APPENDIX 7-A

Baseline Hydrogeological Assessment

GOLDCORP

Coffee Gold Baseline Hydrogeological Assessment

Project No. A362-5
7 March 2017

LORAX ENVIRONMENTAL

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Preface

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Preface

This report constitutes a baseline hydrogeological assessment of the Project that was first published in 2016, prior to the acquisition of Kaminak Gold Corporation by Goldcorp. The results presented herein are current to the end of October 2015, when the previously proposed (Kaminak) mine plan was still in effect. Accordingly, document figures, tables and text reference mine facilities that are consistent with the previous mine plan. Revision of the mine plan under Goldcorp has not undermined the applicability of the monitoring network. The monitoring network remains well-positioned to quantify changes to the groundwater system brought about by the Project.

In 2016, Lorax undertook a drilling program in the area of the proposed heap leach facility in order to establish a monitoring well (Westbay system) and thermistor/vibrating wire piezometer string in close proximity to the facility. The methods and preliminary results of the 2016 field program have been appended to the end of this document as Appendix P-1. Otherwise, results of the 2016 field program have not been incorporated into this document. Other than the addition of Appendix P-1, this document remains identical to the previous version distributed to First Nations at the end of January, 2017.

Executive Summary

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Executive Summary

The Coffee Gold Project (the Project) is a proposed open-pit heap leach mine development located in west-central Yukon, 130 kilometers (km) south of Dawson City. The Project is subject to an assessment under the Yukon Environmental and Socio-economic Assessment Act (YESAA). Upon completion of the adequacy review, the Project will apply for a Type "A" water license from the Yukon Water Board and a quartz mining license from the Government of Yukon, Department of Energy, Mines and Resources.

This report constitutes a baseline hydrogeological assessment of the Project. It summarizes the findings of multiple hydrogeological field investigations which have been undertaken by Lorax Environmental Services Ltd. (Lorax) and others at the Project between 2013 and 2015. It discusses groundwater quality and groundwater level data collected up to the end of October 2015.

The field programs have established a robust network of hydrogeological monitoring installations in, around and downgradient of major mine facilities. The instrumentation includes eleven conventional monitoring wells, six Westbay monitoring systems, nine combination vibrating wire piezometer (VWP)/thermistor strings, plus five stand-alone thermistors and four stand-alone VWP strings. Groundwater level information is available from selected sites from as early as 2013, with all installations recording high frequency (sub-daily) water level and ground temperature information from mid-2015 onward.

Ground temperature data obtained from thermistors, as well as observations from drilling and monitoring well sampling, indicate that permafrost is extensive across the project area. The temperature monitoring network extends to greatest depths on north-facing ridge areas with the thickest permafrost (~165 metres) encountered near the north end of the proposed Supremo pit. Permafrost appears to decrease in thickness with declining elevation. Permafrost in the project area is relatively warm (between 0 and -2^{o}C) and is coolest (-1.4^{o}C to -1.9^{o}C) on north-facing slopes.

Over forty successful measurements of bedrock hydraulic conductivity (K) have been obtained through a combination of different hydraulic testing methods. Bedrock hydraulic conductivity ranges over several orders of magnitude, from below test resolution (<1E-10 m/s) to over 1E^{-}06 m/s, consistent with a fractured bedrock system. Packer and airlift yield recovery tests targeting geologic structures in proposed pit areas report a narrow range of K values with an arithmetic mean of 7E^{-}07 m/s. Hydraulic tests undertaken in valley locations also report higher K values in the range of 1E-06 m/s.

Groundwater levels generally follow topography, with deepest water levels (ranging from ~130 metres to over 220 metres below ground surface) found in ridge areas, and confined/artesian pressures encountered at lower elevations. Permafrost in combination with higher quality rock is believed to act as a confining unit in some areas. The hydrographs at most of the deep groundwater installations indicate a seasonal response to recharge with groundwater levels starting to rise within one to four weeks of the onset of consistent summer rainfall in late-June 2015. The water level response recorded to the end of October 2015 reflects seasonal hydrograph increases anywhere from one to over 30 metres.

Most of the deep well hydrographs are insensitive to short-term rainfall events and are presumed to reflect confined conditions. Conversely, the shallow bedrock well at Kona pit and VWPs installed adjacent to Halfway Creek and upper Latte Creek do show some responsiveness to short-term rainfall events. Hydrographs measured in active zone/overburden wells mimic the flashiness of short term rainfall events reflected in hydrometric station data. A below-average freshet peak recorded at hydrometric stations starting May 9th, 2015 was not captured in the 2015 monitoring well hydrographs, with the exception of one installation in Halfway Creek.

Vertical hydraulic gradients are highly variable across the site (ranging from negligible to 40% upward or downward) and do not necessarily reflect typical gradient patterns that would be expected in this type of terrain. For example, in a more homogeneous system, downward hydraulic gradients would be expected in groundwater recharge areas in upland regions while upward gradients and artesian conditions would be expected in groundwater discharge areas in valley bottoms. In some cases, the opposite is observed in the Project groundwater data which speaks to the complexity of the groundwater system influenced by permafrost, fractures and large-scale geologic structures.

Groundwater sampling was conducted on five occasions between 2014 and 2015. Sampling was conducted at monitoring wells installed by Lorax in 2014 and 2015 and covers the period from September 2014 to September 2015. Data from these sampling events are included in the evaluation of groundwater quality, although several results were discounted due to potential influences from drilling and well installation artifacts.

Groundwater in the Project area is predominantly circum-neutral (pH 6 to 8), with most groundwater samples between pH 7 and 8. Groundwater quality shows variable influence from weathering of sulphide minerals and/or dissolution of sulphate minerals, either from the deposits or other disseminated mineralization across the Project area. This is evidenced by low to substantial sulphate concentrations and variable salinity (specific conductance between 28 and 2269 µS/cm). Major ion chemistry in overburden wells is calcium-bicarbonate-type. The groundwater in gneiss has a wide ranging major ion chemical signature which ranges from calcium-bicarbonate to mixed magnesium-calcium-sodium-sulphate-type water, reflecting variable influence of sulphide weathering. Groundwater in the granite is generally more sodic than other groundwater on site with major ion chemistry ranging from calcium-bicarbonate to sodium-bicarbonate. The groundwater sampled from the hydrothermal breccia and schist tends to be calcium-bicarbonate to magnesium-sulphate.

Baseline groundwater quality in the Project area is characterized the presence of elevated dissolved arsenic and uranium. Dissolved arsenic and uranium concentrations were generally highest in the bedrock groundwater, ranging from 0.27 to 1860 µg/L and 7.6 to 589 µg/L, respectively.

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Glossary and Abbreviations

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

µg/L	micrograms per litre, unit of concentration
µS/cm	micro-Siemens per centimeter, unit of specific conductance
As	arsenic
BFS	biotite feldspar schist
BP	bladder pump
BtS	biotite schist
Ca	calcium
carb	carbonate
CB	crackle breccia
Cd	cadmium
CHI	constant head injection test
Cl-LiB	chlorite limonite breccia
Co	cobalt
Cu	copper
D	dacite
D/S	downstream
DC	direct circulation
DDH	diamond drill hole
DO	dissolved oxygen
EBA TT	EBA Tetra Tech
Fe	iron
FH	falling head test
GN	gneiss
GR	granite
HAR	hydrothermally altered rock
HCO_3^-	bicarbonate
HLF	heap leach facility
HQ	diamond drill tooling producing hole diameter of 96 mm or 3.78 inches
HWT	drill casing of 114.3 mm or 4.5-inch outer diameter
IP	inertial pump
K	hydraulic conductivity
K	potassium
km	kilometre
KP	Knight Piésold
$L/s/km^2$	litres per second per square kilometre
m	metre
M	metacarbonate
m AH	metres along hole
m asl	metres above sea level
m bgs	metres below ground surface

m/s	metres per second, unit of hydraulic conductivity
MDL	method detection limit
Mg	magnesium
mg/L	milligram per litre, unit of concentration
mm	millimetre
mm/yr	millimetres per year
Mn	manganese
Mt	megatonne
Na	sodium
NH3	ammonia
Ni	nickel
NO_3^-	nitrate
NTU	Nephelometric Turbidity Unit, unit of turbidity
NQ2	diamond drill tooling producing hole diameter of 75.8 mm or 2.98 inches
O_2	oxygen
^oC	degrees Celsius
ORP	oxidation-reduction potential
Pb	lead
PP	peristaltic pump
PQ	diamond drill tooling producing diameter of 122.6 mm or 4.83 inches
the Project	the Coffee Gold Project
RC	reverse circulation
RQD	rock quality designation
RTK	real time kinematic
S^{2-}	sulphide
Sb	antimony
Se	selenium
SO_4^{2-}	sulphate
SZ	shear zone
TDS	total dissolved solids
TSS	total suspended solids
U	uranium
U/S	upstream
UTM NAD83	Universal Transverse Mercator projection, North American Datum 1983
v m bgs	vertical metres below ground surface
VWP	vibrating wire piezometer
WB	Westbay
WRSF	waste rock storage facility
YESAA	Yukon Environmental and Socio-economic Act
Zn	zinc

1. Introduction

1. Introduction

1.1 Project overview

The Coffee Gold Project (the Project) is a proposed open pit mine development located in west-central Yukon, within the Whitehorse Mining District, Canada, 130 kilometers (km) south of Dawson City (Figure 1-1). The Project was developed by Kaminak Gold Corporation, which was recently acquired by Goldcorp Inc. in July 2016.

The proposed mine will produce a total of 46.4 Mt of heap leach feed and 265 Mt of waste over a nine-and-a-half-year mine production life (including one year of pre-production). Ore is proposed to be extracted from four pits (Latte, Double Double, Supremo and Kona) by open-pit shovel and truck mining methods. Most waste rock is planned to be deposited in various engineered waste rock storage facilities (WRSF) near to the pits from which the waste is sourced; some waste rock will be backfilled into the mined-out pits. The proposed heap leach facility consists of a conventional, multi-lift, free-draining ridge-top leach pad.

1.2 Scope of this document

The Project is subject to an assessment under the Yukon Environmental and Socio-economic Assessment Act (YESAA). Upon completion of the adequacy review, the Project will apply for a Type “A” water license from the Yukon Water Board and a quartz mining license from the Government of Yukon, Department of Energy, Mines and Resources. The assessment and regulatory processes require that the proponent provide sufficient information on surface water and groundwater quality, quantity and variability under baseline (pre-project) conditions, such that changes in these components resulting from the Project can be adequately predicted for all project phases.

This report constitutes the assessment of baseline groundwater conditions at the Project. It presents data collected in multiple hydrogeological field investigations advanced between 2013 and 2015. The cut-off date for data presented in the report is October 31st, 2015, coincident with the last site visit where groundwater level data was collected. Collection of baseline groundwater quality and water levels is ongoing and will be continued through the assessment and licensing process. Section 2 of this report provides background information from other disciplines which impact the groundwater system. Section 3 describes field methods employed during the field programs. Section 4 presents the results of physical groundwater data collection while Section 5 presents groundwater quality results.

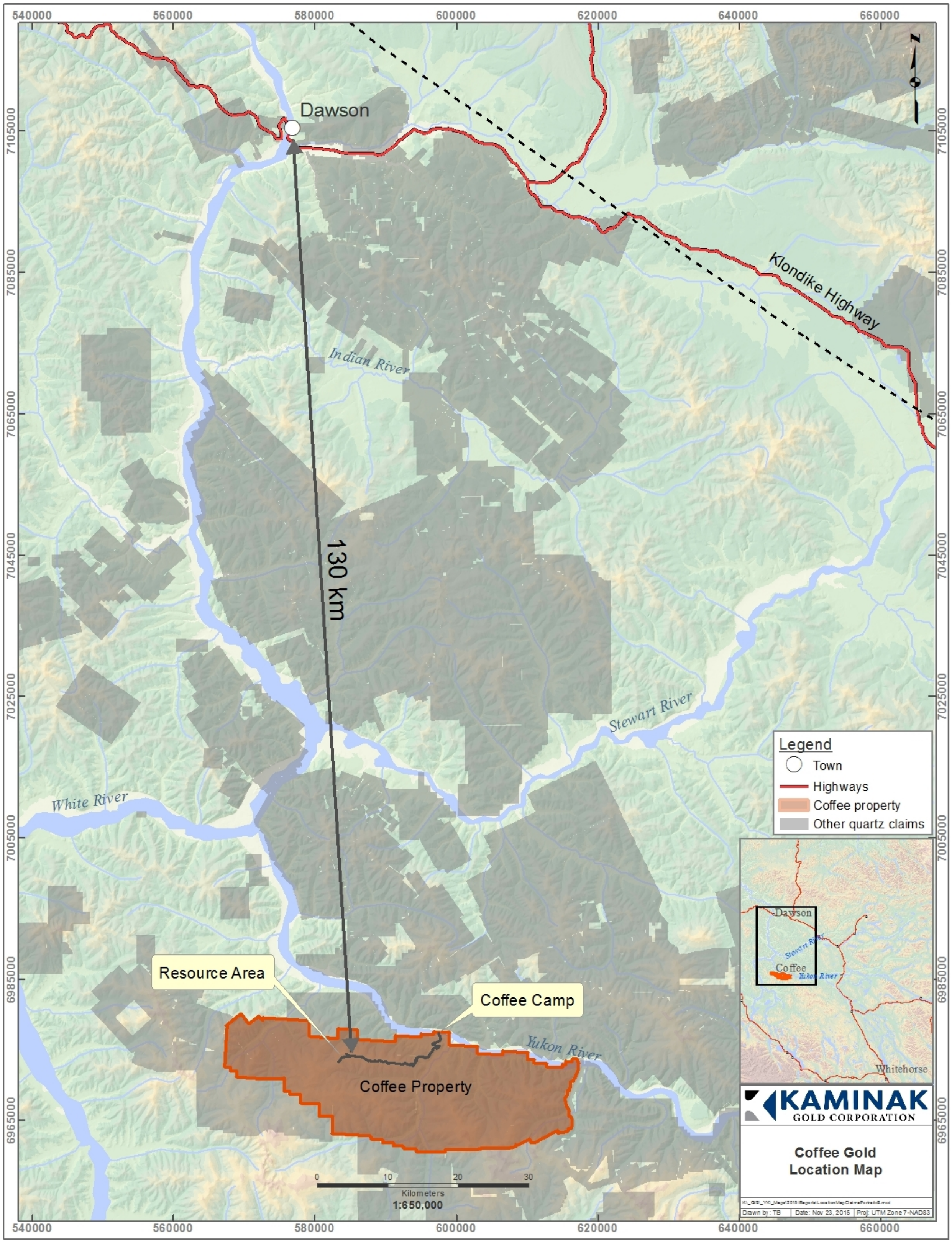


Figure 1-1: Coffee Project Location Map

2. Background

2. Background

The following section provides a high-level summary of climatic, hydrologic and geological information relevant to the groundwater system at the Coffee Gold Project. Detailed baseline reports for each discipline below are presented under separate cover.

2.1 Climate

A baseline meteorological program was initiated at the Project in July 2012. Baseline hydrometeorological data are presented in Lorax (2016). The study area is characterized by a cold, continental climate with an average annual temperature of -2.5°C, with monthly average air temperatures ranging from -19°C (December) to +13°C (July). Pronounced valley bottom temperature inversions occur during the winter months whereby ridgetop temperatures are up to 10°C higher than measurements recorded at valley bottom locations.

Precipitation and snow course data gathered during the baseline study period indicates that the annual precipitation averages 370 mm/yr (at 975 m elevation), with 32% of this amount falling as snow between October and April, and 68% falling as rain from May to September. Analysis of regional data indicates an annual precipitation gradient of 3% per 100 metres elevation gain. Annual site evapotranspiration is estimated to be 182 mm/yr while annual site potential evaporation is estimated to be 501 mm/yr.

2.2 Hydrology

A baseline surface water hydrology monitoring program was initiated in the autumn of 2010 and augmented with enhanced instrumentation and additional stations in the spring of 2014. The result is an extensive hydrometric network with a high quality and high-resolution streamflow data set.

Local patterns of streamflow are dominated by a snowmelt freshet that typically occurs late-April to mid-June and punctuated by multiple rainfall-induced high flow events that occur throughout the summer and autumn. In general, these high flow events are short-lived, with common durations of 1 to 2 days. Peak flows are driven primarily by the intense convective rainfall events that are common in the summer months, with secondary peaks occurring in late-May as a result of the melting snowpack.

In general, average unit yields across the project site are 9 L/s/km^2 for the open water season (May to October), and range from 4.5 to 15 L/s/km^2, depending on the drainage. Low flows measured in June 2015 after a prolonged dry period were on the order of 1 L/s/km^2. As the summer progresses, baseflows are enhanced by active layer melt and soil moisture recharge.

By November, unit yields drop to 0.5 to 1.5 L/s/km^2 in all project drainages and zero flow conditions are widespread by late January, accompanied by extensive aufeis formation. Aufeis or icing is pervasive in creeks and streams at the Project site. Aufeis forms when shallow groundwater discharge and/or baseflow freezes in the stream channel thereby impeding flow, which is then forced on top of the existing ice sheet where it freezes. Aufeis melts during the freshet, but may persist into the early summer (mid- to late-June). This influences the distribution of annual streamflow, as the baseflow stored in aufeis during the winter months is released during the freshet and early summer periods. This means that proportionately even more of the total annual runoff is expressed during the months of May through October.

2.3 Physiography

The Project is located in the northern Dawson Range of the Yukon-Tanana terrane, forming a moderate plateau that escaped Pleistocene glaciation. The landscape evolved through erosional and periglacial processes. The dominant periglacial processes at Coffee Gold site are cryoturbation, solifluction, slope wash and thermal erosion. The topography generally consists of rounded ridges with incised v-shaped valleys (AECOM, 2012). Elevations across the property range from 400 to 1,500 m above sea level with the majority of the property above the tree line and supporting short shrubby vegetation (JDS, 2016). The property has local mature pine forests with thick moss cover on the ground. Bedrock exposures on the property are rare (<5%).

A surficial geology map of the Coffee Creek area has been compiled by the Geological Survey of Canada (Huscroft, 2002). AECOM (2012) was retained by Kaminak to compile a detailed geomorphological map to aid in the selection of appropriate sampling sites for soil geochemical characterization. Both maps identify colluvium as the most widespread surficial material within the project area. The ridgetops and upper slopes are generally dominated by in-situ residual soils and colluvium derived from weathering of bedrock. The colluvial material is variable and typically contains mixtures of gravels, sands and silts with organic materials in the upper 0.1 to 0.2 m layer. The ridgetop soils are up to approximately 1.8 m deep and generally ice-poor. The thickness of the strongly-weathered bedrock is variable but is generally less than a metre. Colluviation is greatest on lower slopes, which tend to be steeper than upper slopes. Dominant colluvial processes include slope creep, debris slides and minor rock fall.

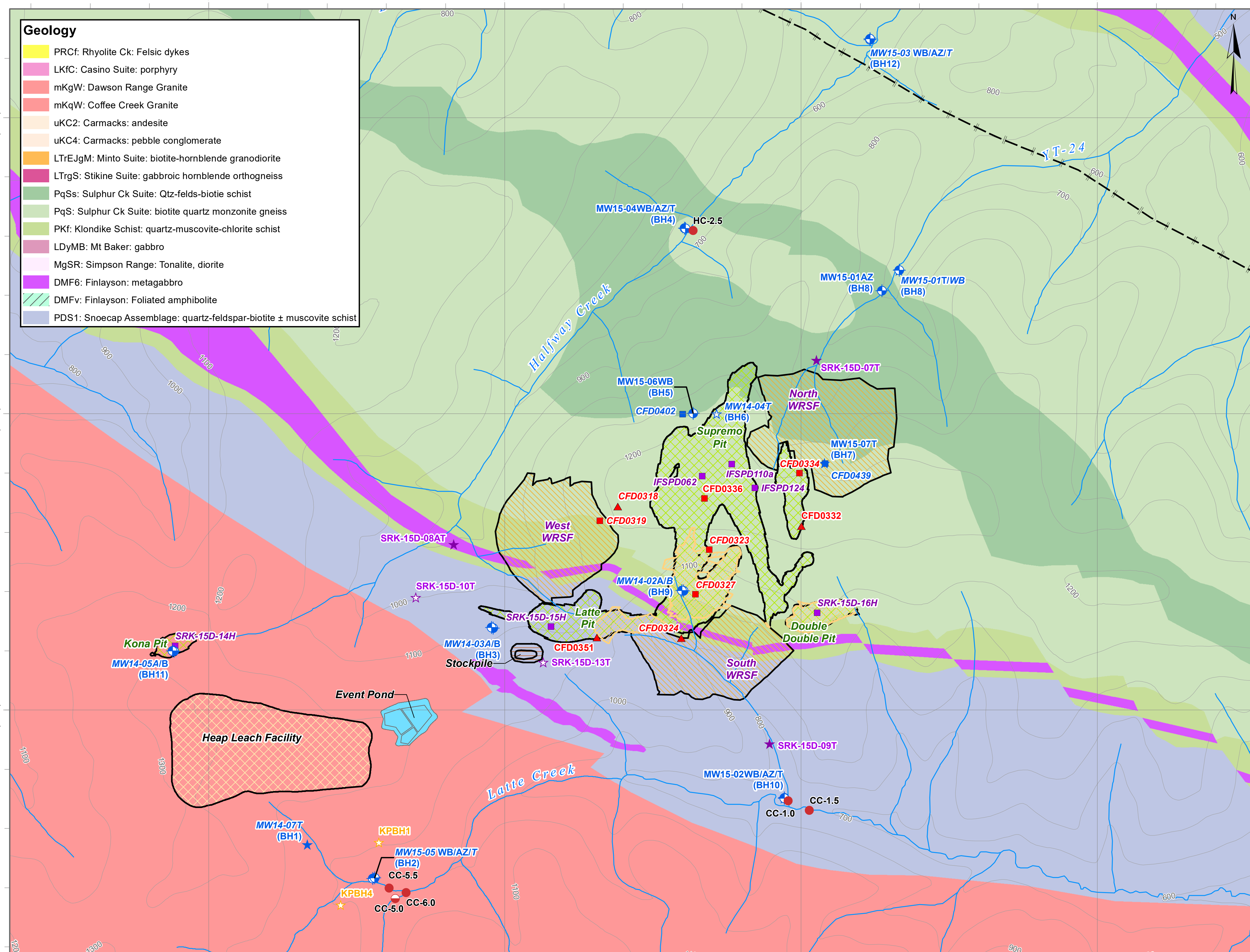
2.4 Geology

A detailed account of the geologic setting and mineralization of the of the Coffee Gold Project is provided in the 2016 Feasibility Study (JDS, 2016). The Project is underlain by a package of metamorphosed Paleozoic rocks of the Yukon-Tanana terrane that was intruded by a large granitic body in the Late Cretaceous. The Paleozoic rock package is predominantly a biotite (+ feldspar + quartz + muscovite ± carbonate) schist that overlies an augen orthogneiss. Both the Paleozoic metamorphic rocks and Cretaceous granite are cut by intermediate to felsic dykes of andesitic to dacitic composition. Grodziki *et. al.* (2015) have compiled the most recent geological map of the Coffee Gold deposit area, informed by a combination of geological traverses, bedrock mapping, borehole data, soil geochemistry, and geophysics. This map has been used as base map for Figure 2-1, which also shows mine facilities and instrument locations for reference.

The main Coffee Gold mineralization is associated with an extensional deformation event that occurred during the Cretaceous. This event resulted in formation of steep-to-vertical brittle fractures and normal faults cross-cutting all lithologies at Coffee (Berman *et al.*, 2007). A CO_2-rich fluid flowed through the region and travelled upwards in the system into the epizonal domain of the Coffee Gold Project, where it was controlled by the structural framework of the Coffee fault system and reacted with favorable host rocks (Buitenhuis *et. al.*, 2015; Buitenhuis, 2014). The fluid travelled along brittle structures and deposited gold-rich arsenian pyrite through sulphidation, and in high-energy pulses, formed gold-rich hydrothermal breccias (Buitenhuis, 2014). The planar gold mineralized zones at the Project exhibit a number of strike orientations, dominated by east-west, north-south, and east-northeast–west-southwest strike directions.

The Supremo zone is housed in several drill-tested T-structure gold corridors which are 5 to 30 m wide. The Latte zone consists of a stacked set of moderately-to-steeply south-southwest dipping, east-southeast striking brittle-ductile structures. The Double Double zone consists of a number of discrete, high-grade strands of mineralization up to several metres wide, trends east-northeast steeply dipping to the north and consists of a number of discrete, high-grade strands of mineralization up to several metres wide. The Kona zone is hosted in equigranular granite and consists of east-northeast trending, steeply south-dipping stacked structures. The gold structures are associated with narrow, less than 5 m wide, sparsely feldspar phenocrystic to aphanitic andesite to dacite dykes.

Kaminak (2015) has prepared a map of all confirmed mineralized structures currently identified on the property. The map identifies structures confirmed by drilling, trenching, or soil sampling and does not include regional-scale inferred faults. Structures identified in this map have been included in hydrogeologic maps provided in subsequent sections of this report due to their relevance as potential groundwater conveyance pathways.



LEGEND

- Surface WQ Monitoring Stations
- Surface and Hydrology Monitoring Stations
- Monitoring Well — *AZ = active zone, WB = Westbay, A = deep conventional (200+m), B = shallow conventional (150+m), T = thermistor/VWP*
- Thermistor (Lorax 2014)
- Thermistor (KP 2014)
- Thermistor (SRK 2015)
- Thermistor/VWP (Lorax 2015)
- Thermistor/VWP (SRK 2015)
- Vibrating Well Piezometer (VWP) (EBA 2013)
- Packer Tests (EBA 2013)
- Packer/Slug Tests (Lorax 2014)
- Packer Tests (SRK 2015)
- *BH = original drill pad name*
- Lineament (Huscroft, 2002)

Proposed Mine Infrastructure

- Backfill
- Pits
- Event Pond
- Stockpile
- Heap Leach Pad
- Waste Rock Storage Facility

Italics in name indicates location was hydraulic tested (packer or airlift)

Note: Geology from MDRU Map M-9 (Grodzicki et al, 2015)

Coordinate System: *NAD 1983 UTM Zone 7N*
Projection: *Transverse Mercator*
Datum: *North American 1983*
Units: *Meter*

1:32,000

0 500 1,000 Meters

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REVIEWED:	LF
VERSION:	1

CLIENT:

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PROJECT:

Coffee Gold Project

TITLE:

Bedrock Geology of the Coffee Gold Project

PROJECT #: A362-5 *FIGURE:* 2-1

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3. Hydrogeological Field Investigations

GOLDCORP

3. Hydrogeological Field Investigations

Multiple hydrogeological field programs have been undertaken at the Project between 2013 and 2015 (Table 3-1). As a result of these field programs, a robust network of hydrogeological installations has been established in, adjacent to and downstream of proposed major mine facilities (Figure 3-1). The groundwater field installations are as summarized as follows:

- Eleven conventional monitoring wells (five wells less than 10 meters deep; six wells between 150 and 220 metres deep);
- Six individual Westbay installations monitoring groundwater 10 to 286 metres deep;
- Five stand-alone thermistor strings ranging from 25 to 300 metres deep;
- Four stand-alone VWP installations ranging from 120 to 185 metres deep; and
- Nine combination VWP/thermistor installations ranging from 52 to 268 metres deep.

Completion details of the conventional monitoring wells, Westbay systems and thermistor/VWP installations are provided in Table 3-2, Table 3-3 and Table 3-4, respectively. Borehole logs and instrumentation documentation are provided in Appendices 3-A through 3-C.

Many of the drilling programs have incorporated hydraulic testing of bedrock, predominantly through a combination of packer testing and airlift testing. Limited slug testing has also been conducted. In conjunction with monitoring well installations, multiple groundwater sampling events have been undertaken to characterize baseline groundwater quality and its range of variability. The discussion below provides a high-level overview of the field programs with emphasis on those conducted by Lorax. Field protocols utilized in the Lorax programs are described in detail in Appendices 3-D through 3-F.

3.1 EBA Tetra Tech 2013 Program

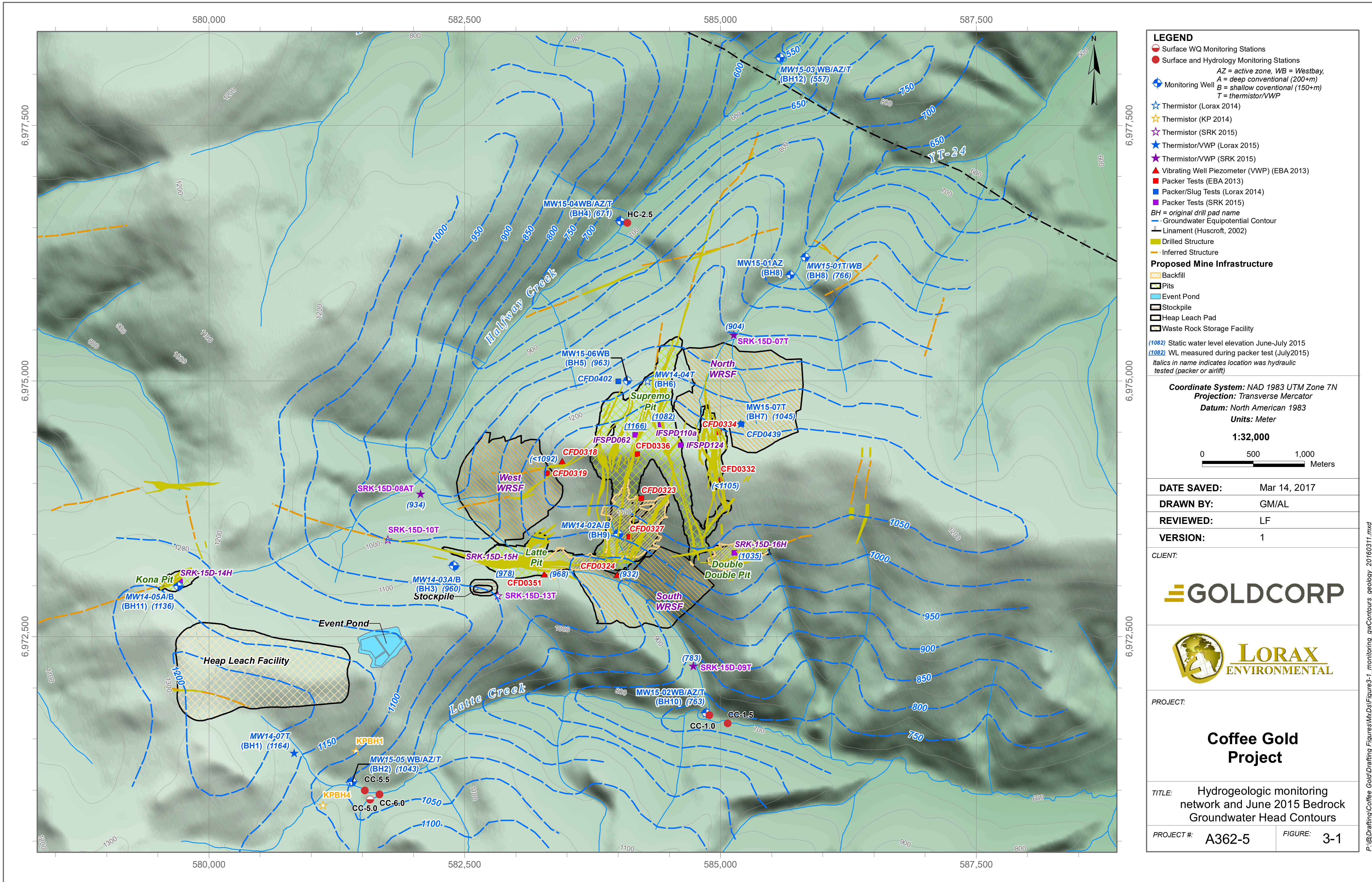
The first hydrogeological field program, supervised by EBA Tetra Tech (EBA TT) in the fall of 2013, collected hydraulic testing data from and installed four single-point vibrating wire piezometers (VWPs) in NQ2-sized boreholes advanced as a part of the exploration program. The program utilized a diamond drill rig owned and operated by Cyr Drilling International Ltd. of Manitoba. The majority of the field work was conducted by Kaminak staff, with training from EBA TT. A total of four VWPs (Table 3-4, Figure 3-1), manufactured by RST Instruments, were installed with readings taken on a monthly basis with a manual readout unit (as these installations were not equipped with dataloggers).

Table 3-1:
Summary of hydrogeological drilling programs undertaken at the Coffee Gold Project

Date	Consultant	Study Objective	Installations[1]	Hydraulic Testing	Reference
Fall 2013	EBA Tetra Tech	Preliminary hydrogeological data collection to support a detailed work plan for the hydrogeological baseline assessment.	4 VWP installations in the Supremo and Latte pit footprints	✓	2013 Hydrogeological Data Collection, Coffee Gold Project, Yukon.
Summer 2014	Knight Piésold	Geotechnical site investigations and laboratory testing to assess: (1) subsurface conditions within the footprint of the HLF (former valley fill location) and stockpile and (2) the geotechnical engineering material properties of the materials encountered.	Two thermistor strings in previously proposed valley HLF footprint area		Kaminak Gold Corporation Coffee Gold Project: Report on Feasibility Study Level Geotechnical Investigations, March 12, 2015.
Summer/ Fall 2014	Lorax	First phase of a detailed hydrogeological baseline program establishing groundwater sampling locations in and around proposed pits.	Conventional monitoring wells and thermistor in pit area; thermistor/VWP in formerly proposed HLF area.	✓	Coffee Creek Hydrogeological Drilling Program – Program Summary, Memorandum to Kaminak Gold dated October 17th, 2014.
March 2015	Lorax	Second phase of a detailed hydrogeological baseline program establishing ground conditions, permafrost conditions and groundwater pressures downgradient of waste facilities ahead of a larger, subsequent field program.	Thermistor/VWP installations downgradient of North and South WRSFs		2015 Phase l Baseline Hydrogeology Field Program – Program Summary, Memorandum to Kaminak Gold dated April 7th, 2015.
May/June 2015	Lorax	Third phase of a detailed hydrogeological field program establishing remaining groundwater quality, groundwater pressure and ground temperature stations downgradient of mine facilities.	Thermistor/VWP; Westbay groundwater monitoring systems (sub-permafrost groundwater); shallow monitoring wells (overburden).	✓	This report.
June/July 2015	SRK	Hydrogeological investigation targeting principal geologic structures that will be mined in the open pits, combined with a geotechnical program characterizing permafrost in facility in proposed facility footprint areas	Thermistor/VWP installations in proposed WRSFs and stockpile locations.	✓	Hydrogeologic Investigations Report Coffee Project, Yukon, December 18, 2015. 2015 Geotechnical Field Investigation Report Coffee Gold Project, Yukon, Canada, January 4, 2016.

Notes:

VWP – vibrating wire piezometer, HLF – heap leach facility, WRSF – waste rock storage facility.


LEGEND
Surface WQ Monitoring Stations
Surface and Hydrology Monitoring Stations
Monitoring Well
AZ = active zone, WB = Westbay, A = deep conventional (200+m) B = shallow conventional (150+m) T = thermistor/VWP
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Vibrating Well Piezometer (VWP) (EBA 2013)
Packer Tests (EBA 2013)
Packer/Slug Tests (Lorax 2014)
Packer Tests (SRK 2015)
BH = original drill pad name
Groundwater Equipotential Contour
Linament (Huscroft, 2002)
Drilled Structure
Inferred Structure
Proposed Mine Infrastructure
Backfill
Pits
Event Pond
Stockpile
Heap Leach Pad
Waste Rock Storage Facility
(1082) Static water level elevation June-July 2015
(1082) WL measured during packer test (July2015)
Italics in name indicates location was hydraulic tested (packer or airlift)
Coordinate System: NAD 1983 UTM Zone 7N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
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PROJECT:
Coffee Gold Project
TITLE: Hydrogeologic monitoring network and June 2015 Bedrock Groundwater Head Contours
PROJECT #: A362-5
FIGURE: 3-1
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580,000
582,500
585,000
587,500
6,977,500
6,975,000
6,972,500
Halfway Creek
Latte Creek
YT-24
North WRSF
West WRSF
South WRSF
Supremo Pit
Latte Pit
Double Double Pit
Kona Pit
Heap Leach Facility
Event Pond
Stockpile
MW15-03 WB/AZ/T (BH12) (557)
MW15-04WB/AZ/T (BH4) (671)
HC-2.5
MW15-01AZ (BH8)
MW15-01T/WB (BH8) (766)
MW15-06WB (BH5) (963)
MW14-04T (BH6)
CFD0402
SRK-15D-07T (904)
MW15-07T (BH7) (1045)
CFD0439
CFD0334
IFSPD110a
IFSPD124
IFSPD062
CFD0336
CFD0318
CFD0319
CFD0332
CFD0323
CFD0327
CFD0324
CFD0351
SRK-15D-08AT (934)
SRK-15D-10T
SRK-15D-15H
SRK-15D-14H
SRK-15D-13T
SRK-15D-16H (1035)
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MW14-03A/B (BH3) (960)
MW14-05A/B (BH11) (1136)
SRK-15D-09T (783)
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CC-1.5
CC-1.0
MW14-07T (BH1) (1164)
KPBH1
MW15-05 WB/AZ/T (BH2) (1043)
CC-5.5
CC-5.0
CC-6.0
KPBH4

Table 3-2:
Summary of conventional monitoring well installations at the Project

Pad ID	**Units**[4]	**BH5**	**BH5**	**BH9**	**BH9**	**BH3**	**BH3**	**BH11**	**BH11**	**BH7**	**BH7**	**BH8-AZ**	**BH10-AZ**	**BH12-AZ**	**BH04-AZ**	**BH02-AZ**
Mine ID		**CFD-0419**	**CFD-0434**	**CFD-0428**	**CFD-0418**	**CFD-0432**	**CFD-0442**	**CFD-0444**	**CFD-0455**	**CFD-0453**	**CFD-0463**	**CFR-0982**	**CFR-0998**	**CFR-0986**	**CFR-0992**	**CFR-0995**
Monitoring Well ID		**MW14-01A**	**MW14-01B**	**MW14-02A**	**MW14-02B**	**MW14-03A**	**MW14-03B**	**MW14-05A**	**MW14-05B**	**MW14-06A**	**MW14-06B**	**MW15-01AZ**	**MW15-02AZ**	**MW15-03AZ**	**MW15-04AZ**	**MW15-05AZ**
Mine Area[1]		N. Supremo	N. Supremo	S. Supremo	S. Supremo	Latte	Latte	Kona	Kona	North WRSF	North WRSF	North WRSF D/S	South WRSF D/S	West WRSF D/S	West WRSF D/S	Heap Leach D/S
Installation Status		collapsed	collapsed	open/frozen	open/frozen	open	open	open	open	collapsed	collapsed	Functioning	Functioning	Functioning	Functioning	Functioning
Drilling Start Date		20-Aug	01-Sep	25-Aug	19-Aug	29-Aug	08-Sep	12-Sep-14	17-Sep-14	16-Sep	22-Sep-14	05-May-15	24-May-15	09-May-15	14-May-15	20-May-15
Drilling Completion Date		27-Aug	03-Sep	28-Aug	24-Aug	05-Sep	12-Sep	16-Sep-14	19-Sep-14	21-Sep	24-Sep-14	05-May-15	24-May-15	09-May-15	14-May-15	20-May-15
Easting[2]	m	583,995	583,995	583,994	584,008	582,401	582,388	579,708	579,695	585,202	585,195	585,683	584,858	585,583	584,016	581,387
Northing[2]	m	6,975,003	6,975,003	6,973,508	6,973,507	6,973,191	6,973,197	6,972,998	6,972,999	6,974,583	6,974,583	6,976,038	6,971,754	6,978,157	6,976,566	6,971,079
Ground Elevation[2]	m asl	1177.0	1177.0	1029.5	1030.9	1097.6	1095.2	1268.5	1270.3	1183.0	1183.3	809.8	737.2	557.9	672.5	1068.9
Estimated depth to bedrock	m bgs			5	5							4.7	8.8	not encountered	5.1	4.8
Casing Depth	m bgs	38.6	5.0	6.0	6.5	6.0	5.0	2.0	2.0	9.0	9.0	n/a	n/a	n/a	n/a	n/a
Casing ID/OD	inch											4.5 OD	4.5 OD	4.5 OD	4.5 OD	4.5 OD
Casing Method												ODEX	ODEX	ODEX	ODEX	ODEX
Borehole ID	inch	3.78	3.78	3.78	3.78	3.78	3.78	3.78	3.78	4.83	4.83	4.5	4.5	4.5	4.5	4.5
Borehole Method[2]		DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/PQ	DDH/PQ	ODEX	ODEX	ODEX	ODEX	ODEX
Borehole Drilled Depth	m bgs											5.9	10.3	5.6	5.7	5.7
Borehole Measured Depth	m bgs	212.0	160.0	197.0	200.0	198.5	152.0	220.5	179.5	215.7	164.4	5.9	10.3	5.5	5.7	5.7
Stickup (Steel Surface Casing)	m ags	0.46				0.37	0.48		-				0.68	0.6		
Installations																
Start Date		27-Aug-14	03-Sep-14	27-Aug-14	23-Aug-14	05-Sep-14	08-Sep	16-Sep-14	17-Sep-14	21-Sep-14	24-Sep-14	05-May-15	24-May-15	09-May-15	14-May-15	20-May-15
Completion Date		27-Aug-14	04-Sep-14	28-Aug-14	24-Aug-14	07-Sep-14	12-Sep	17-Sep-14	20-Sep-14	22-Sep-14	24-Sep-14	05-May-15	24-May-15	09-May-15	14-May-15	20-May-15
2" PVC Install		Sch. 40	Sch. 40	Sch. 40	Sch. 40	Sch. 40	Sch. 80	Sch. 80	Sch. 80	Sch. 80	Sch. 80	Sch. 40	Sch. 40	Sch. 40	Sch. 40	Sch. 80
stickup (PVC)	m	0.5	0.3	1.0	1.3	1.0	0.9	1.1	0.7	0.9	1.0	0.6	0.7	0.7	0.5	0.6
Screened lithology		Gneiss	Gneiss/Schist	Hydrothermally altered rock/Crackle Breccia	Biotite Feldspar Schist	Biotite Feldspar Schist & Shear Zone	Biotite Feldspar Schist with Weak Zone	Granite	Granite	Mixed Felsic Gneiss	Gneiss with some occasional schist	Colluvium	Colluvium	Colluvuim/Alluvium	Colluvium	Colluvium
bottom of screen (installed)	m bgs	210.3	160.0	195.5	150.8	198.5	150.6	220.5	179.2	220.5	164.4	4.9	10.3	5.5	5.7	4.7
top of screen	m bgs	201.1	150.3	186.4	144.7	189.4	144.5	202.2	160.8	202.2	155.3	1.8	2.3	2.5	2.7	1.7
bottom of screen (installed)	m asl	966.7	1017.0	834.0	880.1	899.1	944.6	1048.0	1091.1	962.6	1018.9	804.9	726.9	552.4	666.8	1064.1
top of screen	m asl	975.9	1026.7	843.2	886.2	908.2	950.7	1066.3	1109.5	980.9	1028.1	807.9	735.0	555.4	669.8	1067.2
depth to bottom (measured)	m btoc			196.8	148.4	199.8	154.2	221.6	180.4	217.1	165.5	5.2	10.7	6.2	6.3	5.3
bottom of sand	m bgs	210.3	160.0	196.1	150.8	198.5	151.1	220.5	179.5	215.7	164.4	5.9	10.3	5.6	5.7	5.7
top of sand	m bgs	199.6	149.0	180.4	142.4	184.0	140.2	192.3	162.5	197.1	151.5	0.8	0.8	1.0	1.7	0.6
bottom of sand	m asl	966.7	1017.0	833.5	880.1	899.1	944.1	1048.0	1090.8	967.3	1018.9	803.8	726.9	552.3	666.8	1063.1
top of sand	m asl	977.4	1028.0	849.1	888.5	913.6	955.0	1076.2	1107.8	985.9	1031.8	809.0	736.4	556.9	670.8	1068.2
bottom of bentonite chips/pellets	m bgs	199.6	149.0	180.4	142.4	*184.0*	140.2	192.3	158.9	197.1	151.5	0.8	0.8		1.7	
top of bentonite chips/pellets	m bgs	193.9	144.9	176.5	140.3	*172.0*	136.7	190.3	156.1	194.7	149.1	0.0	0.0		0	
bottom of grout	m bgs	41.5	144.9	176.5	140.3	172.0	140.2	190.3	156.1	194.7	149.1			1.0		
top of grout	m bgs	0.0	92.0			0.5	1.2	0.9	3.0	5.4	5.5			0.0		

Notes:

1. D/S = downstream; WRSF =waste rock storage facility, N = north, S = South.
2. Measured by RTK (real time kinematic) (UTM NAD83 Zone 7). All holes drilled vertical.
3. DDH – diamond drill hole, HQ = borehole diameter of 96.0 mm; PQ = borehole diameter of 122.6 mm.
4. m bgs – metres below ground surface, m asl – metres above sea level, m btoc = metres below top of casing.

Table 3-3:
Summary of Westbay system installations at the Project

Pad ID	Units[4]	BH8	BH10	BH12	BH4	BH2	BH5
Mine ID		**CFR-0977**	**CFR-0997**	**CFR-0987**	**CFR-0993**	**CFR-0996**	**CFR-0999**
Westbay ID		**MW15-01WB**	**MW15-02WB**	**MW15-03WB**	**MW15-04WB**	**MW15-05WB**	**MW15-06WB**
Mine Area[1]		North WRSF D/S	South WRSF D/S	West WRSF D/S	West WRSF D/S	Heap Leach Facility D/S	North Supremo
Consultant		Lorax	Lorax	Lorax	Lorax	Lorax	Lorax
Easting[2]	m	585,829	584,858	585,581	584,024	581,402	584,090
Northing[2]	m	6,976,212	6,971,758	6,978,165	6,976,566	6,971,084	6,975,003
Ground Elevation[2]	m asl	803.6	737.1	557.9	671.5	1067.7	1184.9
Estimated depth to bedrock	m bgs	not logged	9.0	4.27	2.4	5.49	1.22
Surface Casing Depth	m bgs	21.3	10.1	10.36	7.0	6.7	162/ 203.6
Surface Casing ID/OD	inch	5.07/ 5.5	5.07/ 5.5	5.07/ 5.5	5.07/ 5.5	5.07/ 5.5	4.06/4.63
Protective Casing Depth[3]	m bgs	78	none	33.5	30.4	56.3	203.6
Protective Casing ID/OD[3]	inch	3.06/3.5 (HQ)	(-)	3.06/3.5 (HQ)	3.06/3.5 (HQ)	3.06/3.5 (HQ)	3.06/3.5 (HQ)
Borehole ID	inch	4.5	4.5	4.5	4.5	4.5	4.5" to 200.3/3.8" to 293
Borehole Depth	m bgs	116.72	66.2	99.52	61.1		291.8
Completion Date		05-May-15	24-May-15	05-Dec-15	19-May-15	22-May-15	05-Jun-15
Westbay Primary Sampling Zones							
Zone 1	m bgs	109-112	60.8-65.7	93.9-96.7	54.5-56.7	77.9-82.7	280.7-285.9
Zone 1 Lithology		Felsic Gneiss	Biotite Schist	Gneiss	Felsic Gneiss	Fresh Granite	Mixed Mafic Gneiss
Zone 2	m bgs	82-87.5	25.7-30.9	81.7-86.9	38.1-40.2	63.6-67.3	247.1-250.8
Zone 2 Lithology		Mixed Mafic Gneiss	Schist with chlorite alteration	Mixed Felsic Gneiss	Mixed Felsic Gneiss	Oxidized Granite	Mixed Felsic Gneiss
Zone 3	m bgs	-	-	46.7-50.3	-	-	238.0-243.2
Zone 3 Lithology		-	-	Mixed Mafic Gneiss	-	-	Mixed Felsic Gneiss
Zone 4	m bgs	-	-	-	-	-	221.2-226.4
Zone 4 Lithology		-	-	-	-	-	Mixed Felsic Gneiss
Zone 5	m bgs	-	-	-	-	-	210.6-220.3
Zone 5 Lithology		-	-	-	-	-	Mixed Felsic Gneiss

Notes:
1. D/S = downstream; WRSF =waste rock storage facility.
2. Measured by RTK (real time kinematic) (UTM NAD83 Zone 7). All holes drilled vertical.
3. Protective steel casing (typically HQ rods) left in hole to blind off permafrost zones.
4. m bgs – metres below ground surface, m asl – metres above sea level.

Table 3-4:
Thermistor and vibrating wire piezometer installations at the Project

Pad ID	Units[1]	BH1	BH2	BH4	BH6	BH7	BH8	BH10	BH12											
Mine ID		**CFD-0462**	**CFR-0994**	**CFR-0990**	**CFD-0439**	**CFD0596**	**CFR-0941**	**CFR-0948**	**CFR-0983**	**CFD-0600**	**CFD-0595**	**CFD-0599**	**CFD-0593**	**CFD-0594**	**CFD-0451**	**CFD-0454**	**CFD-0318**	**CFD-0324**	**CFD-0332**	**CFD-0351**
Station ID		**MW14-07T**	**MW15-05T**	**MW15-04T**	**MW14-04T**	**MW15-07T**	**MW15-01T**	**MW15-02T**	**MW15-03T**	**SRK-15D-07**	**SRK-15D-08**	**SRK-15D-09**	**SRK-15D-10T**	**SRK-15D-13T**	**KPBH-01**	**KPBH-04**	**CFD-0318**	**CFD-0324**	**CFD-0332**	**CFD-0351**
Mine Area[2]		HLF D/S	HLF D/S	West WRSF D/S	Supremo	Supremo	North WRSF D/S	South WRSF D/S	West WRSF D/S	North WRSF D/S	West WRSF D/S	South WRSF D/S	Halfway Ck U/S	Stockpile	Valley HLF	Valley HLF	Sumatra	Supremo	Supremo	Latte
Consultant		Lorax	Lorax	Lorax	Lorax	Lorax/SRK	Lorax	Lorax	Lorax	SRK	SRK	SRK	SRK	SRK	KP	KP	EBA	EBA	EBA	EBA
Easting[3]	m	580,832	581,406	584,027	584,287	585,198	585,826	584,855	585,584	585,124	582,057	584,734	581,752	582,825	581,438	581,115	583,450	583,993	585,000	583,275
Northing[3]	m	6,971,365	6,971,083	6,976,568	6,975,001	6,974,583	6,976,210	6,971,756	6,978,168	6,975,415	6,973,891	6,972,215	6,973,455	6,972,904	6,971,384	6,970,857	6,974,220	6,973,100	6,974,050	6,973,115
Ground Elevation[3]	m	1,156.3	1,067.1	670.9	1,185.8	1,183.1	803.9	737.1	557.7	948.9	925.1	784.3	1008.2	1136.9	1122.7	1121.3	1233.0	956.0	1246.6	1120.5
Azimuth[4]	degrees	0	125	40	0	0	0	0	39	0	0	0	0	0	0	0	175	280	275	0
Dip[4]	degrees	-90	-80	-80	-90	-90	-90	-90	-80	-90	-90	-90	-90	-90	-90	-90	-45	-45	-45	-65
Borehole ID	inch	3.78	4.5	4.5	3.78	3.78	4.5	4.5	4.5	3.78	3.78	3.78	3.78	3.78	3.78	3.78	2.99	2.99	2.99	2.99
Drilling Method[5]		DDH/HQ	RC	RC	DDH/HQ	DDH/HQ	DC	DC	RC	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/HQ	DDH/NQ2	DDH/NQ2	DDH/NQ2	DDH/NQ2
Borehole Depth	m AH		83.8	53.3		268	90.5	34.4	98.14	149	149	101	26	26	50	50	200	200	200	200
Installation Date		24-Sep-14	20-May-15	14-May-14	12-Sep-14	06-Jul-15	24-Mar-15	26-Mar-15	10-May-15	09-Jul-15	03-Jul-15	07-Jul-15	Jun/Jul -15	Jun/Jul-15	Sep-14	Sep-14	Jul-13	Aug-15	Aug-15	Oct-13
Logging Freq.		4 hrs	4 hrs	1 hr	4 hrs	1 hr	4 hrs	4 hrs	4 hrs	12 hrs	12 hrs	12 hrs	12 hrs	12 hrs	12 hrs	12 hrs	1 hr	1 hr	1 hr	4 hrs
Thermistor Sensors																				
Therm 1-1	v. m bgs	0.6	0.75	1.7	3.1	7	0.5	1.2	0.53	0.7	1	1.1	0.5	0.5	-1.5	-1.5	-	-	-	-
Therm 1-2	v. m bgs	1.4	1.5	13.8	26.1	8	1.3	3.2	1.2	2.2	4	2.6	3.0	3.0	0.0	0.0	-	-	-	-
Therm 1-3	v. m bgs	2.1	2.2	26.1	51.1	11	2.0	5.2	1.9	3.7	9	4.1	5.5	5.5	0.8	0.8	-	-	-	-
Therm 1-4	v. m bgs	2.9	3.0	38.1	76.1	26	2.8	10.2	2.6	5.2	16	7.1	8.0	8.0	1.5	1.5	-	-	-	-
Therm 1-5	v. m bgs	3.7	3.7	50.3	101.1	41	3.5	15.2	3.4	6.7	26	10.1	13.0	13.0	2.3	2.3	-	-	-	-
Therm 1-6	v. m bgs	4.4	4.5	-	126.1	56	4.3	24.2	4.1	8.2	41	15.1	15.5	15.5	3.1	3.1	-	-	-	-
Therm 1-7	v. m bgs	5.1	5.2	-	151.1	86	5.0	-	4.9	9.7	61	22.1	18.0	18.0	4.6	4.6	-	-	-	-
Therm 1-8	v. m bgs	17.4	17.2	-	176.1	106	12.3	-	16.9	12.7	81	32.1	20.5	20.5	7.6	7.6	-	-	-	-
Therm 1-9	v. m bgs	29.7	29.5	-	201.1	121	19.8	-	28.9	17.7	101	47.1	23.0	23.0	13.7	13.7	-	-	-	-
Therm 1-10	v. m bgs	42.5	41.8	-	226.1	136	27.3	-	41.0	24.7	121	77.1	25.5	25.5	19.8	19.8	-	-	-	-
Therm 1-11	v. m bgs	54.9	54.0	-	251.1	151	34.8	-	53.1	34.7	-	97.1	-	-	29.0	29.0	-	-	-	-
Therm 1-12	v. m bgs	67.4	66.3	-	276.1	166	42.3	-	65.1	49.7	-	-	-	-	38.1	38.1	-	-	-	-
Therm 1-13	v. m bgs	80.0	78.4	-	301.1	181	49.8	-	77.2	69.7	-	-	-	-	48.8	48.8	-	-	-	-
Therm 1-14	v. m bgs	-	-	-	-	-	-	-	-	89.7	-	-	-	-	-	-	-	-	-	-
Therm 1-15	v. m bgs	-	-	-	-	-	-	-	-	109.7	-	-	-	-	-	-	-	-	-	-
Therm 1-16	v. m bgs	-	-	-	-	-	-	-	-	129.7	-	-	-	-	-	-	-	-	-	-
Therm 2-1	v. m bgs	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VWP1	v. m bgs	124.36	55.4	38.8	-	239.0	76.0	33.9	48.8	103.6	103.6	99.7	-	-	-	-	118	178	117	184
VWP2	v. m bgs	-	81.4	51.62	-	267.8	89.1	-	94.7	149.2	149.2	-	-	-	-	-	-	-	-	-

Notes:
1. m AH – metres along hole, v. m bgs – vertical metres below ground surface
2. HLF – heap leach facility, WRSF – waste rock storage facility, D/S – downstream, U/S – upstream
3. Measured by RTK (real time kinematic) (UTM NAD83 Zone 7).
4. Dip and azimuth are estimated. Hole survey not performed.
5. DDH – diamond drill hole, HQ = borehole diameter of 96.0 mm, PQ = borehole diameter of 122.6 mm, NQ2 = borehole diameter of 75.8 mm; RC – reverse circulation open hole; DC- direct circulation open hole.

3.2 Lorax 2014 Drilling Program

The data from the EBA TT 2013 program were used to inform the design of detailed hydrogeological baseline program conducted by Lorax between August 10th and September 25th, 2014. The primary goals of the 2014 program were to collect additional hydraulic testing data downgradient of mine facilities and to establish long-term groundwater monitoring and sampling locations. The program was undertaken using both skid-mounted and heli-portable diamond drill rigs (Boyles 37, Duralite D-10 and Silver Bear A5) owned and operated by Cyr Drilling. Two drill rigs were run concurrently for the majority of the program. Most drillholes were HQ-sized (96 mm) with the exception of two PQ-sized (122.6 mm) holes. The use of drilling additives was initially avoided to minimize potential impacts to groundwater quality following well installation, but drilling conditions necessitated their use in holes numbered MW14-03AB and higher. Drilling additives used included AMC Pure-Vis, AMC Corewell, MATEX Ultra-Vis and Di-Corp G-Stop. All drilling and installations were supervised by Lorax personnel.

Challenging ground conditions, including permafrost, led to early termination of the 2014 field program. As such, the 2014 program was limited to upland areas in and around planned pits and the formerly proposed valley-fill HLF footprint. Three deep (>150 m) 2-inch conventional well pairs were established at Kona (MW14-05A/B), Latte (MW14-03A/B) and in south Supremo (MW14-02A/B). Two additional monitoring well pairs were established north of the Supremo pit (BH5 [MW14-01A/B] and BH7 [MW14-06A/B] locations, Figure 3-1); however, both wells in both pairs later became blocked, presumably due to ice-jacking. Logs for the 2014 monitoring wells are provided in Appendix 3-A.

A 300-metre, grouted-in thermistor string was established in north Supremo (MW14-04T) and a combination thermistor/VWP string was established in the Heap Leach Facility (HLF) footprint (MW14-07T) (Appendix 3-A). Methods for grouting in the thermistor string were similar as those used for the combination thermistor/VWP string; however, a higher proportion of bentonite was used for the latter (Appendix 3-D). Both locations were equipped with a dedicated datalogger housed inside a steel enclosure at surface for acquisition of high resolution (hourly) data (Figure 3-2). Similar dataloggers were also installed at the four VWPs installed by EBA TT in 2013. All instrumentation (except the steel enclosures) were manufactured by RST Instruments.

One hole at each drilling location was packer tested using a single packer setup. All of the packer tests were injection tests (either constant head or step-test). Both a hydraulic packer (Inflatable Packers International) and pneumatic packer (RST Instruments) were utilized during the 2014 drilling program. Field procedures for packer testing are outlined in Appendix 3-E.

Figure 3-2: Thermistor installation at MW14-04T (left) and VWP installation at CFD-0318 (right).

3.3 Knight Piésold 2014 Program

Between August 28th and September 21st, 2014, Knight Piésold (KP) conducted a geotechnical field program in the formerly proposed valley-fill HLF footprint area. The KP investigation comprised a combination of test pits and boreholes to assess shallow and deeper sub-surface conditions, respectively, within the limits of the valley fill HLF, ore stockpile and event pond. It should be noted that the HLF and associated facilities have been relocated to the presently proposed ridgetop location in 2015. Of particular significance to hydrogeological assessment of the Project, KP established two 50-metre (RST) thermistor strings in the previously proposed HLF footprint area. The thermistors strings are inserted into sealed 1" PVC standpipes that have been cemented in place and are connected to dedicated loggers at surface.

3.4 Lorax 2015 Drilling Programs

The widespread occurrence of permafrost encountered during the 2014 field programs prompted a refinement of the instrumentation required to collect water quality samples from sub-permafrost groundwater. This led to the selection of Westbay technology for this purpose. Illustrated in Figure 3-3, the Westbay system is comprised of a versatile, modular, sealed custom-manufactured PVC pipe with sampling zones located at the discretion of the hydrogeologist in the field. The pipe is lowered down the hole and packer elements bracketing each zone are inflated with a specialized tool. Figure 3-4 shows a photograph of the Westbay pipe and a packer element as it is being lowered into a borehole during installation. Groundwater is monitored/sampled using a specialized tool deployed from surface which docks into valved monitoring ports located within the sampling zone. In permafrost environments, a steel guide tube (typically HQ rods) is left in place which blinds off the frozen ground. A packer element resides inside the HQ rods, near the base, to prevent water ingress (and thus ice formation) in the annular space between the steel casing and Westbay system. The inside of the Westbay pipe and the annulus between the Westbay and steel protective casing is filled with 3:1 dilution of propylene glycol to prevent ice formation inside and outside of the Westbay. Westbay's custom-built sampling tool docks with the sampling ports in the assembly, opening the ports only after a seal has been established to prevent any exchange between the glycol inside the assembly and the groundwater outside.

Given the complexity and costs associated with Westbay system installations, the approach for installations in low-lying valleys was to first establish a thermistor/VWP installation at each drilling location and use the drilling and thermistor data to inform the Westbay installation at a second hole located off the same drill pad. A third, shallow (5 to 10 metres deep), conventional monitoring well was installed from a second, smaller drill pad to screen shallow groundwater in overburden/weathered bedrock.

