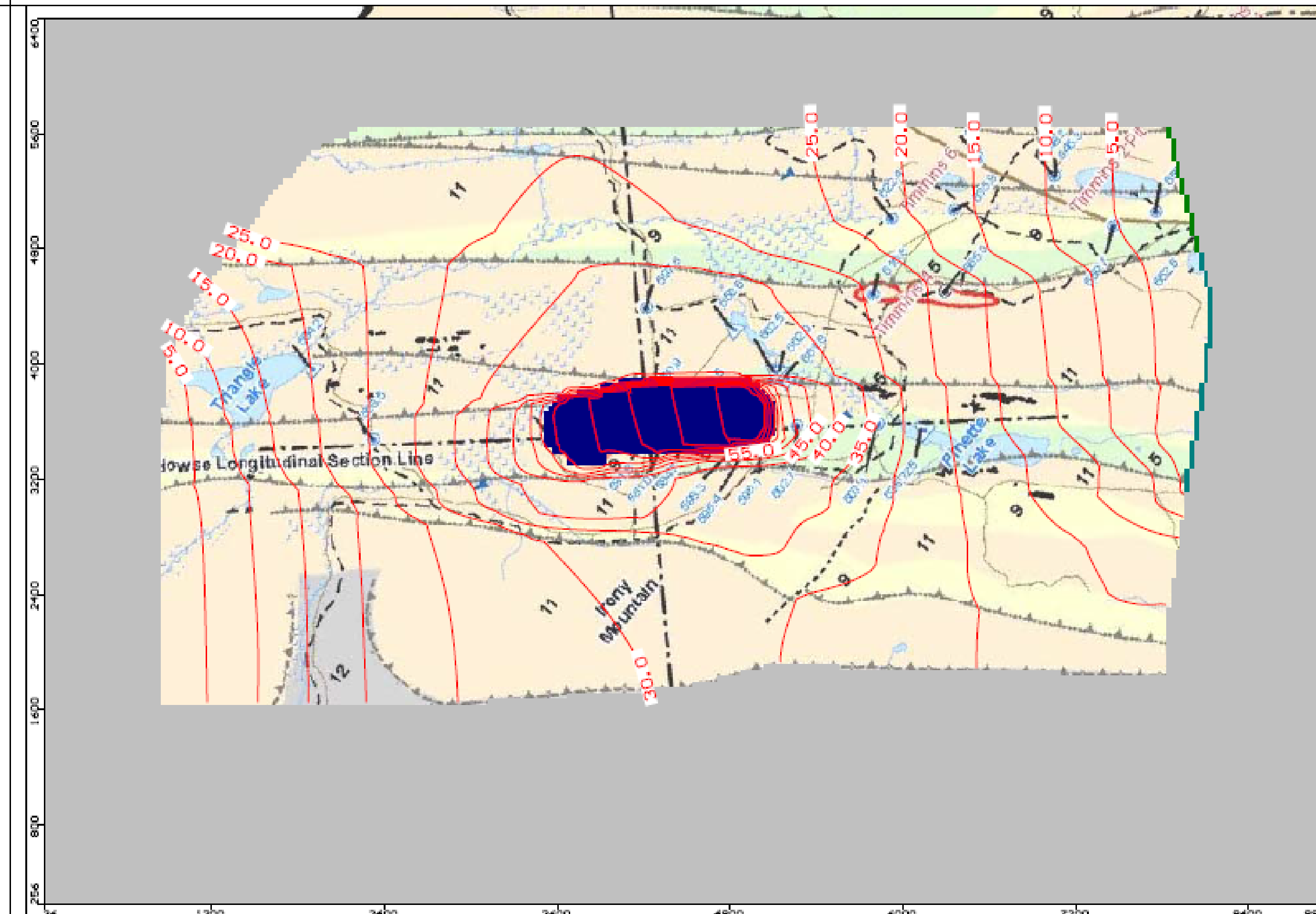
Piezometric Map during Pit Dewatering (Final Depth)



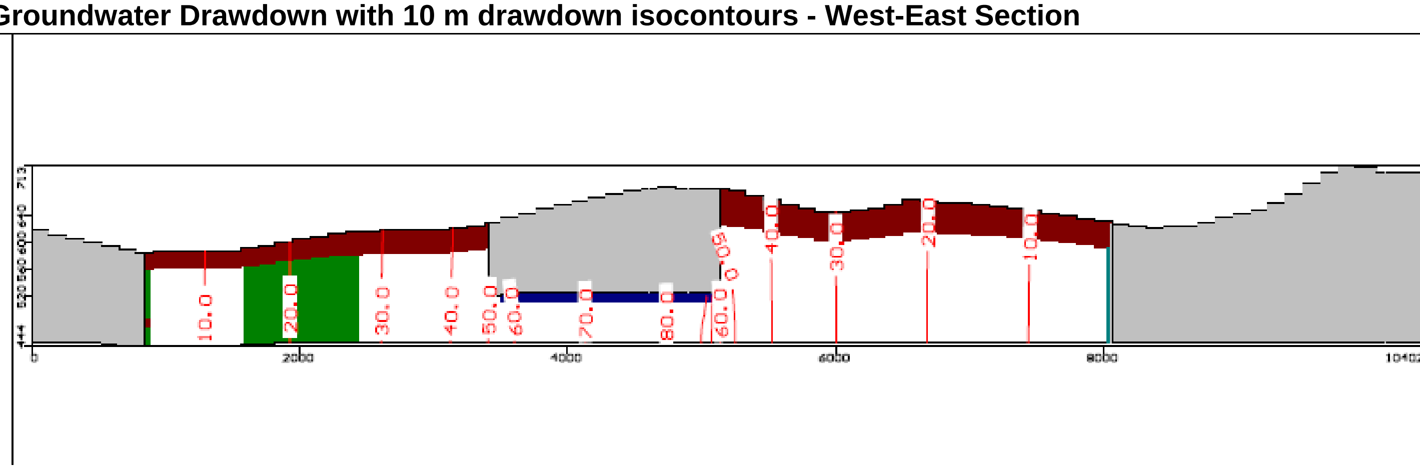
Groundwater Drawdown – 10 m drawdown isocontours



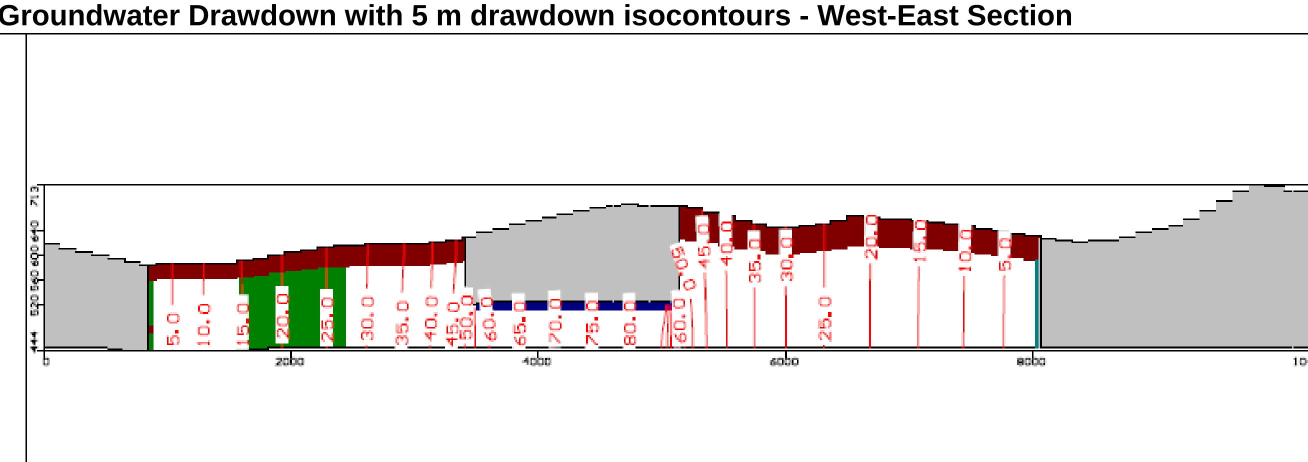
Groundwater Drawdown – 5 m drawdown isocontours