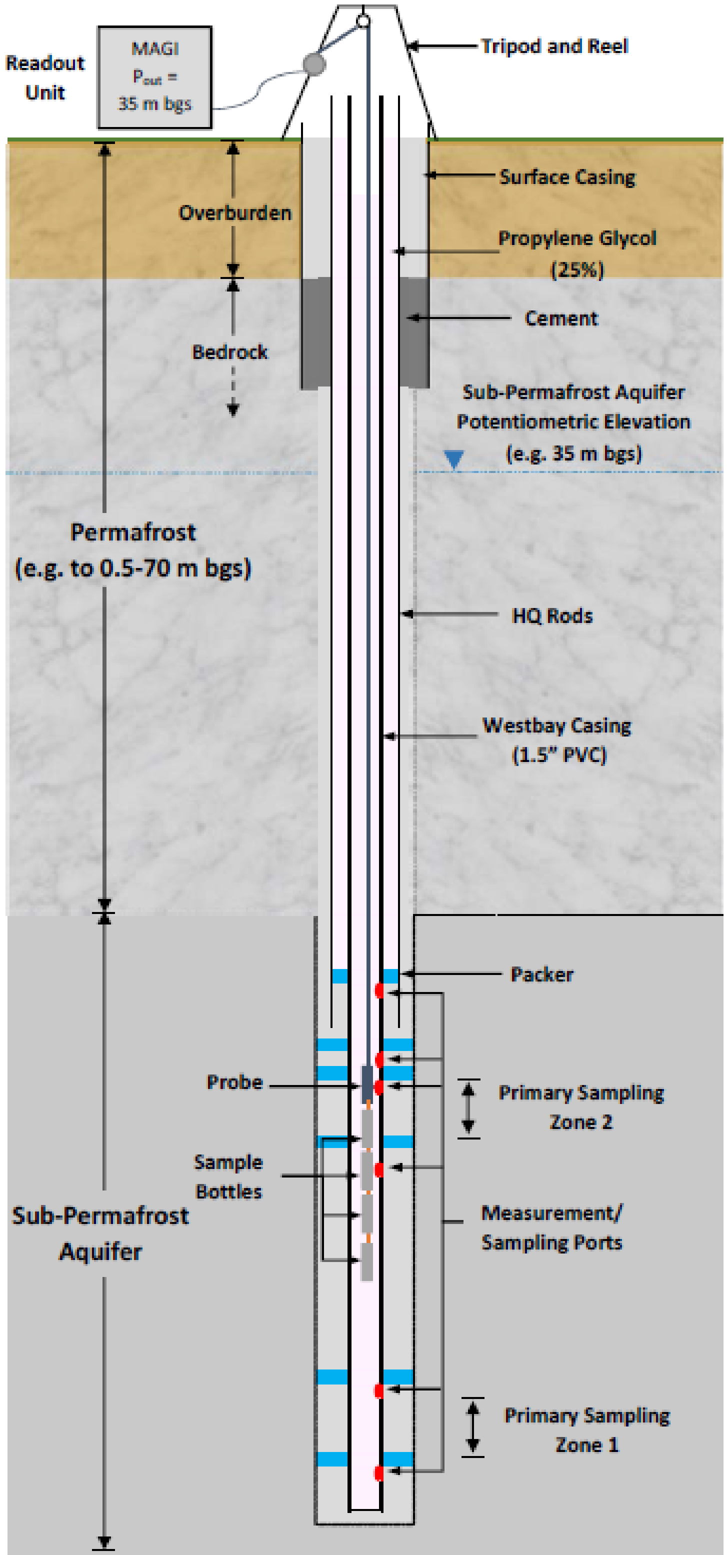


Figure 3-3: Schematic of an example Westbay system installed in permafrost (drawing not to scale).

Figure 3-4: Westbay installation at MW15-06T (BH5) using the Boyles 37 diamond drill rig. Blue gland is packer element which is inflated downhole with a 3:1 dilution of propylene glycol. PVC is 1.5” Sched 80 with ends machined to mate with Westbay System couplings incorporating a shear-rod connection and an o-ring seal (no glue).

The modified baseline hydrogeological program was implemented by Lorax in two separate field programs in 2015. The first program was undertaken between March 18th and March 26th, 2015, and utilized a heli-portable Hornet reverse circulation (RC) rig owned and operated by Northspan Explorations Ltd. Two combination thermistor/VWP strings were installed downgradient of proposed North and South WRSF footprints at locations MW15-01T and MW15-02T, respectively. The boreholes were drilled vertically; 5-inch casing was keyed into competent bedrock followed by direct circulation open hole drilling using a 4.5-inch bit. The instruments were installed according to the protocols outlined in Appendix 3-D. Borehole and instrument logs are found in Appendix 3-A.

The initial drilling campaign in March provided critical information on permafrost depth for the planning of a subsequent, larger field program undertaken by Lorax between April 30th and June 9th, 2015. All drillholes were advanced using the Hornet RC rig operated by Northspan, with exception to MW15-06WB, which is discussed separately below. No drilling additives were used on the RC holes. Westbay systems were installed in vertical holes at all valley drilling locations. Each Westbay was preceded by thermistor/VWP installations in sub-vertical angled holes (80° dip) advanced from the same pad. The thermistor holes were located on the downgradient edge of the pad and pointed in the downgradient direction to maximize the separation between the grouted VWP/thermistor hole and the Westbay completion. The grout backfill securing each thermistor/VWP install was allowed to cure for 24 hours before drilling of the adjacent Westbay hole was initiated.

During advancement of each Westbay hole, formation water reporting to the cyclone was regularly field-tested for pH and electrical conductivity (EC) to assess whether grout from the adjacent hole had influenced water quality. Where there was suspicion of grout influence (*e.g.,* low pH), the Westbay zones were configured to avoid each potentially impacted area. For the most part, two primary Westbay sampling zones were implemented at each installation. The zones were situated to intercept the first occurrence of substantial water and a second productive zone at depth (Table 3-3). The intention was to have a back-up zone should one zone become compromised or inaccessible. Westbay field technicians installed the Westbay instrumentation with assistance from Lorax and Northspan personnel. The Westbay completion report is provided in Appendix 3-B.

Shallow conventional wells (>4.5 m to 10 m deep) were initiated at valley drilling locations to characterize potential active zone flow in areas of permafrost, or overburden flow where permafrost is absent. Most of the 'active zone' wells were advanced from a separate pad ~25 metres away from the thermistor/VWP and Westbay pad. These holes were advanced using 4.5" ODEX casing which was withdrawn as the installation proceeded.

A combination of drilling methods was used to establish MW15-06WB, a Westbay system north of Supremo pit implemented to replace the 2014 conventional well pair (MW14-01A/B) that ice-jacked at the previous BH5 location. A 4.5" drillhole was first advanced using the Hornet RC rig to 200 metres, the depth limit of the rig, and found to be dry. A Boyles 37 diamond rig operated by Cyr was then mobilized onto the hole and HWT casing (4.5" OD) was reamed down to 162 m bgs. The hole was then deepened to

293 m bgs using HQ coring methods. A heavy mud (using AMC drilling additives Pure-Vis, Corewell and CR-650) was used during reaming and drilling. The hole was flushed for three hours prior to the commencement of Westbay installation. HQ rods were left in the hole to a depth of ~ 204 m to act a protective guard against permafrost.

Hydraulic testing during the Lorax 2015 field program consisted of airlift yield measurements at regular intervals during drilling plus an extended airlift yield test with monitored water level recovery on selected boreholes. A shut-in, constant head test was also conducted on MW15-04T, an artesian hole in Halfway Creek (Figure 3-1). Field protocols for the hydraulic tests are provided in Appendix 3-E.

3.5 SRK 2015 Program

In the summer of 2015, SRK conducted a hydrogeological program targeting geologic structures intersecting the pits and led a site-wide geotechnical program characterizing ground conditions in mine facility footprint areas. Airlift tests and/or packer tests were performed on the structures and thermistor/VWP strings were installed directly beneath or near proposed waste rock and ore stockpile footprint areas. The SRK hydrogeology field investigation report is included as Appendix 3-G of this report.

3.6 Groundwater Sampling

Monitoring wells were developed after installation and prior to groundwater sampling in 2014 and 2015. Well development was conducted using several methods, including purging with a bailer-winch system, inertial pump actuated with a Hydrolift-II, Westbay sampler, and air-lift pumping. The available well development method(s) depended on the type of well installation and depth to groundwater. Monitoring wells were developed between September 24 and October 9, 2014, May 29 and June 21, 2015, and on September 6, 2015. Details regarding the development of MW14-series (completed in 2014) and MW15-series wells (completed in 2015) are presented in Appendix 5-D.

Groundwater monitoring events were conducted in September/October 2014, May/June 2015, July 2015, August 2015 and September 2015. This modified quarterly sampling frequency is often employed in the Yukon to capture the range of seasonal variability accounting for extended winters and compressed spring/summer/fall seasons.

All new monitoring wells installed in 2014 and 2015 were sampled for groundwater quality with the exception of MW14-06A, MW14-06B, MW15-01AZ and MW15-04AZ which could not be sampled due to damage or water limitations (*e.g.,* frozen or dry) (Table 3-5). Table 3-5 presents a summary of the 2014 and 2015 groundwater sampling programs, including sampling methods used at each monitoring well.

Groundwater sampling was conducted in accordance with methods outlined in the BC Field Sampling Manual (Clark, 2002). Sampling was conducted using several different types of pumps. The pump employed at each well depended on the type of well installation, permeability of the geological unit being sampled, and depth to groundwater. Inertial pumps actuated with a Hydrolift-II mechanical actuator and peristaltic pumps were used to sample monitoring wells screened in permeable formations. Bladder pumps were used to collect groundwater samples from deep wells screened in low permeability bedrock which would not permit sampling with conventional methods (*e.g.*, inertial pump). The Westbay sampler was necessarily used to collect groundwater samples from the Westbay installations. Field parameters were continuously monitored with a multi-parameter probe (YSI 556 MPS or YSI Professional Plus) coupled to an in-line flow-through cell during groundwater purging. Field parameters were monitored to ensure collection of representative samples and to provide reliable field-based estimates of temperature, pH, specific conductance, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Low-flow sampling methods were employed, and groundwater samples were collected after water levels in monitoring wells and purge water field parameters had stabilized.

Table 3-5:
Summary of 2014 and 2015 Groundwater Sampling Programs

Station	Sept./Oct. 2014	May/Jun. 2015	Jul. 2015	Aug. 2015	Sept. 2015	Sample Count
MW14-02A	IP	IP	IP	IP	IP	5
MW14-02B	IP	IP	IP	IP	IP	5
MW14-03A	BP	BP	BP	BP	BP	5
MW14-03B	BP	BP	BP	BP	BP	5
MW14-05A	BP	BP	BP	BP	BP	5
MW14-05B	BP	BP	BP	BP	BP	5
MW14-06A	frozen[1]	damaged[2]		decommissioned[3]		0
MW14-06B	frozen[1]	damaged[2]		decommissioned[3]		0
MW15-01AZ	-	dry	frozen	frozen	frozen	0
MW15-01WB (Port 4)	-	WB	WB	WB	WB	4
MW15-02AZ	-	PP	PP	PP	PP	4
MW15-02WB (Port 3)	-	WB	WB	WB	WB	4
MW15-03AZ	-	PP	PP	PP	PP	4
MW15-03WB (Port 6)	-	WB	WB	WB	WB	4
MW15-04AZ	-	dry	dry	dry	dry	0
MW15-04WB (Port 4)	-	WB	WB	WB	WB	4
MW15-05AZ	-	dry	dry	dry	PP	1
MW15-05WB (Port 3)	-	WB	WB	WB	WB	4
MW15-06WB (Port 6)	-	WB	WB	WB	WB	4

Notes:
BP = bladder pump, IP = inertial pump actuated with a Hydrolift-II, PP = peristaltic pump, WB = Westbay sampler
1. Water inside monitoring well had started freezing at the time of sampling.
2. Monitoring well casing collapsed near surface, likely due to freeze/thaw action in the active layer. Consequently, well screen could not be accessed.
3. Monitoring well decommissioned by Kaminak.

De-icing was required at monitoring wells MW14-02A and MW14-02B prior to groundwater sampling. Artesian conditions at both wells resulted in the top of the water column freezing inside the well casing installed through permafrost. De-icing was conducted with a hot water power washer equipped with high-pressure hoses and a drain jetting nozzle. Groundwater sampling was conducted after the volume of injected de-icing water plus a minimum of one well volume had been purged and purge water field parameters had stabilized.

Low water levels and low yields at monitoring well MW14-05B challenged the equipment capabilities and sampling procedures. Consequently, a modified purging/sampling procedure was employed to obtain representative formation groundwater at MW14-05B. The water level was drawn down to the lowest possible level (pump elevation) to maximize the amount of purged groundwater. The well was then allowed to recover for a day prior to sampling, to ensure the greatest displacement and the largest buffer between 'new' formation water and 'old' residual standing water.

Since Westbay sample zones are isolated (*i.e.* not in direct contact) from atmospheric conditions, collecting representative groundwater samples does not require the use of typical sampling methods whereby large volumes of water are purged. Westbay installations MW15-01WB to MW15-06WB were sampled after completion of well development and purging in June 2015. Subsequent groundwater sampling was conducted after purging a minimum of 4 L. Additional detail regarding groundwater sampling methods is included in Appendix 5-D.

Groundwater samples were collected and preserved in the field with the appropriate laboratory supplied bottles and preservatives. Samples analyzed for dissolved parameters were filtered in the field with disposable in-line 0.45 micron filters, with the exception of groundwater samples collected from Westbay installations which were filtered in the lab. Quality control sampling was conducted in the field and included the collection of field blanks, a trip blank, and field replicate samples. After collection, samples were kept cool in the field and during shipping until delivery to the laboratory. Groundwater samples were submitted for chemical analysis to the ALS Environmental (ALS) laboratory in Burnaby, BC in 2014, and to the Maxxam Analytics (Maxxam) laboratory in Burnaby, BC in 2015. Groundwater samples were analyzed for the following parameters:

- Physical parameters
- Anions
- Nutrients
- Organic and inorganic carbon
- Total and dissolved metals

Groundwater quality parameters and the corresponding detection limits for groundwater sampling conducted in 2014 and 2015 are presented in Table 3-6 and Table 3-7, respectively.

Groundwater samples were also collected in 2014 and 2015 for the analysis of stable isotopes of hydrogen ($\delta^{2}H$) and oxygen ($\delta^{18}O$), the stable isotope of carbon in dissolved bicarbonate ($\delta^{13}C$), and the radiogenic isotopes tritium (^{3}H) and carbon-14 (^{14}C). Stable isotopes are used to assess provenance of groundwater samples. Groundwater samples have been submitted for isotope analyses to the Brigham Young University Isotope Laboratory. Analytical results were not ready at the time of reporting and will be reported under separate cover.

Table 3-6:
Groundwater Quality Parameters and Detection Limits (ALS 2014)

Parameter	Symbol	Unit	Detection Limit
Physical Properties			
Conductivity	EC	µS/cm	2
Hardness (as CaCO3)	H	mg/L	0.5
pH	pH	pH	0.1
Total Suspended Solids	TSS	mg/L	3
Total Dissolved Solids	TDS	mg/L	20
Turbidity	-	NTU	0.1
Anions and Nutrients			
Alkalinity, Total (as CaCO3)	-	mg/L	1
Ammonia, Total (as N)	NH_3	mg/L	0.005
Chloride	Cl	mg/L	0.5
Fluoride	F	mg/L	0.02
Nitrate	NO_2	mg/L	0.005
Nitrite	NO_3	mg/L	0.001
Total Kjeldahl Nitrogen	TKN	mg/L	0.05
Total Nitrogen	N	mg/L	0.05
Phosphorus	P	mg/L	0.002
Sulfate	SO_4	mg/L	0.5
Sulphide	S	mg/L	0.002
Organic/Inorganic Carbon			
Dissolved Organic Carbon	DOC	mg/L	0.5
Total Organic Carbon	TOC	mg/L	0.5
Total and Dissolved Metals			
Aluminum	Al	mg/L	0.0030 [1] / 0.0010 [2]
Antimony	Sb	mg/L	0.0001
Arsenic	As	mg/L	0.0001
Barium	Ba	mg/L	0.00005
Beryllium	Be	mg/L	0.0001
Bismuth	Bi	mg/L	0.0005
Boron	B	mg/L	0.01
Cadmium	Cd	mg/L	0.00001
Calcium	Ca	mg/L	0.05
Chromium	Cr	mg/L	0.0001
Cobalt	Co	mg/L	0.0001

Parameter	Symbol	Unit	Detection Limit
Copper	Cu	mg/L	0.0005 [1] / 0.0002 [2]
Iron	Fe	mg/L	0.01
Lead	Pb	mg/L	0.00005
Lithium	Li	mg/L	0.0005
Magnesium	Mg	mg/L	0.1
Manganese	Mn	mg/L	0.00005
Mercury	Hg	mg/L	0.0001 [1] / 0.0005 [2]
Molybdenum	Mo	mg/L	0.00005
Nickel	Ni	mg/L	0.0005
Phosphorus	P	mg/L	0.05
Potassium	K	mg/L	0.1
Selenium	Se	mg/L	0.0001
Silicon	Si	mg/L	0.05
Silver	Ag	mg/L	0.00001
Sodium	Na	mg/L	0.05
Strontium	Sr	mg/L	0.0002
Sulphur	S	mg/L	0.5
Thallium	Tl	mg/L	0.00001
Tin	Sn	mg/L	0.0001
Titanium	Ti	mg/L	0.01
Uranium	U	mg/L	0.00001
Vanadium	V	mg/L	0.001
Zinc	Zn	mg/L	0.0030 [1] / 0.0010 [2]

Notes:
1. Detection Limit for Total Metal
2. Detection Limit for Dissolved Metal

Table 3-7:
Groundwater Quality Parameters and Detection Limits (Maxxam 2015)

Parameter	Symbol	Unit	Detection Limit
Physical Properties			
Conductivity	EC	µS/cm	1.0
Hardness (CaCO3)	H	mg/L	0.50
pH	pH	pH	N/A
Total Suspended Solids	TSS	mg/L	1.0
Total Dissolved Solids	TDS	mg/L	10
Turbidity	-	NTU	0.10
Anions and Nutrient			
Alkalinity (Total as $CaCO_3$)	-	mg/L	0.50
Alkalinity (PP as $CaCO_3$)	-	mg/L	0.50
Ammonia, Total (as N)	NH_3	mg/L	0.0050
Chloride	Cl	mg/L	0.50
Fluoride	F	mg/L	0.010
Nitrate	NO_2	mg/L	0.0020
Nitrite	NO_3	mg/L	0.0020
Nitrate plus Nitrite	-	mg/L	0.0020
Total Nitrogen	N	mg/L	0.020
Total Total Kjeldahl Nitrogen	TKN	mg/L	0.020
Phosphorus	P	mg/L	0.0020
Dissolved Sulphate	SO_4	mg/L	0.50
Sulphide	S	mg/L	0.0050
Inorganics			
Bicarbonate	HCO_3	mg/L	0.50
Carbonate	CO_3	mg/L	0.50
Hydroxide	OH	mg/L	0.50
Organic/Inorganic Carbon			
Dissolved Organic Carbon	DOC	mg/L	0.50
Total Organic Carbon	TOC	mg/L	0.50
Total and Dissolved Metals			
Aluminum	Al	µg/L	0.50
Antimony	Sb	µg/L	0.020
Arsenic	As	µg/L	0.020
Barium	Ba	µg/L	0.020
Beryllium	Be	µg/L	0.010
Bismuth	Bi	µg/L	0.0050
Boron	B	µg/L	10
Cadmium	Cd	µg/L	0.0050
Calcium	Ca	mg/L	0.050
Chromium	Cr	µg/L	0.10
Cobalt	Co	µg/L	0.0050
Copper	Cu	µg/L	0.050
Iron	Fe	µg/L	1.0

Parameter	Symbol	Unit	Detection Limit
Lead	Pb	µg/L	0.0050
Lithium	Li	µg/L	0.50
Magnesium	Mg	mg/L	0.050
Manganese	Mn	µg/L	0.050
Mercury	Hg	µg/L	0.0020
Molybdenum	Mo	µg/L	0.050
Nickel	Ni	µg/L	0.020
Phosphorus	P	µg/L	2.0
Potassium	K	mg/L	0.050
Selenium	Se	µg/L	0.040
Silicon	Si	µg/L	50
Silver	Ag	µg/L	0.0050
Sodium	Na	mg/L	0.050
Strontium	Sr	µg/L	0.050
Sulphur	S	mg/L	3.0
Thallium	Tl	µg/L	0.0020
Tin	Sn	µg/L	0.20
Titanium	Ti	µg/L	0.50
Uranium	U	µg/L	0.0020
Vanadium	V	µg/L	0.20
Zinc	Zn	µg/L	0.10
Zirconium	Zr	µg/L	0.10

4. Physical Hydrogeology Results

4. Physical Hydrogeology Results

This section discusses physical groundwater data collected during the field programs outlined in Section 3. The discussion covers permafrost characterization, hydraulic testing results, water level time series and hydraulic gradients.

Data presented in this section have undergone various forms of quality assurance/quality control. Hydraulic testing data have been vetted to ensure results only from saturated test interval are presented; analyses have also been checked by multiple parties. Unusual hydraulic gradients recorded between vibrating wire piezometers have been field verified to ensure sensors are correctly identified. Some of ground temperature profiles plotted in Appendix 4-A display unusual jogs suggesting thermistor sensor malfunction. These data have been removed when clearly out of range or flagged as 'suspicious' in the plots and not used for subsequent analysis.

4.1 Permafrost

Permafrost is an important consideration in the conceptualization groundwater systems as it imparts controls on groundwater movement. When ground temperatures fall below the freezing point, the hydraulic conductivity sharply decreases as unfrozen water content drops and pores and cracks are increasingly filled with ice (Woo, 2012). Permafrost is considered to behave like an aquiclude or an aquitard and can confine sub-permafrost groundwater such that it exhibits artesian conditions (Woo, 2012). Active groundwater circulation can occur above, within and beneath permafrost (supra, intra and sub-permafrost groundwater).

The Project is located in an area classified as extensive discontinuous permafrost with low to medium ice content (National Resources Canada, 1995). Extensive discontinuous permafrost is defined as 50% to 90% of the land area underlain by permafrost, while low to medium ice content is defined as less than 10% to 20% by volume of visible ice content. Recharge of sub-permafrost groundwater in discontinuous regions can be directly from adjacent non-permafrost uplands or through supra and intra-permafrost connections (Woo, 2012).

Frozen ground has been mapped at the Project using a variety of methods. AECOM (2012) first mapped frozen ground on the property for a geomorphological mapping study supporting strategic soil sampling for exploration purposes. In 2015, SRK undertook sonic drilling and test pitting in footprint areas of mine facilities to characterize geotechnical and permafrost conditions (SRK, 2016). Thermistor strings were installed as a part of this program (see Section 3.5). EBA TT has further investigated permafrost occurrence through field mapping and air photo interpretation (2016) and a terrain stability/geohazard map has been produced by Palmer (2016).

The permafrost data presented in this section is limited to ground temperatures measured by thermistors installed by Lorax, SRK and KP, and other anecdotal observations of bedrock ice occurrence from the Lorax field programs. Key findings are summarized Table 4-1. While most thermistor installations indicate sub-zero temperatures in bedrock, observations of ice in bedrock are somewhat limited. These observations include visible ice shards in RC chips from shallow, fractured bedrock in Halfway Creek (MW15-03) and small lenses of ice at depth in core holes in Latte (MW14-03B) and Kona North (exploration hole CFD0376) (Figure 4-1). The water column in well MW14-03B has remained unfrozen. While not listed in Table 4-1, ice was more commonly visible in overburden in RC holes. At the extreme end, three large lobes of ice were intercepted between 8 and 13 metres below ground surface at MW15-01T (Figure 4-2). This drill pad is located on a slope classified as poorly drained colluvial veneer modified by solifluction (xszCv-S:p-i) (AECOM, 2012).

Ground temperature profiles for all thermistor locations are provided in Appendix 4-A. Where applicable, readings from VWP temperature sensors are included in the plots; however, the thermistors contained within VWPs are reported by the manufacturer to be less accurate than those used in thermistor strings. A typical ground thermal profile measured at thermistor MW14-07T is shown in Figure 4-3. At MW14-07T, the active layer, defined as the top layer of ground that seasonally freezes and thaws, is less than 0.6 m thick as the uppermost sensor at 0.6 m remains below 0°C throughout the year. The active zone is generally shallow across the site (less than 2 m deep), except in areas where vegetation has been stripped (*i.e*. road cuts) (Table 4-1). This is because the high amount of air in dry moss and lichen is an effective insulator which buffers the ground from summer heat and maintains a thinner active layer than that which would be found beneath bare ground (Woo, 2012).

Figure 4-1: Ice lens observed in exploration hole CFD0376 (Kona North). Depth is ~85 m vertical.

Figure 4-2: Ice "cuttings" intercepted at MW15-01T while advancing casing through colluvium.

Table 4-2 provides the period of record for which shallow temperature sensors record above zero readings, providing insight into when the active layer is ‘active’. Time series plots of the shallow temperature data are found in Appendix 4-B. MW15-03T records above zero ground temperatures for all sensors within 5 metres of ground surface for essentially the entire period of record for the instrument (May 10 through October 31st, 2015). MW15-03T is also the lowest elevation thermistor on site, and is at the fringe of permafrost coverage. Farther upstream at MW15-04T, the shallowest thermistor sensor (1.7 m bgs) remains frozen throughout the entire data record. Of the higher elevation sensors, KPBH01 (elevation 1123 m asl) records the earliest shallow thaw (0.76 m bgs) starting May 21st, 2015. Overall, the period of thaw for shallow temperature sensors within 5 metres of ground surface is highly variable across the site in both timing and duration.

The base of permafrost at MW14-07T is estimated to be 62 m bgs, *i.e.* where the thermal profile crosses the 0°C line. This assumes that the freezing point has not been significantly depressed due to the presence of solutes, which is a reasonable assumption given the generally low levels of total dissolved solids in the sub-permafrost groundwater across the site (generally less than 1000 mg/L, see Section 5). The interpreted base of permafrost for other locations is reported in Table 4-1 and plotted in Figure 4-4. In cases where the depth of permafrost extends beyond the depth of the thermistor installation, the base of permafrost was estimated by extrapolating the thermal gradient to the 0°C line.

Overall, permafrost extends to greatest depths in ridge areas and appears to reduce in thickness towards areas of lower elevation; north-facing slopes tend to have thicker permafrost than south-facing slopes. The only drilling locations where permafrost was absent were the two instruments established in the lower reaches of the South WRSF drainage (MW15-02T, SRK-15D-09T). The depth of permafrost at MW15-03T is also highly questionable. The thickest permafrost (~165 metres) is encountered near the north end of the proposed Supremo pit at MW14-04T. Permafrost in the project area is relatively warm (between 0 and -2°C) and at 20 metres depth (*i.e.* beyond the depth of zero annual fluctuation), is coolest (-1.4°C to -1.9°C) on north facing slopes.

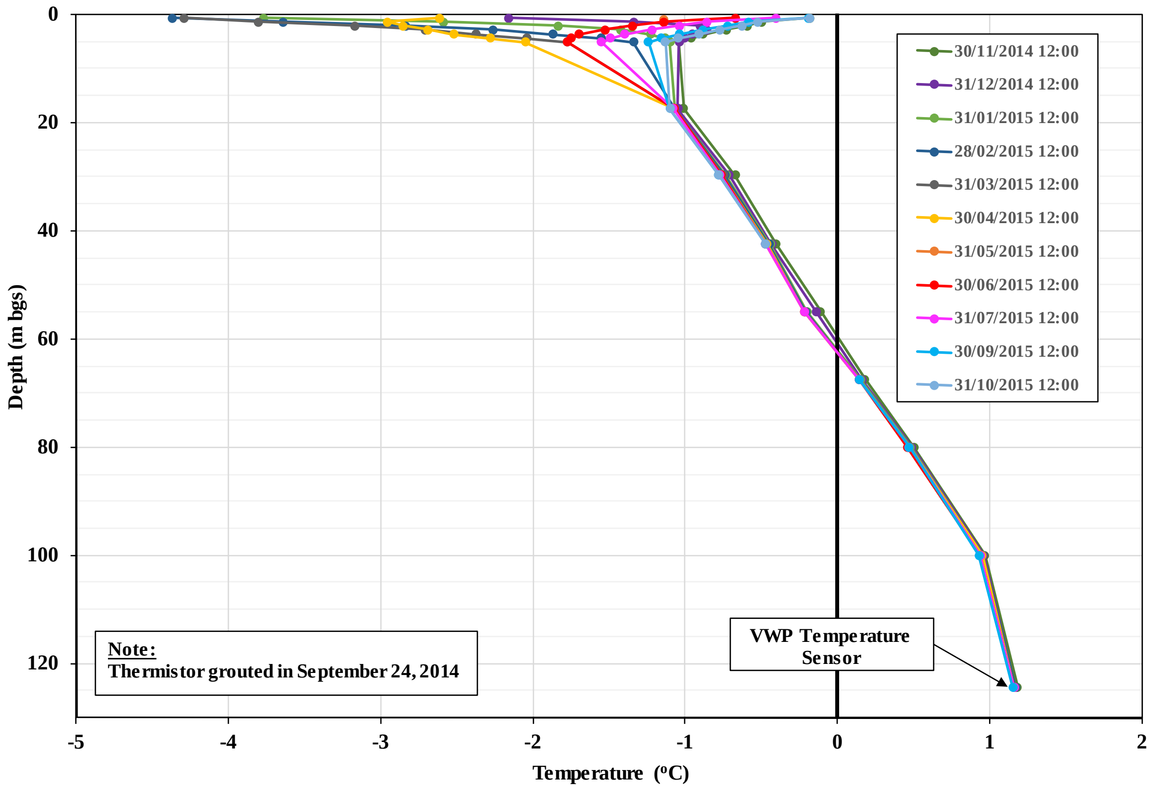
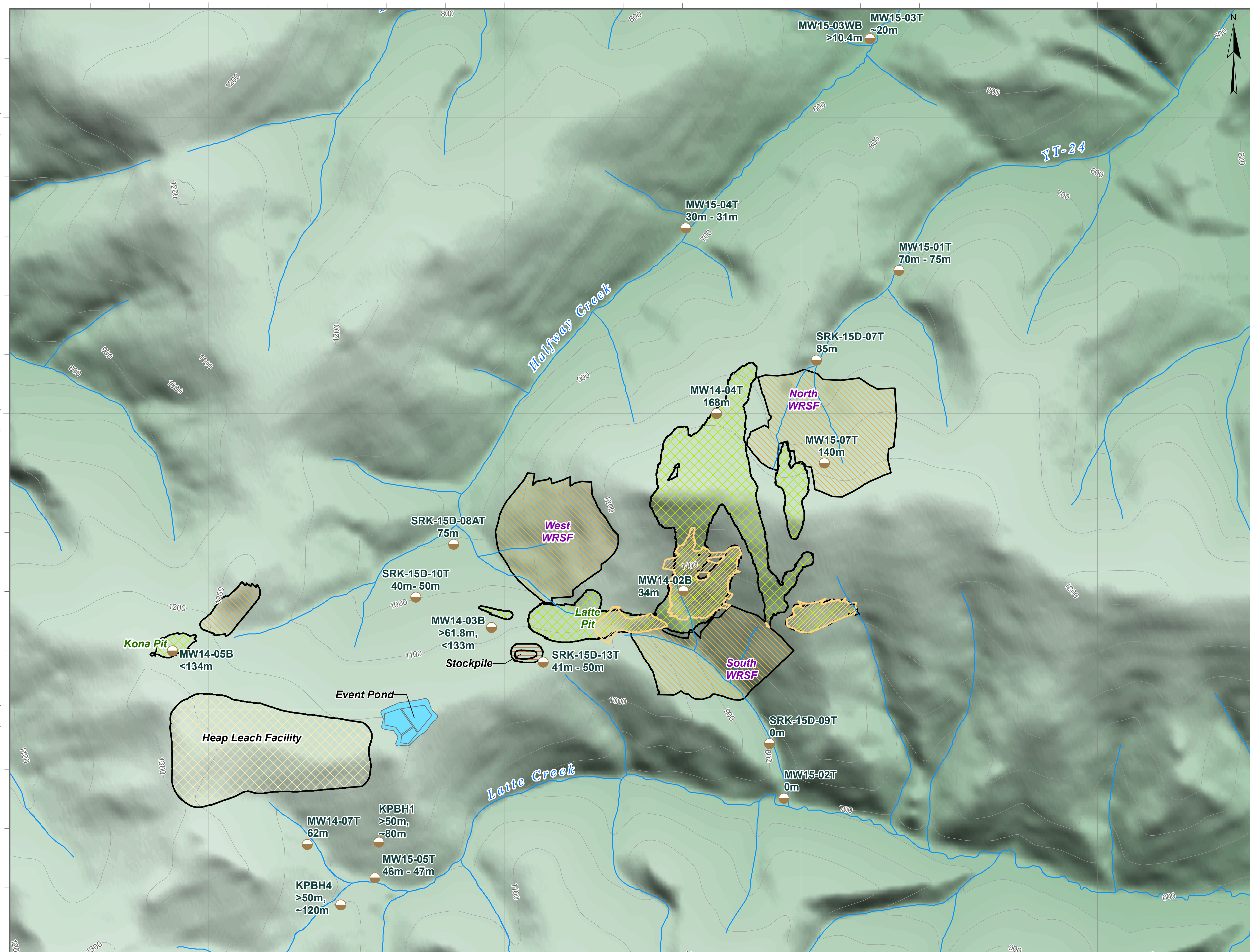


Figure 4-3: Thermal profile at MW14-07T, downgradient of the proposed heap leach facility.

Table 4-1:
Observations of permafrost depth from thermistor installations, exploration drilling and monitoring well sampling.

Monitoring ID	Mine ID	Ground Surface (m asl)	Active Zone Thickness (m)	Base of Permafrost (m bgs)	Temperature at 20 m bgs (°C)	Comment
KPBH-01	CFD0451	1122.7	1.5	>50m, approx. 80m	-0.92	Projected trend as thermistor string terminates at 50 m bgs.
KPBH-04	CFD0454	1121.3	1.5	>50m, approx. 120m	-1.04	Projected trend as thermistor string terminates at 50 m bgs.
MW14-02B	CFD0418	1030.9		34		Base of ice in conventional MW after several months of inactivity.
MW14-03B	CFD0432	1097.6		$61.8 \leq x \leq 133$		Small ice lens observed in core at 61.8 m, water in well is unfrozen at ~133 m bgs.
MW14-04T	CFD0439	1185.8	>3	168	-1.4	In road cut, vegetation stripped.
MW14-05B	CFD0455	1270.3		<134		Water level in well remains unfrozen to 134 m.
MW14-07T	CFD0462	1156.3	<0.6	62	-1.1	
MW15-01T	CFR0941	803.9	<0.6	70 to 75	-1.4	
MW15-02T	CFR0948	737.1	n/a	0	0.6	Permafrost absent.
MW15-03T[1]	CFR0983	557.7	?	~20	0	Ice shards observed in rock chips 8.8-10.4 m, near zero temperatures observed at 16.7 m.
MW15-03WB[1]	CFR0987	557.9	?	$x \geq 10.4$		Ice shards observed in rock chips 7.7, 8.2 and 8.5-10.4 m.
MW15-04T	CFR0990	670.9	<1.7	30 to 31	-0.4 to -0.35	
MW15-05T	CFR0994	1067.1	1.5	46 to 47	-0.6	
MW15-07T	CFD0596	1183.1	<7	140	-1.3	In road cut, vegetation stripped.
SRK-15D-07T	CFD0600	946.0	<1.5	85	-1.85	
SRK-15D-08AT	CDF0595	925.0	~1.1	75	-0.9	
SRK-15D-09T	CFD0599	784.0	n/a	0	0.8	Permafrost absent.
SRK-15D-10T	CFD0593	1008.2	~2	40 to 50	-1.85	Projected trend as thermistor string terminates is frozen to depth at 25 m bgs.
SRK-15D-13T	CFD0594	1136.9	~2	41 to 50	-0.2	Projected trend as thermistor string terminates is frozen to depth at 25 m bgs.
	CFD0376	1052.1	n/a	$x \geq 85$	n/a	Exploration hole in Kona North; ice lens observed around 85 m.

Notes:
n/a: not applicable, active zone necessarily requires presence of permafrost.
1. Unable to determine active zone thickness from plot due depth of sensors; base of permafrost is also questionable.



LEGEND

Permafrost Depth

Proposed Mine Infrastructure

- Backfill
- Pits
- Event Pond
- Stockpile
- Heap Leach Pad
- Waste Rock Storage Facility

(1082) Static water level elevation June-July 2015

(1082) WL measured during packer test (July2015)

Italics in name indicates location was hydraulic tested (packer or airlift)

Coordinate System: *NAD 1983 UTM Zone 7N*
Projection: *Transverse Mercator*
Datum: *North American 1983*
Units: *Meter*

1:32,000

0 500 1,000 Meters

DATE SAVED:	Mar 14, 2017
DRAWN BY:	GM/AL
REVIEWED:	LF
VERSION:	1

CLIENT:

GOLDCORP

LORAX ENVIRONMENTAL

PROJECT:

Coffee Gold Project

TITLE: Measured and Estimated Base of Permafrost at the Coffee Gold Site

PROJECT #: A362-5 *FIGURE:* 4-4

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Table 4-2:
2015 Period of record with above 0°C temperatures at shallow thermistor sensors

Instrument	Ground Surface Elevation (masl)	Sensor Depth (m bgs)	Start of >0˚C Temperatures in 2015	Stop of >0˚C Temperatures in 2015	Comments
Halfway Creek					
SRK-15D-10T	1008	0.5	20-Sep-15	19-Oct-15	>0°C intermittently through range
SRK-15D-10T	1008	3.0	Always below zero		
SRK-15D-10T	1008	5.5	Always below zero		
SRK-15D-08T	925	1.0	9-Jul-15[1]	22-Sep-15	
SRK-15D-08T	925	4.0	9-Jul-15[1]	29-Jul-15	
MW14-04T	1186	3.1	1-Jul-15	31-Oct-15	In road cut
MW15-04T	671	1.7	Always below zero		
MW15-03T	558	0.5	10-May-15[1]	27-Oct-15	
MW15-03T	558	1.2	10-May-15[1]	31-Oct-15[2]	
MW15-03T	558	1.9	10-May-15[1]	31-Oct-15[2]	
MW15-03T	558	2.6	10-May-15[1]	31-Oct-15[2]	
MW15-03T	558	3.4	10-May-15[1]	31-Oct-15[2]	
MW15-03T	558	4.1	10-May-15[1]	31-Oct-15[2]	
MW15-03T	558	4.9	10-May-15[1]	31-Oct-15[2]	
YT-24 Drainage					
MW15-07T	1183	7.0	Always below zero		
SRK-15D-07T	949	0.7	Always below zero		Below zero after initial grout curing
SRK-15D-07T	949	2.2	Always below zero		Below zero after initial grout curing
SRK-15D-07T	949	3.7	Always below zero		Below zero after initial grout curing
SRK-15D-07T	949	5.2	Always below zero		Below zero after initial grout curing
MW15-01T	804	0.5	21-May-15	24-Oct-15	
MW15-01T	804	1.3	Always below zero		
Upper Latte Creek					
MW14-07T	1156	0.6	Always below zero		
MW14-07T	1156	1.4	Always below zero		
KPBH01	1123	0.8	21-May-15	1-Oct-15	
KPBH01	1123	1.5	8-Aug-15	20-Sep-15	
KPBH04	1121	0.8	17-Jun-15	30-Sep-15	
KPBH04	1121	1.5	20-Aug-15	22-Sep-15	
MW15-05T	1067	0.8	16-Jul-15	11-Oct-15	
MW15-05T	1067	1.5	13-Sep-15	16-Sep-15	
SRK-15D-13T	1137	0.5	10-Sep-15	22-Sep-15	
SRK-15D-13T	1137	3.0	Always below zero		
SRK-15D-13T	1137	5.5	Always below zero		
South WRSF Drainage					
SRK-15D-09T	784	1.1	9-Jul-15[1]	31-Oct-15[2]	
SRK-15D-09T	784	2.6	9-Jul-15[1]	31-Oct-15[2]	
SRK-15D-09T	784	4.1	9-Jul-15[1]	31-Oct-15[2]	
MW15-02T	737	1.2	29-May-15	25-Oct-15	
MW15-02T	737	3.2	13-Apr-15	29-Apr-15	Sensor essentially records 0°C for entire data period.
MW15-02T	737	5.2	13-Apr-15	9-Jul-15	

Notes:
1. Above zero temperatures coincide with start of record.
2. Above zero temperatures until end of record.

4.2 Hydraulic Testing

Over 40 successful measurements of bedrock hydraulic conductivity have been collected throughout the various field programs undertaken at the site. Hydraulic testing results are summarized in Table 4-3 and plotted versus vertical depth below ground surface in Figure 4-5 and Figure 4-6. Values obtained for intervals suspected of being unsaturated have been removed from Table 4-3, but are included the results tabulated in Appendix 4-C. Most measurements were acquired through packer testing (constant head injection and Lugeon tests), but airlift yield recovery tests and slug tests were also performed. In one case, hydraulic conductivity was determined from a water level response due to sampling of a well. Field and analytical methods for hydraulic testing have been provided in Appendix 3-E along with detailed results.

The hydraulic conductivity data range over several orders of magnitude with values exceeding 1E-06 m/s and others below the resolution of the testing method (<1E-10 m/s). A broad range in hydraulic conductivity values is typical of a fractured bedrock system (Golder, 2010). A regression line though the data points (Figure 4-5) indicates a broad trend of decreasing hydraulic conductivity with depth with exception to a cluster of higher hydraulic conductivity values at over 200 metres depth. Most of these elevated values at depth are attributed to SRK's testing program which specifically targeted geologic structures intersecting the proposed pits. They report a narrow range (1E-07 m/s to 3E-06 m/s) of hydraulic conductivity values for the structures with an arithmetic mean value of 7E-07 m/s (Appendix 3-G). An arithmetic mean was presented for the fracture zone tests rather than a geometric mean because the values represent uni-directional flow in planar features rather than radial groundwater flow. The arithmetic mean of tests performed in valley locations (Table 4-3) is 1E-06 m/s, which is consistent with SRK's pit structure results and supports the inference that valley traces represent fault structures. An arithmetic mean of all valley and pit structure hydraulic conductivity results is 9E-07 m/s.

Figure 4-6 plots hydraulic conductivity results versus depth grouped by lithology. Based on the wide spread in values for the major rock units and combinations thereof, rock type does not appear to play a large control on hydraulic properties. Rather, structural features, which cross-cut all lithologies, impart the dominant control on hydraulic conductivity.

Figure 4-7 presents statistics for the hydraulic conductivity data set as box and whisker plots (legend in lower pane). For the upper box, a mean hydraulic conductivity value was computed for each hole where multiple hydraulic tests were performed, and then statistics were computed on the resultant data set of 22 values. Following the protocols above, multiple tests on fractured holes (valley and SRK tests) were computed as an arithmetic average, while multiple tests on other boreholes were averaged geometrically. For the bottom box, all tests were treated individually (43 values). Predictably, the pre-processed data set in the upper box shows a tighter spread in the values, with 25th to 75th percentile hydraulic conductivity values ranging from 2E-08 to 2E-07 m/s, with a geometric mean of all boreholes of 5E-8 m/s. When all tests are treated individually, the geometric mean of the entire 43-value data set is 2E-08 m/s.

Slug tests were performed on overburden wells MW15-03AZ (lower Halfway Creek) and MW15-02AZ (South WRSF drainage). The formation recovered within a few seconds suggesting extremely high formation permeability. The test data could not be interpreted due to influence from the sand pack but are included in Appendix 3-E for completeness.

**Table 4-3:
Hydraulic testing results for the Coffee Gold project.**

Hole ID	Consultant	Azimuth	Dip	Test Interval[1] (v. m bgs) From	To	Test Method	Test Type[2]	Analysis Type[3]	K[4] (m/s)	Geologic Unit[5]
Supremo										
MW14-01A	Lorax	0	-90	155	166	Packer	CHI	Thiem	4E-08	GN
MW14-01A	Lorax	0	-90	179	202	Packer	CHI	Thiem	3E-08	GN/BFS/GN
MW14-04T	Lorax	0	-90	182	202	Packer	CHI	Thiem	2E-10	BFS
MW14-04T	Lorax	0	-90	164	202	Packer	Lugeon	Thiem	6E-10	GN/BFS
MW14-04T	Lorax	0	-90	203	232	Packer	Lugeon	Thiem	1E-09	BFS/GN
MW14-04T	Lorax	0	-90	233	256	Packer	Lugeon	Thiem	4E-09	GN
MW14-04T	Lorax	0	-90	251	280	Packer	CHI	Thiem	3E-10	GN
MW14-04T	Lorax	0	-90	281	301	Packer	CHI	Thiem	*4E-11*	GN
MW14-06A	Lorax	0	-90	197	216	Slug Test	RH Slug	Hvorslev	1E-07	GN
MW15-06T	Lorax	0	-90	281	286	Westbay	Pulse Test	Hvorslev	1E-09	GN
MW15-06T	Lorax	0	-90	238	243	Westbay	Pulse Test	Hvorslev	2E-07	GN
MW15-06T	Lorax	0	-90	227	237	Westbay	Pulse Test	Hvorslev	1E-08	GN
CFD-0318	EBA	175	-45	89	91	Packer	Lugeon	Thiem	5E-07	Dikes/GN
CFD-0318	EBA	175	-45	105	108	Packer	Lugeon	Thiem	1E-06	Amph
CFD-0318	EBA	175	-45	118	122	Packer	Lugeon	Thiem	5E-08	GN
CFD-0319	EBA	0	-45	76	83	Packer	Lugeon	Thiem	7E-08	GN/Dikes
CFD-0323	EBA	280	-70	93	118	Packer	Lugeon	Thiem	4E-08	GN/BtS
IFSPD124	SRK	270	-50	36	125	Slug Test	FH Slug	Hvorslev	2E-07	GN
IFSPD110a	SRK	270	-50	220	239	Slug Test	FH Slug	Hvorslev	2E-07	GN
CFD-0324	EBA	280	-45	54	60	Packer	Lugeon	Thiem	4E-08	BtS_Carb
CFD-0324	EBA	280	-45	72	105	Packer	Lugeon	Thiem	1E-07	BtS_Carb
CFD-0327	EBA	275	-60	73	86	Packer	Lugeon	Thiem	5E-08	GN
MW14-02B	Lorax	0	-90	85	104	Packer	CHI	Thiem	5E-09	GN
MW14-02B	Lorax	0	-90	103	125	Packer	CHI	Thiem	8E-08	GN
MW14-02B	Lorax	0	-90	130	137	Packer	CHI	Thiem	3E-08	SZ/BFS
MW14-02B	Lorax	0	-90	139	152	Packer	CHI	Thiem	1E-07	BFS/CB
MW14-02B	Lorax	0	-90	157	173	Packer	CHI	Thiem	1E-08	CB/HAR/CB
MW14-02B	Lorax	0	-90	181	200	Packer	CHI	Thiem	1E-08	BFS
Latte										
MW14-03A	Lorax	0	-90	157	199	Packer	CHI	Thiem	5E-09	BFS/SZ/BFS
SRK-15D-15P	SRK	0	-90	200	274	Airlift	Airlift Recovery	Theis Recovery	3E-07	GN/BtS/Cl-LiB
Kona										
MW14-05A	Lorax	0	-90	156	179	Packer	CHI	Thiem	*4E-11*	GR
MW14-05A	Lorax	0	-90	183	200	Packer	CHI	Thiem	3E-09	GR
MW14-05A	Lorax	0	-90	201	221	Packer	CHI	Thiem	1E-09	GR
MW14-05A	Lorax	0	-90	156	221	Packer	CHI	Thiem	1E-09	GR
MW14-05B	Lorax	0	-90	139	118	Slug Test	RH Slug	Hvorslev	5E-10	GR
SRK-15D-14P	SRK	345	-70	173	212	Packer	CHI/FH Slug	Hvorslev	1E-07	GR
Double Double										
SRK-15D-16P	SRK	165	-70	137	150	Packer	CHI/FH Slug	Cooper-Jacob/Theis	2E-07	CB/dyke
SRK-15D-16P	SRK	165	-70	167	214	Packer	Airlift Recovery	Theis Recovery	1E-07	dyke/GN
Valley										
MW14-07T	Lorax	0	-90	64	89	Packer	Lugeon	Thiem	3E-08	GR
MW14-07T	Lorax	0	-90	83	125	Packer	Lugeon	Thiem	1E-08	GR
MW15-05T	Lorax	125	-80	51	83	Airlift	Airlift Recovery	Cooper-Jacob	3E-06	GR
MW15-03T	Lorax	39	-80	32	97	Airlift	Airlift Recovery	Cooper-Jacob	3E-07	BN/BtS
MW15-04T	Lorax	40	-80	40	53	Packer	Shut-In/CHI	Lugeon	4E-06	GN

Notes:
m AH = metres along hole, v mbgs = vertical metres below ground surface, K = hydraulic conductivity
1. Depth below ground surface for inclined tests has been calculated by Lorax to take surface topography into account.
2. CHI = constant head injection, FH = falling head test
3. Thiem (1906); Cooper-Jacob (1946), Hvorslev (1951), Theis (1935)
4. *Italicised red* values are an inferred upper value computed based on injection pressures and resolution of flow gauge
5. Multiple tests at valley drillholes and pit structures (SRK tests) averaged arithmetically; all other holes with multiple tests averaged geometrically
6. Tests straddling two or more geologic units denoted by a '/' (*e.g.* BFS/CB). Amph = Amphibole rich rock, BtS = Biotite Schist, BFS = Biotite Feldspar Schist, CB = Crackle Breccia, Carb = Carbonates, D = Dacite, GN = Gneiss, GR = Granite, HAR = Hydrothermally Altered Rock, M = Metacarbonate, SZ = Shear Zone, Cl-LiB = Chlorite limonite breccia

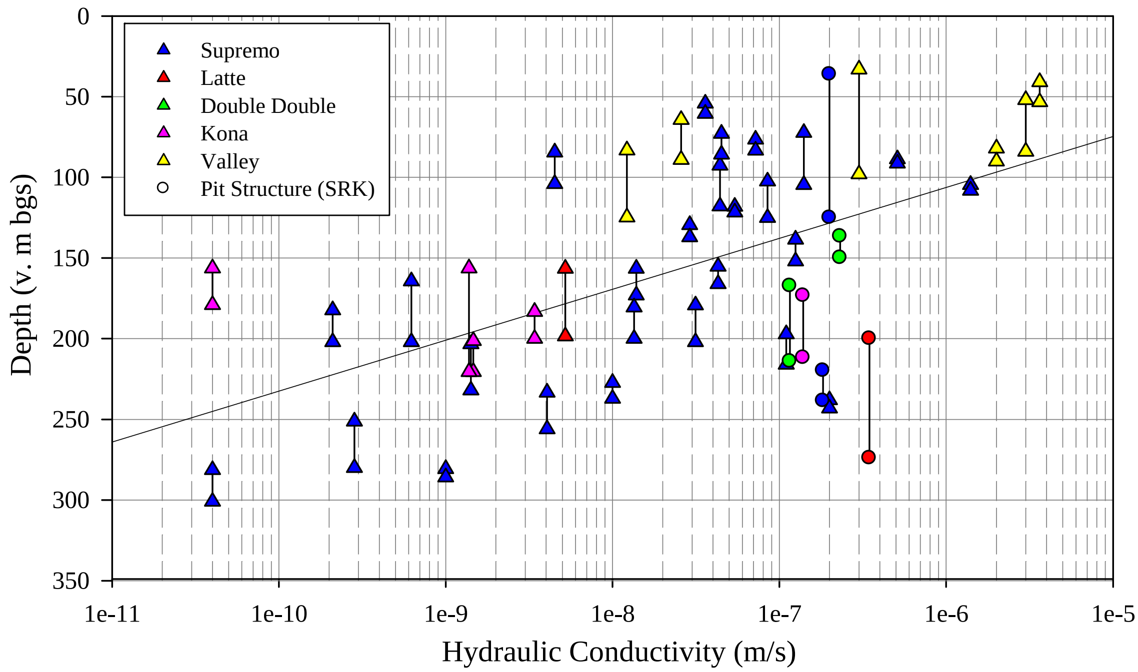

Figure 4-5: Bedrock hydraulic conductivity versus vertical depth below ground surface at the Coffee Gold Project (organized by area).

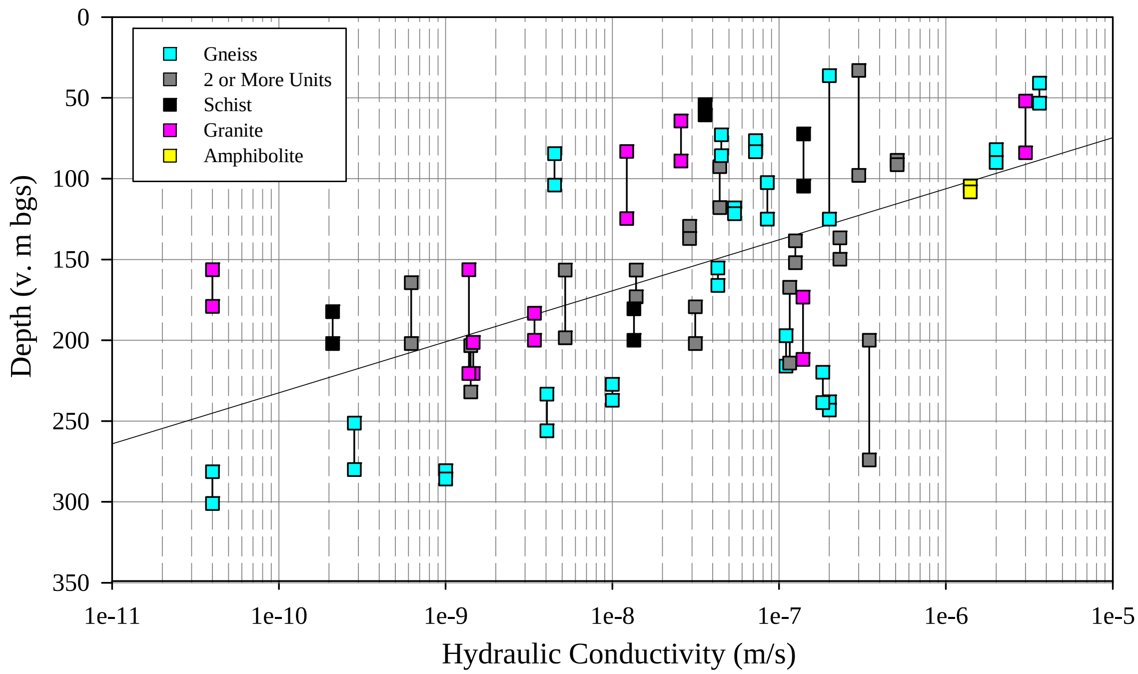

Figure 4-6: Bedrock hydraulic conductivity versus vertical depth below ground surface at the Coffee Gold Project (organized by lithology).

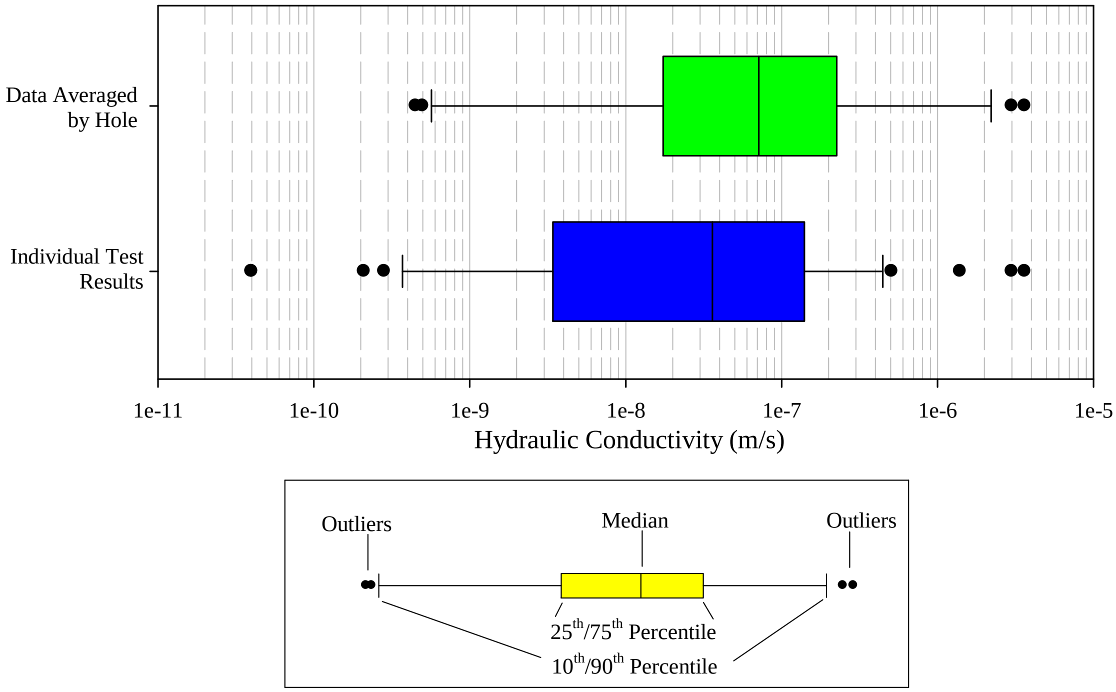

Figure 4-7: Box and whisker plot of hydraulic testing results with legend in bottom pane.

4.3 Water Levels and Gradients

A summary of groundwater level monitoring at the Coffee Gold site is provided in Table 4-4. Groundwater level monitoring started in the fall of 2013 with the inception of the VWPs installed by EBA TT. Readings from these installations were collected sporadically until dedicated, continuously recording dataloggers were connected in the fall of 2014. Conventional monitoring wells installed by Lorax in the summer/fall of 2014 were equipped with Solinst Leveloggers (pressure transducer with onboard datalogger) but the loggers were pulled shortly thereafter (except at MW14-03A/B) over concern of freezing. The loggers were reinstated in June 2015 and remain in place at the time of reporting. Pressure data recorded by Leveloggers (deployed at conventional monitoring wells) have been corrected for barometric pressure while pressure data from VWPs have not as they are not directly exposed to atmospheric pressure. A continuous water level record is available from most instruments on site from June 2015 onwards.

Bedrock water levels measured in June 2015 are presented in Table 4-4 and are contoured in Figure 3-1. Vertical hydraulic gradients measured at conventional wells pairs and nested VWP sensors are summarized in Table 4-5 and plotted in Figure 4-8. Horizontal hydraulic gradients measured between installations in June 2015 are summarized in Table 4-6. Water levels are highly variable across the site with the deepest water levels (from 130 to over

220 metres below ground surface) measured in ridge areas and flowing artesian conditions measured in the drainages. Figure 3-1 shows groundwater levels mimic topography in a subdued fashion, which is typical of hilly/mountainous terrain but not necessarily typical of groundwater systems influenced by permafrost. Permafrost is inferred to confine groundwater levels at some locations.

Water level hydrographs are discussed in more detail below, grouped by drainage area, with focus on 2015 data. As indicated above, several locations (namely CFD0351, CFD0324, CFD0318, MW14-07T) do have continuous data extending back 2014. Differences in annual recharge distribution are manifested in the groundwater hydrographs. An extended dry period persisted well into June 2015 which was followed by regular precipitation amounting to over 240 mm, more than double than what fell in the same period in 2014 (~100 mm). This has resulted in a much larger seasonal fluctuation in VWP hydrographs in 2015 over 2014 although it is hard to accurately constrain this given the gap in some of the data records between May and October of 2014. The short 2014 data record, confounded by drilling artefacts, precludes comparison of 2014 and 2015 hydrographs at conventional monitoring well pairs. 2015 experienced a below average snowpack that resulted in a modest snowmelt freshet which started around May 9th, 2015. The freshet peak is noticeable in some of the hydrometric station plots, but is largely absent in the groundwater hydrographs.

Table 4-4:
Selected water level information for the Coffee Gold project.

Monitoring ID[1]	Pad	Class[2]	Period of Record[3]	Monitoring Depth[4] (m bgs)	Base of Permafrost (m bgs)	Water Level[5]			WL Fluctuation[6] (m)
						m bgs	m asl	date	
MW14-02A	BH9	MW	sporadic Sep/14, continuous Jun/15 onward	188.2	34	11.9	1017.7	23-Jun-15	13.0
MW14-02B	BH9	MW	sporadic Sep/14, continuous Jun/15 onward	146.6	34	21.4	1009.6	23-Jun-15	12.2*
MW14-03A	BH3	MW	since Oct/14	191.3	62≤ x ≤133	137.8	959.8	23-Jun-15	5.4
MW14-03B	BH3	MW	since Oct/14	145.7	62≤ x ≤133	135.3	959.8	23-Jun-15	5.4
MW14-05A	BH11	MW	sporadic Sep/14, continuous Jun/15 onward	206.4	<134	132.3	1136.2	23-Jun-15	0.5
MW14-05B	BH11	MW	sporadic Sep/14, continuous Jun/15 onward	171.0	<134	134.1	1136.2	23-Jun-15	0.5
MW15-02 AZ	BH10	OW	since May 31/15	5.6	none	6.1	731.2	23-Jun-15	-0.9
MW15-03 AZ	BH12	OW	since Jun 16/15	3.3	10 ≤ x ≤ 20	1.6	556.3	23-Jun-15	0.0*
MW15-01WB-P1	BH8	WB	4 spot measurements Jun-Sep, 2015	90.5	70	36.2	767.4	07-Jun-15	
MW15-01WB-P6	BH8	WB	4 spot measurements Jun-Sep, 2015	77.8	70	36.1	767.4	07-Jun-15	
MW15-02WB-P1	BH10	WB	4 spot measurements Jun-Sep, 2015	63.3	0	9.2	727.9	07-Jun-15	
MW15-02WB-P4	BH10	WB	4 spot measurements Jun-Sep, 2015	19.2	0	2.5	734.6	07-Jun-15	
MW15-03WB-P1	BH12	WB	4 spot measurements Jun-Sep, 2015	98.7	10 ≤ x ≤ 20	-2.0	559.9	15-Jun-15	
MW15-03WB-P7	BH12	WB	4 spot measurements Jun-Sep, 2015	40.9	10 ≤ x ≤ 20	0.4	557.5	15-Jun-15	
MW15-04WB-P1	BH4	WB	4 spot measurements Jun-Sep, 2015	61.7	31	-0.9	672.3	13-Jun-15	
MW15-04WB-P5	BH4	WB	4 spot measurements Jun-Sep, 2015	35.1	31	-1.1	672.5	13-Jun-15	
MW15-05WB-P1	BH2	WB	4 spot measurements Jun-Sep, 2015	80.3	47	23.1	1044.6	17-Jun-15	
MW15-05WB-P4	BH2	WB	4 spot measurements Jun-Sep, 2015	62.7	47	23.0	1044.7	17-Jun-15	
MW15-06WB-P3	BH5	WB	4 spot measurements Jun-Sep, 2015	265.8	168	228.1	956.8	19-Jun-15	
MW15-06WB-P7	BH5	WB	4 spot measurements Jun-Sep, 2015	232.2	168	222.3	962.7	19-Jun-15	
MW14-07T	BH1	T/VWP	since Oct 2014	124.4	62	-8.0	1164.2	23-Jun-15	1.3
MW15-01T	BH8	T/VWP	since May 25/15	76.0	70	37.4	766.6	23-Jun-15	4.8
MW15-01T	BH8	T/VWP	since May 25/15	89.0	70	37.8	766.2	23-Jun-15	4.8
MW15-02T	BH10	T/VWP	since Mar 26/15	33.9	0	10.3	726.8	23-Jun-15	1.3

Monitoring ID[1]	Pad	Class[2]	Period of Record[3]	Monitoring Depth[4] (m bgs)	Base of Permafrost (m bgs)	Water Level[5]			WL Fluctuation[6] (m)
						m bgs	m asl	date	
MW15-03T	BH12	T/VWP	since Jun 15/15	48.8	10 ≤ x ≤ 20	0.0	557.0	23-Jun-15	-0.9
MW15-03T	BH12	T/VWP	since Jun 15/15	94.7	10 ≤ x ≤ 20	-5.1	561.2	23-Jun-15	1.5
MW15-04T	BH4	T/VWP	since May 14/15	51.6	31	-0.6	670.9	23-Jun-15	2.7*
MW15-04T	BH4	T/VWP	since May 14/15	38.8	31	-0.5	670.8	23-Jun-15	2.7*
MW15-05T	BH2	T/VWP	since May 22/15	55.4	47	24.3	1042.7	23-Jun-15	0.8
MW15-05T	BH2	T/VWP	since May 22/15	81.4	47	37.9	1029.1	23-Jun-15	3.6
MW15-07T	BH7	T/VWP	since Jul 10/15	267.8	140	136.8	1046.4	10-Jul-15	10.7
MW15-07T	BH7	T/VWP	since Jul 10/16	239.0	140	138.2	1045.0	10-Jul-15	11.3
SRK-15D-07T		T/VWP	since Sep 8/15	149.2	85	50.5	898.4	08-Sep-15	0.0
SRK-15D-07T		T/VWP	since Sep 8/15	103.6	85	44.7	904.1	08-Sep-15	0.0
SRK-15D-08AT		T/VWP	since Jul 9/15	149.2	75	-2.2	927.3	09-Jul-15	3.9*
SRK-15D-08AT		T/VWP	since Jul 9/15	103.6	75	-9.1	934.2	09-Jul-15	3.7
SRK-15D-09T		T/VWP	since Jul 9/15	99.7	0	1.4	782.9	09-Jul-15	3.3
CFD318		VWP	Sporadic Oct/13, continuous Oct/14 onward	118.0	?	118.0	1092.0	23-Jun-15	28**
CFD324		VWP	Sporadic Oct/13, continuous Oct/14 onward	178.3	?	61.3	931.6	23-Jun-15	5.0
CFD332		VWP	Sporadic Oct/13, continuous Oct/14 onward	116.6	?	(-)	(-)	(-)	dry from start
CFD351		VWP	Sporadic Oct/13, continuous Oct/14 onward	184.4	?	155.9	967.8	23-Jun-15	32*

Notes:
1. MW15-01WB-P1 – P1 indicates the port number in the Westbay system, not all ports are presented
2. MW-conventional monitoring well (deep), OW-conventional overburden monitoring well, WB – Westbay monitoring system, VWP-vibrating wire piezometer, T-thermistor
3. Last download of VWPs and conventional monitoring well loggers occurred late October 2015
4. Monitoring depth equivalent to sand pack midpoint for conventional monitoring wells, zone midpoint in Westbay, vertical depth below ground surface for VWP sensor
5. Water levels used for groundwater model calibration, roughly coincides with low point in the 2015 well hydrograph.
6. Water level fluctuation as measured from June/July 2015 to end of period of record (late October 2015). Computed for continuously logged instruments only (wells with loggers and VWPs). May not capture full magnitude of changes except where indicated by asterisk*. ** indicates 2014 fluctuation.