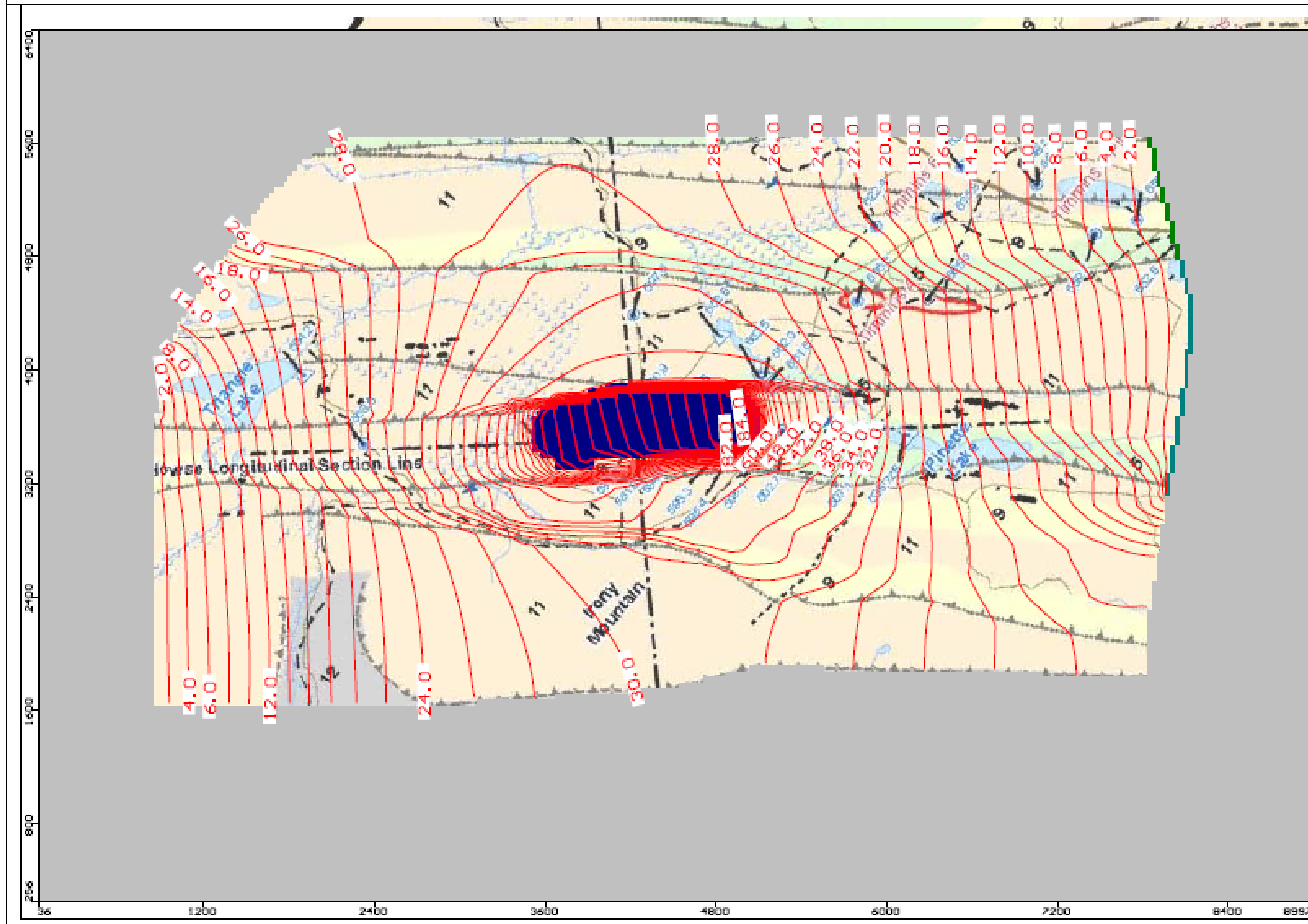
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



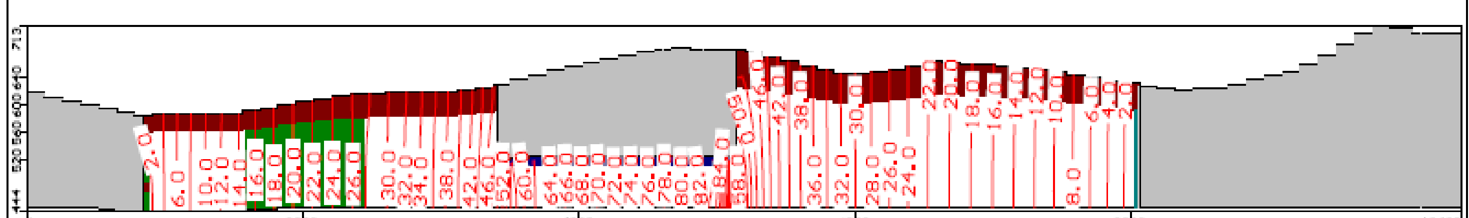
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



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:

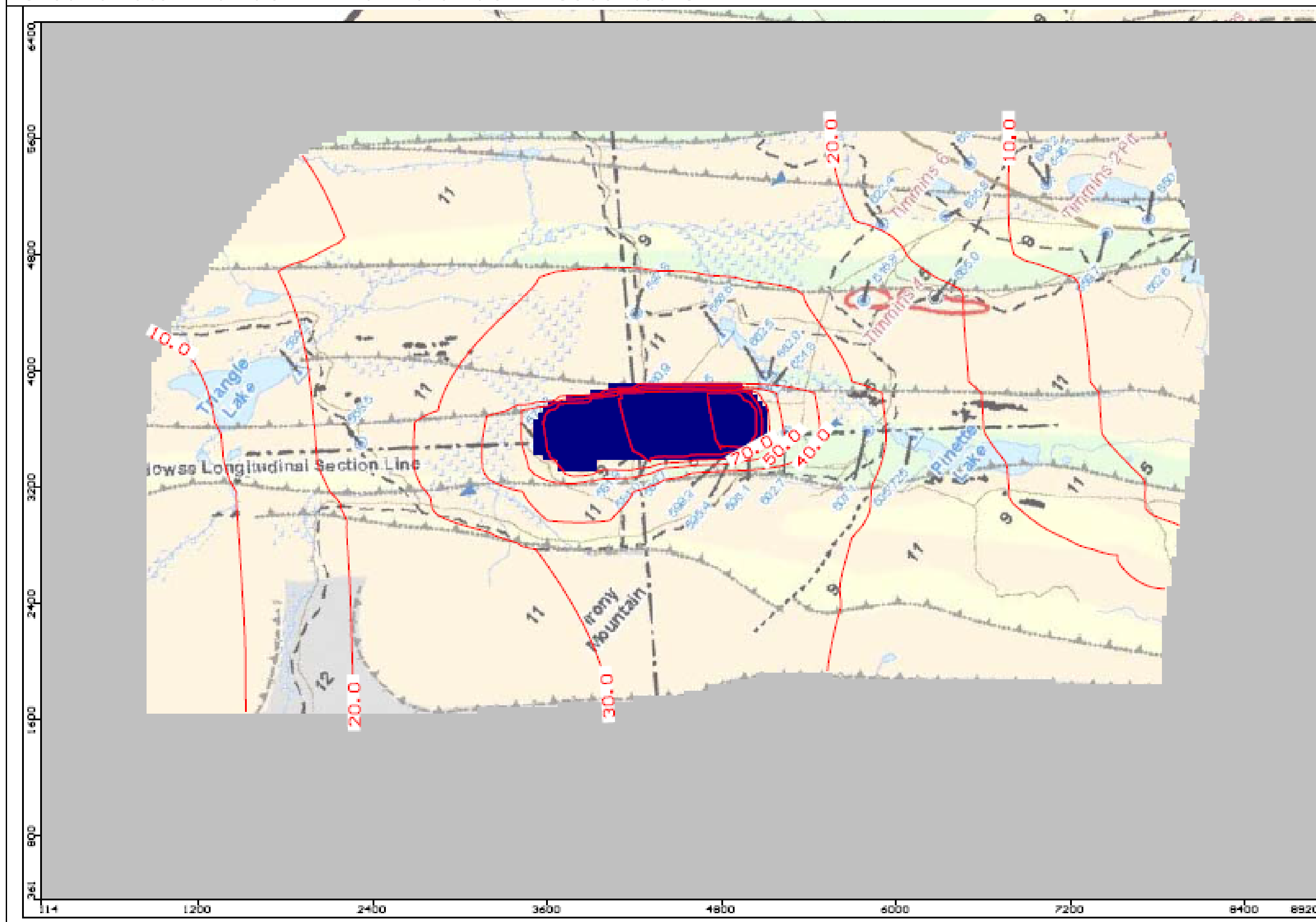
TableB1 Sensitivity analysis – Case 1

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

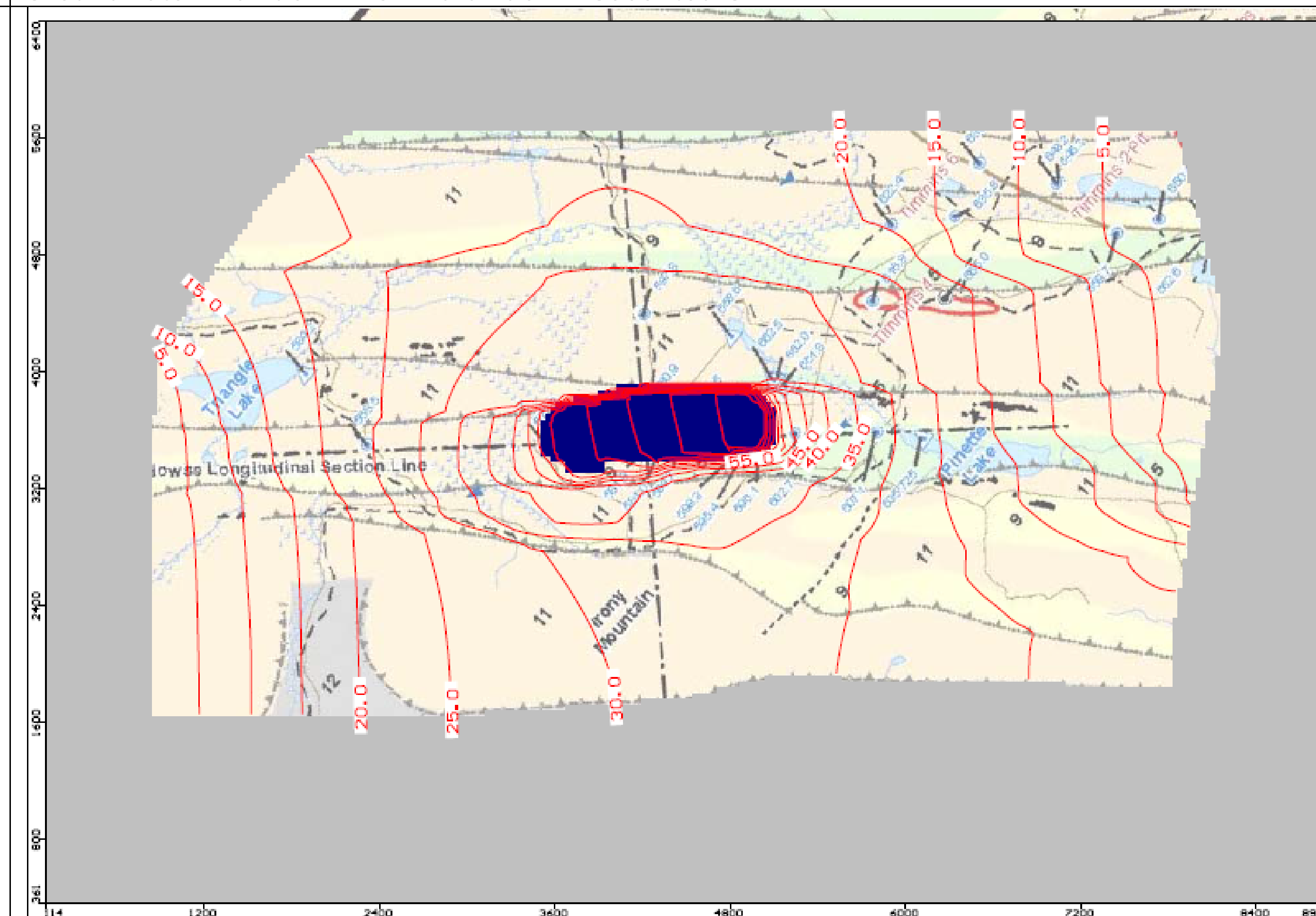
Recharge (mm/year)	Calibrated	Sensitivity analysis
R(1)	100	200

(Highlighted values were modified)

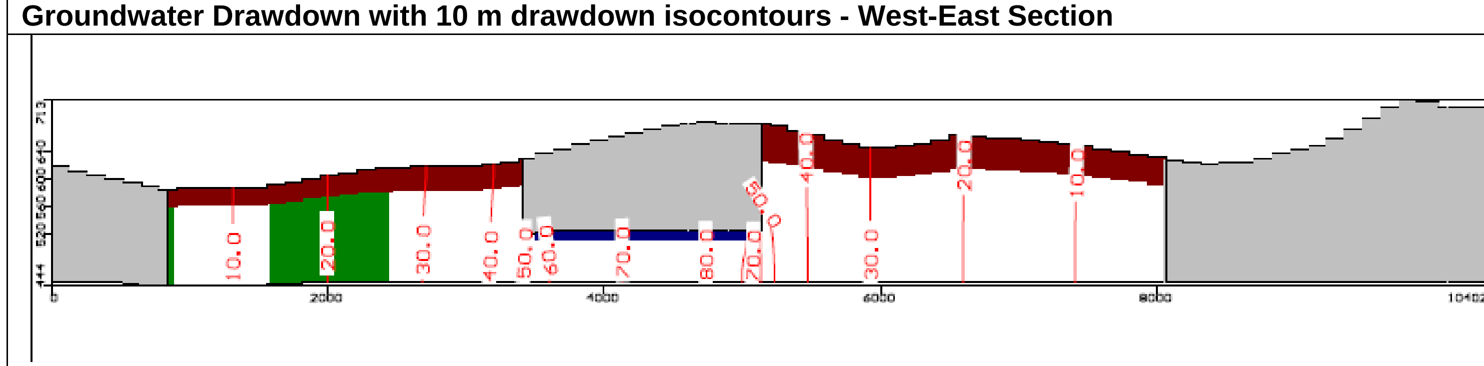
Groundwater Drawdown – 10 m drawdown isocontours



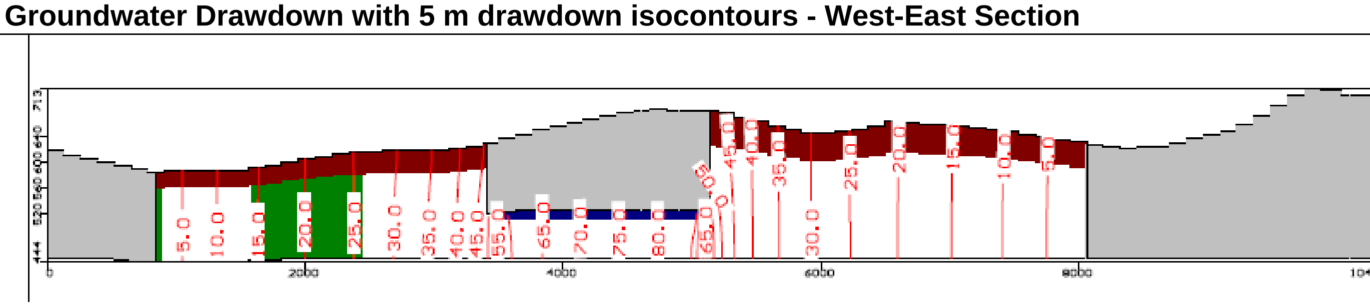
Groundwater Drawdown – 5 m drawdown isocontours



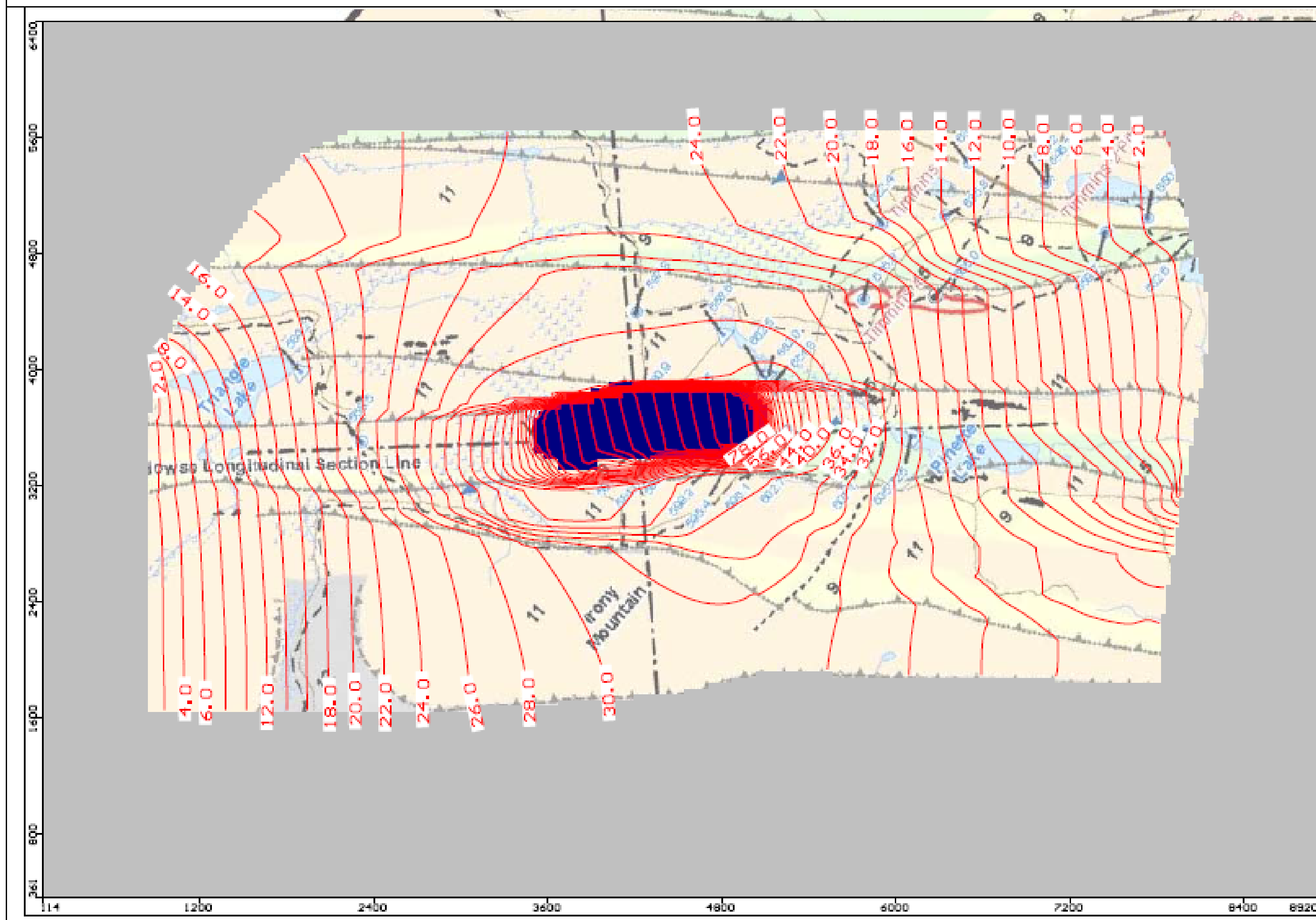
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