Table 4-5:
Vertical hydraulic gradients measured at selected installations across the Coffee Gold Project.

Monitoring Location	Shallow Monitoring Point[1] (m bgs)	Deep Monitoring Point[1] (m bgs)	Vertical distance (m)	Approximate Gradient Range[2,3] (m/m)
MW15-01T	76.0	89.1	13.1	0.03 to 0.035
MW15-02WB	13.7	9.2	4.5	-0.39
MW15-02WB	32	61	29	0.24
MW15-03T	49.6	96.2	46.7	-0.08 to -0.11
MW15-04T	38.8	51.6	12.8	-0.01 to 0.033
MW15-05T	55.4	81.4	26.0	0.56 to 0.42
MW15-06WB	241.3	251.9	10.6	0.72
MW15-06WB	251.9	287	35.1	-0.18
MW15-07T	239	267.8	28.8	-0.02 to -0.04
SRK-15D-07T	103.6	149.2	45.6	-0.18 (steady)
SRK-15D-08AT	103.6	149.2	45.6	0.13 to 0.16
MW14-02A/B	146.6	188.2	41.6	-0.20 to -0.26
MW14-03A/B	145.7	191.3	45.6	0.005 to -0.002
MW14-05A/B	171	206.4	35.4	0.0 to -0.01

Notes:
1. Monitoring point depths as follows: VWP sensor depth in vertical metres below ground surface; Westbay port depth; conventional monitoring well screen midpoint.
2. Positive values indicate downward gradient, negative values indicate upward gradient.
3. Based on 2015 data only for continuously logged locations ignoring initial readings after installation; gradient at Westbay installations computed for September 2015 readings only.

Table 4-6:
Horizontal hydraulic gradients measured in June 2015 across the Coffee Gold Project in June 2015.

Well Pair	Horizontal Distance	Topographic Gradient	Hydraulic Gradient[1,2]
YT-24 Drainage			
MW15-07T – SRK-15D-07T	835	28%	18%
SRK-15D-07T – MW15-01T	1,061	14%	12%
Halfway Creek Drainage			
MW14-03B - SRK-15D-08AT	3,522	4%	1%
MW14-05B - SRK-15D-08AT	5,943	5%	4%
MW15-06WB (P7) – Halfway Ck	1,256	39%	21%
SRK-15D-08AT – MW15-04T	1,592	17%	16%
MW15-04T – MW15-03T	2,233	5%	5%
South WRSF Drainage			
CFD0351 – CFD0324	718	23%	5%
MW14-02B – CFD0324	408	18%	21%
CFD324 – SRK-15D-09T	1,154	15%	13%
SRK-15D-09T – MW15-02T	475	10%	12%
Latte Creek Drainage			
MW14-07T – MW15-05T	639	14%	19%

Notes:
1. Water levels from SRK VWPs are measured in July and September, 2015; all other water levels measured in June, 2015.
2. Where two or more monitoring levels are available at an installation, the measurement from the shallower install is used.

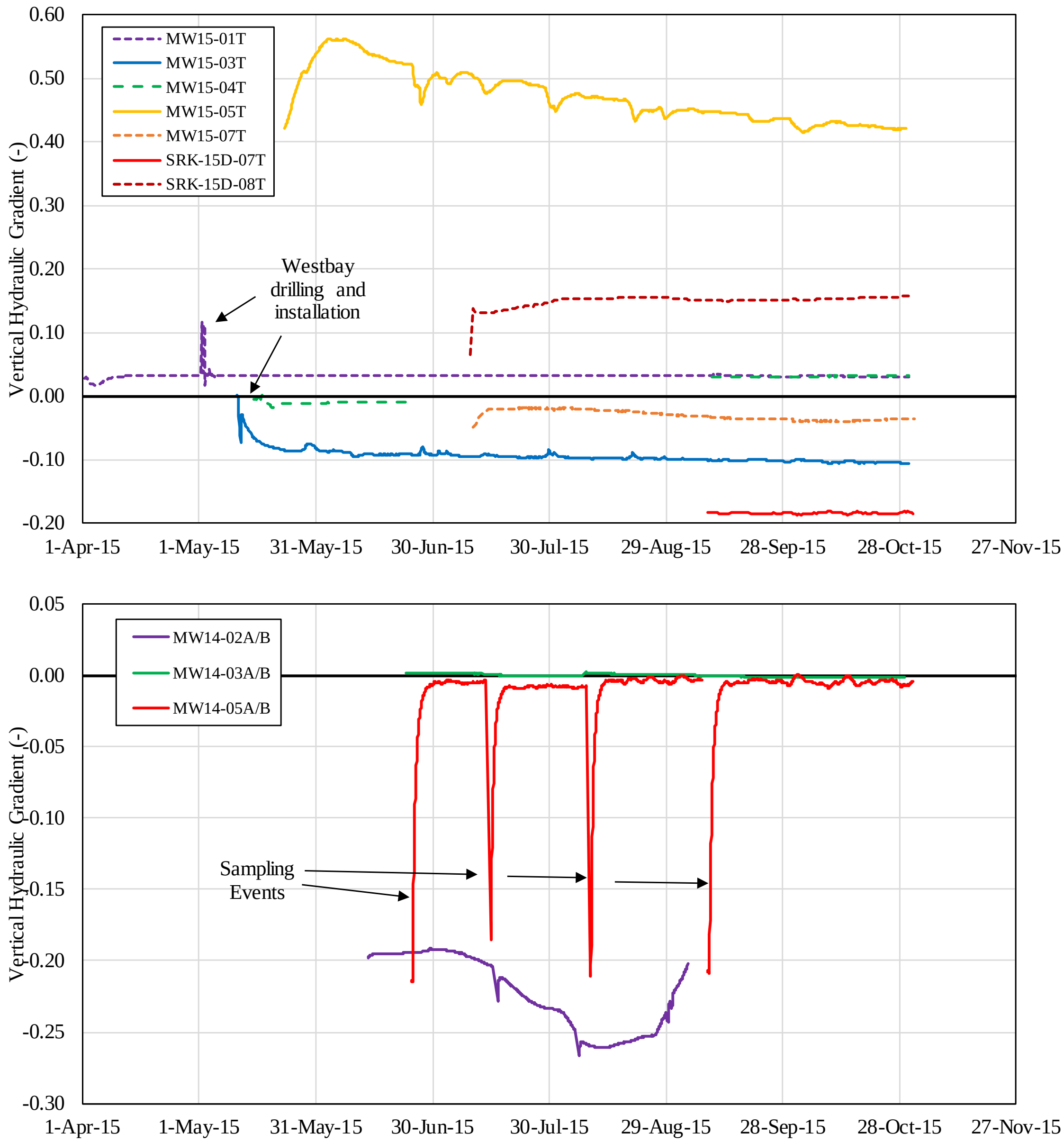

Figure 4-8: 2015 Vertical gradient time series for VWPs (upper pane) and conventional monitoring wells (bottom pane).

4.3.2 Halfway Creek

There are several installations that fall within the Halfway Creek catchment. Monitoring locations MW14-05A/B, MW14-03A/B and SRK-15D-08T fall in the southern extent of the drainage and are grouped together in Figure 4-9. All other installations, including those completed near the proposed Supremo pit and in the lower reaches of the drainage are shown in Figure 4-10.

The 2014 data collected from MW14-03A/B and MW14-05A/B is heavily influenced by drilling artefacts (not all data are shown). From June 2015 onward, the hydrographs for these locations are considered representative of natural conditions, minus the influence of groundwater sampling at MW14-05A/B. Vertical gradients between the shallow and deep wells at both locations are essentially negligible (<1%). The hydrographs at MW14-03A/B start climbing in response to seasonal recharge in mid-July, a few weeks after the onset of summer precipitation and do not respond to individual rainfall events. Water levels have increased by ~5 metres as of the end of October and could increase more. An ice lens observed in core while drilling MW14-03A/B suggests permafrost is present to at least 62 metres depth; however, it does not appear to extend to the saturated zone as the wells remain unfrozen (water levels are ~130 metres below ground surface). Good to excellent quality rock (with RQD exceeding 75%) above the screened interval likely confines groundwater in this area. RQD information is provided in the borehole logs (Appendix 3-A).

The groundwater levels in the footprint area of the proposed Kona Pit (MW14-05A/B) are of similar depth as at the well pair MW14-03A/B; however, there is a much more subdued response to seasonal recharge (<1 metre) from August to October. There is some noise in the record, which appears to be an artefact of barometric compensation of the files. Besides this, there is an increase in the deep well water level that starts in early July and recovers by mid-August, suggesting a short-term response to early summer rainfall.

SRK-15D-08AT is located at the confluence of the east and west forks of Halfway Creek. Groundwater pressures measured at both shallow and deep VWP sensors are strongly artesian (2 to 13 metres above ground surface) although the vertical gradient is markedly downward (~15%). This could suggest that a deep permeable feature is under-draining the area. Permafrost, as measured by the accompanying thermistor string, extends to 75 metres below ground surface at this location and likely contributes as a confining unit. The hydrographs show a seasonal response to rainfall, climbing 3 to 4 metres from the instrument inception in early July through mid-October. Water levels appear to be recovering at the end of October. Water levels appear to be insensitive to individual rainfall events.

Horizontal hydraulic gradients measured between MW14-05B and SRK-15D-08AT in the summer of 2015 are reasonably consistent with the topographic gradient of 5% (Table 4-5). The horizontal hydraulic gradient between MW14-03B and SRK-15D-08AT is more subdued at 1%.

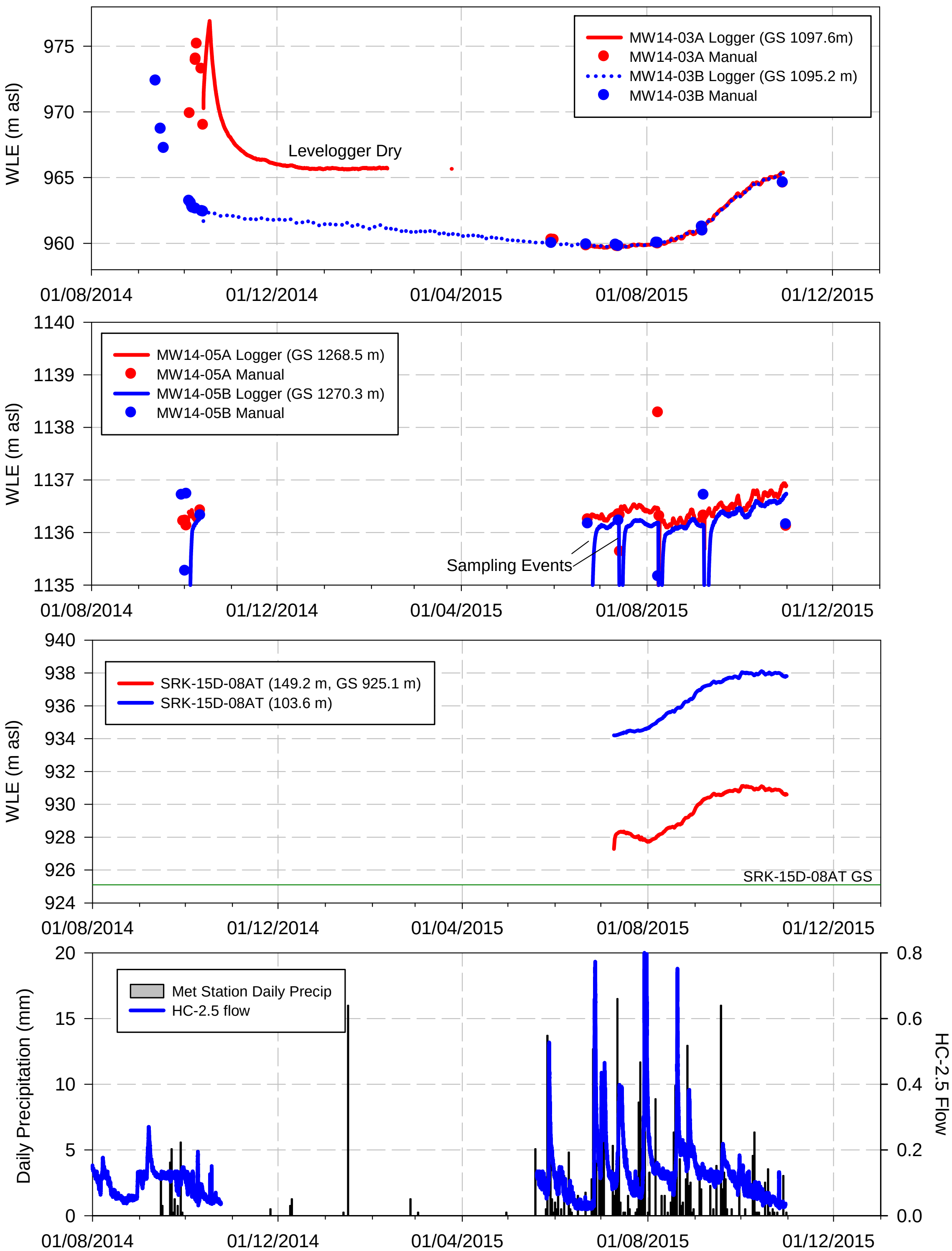

Figure 4-9: Groundwater level hydrographs measured in Halfway Creek drainage, south extent.

MW15-06WB and CFD0318 characterize groundwater draining the northwest and southwest slopes surrounding the proposed Supremo Pit, respectively. As MW15-06WB is a Westbay install, only spot measurements are available (Figure 4-10). The readings taken during the 2015 sampling rounds indicate a very deep water table (>220 metres below ground surface) without a clear response to seasonal recharge. Bedrock ~252 metres below ground surface appears to be draining more readily, as vertical hydraulic gradients are towards this zone (70% downward from an upper port at 241 m, and 18% upward from a lower port at 287 m). The horizontal hydraulic gradient measured between one of the shallower ports at MW15-06WB and Halfway Creek is approximately 21% or half of the topographic gradient.

The water level at CFD0318 has continually declined since September 2014; the sensor apparently became dry in March/April and has not re-wetted. It is unclear if data from this sensor are presently reliable. If it is not malfunctioning, the 2014 groundwater pressures that water levels are much closer to ground surface on this side of the ridge (90 to >120 m bgs) as compared to MW15-06WB (>220 m bgs).

The final two installations, MW15-04T and MW15-03T, are located immediately adjacent to the Halfway Creek channel. MW15-04T is located in close proximity to the hydrometric station HC-2.5. The hydrograph at MW15-04T responds to both short term rainfall events and is overprinted by a longer term seasonal trend. Some of the flashiness recorded at the HC-2.5 station is represented in the MW15-04T hydrograph, although with a time lag and some peaks appear muted compared to others. The early decline in the hydrographs (mid-May through end of June) appears to coincide with recovery from freshet. The long term seasonal increase starting from late-June is synchronous with the onset of consistent rainfall in the area. The hydrographs peak at the end of September, 2.5 metres higher than June. Groundwater levels measured by both VWP sensors have been flowing artesian (~3 m above ground) since inception of the instrument, indicating confined conditions, possibly arising from permafrost. Resting flow rates measured at the Westbay hole advanced from the same pad were on the order of 30-40 US GPM (Figure 4-11). Vertical gradients computed from VWP sensors were essentially negligible in May/June, but have become more strongly downward (3%) through the summer. The active zone well at this location has remained dry since inception. The horizontal hydraulic gradient measured between this VWP and the upgradient installation SRK15D-08AT is 16% which is roughly equivalent to the topographic gradient (Table 4-5).

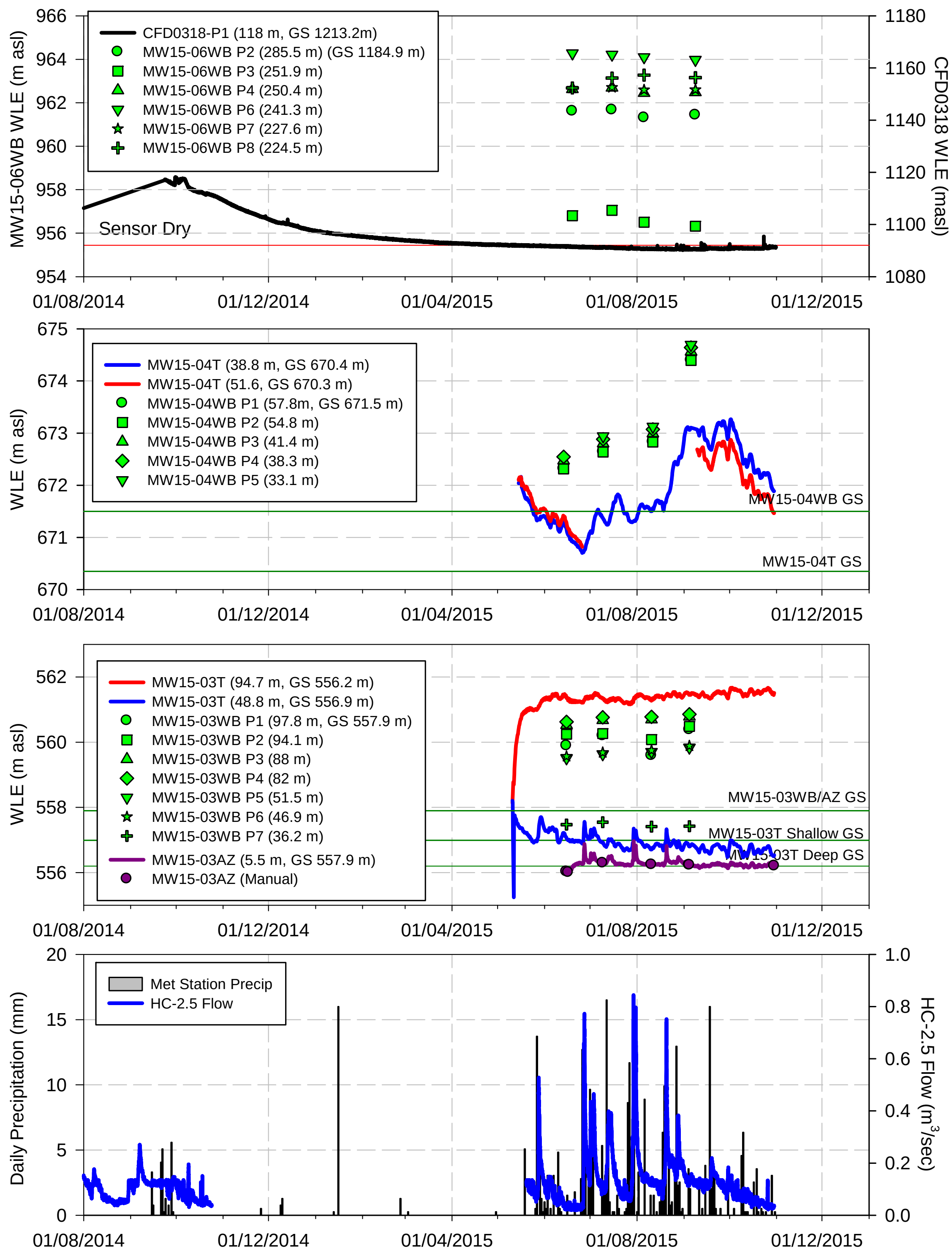

Figure 4-10: Groundwater level hydrographs measured in Halfway Creek drainage, west and north extent.

Figure 4-11: Artesian flows encountered during advancement of MW15-04WB.

MW15-03T and MW15-03WB were installed to characterize groundwater downgradient of a lineament (inferred to be a fault) that crosscuts Halfway Creek and adjacent drainages (Figure 3-1). The VWP sensors reveal an upward hydraulic gradient at this location which has become stronger through September/October (10%). The shallow and deep VWP sensors display opposite trends, with the deeper sensor showing much more muted responses to individual rainfall events. The lower sensor has recorded artesian pressures since inception, while artesian pressures measured at the shallower sensor have receded to just below ground surface. It is unclear if permafrost contributes to groundwater confinement in this area. Ice fragments were encountered in shallow bedrock at this hole, however the thermistor string does not capture frozen ground conditions. The shallow/active zone well has contained water since May and remained unfrozen through October 2015. The water level trend through 2015 is generally flat but reflects some of the flashiness of the HC-2.5 hydrograph. The horizontal hydraulic gradient between MW15-03T and MW15-04T is approximately equivalent to the topographic gradient (5%).

4.3.3 YT-24 Drainage

Groundwater level data is available for several installations along the YT-24 drainage (Figure 4-12). At the headwaters, both VWPs at MW15-07T have shown a steady increase in pressure (nearly 12 metres) since inception in July 2015. The water levels have now climbed several meters above the inferred base of permafrost (~140 m bgs). The hydrograph is smooth and does not show perturbations caused by individual rainfall events. The gradient thus far has been consistently upward, slightly increasing (to 4%) into the fall/winter of 2015. Water levels measured at this installation fall in line with a stabilized water level at MW14-06A, a 2014 monitoring well established at the same pad which later collapsed. The bedrock is inferred to be confined at this location.

Farther downgradient, the water levels measured at SRK-15D-07T have remained very flat over the short period of record (September 9th to October 31st, 2015). At this location, there is a much stronger upward gradient (~18%) and groundwater pressures are ~35 to 40 m above the base of permafrost. The deeper piezometer (~150 m bgs) shows some small fluctuations (tens of centimetres) that are consistent with barometric pressure changes. The bedrock is inferred to be confined at this location as well. The horizontal hydraulic gradient measured between MW15-07T and SRK-15D-07T is 18%, about two thirds of the topographic gradient.

MW15-01T has the longest water level record in this drainage (Table 4-4). As opposed to installations completed further upgradient, the vertical gradient at this location is downward (~3%). The hydrographs have risen three metres since the end of July, more or less at the same time as MW15-07T. Like MW15-07T, individual rainfall events are not discernible in the hydrograph at MW15-01T. The groundwater pressures at this location are greater than 30 metres above the base of permafrost. The bedrock is inferred to be well confined at this location. The active zone well MW15-01AZ intercepted water at some point in June/July 2015, which froze the logger in place. Free water was not observed in the well in subsequent visits. The horizontal hydraulic gradient measured between MW15-07T and MW15-01T is 12%, nearly equal to the topographic gradient (Table 4-5).

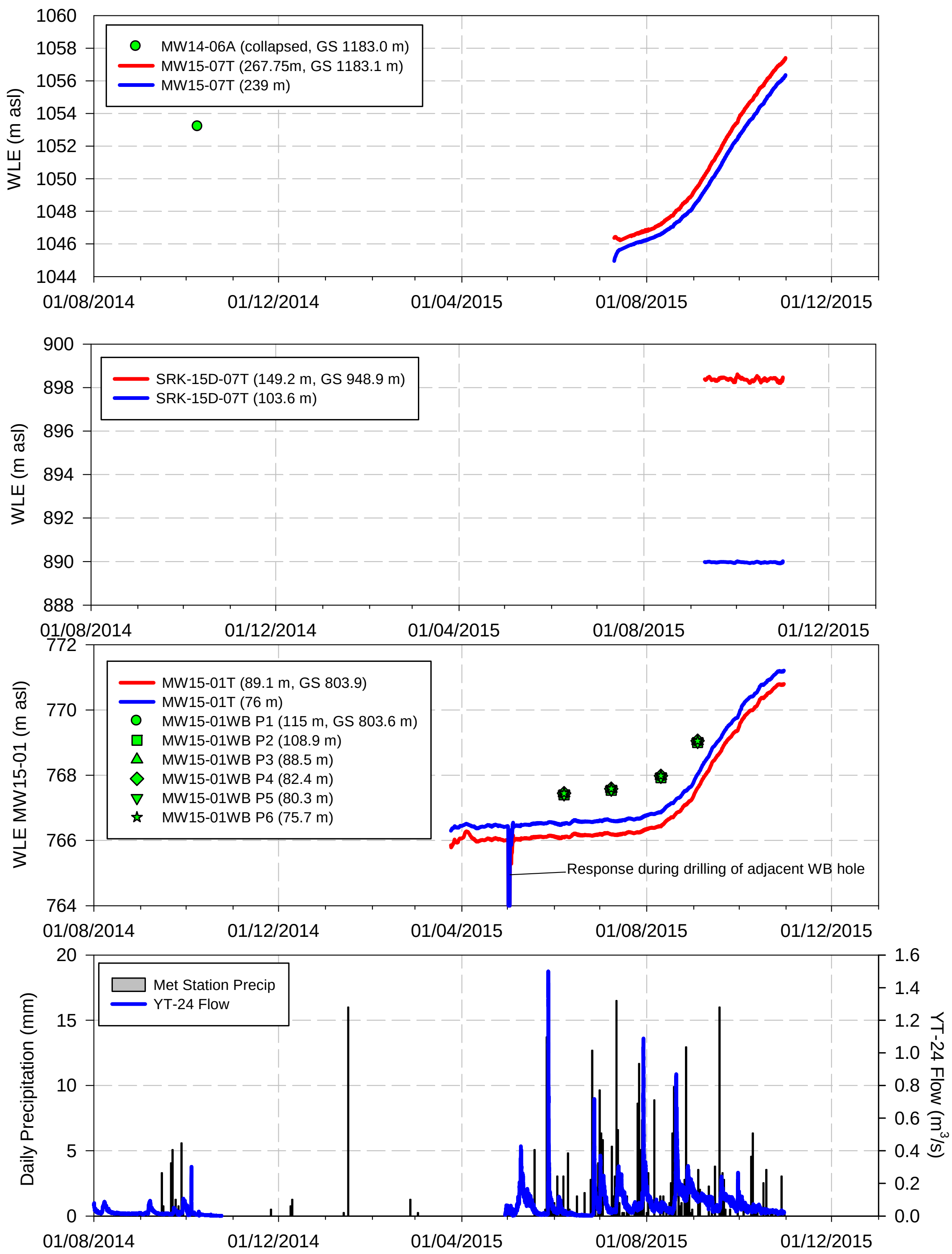

Figure 4-12: Groundwater level hydrographs measured in YT-24 drainage.

4.3.4 South Waste Rock Storage Facility Drainage

The South Waste Rock Storage Facility (WRSF) drainage is instrumented in its upper reaches with a conventional monitoring well pair (MW14-02A/B) on the north fork and VWP CFD0351 on the west fork. Both locations demonstrate a strong response to seasonal recharge; water levels through 2015 have climbed ~13 metres at MW14-02A/B and over 30 metres at CFD0351 (Figure 4-13). The timing of the hydrograph increase is nearly the same at both installs, MW14-02A/B starts to rise at the beginning of July while CFD0351 follows in mid-July. Despite similar hydrograph responses, the water level at CFD0351 is deep (~125 to 155 m bgs) compared to the water levels at MW14-02A/B which are near ground surface. The deep well at MW14-02A ultimately became flowing artesian in September and has remained flowing at surface through October 2015. Once MW14-02A started to flow, the bedrock started to depressurize as evidenced by declining water levels at MW14-02B. Up to this point, vertical gradients at this well pair were ~18% upward. In 2014, water levels remained below ground surface and the water column froze to approximately 34 metres below ground surface over the winter (due to permafrost). Both permafrost and good quality rock may serve as confining units at MW14-02A/B.

Near the confluence of the two forks, the groundwater pressure at VWP CFD0324 responds to seasonal recharge near the end of June, however the increase is much more subdued (~5 m) than at the upgradient locations. While the groundwater pressure at CFD0351 peaked in mid-September, the pressure at CFD324 continued to climb. The pressure at CFD0324 is around 60 m bgs and displays small fluctuations consistent with barometric pressure changes. The horizontal hydraulic gradient between CFD0351 and CFD0324 is 5%, much less than the topographic gradient (23%). The horizontal hydraulic gradient between CFD0324 and MW14-02B is 21% and exceeds the topographic gradient (18%).

Farther down the drainage, the instrumentation suggests that permafrost is absent. The water level at SRK-15D-09T has climbed modestly (~3 m) since inception in early July, following a similar hydrograph shape as CFD0324. The hydraulic gradient between SRK-15D-09T and upgradient install CFD-0324 is 13% and nearly equal to the topographic gradient (15%). Groundwater pressures at SRK-15D-09T became flowing artesian in August and remain two metres above ground surface as of October.

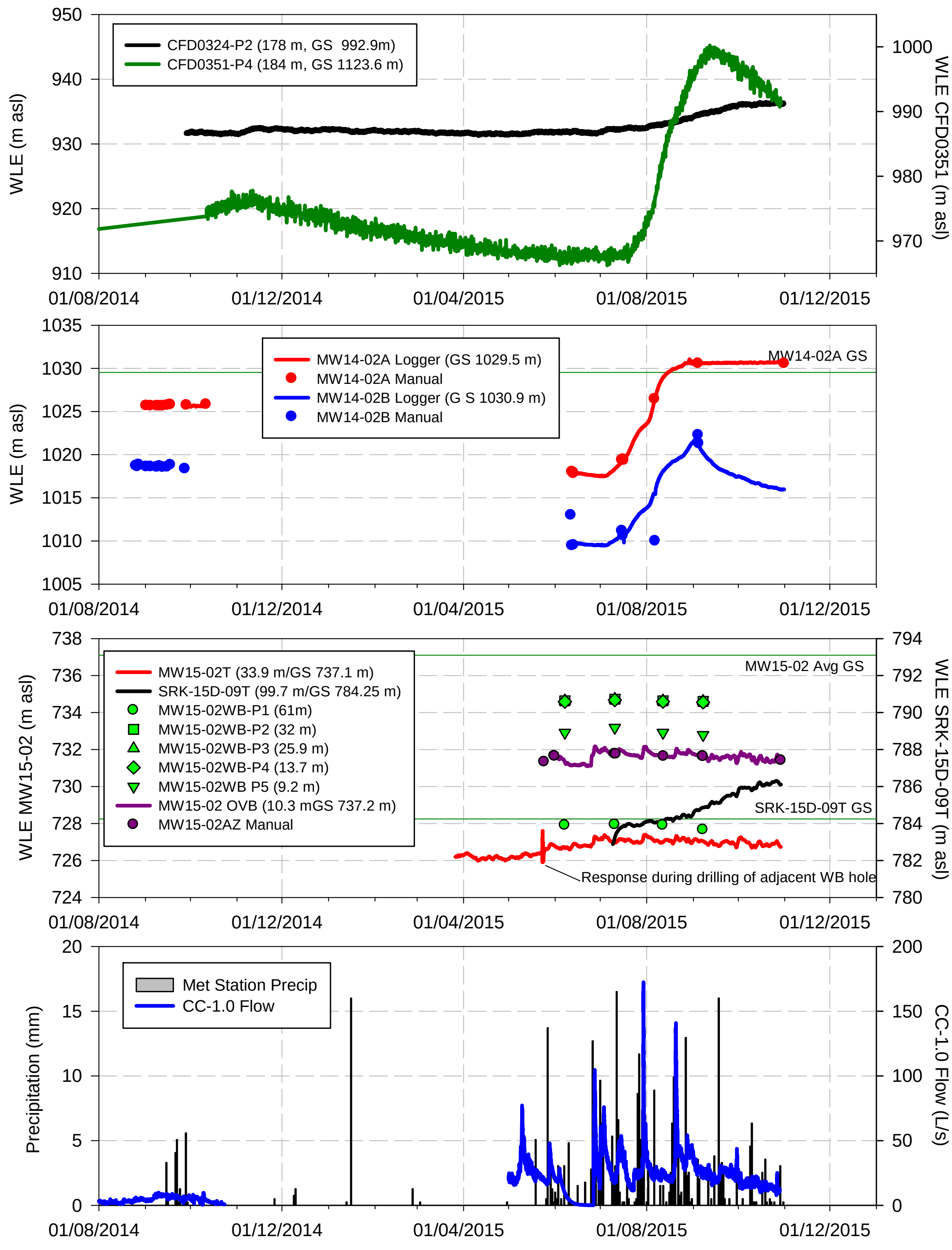

Figure 4-13: Groundwater level hydrographs measured in South Dump drainage.

Farther still down the drainage, near the confluence with Latte Creek, bedrock groundwater pressure at MW15-02T is not flowing artesian, but is greater than that measured in overburden indicating an upward hydraulic gradient. The hydrograph trend at MW15-02T is very subdued, with the seasonal maximum (~1.5 metres) registered in August. The hydrograph is more synchronized to the timing of recharge which suggests a quick connection to surface recharge. This is supported by high airlift yields and fractured ground encountered during RC drilling of this location.

Groundwater pressure measured at the Westbay ports indicate an upward gradient in very shallow bedrock (between 9 and 14 m bgs), while a strong downward gradient (~24%) is measured across deeper bedrock (32 and 61 m bgs). The downward gradient in deeper bedrock may suggest a hydraulically significant feature at depth under-draining the area. The horizontal hydraulic gradient between SRK-15D-09T and MW15-02T is 12% and slightly exceeds the average topographic gradient (10%) (Table 4-5).

The shallow well, MW15-02AZ screens several metres of a cobbly/bouldery package of colluvial sediments classified by AECOM (2012) as a poorly drained apron of colluvial complex (xzsC1a:p). Finer intervals in the upper 4 m appeared frozen in March, when the adjacent VWP hole was advanced. The water level trend through 2015 has remained generally flat at this hole with the exception of short-term responses to discrete rainfall events.

4.3.5 Latte Creek

There are three hydrogeological installations along Latte Creek. The first, MW14-07T, is several hundred metres downgradient of the proposed heap leach facility and was established in September 2014. The thermistor string installed in this hole indicates a permafrost depth of approximately 60 metres. The water level recorded at the single VWP is flowing artesian and consistently several metres above ground (Figure 4-14). Rock quality is generally poor to fair (RQD 20-75%) throughout the entire borehole (see borehole log) and it is inferred that permafrost comprises the confining unit in this area. In 2015, the hydrograph started to rise in late June and appears to have reached a plateau as of mid-October; the total amplitude of the seasonal response is small (~1.5 m). Fluctuations in barometric pressure are reflected in the water level record.

MW15-05T lies ~600 metres downgradient of MW14-07T. The horizontal hydraulic gradient between these two locations is 19%, which exceeds the topographic gradient of 14%. Water levels at this location respond differently than MW14-07T, despite there being a substantial thickness of permafrost at this location (~47 m thick). Groundwater pressures are not flowing artesian, but are 10 to greater than 20 metres above the base of permafrost. Groundwater pressure at the shallow VWP has remained more or less stable since inception, even declining marginally (<1 metre). The groundwater pressure at the deeper piezometer has increased 2-3 metres over the same period of time. The hydrograph of the deeper sensor is flashier and tracks well with the discharge measured at hydrometric station CC-6.0 (Figure 4-14). There is a strong downward gradient captured by the VWP sensors at this location (40-55%), but this is not reflected in the Westbay pressure readings. While this could potentially reflect a sensor malfunction, a strong downward gradient is also measured several kilometres downstream at MW15-02WB as well as in the headwaters of Halfway Creek (SRK-15D-08AT). This may suggest a permeable structure under-draining bedrock at these locations.

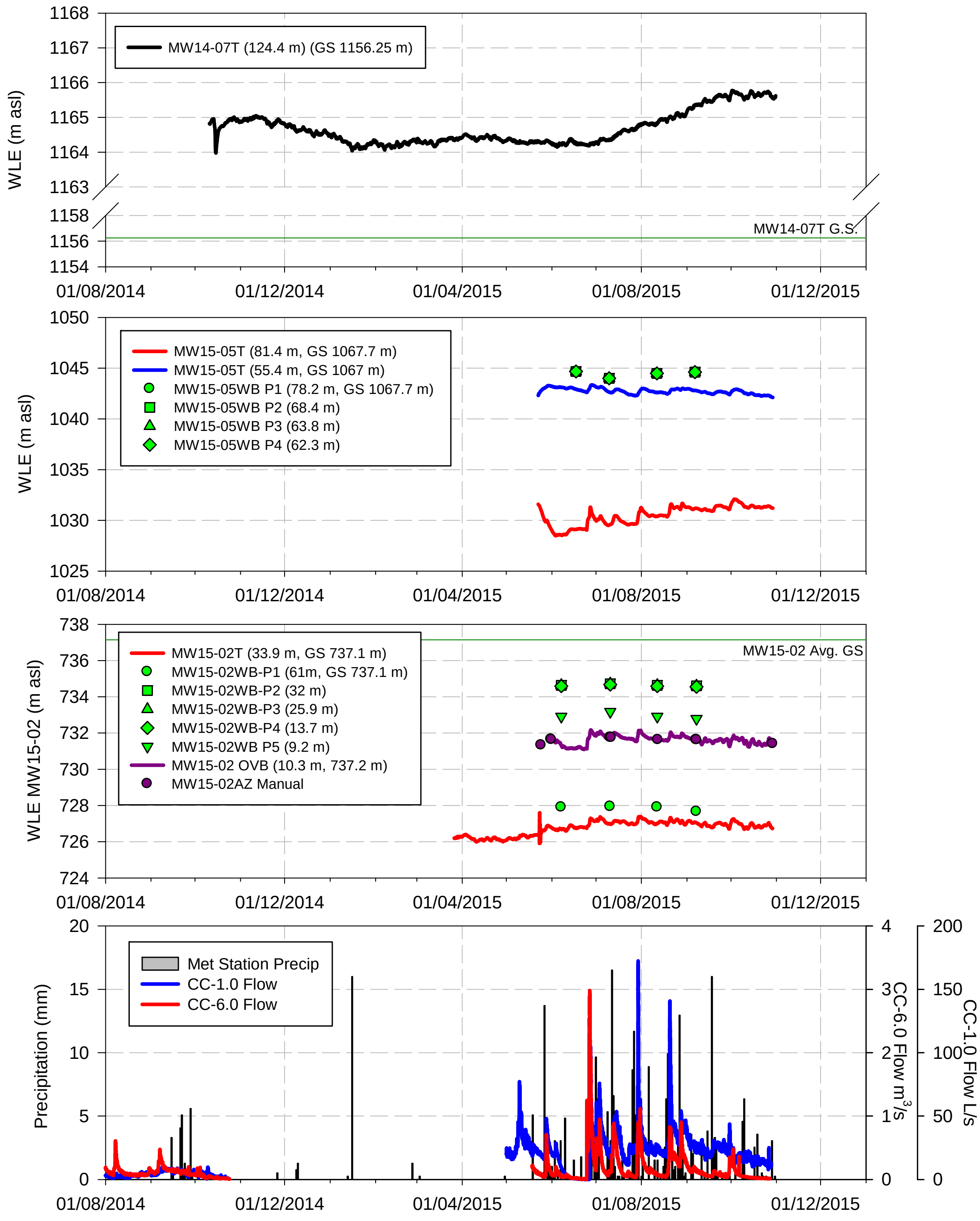

Figure 4-14: Groundwater level hydrographs measured in Latte Creek.

4.4 Summary

The field programs discussed in Section 3 have produced a robust data set of physical groundwater data that reveal a complex hydrogeological system at the Project. Permafrost is relatively warm and extensive across the project area and appears to act as a confining mechanism for the bedrock groundwater system.

Hydraulic conductivity data range over several orders of magnitude and generally decreased with depth which is typical of a fractured bedrock system. Tests that targeted geologic structures within proposed pit areas were found to have tight range in hydruaulic conductivity (mean of 7E-07 m/s) even at depths exceeding 200 m below ground surface. Hydraulic tests in valley areas produced similarly high results, supporting the inference that valley traces follow fault structures. There does not appear to be a correlation between hydraulic conductivity and lithology.

Water levels are relatively deep (from 130 metres to over 220 metres below ground surface) in ridge areas, but flowing artesian conditions are encountered even at moderate to high elevation in the drainages. Water level hydrographs indicate variable response to seasonal recharge patterns, with fluctuations ranging from approximately 2 m to over 30 m. Nested instrumentation reveals both upward and downward vertical hydraulic gradients in both upland and low-lying areas. In some instances, horizontal hydraulic gradients exceed topographic gradients. Overall, the physical hydrogeological data reveal a complex groundwater system influenced by both discontinuous permafrost and a well-developed fracture system.

5. Groundwater Quality Results

5. Groundwater Quality Results

Groundwater quality in the Project area is discussed in terms of major ion chemistry with reference to physical parameters (pH, specific conductance) followed by oxidation-reduction (redox) conditions and trace element geochemistry. Where analytical results are reported as non-detectable, the method detection limit (MDL) values are conservatively used for graphing purposes. The groundwater quality is discussed in relation to the principal lithology at the screened interval of each monitoring well: overburden, gneiss, granite, breccia and schist (Figure 2-1, Table 3-2, Table 3-3). Borehole and well completion logs can be referenced in Appendix 3-A. Groundwater quality data is tabulated in Appendix 5-A while a statistical summary of the data (count, minimum, mean, median, maximum and the number of analyses below MDL) is provided in Appendix 5-B. The laboratory certificates of analysis for samples collected by Lorax in 2014 and 2015 are included in Appendix 5-C.

A quality assurance/quality control (QA/QC) assessment was performed on the groundwater quality data set and is included in Appendix 5-D. As described, several samples were deemed to have been influenced by artifacts of drilling and monitoring well installation: MW14-03A, MW14-03B, MW14-05A, and MW14-05B in October 2014, and MW15-06WB in June 2015. This is discussed further in Appendix 5-D. These results have been omitted from the discussion below.

5.1 Major Ions

The relationship of major ion charge equivalents in the Project groundwater is presented in a tri-linear Piper plot (Figure 5-1) which identifies wells of similar screened lithology by colour. Field-measured physical parameters, grouped by lithology, are presented in Figure 5-2. Absolute concentrations of major ions are similarly plotted in Figure 5-3 and Figure 5-4. Field-measured pH and specific conductance are referenced and discussed with major ion chemistry. Field-measured dissolved oxygen (DO) and oxidation-reduction potential (ORP) are discussed with redox geochemistry in Section 5.2.

Groundwater at the Project is predominantly circum-neutral (pH 6 to 8), with most samples characterized by pH 7 to 8 (Figure 5-2). Two samples were characterized by alkaline groundwater with values up to pH 8.3, and one sample with acidic groundwater with a pH of 5.8. Groundwater wells show variable influence from weathering of sulphide minerals and/or dissolution of sulphate minerals, either from the deposits or other disseminated mineralization across the Project area. This is evidenced by low to substantial sulphate

(SO_4) concentrations which range from 12 to 954 mg/L (Figure 5-4) and variable salinity with specific conductance ranging from 28 to 2269 µS/cm (Figure 5-2).

5.1.1 Overburden

Groundwater encountered in overburden wells (orange symbols in Figure 5-1) is calcium-bicarbonate-type (Ca-HCO_3), irrespective of the type of deposit screened (colluvium, colluvium/bedrock interface). MW15-02AZ and MW15-03AZ have similar proportions of dissolved calcium (Ca), magnesium (Mg) and sodium (Na); the spread in the data points largely reflects a variable sulphate (SO_4) content. The groundwater composition at both wells shows decreasing SO_4 content between June and September 2015, while the composition at MW15-03AZ clusters together in June and July, and August and September 2015 on the Piper plot. Calcium is the dominant cation in the overburden groundwater samples, which, along with significantly lower specific conductance at MW15-03AZ (213 to 322 µS/cm) relative to MW15-02AZ (728 to 874 µS/cm), suggests that groundwater in the shallow overburden at MW15-03AZ is fresher. Groundwater pH is circum-neutral at MW15-02AZ (pH 7.3 to 7.5) and MW15-03AZ (pH 6.6 to 7.1).

The groundwater at MW15-05AZ is also classified as Ca-HCO_3-type. However, in contrast to groundwater at MW15-02AZ which has significant SO_4 influence (~41 to 49%) and MW15-03AZ with moderate SO_4 influence (~21 to 34%), the groundwater at MW15-05AZ is characterized by very little SO_4 content (~5%). In addition, the chloride content in MW15-05AZ groundwater is elevated (~ 7%) in relation to other Project area groundwater which typically has chloride contents <1%. The field pH at MW15-05AZ is slightly acidic (pH 5.8) and the lowest measured in the Project area. Field measured specific conductance is also low (28 µS/cm) indicating very fresh water.

5.1.2 Gneiss

Monitoring wells screened in gneiss are located on the north side of the Project area (black symbol in Figure 5-1). Groundwater sampled from these wells presents a wide range of hydrogeochemical compositions that range from Ca-HCO_3 to mixed magnesium-calcium-sodium-sulphate-type (Mg-Ca-Na-SO_4).

The groundwater downstream from the proposed Supremo Pit at MW15-06WB and along Halfway Creek at MW15-04WB is predominantly Ca-HCO_3 type with significant Mg influence. Groundwater sampled at MW15-06WB in July 2015 is classified as Ca-Mg-HCO_3-type, however its composition is similar to that sampled in subsequent monitoring events (Ca-HCO_3 with significant Mg influence). The groundwater at both wells has similar major ion proportions and concentrations, in addition to specific conductance which ranges from 601 to 671 µS/cm at MW15-06WB and 648 to 690 µS/cm at MW15-04WB.

Field pH at these wells is circum-neutral, ranging from pH 7.7 to 8.0 at MW15-06WB and pH 6.3 to 8.3 at MW15-04WB.

The groundwater downstream from the proposed Supremo Pit at MW15-01WB along YT-24 and at MW15-03WB along Halfway Creek (downstream from MW15-04WB) is characterized by elevated sulphate, suggesting the oxidation of sulphide minerals. Groundwater at MW15-01WB is classified as magnesium-sulphate-type (Mg-SO_4) with significant Ca influence, while groundwater at MW15-03WB is Mg-Ca-Na-SO_4-type. Groundwater sulphate concentrations and proportions at both wells are the greatest in the Project area. In addition, the groundwater at MW15-03WB and MW15-01WB is the most saline in the Project area, with elevated specific conductance values of 1883 to 1978 µS/cm and 2160 to 2218 µS/cm, respectively. The field pH is circum-neutral at MW15-03WB (pH 7.4 to 7.7) and MW15-01WB (pH 6.8 to 7.9).

5.1.3 Granite

Monitoring wells screened in granite (pink symbols in Figure 5-1) are located adjacent to Latte Creek downstream from the proposed HLF (MW15-05WB) and in the Kona Pit (MW14-05A and MW14-05B). Groundwater sampled from these wells ranges from Ca-HCO_3-type to sodium-bicarbonate-type (Na-HCO_3).

The groundwater at MW15-05WB is Ca-HCO_3-type and is characterized by a uniform composition. Groundwater at this well is fresh with low specific conductance (291 to 306 µS/cm) and circum-neutral pH (6.6 to 7.6).

Monitoring wells MW14-05A and MW14-05B present among the most variable groundwater hydrogeochemical compositions in the Project area. Groundwater at MW14-05A and MW14-05B presents variable sodium and sulphate proportions, with higher concentrations observed at MW14-05B. Groundwater at MW14-05A is Ca-HCO_3-type, while that at MW14-05B presents a more intermediate chemistry, classified predominantly as Na-HCO_3-type with significant SO_4 influence in two samples. The decreased sodium concentration/proportion in groundwater collected at MW15-05B in September 2015 results in its classification as mixed-sodium-calcium-magnesium-bicarbonate-type (Na-Ca-Mg-HCO_3). Of note at MW14-05B are elevated chloride concentrations and the greatest chloride proportion relative to other groundwater in the Project area. Groundwater at MW14-05B is more saline than that at MW14-05A with specific conductance values of 569 to 709 µS/cm and 329 to 379 µS/cm, respectively. The field pH at both monitoring wells is circum-neutral with groundwater at MW14-05A (pH 6.5 to 7.3) slightly more acidic than MW14-05B (pH 7.2 to 7.7).

5.1.4 Hydrothermal Breccia

Monitoring well MW14-02A screens groundwater in hydrothermal breccia (green diamond symbol in Figure 5-1). It is located on the south side of the Project in Latte Pit. The groundwater at this location is Ca-HCO_3 with significant Mg influence. MW14-02A is characterized by circum-neutral to slightly alkaline (pH 7.3 to 8.2) groundwater with relatively low specific conductance (349 to 400 µS/cm).

5.1.5 Schist

Monitoring wells screened in schist are distributed on the north and south sides of the Project in the vicinity and downstream from the proposed Latte Pit (dark blue symbols in Figure 5-1). MW14-03A and MW14-03B are upgradient and adjacent to Latte Pit on the north side of the Project, while MW14-02B and MW15-02WB are located upgradient and downgradient of the South WRSF, respectively. Groundwater at these monitoring wells ranges from Ca-HCO_3 to Mg-SO_4-type.

Groundwater collected at MW14-02B is characterized by uniform major ion proportions and concentrations. The groundwater composition at this well ranges from Ca-HCO_3-type with significant Mg influence to mixed calcium-magnesium-bicarbonate-type (Ca-Mg-HCO_3). MW14-02B has circum-neutral field pH (7.5 to 7.6) and relatively low specific conductance which ranges between 481 and 509 µS/cm. The groundwater at MW14-02B is more saline than groundwater at MW14-02A which has observed specific conductance values ranging between 349 and 400 µS/cm.

MW15-02WB displays a more intermediate chemistry, classified primarily as calcium-sulphate-type (Ca-SO_4) water with significant HCO_3 influence. The groundwater composition is slightly more variable compared with other wells screened in schist. A small shift towards increased HCO_3 influence is observed in September 2015, with groundwater classified as Ca-HCO_3-type with significant SO_4 influence. This shift corresponds with a slight decrease in the sodium proportion and slight increase in the potassium proportion. Groundwater a MW15-02WB has circum-neutral field pH (7.3 to 7.5) and is moderately saline with specific conductance values between 863 and 898 µS/cm.

Groundwater collected at both MW14-03A and MW14-03B plots as magnesium-bicarbonate-type (Mg-HCO_3) with significant SO_4 influence and Mg-SO_4-type with significant HCO_3 influence. The groundwater compositions plot as two different water types as a result of straddling the divide between water types and slight variations in HCO_3 and SO_4 proportions in individual samples collected from both wells. Despite this, both wells are characterized by uniform major ion proportions and concentrations. The groundwater at MW14-03B (1604 to 1717 µS/cm) is more saline than groundwater at MW14-03A (1376 to 1620 µS/cm). Field pH is comparable at both wells with values of pH 7.4 at MW14-03A and pH 7.2 to 7.5 at MW14-03B.

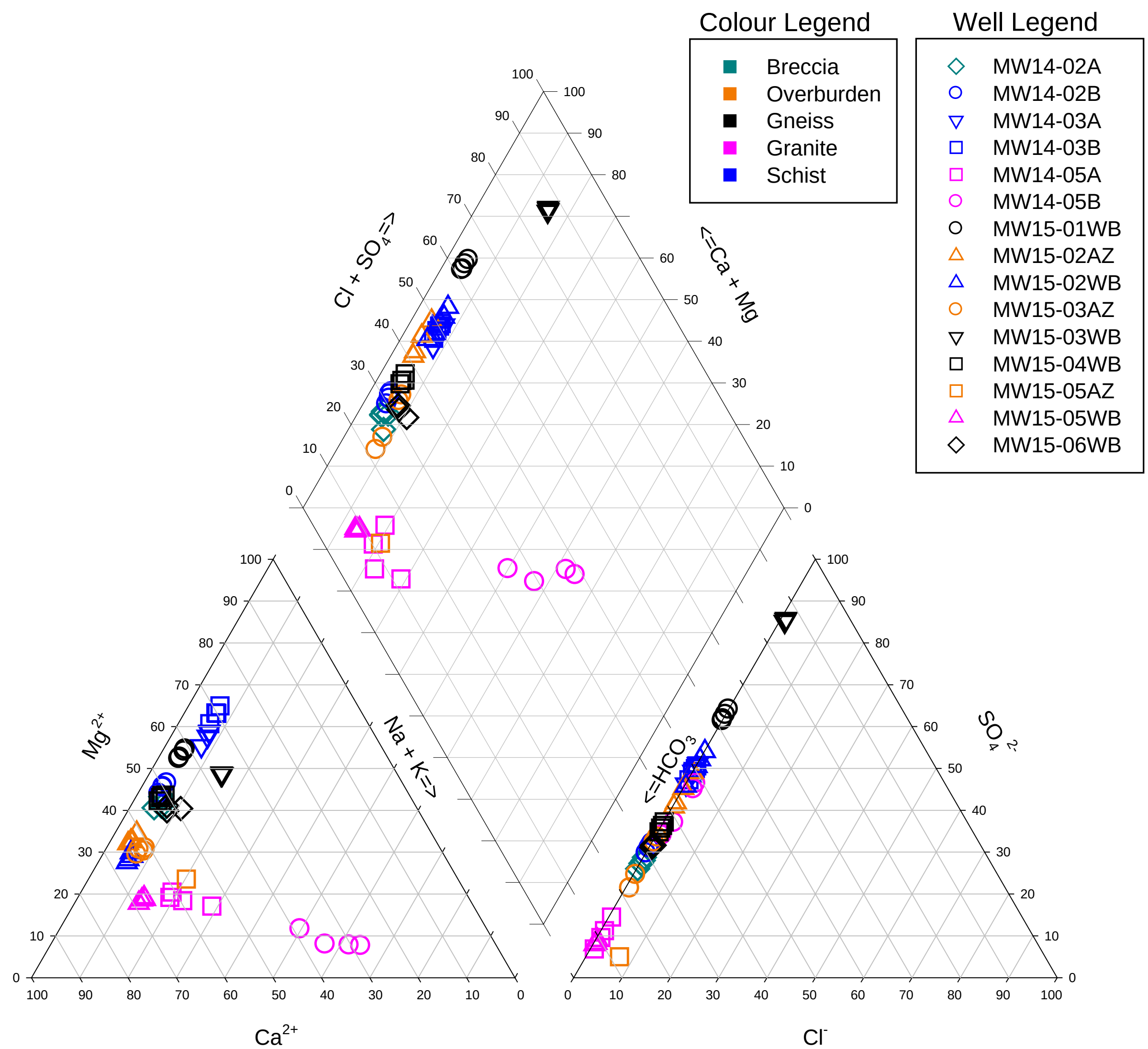

Figure 5-1: Piper Plot of Project Groundwater Quality Data (2014 and 2015).

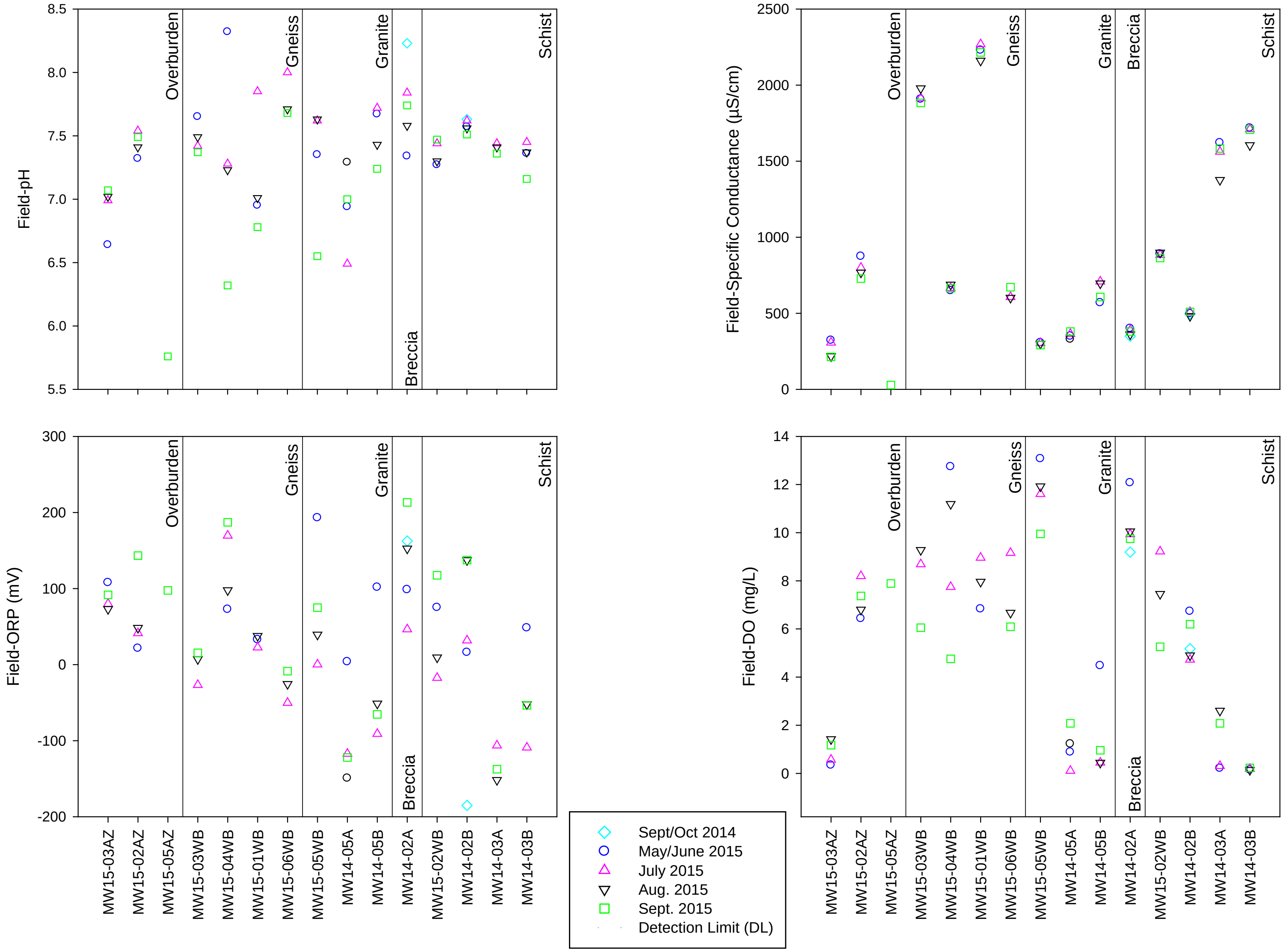

Figure 5-2: Field-Measured Physical Parameters in Project Groundwater (2014 and 2015).

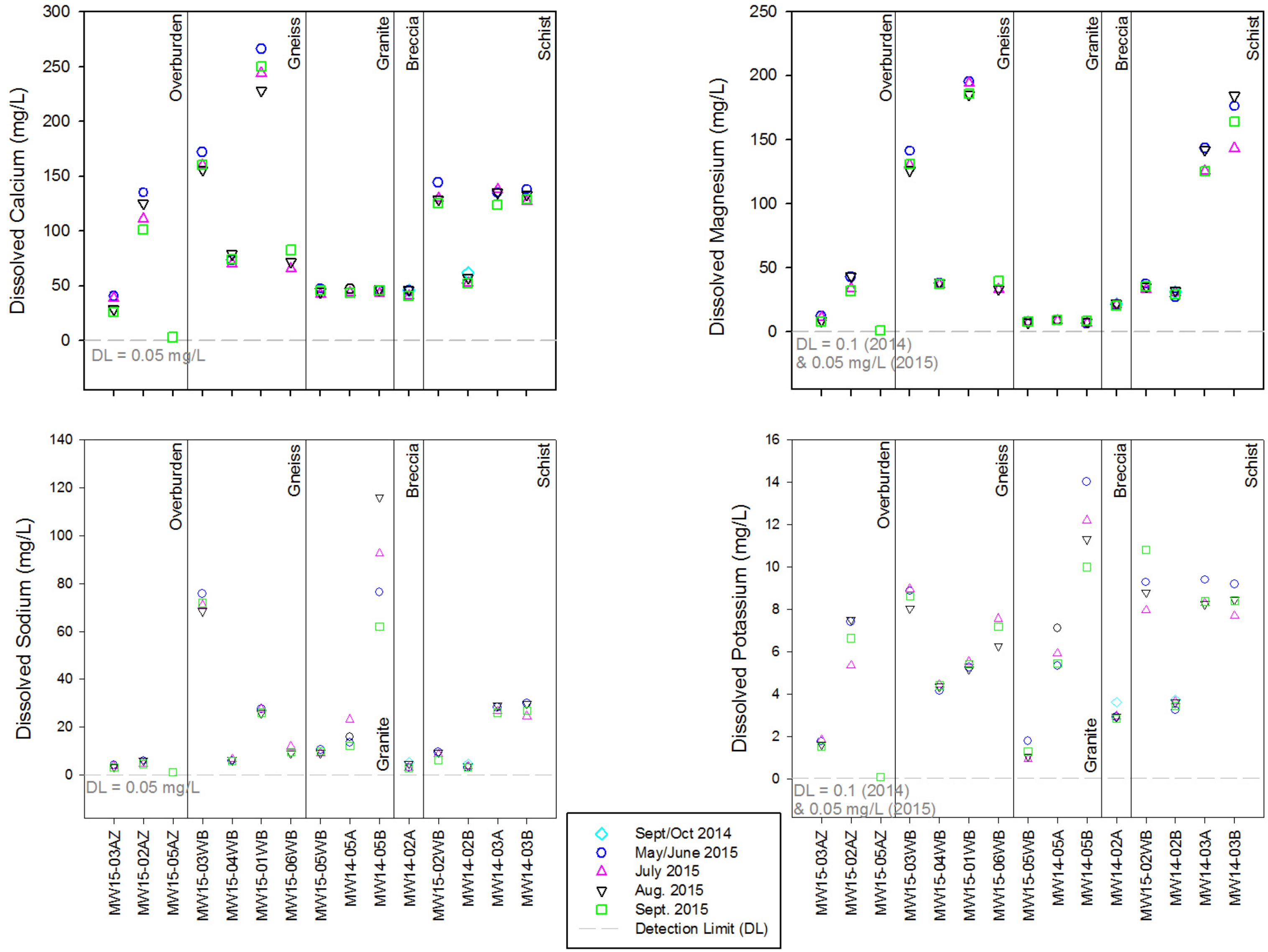

Figure 5-3: Major Cation **Concentrations in Project Groundwater (2014 and 2015).**

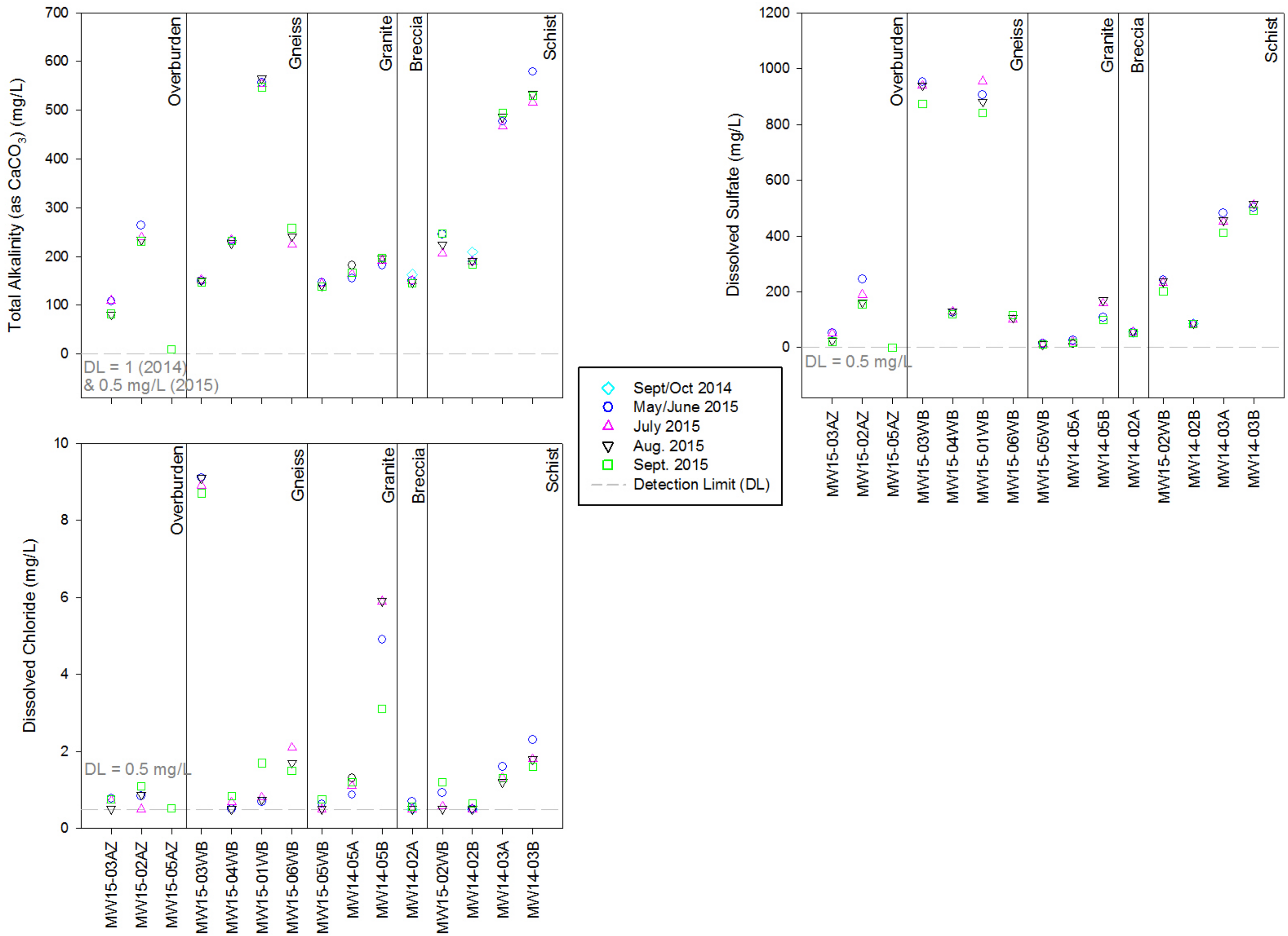

Figure 5-4: Major Anion Concentrations in Project Groundwater (2014 and 2015).

5.2 Oxidation-Reduction Geochemistry

Redox conditions within a groundwater system can be assessed based on the presence and concentration of oxidized and reduced inorganic compounds in groundwater samples. Microbial populations utilize electron acceptors in order of their free energy yield (Table 5-1). To emphasize the exchange of electrons during redox processes, valence charges are expressed on ions in this subsection of the report. In the presence of oxygen (O_2), aerobic bacteria will utilize O_2 as a terminal electron (e^-) acceptor since this redox reaction affords the greatest energy yield. However, in environments where the rate of DO consumption exceeds the rate of re-supply, DO will become depleted and other secondary oxidants will be utilized. These, in order of their free energy yield, are nitrate (NO_3^-), manganese (Mn^{4+})-oxides, ferric iron (Fe^{3+})-oxides, sulphate SO_4^{2-} and carbon dioxide (CO_2).

Table 5-1:
Oxidation-Reduction Reactions. Parameters Measured in Groundwater Samples to Infer Oxidation-Reduction Conditions are Highlighted in Red

Decreasing Redox Potential ↓

Increasing Free Energy Yield ↑

1. Oxygen (O_2) Consumption:

$$\boldsymbol{O_2} + 4H^+ + 4e^- \rightarrow 2H_2O$$

2. Nitrate (NO_3^-) Reduction (Denitrification)

$$2\boldsymbol{NO_3^-} + 12H^+ + 10e^- \rightarrow N_2 + 6H_2O$$

3. Manganese Oxide (MnO_2) Reduction:

$$MnO_2(s) + 4H^+ + 2e^- \rightarrow \boldsymbol{Mn^{2+}} + 2H_2O$$

4. Iron Oxide (FeOOH) Reduction:

$$FeOOH(s) + 3H^+ + e^- \rightarrow \boldsymbol{Fe^{2+}} + 2H_2O$$

5. Sulphate (SO_4^{2-}) Reduction:

$$\boldsymbol{SO_4^{2-}} + 9H^+ + 8e^- \rightarrow \boldsymbol{HS^-} + 4H_2O$$

The characterization of redox zonation can be achieved through the examination of various redox-sensitive parameters including O_2, NO_3^-, dissolved Mn^{2+}, dissolved Fe^{2+}, SO_4^{2-}, and dissolved sulphide species (S^{2-}, HS^- and H_2S), hereafter referred to as S^{2-}. Key indicators of suboxia can include:

- absence of O_2;
- removal of NO_3^- and/or nitrite (NO_2^-) (associated with NO_3^- reduction);
- elevated (>0.5 mg/L) concentrations of ammonia (NH_3); NH_3 is unstable in the presence of O_2;

- elevated (>1 mg/L) concentrations of dissolved Mn^{2+} and/or Fe^{2+} at circum-neutral pH, which implies the reductive dissolution of Mn^{4+}-oxide and Fe^{3+}-oxide phases, respectively; and
- presence of dissolved S^{2-}, reflecting SO_4^{2-} reduction.

Of these, the presence of elevated dissolved Fe^{2+} and/or the presence of detectable dissolved S^{2-} provide the most robust indicators of suboxia, given that the presence of these parameters is incompatible with that of O_2. ORP (units of millivolts (mV)) is a field measured parameter and provides a qualitative assessment of the general redox conditions only. Strongly negative ORP values are associated with suboxic conditions whereas positive values are associated with oxic conditions. Field-measured DO and ORP are presented in Figure 5-2. Analytical results for NO_3^-, NH_3, dissolved Mn, dissolved Fe, and S^{2-} are presented in Figure 5-5.

Field DO and ORP readings corresponding with groundwater samples collected from Westbay installations in 2015 are not considered to be necessarily representative of formation conditions since measurements were made in a graduated cylinder (not isolated from atmospheric conditions). Consequently, field DO and ORP measurements are not used for interpretation purposes and the assessment of redox conditions at MW15-01WB to MW15-06WB relies solely on groundwater analytical data.

Total NH_3 and dissolved S^{2-} were detected at concentrations ≤ 2 times the MDLs of 0.005 mg/L in four of five field and trip blank samples collected in 2015 (see Appendix 5-D). Therefore, for the purpose of interpretation and assessing redox conditions, NH_3 and S^{2-} are not considered present in 2015 groundwater samples with concentrations ≤ 3 times the MDLs.

5.2.1 Overburden

Groundwater sampled from overburden wells was oxic to mildly suboxic.

Shallow groundwater at MW15-02AZ was oxic. NO_3^- was measured in every sampling event between 0.23 and 0.54 mg/L, and dissolved Mn and Fe were measured at very low concentrations (<29 and <11 µg/L, respectively). NH_3 was measured in half of the sampling events at low levels. Moderate DO (>6.4 mg/L) readings and positive ORP measurements indicate oxygenated groundwater.

The groundwater at MW15-03AZ was oxic to mildly suboxic. NO_3^- was consistently measurable in groundwater. Samples collected in June and July 2015 had low NO_3^- (0.026 and 0.029 mg/L) concentrations and low DO (0.3 to 0.6 mg/L), while August and September 2015 samples had higher NO_3^- (0.15 and 0.17 mg/L) and DO (1.4 and 1.2 mg/L). ORP measurements were consistently positive, ranging from 73 to 108 mV. The presence of NO_3^-, DO and positive ORP indicate oxic conditions. Low levels of dissolved Mn and very low dissolved Fe were measured during every sampling event, in addition to low levels of NH_3 in two samples, which are indicative of slightly reducing conditions.

The single groundwater sample collected at MW15-05AZ in September 2015 was oxic to slightly suboxic. The presence of NO_3^-, in addition to substantial levels of DO (7.9 mg/L) and positive ORP (98 mV) indicate oxygenated water, while measurable NH_3 (0.6 mg/L), dissolved Mn (617 µg/L) and Fe (931 µg/L) suggest mildy to moderately reducing groundwater.

5.2.2 Gneiss

Monitoring wells screened in gneiss are situated on the north side of the Project in the Halfway Creek (MW15-06WB, MW15-04WB and MW15-04WB) and YT-24 (MW15-01WB) drainages. Redox conditions at monitoring wells screened in the gneiss range from oxic to moderately suboxic.

MW15-06WB was mildly to moderately suboxic. NH_3, dissolved Mn and Fe were consistently measured. Groundwater samples indicate decreasing NH_3 and increasing dissolved Mn concentrations between July and September 2015; dissolved Fe concentrations increased significantly between August and September 2015. NO_3^- and dissolved S^{2-} (< 3 times MDL) were absent in all samples, indicating that groundwater at this location is mildly to moderately reducing. The observed trends suggest that groundwater chemistry at MW15-06WB has not stabilized, consistent with the QA/QC assessment in Appendix 5-D. Subsequent groundwater sampling at MW15-06WB should inform whether the observed trends are a result of residual influence from drilling and monitoring well installation or natural variability.

Groundwater at MW15-04WB was oxic to mildly suboxic. NO_3^-, NO_2^-, NH_3 and dissolved Mn were consistently measured in groundwater samples. NO_3^- levels were highest ranging from 0.07 to 0.23 mg/L, while NO_2^-, NH_3 and dissolved Mn levels were generally low. Dissolved S^{2-} was absent (< 2 times MDL) from groundwater samples, while dissolved Fe concentrations were very low (<15 µg/L). The presence of NO_3^- indicates oxic conditions, while low levels of NO_2^- and dissolved Mn indicate mildly reducing conditions.

Monitoring well MW15-03WB is classified as suboxic and mildly to moderately reducing. Low levels of dissolved Mn (74 to 84 µg/L) were consistently measured, along with negligible dissolved S^{2-} (< 3 times MDL). Dissolved Fe concentrations were very low in June to August (5.6 to 11 µg/L), with a significant increase to 569 µg/L in September 2015. NH_3 levels were sporadic and variable, with measurable concentrations in July (0.92 mg/L) and September 2015 (0.039 mg/L). Low levels of NO_3^- were measured in two samples, with concentrations just above the MDL of 0.002 mg/L in June (0.0076 mg/L) and September 2015 (0.003 mg/L).

The groundwater redox condition at MW15-01WB was anoxic and mildly to moderately reducing. Dissolved Mn was consistently measured between 357 and 382 µg/L, along with absence of dissolved S^{2-} (< 2 times MDL). Dissolved Fe concentrations were very low in June to August (2.6 to 25 µg/L), increasing significantly to 558 µg/L in September 2015. Low levels of NH_3 and NO_3^- were sporadically measurable, with NH_3 present in July 2015 and NO_3^- measured close to the MDL in September 2015. The absence of dissolved S^{2-} and presence of dissolved Mn and Fe indicates that groundwater at MW15-01WB is mildly to moderately reducing.

5.2.3 Granite

Groundwater redox conditions at monitoring wells screened in granite were mildly to strongly anoxic. Monitoring wells MW14-05A and MW14-05B had measurable dissolved Mn, Fe and S^{2-} indicating moderately to strongly reducing conditions. NH_3 levels in both wells were generally close to the MDL (0.005 mg/L). Field DO was negligible (<2 mg/L) and ORP readings predominantly negative in both wells. Groundwater was slightly more reducing at MW14-05A which was characterized by greater dissolved Mn, Fe and S^{2-} concentrations in comparison with MW14-05B, despite greater salinity at MW14-05B. Field ORP readings were also consistently more negative at MW14-05A than MW14-05B. The MW14-05B Jun. 2015 sample was oxic to slightly suboxic in contrast with subsequent sampling. This sample had moderate DO (4.5 mg/L) and positive ORP (102 mV), an absence of NO_3^- and dissolved S^{2-}, and low levels of NH_3 and dissolved Mn and Fe. Dissolved Mn and Fe concentrations increased in subsequent samples collected at MW14-05B. The observed trends suggest that groundwater chemistry at MW14-05B has not stabilized, consistent with the QA/QC assessment in Appendix 5-D. Subsequent groundwater sampling at MW14-05B should inform whether the observed trends are a result of residual influence from drilling and monitoring well installation or natural variability.

The groundwater at MW15-05WB is classified as anoxic and mildly to moderately reducing. Very low levels of dissolved Mn (4.6 to 13 µg/L) and Fe (2.3 to 11 µg/L) were consistently measured, along with absence of dissolved S^{2-} (<2 times MDL). NH_3 and NO_3^- were measured occasionally in groundwater at MW15-05WB. NH_3 concentrations were variable, with 0.016 mg/L in July and 0.14 mg/L in September 2015. Negligible NO_3^- (0.0031 mg/L) was measured in September 2015.

5.2.4 Hydrothermal Breccia

Groundwater at monitoring well MW14-02A screened in hydrothermal breccia was oxic. NO_3^- was consistently measured between 0.14 and 0.17 mg/L, with high field DO (>9 mg/L) and positive ORP (47 to 213 mV) indicating oxygenated water. NH_3 was only present in one sample (September 2014) at levels >3 times MDL. Dissolved Mn (<20 µg/L) and Fe (<30 µg/L) were consistently measured at very low levels, along with absence of S^{2-} (<3 times MDL).

5.2.5 Schist

Monitoring wells screened in schist span the entire range of redox conditions from oxic to strongly reducing. Groundwater at MW14-02B was oxic to mildly suboxic, while that at MW14-03A, MW14-03B and MW15-02WB was moderately to strongly suboxic.

Groundwater at MW14-02B consistently had measurable levels of NO_3^- (0.01 to 0.14 mg/L) and dissolved Mn (162 to 710 µg/L) which along with moderate DO (4.7 to 6.7 mg/L) and generally positive ORP suggest oxic to mildly reducing conditions. Dissolved Fe was very low (<10 µg/L) and dissolved S^{2-} was absent in all sampling events. Measurable NH_3 was present in only one sample (September 2015, 0.02 mg/L).

Groundwater at nested monitoring well pair MW14-03A and MW14-03B was anoxic and moderately to strongly reducing. The consistent presence of NH_3, dissolved Mn, Fe and S^{2-} along with negligible NO_3^- during all sampling rounds indicate that suboxic conditions predominated at MW14-03A and MW14-03B. The groundwater at MW14-03B was moderately reducing due to higher NH_3 and dissolved Mn concentrations and lower dissolved Fe and S^{2-} relative to MW14-03A which is classified as strongly reducing.

The groundwater redox condition at MW15-02WB was mildly to moderately suboxic from June to August 2015 and oxic to mildly suboxic in September 2015. Dissolved Mn and Fe were consistently measured, while dissolved S^{2-} was consistently absent (<2x MDL). Groundwater sampled between June and August 2015 had measurable dissolved Mn (98 to 111 µg/L) and Fe (3.9 to 362 µg/L), and absent or negligible NO_3^- and NH_3 indicating mildly to moderately reducing conditions. In September 2015, groundwater had measurable NO_3^- (0.14 mg/L) and low levels of NH_3 and dissolved Mn and Fe indicating oxic to mildly reducing conditions. The dissolved Mn concentrations decreased and NO_3^- increased between August and September 2015 indicating a shift towards less reducing conditions.

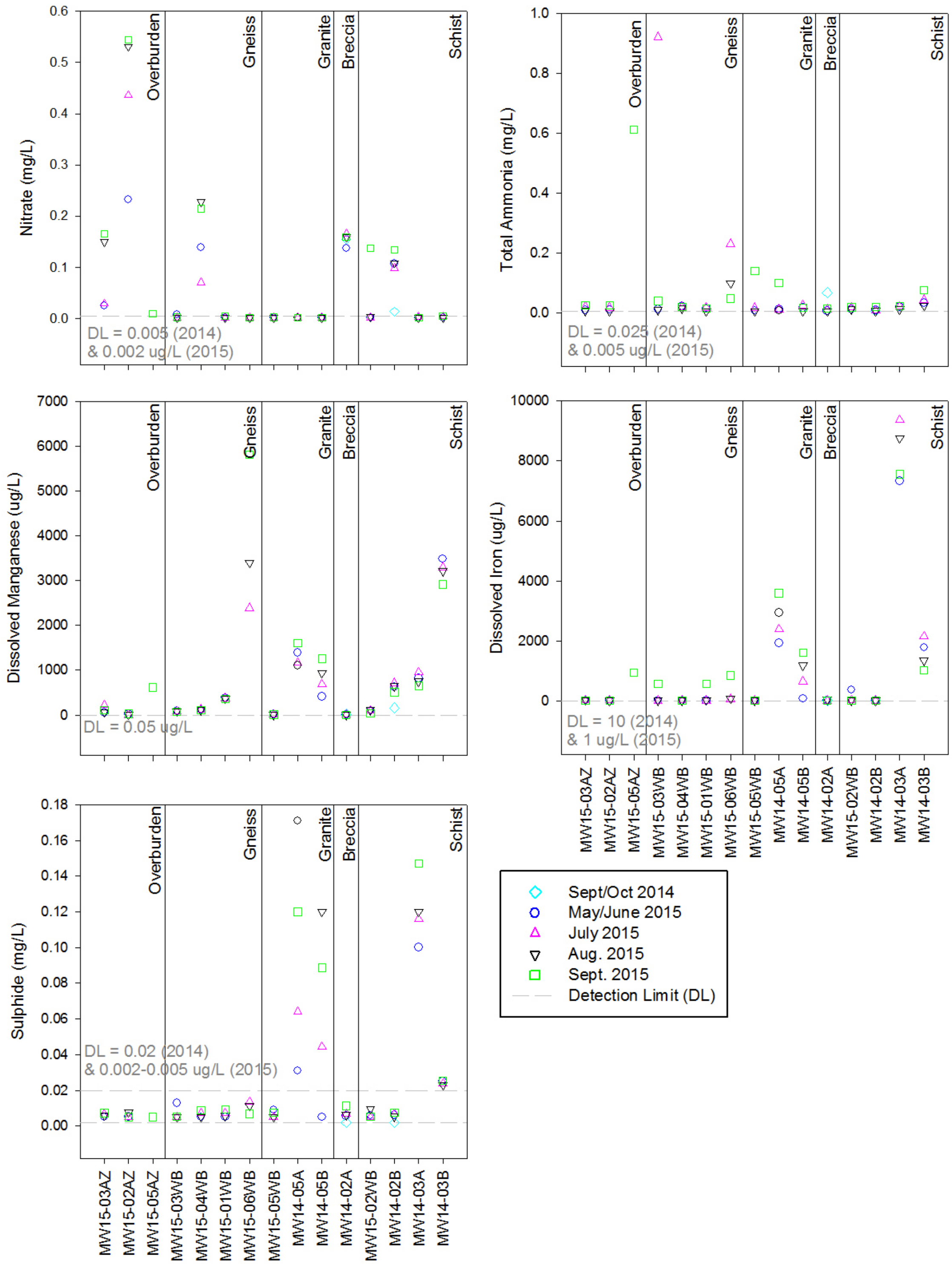

Figure 5-5: Groundwater Quality Data for Redox-sensitive Parameters: Nitrate, Ammonia, Dissolved Manganese, Dissolved Iron, Sulphide (2014 and 2015).

5.3 Trace Elements

This section presents a review of trace element concentrations across the Project area. Groundwater data for all analysed parameters is tabulated and presented in Appendix 5-A. Selected dissolved metal parameters of concern (arsenic (As), antimony (Sb), cadmium (Cd), cobalt (Co), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), uranium (U) and zinc (Zn)) are presented in Figure 5-6 to Figure 5-8. These parameters were selected based on geochemical test results and potential for complexation with cyanide. Dissolved metals are presented and discussed since guidelines, standards and regulations generally apply to dissolved substance concentrations for inorganics in groundwater.

Overburden groundwater samples were characterized by low TSS with concentrations close to or below the MDL of 1.0 mg/L at MW15-02AZ, MW15-03AZ and MW15-05AZ. TSS levels in bedrock groundwater samples were generally higher, ranging from below MDL to 64 mg/L. Bedrock groundwater samples collected from Westbay installations had the lowest TSS levels (<1.0 to 4.6 mg/L), while samples collected from conventional monitoring wells had slightly higher levels which were predominantly between 1.8 and 9.8 mg/L. Bedrock groundwater samples collected at conventional wells MW14-03A (23 to 31 mg/L) and MW14-05B (7 to 64 mg/L) were the exception with significantly higher TSS levels.

Dissolved As was measured in all groundwater samples. Concentrations were generally lowest in overburden groundwater (0.43 to 2.3 µg/L) and higher in bedrock groundwater (0.27 to 1860 µg/L). Concentrations of dissolved As were below 5 µg/L at all three overburden wells and bedrock wells MW15-02WB, MW15-03WB, MW15-04WB, and MW15-05WB. The highest concentrations were in granite at MW14-05B (117 to 161 µg/L) and MW14-05A (1480 to 1860 µg/L).

Concentrations of dissolved Sb were generally below 1 µg/L in overburden and bedrock groundwater, except at MW14-02B, MW15-04WB, MW14-05B and MW15-06WB. Dissolved Sb was highest at MW14-02B (3.3 to 6.6 µg/L), MW15-04WB (2.6 to 3 µg/L), MW15-06WB (0.7 to 2.8 µg/L), and MW14-05B (0.6 to 1.2 µg/L).

Dissolved Cd measured in overburden and bedrock groundwater was predominantly in the 0.006 to 0.06 µg/L range, except at MW15-02AZ and MW15-04WB. Concentrations at MW15-02AZ were quite variable (<0.005 to 0.125 µg/L), while concentrations at MW15-04WB were more consistent (0.04 to 0.01 µg/L).

Dissolved Co concentrations were generally higher in bedrock groundwater than in overburden groundwater. Concentrations of dissolved Co were highest in schist at MW14-03B (6.1 to 7.6 µg/L), MW14-03A (1.3 to 2.5 µg/L) and MW14-02B

(0.6 to 2.5 µg/L). Dissolved Co concentrations in overburden groundwater were generally below 0.25 µg/L, except at MW15-05AZ which had elevated Co at 2.5 µg/L.

Concentrations of dissolved Cu was generally highest in overburden groundwater (0.95 to 2.0 µg/L). Concentrations in bedrock groundwater ranged from below MDL (0.05 µg/L) to 2.5 µg/L. Dissolved Cu levels exceeded 2 µg/L in two samples, both in June 2015: MW14-05B (2.5 µg/L) and MW15-04WB (2.3 µg/L).

Dissolved Pb concentrations were low in the overburden and bedrock groundwater. Concentrations were lowest in the overburden (<0.005 to 0.033 µg/L) and more variable in bedrock, ranging from below MDL (0.005 µg/L) to 0.34 µg/L.

Dissolved Hg concentrations were below MDL in the majority of overburden and bedrock groundwater samples. All wells with measurable dissolved Hg were characterized by concentrations <0.01 µg/L, except MW15-06WB (0.02 to 0.10 µg/L) where the highest concentrations were detected.

Concentrations of dissolved Ni in groundwater were generally below 5 µg/L, except at MW14-05B, MW14-02B and MW14-03B. Dissolved Ni concentrations were highest and most variable at MW14-05B (2.9 to 7.2 µg/L), MW14-02B (2.5 to 15 µg/L) and MW14-03B (17 to 22 µg/L).

Dissolved Se was generally low in overburden and bedrock groundwater, with concentrations ranging from below MDL (0.04 µg/L) to 0.5 µg/L. The May 2015 sample collected at MW15-02AZ had the highest Se concentration of any overburden or bedrock well at 1.1 µg/L. All other samples collected at MW15-02AZ were consistently between 0.16 and 0.20 µg/L.

Concentrations of dissolved U were consistently elevated (>15 µg/L) at most wells, with the exception of MW15-03WB and MW15-05AZ. Dissolved U concentrations were highest in gneiss at MW15-01WB (530 to 589 µg/L), MW15-04WB (154 to 176 µg/L) and MW15-06WB (100 to 103 µg/L). The concentration at MW15-03WB, the only other well screened in gneiss, was significantly lower ranging from 7.6 to 9.1 µg/L. Dissolved U levels were lowest in the overburden groundwater (0.90 to 35 µg/L).

Dissolved Zn was consistently measured across the Project area with higher and more variable concentrations measured in Westbay installations screened in the bedrock. Dissolved Zn levels were lowest in the overburden and bedrock groundwater collected from conventional wells, with concentrations ranging between 0.27 and 16.5 µg/L. In contrast, groundwater concentrations at MW15-01WB to MW15-06WB ranged between 4.9 and 253 µg/L.

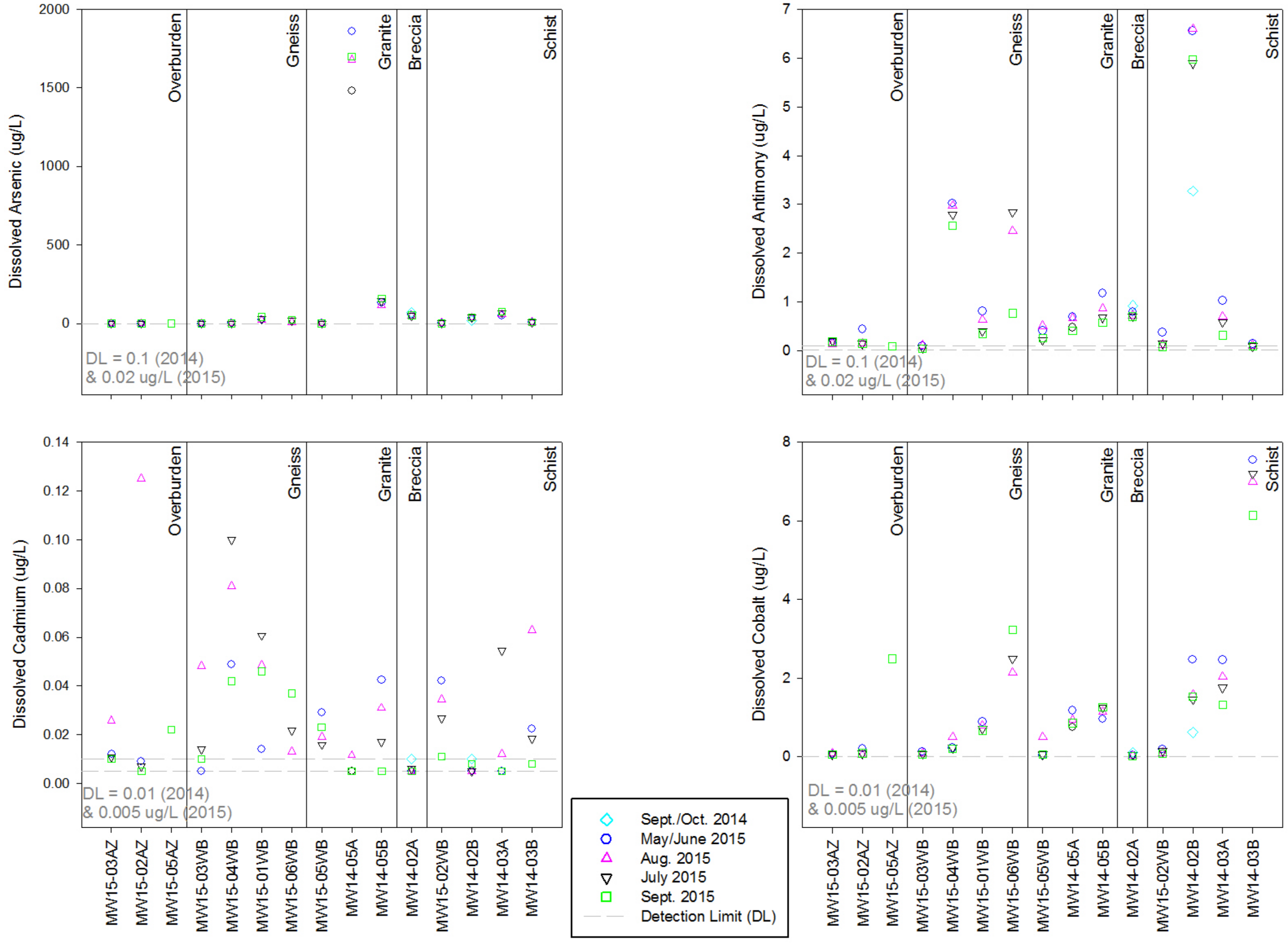

Figure 5-6: Groundwater Quality Data for Dissolved Arsenic, Antimony, Cadmium and Cobalt (2014 to 2015).

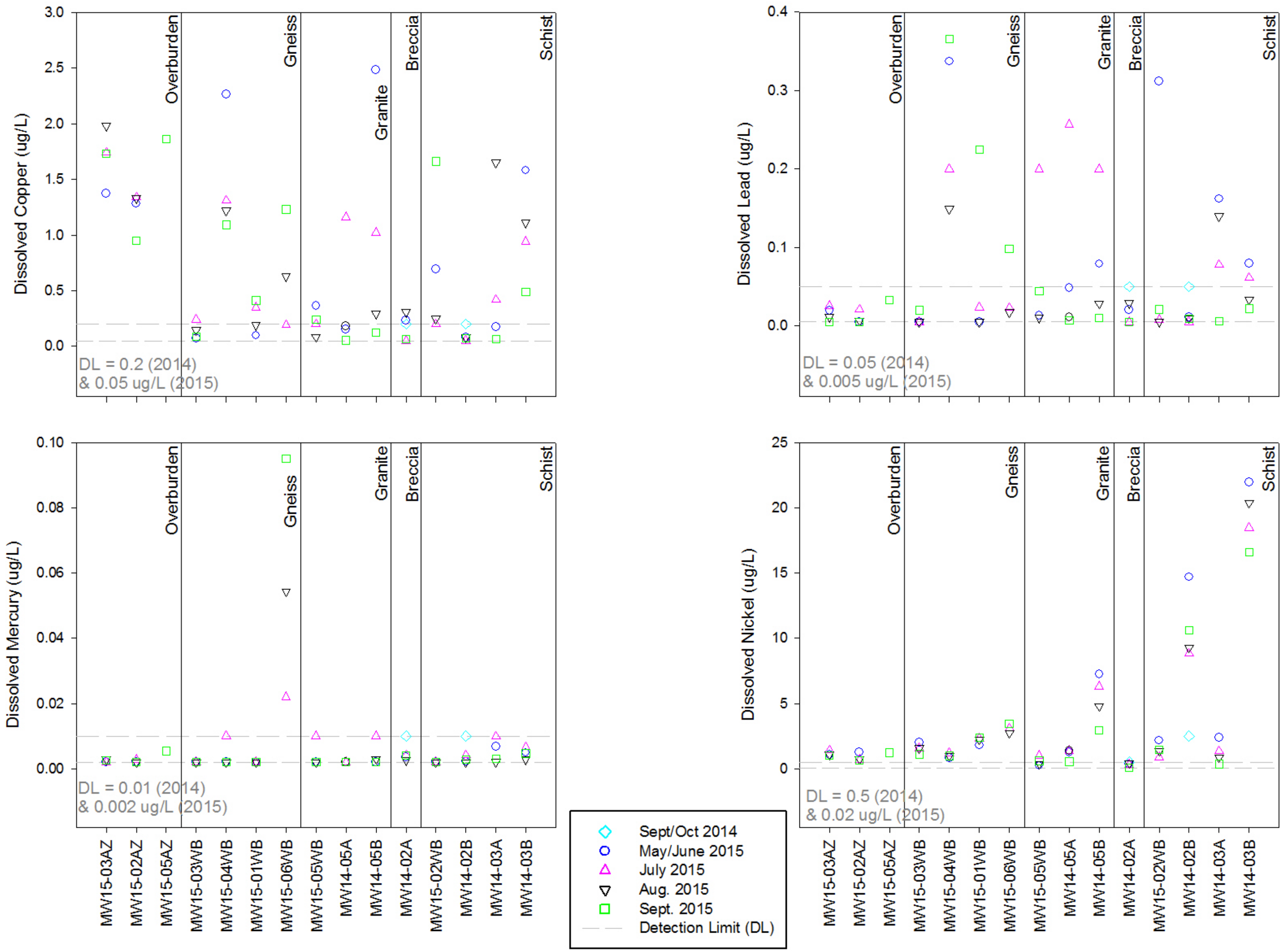

Figure 5-7: Groundwater Quality Data for Dissolved Copper, Lead, Mercury and Nickel (2014 to 2015).

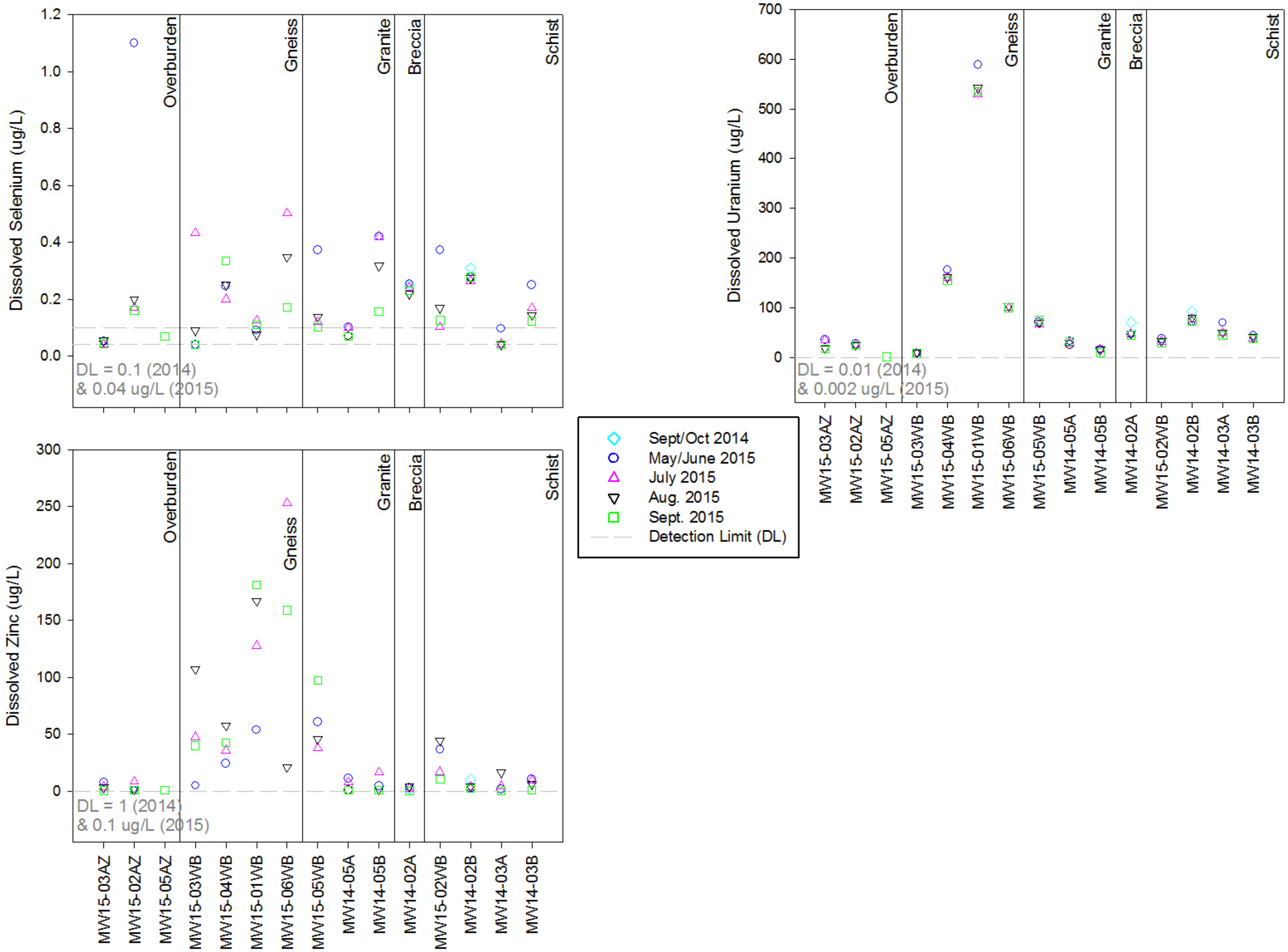

Figure 5-8: Groundwater Quality Data for Dissolved Selenium, Uranium and Zinc (2014 to 2015).

6. Conclusions

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6. Conclusions

Multiple hydrogeological and geotechnical field investigations have been advanced at the Project between 2013 and 2015. This report constitutes the synthesis of all baseline hydrogeological data up to the end of October 2015. The investigations have revealed a complex groundwater system influenced by permafrost and fractures. The main findings of this baseline study are as follows:

- Overall, permafrost is widespread across the Project. It extends to greatest depths in ridge areas and appears to thin towards areas of lower elevation; north facing slopes tend to have thicker permafrost than south-facing slopes. The thickest permafrost (~165 metres) is encountered near the north end of the proposed Supremo pit. Permafrost in the project area is relatively warm (between 0 and -2°C) and is coolest (-1.4°C to -1.9°C) on north facing slopes.
- Hydraulic conductivity data range over several orders of magnitude and generally decreased with depth which is typical of a fractured bedrock system. Tests that targeted geologic structures within proposed pit areas were found to have tight range in hydruaulic conductivity (mean of 7E-07 m/s) even at depths exceeding 200 m below ground surface. Hydraulic tests in valley areas produced similarly high results, supporting the inference that valley traces follow fault structures. There does not appear to be a correlation between hydraulic conductivity and lithology.
- Groundwater draining the Halfway Creek catchment at higher elevations occurs at significant depth (130 to over 220 metres below ground surface). Along the drainage channel itself, groundwater pressures are flowing artesian and vertical groundwater gradients vary in both magnitude and direction, indicative of the complex hydrogeologic regime at the Project. Most water level hydrographs increased through 2015 on the order of few metres in response to seasonal recharge.
- Groundwater is well-confined along the upper reaches of the YT-24 drainage. The piezometric surface is several to tens of metres above the base of permafrost and vertical hydraulic gradients vary in both magnitude and direction along the drainage, indicative of the complex hydrogeologic regime at the Project. The hydrographs do not appear sensitive to individual rainfall events and demonstrate variable increases (zero to over 10 metres) in response to longer term seasonal rainfall trends through 2015.
- Groundwater levels measured along the South WRSF drainage range from flowing artesian to several tens of metres below ground surface. In the saddle area, groundwater is more than 120 metres deep. Water level hydrographs start to climb

within one to four weeks of the onset of continuous summer rainfall in the final week of June 2015 with the longest time lag associated with the deepest water levels. The magnitude of seasonal water level response ranges from approximately 2 m to over 30 m. Strong upward hydraulic gradients are measured in upper reaches of the drainage, while both upward and downward hydraulic gradients are measured in bedrock at the confluence with Latte Creek, indicative of the complex hydrogeologic regime at the Project.

- Strong artesian groundwater pressures are measured at the headwaters of Latte Creek. Immediately downstream, the piezometric surface is above the base of permafrost, but groundwater pressures are not flowing artesian. Seasonal trends in water pressure are subdued compared to other areas, with water levels rising on the order of a few metres at some locations. Strong downward vertical gradients are observed in both upper and lower reaches of the drainage.
- Groundwater is predominantly circum-neutral (pH 6 to 8), with most groundwater between pH 7 and 8. Groundwater quality shows variable influence from weathering of sulphide minerals and dissolution of sulphate minerals, either from the deposits or other disseminated mineralization across the Project area. Sulphate concentrations range from low to substantial (12 to 954 mg/L) and salinity is variable (field specific conductance readings between 28 and 2269 µS/cm).
- Major ion chemistry of overburden groundwater is calcium-bicarbonate-type. The bedrock groundwater has a wide range of major ion signatures from calcium-bicarbonate to mixed magnesium-calcium-sodium-sulphate-type water, reflecting variable influence of sulphide weathering. The groundwater in granite is generally more sodic than other groundwater on site and ranges from calcium-bicarbonate-type to sodium-bicarbonate-type water.
- Dissolved arsenic and uranium were consistently measured in the overburden and bedrock groundwater during baseline monitoring. Groundwater quality in the Project area is characterized by elevated dissolved arsenic and uranium concentrations which generally were highest in the bedrock, ranging from 0.27 to 1860 µg/L and 7.6 to 589 µg/L, respectively.

7. Closure

7. Closure

We trust that this baseline report on the hydrogeology of the Coffee Creek Project meets your requirements at this time. Please contact us should you have any questions or concerns, or require additional information in support of this work.

Yours sincerely,

LORAX ENVIRONMENTAL SERVICES LTD.

Report prepared by:

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Appendices

GOLDCORP

GOLDCORP

Appendix 3-A:
Borehole and Instrument Log

GOLDCORP

LORAX ENVIRONMENTAL

MW14-01A / BH5 / CFD-0402

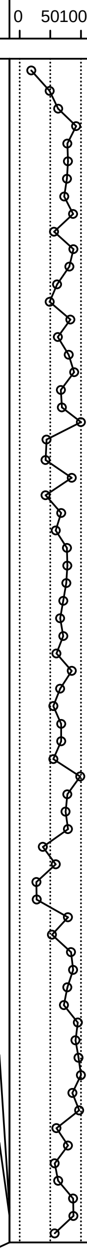
KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: Aug 11, 2014	Northing Coord.	: ~6,975,003
Install Completed	: Aug 13, 2014	Easting Coord.	: ~583,990
Drilling Method	: Diamond / HQ	Ground Surface	: ~1175 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: LF/MS	Checked By	: LF

Depth (m)	Elev. (m amsl) 1175	DESCRIPTION	Fracture = Fr, Fault = Flt	Packer Test Interval (m amsl)	K (m/s)	Depth (m)
0	1175	**GNEISS** Weakly oxidised gneiss, biotite schist zones are weakly carbonaceous				0
20	1155	Biotite schist zones are weakly carbonaceous and stongly chloritic 21.7 to 91.6 m				20
40	1135	Dark mafic / schistose bands are strongly chloritic with moderate carbonate alteration parallel to schistosity 91.6 to 196.17 m *40 m - loss of half of return				40
60	1115		N/A			60
		*72 m - some loss of return				
80	1095	*80 m - lost circulation (G-Stop used)				80
100	1075					100
		*109 m - lost circulation (G-Stop used)				
120	1055	*118 m - 121 m inferred fault zone, highly fractured with possible 10" core loss around 121 m, circulation lost @ 118 m				120
140	1035					140
160	1015			155.3 - 166.0	4E-08	160
		BIOTITE FELDSPAR SCHIST Strongly chlorite altered biotite schist				
180	995					180
		GNEISS Dark mafic / schistose bands are strongly chloritic with moderate carbonate alteration parallel to schistosity		179.3 - 202.0	3E-08	
200	975	EOH @ 202 m Hole position not surveyed. Co-ordinates estimated from CFD-0419 N/A: Borhole not logged for structure *Comment from supervising hydrogeologist, all other descriptons provided by Kaminak				200
220						220

RQD (%)



Well: Abandoned
Elev.: N/A

MW14-01A / BH5 / CFD-0419

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: Aug 20, 2014	Northing Coord.	: 6,975,002.66
Install Completed	: Aug 27, 2014	Easting Coord.	: 583,995.31
Drilling Method	: Diamond / HQ	Ground Surface	: 1177.01 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: SK/LF/JY	Checked By	: LF

Water Level:

1083.30 m amsl 03-Sep-14 @ 23:15 (still falling)

Well: Collapsed
Elev.: 1177.47 m amsl (TOC)

Depth (m) | Elev. (m amsl)1177.01 | DESCRIPTION | RQD (%) 0 50 100 | Fracture = Fr, Fault = Flt | Packer Interval (mbgs) | K (m/s) | Depth (m)

Depth (m): 0, 20, 40, 60, 80, 100, 120
Elev. (m amsl): 1175, 1155, 1135, 1115, 1095, 1075

OVERBURDEN

ANDESITE
Dark blackish green,feldspar phyric dyke, moderate hematite and limonite after mafic groundmass

GNEISS
Zone: Bleached cream-organge felsic augen gneiss with local ones of biotite schist, limonite
and hematite in groundmass and fractures

LIMONITE MATRIX BRECCIA
Zone: Bleached orange limonite and clay filled breccia, moderate clay overprint on sericitized and strongly oxized rock

FELSIC GNEISS
Zone: pale pink to orange augen gneiss, limonitic fractures

DIORITE
Dark green phyric dyke

GNEISS
Pink augen gneiss with narrow 30-60 cm bands of chloritic biotite schist, weakly disseminated hematite, minor limonite on fractures

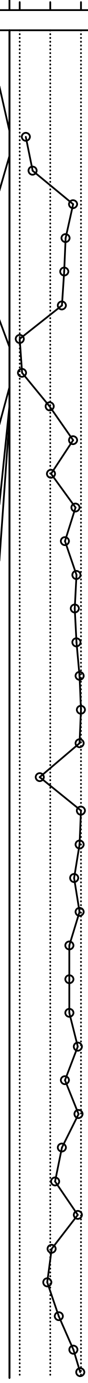
Bleached orange white augen gneiss with minor 30 cm bands of biotite schist, moderate limonite and hematite in fractures and in groundmass, narrow crackle or fault at 46.4 to 46.5 m

Pale pink to grey augen gneiss, weak to moderate hematite dusting throughout, minor limonite on fracture faces 54.1 to 82.8 m

Pale bleached orange augen gneiss 82.8 to 84.5 m

Pink to grey felsic gneiss with local 60 cm intervals of chloritic biotite schist 84.5 to 118.9 m

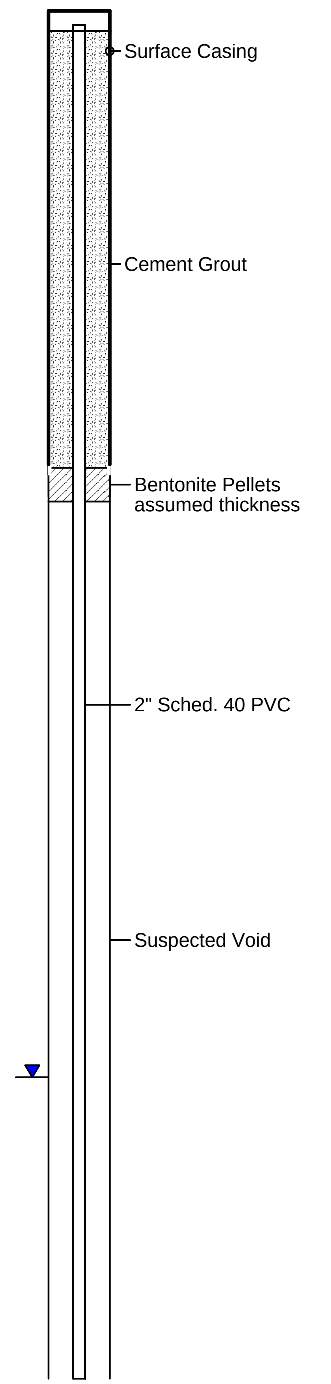
Pink massive with little to no augen, gneiss, minor intervals of banded biotite schist, minor oxidation at 131 to132 m.



Fracture/Fault: Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr, Fr

Packer Interval (mbgs): N/A

K (m/s): N/A



MW14-01A / BH5 / CFD-0419

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

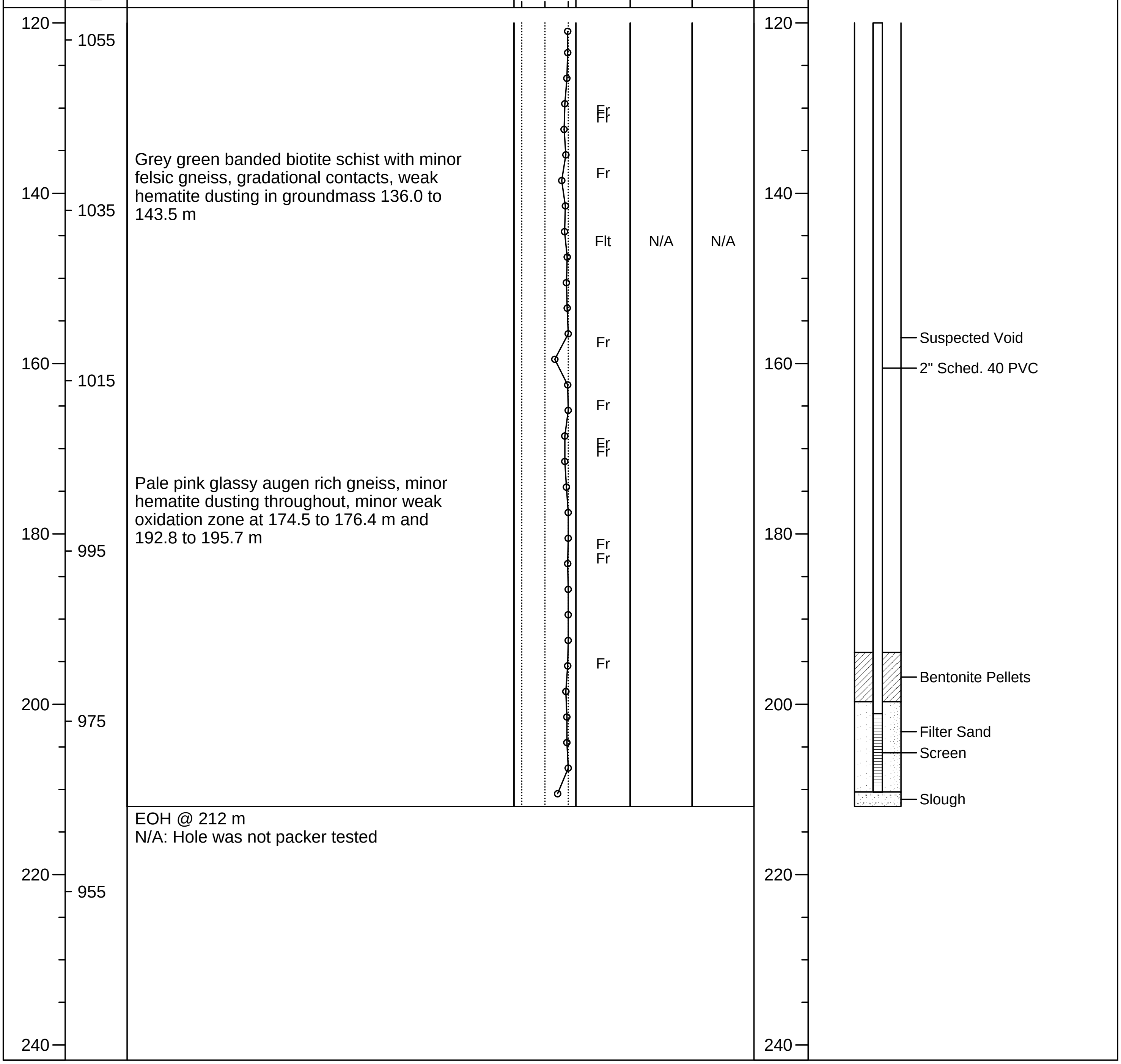
Drilling Started	: Aug 20, 2014	Northing Coord.	: 6,975,002.66
Install Completed	: Aug 27, 2014	Easting Coord.	: 583,995.31
Drilling Method	: Diamond / HQ	Ground Surface	: 1177.01 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: SK/LF/JY	Checked By	: LF

Water Level:
1083.30 m amsl 03-Sep-14 @ 23:15 (still falling)

Well: Collapsed
Elev.: 1177.47 m amsl (TOC)

Depth (m)	Elev. (m amsl) 1177.01	DESCRIPTION	Fracture = Fr / Fault = Flt	Packer Interval (mbgs)	K (m/s)
120–143.5	1055–1035	Grey green banded biotite schist with minor felsic gneiss, gradational contacts, weak hematite dusting in groundmass 136.0 to 143.5 m	Fr, Fr, Fr, Flt	N/A	N/A
143.5–212	1035–975	Pale pink glassy augen rich gneiss, minor hematite dusting throughout, minor weak oxidation zone at 174.5 to 176.4 m and 192.8 to 195.7 m	Fr, Fr, Fr, Fr, Fr, Fr, Fr		

EOH @ 212 m
N/A: Hole was not packer tested



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MW14-01B / BH5 / CFD-0434

LORAX ENVIRONMENTAL

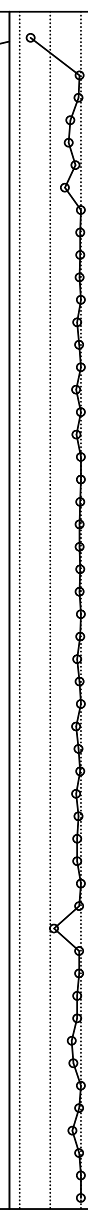
KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

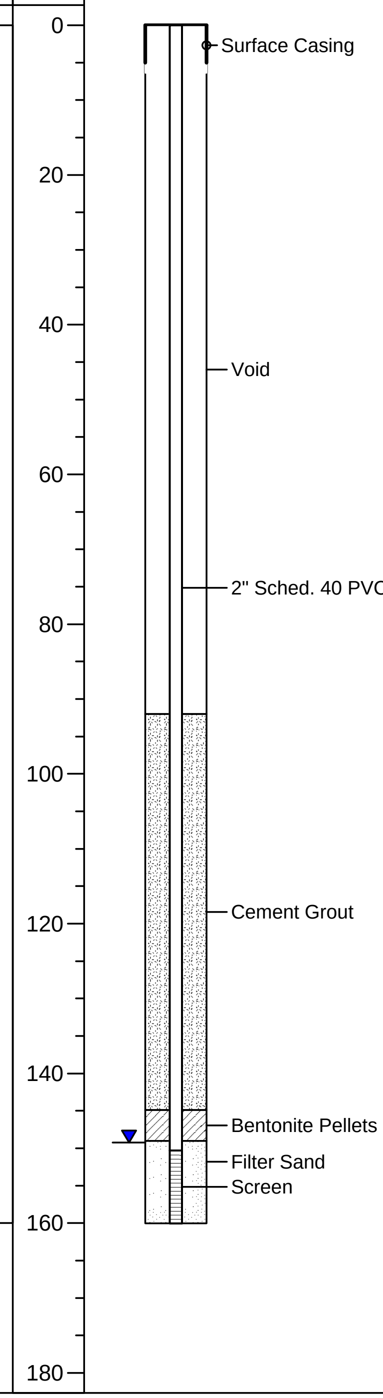
Drilling Started	: Sep 1, 2014	Northing Coord.	: 6,975,002.66
Install Completed	: Sep 4, 2014	Easting Coord.	: 583,995.31
Drilling Method	: Diamond / HQ	Ground Surface	: 1177.01 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: SK/JY/LF	Checked By	: LF

Water Level:
1027.75 m amsl 08-Sep-14 @ 12:55

Depth (m)	Elev. (m amsl) 1177.01	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Interval (mbgs)	K (m/s)
0	1175	**OVERBURDEN**				
		GNEISS Mix felsic gneiss & biotite schist, dark green, fine-coarse, moderate-strong chlorite alteration, variable weak - no oxide				
20	1155	See MW14-01A for more details				
40	1135					
60	1115			N/A	N/A	N/A
80	1095					
100	1075					
120	1055					
140	1035					
160	1015	EOH @ 160 m N/A: Hole not logged for structure or packer tested				
180						



Well: Collapsed
Elev.: 1177.01 m amsl



LORAX ENVIRONMENTAL

MW14-02A / BH9 / CFD-0428

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

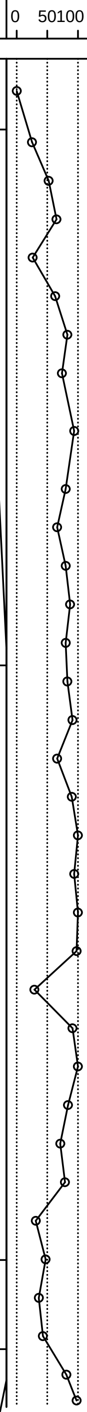
Drilling Started	: Sep 25, 2014	Northing Coord.	: 6,973,507.99
Install Completed	: Sep 28, 2014	Easting Coord.	: 583,993.73
Drilling Method	: Diamond / HQ	Ground Surface	: 1029.54 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: MS/RC/CB	Checked By	: LF

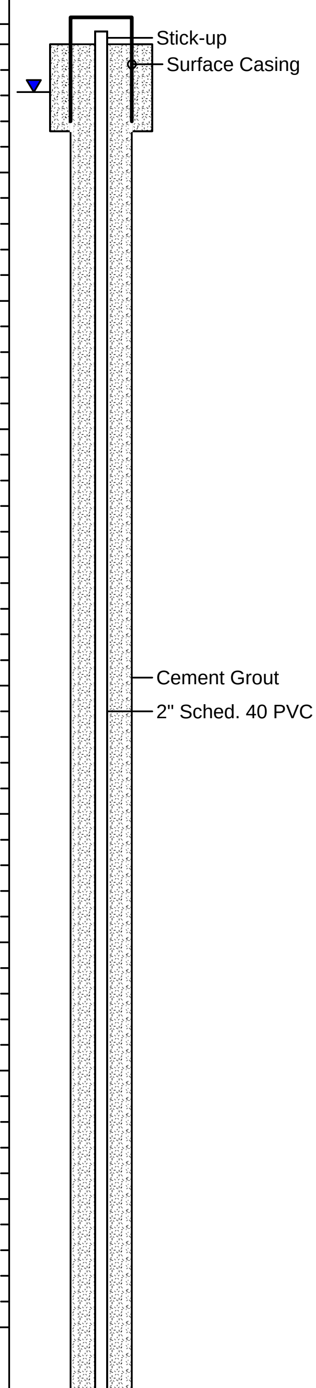
Water Level:
1025.81 m amsl 11-Oct-14 @ 13:30

Well: MW14-02A, partially frozen
Elev.: 1030.54 m amsl (TOC)

Depth (m)	Elev. (m amsl) 1029.54	DESCRIPTION	Fracture = Fr; Fault = Flt; Joint = J	Packer Test Interval (mbgs)	K (m/s)
0		**OVERBURDEN**	J(73)		
	1025				
		BIOTITE-FELDSPAR SCHIST Biotite schist, 10% pervasive-fractured oxide (surface weathering?), 0.5% fractured limotite			
10			Fr		
	1015		Fr Fr		
			Fr		
20			Fr J(11)		
	1005				
30		**FELSIC GNEISS** Massive pink hard felsic gneiss			
	995				
40			J(21)	N/A	N/A
	985				
50		**GNEISS** Biotite schist, moderate fracturing, weak fractured clay, 10% pervasive-fractured oxide (surface weathering?), 0.5% fractured limonite			
	975		Fr		
60			J((6)		
	965				
70			Fr		
	955				
			J(18)		
80			Fr		
	945	*85.3 to 85.5 m some circulation loss			
90					
	935	**BIOTITE-FELDSPAR SCHIST** Biotite schist			
100			J(22)		
		ANDESITE Mafic dykes intruding biotite schist, weak fractured clay, dark orange fracture staining			