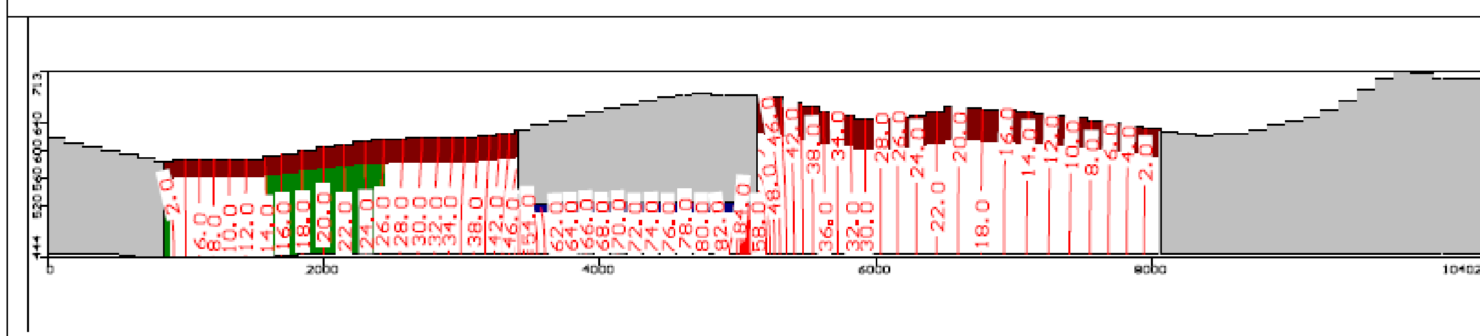
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



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:

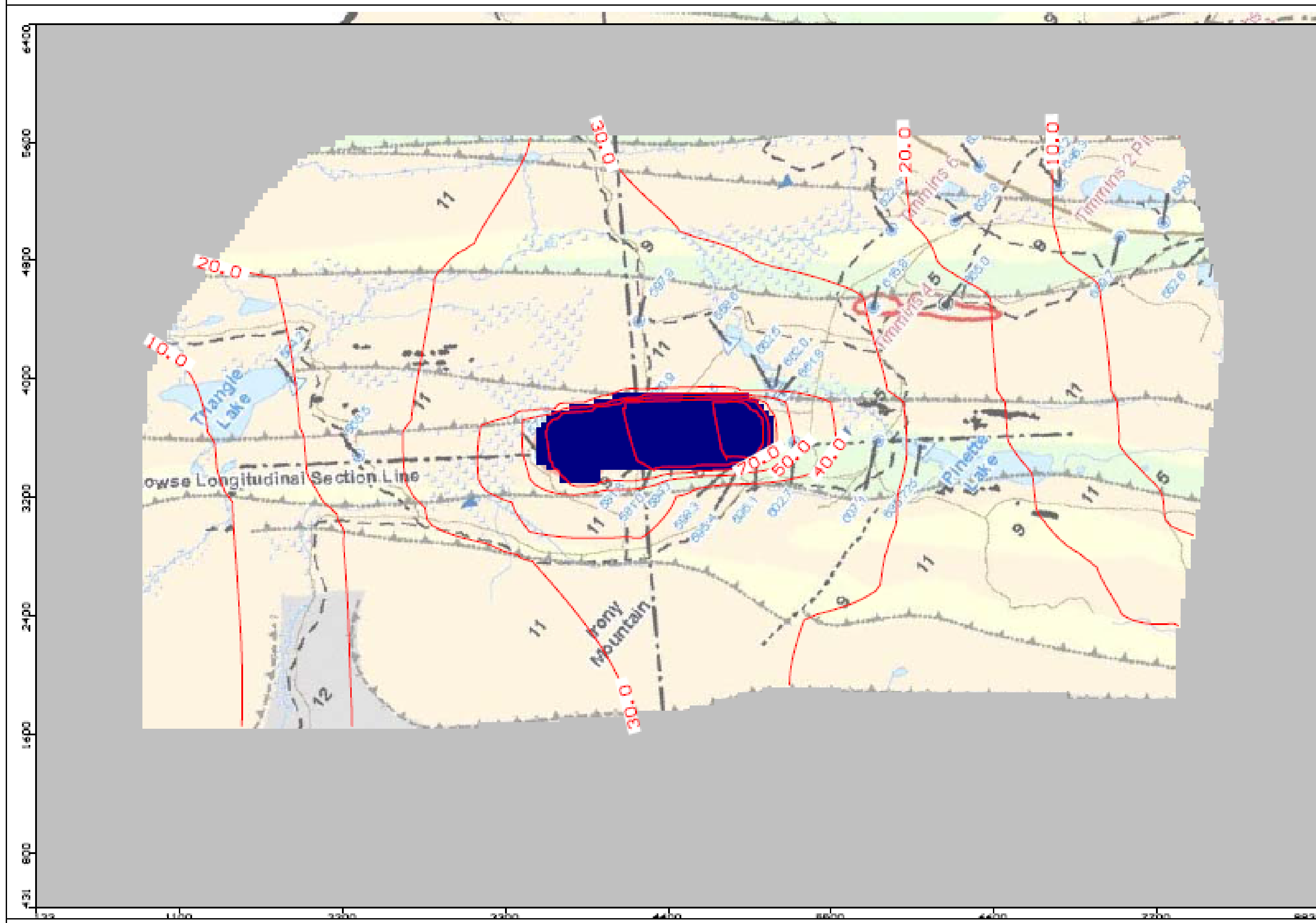
Table B2 Sensitivity analysis – Case 2

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

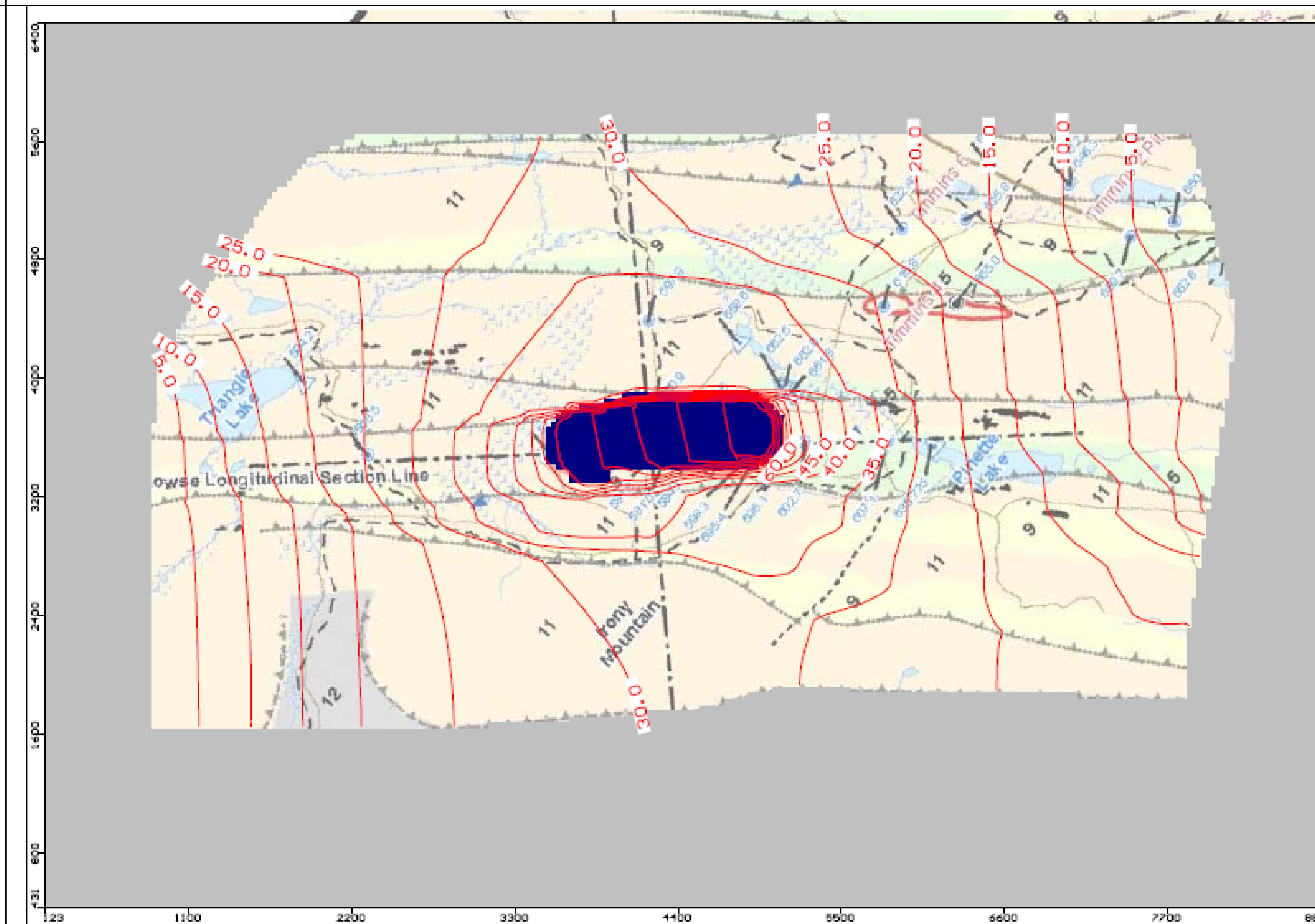
Recharge (mm/year)	Calibrated	Sensitivity analysis
R(1)	100	200