RQD (%)





MW14-02A / BH9 / CFD-0428

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

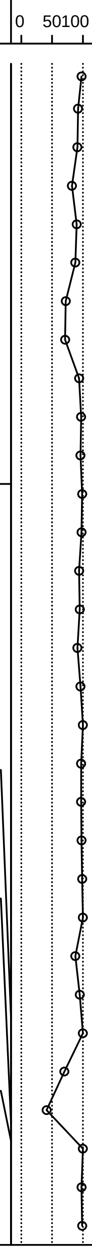
Drilling Started	: Sep 25, 2014	Northing Coord.	: 6,973,507.99
Install Completed	: Sep 28, 2014	Easting Coord.	: 583,993.73
Drilling Method	: Diamond / HQ	Ground Surface	: 1029.54 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: MS/RC/CB	Checked By	: LF

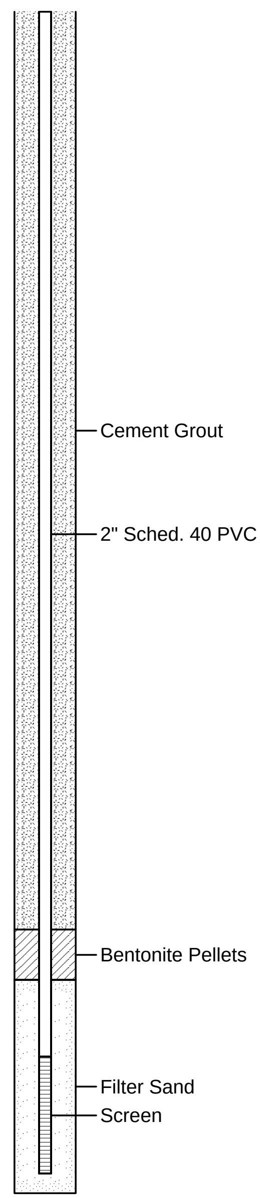
Water Level:
1025.81 m amsl 11-Oct-14 @ 13:30

Well: MW14-02A, partially frozen
Elev.: 1030.54 m amsl (TOC)

Depth (m)	Elev. (m amsl) 1029.54	DESCRIPTION	Fracture = Fr; Fault = Flt ; Joint = J	Packer Test Interval (mbgs)	K (m/s)
105					
	920				
115					
	910		J(22)		
125			Fr		
			Fr		
	900				
135					
	890	**GABBRO** Gabbro, coarse, varying orange oxide bands	J(28)	N/A	N/A
145			Fr		
	880				
155					
	870	**HYDROTHERMALLY ALTERED ROCK** Breccia zone overlaps gabbro-biotite schist contact around 180.3m. At 184 m, increased brecciation with stronger pervasive oxide	J(3)		
165					
	860	**CARBONATE +/- LIMONITE MTX BX** Clasts in orange & white carbonate matrix (dolomite, ankerite)			
175					
	850				
185		**HYDROTHERMALLY ALTERED ROCK** Crackle breccia. At 189.9 m, less intensely yet strong fracturing with carbonate infill *193 m some circulation loss			
	840				
195					
	830	EOH @ 197 m			
205					

RQD (%)





EOH @ 197 m
N/A: Hole not packer tested
*Comment from supervising hydrogeologist, all other descriptons provided by Kaminak
Number of joints reported for every 20 m interval

MW14-02B / BH9 / CFD-0418

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

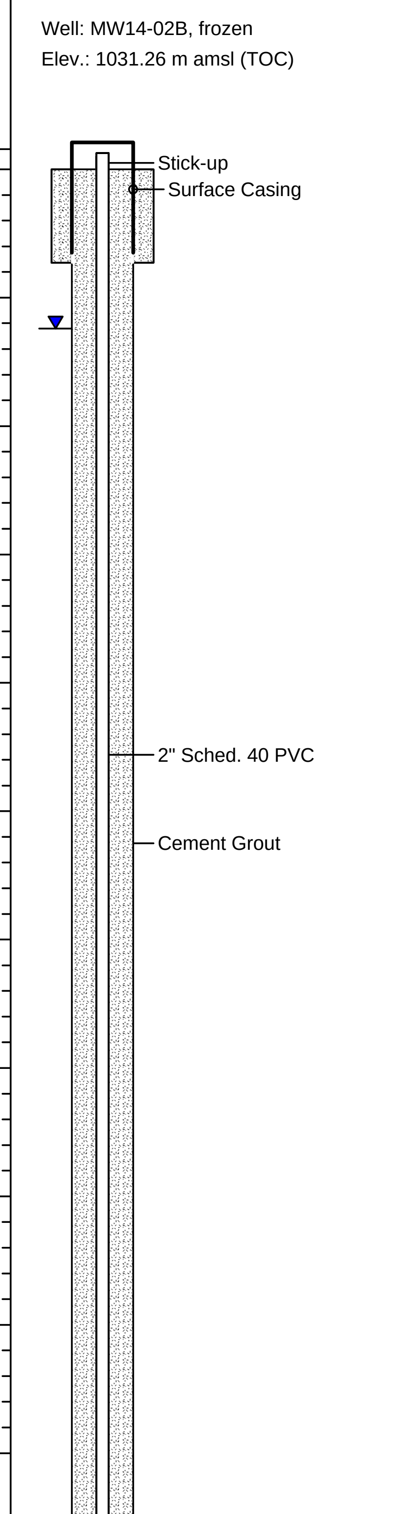
Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 19, 2014	Northing Coord.	: 6,973,507.27
Install Completed	: Sep 24, 2014	Easting Coord.	: 584,008.13
Drilling Method	: Diamond / HQ	Ground Surface	: 1030.93 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: MS/RC	Checked By	: LF

Water Level:
1018.80 m amsl 17-Sep-14 @ 18:08

Depth (m)	Elev. (m amsl) 1030.93	DESCRIPTION	Fracture = Fr / Fault = Flt	Packer Test Interval (mbgs)	K (m/s)
0	1030	**OVERBURDEN** Pebbles and boulders of mixed mafic gneiss			
		GNEISS Grey with orange strongly banded chlorite and feldspar rich gneiss	Fr		
10	1020		Fr		
			Fr Fr		
20	1010	Augen rich chlorite and feldspar rich gneiss 22.1 to 46.9 m	Fr		
30	1000		Fr Fr		
			Fr Fr		
40	990		Fr		
		Weakly oxidized mixed mafic, augen rich gneiss, weak patchy oxidation 46.9 to 56.4 m	Fr Fr		
50	980	Mixed biotite schist and augen rich gneiss, weak patchy oxidation 56.4 to 76.5 m	Fr Fr		
60	970		Fr		
70	960		Fr Fr		
		Weak Zone: Pale buff and orange strongly foliated chlorite rich an augen gneiss, pervasive limonite and foliation controlled hematite 76.5 to 83.8 m	Fr Fr		
80	950	Fresh biotite and augen rich gneiss, moderate hematite dusting 83.8 to 87.5 m	Fr Fr		
90	940	Weak Zone: Bleached buff orange well foliated mixed gneiss, limonite in groundmass hematite in fractures and foliation parallel 87.5 to 96.1 m	Fr	84.5 - 104.0	5E-9
100		Pink and green fresh looking biotite schist and augen gneiss 96.1 to 108.0 m	Fr Fr		

RQD (%) 0 50 100



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![Lorax Environmental / Kaminak Gold Corporation]

MW14-02B / BH9 / CFD-0418

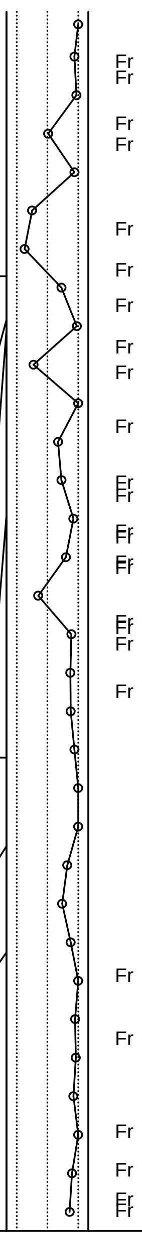
Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 19, 2014	Northing Coord.	: 6,973,507.27
Install Completed	: Sep 24, 2014	Easting Coord.	: 584,008.13
Drilling Method	: Diamond / HQ	Ground Surface	: 1030.93 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: MS/RC	Checked By	: LF

Water Level:
1018.80 m amsl 17-Sep-14 @ 18:08

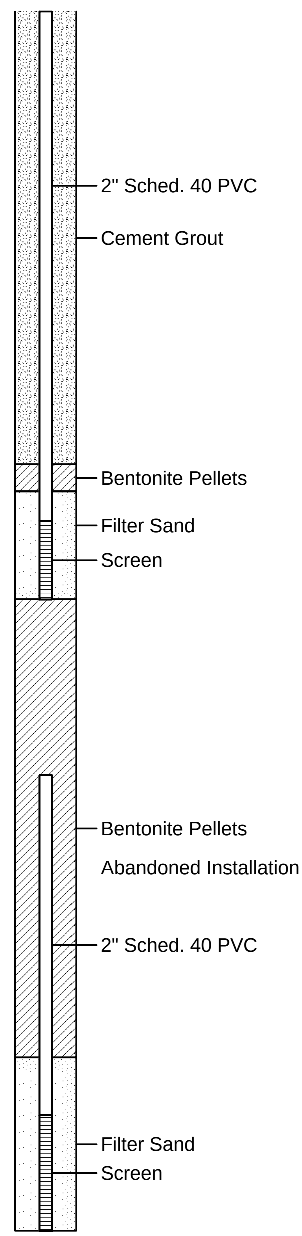
Depth (m) | Elev. (m amsl)1030.93 | DESCRIPTION | RQD (%) 0 50 100 | Fracture = Fr, Fault = Flt | Packer Test Interval (mbgs) | K (m/s) | Depth (m)

Depth (m)	Elev. (m amsl)	DESCRIPTION
105	925	Strong Zone: Patchy orange and grey mixed gneiss, patchy strong to weak oxidation 108.0 to 126.6 m
126.6		**BIOTITE-FELDSPAR SCHIST** Green well foliated biotite schist, common limonite fractures
		SHEAR ZONE Pale green highly deformed and folded chloritic +- talc schist. Moderate carbonate overprint as stringers
		BIOTITE FELDSPAR SCHIST Zone: Orange strongly oidized biotite schist, strong pervasive limonite and hematite Green-orange feldspar rich biotite schist, moderate limonite on fractures and in groundmass with hematite 139.3 to 144.2 m
		CRACKLE BRECCIA Zone: Bright orange crackle breccia to biotite schist? Strong pervasive hematite and limonite
		HYDROTHERMALLY ALTERED ROCK Bleached cream-orange qtz-sericite-pyrite altered zone, moderate limonite oxidation throughout.
		CRACKLE BRECCIA Bleached cream-orange qtz-sericite-pyrite altered zone, moderate limonite oxidation throughout
		BIOTITE-FELDSPAR SCHIST Green feldspar rich biotite schist, Pale orange and bleached white biotite schist? Weak patchy oxidation 183.9 to 200.0 m
200		EOH @ 200 m



Packer Test Interval (mbgs)	K (m/s)
102.5 - 125.0	8E-8
129.5 - 137	3E-8
138.5 - 152.0	bypass
156.5 - 173.0	1E-8
180.5 - 200.0	1E-8

Well: MW14-02B, frozen
Elev.: 1031.26 m amsl (TOC)



MW14-03A / BH3 / CFD-0432

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: Aug 29, 2014	Northing Coord.	: 6,973,191.08
Install Completed	: Sep 07, 2014	Easting Coord.	: 582,401.16
Drilling Method	: Diamond / HQ	Ground Surface	: 1097.59 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: RC/CB	Checked By	: LF

Water Level:
997.10 m amsl 04-Oct-14 @ 10:00 (not stable)

Depth (m) | Elev. (m amsl)1097.59 | DESCRIPTION | RQD (%) 0 50 100 | Fracture = Fr, Fault = Flt ; Joint = J | Packer Test Interval (mbgs) | K (m/s) | Depth (m)

Depth scale: 0, 20, 40, 60, 80, 100 m. Elevation scale: 1095, 1075, 1055, 1035, 1015 m amsl.

OVERBURDEN
*Ice crystals observed in silty sand 7.6 m to 8.3 m

METACARBONATE
Massive to weakly foliated carbonate unit with minor intervals of biotite schist

*Ice lens (<1cm) observed at 10.9 m

*23 m loss of circulation (poly added)

*33m loss of circulation

CRACKLE BRECCIA
Orange polymictic clast supported breccia, carbonate and qtz fragments, moderate to strong oxidation

METACARBONATE
Massive to weakly foliated carbonate unit as above

*51.5 m cave-in observed with loss of recovery (rods greased)

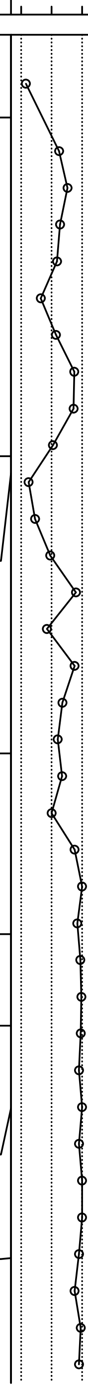
CARBONATE +/- LIMONITE
Orange polymictic cement and clast supported breccia

METACARBONATE
Massive to weakly foliated carbonate unit as above

CRACKLE BRECCIA
Orange crackled breccia of marble, minor biotite schist, and minor dacitic dyke, moderate to strong pervasive oxidation, weak patchy clay alteration in fractures

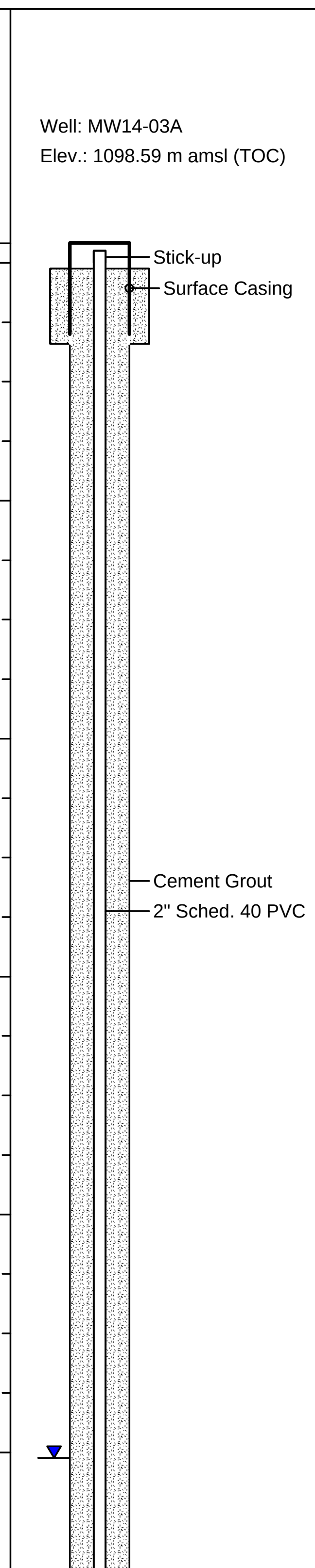
DACITE
Patchy blackish green to light orangy grey massive to weakly foliated dyke, common fractures with weakly oxidized halos

BIOTITE FELDSPAR SCHIST
Dark green well foliated biotite schist with minor intervals of marble



Fractures (Fr) noted at approx. 12 m, 16 m, 22 m, 51 m, 83 m, 92 m, 93 m, 98 m, 103 m.

Packer Test Interval: 81.5 - 110.0 mbgs; K (m/s): 1



LORAX ENVIRONMENTAL

MW14-03A / BH3 / CFD-0432

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

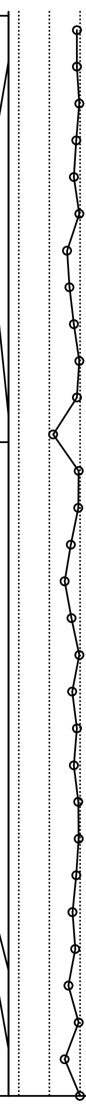
Drilling Started	: Aug 29, 2014	Northing Coord.	: 6,973,191.08
Install Completed	: Sep 07, 2014	Easting Coord.	: 582,401.16
Drilling Method	: Diamond / HQ	Ground Surface	: 1097.59 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: RC/CB	Checked By	: LF

Water Level:

997.10 m amsl 04-Oct-14 @ 10:00 (not stable)

Depth (m)	Elev. (m amsl)1097.59	DESCRIPTION	Fracture = Fr Fault = Flt ; Joint = J	Packer Test Interval (mbgs)	K (m/s)
110	985	**METACARBONATE** White marble unit with light grey banding and minor intervals of biotite schist, limonite on fractures	Fr	111.5 - 140.0	1
		BIOTITE FELDSPAR SCHIST Dark green well foliated biotite schist with minor marble intervals as above, limonite along fractures and minor oxidation as halos to carbonate stringers			
130	965	**CRACKLE BRECCIA** Dark green weak crackle breccia in biotite schist and minor marble, moderate fracture controlled clay	Fr Fr		
			Fr Fr	132.5 - 155.0	2
		BIOTITE FELDSPAR SCHIST Dark green well foliated biotite schist with minor marble intervals as above, limonite along fractures and minor oxidation as halos to carbonate stringers.	Fr		
150	945		Fr	156.5 - 198.5	5E-09
			J(7)		
170	925				
		SHEAR ZONE Pale green sheared biotite schist			
190	905	**BIOTITE FELDSPAR SCHIST** Pale cream grey biotite schist partially obscured by alteration			
210					

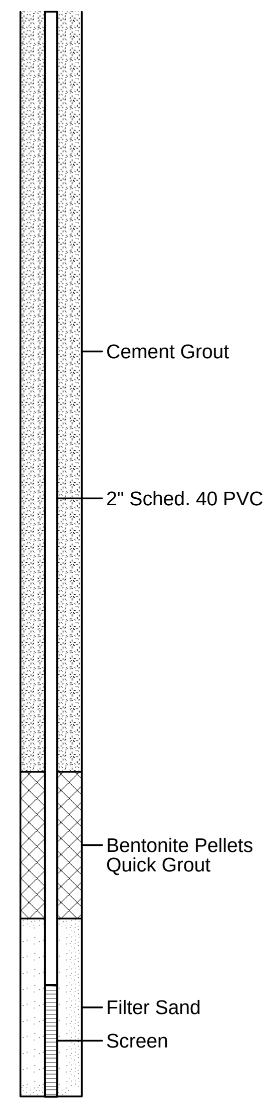
RQD (%) 0 50 100



EOH @ 198.5 m
*Comment from supervising hydrogeologist, all other descriptons provided by Kaminak
Number of joints reported for every 20 m interval
1. Packer test performed in unsaturated zone; test analysis is not valid
2. Packer test performed in unsaturated zone; test analysis is not valid. Interval did not hold water (i.e. bedrock highly permeable)

Depth (m): 110, 130, 150, 170, 190, 210

Well: MW14-03A
Elev.: 1098.59 m amsl (TOC)



MW14-03B / BH3 / CFD-0442

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

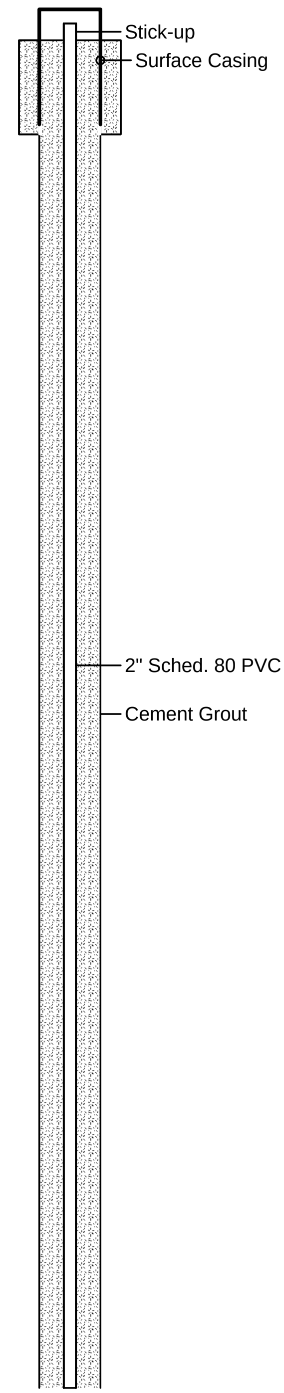
Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 08, 2014	Northing Coord.	: 6,973,196.66
Install Completed	: Sep 12 , 2014	Easting Coord.	: 582,388.30
Drilling Method	: Diamond / HQ	Ground Surface	: 1095.16 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: RC / CB	Checked By	: LF

Water Level:
962.39 m amsl 13-Oct-14 @ 15:41

Well: MW14-03B
Elev.: 1096.13 m amsl (TOC)

Depth (m)	Elev. (m amsl)1095.16	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
0	1095	**OVERBURDEN** *Silty sand, ice lenses observed near base					0
		HYDROTHERMALLY ALTERED ROCK Strongly oxidised, massive to local weak fracture breccia, clay rich with fault pug from 11.9 to 13.1 m.					
		METACARBONATE Alternating white-grey marble with weak foliation					
		FAULT Crumbly, broken up, clay rich fault pug *Loss of circulation at 17 m					
20	1075	**METACARBONATE** Alternating white-grey marble with weak remnant patches of fracture controlled, weak limonite					20
		GNEISS Foliated mafic gneiss, facture controlled limonite		N/A	N/A	N/A	
		METACARBONATE White-grey marble with fracture controlled limonite					
40	1055	*Loss of circulation at 41 m					40
		HYDROTHERMALLY ALTERED ROCK Hydrothermally altered. Monomictic, sub-angular to sub-rounded, fine to medium grained quartz clasts supported in a limonite matrix breccia					
		MEATACARBONATE Banded white-grey marble with strongly altered limonite bands *Minor cave-in at bit change at 54 m					
60	1035	**HYDROTHERMALLY ALTERED ROCK** Strongly limonite altered, fine grained monomictic, round marble clasts in a limonite supported matrix					60
		METACARBONATE Alternating grey-white and brown limonite altered marble					
		HYDROTHERMALLY ALTERED ROCK Fine-grained, rounded carbonate clasts supported in a limonite altered matrix					
80		**METACARBONATE** Banded white-grey marble with strongly limonite altered bands					80



MW14-03B / BH3 / CFD-0442

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

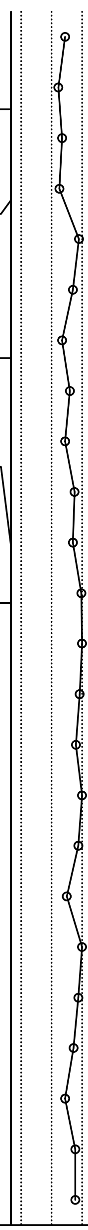
Coffee Creek Gold
Project #: A362-4

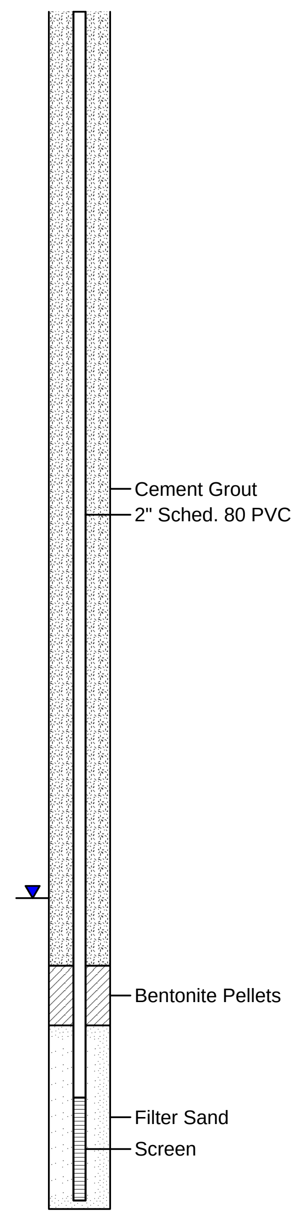
Drilling Started	: Sep 08, 2014	Northing Coord.	: 6,973,196.66
Install Completed	: Sep 12 , 2014	Easting Coord.	: 582,388.30
Drilling Method	: Diamond / HQ	Ground Surface	: 1095.16 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: RC / CB	Checked By	: LF

Water Level:
962.39 m amsl 13-Oct-14 @ 15:41

Well: MW14-03B
Elev.: 1096.13 m amsl (TOC)

Depth (m)	Elev. (m amsl)1095.16	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
80	1015						80
		GNEISS Mafic gneiss with weak patchy carbonate alteration, fracture controlled limonite and interstitial limonite alteration parallel to foliation					
		ANDESITE Fine grained, dark mafic dyke, fractures and carbonate veinlets with +- limonite and alteration halo					
100	995	**GNEISS** Mafic gneiss with minor thin bands of white marble, fracture controlled limonite alteration and selective interstitial limonite replacement		N/A	N/A	N/A	100
		MEATACARBONATE Alternating bands of mafic gneiss and marble, fracture controlled limonite and selective interstitial limonite replacement of marble / gneiss					
120	975	**BIOTITE FELDSPAR SCHIST** Fine grained, with weak patchy carbonate alteration, white marble bands also present, weak frature controlled limonite Zone strongly oxidised with weak, patchy carbonate alteration, fracture controlled limonite, local stockwork of limonite fractures 126.1 to130.5 m Patchy, weak fracture controlled oxdation / limonite alteration, weak fracture controlled clay alteration 130.5 to 137.5 m Weak zone. Moderate oxidation / limonite alteration and patchy hematite alteration 137.5 to 152.0 m					120
140	955						140
		EOH @ 152 m *Comment from supervising hydrogeologist, all other descriptons provided by Kaminak N/A: Hole not logged for structure or packer tested					
160							160





MW14-04T / BH6 / CFD-0439

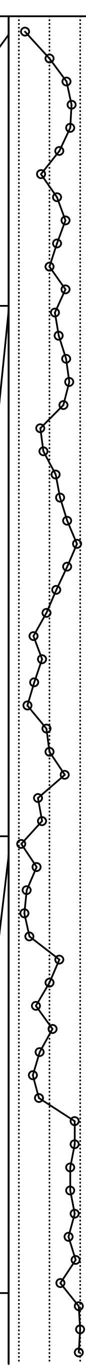
LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

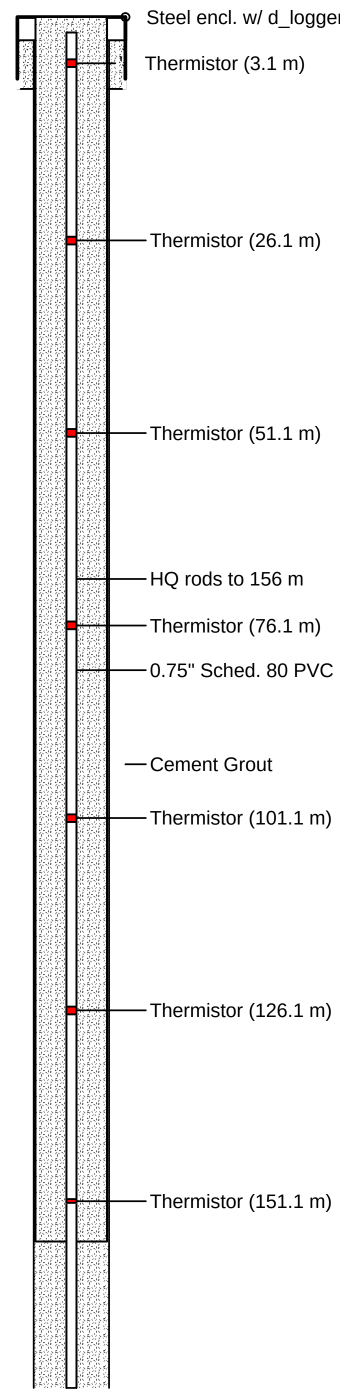
Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 07, 2014	Northing Coord.	: 6,975,001.35
Install Completed	: Sep 12 , 2014	Easting Coord.	: 584,286.64
Drilling Method	: Diamond / HQ	Ground Surface	: 1185.83 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: JY/LF/MS	Checked By	: LF

Depth (m)	Elev. (m amsl)1185.83	DESCRIPTION	RQD (%) 0 50100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
0	1185	**OVERBURDEN**					0
		GNEISS Mix of felsic gneiss dominant over biotite schist, occasional zone of stronger clay fractures alternating					
25	1160						25
		OTHER BRECCIA Low angle brecciation of host with stronger oxide					
50	1135	**GNEISS** Mix of felsic gneiss dominant over biotite schist, occasional zone of stronger clay fractures alternating, various vuggy elongate voids subparallel foliation					50
75	1110			N/A			75
100	1085						100
		OTHER BRECCIA Brecciated closed fractures *lost circulation at 107.5 m, regained on next run					
125	1060	**GNEISS** Mix of felsic gneiss dominant over biotite schist, occasional zone of stronger clay fractures alternating, various vuggy elongate voids subparallel foliation Mix of mafic rich zones and felsic pink gneiss 136.0 to 165.8 m					125
150	1035						150
		BIOTITE FELDSPAR SCHIST Dark grey-black biotite-amphibole schist			164.3 - 202.0	3E-10	
175							175



Well: MW14-04T
Elev.: 1185.83 m amsl



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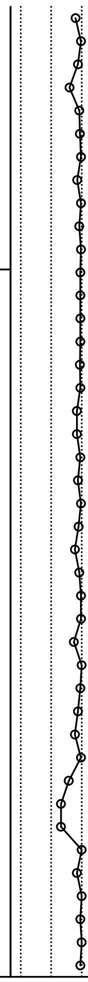
MW14-04T / BH6 / CFD-0439

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 07, 2014	Northing Coord.	: 6,975,001.35
Install Completed	: Sep 12 , 2014	Easting Coord.	: 584,286.64
Drilling Method	: Diamond / HQ	Ground Surface	: 1185.83 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: JY/LF/MS	Checked By	: LF

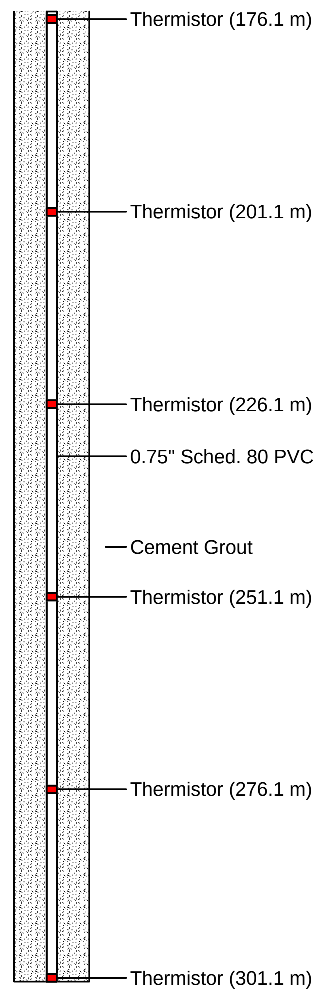
Depth (m)	Elev. (m amsl)1185.83	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
175	1010						175
					182.3 - 202.0	2E-10	
200	985						200
		GNEISS Mixed felsic gneiss with mafic rich bands					
					203.3 - 232.0	1E-09	
225	960						225
					233.3 - 256.0	4E-09	
250	935						250
					251.3 - 280.0	3E-10	
275	910						275
					281.3 - 301.0	No Flow	
300	885						300
325	860						325
350							350



EOH @ 301 m
Notes:
- Steel enclosure with data logger not to scale
- RST Model 2040 Multichannel Data logger S/N: 0215
- Thermistor string (3 m to 301 m) S/N: TS3795
- Solinst Barologger S/N:12036812

*Comment from supervising hydrogeologist, all other descriptons provided by Kaminak
N/A: Hole not logged for structure

Well: MW14-04T
Elev.: 1185.83 m amsl



LORAX ENVIRONMENTAL

MW14-05A / BH11 / CFD-0444

KAMINAK GOLD CORPORATION

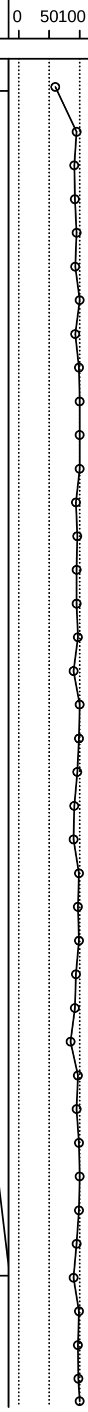
Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 12, 2014	Northing Coord.	: 6,972,997.94
Install Completed	: Sep 17 , 2014	Easting Coord.	: 579,708.14
Drilling Method	: Diamond / HQ	Ground Surface	: 1268.50 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: CB/RC	Checked By	: LF

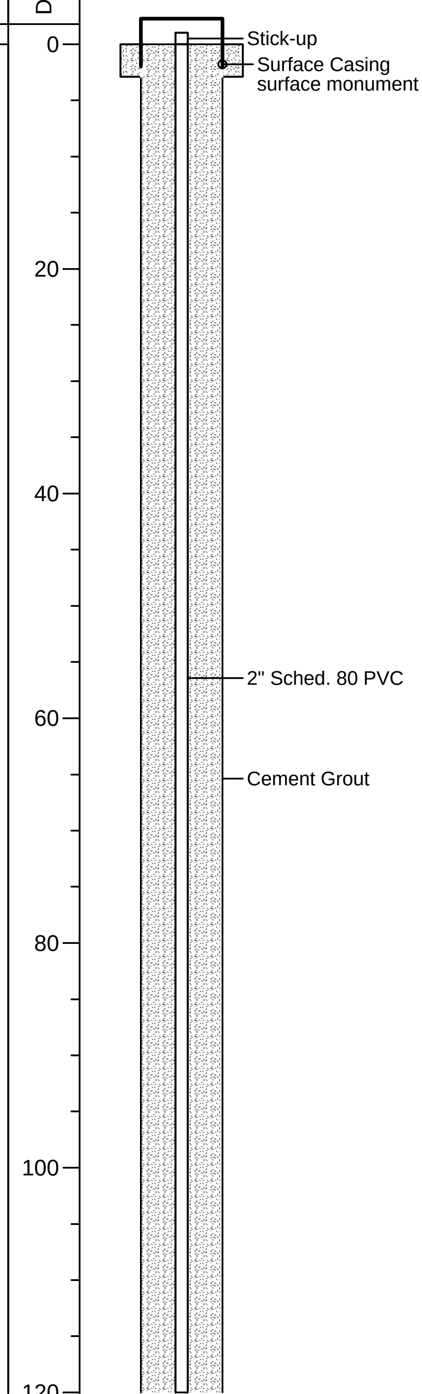
Water Level:
1136.42 m amsl 11-Oct-14 @ 15:45

Depth (m)	Elev. (m amsl) 1268.50	DESCRIPTION	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)
0		**OVERBURDEN**			
	1265	**GRANITE** Coarse grained, pink-grey granite, local, patchy, weak limonite staining			
20	1245				
40	1225		N/A		
60	1205				
80	1185				
100	1165	**ANDESITE** Fresh andesite intrusion			
120		**GRANITE** Coarse grained, grey-pink granite, predominantly fresh and unaltered with patchy fracture controlled limonite alteration limited to small haloes around fractures			

RQD (%)



Well: MW14-05A
Elev.: 1269.61 m amsl (TOC)



LORAX ENVIRONMENTAL

MW14-05A / BH11 / CFD-0444

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

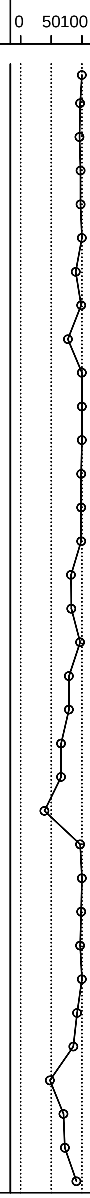
Drilling Started	: Sep 12, 2014	Northing Coord.	: 6,972,997.94
Install Completed	: Sep 17 , 2014	Easting Coord.	: 579,708.14
Drilling Method	: Diamond / HQ	Ground Surface	: 1268.50 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: CB/RC	Checked By	: LF

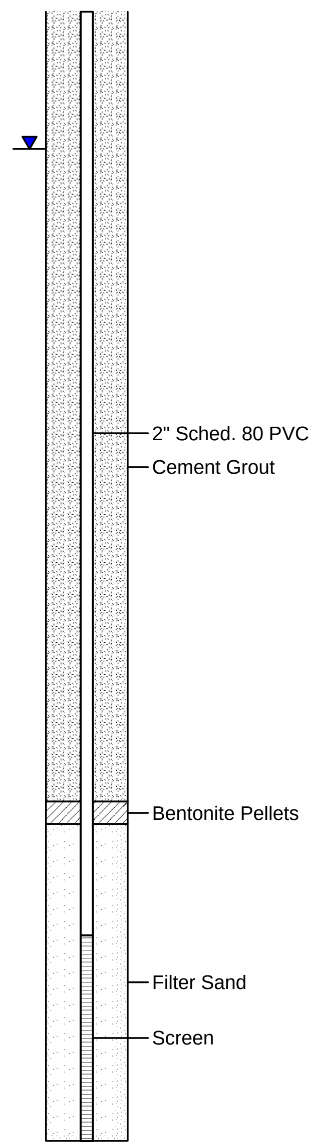
Water Level:
1136.42 m amsl 11-Oct-14 @ 15:45

Well: MW14-05A
Elev.: 1269.61 m amsl (TOC)

Depth (m)	Elev. (m amsl) 1268.50	DESCRIPTION	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)
120	1145			111.3 - 140.0	1
140	1125		N/A		
160	1105	Weak zone; weakly oxidised and limonite altered granite 166.6 to 170.7 m		156.3 - 179.0	No Flow
		Leucocratic granite with weak patchy limonite and clay alteration 170.7 to 178.1 m		156.3 - 220.5	1E-09
180	1085	Zone, moderately oxidised and limonite altered, fracture controlled limonite and clay alteration 178.1 to 182.7 m			
		Coarse grained grey-pink granite 182.7 to 183.7 m			
		Weak zone, fracture controlled limonite with weak to moderate oxidation 183.7 to 185.5 m		183.3 - 200.0	3E-09
200	1065	Coarse grained granite with patchy replacement of feldspars by clay and chlorite 185.5 to 221 m .			
				201.3- 220.5	1e-09
220	1045				
240					

RQD (%)





EOH @ 220.5 m

N/A: Borehole not logged for structure
1. Packer test performed in unsaturated zone; test analysis is not valid.

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MW14-05B / BH11 / CFD-0455

LORAX ENVIRONMENTAL

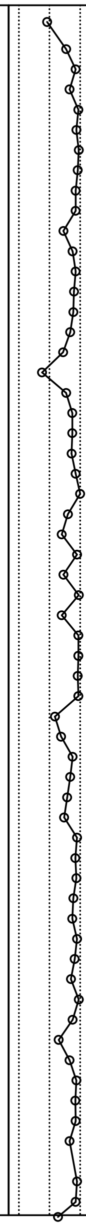
KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

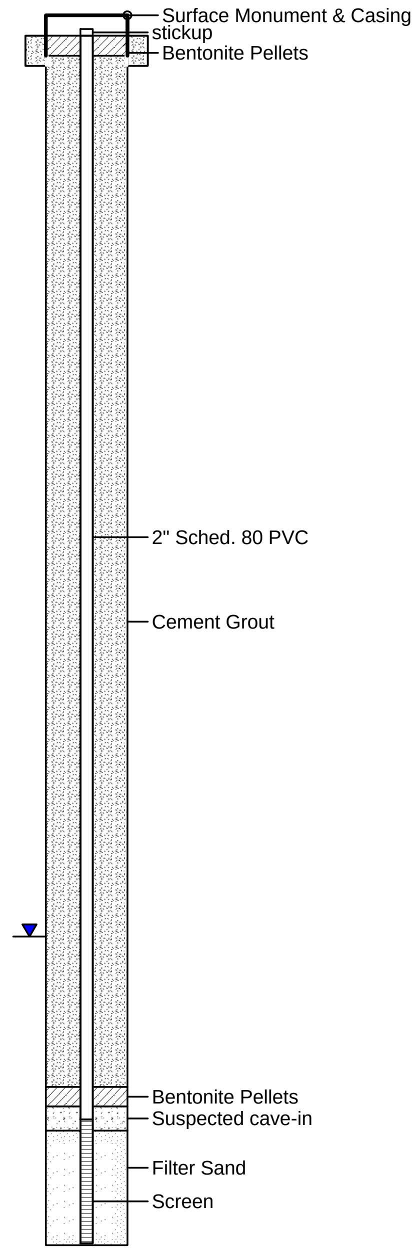
Drilling Started	: Sep 17, 2014		Northing Coord.	: 6,972,998.51
Install Completed	: Sep 20 , 2014		Easting Coord.	: 579,694.92
Drilling Method	: Diamond / HQ		Ground Surface	: 1270.3 m amsl
Drilling Company	: CYR Drilling Ltd.		Logged By	: Kaminak
Supervised By	: JH/JB/MS		Checked By	: LF

Water Level:
1136.32 m amsl 11-Oct-14 @ 15:53

Depth (m)	Elev. (m amsl) 1270.3	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
0	1270	**GRANITE** Fresh coarse grained granite, patchy clay alteration of feldspar, typically associated with fractures, weak to moderate fracture controlled limonite. See MW14-05A for details					0
20	1250						20
40	1230						40
60	1210			N/A	N/A	N/A	60
80	1190						80
100	1170						100
120	1150						120
140	1130						140
160	1110						160
180	1090	EOH @ 179.5 m					180
200		N/A: Borehole not packer tested or logged for structure					200



Well: MW14-05B
Elev.: 1270.9 m amsl (TOC)



MW14-06A / BH7 / CFD-0453

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 16, 2014	Northing Coord.	: 6,974,582.81
Install Completed	: Sep 22 , 2014	Easting Coord.	: 585,202.21
Drilling Method	: Diamond / PQ	Ground Surface	: 1183.0 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: LF/RW/MS	Checked By	: LF

Water Level:
1053.18 m amsl 07-Oct-14 @ 9:46

Depth (m) | Elev. (m amsl)1183.0 | DESCRIPTION | RQD (%) 0 50 100 | Fracture = Fr Fault = Flt | Packer Test Interval (mbgs) | K (m/s) | Depth (m)

Depth (m): 0, 20, 40, 60, 80, 100, 120
Elev. (m amsl): 1180, 1160, 1140, 1120, 1100, 1080

OVERBURDEN

FELSIC GNEISS
Felsic gneiss with muscovite rich mafic bands, fractures with limonite alteration and interstitial limonite

*Drilling additive (Pure Vis) used at 10 m onwards

Weak zone, weakly oxidised with fracture controlled limonite, strong fracture controlled clay alteration 21.9 to 25.3 m

HYDROTHERMALLY ATERED ROCK
Zone, Oxidized and brecciated hydro-thermally altered rock

FELSIC GNEISS
Felsic geiss with weak fracture controlled limonite and clay alteration

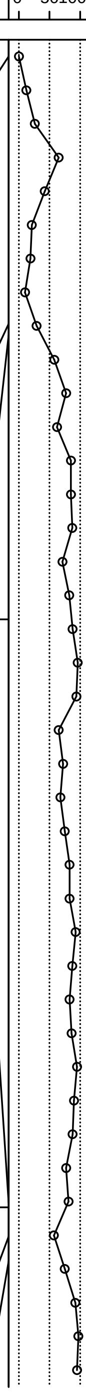
GNEISS
Felsic gneiss mixed with minor mafic, amphibole rich, bands

ANDESITE
Fine grained mafic dyke

GNEISS
Felsic gneiss

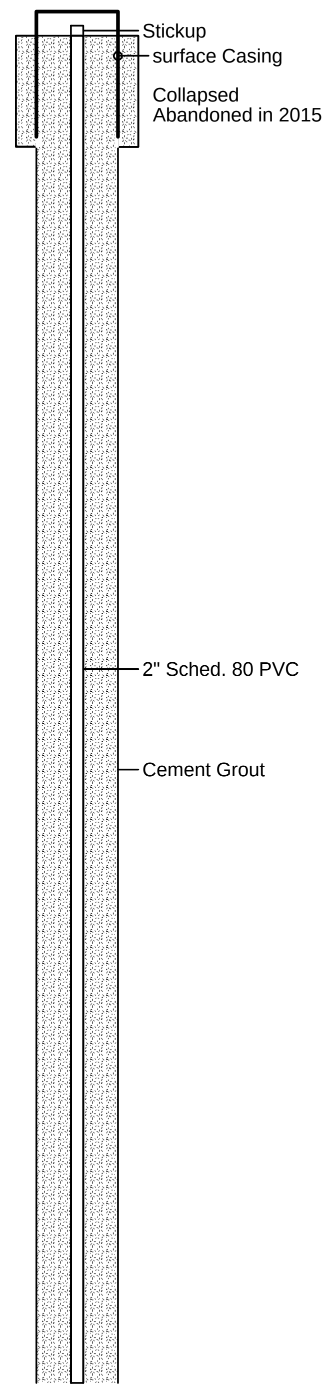
ANDESITE
Fine grained, massive, mafic dyke

GNEISS
Mixed felsic gneiss with mafic, amphibole rich mafic bands



Fracture = Fr / Fault = Flt: N/A
Packer Test Interval (mbgs): N/A
K (m/s): N/A

Well: MW14-06A
Elev.: 1183.9 m amsl (TOC)



LORAX ENVIRONMENTAL

MW14-06A / BH7 / CFD-0453

KAMINAK GOLD CORPORATION

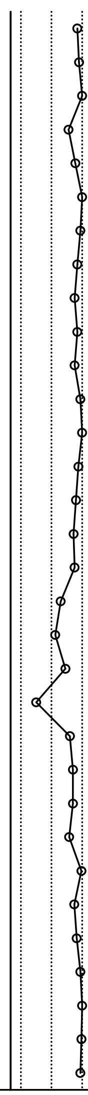
Coffee Creek Gold
Project #: A362-4

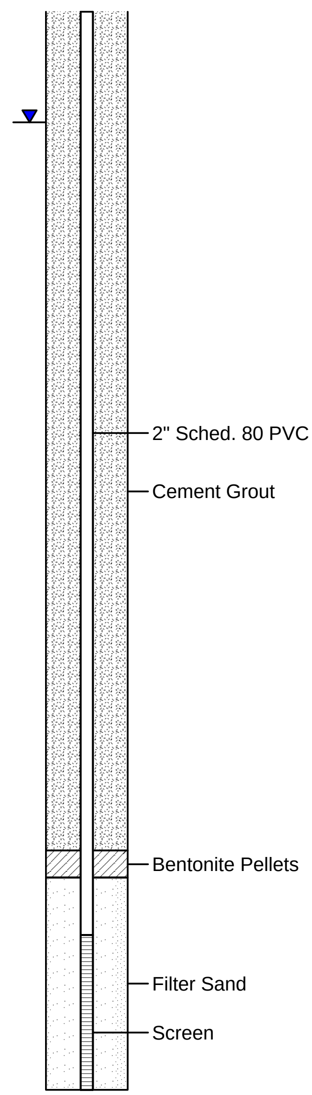
Drilling Started	: Sep 16, 2014	Northing Coord.	: 6,974,582.81
Install Completed	: Sep 22 , 2014	Easting Coord.	: 585,202.21
Drilling Method	: Diamond / PQ	Ground Surface	: 1183.0 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: LF/RW/MS	Checked By	: LF

Water Level:
1053.18 m amsl 07-Oct-14 @ 9:46

Well: MW14-06A
Elev.: 1183.9 m amsl (TOC)

Depth (m)	Elev. (m amsl)1183.0	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
120	1060						120
		*Minor circulation loss noted at 127.5 m, possibly enteriing formation at ~25 m *Stronger iron staining at 129.5 to 130.5 m suggests presence of water					
140	1040			N/A	N/A	N/A	140
160	1020	*Minor iron stained fracture zones suggesting presence of water at ~165, 175, 181, and 187 m					160
		Strongly foliated mixed felsic gneiss, bleached, weak carbonate alteration, white clay alteration to feldspars, weak fracture controlled limonite alteration 171.6 to 177.42 m					
180	1000	Zone, mixed gneiss, possible early mafic dyke with weak alteration 177.4 to 179.17 m					180
		Strongly foliated mixed felsic gneiss, weak carbonate alteration 179.2 to 183.2 m					
		Mixed felsic gneiss, 187.3 to 187.8 m, and EOH fracture zone with limonite alteration					
200	980						200
220	960	EOH @ 216 m *Comment from supervising hydrogeologist, all other descriptons provided by Kaminak N/A: Borehole not packer tested or logged for structure					220
240							240





LORAX ENVIRONMENTAL

MW14-06B / BH7 / CFD-0463

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

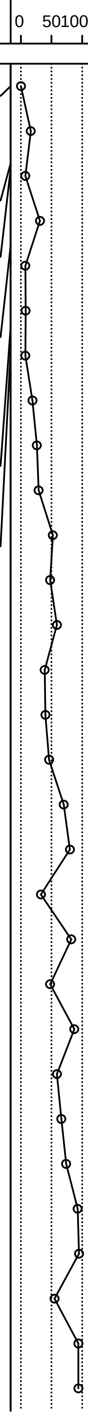
Drilling Started	: Sep 22, 2014	Northing Coord.	: 6,974,583.17
Install Completed	: Sep 24 , 2014	Easting Coord.	: 585,195.39
Drilling Method	: Diamond / PQ	Ground Surface	: 1183.3 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: LF/RW/GB	Checked By	: LF

Water Level:

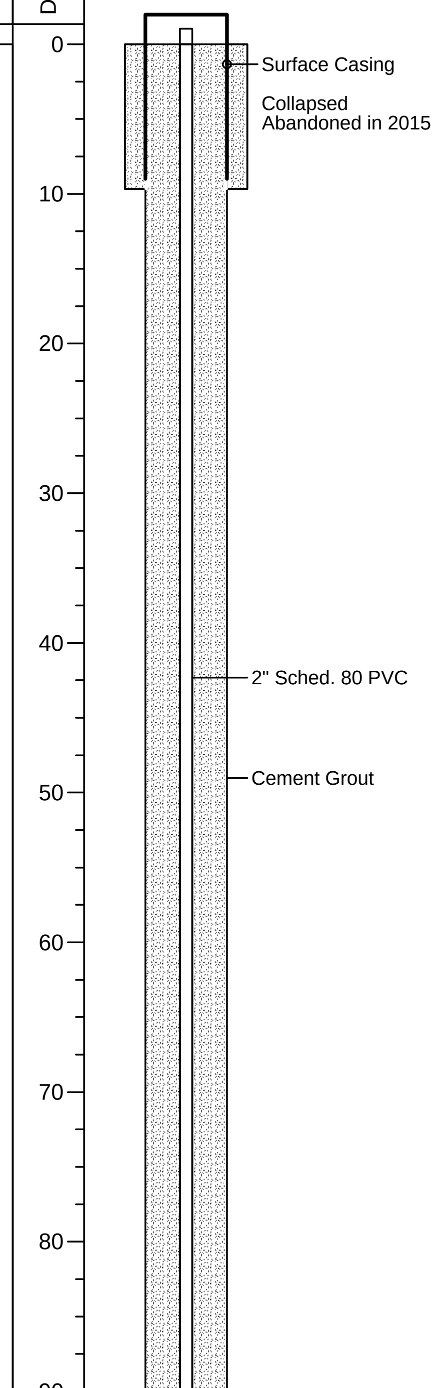
1053.32 m amsl 07-Oct-14 @ 11:15 (approximate)

Depth (m)	Elev. (m amsl) 1183.3	DESCRIPTION	Fracture = Fr / Fault = Flt	Packer Test Interval (mbgs)	K (m/s)
0		**OVERBURDEN**			
	1180	**GNEISS** Weak to modedrate fracture controlled and interstitial limonite alteration and clay alteration to feldspars			
10		**HYDROTHERMALLY ALTERED ROCK** Zone			
	1170	**GNEISS** Weak to moderate fracture controlled and interstitial limonite alteration			
20	1160	**HYDROTHERMALLLY ALTERED ROCK** Zone. Bleached and silicified medium grained, monomictic clasts supported in a pale yellow clay 12.8 to 17.5 m			
30		**ANDESITE** Zone. Strongly oxidised and limonite altered mafic dyke		N/A	N/A
	1150	**GNEISS** Weak fracture controlled limonite alteration			
40					
	1140		Fr		
50					
	1130				
60					
	1120				
70					
	1110				
80					
	1100				
90					

RQD (%)



Well: MW14-06B
Elev.: 1184.3 m amsl (TOC)



LORAX ENVIRONMENTAL

MW14-06B / BH7 / CFD-0463

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

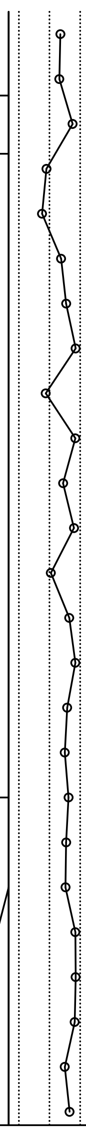
Drilling Started	: Sep 22, 2014	Northing Coord.	: 6,974,583.17
Install Completed	: Sep 24 , 2014	Easting Coord.	: 585,195.39
Drilling Method	: Diamond / PQ	Ground Surface	: 1183.3 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: LF/RW/GB	Checked By	: LF

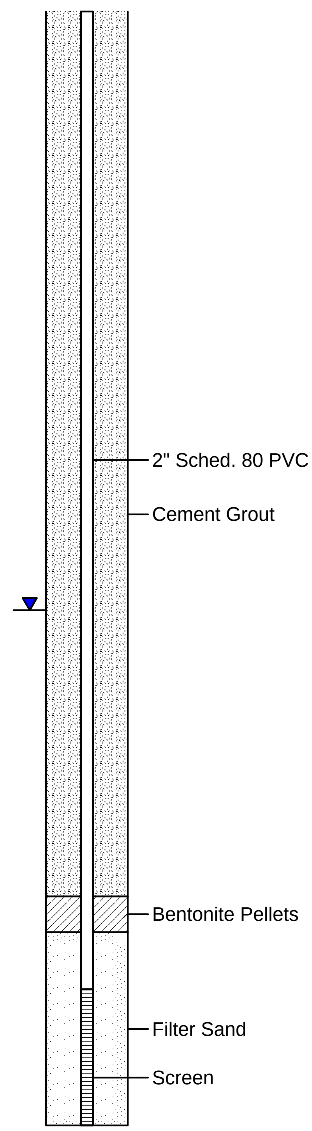
Water Level:
1053.32 m amsl 07-Oct-14 @ 11:15 (approximate)

Elev. (m amsl) 1183.3

Well: MW14-06B
Elev.: 1184.3 m amsl (TOC)

Depth (m)	Elev. (m amsl)	DESCRIPTION	RQD (%) 0 50 100	Fracture = Fr Fault = Flt	Packer Test Interval (mbgs)	K (m/s)	Depth (m)
90	1090						90
100	1080	**ANDESITE** Sharp fg dark-grey black dykes **GNEISS** Felsic bands common augens occ bt schist +/- amph, occ band pervasive pink = hematite? <1m					100
110	1070						110
120	1060						120
130	1050	*Iron stained fractures 133.3 to 136.0 m suggesting presence of water			N/A	N/A	130
140	1040	**HYDROTHERMALLY ALTERED ROCK** Minimal zone mix ox & sulph *Iron stained fractures at ~144 and 148 m suggesting presence of water					140
150	1030	**GNEISS** Felsic bands common augens occ bt schist +/- amph, occ band perv pink = hematite? <1m					150
160	1020						160
170	1010	EOH @ 164.4 m N/A: Borehole not packer tested					170
180							180





MW14-07T / BH1 / CFD-0462

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: Sep 21, 2014	Northing Coord.	: 6,971,364.89
Install Completed	: Sep 24, 2014	Easting Coord.	: 580,832.07
Drilling Method	: Diamond / HQ	Ground Surface	: 1156.25 m amsl
Drilling Company	: CYR Drilling Ltd.	Logged By	: Kaminak
Supervised By	: JH/MS	Checked By	: LF

Depth (m) | Elev. (m amsl)1156.25 | DESCRIPTION | RQD (%) 0 50 100 | Fracture = Fr, Fault = Flt | Packer Test Interval (mbgs) | K (m/s) | Depth (m)

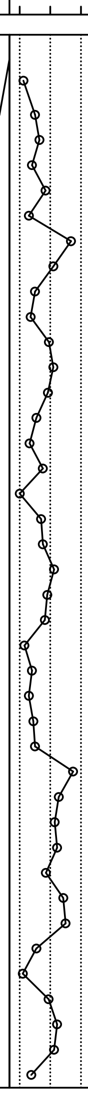
VWP Water Level:
1160.7 m amsl Oct 13, 2014 @ 16:00 (artesian)

Depth (m)	Elev. (m amsl)
0	1155
20	1135
40	1115
60	1095
80	1075
100	1055
120	1035
140	1015
160	

OVERBURDEN
*Cored with rods and shoe to 4.8 m.
Ice observed from 0.6 to 1.3 m

GRANITE
Coarse grained, massive, variable orange oxide fracture controlled-pervasive, variable weak- moderate limonite +/- hematite fracture coating

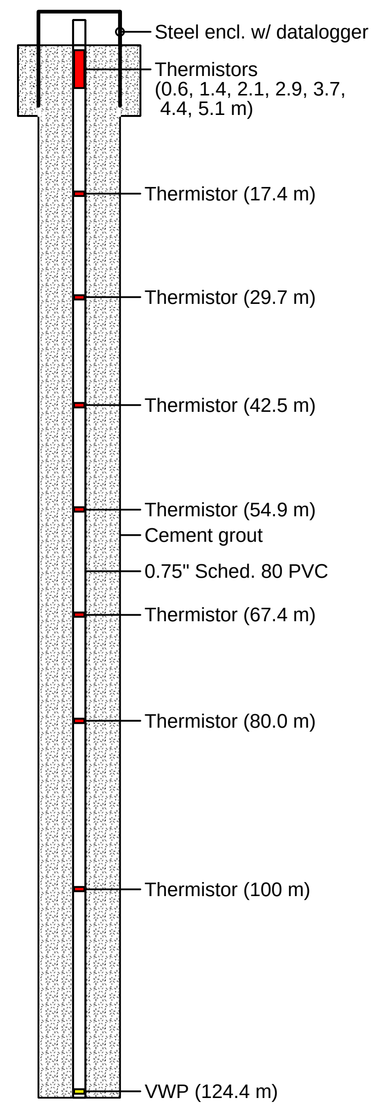
*Drilling additive (Pure Vis) used at 115 m onwards
*Hole observed making water at 113 m
*Hole observed making water at EOH (<1L/min)



Fracture / Fault: N/A

Packer Test Interval (mbgs)	K (m/s)
64.4 - 89.0	3E-08
83.2 - 124.7	1E-08

Well: MW14-07T
Elev.: 1152 m amsl (collar)



EOH @ 125 m
Notes:
*Comment from supervising hydrogeologist, all other descriptons provided by Kaminak
N/A: Borehole not logged for structure
Steel enclosure with data logger not to scale
RST Model 2040 Multichannel Data logger S/N: 2018
Thermistor string #1 (0.6 to 80.0 m) S/N: TS3796
Thermistor string #2 (100.0 m) S/N: TS3830
VWP S/N: VW30262

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LORAX ENVIRONMENTAL

MW15-01AZ / BH08-AZ / CFR-0982

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

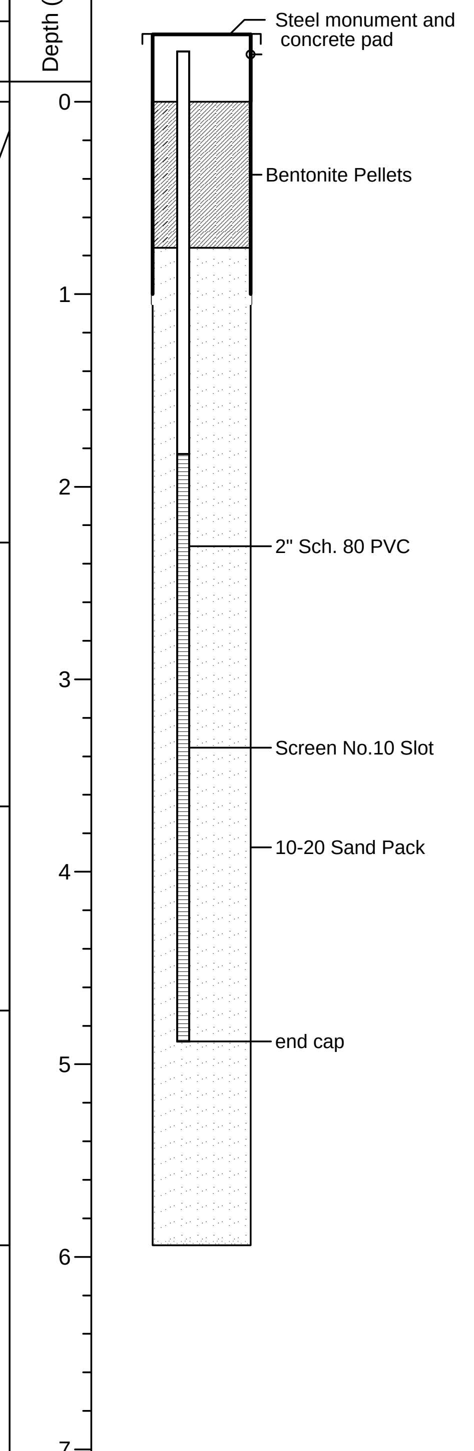
Drilling Started	: May 5,2015	Drilling Method	: Casing Advance ODEX
Install Completed	: May 5,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 4.5 "	Supervised By	: JH (Lorax)
Total Depth	: 5.94 mbgs	Logged By	: Kaminak
Completion Depth	: 5.90 mbgs	Checked By	: LF

ODEX Casing: pulled
PVC Stickup: 0.55 m ags
Top of PVC: 810.30 m asl

Easting: 585,683.0 m
Northing: 6,976,037.9 m
Elevation: 809.75 m asl
Survey Type: RTK GPS

Water Level: frozen @ 3.79 m (8-Jul-15)
No free water in well

Depth (m)	Elev. (masl)	LITHOLOGY
0–0.3		OVERBURDEN-Colluvium *Organic material.
0.3–2.3	809, 808	OVERBURDEN *Gravel, boulders.
2.3–3.67	807	OVERBURDEN *Sand, silt and gravel. Moisture observed on fines at 2.3 m.
3.67–4.73	806	OVERBURDEN *Brown silt, sand, gravel.
4.73–5.94	805, 804	SCHIST *Harder drilling, dusty.
5.94	803	End of hole at 5.94 m (19.5 ft) *Comment from supervising hydrogeologist. Datum: UTM NAD83 Zone 7



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LORAX ENVIRONMENTAL

MW15-01T / BH-08T / CFR-0941 (North Dump D/S)

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

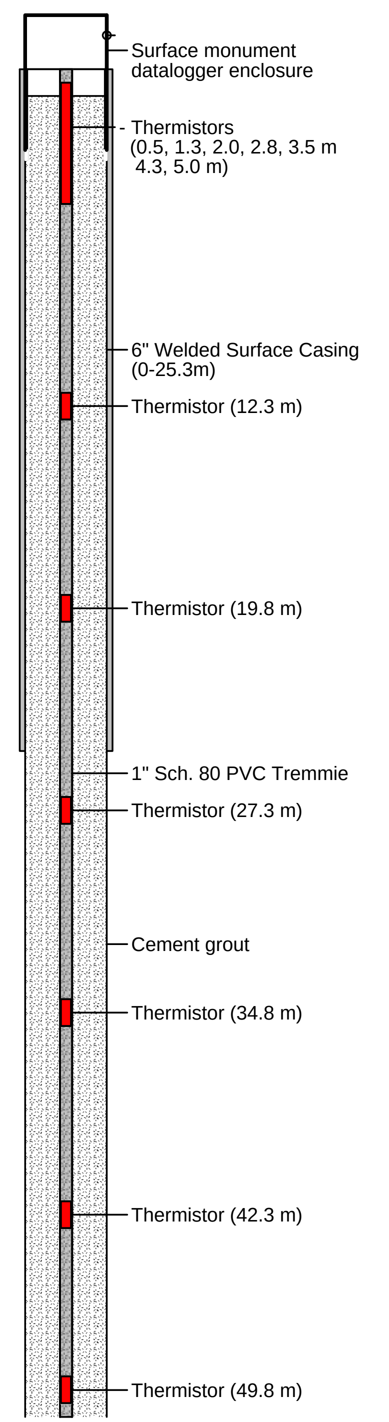
Drilling Started	: March 21, 2015
Install Completed	: March 24,2015
Drilling Diameter(s)	: 6.0" & 4.5"
Total Depth	: 90.5 mbgs
Completion Depth	: 89.3 mbgs
Drilling Method	: Casing Advance & Convent.
Drilling Company	: Northspan
Supervised By	: LF/AS (Lorax)
Logged By	: Kaminak
Checked By	: LF

Depth to Bedrock: 17.1 mbgs
Casing Depth: 25.3 mbgs

Easting: 585,826
Northing: 6,976,210.3
Elevation: 803.93
Survey Type: RTK GPS

Well: MW15-01T
Installation depths along hole (m)

Depth (m)	Elev. (masl)	LITHOLOGY	Fracture = Fr Fault = Flt	Airlift Yield** (USGPM)
0		Muddy brown organics & Colluvium		
	800	Colluvium. Ranges from silty fine sand to coarse sand with gravel. Clasts of schist and gneiss. *Ice rich. Massive ice lenses observed (8.8-9.4, 10.0-11.3, 11.9-12.5 m).		
10	790			
		Overburden *bouldery		
20		SCHIST/GNEISS *Surface casing breaks at 21.6 m. Casing is cemented in.		
	780	NO SAMPLES		
		Green-grey mafic schist with pink-grey felsic gneiss. Pale orange-grey from 107-112 ft (32.6-34.1 m).		
30	770			
40	760			
50		Schist & gneiss w/ orange texture observed unit with minor milky quartz fragments.		



MW15-01T / BH-08T / CFR-0941 (North Dump D/S)

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

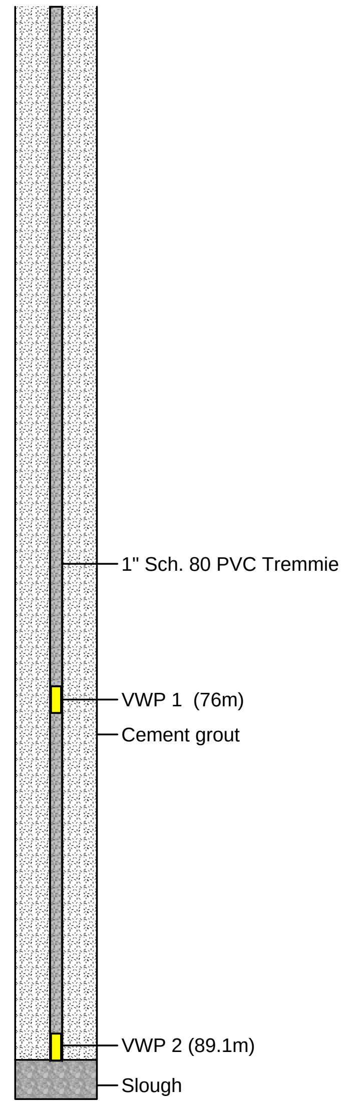
Drilling Started	: March 21, 2015	Drilling Method	: Casing Advance & Convent.
Install Completed	: March 24,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: LF/AS (Lorax)
Total Depth	: 90.5 mbgs	Logged By	: Kaminak
Completion Depth	: 89.3 mbgs	Checked By	: LF

Depth to Bedrock: 17.1 mbgs
Casing Depth: 25.3 mbgs

Easting: 585,826
Northing: 6,976,210.3
Elevation: 803.93
Survey Type: RTK GPS

Well: MW15-01T
Installation depths along hole (m)

Depth (m)	Elev. (masl)	LITHOLOGY	Fracture = Fr Fault = Flt	Airlift Yield** (USGPM)
50		Grey-pink felsic gneiss with light grey-green mafic schist. Both are slightly bleached, increasing with depth. Minor limonite from 197-202 ft (60-61.6m).		
	750			
60				
	740			
70		Black, *Much less dust at 235 ft (70.7 m). Water discharge at cyclone at 235 ft (71.6 m).		2-3
	730	Orange texture observed with moderate limonite and serricite alteration. *Rod feels fractured. Pick up water.		
		Dark green to green grey mafic schist with moderately disseminate hematite. Well foliated.		4-5
80				
	720	Grey felsic gneiss with trace pink. Dark grey mafic schist. Trace to moderate quartz vein fragments. *Pick up minor water 86.0-87.5m.		6-7
90		Dark grey-green mafic schist with minor grey felsic gneis. Minor disseminated hematite.		
	710			
100				



EOH 90.5 m
Datum: UTM NAD83 Zone 7
RST Model 2040 Multichannel Data Logger S/N: 2017
Thermistor String (0-50 m) S/N: TS3797
VWP 1 (76 m) S/N: 30462; VWP 2 (89.1 m) S/N: 30463
*Comment from Hydrogeologist, others by Kaminak Geologist
** Visual estimation of flow

LORAX ENVIRONMENTAL

MW15-01WB / BH8-WB / CFR-0977

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

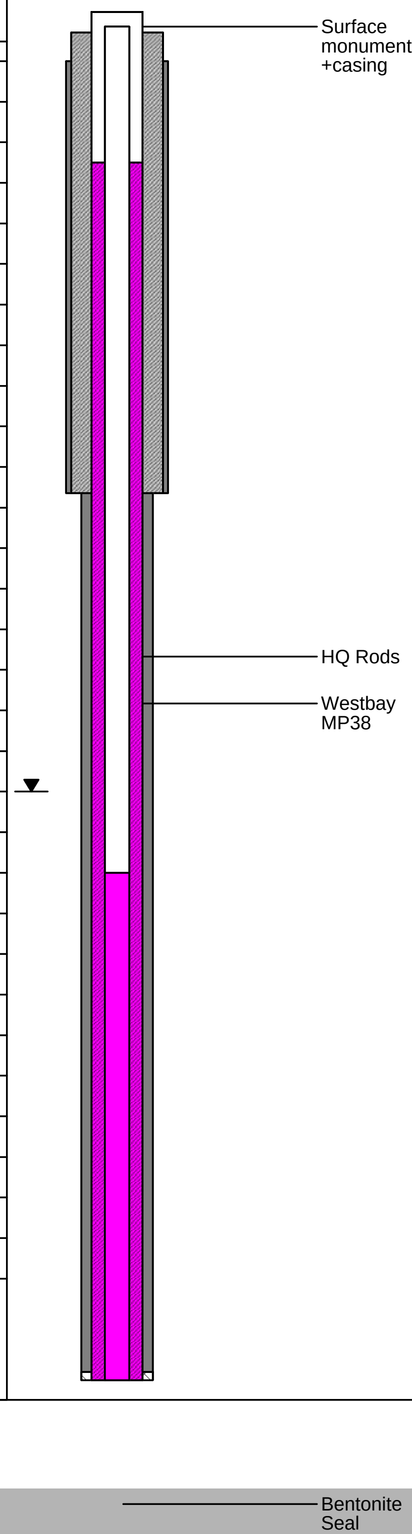
Drilling Started	: April 30,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 05,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JH/AS/CS (Lorax)
Drilled Depth	: 118.56 m	Logged By	: Kaminak
Completion Depth	: 116.72m	Checked By	: LF

Casing Depth: 21.3 mbgs
HQ Depth: 76.12 mbgs
Westbay Depth: 117.0 m bgs

Easting: 585,828.6 m
Northing: 6,976,211.9 m
Elevation: 803.58 m asl
Survey Type: RTK GPS

Surface Casing Stickup: 1.4 m ags
HQ Stickup: 1.56 m ags
Westbay Stickup: 1.67 m ags
Water Level: 36.0 m bgs
(8-Jul-15; Port 4)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (µS/cm)	Airlift Yield (USGPM)	Depth (m)
0	803	Not logged to 17.1 m See MW15-01T for details				0
10	793					10
		FELSIC GNEISS Fresh				
20	783					20
		Not Logged				
30	773					30
40	763					40
		FELSIC GNEISS clay-sericite alteration				
		Not Logged				
50	753					50
60						60



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MW15-01WB / BH8-WB / CFR-0977

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

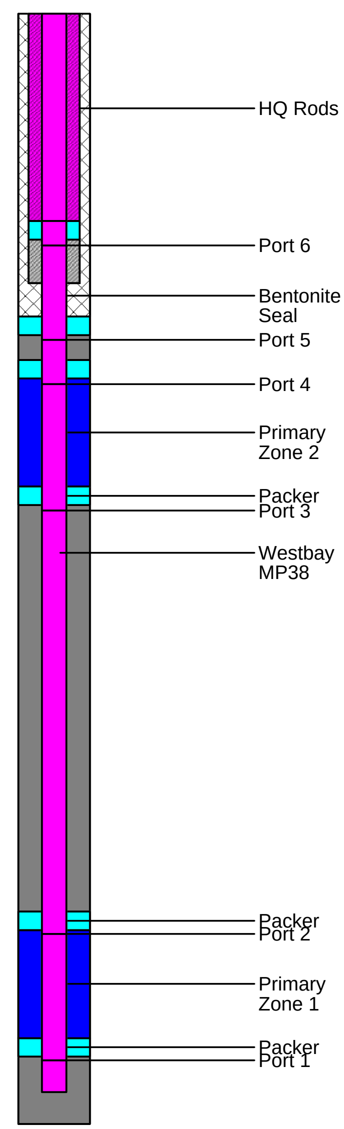
Drilling Started	: April 30,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 05,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JH/AS/CS (Lorax)
Drilled Depth	: 118.56 m	Logged By	: Kaminak
Completion Depth	: 116.72m	Checked By	: LF

Casing Depth: 21.3 mbgs
HQ Depth: 76.12 mbgs
Westbay Depth: 117.0 m bgs

Easting: 585,828.6 m
Northing: 6,976,211.9 m
Elevation: 803.58 m asl
Survey Type: RTK GPS

Surface Casing Stickup: 1.4 m ags
HQ Stickup: 1.56 m ags
Westbay Stickup: 1.67 m ags
Water Level: 36.0 m bgs (8-Jul-15; Port 4)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (µS/cm)	Airlift Yield (USGPM)
65	738				
		FELSIC GNEISS bleached, clay-sericite altered			
		FELSIC GNEISS fresh			
75	728	FELSIC GNEISS Weakly serricite altered			
		FELSIC GNEISS fresh *77.7 m less dusty drilling			
85	718	FELSIC GNEISS oxidized, silicified, 0.5% dissemianted limonite	n/a	n/a	4.9
		*82.1 m hit water *82.6 m cuttings show signs of reddish brown staining	n/a	n/a	5.4
		FELSIC GNEISS fresh	n/a	n/a	2
95	708				
		FELSIC GNEISS fresh	n/a	n/a	4
			n/a	n/a	5
105	698	MIXED MAFIC GNEISS fresh, biotite rich	n/a	n/a	6
115	688	MIXED MAFIC GNEISS bleached			
		MIXED MAFIC GNEISS bleached			
125		End of hole 118.6 m (389 ft). *Comment from supervising hydrogeologist; lithology logged by Kaminak Primary Zone 2 was sampled Datum: UTM NAD83 Zone 7			



MW15-02AZ / BH10-AZ / CFR-0995

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

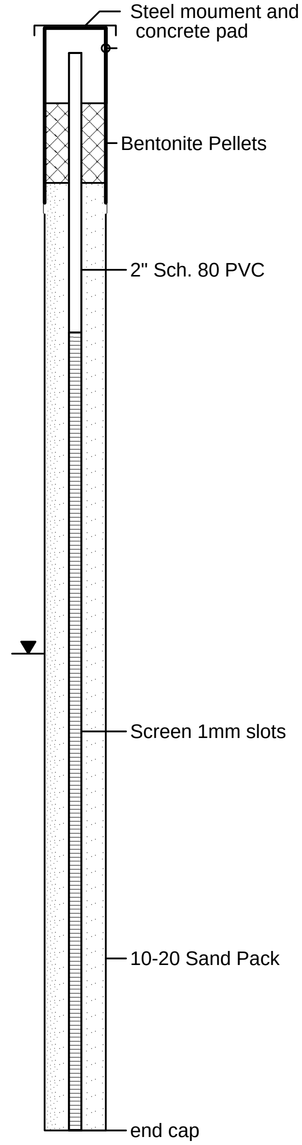
Drilling Started	: May 24,2015	Drilling Method	: Casing Advance ODEX
Install Completed	: May 24,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 4.5 "	Supervised By	: JY/LF (Lorax)
Drilled Depth	: 10.3 mbgs	Logged By	: LF
		Checked By	: LF

ODEX Casing: pulled
PVC Stickup: 0.68 m
Top of PVC: 737.93 m asl

Easting: 584,857.8 m
Northing: 6971754.5 m
Elevation: 737.25 m asl
Survey Type: RTK GPS

Water level: 5.5 m bgs (11-Jul-15)

Depth (m)	Elev. (masl)	LITHOLOGY
0	737	*OVERBURDEN *Not logged.
1	736	
2	735	
3	734	
4	733	*Damp ~4.0 m.
5	732	
6	731	
7	730	*Some drizzle at 7.3 m bgs.
8	729	
9	728	*SCHIST *Not logged
10	727	End of hole at 10.3 m (34 ft). *Comment from supervising hydrogeologist. Datum: UTM NAD83 Zone 7
11	726	
12		



MW15-02T / BH10-T / CFR-0948 (South Dump D/S)

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

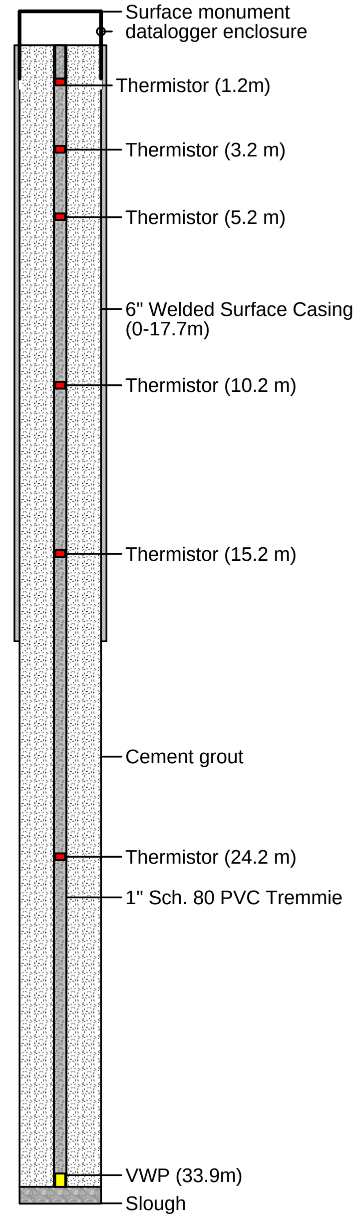
Coffee Creek Gold
Project #: A362-4

Drilling Started	: March 25,2015	Drilling Method	: Casing Advance & Convent.
Install Completed	: March 26,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: LF/AS/CS (Lorax)
Total Depth	: 34.4 mbgs	Logged By	: Kaminak
Completion Depth	: 33.7 mbgs	Checked By	: LF

Depth to Bedrock: 10.7 mbgs
Casing Depth: 17.7 mbgs
Stick up: 0.38 m

Easting: 584,854.9
Northing: 6,971,756.0
Elevation 737.1
Survey Type: Handheld +/-8m

Depth (m)	Elev. (masl)	LITHOLOGY	Fracture = Fr Fault = Flt	Airlift Yield (GPM)**	Depth (m)
0	735	OVERBURDEN Brown to light dirty orange felsic gneiss, granite and schist. *Colluvium ranging from sitly sand to bouldery sections. Visibly frozen 0-2.4 m. *Water present at casing weld at 7 m, may have orginated between 5.5-7m (flow not sustained).		Present	0
5	730				5
10	725	SCHIST Light grey to green, well foliated schist. Moderately chlorite altered. *Small fracture at 45 ft (13.8 m), 50 ft (15.2 m)			10
15	720	SCHIST Light grey to green, well foliated schist. Common strained feldspr and pyrite blebs. Moderately chlorite altered. *Broken area with iron stained surfaces 68-72 ft (20.7-21.9m). Interval grabs onto rods (cave).		0.25	15
20	715			3 15-20	20
25	710	SILTY SAND, *Fractured area ~26 m, water increases but not measurable at cyclone.		15-20+	25
30	705	SCHIST Dark grey to greenish biotite schist. Increased pervasive chlorite alteration. Common pyrite. Decrease in feldspar/quartz content.			30
35	700	RST Model DT2055-B Multichannel Data logger S/N: 3686 Logging Frequency: 4 hrs Thermistor string (0-24 m) S/N: TS3798 VWP (33.9 m) 1MPa, S/N: 30460 *Comment from supervising hydrogeologist; all other descriptions provided by Kaminak **Visual estimations of flow only.			35
40					40



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MW15-02WB / BH10-WB / CFR-0997

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

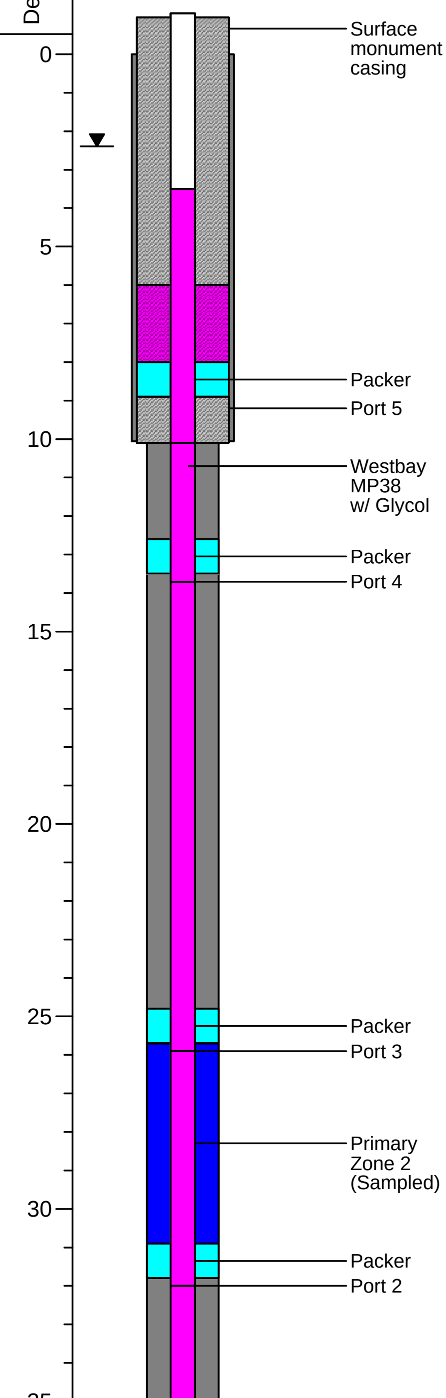
Drilling Started	: May 22,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 24,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: VS/JY/LF (Lorax)
Drilled Depth	: 66.4m	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 10.1 m bgs
HQ: not deployed
Westbay Depth: 65.5 m bgs

Easting: 584,857.7
Northing: 6,971,757.8
Elevation: 737.11
Survey Type: RTK GPS

Surface Casing Stickup: 0.93 m ags
Westbay Stickup: 1.06 m ags
Water Level: 2.4 m bgs
(10-Jul-15; Port 3)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (µS/cm)	Airlift Yield (USGPM)
0	737	*OVERBURDEN *Loose sand and gravel with variable silt content, occasional cobble/boulders. Moist to dry 0-0.9m, possibly frozen. *Moist 0.9-7.3 m.			
5	732				moist
		*Moist to wet 7.3-8.5 m. Small amount of water returned at cyclone after casing weld at 8.5 m.			
10	727	BIOTITE SCHIST Weakly oxidized, weak sericite. *Variably fractured throughout hole.			
		*Not sampled.			
		BIOTITE SCHIST Weak clay and sericite alteration.			
		*Not sampled.			
15	722	BIOTITE SCHIST Patchy blebs of brassy pyrite (0.1%), weak patchy chlorite.			
			9.4	923	5
20	717	BIOTITE SCHIST Weak clay alteration, moderate chlorite alteration.			0
					0
					Spotty
25	712	*Intermittent wet and dry patches encountered 23.8-28.3 m.			
		BIOTITE SCHIST Generally fresh, weak patchy chlorite. *Two separate fractures noted at 29, 29.7 m.			
30	707	*Zero water during spot airlift measurement at 29.9 m, water appears to be lost to fractures.	8.4	1007	0
			8.4	1006	35
		*Formation grabby at 32.3 m.			
			8.4	992	8
35					



MW15-02WB / BH10-WB / CFR-0997

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

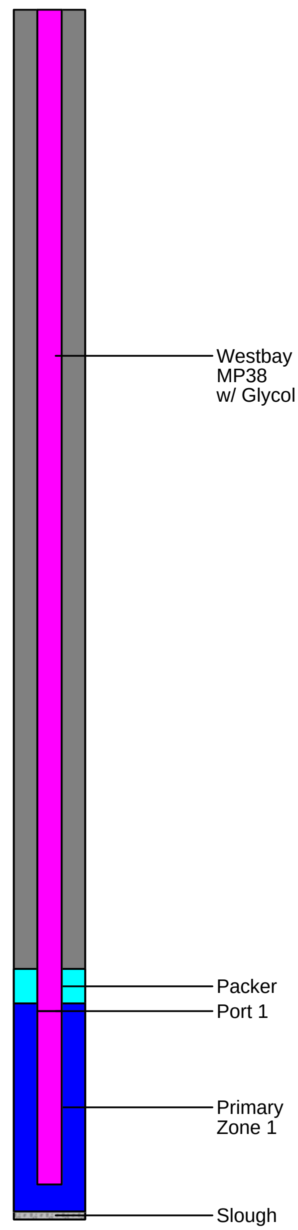
Drilling Started	: May 22,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 24,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: VS/JY/LF (Lorax)
Drilled Depth	: 66.4m	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 10.1 m bgs
HQ: not deployed
Westbay Depth: 65.5 m bgs

Easting: 584,857.7
Northing: 6,971,757.8
Elevation: 737.11
Survey Type: RTK GPS

Surface Casing Stickup: 0.93 m ags
Westbay Stickup: 1.06 m ags
Water Level: 2.4 m bgs
(10-Jul-15; Port 3)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (µS/cm)	Airlift Yield (USGPM)
35	702				
		*Not sampled.			
		VEIN Pure milky quartz.	8.5	997	8
		*Not sampled.			
40	697	BIOTITE SCHIST Weak patchy chlorite, rare brassy pyrite blebs (0.1%)			
			8.5	963	4
45	692		8.5	873	17
			8.5	955	17
50	687				
			8.5	960	12
		BIOTITE SCHIST Patchy quartz veining.	8.0	960	12
			8.3	960	10**
55	682		8.3	995	9**
			8.4	955	8**
			8.3	950	
60	677		8.6	960	25**
			8.2	960	20**
			8.5	960	11**
65	672		8.3	960	20**
			8.3	965	14**
70		End of hole at 66.4 m (218 ft). *Comment from supervising hydrogeologist; lithology logged by Kaminak geologist. **Trapped air visible during airflow measurements, values may be inaccurate.			



LORAX ENVIRONMENTAL

MW15-03AZ / BH12-AZ / CFR-0986

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

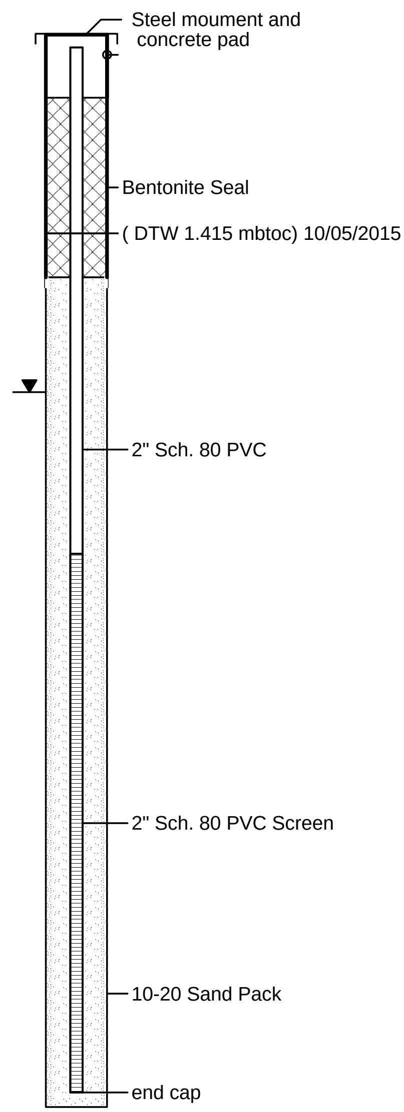
Drilling Started	: May 9,2015	Drilling Method	: Casing Advance ODEX
Install Completed	: May 9,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 4.5 "	Supervised By	: AS (Lorax)
Total Depth	: 5.62 mbgs	Logged By	: Kaminak
Completion Depth	: 5.55 mbgs	Checked By	: LF

ODEX Casing: pulled
Stickup: 0.66 m
Top of PVC: 558.60 m asl

Easting: 585,582.5 m
Northing: 6,978,157.3 m
Elevation: 557.94 m asl
Survey Type: RTK GPS

Water level: 1.65 m bgs (9-Jul-15)

Depth (m)	Elev. (masl)	LITHOLOGY	Depth (m)
0		*OVERBURDEN (Not logged)	0
1	557		1
2	556		2
3	555		3
4	554		4
5	553		5
6	552	Datum: UTM NAD83 Zone 7	6
7	551		7



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LORAX ENVIRONMENTAL

MW15-03T / BH12-T / CFR-0983

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

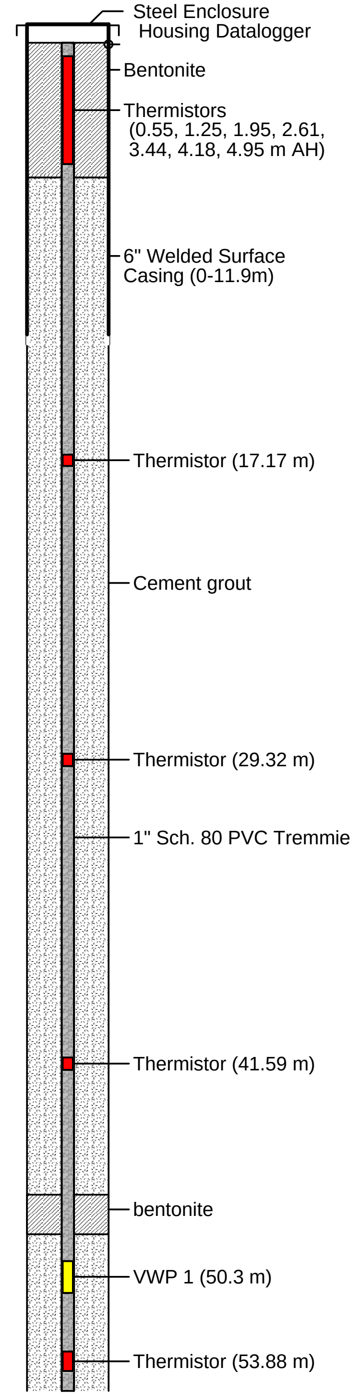
Drilling Started	: May 05,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 10,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JH/AS (Lorax)
Drilled Depth	: 98.14 m along hole (AH)	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 11.9m along hole
Hole Dip: 80°

Easting: 585,584.5. m
Northing: 6,978,167.8 m
Elevation: 557.75 m asl
Survey Type: RTK GPS

Depth Along Hole (m)	Elev. (masl)	LITHOLOGY	pH	EC (uS/cm)	Airlift Yield (USGPM)
0	557	OVERBURDEN *Fine to coarse colluvium. Saturated.			
5	552	MIXED MAFIC GNEISS Weak pervasive epidote and silica.			
10	547	MIXED MAFIC GNEISS Weak pervasive silica. *Flat, thin shards of ice observed in cuttings - possibly frozen fractures (8.8-10.4 m)			
		BIOTITE SCHIST Weak chlorite and sericite.			
15	542	MIXED MAFIC GNEISS Moderate pervasive silica. *Chip samples collected every 10 ft.			
20	537				
25	532	*Moisture observed (26.5 m).			
30	527				
					2.4
35	522	*Water encountered (36.5 m).			
					3
					10
					9.8
40	517				
					11.5
					10
45	512				10
		*Chip size suggests fractured ground (48.2m).			15
50	507	MIXED MAFIC GNEISS Mixed with massive quartz vein.			30
		QUARTZ VEIN			
55		MIXED MAFIC GNEISS Mixed with massive quartz vein.			30

Installation depths along hole (m AH)



LORAX ENVIRONMENTAL

MW15-03T / BH12-T / CFR-0983

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

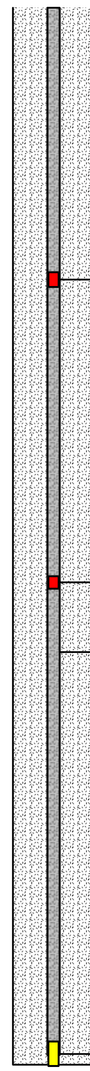
Drilling Started	: May 05,2015
Install Completed	: May 10,2015
Drilling Diameter(s)	: 6.0" & 4.5"
Drilled Depth	: 98.14 m along hole (AH)
Drilling Method	: Casing Advance & RC
Drilling Company	: Northspan
Supervised By	: JH/AS (Lorax)
Logged By	: Kaminak
Checked By	: LF

Casing Depth: 11.9m along hole
Hole Dip: 80°

Easting: 585,584.5. m
Northing: 6,978,167.8 m
Elevation: 557.75 m asl
Survey Type: RTK GPS

Depth Along Hole (m)	Elev. (masl)	LITHOLOGY	pH	EC (uS/cm)	Airlift Yield (USGPM)
55	502				
		QUARTZ VEIN			30
60	497	AMPHIBOLE BEARING SCHIST Moderate sericite and weak epidote alteration.			30
65	492	AMPHIBOLE BEARING SCHIST Weak patchy sericite and epidote. Missing chips; samples collect every 10 ft.			30
					30
70	487				30
					30
75	482				28
					30
80	477				33
85	472				30
90	467				
					25.3
95	462				26.9
100	457				
105	452				
110					

Installation depths along hole (m AH)



End of Hole 98.2 m
Datum: UTM NAD83 Zone 7
Geology & Construction based on drill length along hole
*Comments from supervising hydrogeologist, litholgy logged by Kaminak

RST Model DT2040 Multichannel Data logger S/N: DT2037
Thermistor string S/N: TS3969
VWP 1, 1MPa S/N: 30461; VWP 2, 1MPa S/N: 32594

LORAX ENVIRONMENTAL

MW15-03WB / BH12-WB / CFR-0987

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 10,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 12,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JH/AS (Lorax)
Drilled Depth	: 99.52m	Logged By	: Kaminak
		Checked By	: LF

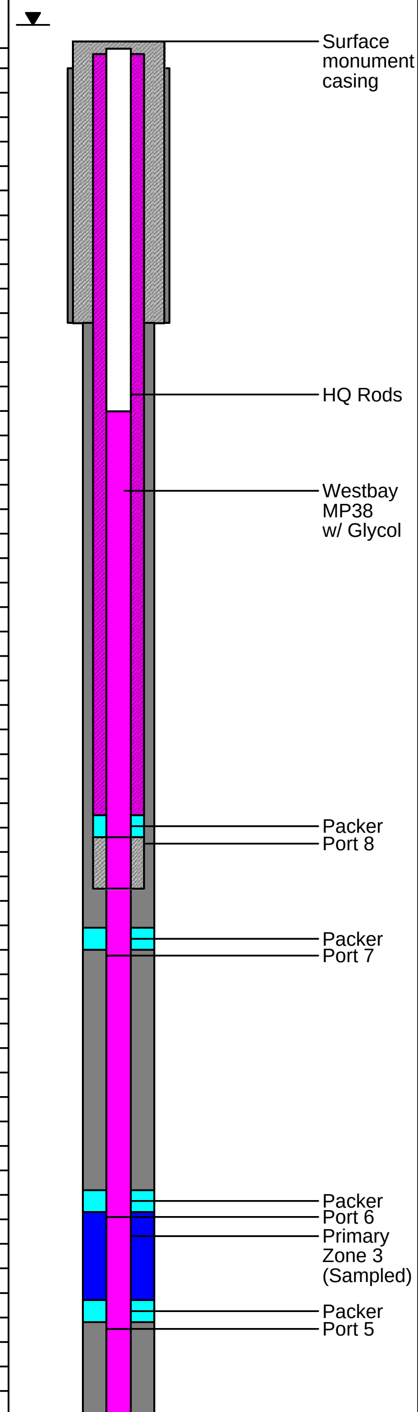
Casing Depth: 10.4 mbgs
HQ Depth: 33.5 mbgs
Westbay Depth: 99.3 mbgs

Easting: 585,581.4 m
Northing: 6,978,164.6 m
Elevation: 557.92 m asl
Survey Type: RTK GPS

Surface Casing Stickup: 0.42 m ags
HQ Rods Stickup: 0.57 m abs
Westbay Stickup: 0.78 m ags
Water Level: 1.8 m above ground (9-Jul-15; Port 6)

Depth (m)	Elev. (masl)	LITHOLOGY
0	557	**OVERBURDEN** *Water return at 1.2 m
5	552	**FELSIC GNEISS** Weathered.
		MAFIC MIXED GNEISS Very small black mafic chips with muscovite mixed with mod silicified felsic chips. Fresh. *Flat, platey ice fragments observed in cuttings representing possible frozen fractures 7.7 m, 8.2 m, 8.5-10.4 m.
10	547	No samples.
15	542	
		MAFIC MIXED GNEISS Moderately silicified.
20	537	No samples.
		MAFIC MIXED GNEISS Moderately silicified.
25	532	No samples.
		BIOTITE SCHIST Fresh with weak muscovite.
30	527	Not sampled.
		MAIFC MIXED GNEISS Weak chlorite after mafics, 0.1% diss brassy pyrite.
35	522	Not sampled.
		FELSIC MIXED GNEISS bleached from moderate sil-ser, 5% vein qtz.
40	517	**MIXED MAFIC GNEISS** Weak patchy chlorite after mafics and weak patchy sil ser. 0.1% diss cubic pyrite. Interval switches: 58.8-60.4 m, 60.4-61 m, 61-62.5 m, 62.5-63 m.
45	512	
50	507	
55		

pH	EC (uS/cm)	Airlift (USGPM)
9.6		2.1
9.9		5.3
9.9		5.1
9.5		5.1
9.2		5.5
9.3		4.5
8.8		6
		6.5
		6



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LORAX ENVIRONMENTAL

MW15-03WB / BH12-WB / CFR-0987

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

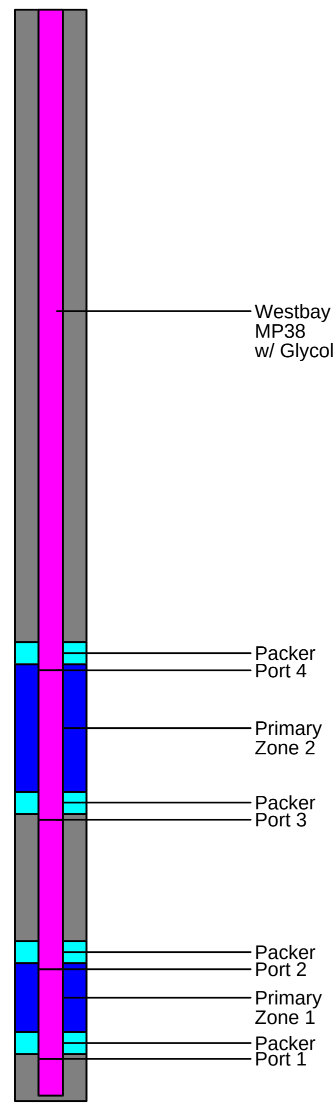
Drilling Started	: May 10,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 12,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JH/AS (Lorax)
Drilled Depth	: 99.52m	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 10.4 mbgs
HQ Depth: 33.5 mbgs
Westbay Depth: 99.3 mbgs

Easting: 585,581.4 m
Northing: 6,978,164.6 m
Elevation: 557.92 m asl
Survey Type: RTK GPS

Surface Casing Stickup: 0.42 m ags
HQ Rods Stickup: 0.57 m abs
Westbay Stickup: 0.78 m ags
Water Level: 1.8 m above ground (9-Jul-15; Port 6)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (uS/cm)	Airlift (USGPM)	Depth (m)
55	502					55
			8.8		7	
60	497					60
			8.4		7.5	
65	492	MIXED FELSIC GNEISS Moderate patchy sil bleaching, weak patchy chlorite 0.1% diss cubic pyrite. Interval switches every 3 ft.	8.1		7.75	65
			8.1		8	
70	487		8.7		8	70
75	482					75
80	477					80
85	472					85
90	467	Not sampled.				90
95	462		8.8		12	95
100	457	End of hole 100 m (328 ft). Datum: UTM NAD83 Zone 7 *Comment from supervising hydrogeologist; lithology logged by Kaminak				100
105	452					105
110						110



MW15-04AZ / BH04-AZ / CFR-0992

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

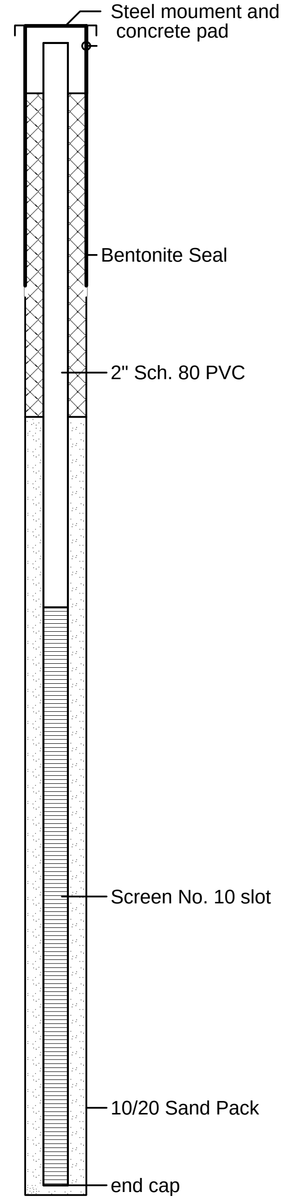
Drilling Started	: May 14,2015	Drilling Method	: Casing Advance ODEX
Install Completed	: May 14,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 4.5 "	Supervised By	: JY (Lorax)
Total Depth	: 5.72 mbgs	Logged By	: Kaminak
Completion Depth	: 5.72 mbgs	Checked By	: LF

ODEX Casing: pulled
PVC Stickup: 0.47 m
Top of PVC: 672.97 masl

Easting: 584,016.4 m
Northing: 6,976,566.0 m
Elevation: 672.50 m asl
Survey Type: RTK GPS

Water Level: Dry (9-Jul-2015)

Depth (m)	Elev. (masl)	LITHOLOGY
0		*OVERBURDEN - Colluvium (Not Logged) *Trace moisture observed in upper half of hole, dry thereafter.
	672	
1		
	671	
2		
	670	
3		
	669	
4		
	668	
5		
		*BEDROCK (not logged)
	667	
		End of hole at 5.7 m. *Comment from supervising hydrogeologist. Datum: UTM NAD83 Zone 7
6		
	666	
7		



LORAX ENVIRONMENTAL

MW15-04T / BH04-T / CFR-0990

KAMINAK GOLD CORPORATION

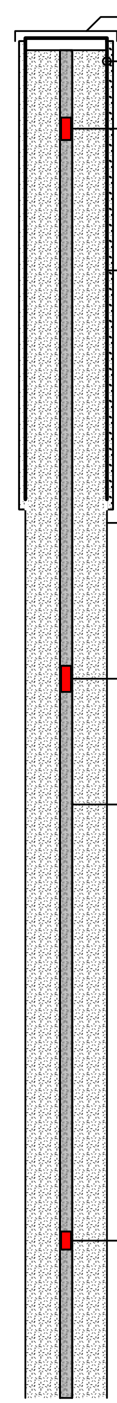
Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 12,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 14,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JH/AS/CS/LF/JY (Lorax)
Drilled Depth	: 53.4 m along hole	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 9.8 m AH
Hole Dip: 80°

Easting: 584,027 m
Northing: 6,976,568 m
Elevation: 670.91
Survey Type: RTK GPS

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (uS/cm)	Airlift Yield (USGPM)	Packer Test
0	670	OVERBURDEN				
5	665	MIXED FELSIC GNEISS Fresh, minor mafic component. Weak patchy sil, weak muscovite along chip fabric. 0.1% fc lim, 0.1% diss brassy cubic pyrite.				
10	660					
15	655					
20	650					
25	645					
30						



MW15-04T / BH04-T / CFR-0990

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

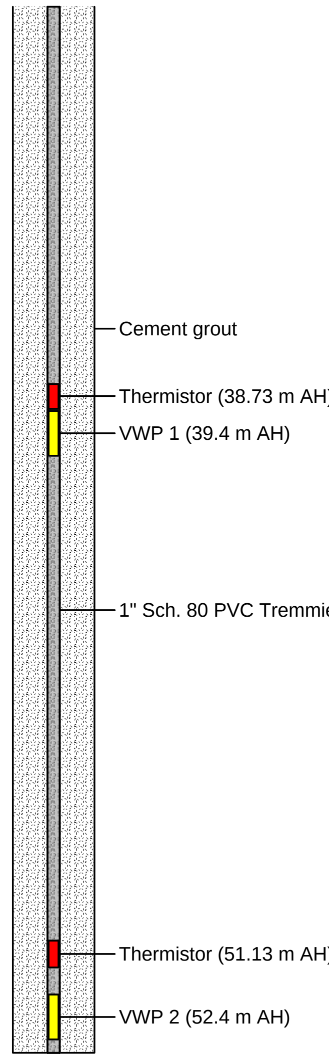
Drilling Started	: May 12,2015
Install Completed	: May 14,2015
Drilling Diameter(s)	: 6.0" & 4.5"
Drilled Depth	: 53.4 m along hole
Drilling Method	: Casing Advance & RC
Drilling Company	: Northspan
Supervised By	: JH/AS/CS/LF/JY (Lorax)
Logged By	: Kaminak
Checked By	: LF

Casing Depth: 9.8 m AH
Hole Dip: 80°

Easting: 584,027 m
Northing: 6,976,568 m
Elevation: 670.91
Survey Type: RTK GPS

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC (uS/cm)	Airlift Yield (USGPM)	Packer Test
30–36.6	640–635	*Damp patch at 32 m., damp again at 34.3m, wet at 35.1 m.				
36.6–42.7	635–630	MIXED FELSIC GNEISS Fresh, with stronger muscovite along chip fabric, weak fc clay,0.1% fc lim. *Soft patch at 39.2 m, 40.8 m.	n/a n/a	n/a n/a	1-2 9	130-175' (failed)
42.7–53.3	630–620	FELSIC GNEISS Weak zone in felsic gneiss. Strong patchy sil and weak fc clay. 1% fc lim. *Cuttings size suggests fracturing (43.5 m), very soft drilling 45.1-45.7 m. *Formation grabby on rods at 47.2 m (fractured). Softer drilling 47.35-48.2 m, becoming hard although still fractured. Driller reports layers of more fractured rock (49.8m). *Return water is very dark orange 50.1 m and alternates between dark orange and very light until end of hole. *Hole stability issues (caving and redrilling) at 52.7 m.	n/a n/a n/a n/a n/a n/a	n/a n/a n/a n/a n/a n/a	10 21 27 30	140-175' (failed) 110-175 shut-in

Depth scale (m): 30, 35, 40, 45, 50, 55, 60; Elevation scale (masl): 640, 635, 630, 625, 620, 615



End of hole at 53.3 m (175 ft) along hole.

RST Model DT2040 Multichannel Datalogger S/N: 2030
Thermistor string S/N: TS3970
VWP 1, 1MPa (39.4m) S/N: 32593; VWP 2, 2MPa (52.4m) S/N: 32596

*Comment from supervising hydrogeologist; geology logged by Kaminak geologists

Datum: UTM NAD83 Zone 7
n/a: not available

LORAX ENVIRONMENTAL

MW15-04WB / BH04-WB / CFR-0993

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 15,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 19,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JY/LF (Lorax)
Drilled Depth	: 61.1 m	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 6.4 mbgs
HQ Depth: 30.4 mbgs
Westbay Depth: 60.85 mbgs

Easting: 584,024.0 m
Northing: 6,976,565.8 m
Elevation: 671.46 m asl
Survey Type: RTK GPS

Surface Casing Stickup: 0.383 m ags
HQ Rods Stickup: 0.99 m
Westbay Stickup: 1.06 m ags
Water Level: 1.42 m above ground (9-Jul-15, Port 4)

Depth (m)	Elev. (masl)
0	671
5	666
10	661
15	656
20	651
25	646
30	641
35	636
40	631
45	626
50	621
55	616
60	611
65	

LITHOLOGY

*OVERBURDEN
*Mix of organics and gravel.

*OVERBURDEN
*Ranging from silty sand with gravel to silty fine sand.
*Damp at 1.5 m, 1.8-2.4 m (appears frozen).

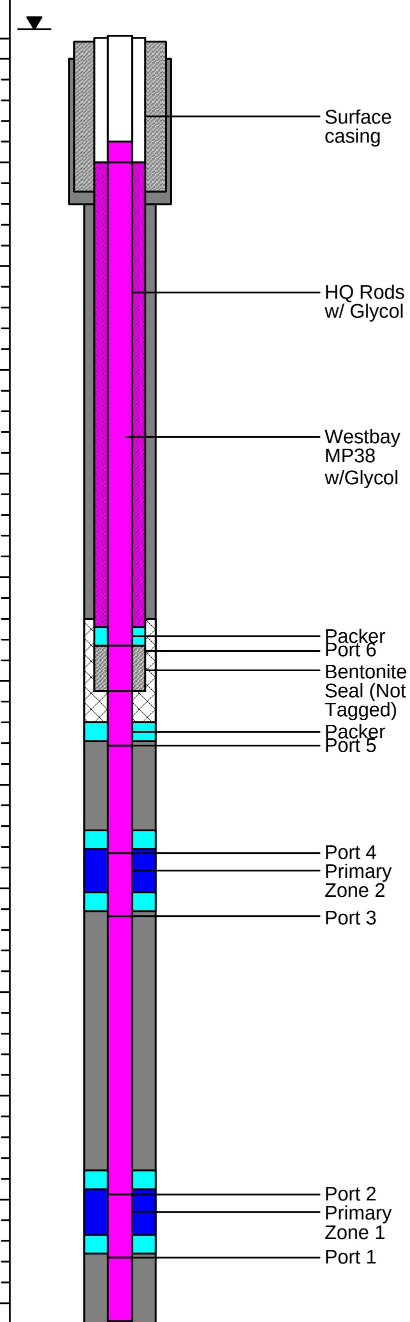
Not logged (no sample collected).

MIXED FELSIC GNEISS
Fresh, minor mafic component. Weak patchy sil, weak muscovite along chip fabric. 0.1% fc lim, 0.1% diss brassy cubic pyrite.

FELSIC GNEISS
Strong red hematite staining 47.2-48.8 m, moderate patchy sil. 0.1% fc lim.

pH	EC µS/cm	Airlift Yield (USGPM)
		<1
10.8	801	1
9.2	770	2
8.3	717	1
8.9	696	1-2
8.6	705	5
		trickle
8.5	705	trickle
8.2	710	8
8.2	782	12
8.2	742	12
8.4	744	40
8	760	24
8.2	767	11.5
8	775	12
8.2	774	5

*Comments from supervising hydrogeologist; lithology by Kaminak. Primary Zone 2 was sampled.
Datum: UTM NAD83 Zone 7



MW15-05AZ / BH02-AZ / CFR-0995

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 20,2015	Drilling Method	: Casing Advance ODEX
Install Completed	: May 20,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 4.5 "	Supervised By	: JY (Lorax)
Drilled Depth	: 5.72 mbgs	Logged By	: N/A
		Checked By	: LF

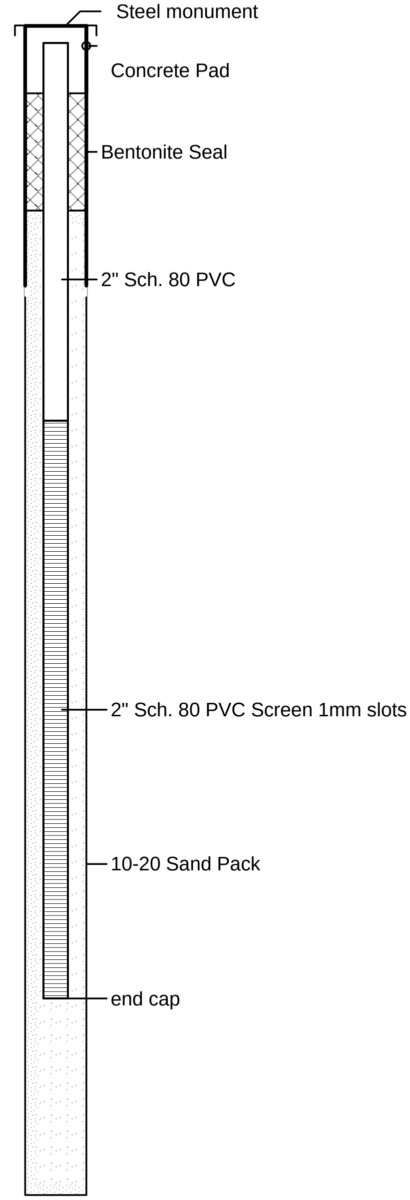
ODEX surface casing: pulled
PVC Stickup: 0.55 m ags
Top of PVC: 1069.4 m asl

Eastiing: 581,387.5 m
Northing: 6,971,079.2 m
Elevation: 1068.86 m asl
Survey Type: RTK GPS

Water Level: Dry (10-Jul-15))

Depth (m)	Elev. (masl)	LITHOLOGY
0 – 4.8		*OVERBURDEN - Colluvium *Not logged.
4.8 – 5.7		*BEDROCK *Not logged
5.7		End of hole at 5.7 m. Datum: UTM NAD83 Zone 7

Depth (m): 0, 1, 2, 3, 4, 5, 6, 7
Elev. (masl): 1068, 1067, 1066, 1065, 1064, 1063, 1062



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MW15-05T / BH02-T / CFR-0994

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 18,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 20,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: LF/JY (Lorax)
Drilled Depth	: 83.8 m AH	Logged By	: Kaminak
		Checked By	: LF

Casing Depth: 7.9 m AH
Hole Dip: 80°

Easting: 581,405.8 m
Northing: 6,971,082.9 m
Elevation: 1067.15 m asl
Survey Type: RTK GPS

Depth (m)	Elev. (masl)
0	1067
5	1062
10	1057
15	1052
20	1047
25	1042
30	1037
35	1032
40	1027
45	1022
50	1017
55	1012
60	1007
65	1002
70	997
75	992
80	987
85	982
90	977
95	

LITHOLOGY

*OVERBURDEN
*Colluvium. Silty sand to bouldery sections. No visible ice.

GRANITE
Weak to moderate oxidation throughout, weak fracture controlled clay.

Not sampled.

GRANITE
Weak fracture controlled oxidation, weak fracture controlled clay and silica.

*Less dust at cyclone (45.7 m)

*Cuttings damp (48.7 m).

*Water at cyclone (51.8 m).

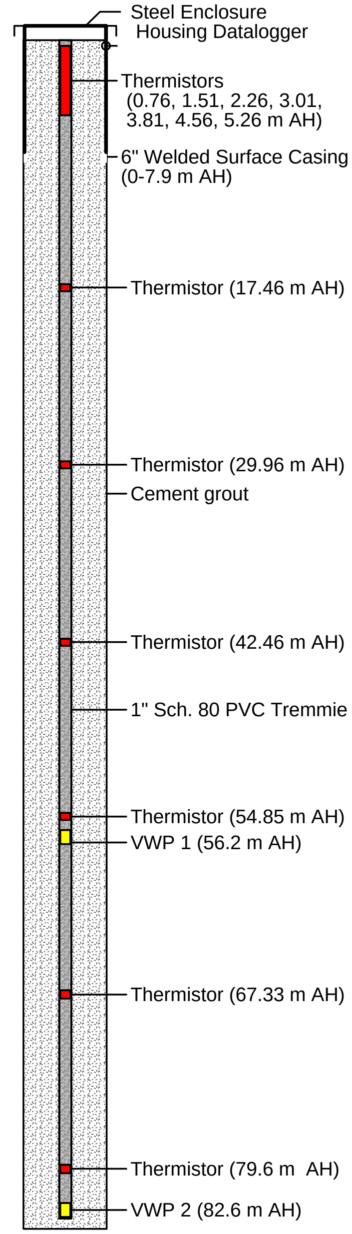
GRANITE
Moderate silica, sooty sulphides up to 2%.