(Highlighted values were modified)

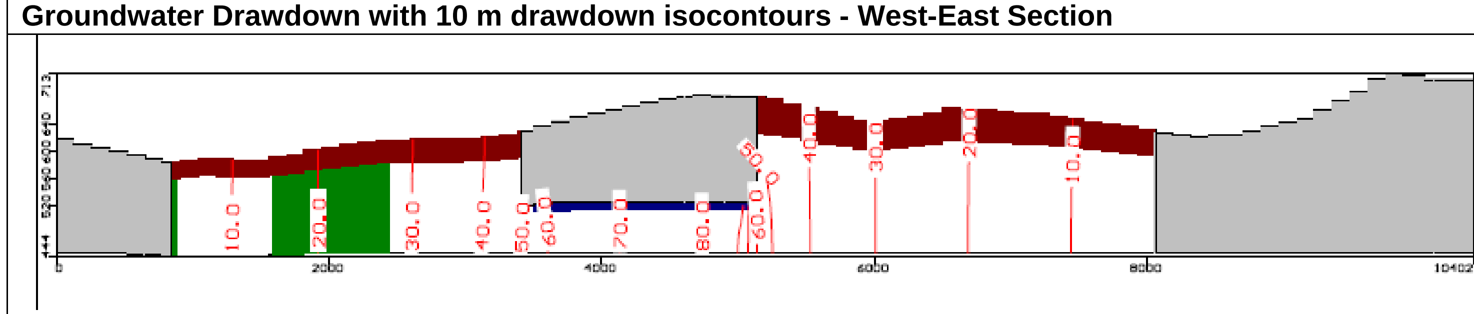
Groundwater Drawdown – 10 m drawdown isocontours



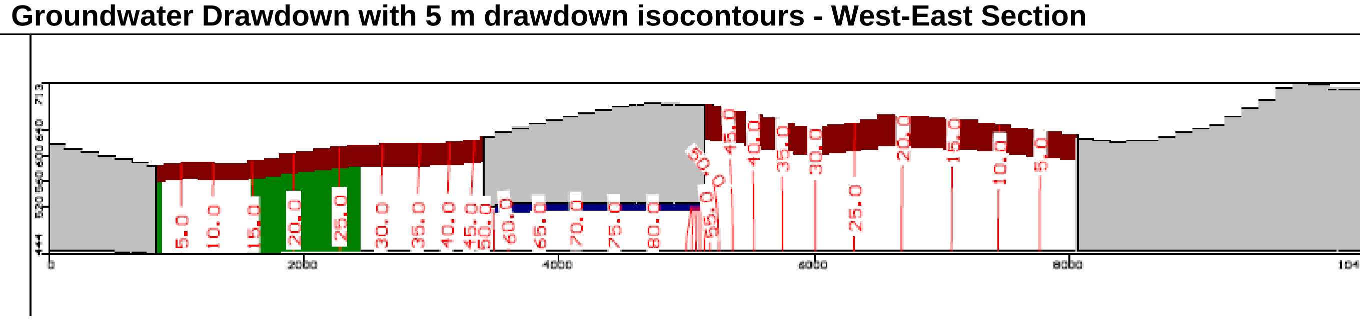
Groundwater Drawdown – 5 m drawdown isocontours



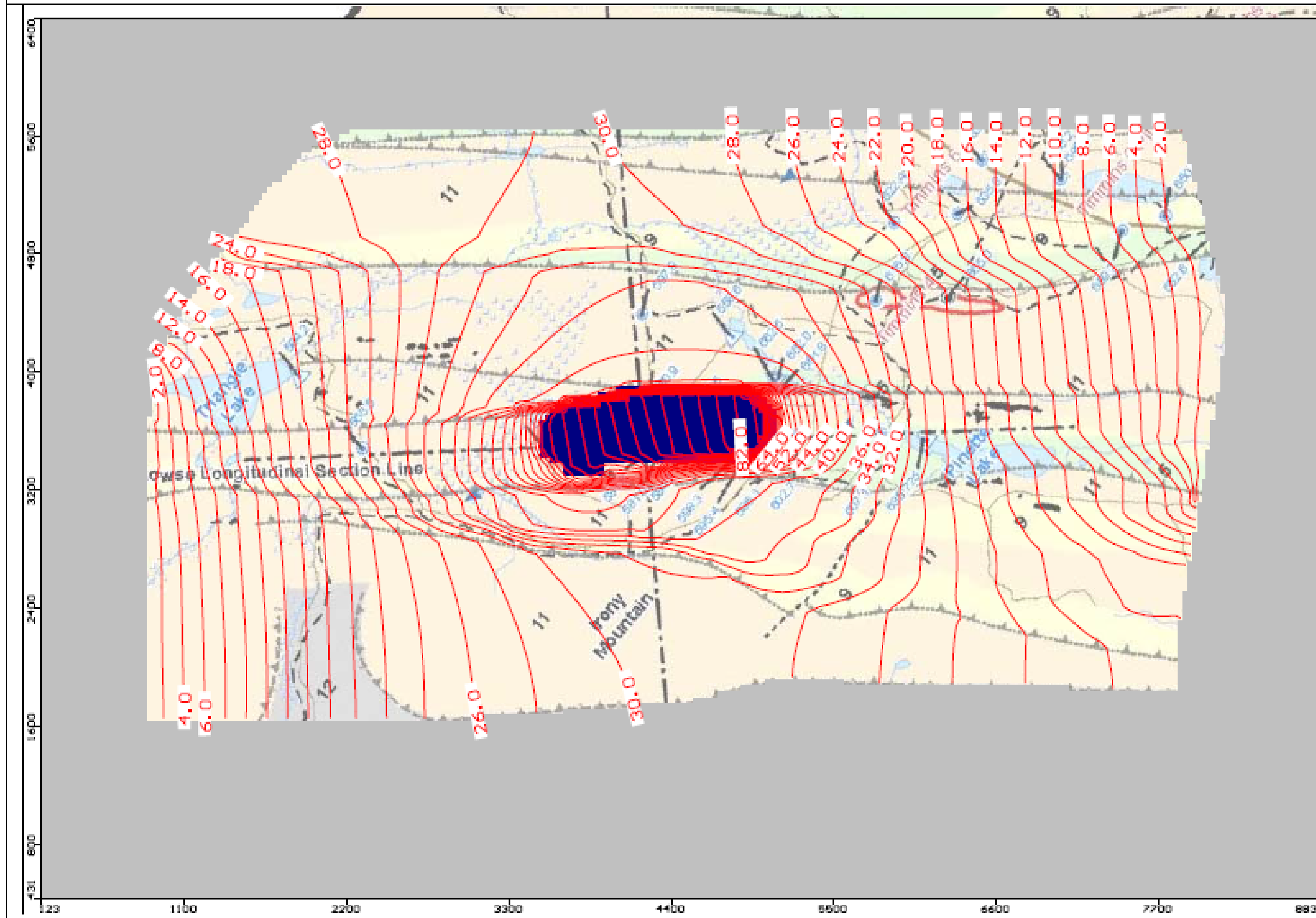
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



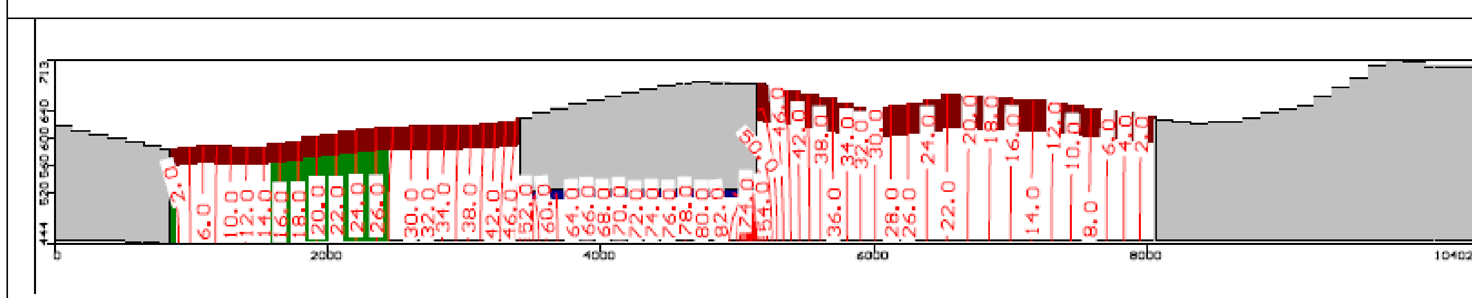
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