GRANITE
Pervasive clay bleaching, weak fracture controlled oxidation. Moderate pervasive silica.

pH	EC (uS/cm)	Airlift Yield (USGPM)	Packer Test
		damp	
8.8	296	3.2	
8.8	307	9.9	
8.8	315	16.7	
		30	
9.2	323	25-30	
8.8	312	30	
8.7	320	30	
8.8	327	30	
8.8	327	33	
8.8	331	33	

End of hole at 83.8 m (274 ft) along hole (AH).
*Comments from supervising hydrogeologist; lithology logged by Kaminak geologist.
RST Model DT2040 Multichannel Datalogger S/N: 2038
Thermistor string S/N: TS3971
VWP 2, 2MPa S/N:30464; VWP 1, 2MPa S/N: 32595
Datum: UTM NAD83 Zone 7

Installation depths along drill hole:



MW15-05WB / BH02-WB / CFR-0996

LORAX ENVIRONMENTAL

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 20,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 22,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JY/VS/LF (Lorax)
Drilled Depth	: 82.9 mbgs	Logged By	: Kaminak
		Checked By	: LF

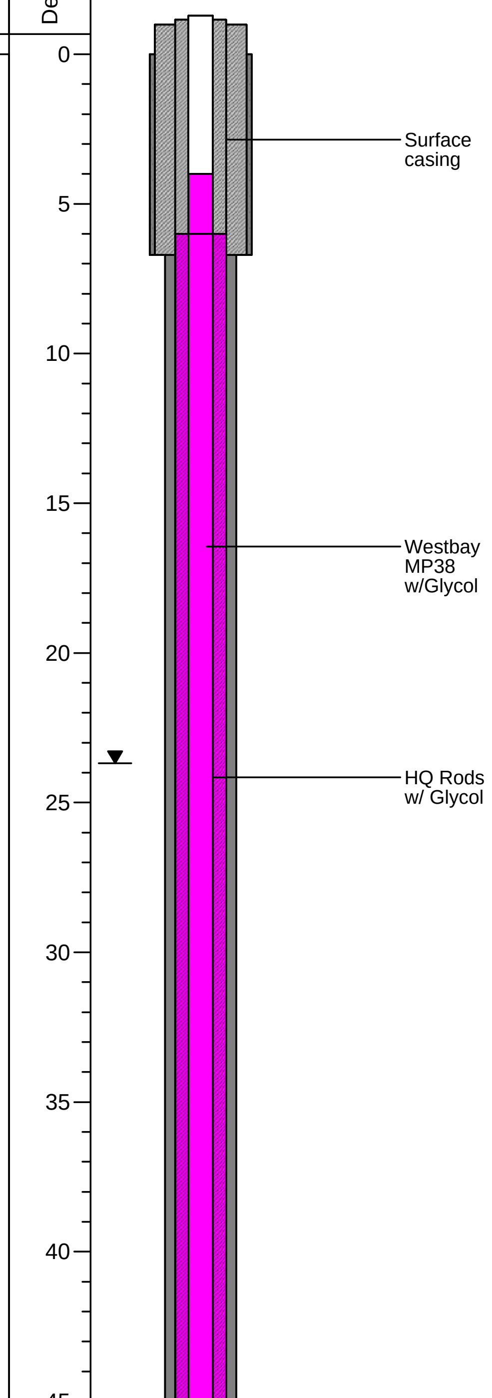
Casing Depth: 6.7 mbgs
HQ Depth: 56.38 mbgs
Westbay Depth: 82.7 mbgs

Easting: 581,402.2
Northing: 6,971,084.0
Elevation: 1067.69 m asl
Survey Type: RTK GPS

HWT Stickup: 0.99 m ags
HQ Stickup: 1.15 m ags
Westbay Stickup: 1.29 m ags
Water Level: 23.7 m bgs
(20-Jul-15; Port 3)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC EC= µS/cm	Airlift Yield (USGPM)
0	1067	*OVERBURDEN *No recovery 0-0.6 m (top soil/muskeg). Silty sand to sand, bouldery in sections. *Moist patch 3.7-5.2 m.			
5	1062	*GRANITE *Weathered bedrock.			
		GRANITE Weak patchy oxidation, and weak patchy clay.			
10	1057				
15	1052				
20	1047				
25	1042				
30	1037				
35	1032				
40	1027	GRANITE Moderate patchy oxidation, weak fracture controlled clay, fracture controlled limonite 0.1%, hematite 0.1%.			
45					

Depth (m)



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MW15-05WB / BH02-WB / CFR-0996

Coffee Creek Gold
Project #: A362-4

Drilling Started	: May 20,2015	Drilling Method	: Casing Advance & RC
Install Completed	: May 22,2015	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: JY/VS/LF (Lorax)
Drilled Depth	: 82.9 mbgs	Logged By	: Kaminak
		Checked By	: LF

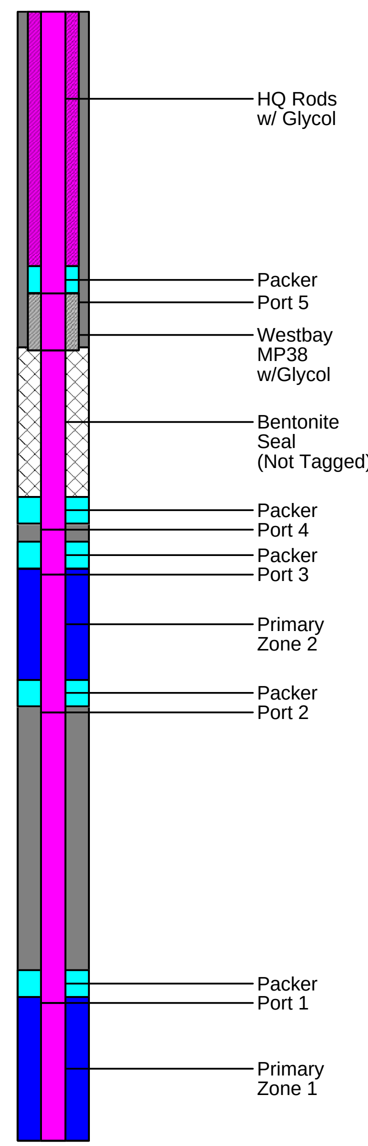
Casing Depth: 6.7 mbgs
HQ Depth: 56.38 mbgs
Westbay Depth: 82.7 mbgs

Easting: 581,402.2
Northing: 6,971,084.0
Elevation: 1067.69 m asl
Survey Type: RTK GPS

HWT Stickup: 0.99 m ags
HQ Stickup: 1.15 m ags
Westbay Stickup: 1.29 m ags
Water Level: 23.7 m bgs
(20-Jul-15; Port 3)

Depth (m)	Elev. (masl)	LITHOLOGY
45	1022	GRANITE Fresh.
48–50	1017	GRANITE Moderate oxidation, moderate clay alteration, disseminated hematite up to 0.25%. *Slightly damp patch 48.8-49.3 m.
		GRANITE Fresh.
55	1012	GRANITE Weak oxidation, fracture controlled hematite up to 0.1%.
		*Not sampled. *Water encountered at 54.9 m.
60	1007	GRANITE Strong clay alteration, moderate oxidation, dissmeminated limonite/ hematite up to 1%.
		GRANITE Strong clay, bleached.
		GRANITE Moderate oxidation, weak fracture controlled clay alteration, patchy disseminated hematite up to 0.25%.
65	1002	GRANITE Generally fresh, weak fracture controlled oxidation. *Driller indicates that water is likely being blown into formation; hence lower airlift yields.
70–75	997, 992	GRANITE Weak-moderate oxidation, patchy weak fracture controlled clay. Fracture controlled hematite up to 0.1%.
80	987	GRANITE Generally fresh, patchy clay bleaching.
85	982	End of hole 82.9 m (272 ft). Primary Zone 2 was sampled *Comment from supervising hydrogeologist; all other descriptions provided by Kaminak Datum: UTM NAD83 Zone 7
90		

pH	EC EC= µS/cm	Airlift Yield (USGPM)
12.3	1045	5
12.2	1630	
10.3	358	10
9.9	338	3
10.1	296	
10.5	321	2
9.3	293	
9.1	302	5
9.3	321	
9	301	4
8.8	310	30
8.3	308	35
8.8	315	35
8.4	303	
8.5	310	
8.5	320	35



LORAX ENVIRONMENTAL

MW15-06WB / BH05-WB / CFR-0999

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

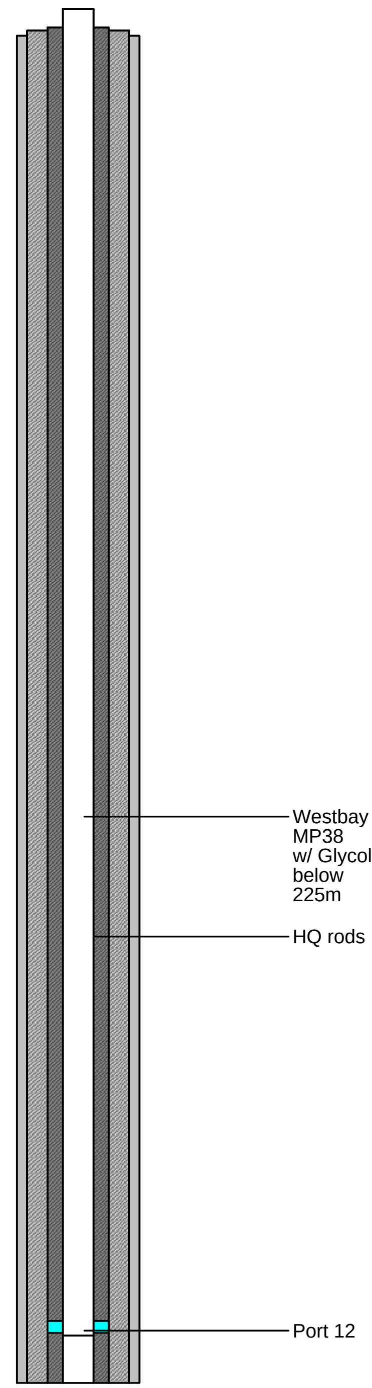
Drilling Started	: May 24,2015	Drilling Method	: RC & DDH
Install Completed	: June 06,2015	Drilling Company	: Northspan, CYR
Drilling Diameter(s)	: 6.0", 4.5", 3.78"	Supervised By	: JY/VS/LF (Lorax)
Drilled Depth	: 293 mbgs	Logged By	: Kaminak
		Checked By	: LF

HWT Depth: 162 mbgs
HQ Depth: 203.6 mbgs
Westbay Depth: #293# m bgs

Easting: 584,089.5
Northing: 6,975,003.3
Elevation: 1184.95 m asl
Survey Type: RTK GPS

HWT Stickup: 0.37 m ags
HQ Stickup: 0.62 m ags
Westbay Stickup: 0.62 m ags
RC 6" 0-8.8m, 4.5" 8.8-200.3 m; DDH HQ 200.3-293 m
WL: 220.73 m bgs (15-Jul-15; Port 6)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC EC= µS/cm	Airlift Yield (USGPM)	Depth (m)
0		FELSIC GNEISS Weak zone. Moderate pervasive clay alteration, fracture controlled hematite and limonite up ot 0.5%.				0
5	1180					5
10	1175	FELSIC GNEISS Weak zone. Red hematite stain, weak silica, clay, and sericite alteration. Disseminated hematite and limonite up to 0.25%.				10
15	1170					15
20	1165					20
25	1160	FELSIC GNEISS Weak zone. Moderate clay alteration, weak silica. Dissminated hematite and limonite up to 0.5%. *Dark brown, slight damp with some visible ice				25
30	1155					30
35	1150	FELSIC GNEISS Weak patchy sericite and silica.				35
40	1145	FELSIC GNEISS Moderate clay alteration, weak sericite. Disseminated limonite up to 0.25%.				40
45	1140	MIXED FELSIC GNEISS Patchy weak sericite and silica, weak fracture controlled clay, trace fracture controlled limonite up to 0.1%.				45
50	1135					50
55	1130					55
60	1125					60
65	1120	MIXED FELSIC Moderate sericite, weak fracture controlled clay. Disseminated limonite up to 0.1%.				65
70	1115					70
75	1110	FELSIC GNEISS Weak sericite. Pink-Purple hematite stain. Weak silica.				75
80	1105	HOST UNIT Zone. Strong clay alteration, disseminated hematite up to 3%, limonite up to 1.5%.				80
85	1100	MIXED FELSIC GNEISS Weak clay and sericite alteration. Fracture controlled limonite up to 0.1%.				85
90	1095	BIOTITE SCHIST Coarse biotite. Frcture controlled hematite up to 0.1%.				90
95	1090					95
100	1085	FELSIC GNEISS Weak sericite and silica. Patchy pink hematite stain.				100



LORAX ENVIRONMENTAL

MW15-06WB / BH05-WB / CFR-0999

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

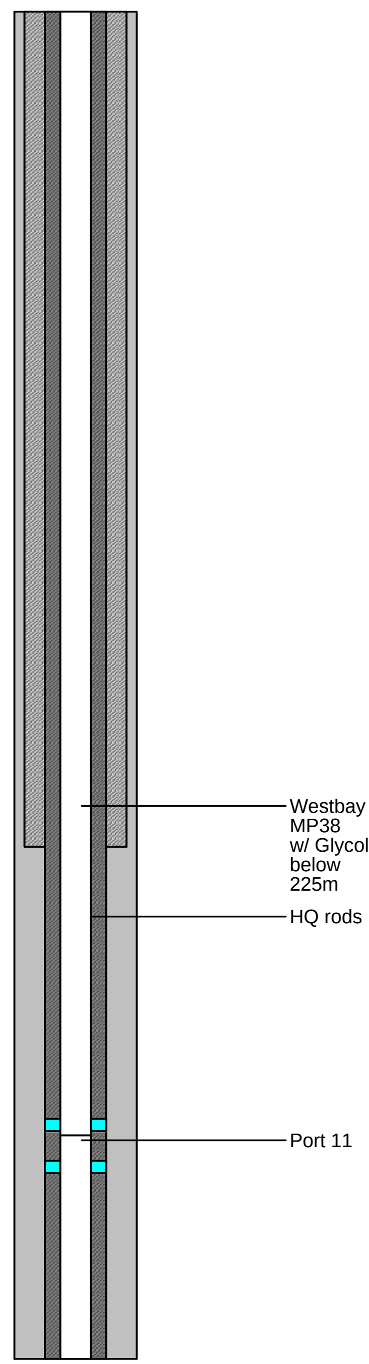
Drilling Started	: May 24,2015	Drilling Method	: RC & DDH
Install Completed	: June 06,2015	Drilling Company	: Northspan, CYR
Drilling Diameter(s)	: 6.0", 4.5", 3.78"	Supervised By	: JY/VS/LF (Lorax)
Drilled Depth	: 293 mbgs	Logged By	: Kaminak
		Checked By	: LF

HWT Depth: 162 mbgs
HQ Depth: 203.6 mbgs
Westbay Depth: #293# m bgs

Easting: 584,089.5
Northing: 6,975,003.3
Elevation: 1184.95 m asl
Survey Type: RTK GPS

HWT Stickup: 0.37 m ags
HQ Stickup: 0.62 m ags
Westbay Stickup: 0.62 m ags
RC 6" 0-8.8m, 4.5" 8.8-200.3 m; DDH HQ 200.3-293 m
WL: 220.73 m bgs (15-Jul-15; Port 6)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC EC= µS/cm	Airlift Yield (USGPM)	Depth (m)
100		MIXED MAFIC GNEISS Fresh Rock. Weak silica altertion.				100
105	1080	MIXED FELSIC GNEISS Weak patchy zone. Weak patchy sericite alteration, patchy fracture controlled weak clay. Patchy fracture controlled hematite and limonite up to 0.5%. Patchy clay bealching.				105
110	1075					110
115	1070					115
120	1065					120
125	1060					125
130	1055					130
135	1050					135
140	1045	MIXED FELSIC GNEISS Patchy moderate sercitite, weak fracture controlled clay, pathy pink hematite stain. *No dust at 139.9 m, brown rock. Dust returns at 140.2m. Trace moisture after rod connected 142.3 m, 145.3 m.				140
145	1040					145
150	1035					150
155	1030					155
160	1025					160
165	1020					165
170	1015					170
175	1010	*Trace moisture 174.3 m.				175
180	1005					180
185	1000	MIXED FELSIC GNEISS Interbedded gneiss and schist. Silicified throughout. Patchy bleaching due to albite altn. Patchy chlorite and epidote altn in mafic bands. Primary pink hematite staining.				185
190	995					190
195	990					195
200	985					200



LORAX ENVIRONMENTAL

MW15-06WB / BH05-WB / CFR-0999

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

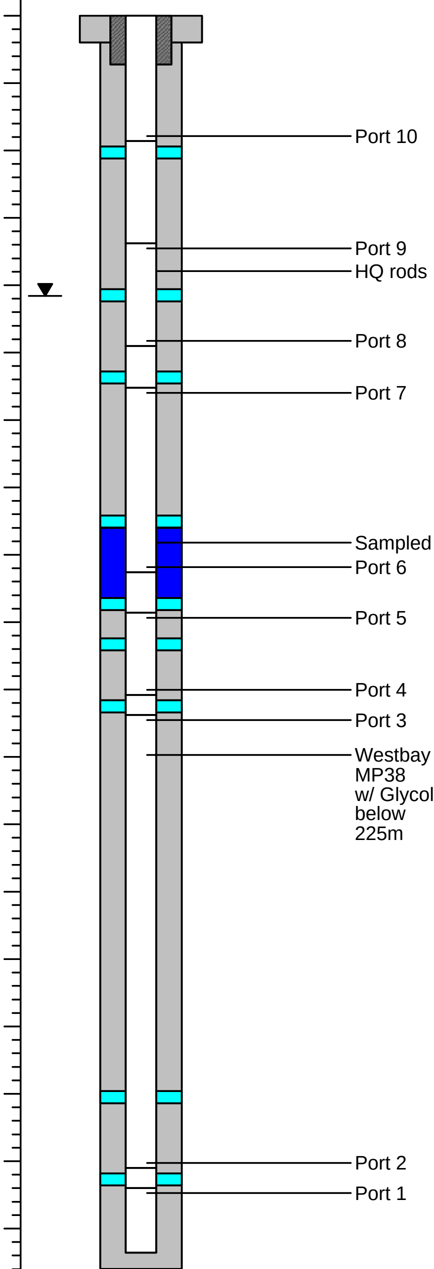
Drilling Started	: May 24,2015	Drilling Method	: RC & DDH
Install Completed	: June 06,2015	Drilling Company	: Northspan, CYR
Drilling Diameter(s)	: 6.0", 4.5", 3.78"	Supervised By	: JY/VS/LF (Lorax)
Drilled Depth	: 293 mbgs	Logged By	: Kaminak
		Checked By	: LF

HWT Depth: 162 mbgs
HQ Depth: 203.6 mbgs
Westbay Depth: #293# m bgs

Easting: 584,089.5
Northing: 6,975,003.3
Elevation: 1184.95 m asl
Survey Type: RTK GPS

HWT Stickup: 0.37 m ags
HQ Stickup: 0.62 m ags
Westbay Stickup: 0.62 m ags
RC 6" 0-8.8m, 4.5" 8.8-200.3 m; DDH HQ 200.3-293 m
WL: 220.73 m bgs (15-Jul-15; Port 6)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	EC EC= µS/cm	Airlift Yield (USGPM)	Depth (m)
200		*Hole drilled RC to 200.3 m by May 26, 2015 2:45 am. Hole dry to depth. Resumed drilling May 30, 2015 04:00am using diamond rig advancing HWT casing followed by HQ drilling.				200
205	980					205
210	975					210
215	970	*Formation grabby on rods at ~213 m, circulation is redulced by half. Fracture at ~215 m results in full circulation loss. Partial return after 215 m, lost again at 218 m, and then parital return thereafter (unchanged to end of hole).				215
220	965					220
225	960					225
230	955	*Rusty fractures ~230-234.5 m. Friable in places from 233.6-234 m.				230
235	950					235
240	945	*Rusty fractures ~238-242 m.				240
245	940					245
250	935					250
255	930					255
260	925	MIXED MAFIC GNEISS Schistose band with minor felsic component. Silicified, interstitial carbonate and weak epidote altn.				260
265	920					265
270	915	*Three clayey seams 270.15-270.25m.				270
275	910	*Rusty fractures ~272-277 m.				275
280	905	*Rusty fractures ~278-287 m.				280
285	900					285
290	895	MIXED MAFIC GNEISS Fresh schist. Foliated and strongly silicifed. Minor cross cutting carb veinlets.				290
295	890	End of hole 292.9 m. *Comments from supervising hydrogeologist; lithology logged by Kaminak geologist. Datum: UTM NAD83 Zone 7				295
300	885					300



LORAX ENVIRONMENTAL

MW15-07T / BH-07T / CFD-0596

KAMINAK GOLD CORPORATION

Coffee Creek Gold
Project #: A362-4

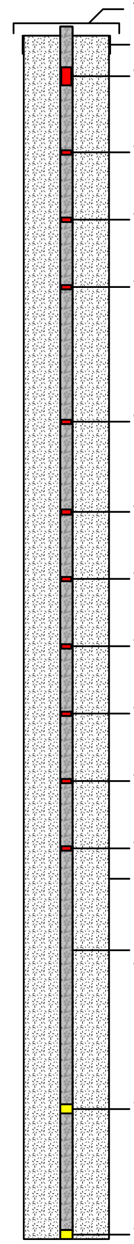
Drilling Started	: August 10, 2015	Drilling Method	: Diamond
Install Completed	: August 12,2015	Drilling Company	: Cyr Drilling
Drilling Diameter(s)	: HQ (96 mm)	Supervised By	: C.Bearor (SRK)
Drilled depth	: 268 mbgs	Logged By	: Kaminak
		Checked By	: LF

Depth to Bedrock: <1.0 mbgs
Casing Depth: n/a mbgs

Easting: 585,198.4 m
Northing: 6,974,582.9 m
Elevation: 1183.14 m asl
Survey Type: RTK GPS

Depth (m)	Elev. (masl)	LITHOLOGY	Fracture = Fr Fault = Flt	Airlift Yield (USGPM)
0	1180	OVERBURDEN		
		MIXED FELSIC GNEISS Grey moderately altered felsic gneiss with minor green mafic schist. Minor patches of bleaching and clay alteration, weakk pathes of oxidation.		
20	1160	YC Orange limonite+-clay altered cemented coarse grained angular monomictic breccia. More of a crackle breccia in to and bottom 20-30cm.		
40	1140			
60	1120	MIXED FELSIC GNEISS 75% grey to dark grey felsic gneiss with immature augens. 25% green mafic schist, biotite-feldspar, moderate chlorite alteration.		
80	1100			
100	1080			
120	1060			
140	1040	MIXED MAFIC GNEISS Same rocks as above, but 40% felsic gneiss and 60% mafic schist. A bit more alteration, a couple blebs of cpy+pyo at 166m, mod oxide zone from 158.6-160.7m		
160	1020			
180	1000	MIXED FELSIC GNEISS 70% drk grey to green-grey felsic gneiss, 30% schist. Trace disseminated pyrite.		
200	980			
220	960			
240	940			
260	920			
280	900	EOH 268 m RST Model 2040 Multichannel Data Logger S/N: Thermistor String (0-200 m) S/N: TS3837 VWP 1 (239 m) 3MPa, S/N: 33363; VWP 2 (267.8m) 3MPa, S/N: 33364 Lithology logged by Kaminak geologist		
300				

Installation depths along hole (m)



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Appendix 3-B:
Westbay Completion Report

GOLDCORP

September 21, 2015

Completion Report WB950

Kaminak Gold Coffee Creek Project

Westbay Instruments

September 21, 2015

Completion Report WB950

Kaminak Gold Coffee Creek Project

Project Number: WB950

Prepared for:

Lorax Environmental Services Ltd.

Prepared by:

Westbay Instruments

3480 Gilmore Way
Suite110
Burnaby, BC
V5G 4Y1

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

This report and the attached Appendices document the technical services carried out by Westbay Instruments (Westbay) under Lorax Environmental Services Ltd. P.O. No. A362-4. Westbay System completions were installed in boreholes BH2-WB, BH4-WB, BH5-WB, BH8-WB, BH10-WB and BH12-WB on a site near Coffee Creek, Yukon Territory.

This report documents the installation tasks and related QA checks.

2 PRE-INSTALLATION ACTIVITIES

All boreholes were drilled using air rotatory methods at a nominal 4.5-inch diameter (HQ-size). Permanent surface casings were installed to bedrock in each borehole. The surface casing depths are not included in this report. An exception to the above drilling method used is discussed in section 4.2, where addition drilling was conducted using a coring rig.

3 INSTALLATION

Westbay technical services representatives were on site for installation of the Westbay System completions as follows: Mr. Mark Lessard, April 29 – May 20, 2015. Mr. Andrew Bessant, May 20 – June 7, 2015, and Mr. Dave Larssen was on site June 7th-June 10th. Lorax representatives Ms. Laura Findlater, Mr. Jordi Helsen, Mr. Andrew Solod, and BGC representative Ms. Catherine Schmid were on-site to assist and supervise the work.

(Note: all depths are with respect to ground surface. Monitoring well reference elevations were not available at the time of writing).

Table 1, Summary of Westbay System Completions

Monitoring Well No.	Installation Dates 2015	Borehole Depth (m)	Depth of HQ rods (m)	MP38 Tubing Length (m)	No. Monitoring Zones
BH2-WB	May 22	82.9	56.5	82.9	2
BH4-WB	May 17-19	61.1	30	60.9	2
BH5-WB	June 6-9	293	200	294	4
BH8-WB	May 4-5	116.7	78	116.7	2
BH10-WB	May 25	65.7	10*	65.6	2
BH12-WB	May 11-14	99.7	34	99.6	3

* HQ rods removed, surface casing only.

The Westbay Systems were installed according to the procedure described below.

3.1 Preparation of Westbay System Design

Packer and zone depths and the projected depth of permafrost for each borehole were provided to Westbay by Mr. Jordi Helsen or Ms. Laura Findlater of Lorax. Well designs were created based on these depths. Each well design was used to prepare a Westbay Completion Log, which specifies the location of components in the well. These logs were reviewed and approved in the field by Mr. Helsen or Ms. Findlater prior to installation of the wells. The Westbay Completion Log as approved was used as an installation guide in the field. Field copies of the logs are in the Appendices.

A measurement port coupling was included in each primary zone to provide the capability to measure fluid pressures and collect fluid samples. Measurement port couplings were also included in QA zones to provide QA testing capabilities. A pumping port was placed above the top packer located directly above the expected base of permafrost in each completion. This pumping port was placed as part of a plan to introduce a 3:1 propylene glycol/water mixture into the steel casing adjacent to the permafrost zone.

Ms. Laura Findlater of Lorax requested that optional synthetic (PET) filters were not to be installed over the measurement port couplings.

3.2 Layout of Westbay System Components

Prior to Westbay System installation, the Westbay System components were set out on a rack near the borehole according to the sequence indicated on the Westbay Completion Log. Each component was numbered beginning with the lowermost as an aid to confirming the proper sequence of components. The appropriate Westbay System couplings were attached to the tubing sections. Magnetic location collars were attached 0.6 meters below the top of the measurement port in each primary zone.

Each component was visually inspected. Serial numbers for each packer, pumping port and measurement port coupling were recorded on the Westbay Completion Log. The well component layout was confirmed with the log before the components were lowered into each borehole.

3.3 Lowering of Westbay System Components

The Westbay System components were lowered into the boreholes by hand or rig assisted as required, through HQ drill rods (nominal 76mm ID) which were used as a temporary guide tube. Each tubing joint was tested with a minimum internal hydraulic pressure of 150 psi for one minute to confirm hydraulic seals. A record of each successful joint test and the placement of each component are noted on the Westbay Completion Log by check marks.

A 3:1 water/propylene glycol mixture supplied by Lorax was added to the Westbay completion when necessary to counter buoyancy effects while components were lowered into each borehole and for testing of joint seals during lowering.

3.4 Hydraulic Integrity Testing

After the Westbay System components were lowered into each borehole, the water inside the tubing was monitored at a depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the tubing. The data from the hydraulic integrity tests are shown in Table 2 below.

Table 2, Borehole and Westbay Tubing Water Level

Well number	Borehole water level Per-Installation (ground surface)	Westbay tubing water level (below top of Westbay)
BH2-WB	24.8 m	65.14 m
BH4-WB	artesian	34.304 m
BH5-WB	215.2 m	282.9 m
BH8-WB	38.41 m	41.32 m
BH10-WB	8.2 m	20.72 m
BH12-WB	~ 1 m	34.304 m

3.5 Positioning of Westbay System Completion

After the components were lowered into the borehole, and the guide tube was removed (BH10-WB) or the guide tube was lifted into position just below the, permafrost interface and was hung permanently from the surface casing. (BH2-WB, BH4-WB, BH8-WB, BH5-WB and BH12-WB). The final position of the guide tube is illustrated on each wells Summary Completion Log in the Appendices. The Westbay System tubing was positioned as indicated on the cover page of the Summary Completion Log. Ground surface was used as zero reference for all installations. The Westbay System components were supported in this position while packer inflations were carried out.

The positioning of the Westbay System is based on the "nominal" lengths of Westbay System components. The positioning calculations do not include allowances for borehole temperature or deviation effects.

The attached figure titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX Transducer sensors to the reference position at the top of the Measurement Port. The attached figure titled "Dimensions of Packer Seals and Monitoring Zones" outlines the calculations used to determine the packer centerline depths and zone length.

The Summary Completion Log and Table 4, shows the final "as-built" locations of key components in the well, and Table 5 shows the final "as-built" locations of all components in the well, are included in the Appendices.

3.6 Pre-inflation Profile

Prior to inflating the packers, a pre-inflation pressure profile was carried out in the Westbay Systems to confirm the proper operation and position of measurement ports and magnetic collars. The data confirmed proper operation and position of all measurment ports (Figure 3). The data for the pre-inflation profile for each well is located in the Appendices.

3.7 Inflation of Westbay System Packers and Placement of Antifreeze Solution

The Westbay packers were inflated using a 3:1 proplyene glycol/water mixture provided by Lorax. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All the packers appear to have inflated normally. The data for inflation of each packer are provided on the Westbay Packer Inflation Records included in the Appendices.

The packers were inflated in a specific sequence as part of a plan to introduce and control an antifreeze solution in the well annulus through the permafrost zone, with the exception of BH5-WB where no glycol/water mixture was introducted as there is no fluid in the annulus between the HQ and the Westbay to flush out of the permafrost zone.

The sequence of tasks for introducing 3:1 proplyene glycol/water mixture is illustrated below:

- A set of two packers positioned inside the HQ rods immediately below the expected base of permafrost are inflated.
- The pumping port above the upper inflated packer was opened.
- A 3:1 mixture of water and propylene glycol supplied by Lorax was pumped inside the Westbay tubing, out the pumping port and into the well annulus (HQ rods). Pumping continued until a return flow of the mixture was observed from the well annulus at ground level, thus indicating that the well annulus (HQ rods) was full of the antifreeze mixture.
- The pumping port above the upper inflated packer was closed.
- The remaining Westbay packers were inflated sequentially beginning at the bottom.
- The squeeze relief venting function of the packer inflation tool was disabled to prevent accidental release of tubing fluid to the formations.

4 EXCEPTIONS TO STANDARD INSTALLATION PROCEDURES

4.1 BH8-WB Release of Antifreeze Solution

There was an unintentional release of 3:1 propylene glycol/water mixture into the annulus of the borehole during the installation process.

1. Packer inflation was completed on May 5th. It was noted by the field crew on May 6th that about 42 liters of the water-glycol mixture had been released from inside the Westbay tubing during the squeeze relief venting by the packer inflation tool.
2. The release was reported on May 6th. After discussions it was decided by Lorax to conduct purging of the individual zones to determine the effect on the native fluid chemistry. This purging was done by the Westbay representative on May 8th to May 10th.
3. We understand that chemical analysis of retrieved samples yielded no detectable glycol mixture after field analysis.
   Lorax sent other samples for more detailed analysis offsite, and these results are not known.
4. The squeeze relief venting capability of the packer inflation tool was mechanically disabled to prevent a similar release in future wells onsite.
5. As a preventive measure against future occurrences, Westbay implemented changes to the field crew mobilization procedures to more clearly document any exceptions to the standard procedures.

After preventive measures were implemented, no further occurrences of propylene glycol/water mixture release occurred during the remaining installations.

4.2 BH5-WB Installation

BH5-WB was first drilled using air rotary to a depth of 200m. On completion it was determined that no water was present in the borehole. It was decided by Lorax to continue drilling to a depth 295m using a diamond coring drill rig. HWT casing was installed to 170m. The remaining 95m to TD was cored with HQ-size wireline equipment. On completion of the coring the water level in the borehole was at surface. The water level was monitored by Lorax, and it dropped to below 200m. It was determined at this point that the plan to introduce and control an antifreeze solution in the well annulus through the permafrost zone would not be followed as there was no drilling fluids that needed to be flushed out above the permafrost packers.

The sequence of events below describes the installation process and the unintentional positioning of the Westbay System.

1. The HQ rods used as a guide tube in BH5-WB were lifted into position, 200m below ground surface and hung permanently from the HWT surface casing using a casing clamp.
2. The borehole was sounded using a tag line supplied and operated by Lorax personnel to confirm total depth (TD) of the borehole (293m). Multiple attempts at sounding where conducted by Lorax and a few different depths were recorded, (291.8m, and 287m) it was uncertain whether the hole was at depth or some material had sluffed in. The unclear readings of TD led to the adjustment of the Westbay System design, removing some tubing components from the bottom to prevent unexpected landing too high in the borehole. The standard installation procedure for landing the Westbay System on bottom were changed to an alternative standard procedure which included suspending the Westbay tubing at ground surface.
3. Lorax approved the changes and signed the installation documentation.
4. Once all Westbay System components were lowered into the borehole, two packers in the HQ guide tube were inflated to hold the Westbay System in its final designed position. These packers would provide support to Westbay System while mobilization of the drill rig off site took place. The Westbay System top section was below the top of HQ rods at the end of shift, safely protected from possible damage.
5. The following morning the Westbay System was found to have had slid down the well 7.55m from top of the HQ rods and was resting on bottom of hole (293m).
6. It was speculated onsite that ice may have formed inside the HQ rods, decreasing the capability of the two inflated packers to support the weight of the Westbay completion string.
7. An additional 7.5m of Westbay tubing were attached to the downhole tubing and the “as-is” position of the packer seals were reviewed and accepted by Lorax.
8. A pre-inflation profile and hydraulic integrity test were carried out, as a QA check to show the Westbay System to be hydraulically sealed and functioning properly.
9. Based on the successful outcome of the QA checks, Lorax approved the inflation of the Westbay System packers as positioned in the borehole.
10. All packers seemed to have inflated normally and the well is operating to designed specifications.

5 FLUID PRESSURE MEASUREMENTS

After packer inflation was completed, fluid pressures were measured at each measurement port. At that time, the in-situ formation pressures may not have recovered from the pre-installation activities and potential groundwater pressure increases in monitoring zones that may result from packer inflation. This latter effect may be more likely to occur in monitoring zones located in low-permeability geological formations. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the piezometric levels in all zones in each well is shown on Figure 4 in the Appendices. The data were examined to confirm proper operation of the measurement ports and as a check on the presence of annulus seals between monitoring zones. The calculation sheets for the pressure profiles of the Westbay System are also enclosed in the Appendices.

6 OPERATOR TRAINING

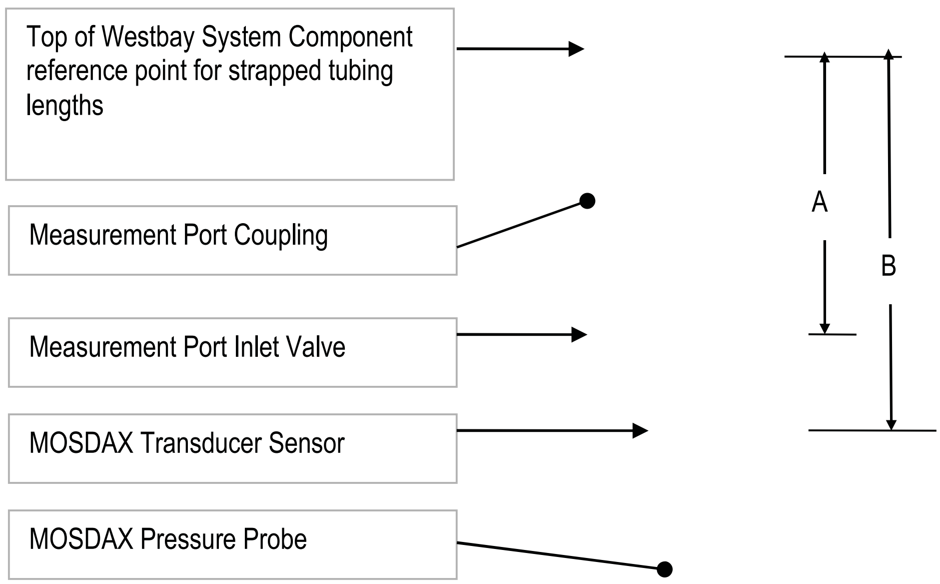
Training was provided to Mr. Jordi Helson, Mr. Chris Bourque, and Ms. Laura Findlater of Lorax. The training covered the following areas:

- Operation and maintenance of Model 2531 Sampler Probe and MAGI controller in pressure profiling, sample collection.
- Cable reheading and troubleshooting.

Mr. Jordi Helson, Mr. Chris Bourque, and Ms. Laura Findlater are certified for un-supervised operation and field maintenance of this Westbay equipment.

MOSDAX Transducer Position

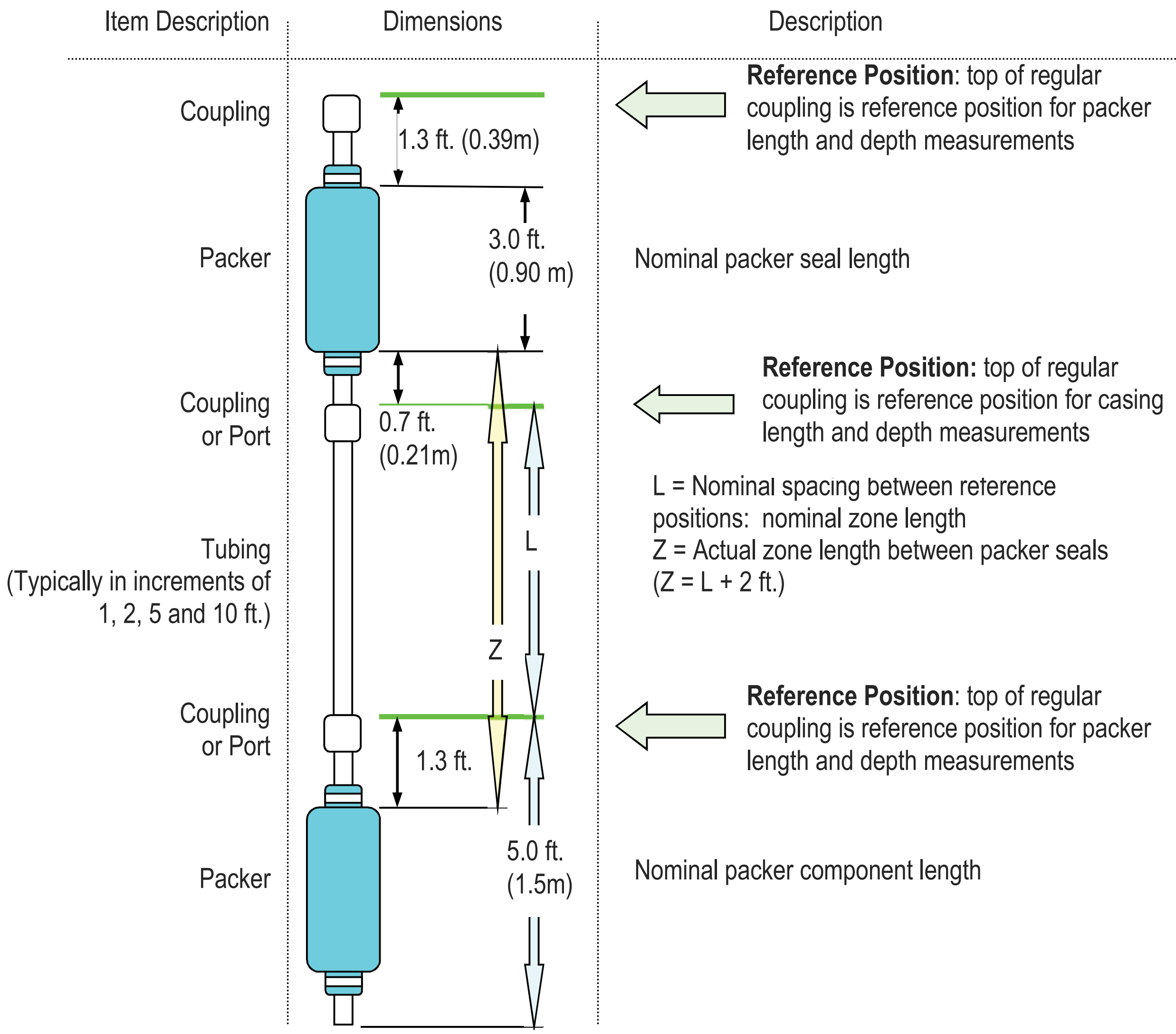
In an Westbay System Measurement Port Coupling



System	Measurement Port	A	B
Plastic MP38	0205	4.5" (114.3 mm)	6.5" (165.1 mm)

Figure 1: MOSDAX Transducer Position

Dimensions of Packer Seals and Monitoring Zones. 0238 Packers



Discussion Points:

- The top of a coupling (Regular Coupling, Measurement Port or Pumping Port) is the reference point for describing nominal depths and nominal lengths. Actual positions of packer seals and zone lengths are determined with respect to the appropriate reference positions.
- Packer Position Example: A packer with a nominal depth of 50 ft. (15.2m), will have a nominal packer seal position of 51.3 to 54.3 ft. (15.59 to 16.49m)
- Zone Length Example: A zone whose upper packer is at 50 ft. (15.2m) and bottom packer is at 70 ft. (21.3m) will have a nominal zone length of 15 ft. (4.6m) and an actual zone length (between packer seals) of 15.0+1.3+0.7 = 17.0ft. (4.6 + 0.39 + 0.2 = 5.19m)
- Information on the position of Measurement Port Valve and MOSDAX Transducer sensor, used for detailed calculation of piezometric level measurements, are described separately.

Figure 2: Zone Dimensions

APPENDIX A: MONITORING WELL: BH2-WB

As-Built Key Components Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 1 page
Summary Completion Log	- 2 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (May 22)	- 1 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (May 22)	- 1 page
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 5 pages
Westbay System Packer Inflation Records	- 5 pages

Table 4: BH2-WB As-Built Packer and Port Summary

AB ,01/06/2015

Port No.	Zone	Measurement Port Depth, (m)	Pumping Port Depth, (m)	Depth to top of Packer, (m)	Top of Zone (m)	Bottom of Zone (m)	Comments
1	1	78.1		76.6	77.9	82.7	
2	QA 1	68.4		66.9	68.2	77.0	
3	2	63.8		62.3	63.6	67.3	
4	QA 2	62.3		60.8	62.1	62.7	
5	QA 3	54.7	53.1	53.1	54.4	61.2	
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Note 1: All depth measurements in meters below datum (GS).
Note 2: All depth measurements use 'Nominal' tubing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All depth measurements to upper edge of Westbay System coupling item.

Table 5: BH2-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
34	20102			203				-1.2896
33	20102			202				-0.81
32	20105			202				-0.20043
31	20110			202		216	1.9	1.3235
30	20110			202				4.3713
29	20110			202				7.4192
28	20110			202				10.467
27	20110			202				13.515
26	20110			202				16.563
25	20110			202				19.611
24	20110			202				22.658
23	20110			202				25.706
22	20110			202				28.754
21	20110			202				31.802
20	20110			202				34.85
19	20110			202				37.898
18	20110			202				40.946
17	20110			202				43.993
16	20110			202				47.041
15	20110			202				50.089
14	238	Packer	19249	224	8716			53.137
13	20110	Measurement Port		205	8463			54.661
12	20110			202				57.709
11	238	Packer	19210	202				60.757
10	238	Packer	19206	205	8461			62.281
9	20110	Measurement Port		205	8460	216	64.4	63.804
8	238	Packer	19207	202				66.852
7	20110	Measurement Port		205	8462			68.376
6	20105			202				71.424
5	20102			202				72.948
4	20110			202				73.558
3	238	Packer	19202	202				76.605
2	20105	Measurement Port		205	8476	216	78.7	78.129
1	20110			202				79.653
0	203							82.701

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

(2) 0203 - MP38 End Cap

(3) 020102 - MP38 Casing 3 (2F/0.6M)

(3) 020105 - MP38 Casing 2 (5F/1.5M)

(23) 020110 - MP38 Casing 1 (10F/3M)

(5) 0238 - MP38 Packer - 74mm (5F/1.5M)

(28) 0202 - MP38 Regular Coupling

(1) 0224 - MP38 Pumping Port

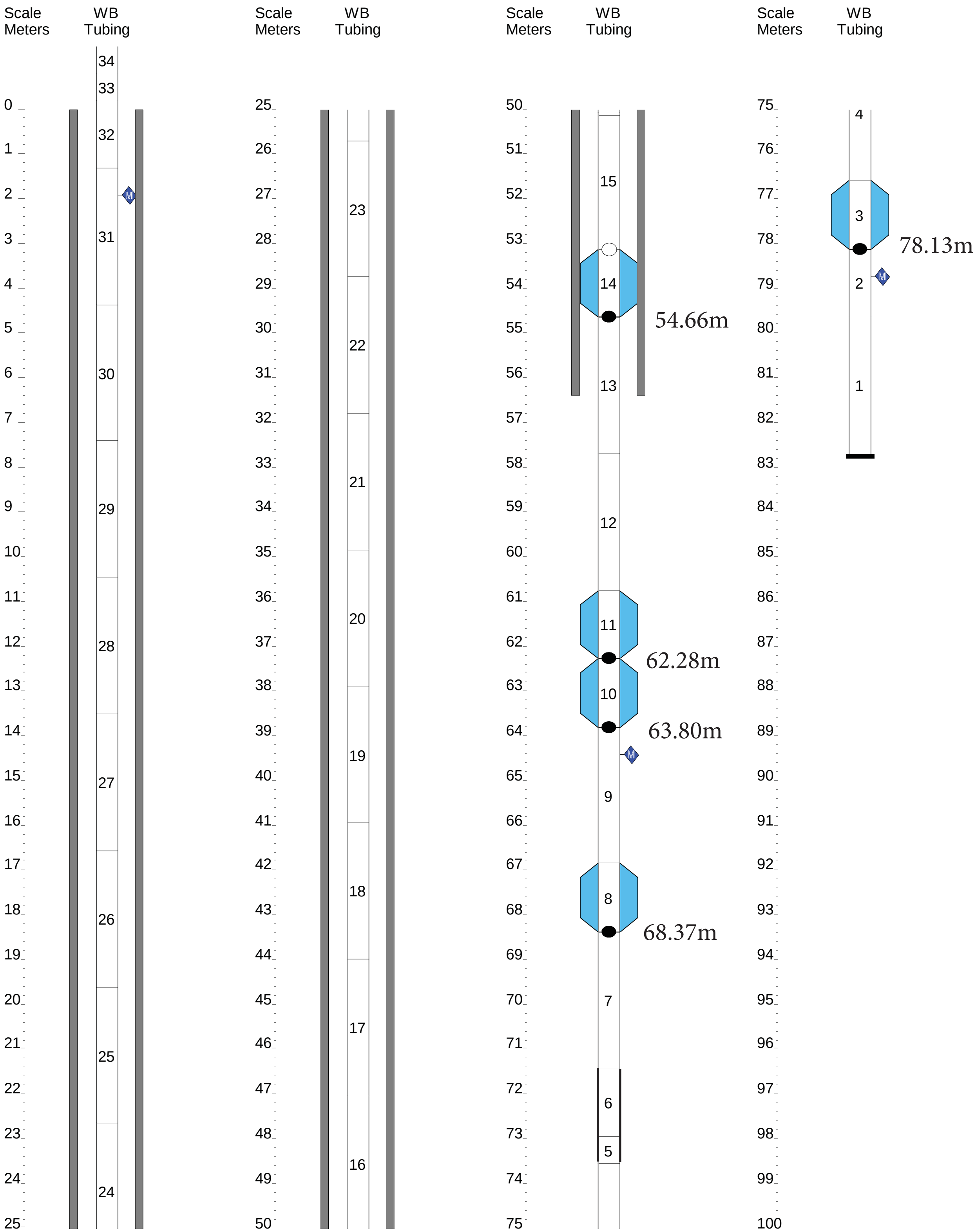
(5) 0205 - MP38 Measurement Port

(4) 0216 - Magnetic Location Collar

Geology

Backfill/Casing

Mild Steel


Scale Meters
WB Tubing
Scale Meters
WB Tubing
Scale Meters
WB Tubing
Scale Meters
WB Tubing
54.66m
62.28m
63.80m
68.37m
78.13m

Westbay Piezometric Pressures/Levels

Westbay Instruments

Pre-deflation

Field Data and Calculation Sheet

Well No.: [illegible]
Datum: —
Elev. G.S.: —
Height of Westbay above G.S.: —
Elev. top of Westbay Casing: —
Reference Elevation: —
Borehole angle: —

Probe Type: [illegible]
Serial No.: 2755
Probe Range: 250
Westbay Casing Type: MP38
Sampler Valve Position: C

Date: [illegible]
Client: [illegible]
Job No.: 950
Location: [illegible]
Weather: [illegible]
Operator: [illegible]

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz)

P_{atm} 12.97 psi

Ambient Reading (P_{atm}) (pressure, temperature, time)

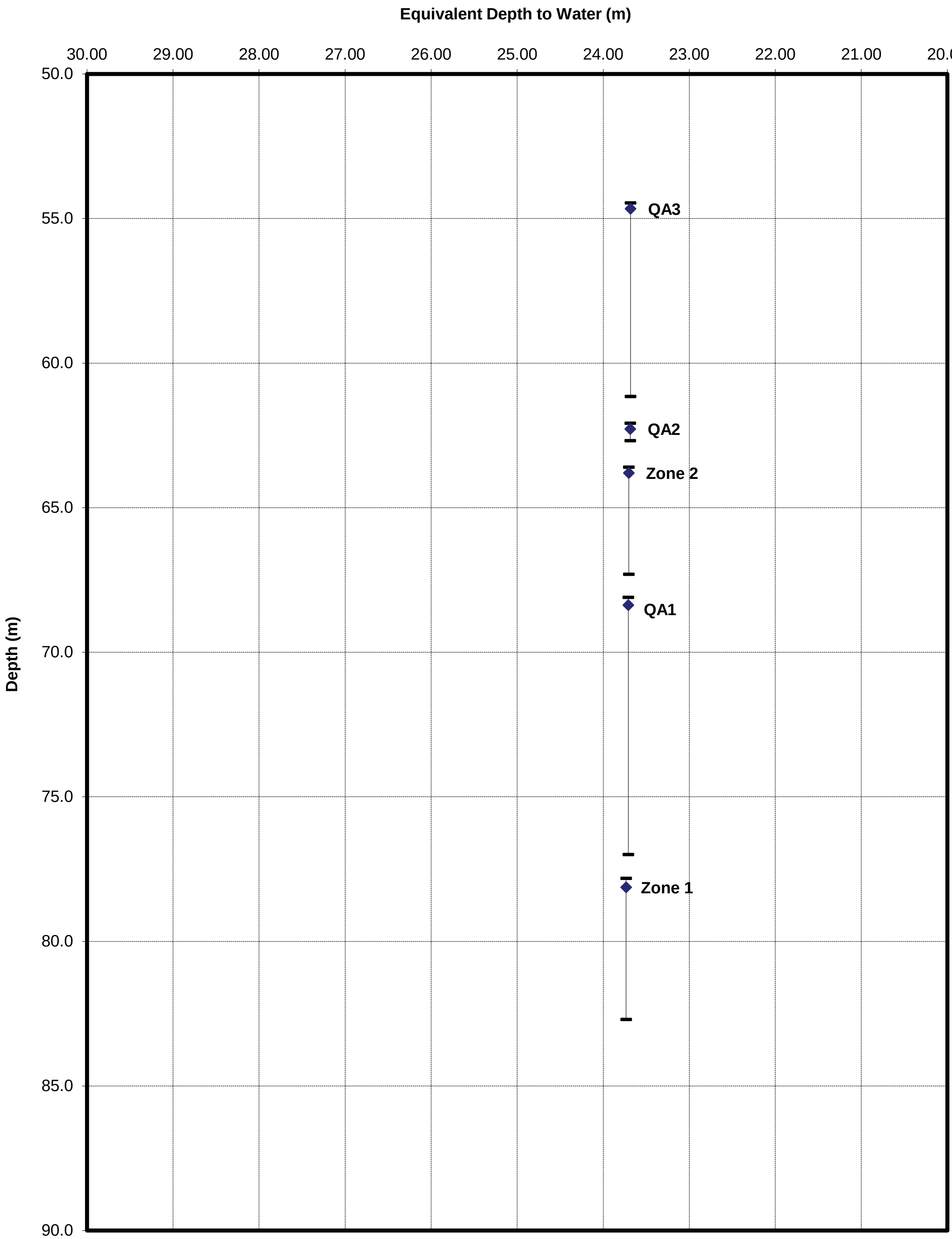
Start: Pressure 12.97 Finish: 13.03
Temp — —
Time — —

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
1	78.1	78.3	—	34.39	90.22	9:26	6.40	34.39	54.39	23.7	
2	68.37	68.6	—	20.21	76.48	9:28	4.32	20.21	44.66	23.7	
3	63.8	63.0	—	13.59	69.99	9:29	3.61	13.59	40.10	23.7	
4	62.28	62.5	—	13.11	67.85	9:32	2.55	13.11	38.59	23.7	
5	54.6	54.8	—	13.11	57.02	9:35	2.18	13.11	30.97	23.7	

Notes: w = 1.422psi / m of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH2-WB

Profile Date: May 22, 2015
Comments: Pre-Inflation Profile



Client:LORAX Environmental Ltd
Site: Coffee Creek
Datum: Ground Surface

Figure 3

Plot By:____Date:____
Checked By:____Date:____
Westbay Project: WB950

Westbay Piezometric Pressures/Levels
Post-deflation Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH-2
Datum: GS
Elev. G.S.: —
Height of Westbay above G.S.: —
Elev. top of Westbay Casing: —
Reference Elevation: —
Borehole angle: —

Probe Type: EMS
Serial No.: 2499
Probe Range: 250
Westbay Casing Type: MP38
Sampler Valve Position: C

Date: 22/05/2015
Client: Zarak
Job No.: 550
Location: Coffee Creek
Weather: Sun 24
Operator: AB LF

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)
Start: Pressure 13.03 Finish: 13.05
Temp — —
Time — —

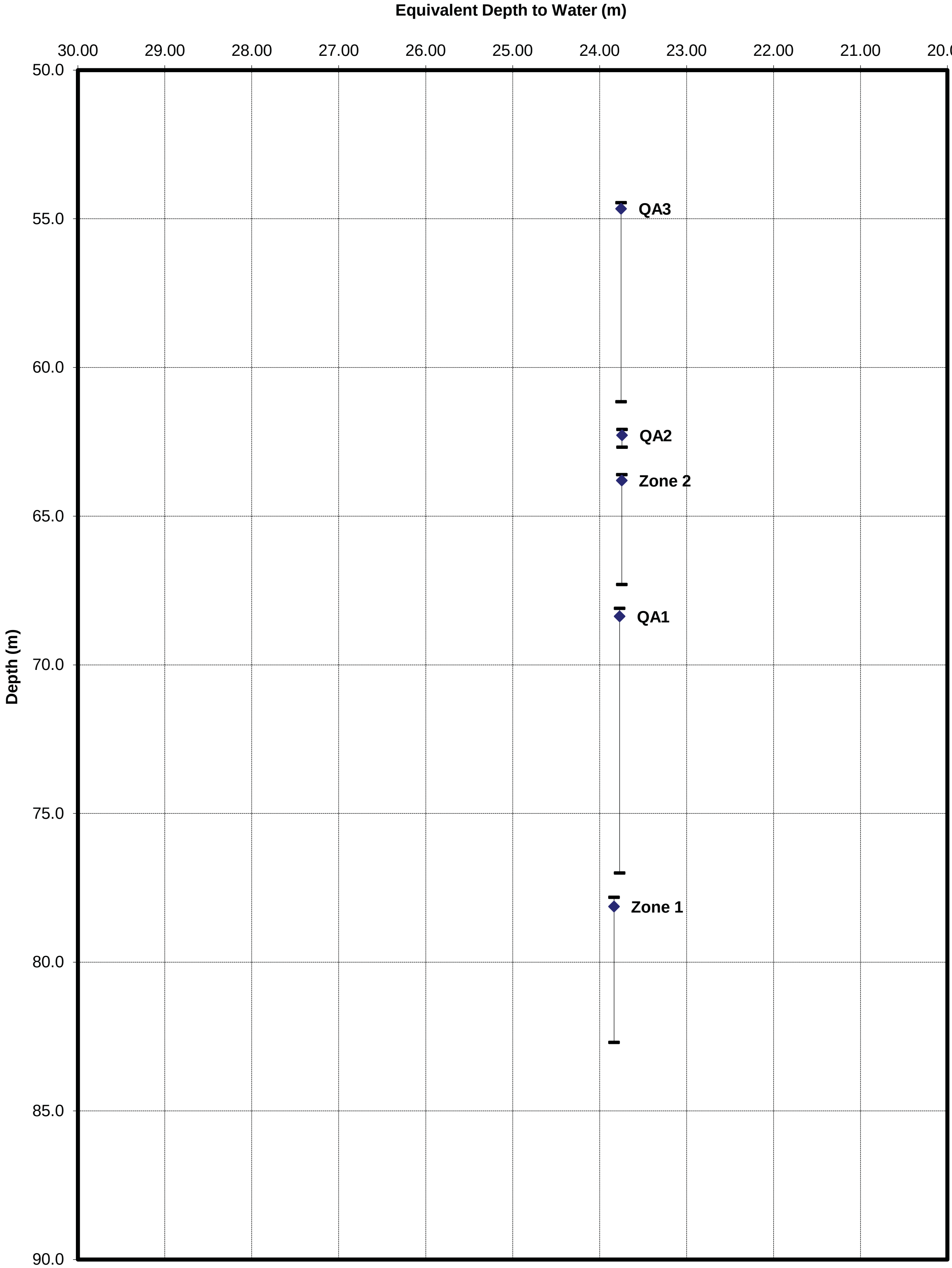
P_{atm} 13.03 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
1	78.1	78.6		127.22	90.24	13:31	7.51	127.27	54.78	23.8	
2	68.4	68.9		113.13	76.45	13:35	3.43	~~76.45~~ 113.14	44.58	23.8	
3	63.8	~~69~~ 63.6		106.58	69.99	13:42	1.35	106.58	40.04	23.7	
4	62.3	62.1		104.37	67.83	13:45	1.05	104.38	38.52	23.8	
5	54.6	54.3		93.36	56.98	13:48	1.47	93.37	30.89	23.7	

Notes: w = 1.422psi / m of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH2-WB

Profile Date: May 22, 2015
Comments: Post-Inflation Profile



Client: LORAX Envivromental Ltd
Site: Coffee Creek
Datum: Ground Surface

Figure 4

Plot By:____Date:______
Checked By:____Date:_____
Westbay Project:WB950

Westbay System Completion Log

Company: Lorax
Well: BH-2
Site: Coffee Creek
Project: 〃

WB #: 950
Author: AB

Well Information

Reference Datum: 0 ft. GS
Elevation of Datum: — ft.
WB Tubing Top: 1.4 ~~ft.~~ m
WB Tubing Length: 83.0 ft.

Borehole Depth: 83.5 ~~ft.~~ m
Borehole Inclination:
Borehole Diameter: 4.5 in.

Well Description:

Other References:

File Information

File Name: ______________
Report Date: ______________
File Date: ______________

Comments

Installation sign-off Information

Borehole condition confirmed.(Client)	(method) Surveyed	Date: 22/05/15
WB System design & preparation.(Client / WB)	By: AB	Date: 22/05/15
WB System design checked. (Client / WB)	By: AB VS	Date: 22/05/15
WB System and borehole approved to install. (Client)	By: VS	Date: 22/05/15

Signature REDACTED

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

Qty	Component
(2)	0203 - MP38 End Cap
(3)	020102 - MP38 Casing 3 (2F/0.6M)
(3)	020105 - MP38 Casing 2 (5F/1.5M)
(23)	020110 - MP38 Casing 1 (10F/3M)
(5)	0238 - MP38 Packer - 74mm (5F/1.5M)
(28)	0202 - MP38 Regular Coupling
(1)	0224 - MP38 Pumping Port
(5)	0205 - MP38 Measurement Port
(4)	0216 - Magnetic Location Collar

Geology

Backfill/Casing

Mild Steel

Westbay Instruments

Westbay System Completion Log

Sheet 1 of 3

Project: Coffee Creek / LORAX

WB#.: 950

Location: ____ Hole No.: BH-2 Installed by: AB

Hole Depth: 83.5m WB Depth: 83.05m Hole Diameter: 4.5" Date Installed: 22/05/15

Measurement Datum: GS Datum Elevation: — Date Drawn: 22/05/15

Scale, (m/ft)	Component Description	Depth Log	WB Tubing Log	Serial No.	Final Packer Pressure/Volume	Comments	Joint Install	Joint Test
		-1.40						
		-.80	34			2	✓	✓
			33			2	✓	✓
0			32			5		
							✓	✓
			31			10		
							✓	✓
			30			10		
							✓	✓
			29			10		
							✓	✓
			28			10		
							✓	✓
			27			10		
							✓	✓
			26			10		
							✓	✓
			25			10		
							✓	✓
			24			10		
							✓	✓
			23			10		
							✓	✓

WB Tubing | WB Packer | Magnetic Collar | Filter Sleeve | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments

Westbay System Completion Log

Sheet 2 of 3

Project: —

WB#.: 950

Location: —

Hole No.: BH2

Installed by: AB

Hole Depth: — WB Depth: —

Hole Diameter: —

Date Installed: —

Measurement Datum: —

Datum Elevation: —

Date Drawn: —

Scale (m/ft)	Component Description	Depth Log	WB Tubing Log	Serial No.	Final Packer Pressure/Volume	Comments	Joint Install	Joint Test
			22			10	✓	✓
			21			10	✓	✓
			20			10	✓	✓
			19			10	✓	✓
			18			10	✓	✓
			17			10	✓	✓
			16			10	✓	✓
			15			10	✓	✓
		53.14		8716				
			14	19249		238	✓	✓
		54.67		8463				
			13			10	✓	✓
			12			10	✓	✓

WB Tubing | WB Packer | Magnetic Collar | Filter Sleeve | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments

Westbay System Completion Log

Sheet 3 of 3

Project: —

WB#: 950

Location: —

Hole No.: BH-2

Installed by: AB

Hole Depth: — WB Depth: —

Hole Diameter: —

Date Installed: —

Measurement Datum: —

Datum Elevation: —

Date Drawn: —

Scale, (m/ft)	Component Description	Depth Log	WB Tubing Log	Serial No.	Final Packer Pressure/Volume	Comments	Joint Install	Joint Test
			11	19210		238		
		62.28		8461			/	/
			10	19206		238	/	/
		63.80		8460				
			9			10	/	/
			8	19207		238		
		68.37		8462			/	/
			7			10	/	/
			6			5	/	/
			5			2	/	/
			4			10	/	/
			3	19202		238		
		78.13		8476			/	/
			2			5	/	/
			1			10		
		82.70					/	/

WB Tubing | WB Packer | Magnetic Collar | Filter Sleeve | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: Coffee Creek Project No.: WB950 Well No.: BH-2

Location: " Completed by: AB Date Inflated: 22/05/2015

Packer No. 19202 #1 Depth (ft / m): — Inflation Tool No.: —

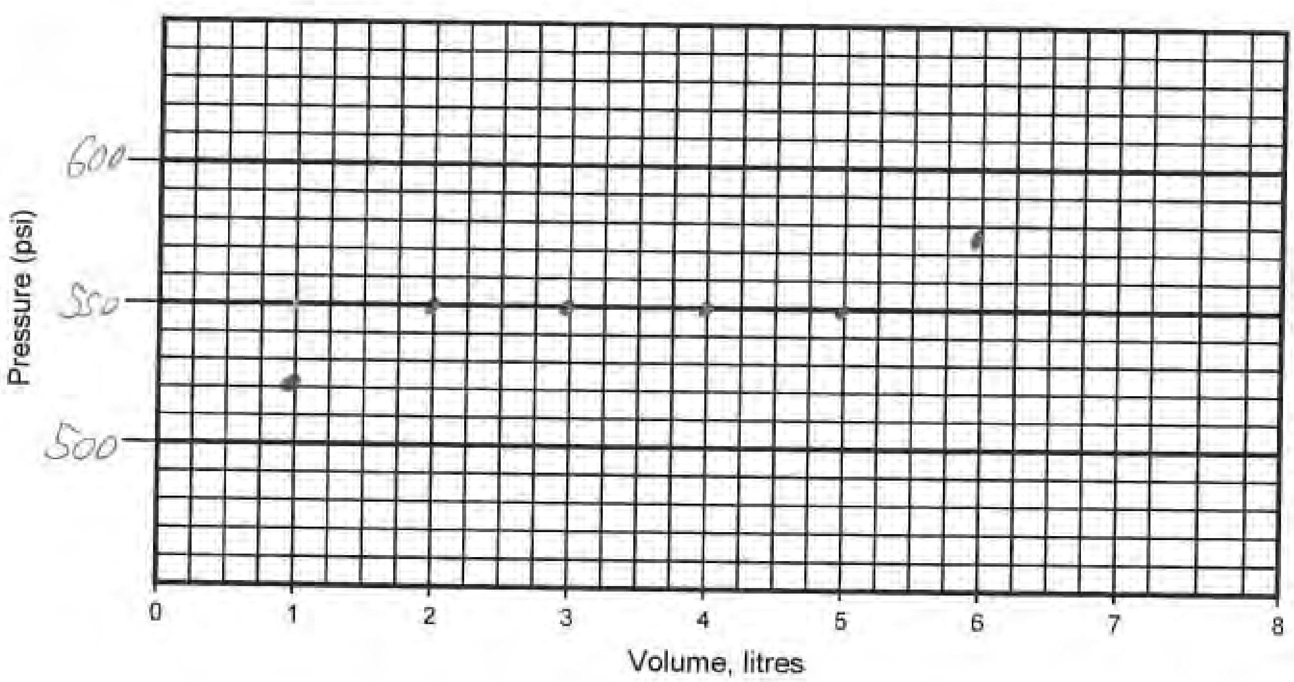
Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 575 psi Tool Pressure, P_T: 300 psi

Borehole Water Level: 24 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 135 psi

Volume, litres	1	2	3	4	5	6	/	5.6		
Pressure, psi	525	550	550	550	550	575	/	0		

Volume, litres										
Pressure, psi										



Comments: ______ Time - 10:22 Start
10:34 Finish

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: Caffe Creek   Project No.: WB 950   Well No.: BH-2

Location: "   Completed by: AB   Date Inflated: 22/05/2005

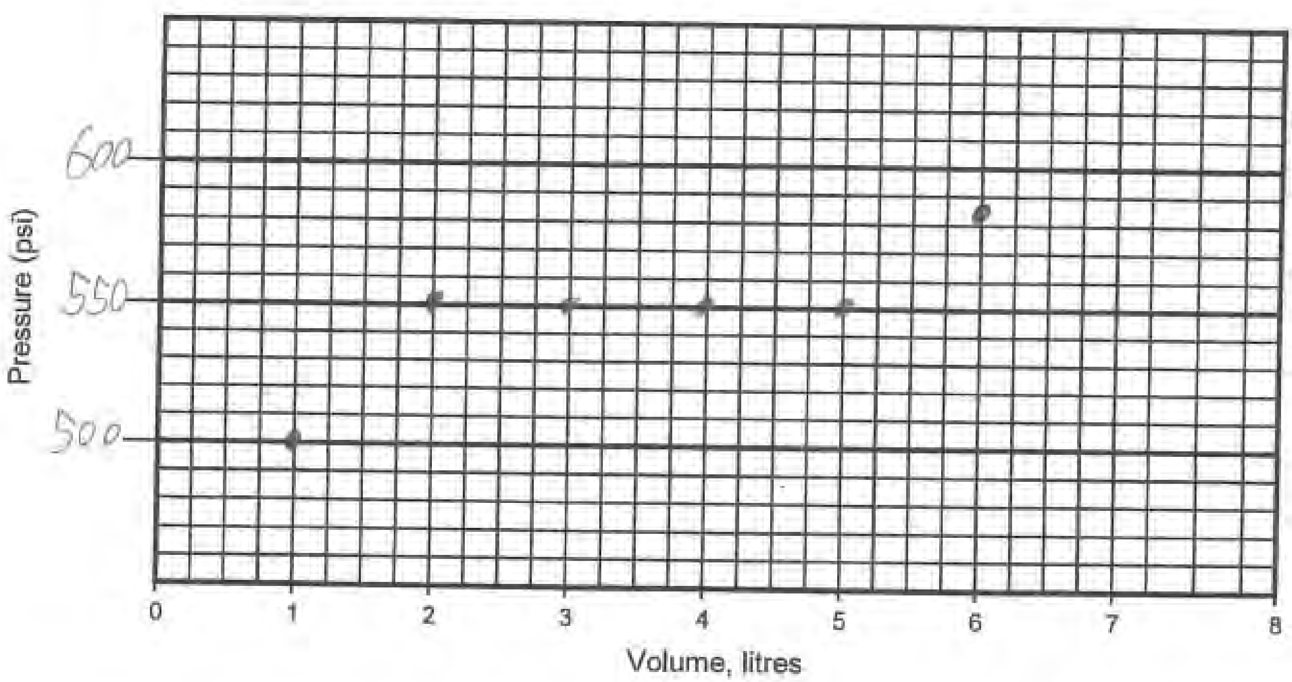
Packer No. 2   19207   Depth (ft / m): —   Inflation Tool No.: —