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

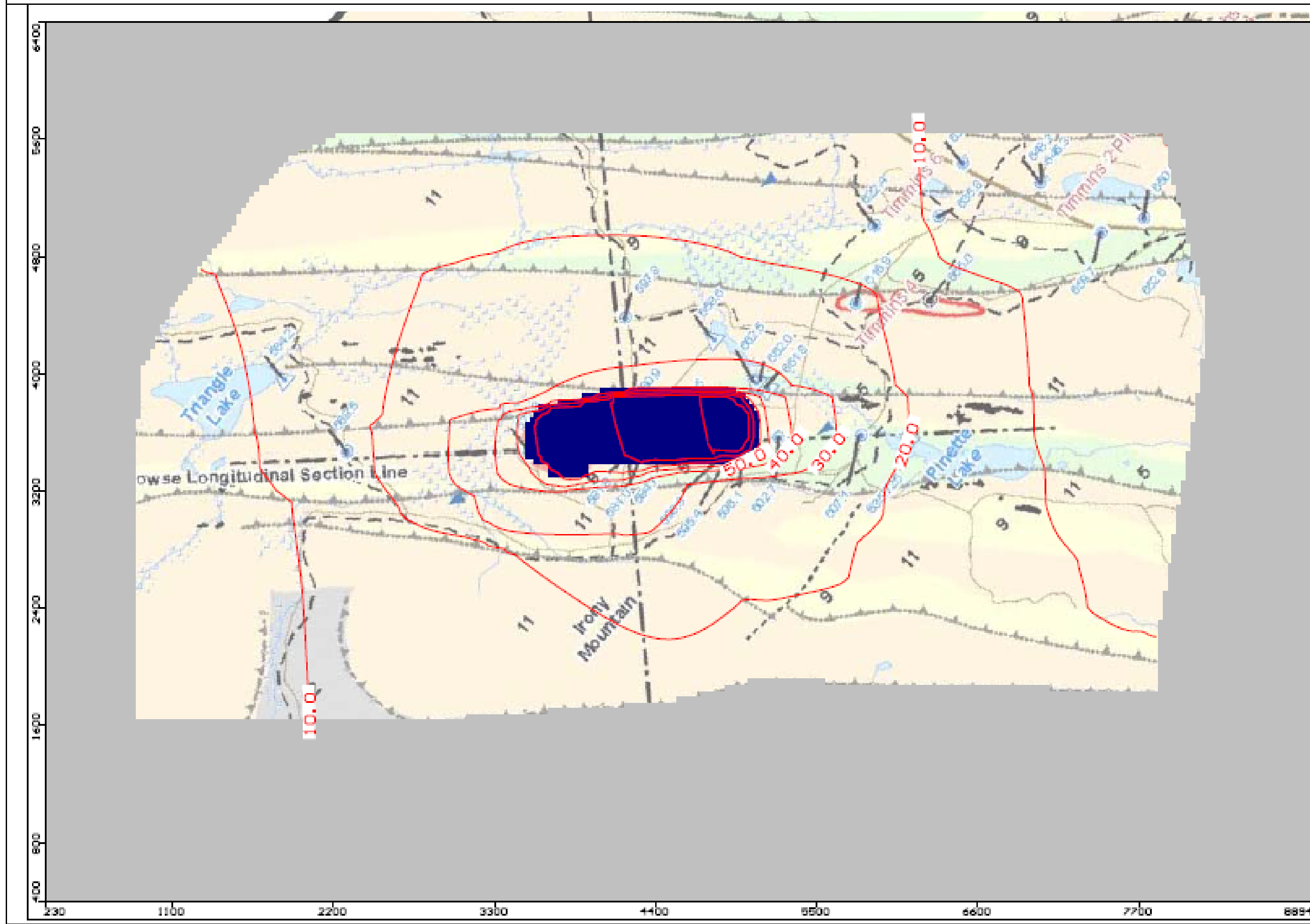
Table B3 Sensitivity analysis – Case 3

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

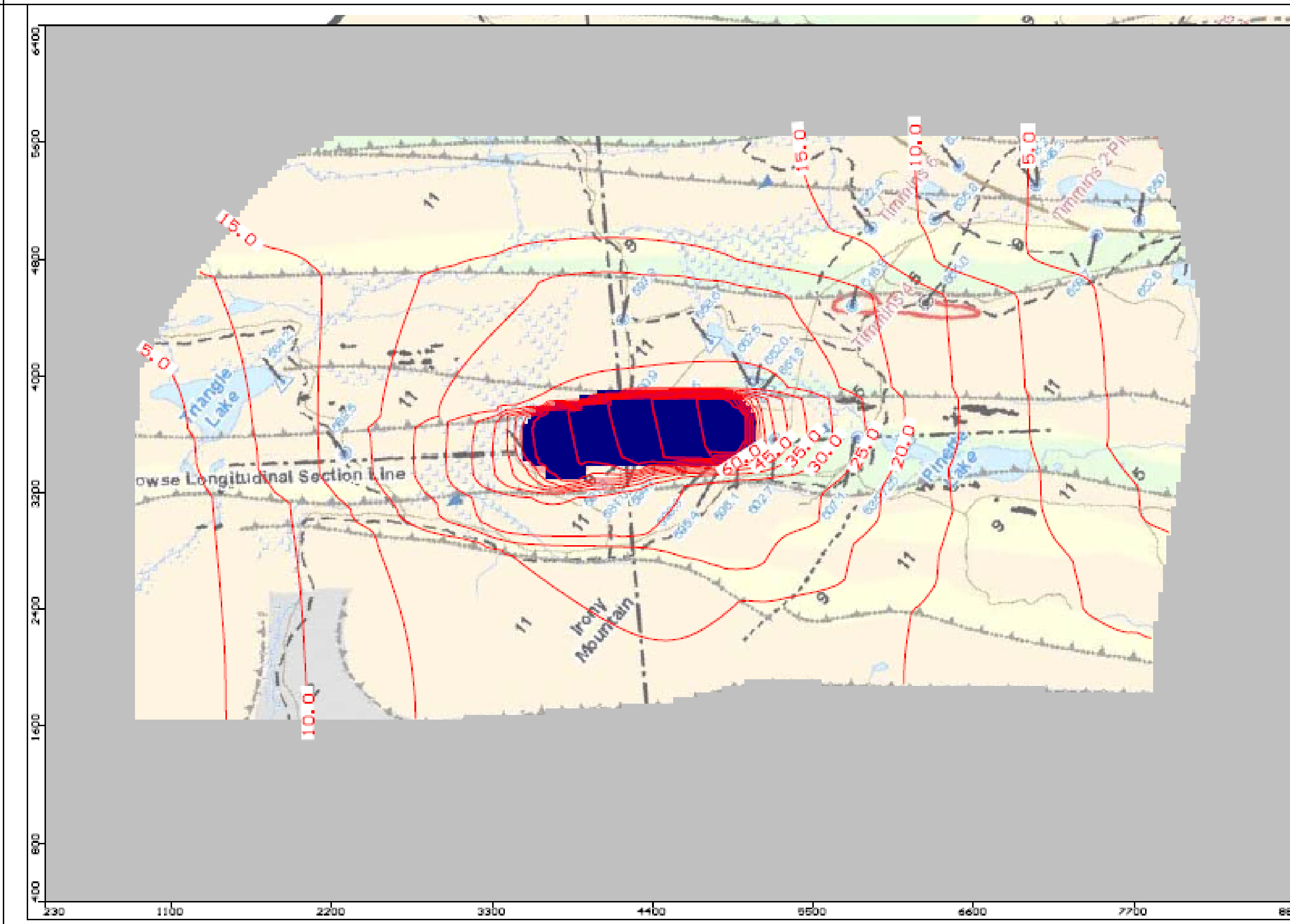
Recharge (mm/year)	Calibrated	Sensitivity analysis
R(1)	100	200

Highlighted values were modified)

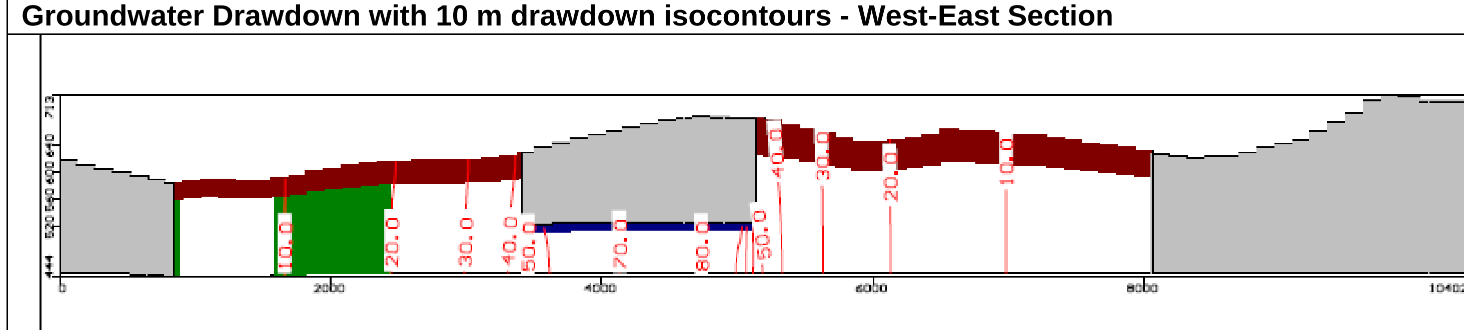
Groundwater Drawdown – 10 m drawdown isocontours



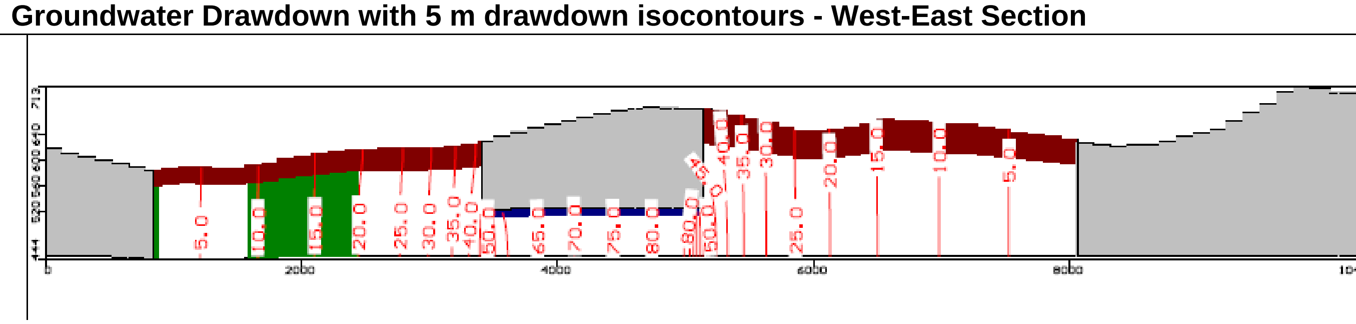
Groundwater Drawdown – 5 m drawdown isocontours



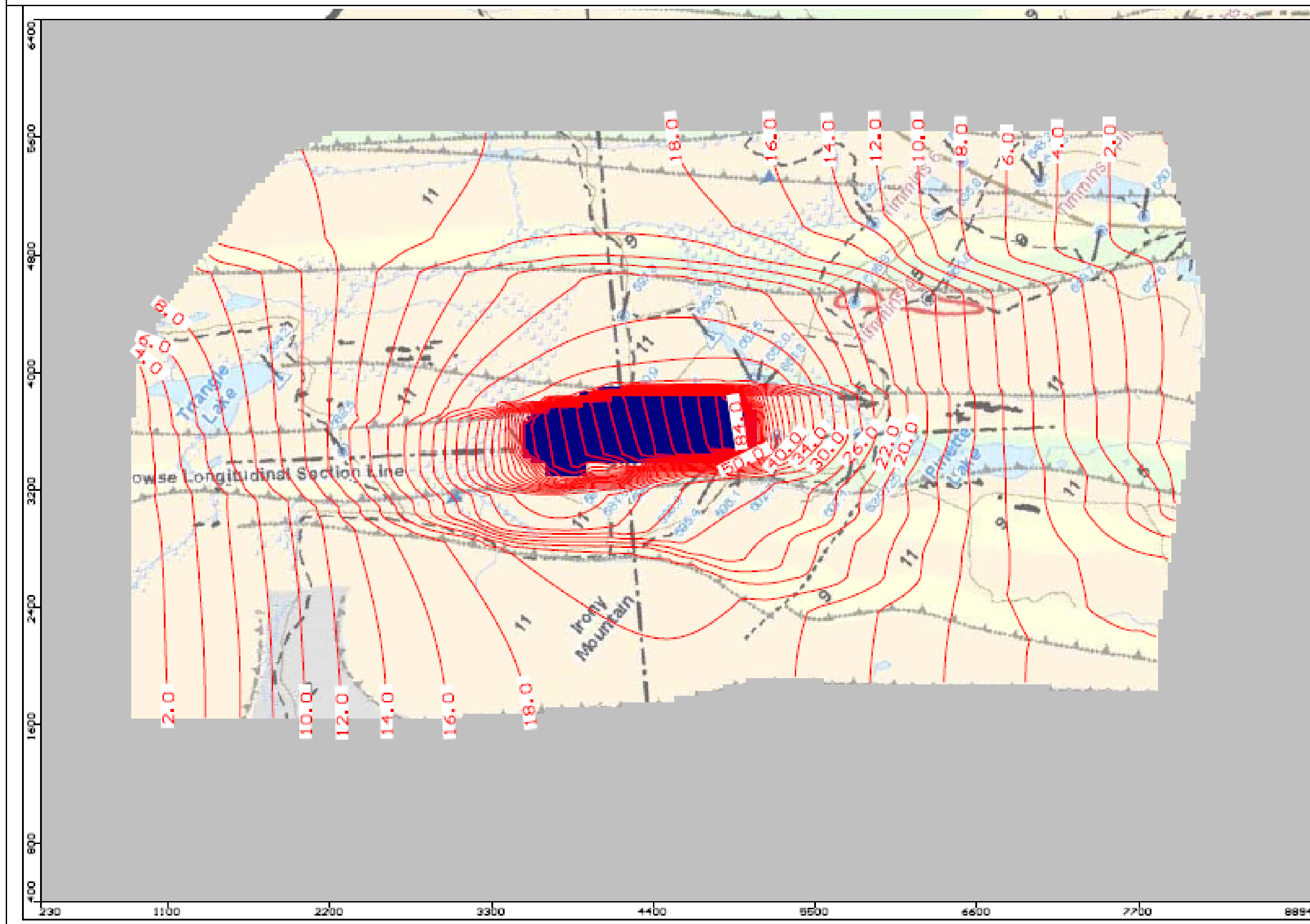
Groundwater Drawdown with 10 m drawdown isocontours - West-East Section



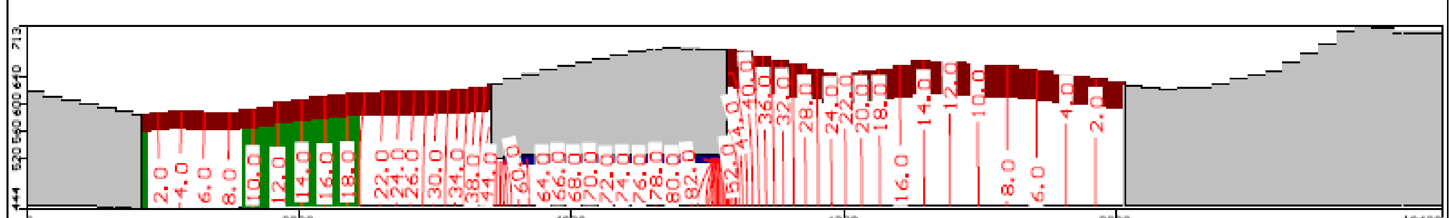
Groundwater Drawdown with 5 m drawdown isocontours - West-East Section



Groundwater Drawdown – 2 m drawdown isocontours



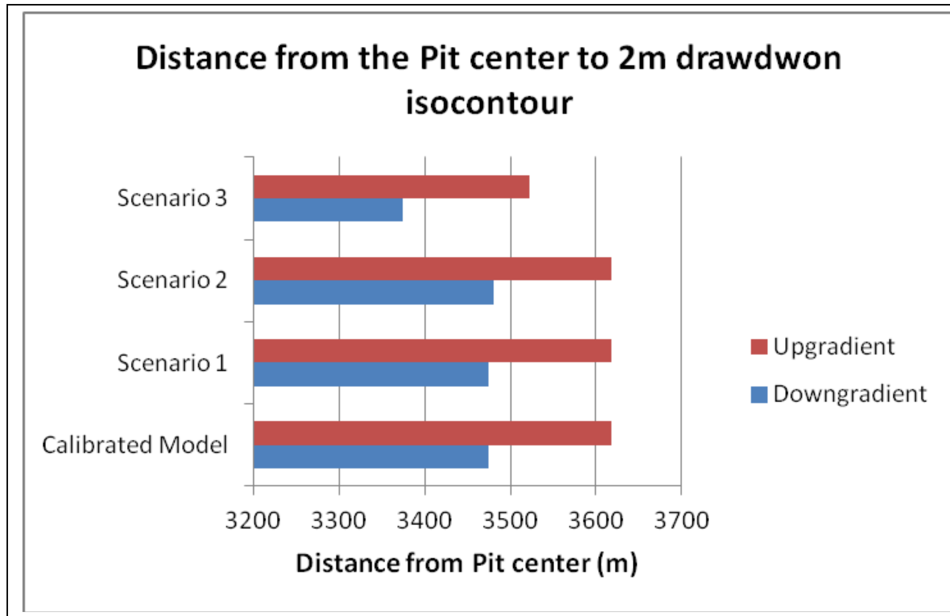
Groundwater Drawdown with 2 m drawdown isocontours - West-East Section

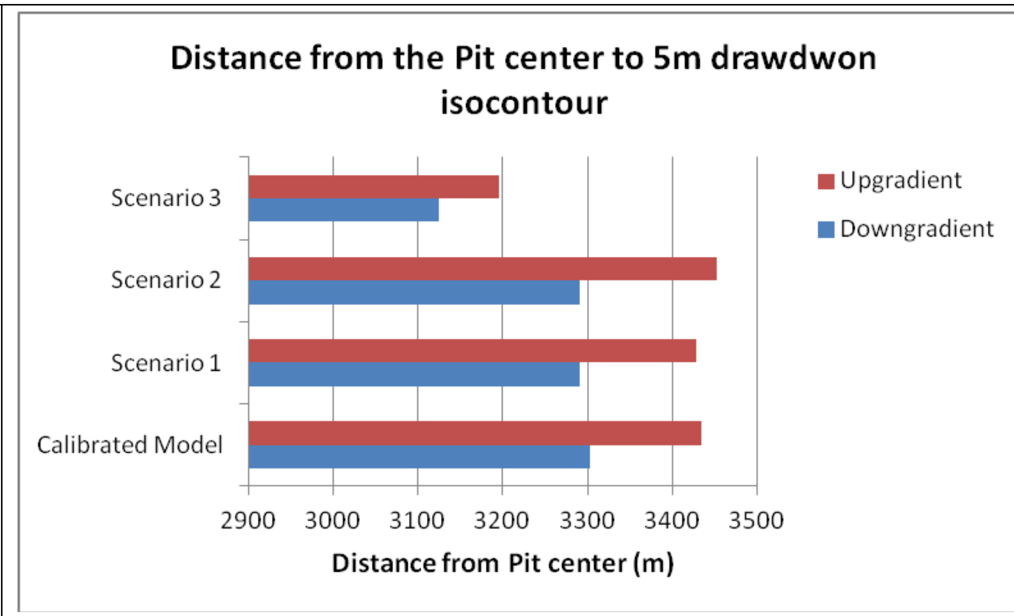


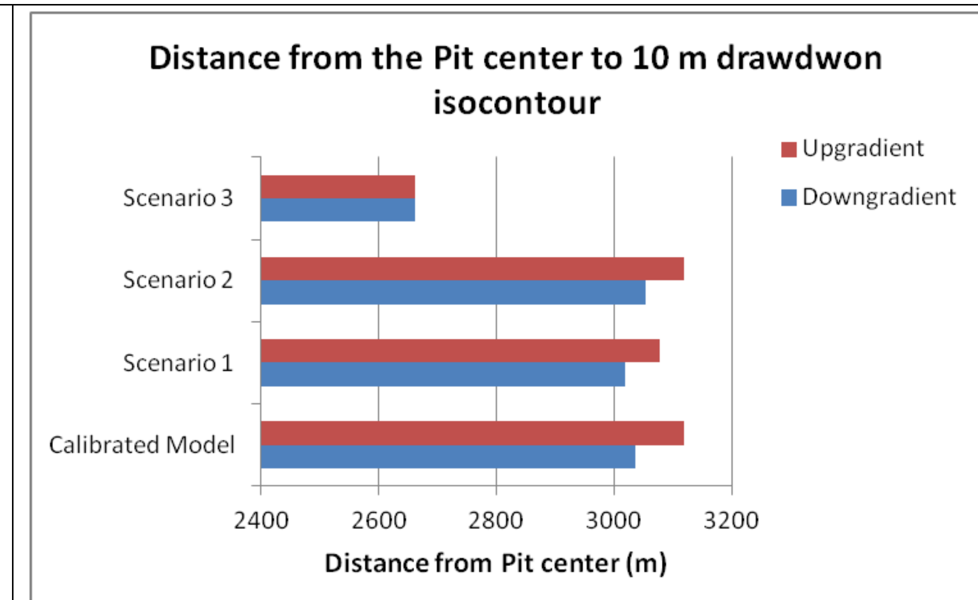
Model Results Summary

	Distance in meters from the center of the Pit to					
	2m isocontour drawdown		5m isocontour drawdown		10m isocontour drawdown	
	Downgradient	*Upgradient*	*Downgradient*	*Upgradient*	*Downgradient*	*Upgradient*
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

Golder Associés

TECHNICAL MEMORANDUM

DATE February 28, 2014 CONFIDENTIAL

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

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

<Original signed by>

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

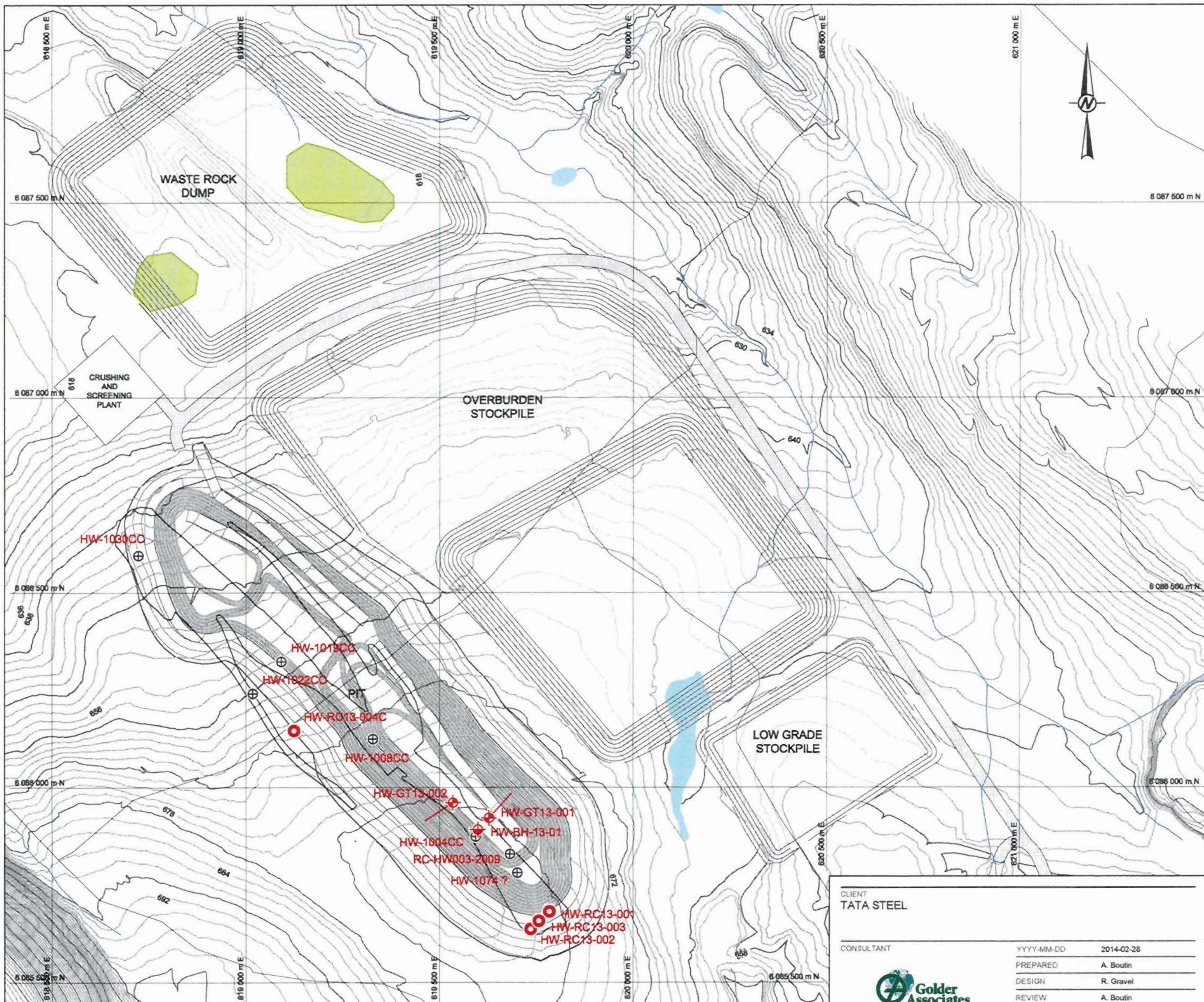
Table 1 : Groundwater Level Measurements

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/r casing (m)	Casing Stick-up (m)	Water Level Depth (mbgs)	Notes
HW-RC13-001	17-nov-13	619784	6085682	619784	6085682	81.9	78.8	0.1	78.7	
HW-RC13-002	18-nov-13	-	-	619736	6085637	161.5	-	-	97.0	2013-11-18: Rising water level during measurement (not static) 2013-11-21: Water level measured when drilling was stand by
	21-nov-13								65.9	
	22-nov-13								74.5	
HW-RC13-003	04-déc-13	-	-	619757	6085658	180	-	-	75.7	2013-12-04/05: Water level measured when drilling was stand by 2013-12-08: Water level measured after lowering PVC tubing in borehole
	05-déc-13								77.7	
	08-déc-13								75.4	
HW-RC13-004C	08-déc-13	-	-	619125	6086146	162	-	-	58.6	2013-12-08/09: Water level measured after borehole cleaning 2013-12-10: Water level measured in PVC tubing
	09-déc-13								56.3 to 68.3	
	10-déc-13								80.4	
HW-1074[1]	17-nov-13	619701	6085781	619685	6085801	94.4	88.3	1.1	87.2	
RC-HW003-2009	17-nov-13	619682	6085829	619683	6085827	90	89.1	0.8	88.3	
HW-1004CC	17-nov-13	619593	6085874	619590	6085878	>100	87.8	0.7	87.1	
HW-1008CC	19-nov-13	619328	6086124	619327	6086124	66	64.9	1.0	63.9	
HW-1019CC	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 Nad83 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)
				Collar Coordinates (m)			Inclined along hole axis		Vertical		
		Azimuth	Dip	Easthing 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-RC13-001 — REVERSE CIRCULATION BOREHOLE (GOLDER 2013)
- HW-GT13-001 — INCLINED ROCK DIAMOND DRILLHOLE 9GOLDER 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 NAD 83, ZONE 19

REFERENCES

BASE PLAN PROVIDED BY TATA STEEL

CONFIDENTIAL

0 250 500
1:10,000 METRES

CLIENT TATA STEEL			PROJECT THE HOWSE PIT GEOTECHNICAL AND HYDROGEOLOGY STUDY
CONSULTANT Golder Associates	YYYY-MM-DD	2014-02-28	TITLE LOCATION OF BOREHOLES
	PREPARED	A. Boutin	
	DESIGN	R. Gravel	
	REVIEW	A. Boutin	PROJECT No. 13-1221-0104 · PHASE 1200 · Rev. 0 · FIGURE 1
	APPROVED	P. Fréchette	