Packer Valve Pressure, P_V: 150 psi   Final Line Pressure, P_L: 575 psi   Tool Pressure, P_T: 300 psi

Borehole Water Level: 24 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 130 psi

Volume, litres	1	2	3	4	5	6	/	5.6		
Pressure, psi	500	550	550	550	550	575	/	Ø		
Volume, litres										
Pressure, psi										



Comments: ________ Time - 10:40 Start

Sheet____of____

Westbay Instruments

Westbay Packer Inflation Record

Project: Coffee Creek Project No.: WB950 Well No.: BH-2

Location: " Completed by: AB Date Inflated: 22/05/2005

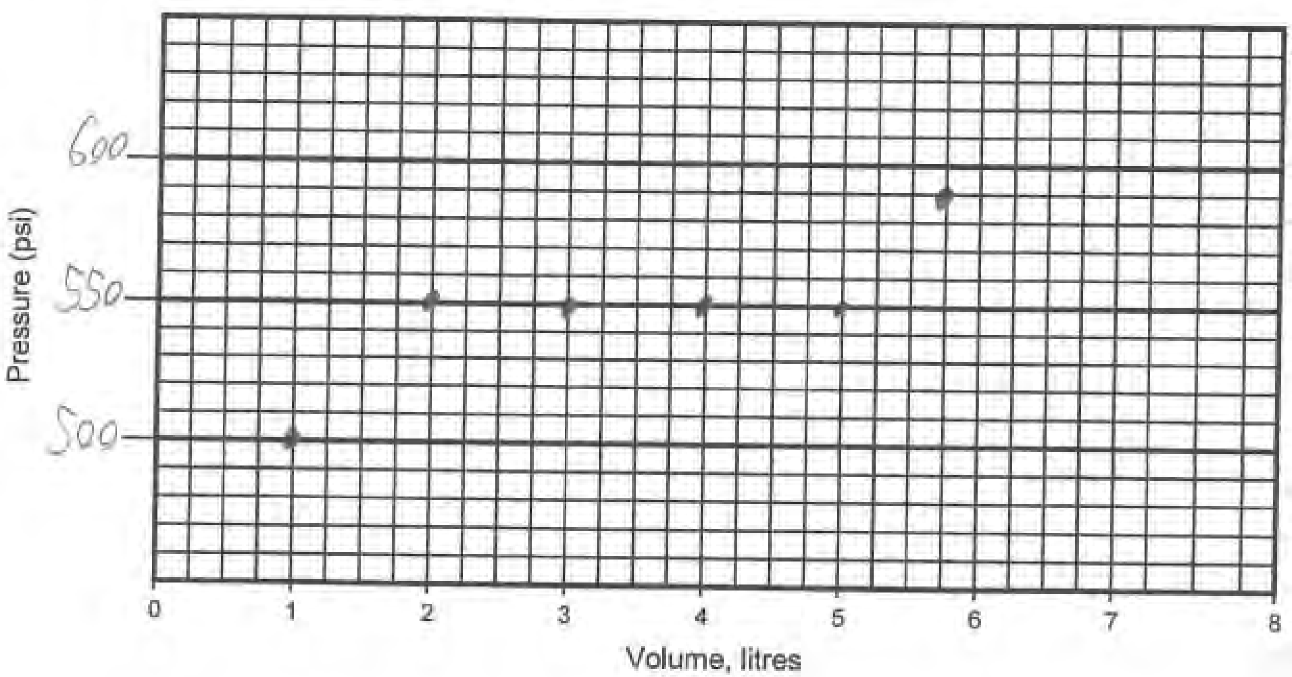
Packer No. 3 19206 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 575 psi Tool Pressure, P_T: 300 psi

Borehole Water Level: 24 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 135 psi

Volume, litres	1	2	3	4	5	5.75	/	5.25		
Pressure, psi	500	550	550	550	550	575	/	0		
Volume, litres										
Pressure, psi										



Comments: Time - 10:59
11:12

Westbay Instruments

Sheet___of___

Westbay Packer Inflation Record

Project: Coffee Creek Project No.: WB950 Well No.: BH-2

Location: ______ Completed by: AB Date Inflated: 22/05/2015

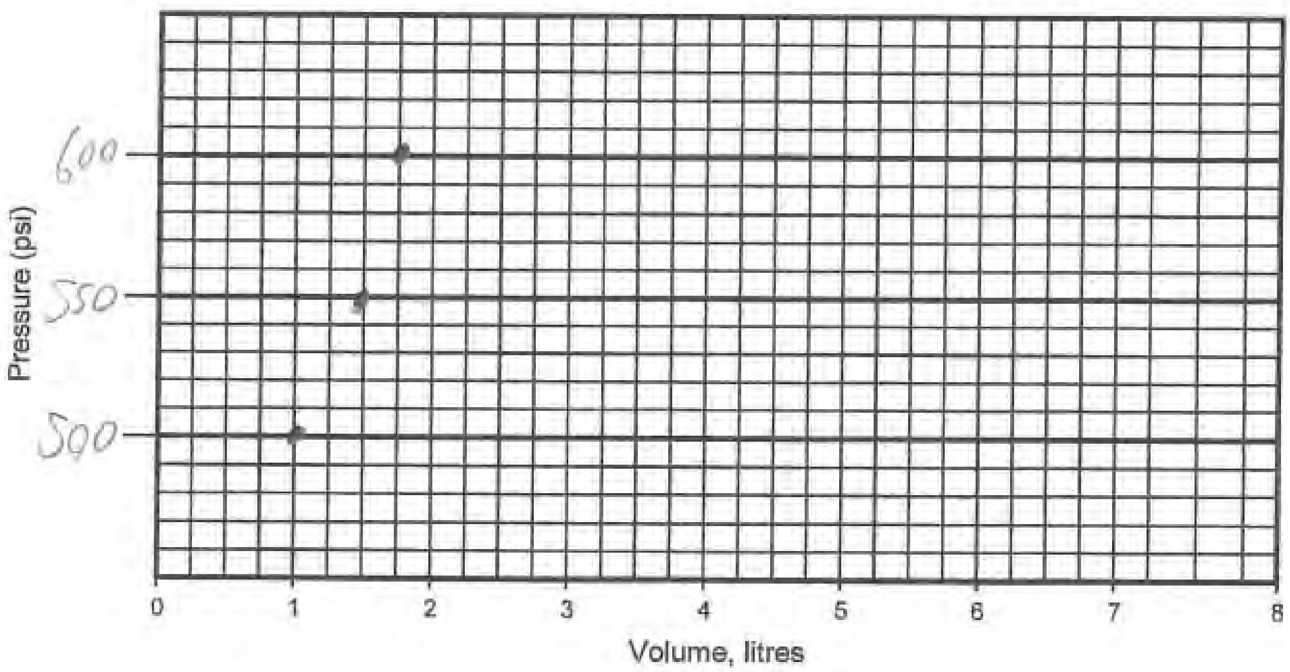
Packer No. 19249 #5 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 600 psi Tool Pressure, P_T: 300 psi

Borehole Water Level: 24 (ft / (m)) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 155 psi

Volume, litres	1	1.5	1.75							
Pressure, psi	500	550	600							
Volume, litres										
Pressure, psi										



Comments: HQ Packer Time - 11:37

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: Coffee Creek   Project No.: WB950   Well No.: BH-2

Location: "   Completed by: AB   Date Inflated: 22/05/2015

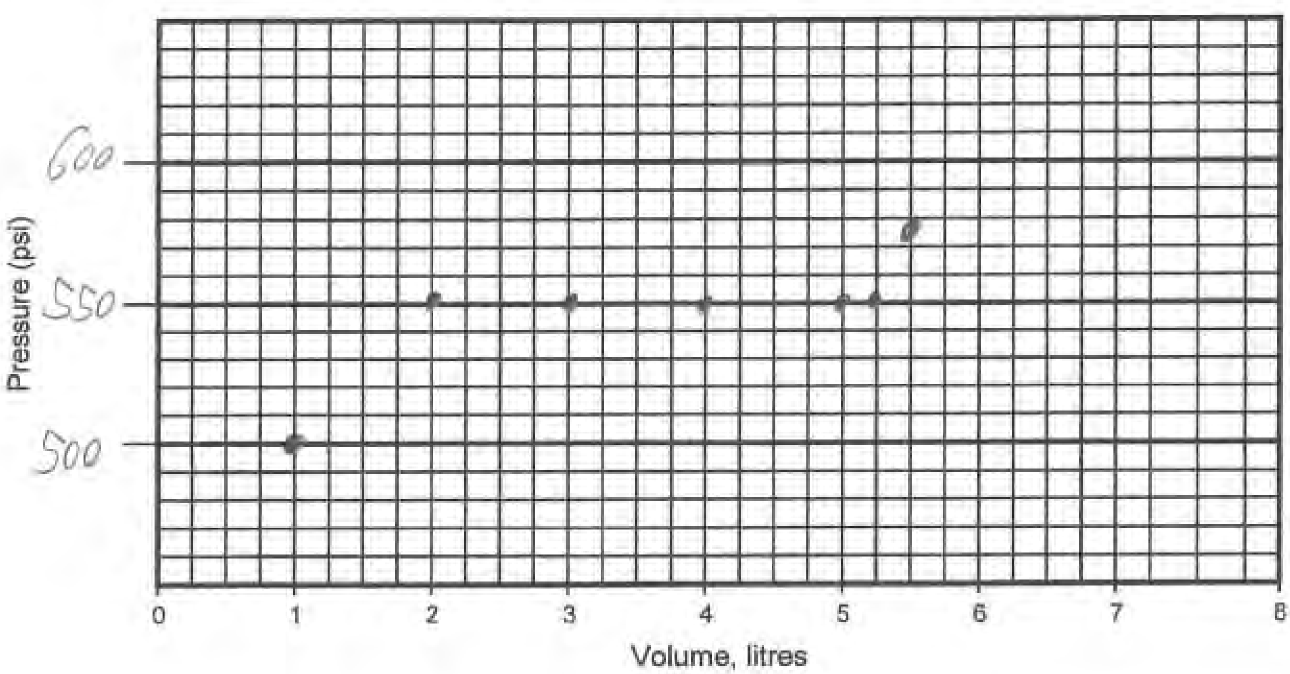
Packer No. 4 19210   Depth (ft / m): —   Inflation Tool No.: ____

Packer Valve Pressure, P_V: 145 psi   Final Line Pressure, P_L: 575 psi   Tool Pressure, P_T: 300 psi

Borehole Water Level: 24 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 145 psi

Volume, litres	1	2	3	4	5	5.25	5.5	/	5.1	
Pressure, psi	500	550	550	550	550	550	575	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Back to Back Packers   Time - 11:16

APPENDIX B: MONITORING WELL: BH4-WB

As-Built Key Components Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 1 page
Summary Completion Log	- 2 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (May 19)	- 1 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (May 19)	- 1 page
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 4 pages
Westbay System Packer Inflation Records	- 6 pages

Table 5: BH4-WB As-Built Summary

AB, 01/06/2015

Port No.	Zone	Measurement Port Depth, (m)	Pumping Port Depth, (m)	Depth to top of Packer, (m)	Top of Zone (m)	Bottom of Zone (m)	Comments
1		57.809		56.285	57.6	65.7	
2		54.762		53.238	54.5	56.7	
3		41.351		39.827	41.1	53.6	
4		38.303		36.779	38.1	40.2	
5		33.122		31.598	32.9	37.2	
6		28.55	27.026	27.026	28.3	32.0	
7							
8							
9							
10							
11							
12							
13							
14							
15							

Note 1: All depth measurements in meters below datum (GS).
Note 2: All depth measurements use 'Nominal' tubing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All depth measurements to upper edge of Westbay System coupling item.

Table 5: BH4-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
29	203							-1.062
28	20102			202				-1.0142
27	20110			202				-0.40459
26	20110			202		216	3.2	2.6433
25	20110			202				5.6911
24	20110			202				8.739
23	20110			202				11.787
22	20110			202				14.835
21	20110			202				17.883
20	20110			202				20.93
19	20110			202				23.978
18	238	Packer	19204	224	8715			27.026
17	20110	Measurement Port		205	8448			28.55
16	238	Packer	19219	202				31.598
15	20110	Measurement Port		205	8477			33.122
14	20102			202				36.17
13	238	Packer	19217	202				36.779
12	20105	Measurement Port		205	8472	216	38.9	38.303
11	238	Packer	19218	202				39.827
10	20110	Measurement Port		205	8475			41.351
9	20110			202				44.399
8	20105			202				47.447
7	20102			202				48.971
6	20102			202				49.58
5	20110			202				50.19
4	238	Packer	19203	202				53.238
3	20105	Measurement Port		205	8474	216	55.4	54.762
2	238	Packer	19220	202				56.285
1	20110	Measurement Port		205	8473			57.809
0	203							60.857

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

Qty	Component
(2)	0203 - MP38 End Cap
(5)	020102 - MP38 Casing 3 (2F/0.6M)
(15)	020110 - MP38 Casing 1 (10F/3M)
(6)	0238 - MP38 Packer - 74mm (5F/1.5M)
(3)	020105 - MP38 Casing 2 (5F/1.5M)
(22)	0202 - MP38 Regular Coupling
(1)	0224 - MP38 Pumping Port
(6)	0205 - MP38 Measurement Port
(3)	0216 - Magnetic Location Collar

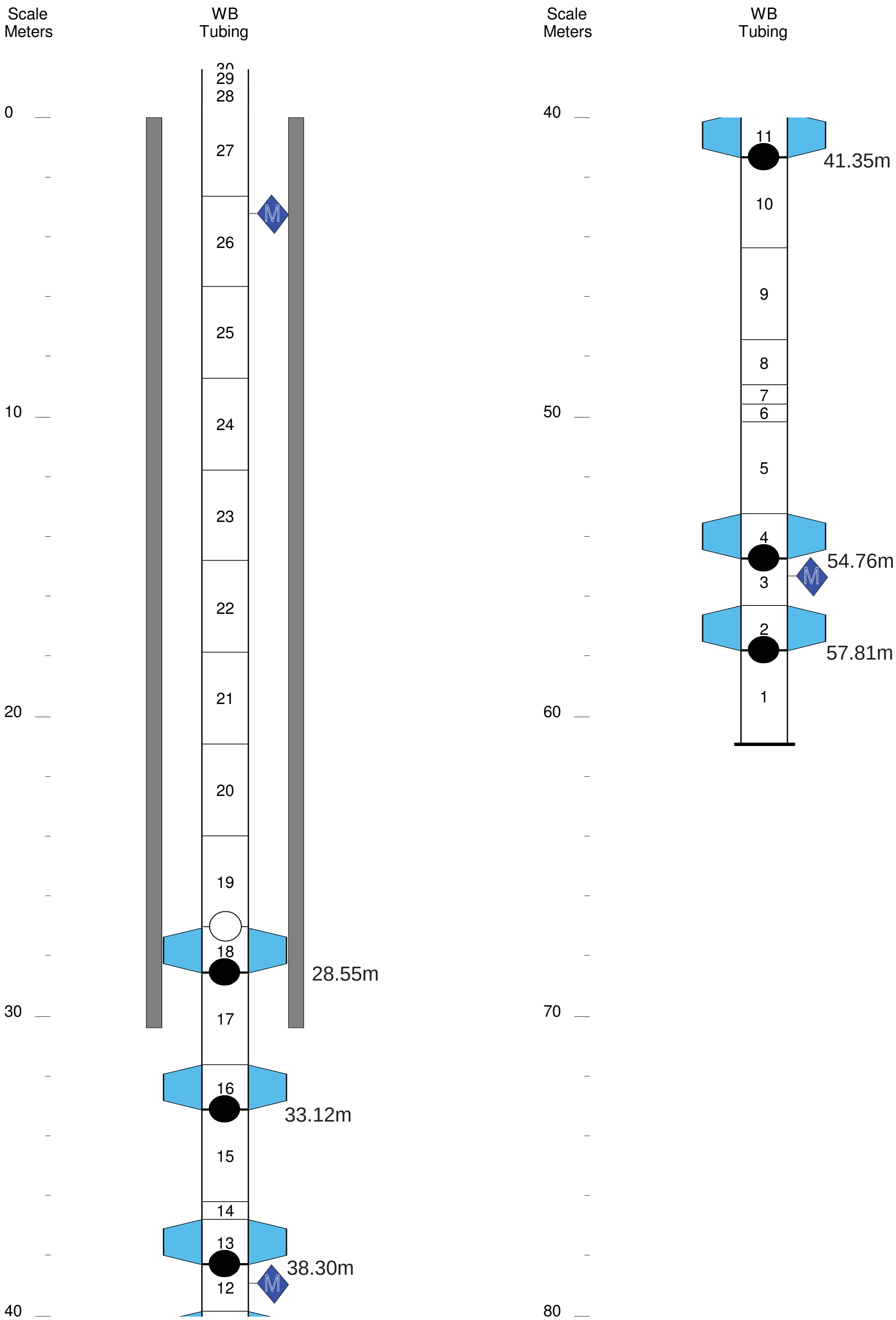
Geology

Backfill/Casing

Mild Steel

Summary Completion Log
LORAX

Job No: WB950
Well: BH4-WB



PRE-INFLATION OF 4 BOTTOM PACKERS

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH4-WB
Datum: G-S
Elev. G.S.: Ø
Height of Westbay above G.S.: 1.44m (recoupling)
Elev. top of Westbay Casing: Ø
Reference Elevation: Ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2499
Probe Range: 250psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May 19/15
Client: CORAX
Job No.: WB950
Location: Coffee
Weather: Overcast/Warm
Operator: Name REDAC

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 13.59 psi; Temp 10.35 °C; Time 8:51 am
Finish: 13.59 psi; 0.61 °C; 9:42 am

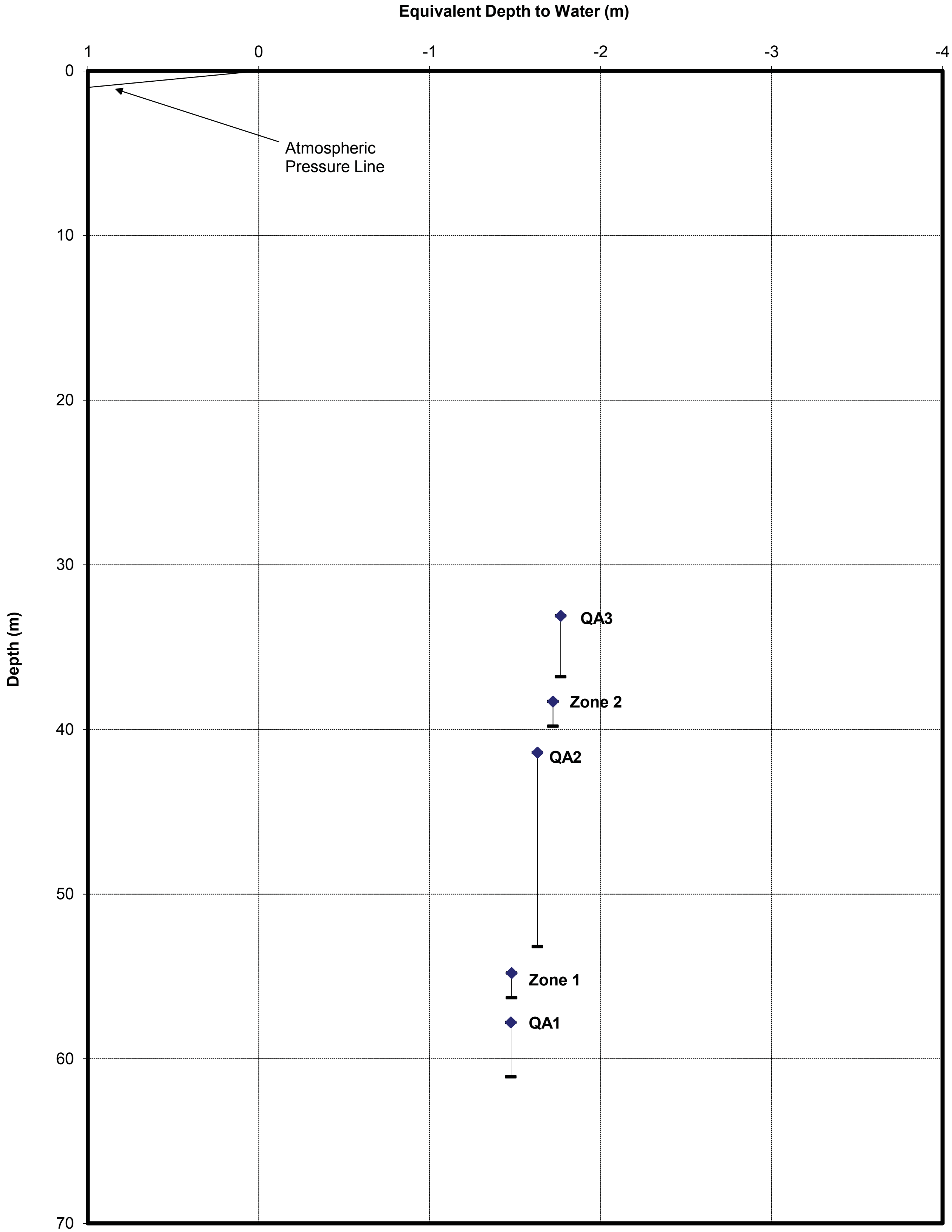
P_{atm} 13.59 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
											ZONES
1	57.8	58.0	-	98.57	97.88	9:31	1.02	98.57	59.3	-1.5	QA1
2	54.8	54.9	-	94.20	93.62	9:33	1.02	94.20	56.3	-1.5	Zone 1
3	41.4	41.5	-	74.84	74.78	9:35	0.86	74.84	43.0	-1.6	QA2
4	38.3	38.4	-	70.45	70.50	9:36	0.75	70.45	40.0	-1.7	Zone 2
5	33.1	33.2	-	62.93	63.17	9:38	0.63	62.94	34.9	-1.8	QA3
6	28.6	28.7	-	56.28	56.66	9:39	0.54	56.28	30.3	-1.7	QA4

Notes: w = 0.4355 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH4-WB

Profile Date: May 19, 2015
Comments: Pre-Inflation Profile



Client: LORAX
Site: Coffee Creek
Datum: GS

Figure 3

Plot By:____Date:____
Checked By:____Date:____
Westbay Project: WB950

Post INFLATION

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH4-WB
Datum: G-S
Elev. G.S.: Ø
Height of Westbay above G.S.:
Elev. top of Westbay Casing: Ø
Reference Elevation: Ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS 2499
Probe Range: 250psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May 19/15
Client: LoRAx
Job No.: WB 950
Location: Coffee
Weather: Hot, Clear.
Operator: [redacted]

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz)

P_{atm} 13.59 psi

Ambient Reading (P_{atm}) (pressure, temperature, time)

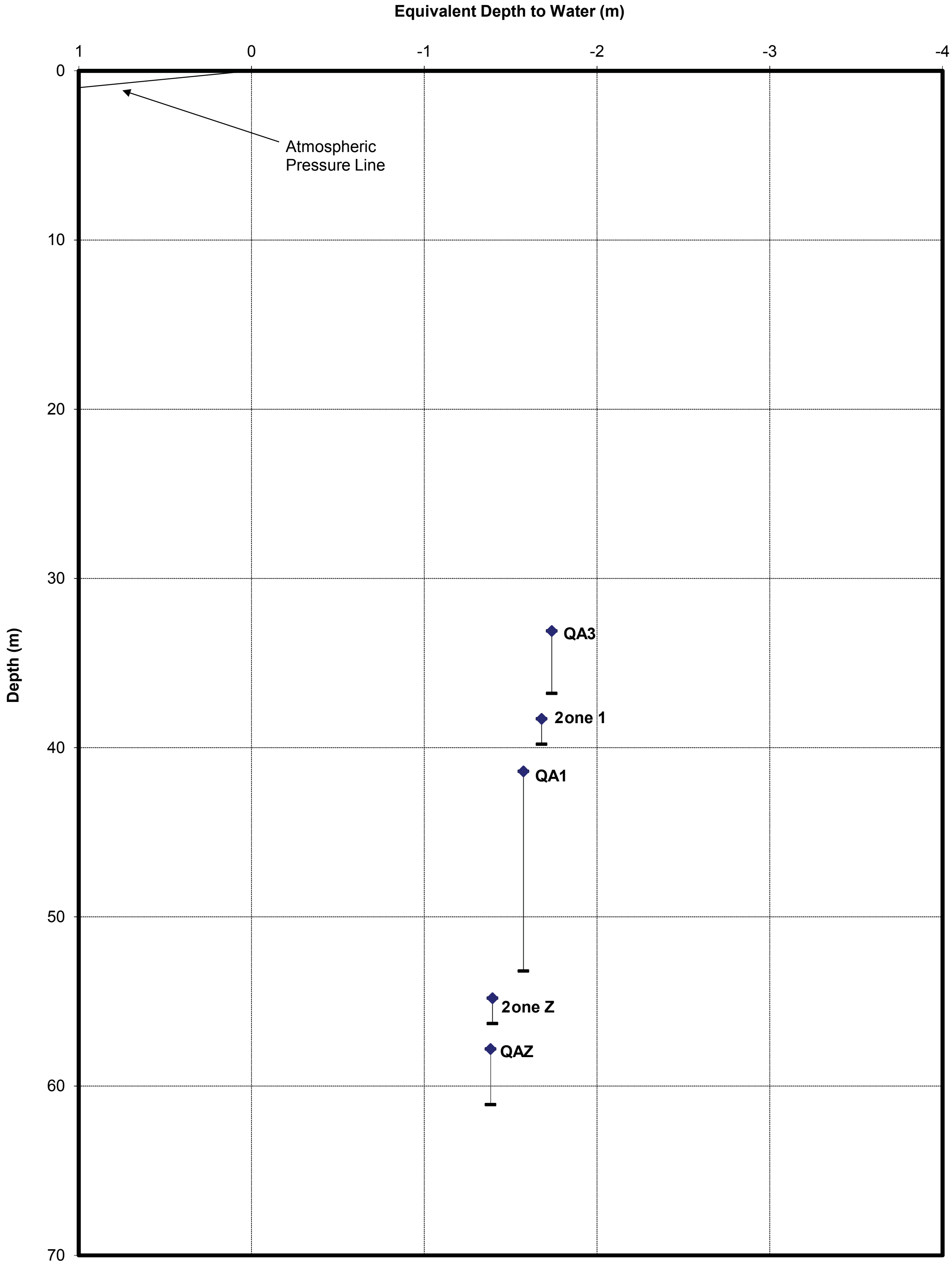
	Start	Finish
Pressure	13.59 psi	13.59 psi
Temp	22.92 °C	2.48 °C
Time	12:37pm	12:54 pm

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp (°C)	Inside Casing (P3)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
											Zones
1	57.8	58.0	-	90.22	97.75	12:42	11.55	90.23	59.2	-1.4	QA1
2	54.8	55.0	-	85.84	93.50	12:44	7.53	85.85	56.2	-1.4	Zone 1
3	41.4	41.5	-	66.54	79.70	12:46	4.74	66.56	43.0	-1.6	QA2
4	38.3	38.4	-	62.16	70.44	12:48	3.47	62.18	40.0	-1.7	Zone 2
5	33.1	33.2	-	54.67	63.19	12:50	2.93	54.68	34.8	-1.7	QA3
6	28.6	28.7	-	48.04	56.63	12:51	2.41	48.05	30.3	-1.7	QA4

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH4-WB

Profile Date: May 19, 2015
Comments: Post-Inflation Profile



Client: LORAX
Site: Coffee
Datum: GS

Figure 4

Plot By:____Date:______
Checked By:____Date:_____
Westbay Project: WB950

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

(2) 0203 - MP38 End Cap

(5) 020102 - MP38 Casing 3 (2F/0.6M)

(15) 020110 - MP38 Casing 1 (10F/3M)

(6) 0238 - MP38 Packer - 74mm (5F/1.5M)

(3) 020105 - MP38 Casing 2 (5F/1.5M)

(22) 0202 - MP38 Regular Coupling

(1) 0224 - MP38 Pumping Port

(6) 0205 - MP38 Measurement Port

(3) 0216 - Magnetic Location Collar

Geology

Backfill/Casing

Mild Steel

Westbay Completion Log

Company: LORAX
Well: BH4-WB
Site: Coffee
Project: Coffee

Job No: WB950
Author: ML

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 60.91 m.

Borehole Depth: 61.10 m.
Borehole Inclination: Vertical
Borehole Diameter: 114.00 mm

Well Description:
Permafrost
Other References:

File Information

File Name: BH4_WB.WWD
Report Date: Sun May 17 17:18:06 2015

File Date: May 17 11:45:14 2015

Comments

Zero reference is ground surface - LF
Filter socks not to be used - LF

Log Information

Borehole condition confirmed.	(method)	Date:
MP well design & preparation.	By: Name REDACTED	Date: 5/17/15
MP well design checked.	By:	Date: 5/17/15
MP well and borehole approved to install.	By:	Date: 5/17/15

Westbay Completion Log
LORAX

Job No: WB950
Well: BH4-WB

Finish lowering at 9:57pm May 17/15

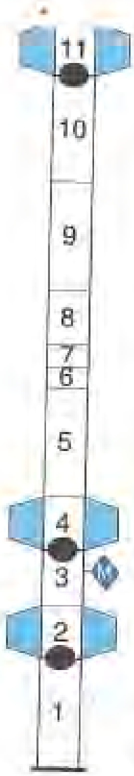
Finish re-lowering at 3:20am on May 17/15

WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
29	1.61m		
28	1.01m		
	0.41m		
27	✓	020110 - MP38 Casing 1 (10F/3M)	
26	✓	020110 - MP38 Casing 1 (10F/3M)	
25	✓	020110 - MP38 Casing 1 (10F/3M)	
24	✓	020110 - MP38 Casing 1 (10F/3M)	
23	✓	020110 - MP38 Casing 1 (10F/3M)	
22	✓	020110 - MP38 Casing 1 (10F/3M)	
21	✓	020110 - MP38 Casing 1 (10F/3M)	
20	✓	020110 - MP38 Casing 1 (10F/3M)	
19	✓	020110 - MP38 Casing 1 (10F/3M)	8715
18	✓	0224 - MP38 Pumping Port	19204-155psi
	✓	0238 - MP38 Packer - 74mm (5F/1.5M)	8448
	✓	0205 - MP38 Measurement Port	
17	✓	020110 - MP38 Casing 1 (10F/3M)	
16	✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19219-150psi
	✓	0205 - MP38 Measurement Port	8477
15	✓	020110 - MP38 Casing 1 (10F/3M)	
14	✓	020102 - MP38 Casing 3 (2F/0.6M)	
13	✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19717-145psi
	✓	0205 - MP38 Measurement Port	8472
12	✓	020105 - MP38 Casing 2 (5F/1.5M)	

Westbay Completion Log
LORAX

Job No: WB950
Well: BH4-WB

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
40	11	✓ ✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19218 - 145 psi:
		✓✓✓ ✓✓✓	0205 - MP38 Measurement Port	8475
	10	✓ ✓	020110 - MP38 Casing 1 (10F/3M)	
		✓✓✓ ✓✓✓		9:00 pm
	9	✓ ✓	020110 - MP38 Casing 1 (10F/3M)	
		✓✓✓ ✓✓✓		
	8	✓ ✓	020105 - MP38 Casing 2 (5F/1.5M)	
50	7	✓✓✓ ✓✓✓	020102 - MP38 Casing 3 (2F/0.6M)	
	6	✓✓✓ ✓✓✓	020102 - MP38 Casing 3 (2F/0.6M)	
	5	✓ ✓	020110 - MP38 Casing 1 (10F/3M)	
	4	✓✓✓ ✓✓✓ ✓ ✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19203 - 150 psi.
		✓✓✓ ✓✓✓	0205 - MP38 Measurement Port	8474
	3	✓ ✓	020105 - MP38 Casing 2 (5F/1.5M)	
	2	✓✓✓ ✓✓✓ ✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19220 - 140 psi:
		✓✓✓ ✓✓✓	0205 - MP38 Measurement Port	8473
60	1	✓ ✓	020110 - MP38 Casing 1 (10F/3M)	
		✓✓✓ ✓✓✓	0203 - MP38 End Cap	



Joint test tool 200 psi.

Start lowering at 08:25pm May 17/15

Borehole is artesian

Start re-lowering casing at 2:10am May 17/15

70

80

Sheet___ of ___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH9-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED)ate Inflated: May 19/15

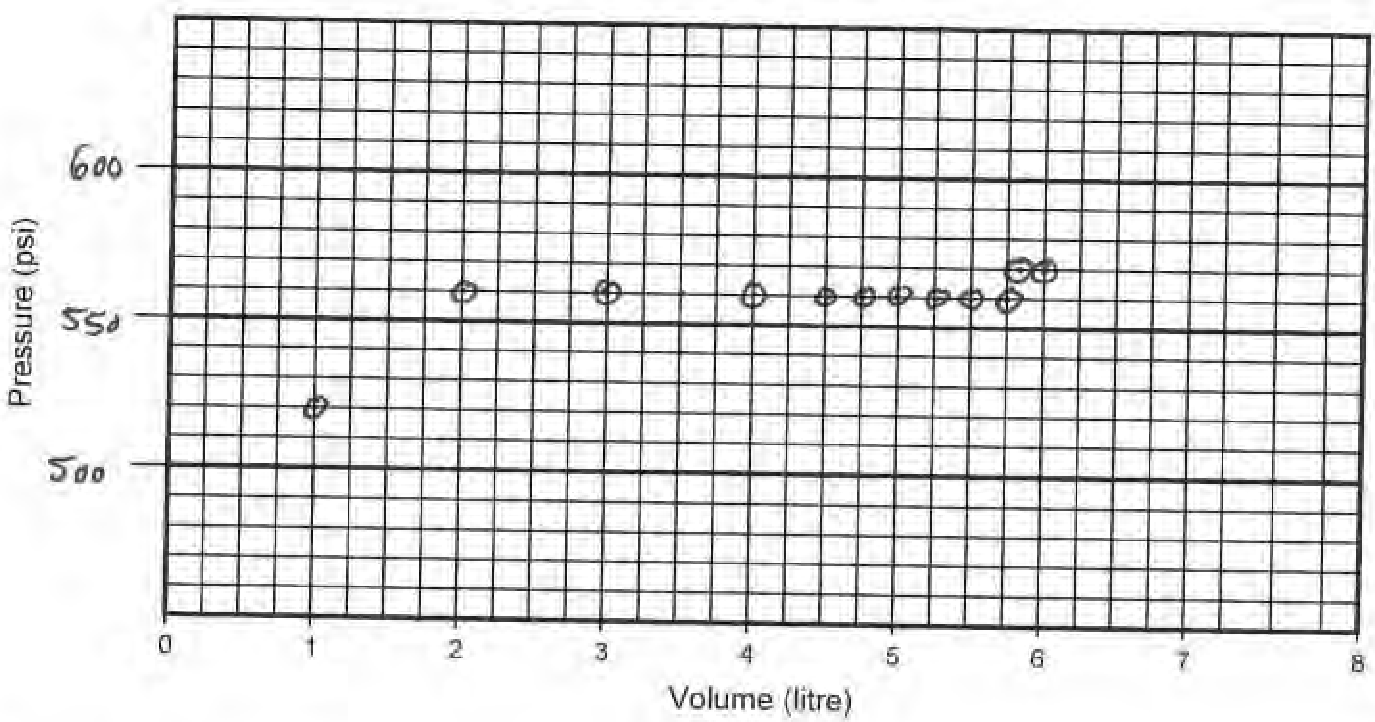
Packer No. 1, comp 2 SN# 19220 Depth (m): ______ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 570 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 80 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.5	5.75
Pressure, psi	520	560	560	560	560	560	560	560	560	560
Volume, litres	5.85	6.0	/	5.6						
Pressure, psi	570	570	/	0						



Comments: ______ Time - 10:54 am

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH4-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 19/15

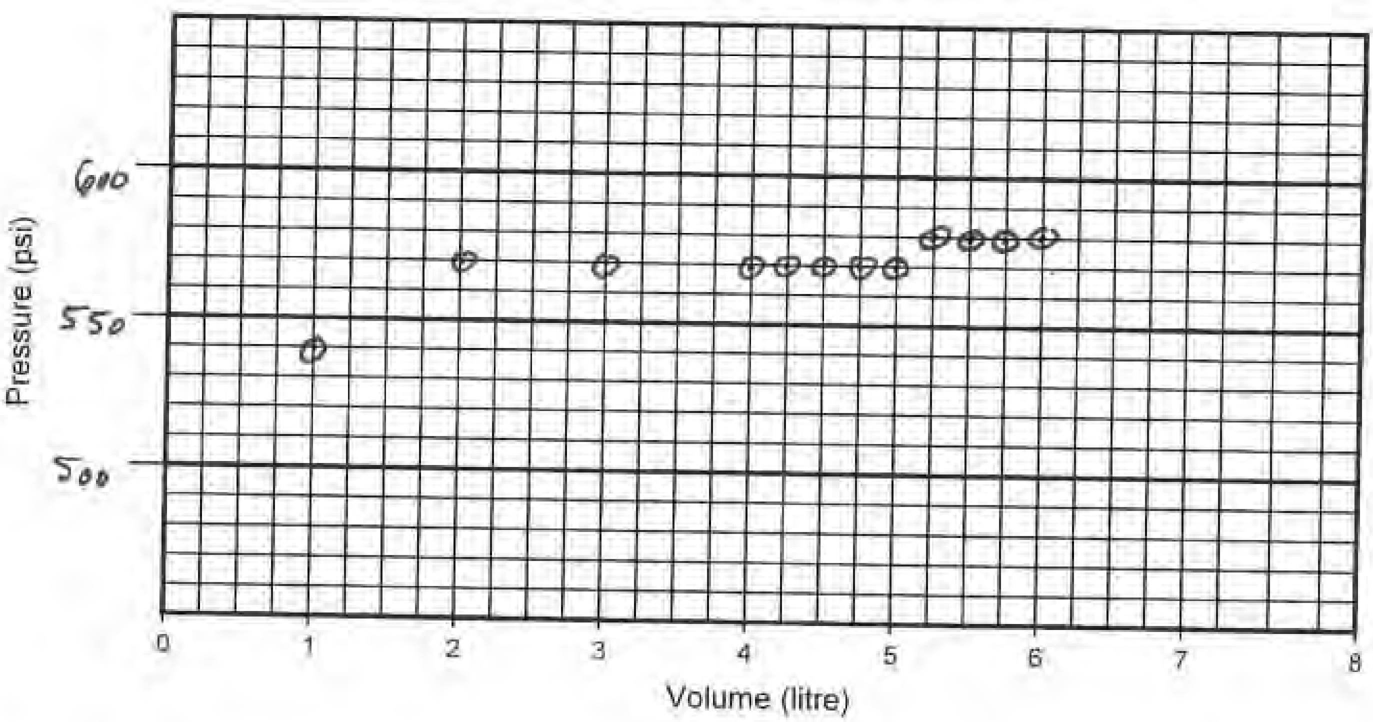
Packer No. 2, comp 4 SN# 19203 Depth (m): ______ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 580 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 80 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.5	5.75
Pressure, psi	540	570	570	570	570	570	570	580	580	580
Volume, litres	6.0	/	5.6							
Pressure, psi	580	/	0							



Comments: ______ Time - 11:18 am

Westbay Instruments

Sheet____of____

Westbay Packer Inflation Record

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH4-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 19/15

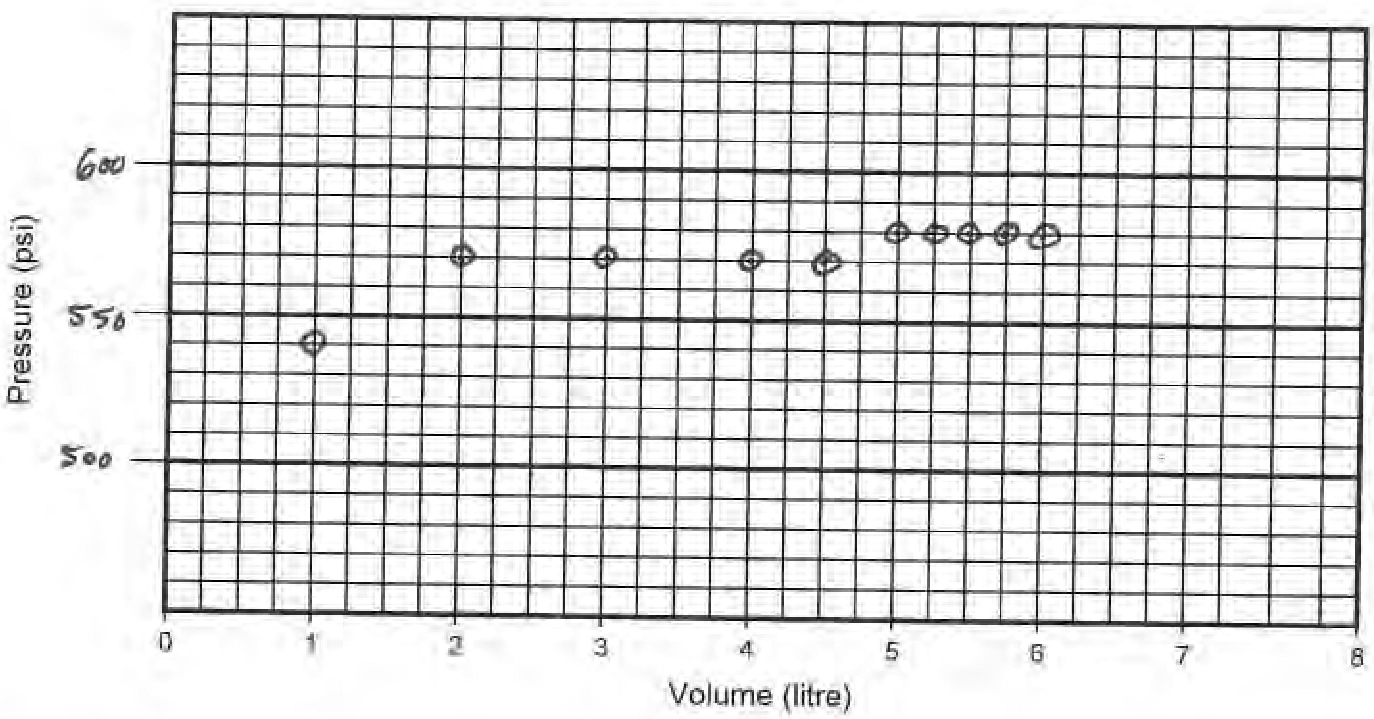
Packer No. 3, comp 11 SN# 19218 Depth (m): ______ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 580 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 85 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.5	5.75
Pressure, psi	540	570	570	570	570	580	580	580	580	580
Volume, litres	6.0	/	5.6							
Pressure, psi	580	/	∅							



Comments: ______________________ Time - 11:43 am

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH4-WB

Location: Coffee Creek, Kaminak Gold Project Completed by Name REDACTED)ate Inflated: May/19/15

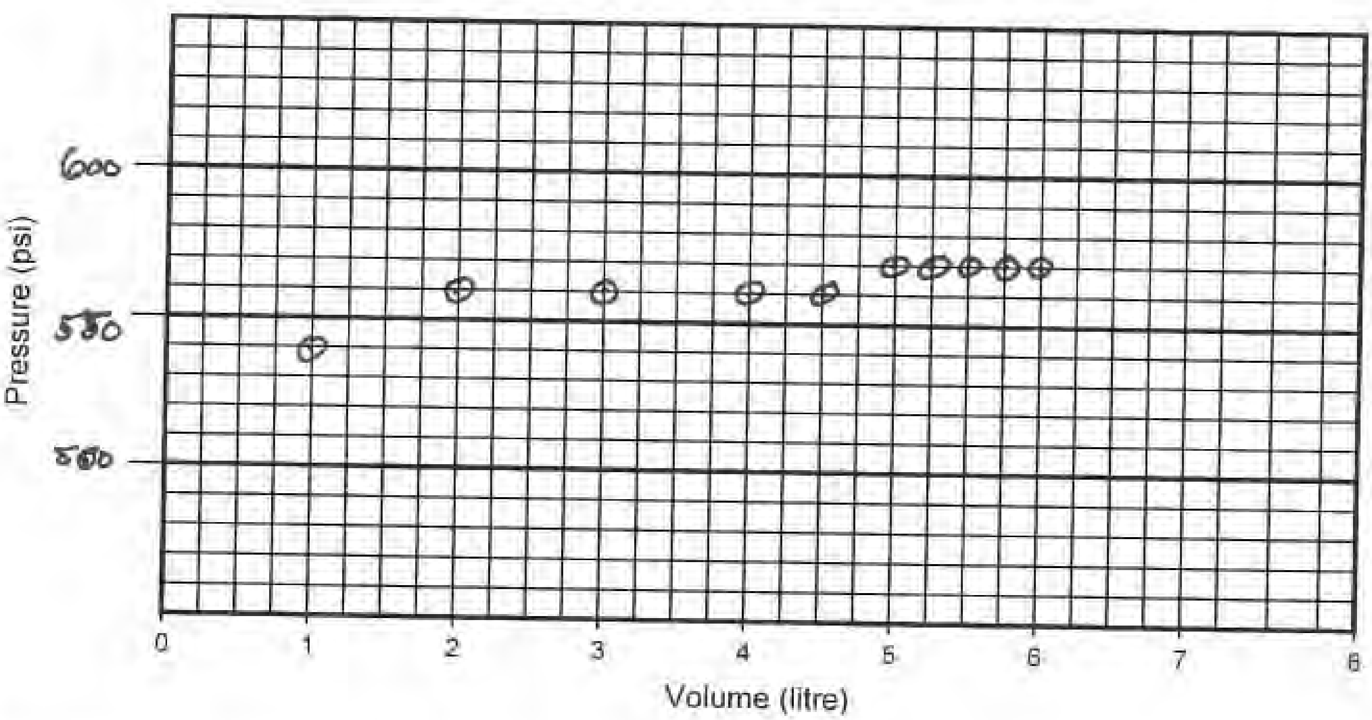
Packer No. 4, comp 13 SN# 19217 Depth (m): ________ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 570 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 75 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	5.0	5.25	5.5	5.75	6.0
Pressure, psi	540	560	560	560	560	570	570	570	570	570
Volume, litres	/	5.6								
Pressure, psi	/	ø								



Comments: ______________________ Time - 12:06 pm

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: May 18/15

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 18/15

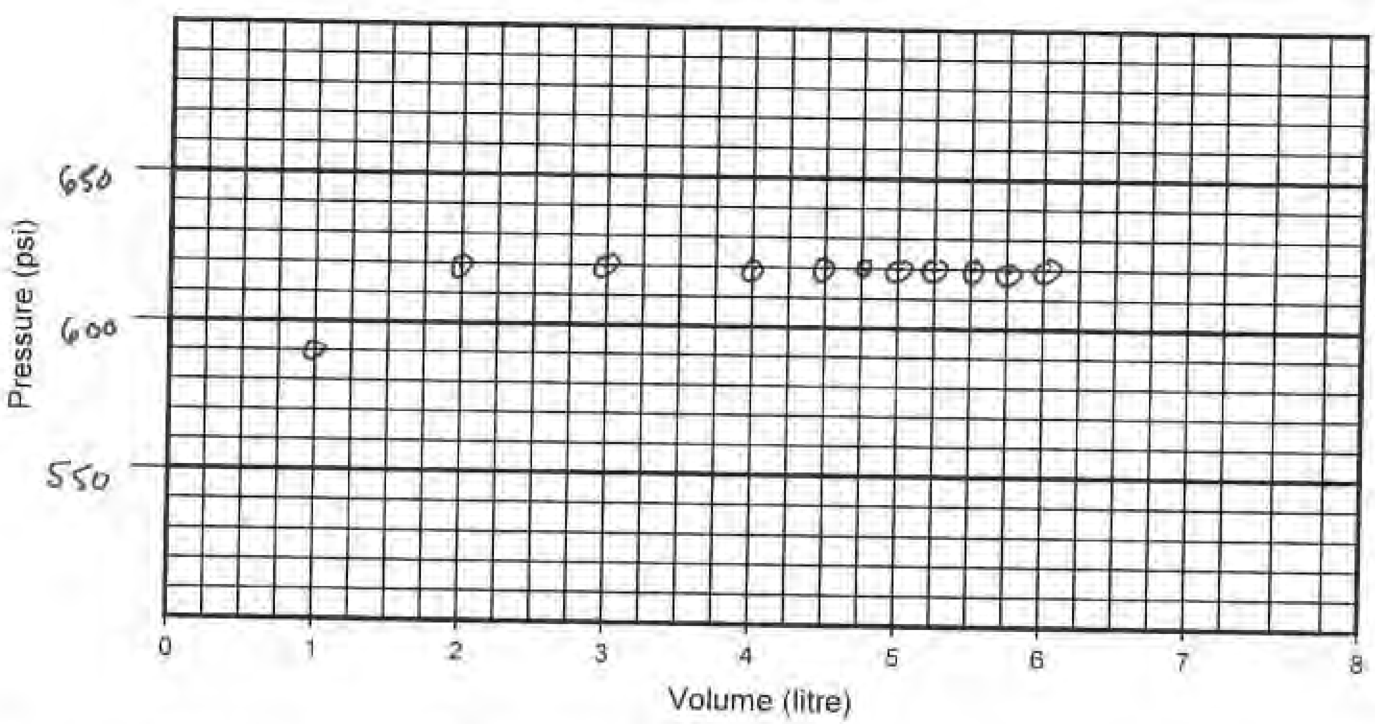
Packer No. 5, comp 16 SN# 19219 Depth (m): _____ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 620 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 70 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.5	5.75
Pressure, psi	590	620	620	620	620	620	620	620	620	620
Volume, litres	6.0	/	5.6							
Pressure, psi	620	/	Ø							



Comments: 3.5L flow stopped Time - 6:04 am

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH4-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 18/15

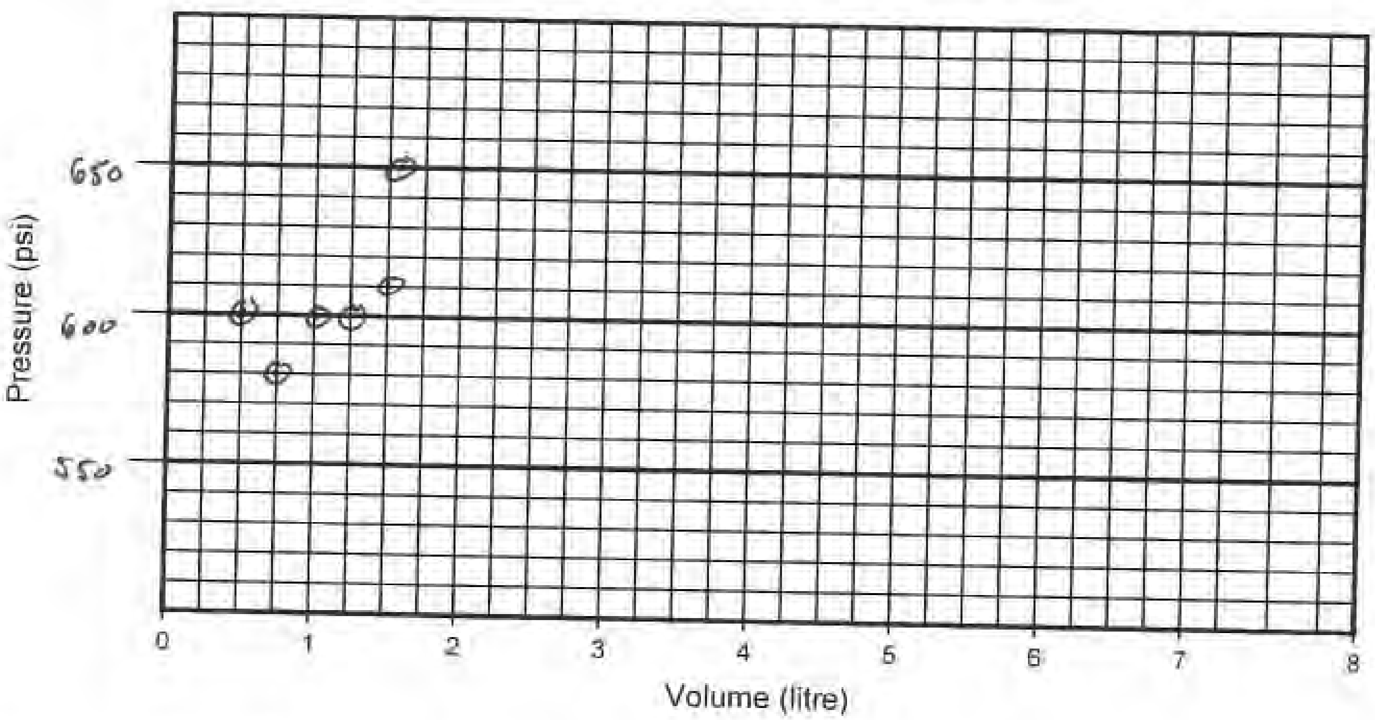
Packer No. 6, comp 18 SN# 19204 Depth (m): ____ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 95 psi

Volume, litres	0.25	0.5	0.75	1.0	1.25	1.5	1.6	/	1.25	
Pressure, psi	350	600	580	600	600	610	650	/	Ø	
Volume, litres										
Pressure, psi										



Comments: In HQ Time - 6:17pm

APPENDIX C: MONITORING WELL: BH5-WB

As-Built Key Components Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 3 pages
Summary Completion Log	- 2 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (June 8)	- 1 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (June 9)	- 2 pages
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 5 pages
Westbay System Packer Inflation Records	- 12 pages

Table 4: BH5-WB As-Built Packer and Port Summary

AB, 01/06/2015

Port No.	Zone	Measurement Port Depth, (m)	Pumping Port Depth, (m)	Depth to top of Packer, (m)	Top of Zone (m)	Bottom of Zone (m)	Comments
1		286.99		285.46	286.8	293.0	
2		285.46		279.37	280.7	285.9	
3		251.94		250.41	251.7	279.8	
4		250.41		245.84	247.1	250.8	
5		244.32		242.79	244.1	246.2	
6		241.27		236.7	238.0	243.2	
7		227.55		226.03	227.3	237.1	
8		224.51		219.94	221.2	226.4	
9		216.89		209.27	210.6	220.3	
10		209.27		184.88	186.2	209.7	
11		183.36		181.84	183.1	185.3	
12		96.497	94.973	94.973	96.3	182.2	
13							
14							
15							

Note 1: All depth measurements in meters below datum (GS).
Note 2: All depth measurements use 'Nominal' tubing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All depth measurements to upper edge of Westbay System coupling item.

Table 5: BH5-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
112	203							-0.77705
111	20102			202				-0.7292
110	20105			202				-0.11963
109	20105			202				1.4043
108	20105			202				2.9282
107	20105			202				4.4521
106	20105			202				5.9761
105	20102			202				7.5
104	20105			202				8.1096
103	20110			202				9.6335
102	20110			202				12.681
101	20110			202				15.729
100	20110			202				18.777
99	20110			202				21.825
98	20110			202				24.873
97	20110			202				27.921
96	20110			202				30.968
95	20110			202				34.016
94	20110			202				37.064
93	20110			202				40.112
92	20110			202				43.16
91	20110			202				46.208
90	20110			202				49.256
89	20110			202				52.303
88	20110			202				55.351
87	20110			202				58.399
86	20110			202				61.447
85	20110			202				64.495
84	20110			202				67.543
83	20110			202				70.591
82	20110			202				73.638
81	20110			202				76.686
80	20110			202				79.734
79	20110			202				82.782
78	20110			202				85.83
77	20110			202				88.878
76	20110			202				91.925
75	238	Packer	19228	202				94.973
74	20110	Measurement Port		205	8482			96.497
73	20110			202				99.545
72	20110			202				102.59
71	20110			202				105.64
70	20110			202				108.69
69	20110			202				111.74

Table 5: BH5-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
68	20110			202				114.78
67	20110			202				117.83
66	20110			202				120.88
65	20110			202				123.93
64	20110			202				126.98
63	20110			202				130.02
62	20110			202				133.07
61	20110			202				136.12
60	20110			202				139.17
59	20110			202				142.22
58	20110			202				145.26
57	20110			202				148.31
56	20110			202				151.36
55	20110			202				154.41
54	20110			202				157.45
53	20110			202				160.5
52	20110			202				163.55
51	20110			202				166.6
50	20110			202				169.65
49	20110			202				172.69
48	20110			202				175.74
47	20110			202				178.79
46	238	Packer/Pumping Port	19230	224	8713			181.84
45	20105	Measurement Port		205	8467			183.36
44	238	Packer	19221	202				184.88
43	20110			202				186.41
42	20110			202				189.46
41	20110			202				192.5
40	20110			202				195.55
39	20110			202				198.6
38	20110			202				201.65
37	20110			202				204.7
36	20105			202				207.74
35	238	Packer/Measurement Port	19227	205	8469			209.27
34	20110			202				210.79
33	20110			202				213.84
32	20110	Measurement Port		205	8481			216.89
31	238	Packer	19222	202				219.94
30	20110			202				221.46
29	20105	Measurement Port		205	8465	216	225.1	224.51
28	238	Packer	19223	202				226.03
27	20110	Measurement Port		205	8480			227.55
26	20110			202				230.6
25	20110			202				233.65
24	238	Packer	19229	202				236.7

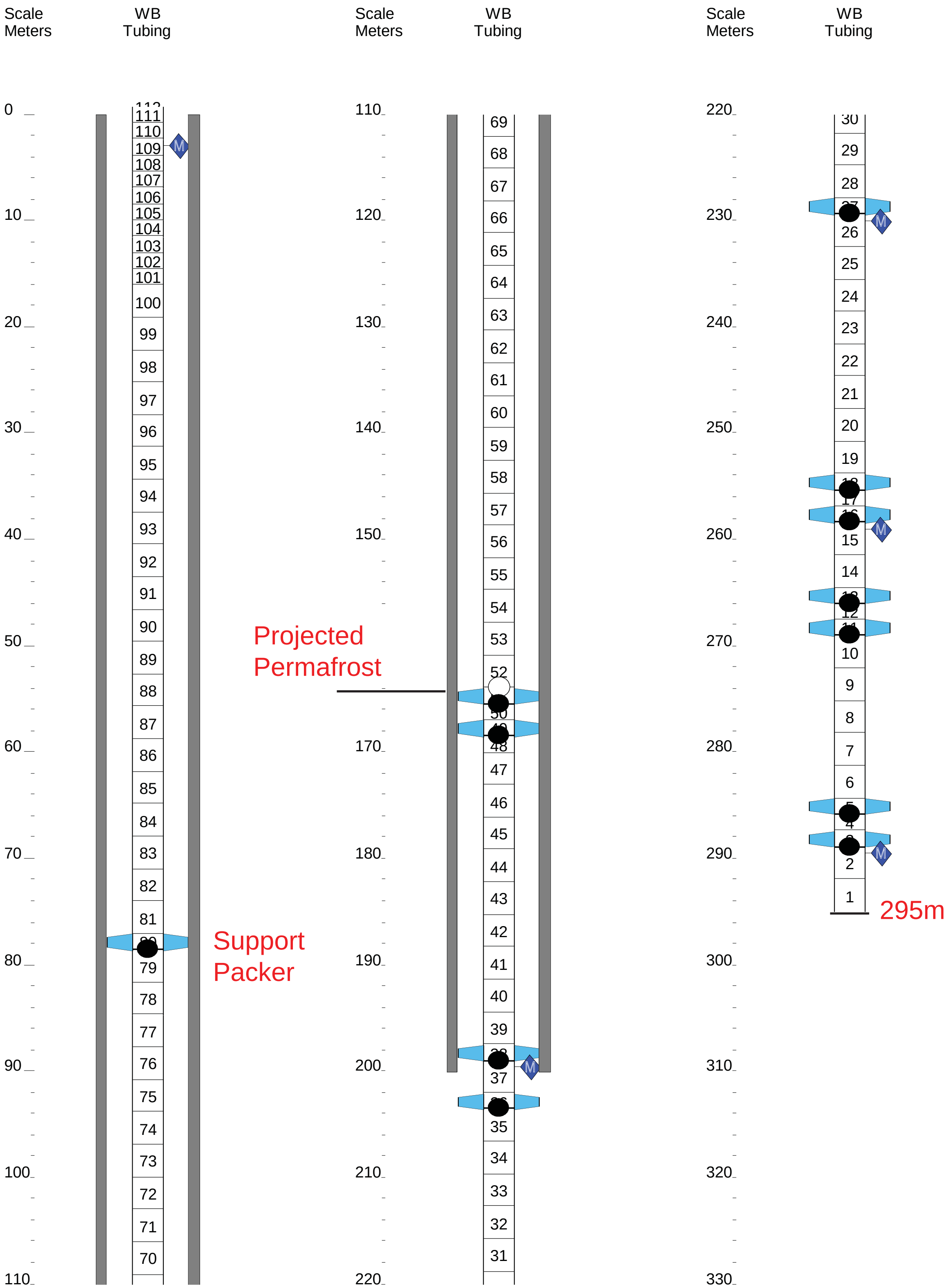
Table 5: BH5-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
23	20110			202				238.22
22	20105	Measurement Port		205	8479	216	241.9	241.27
21	238	Packer	19241	202				242.79
20	20105	Measurement Port		205	8468			244.32
19	238	Packer	19242	202				245.84
18	20110			202		216	248.0	247.37
17	238	Packer/Measurement Port	19226	205	8464			250.41
16	20110	Measurement Port		205	8470			251.94
15	20110			202				254.99
14	20110			202				258.03
13	20110			202				261.08
12	20110			202				264.13
11	20110			202				267.18
10	20110			202				270.22
9	20110			202				273.27
8	20110			202				276.32
7	238	Packer	19239	202				279.37
6	20110			202				280.89
5	20105			202				283.94
4	238	Packer/Measurement Port	19240	205	8466			285.46
3	20105	Measurement Port		205	8471	216	287.6	286.99
2	20105			202				288.51
1	20110			202				290.04
0	203							293.08

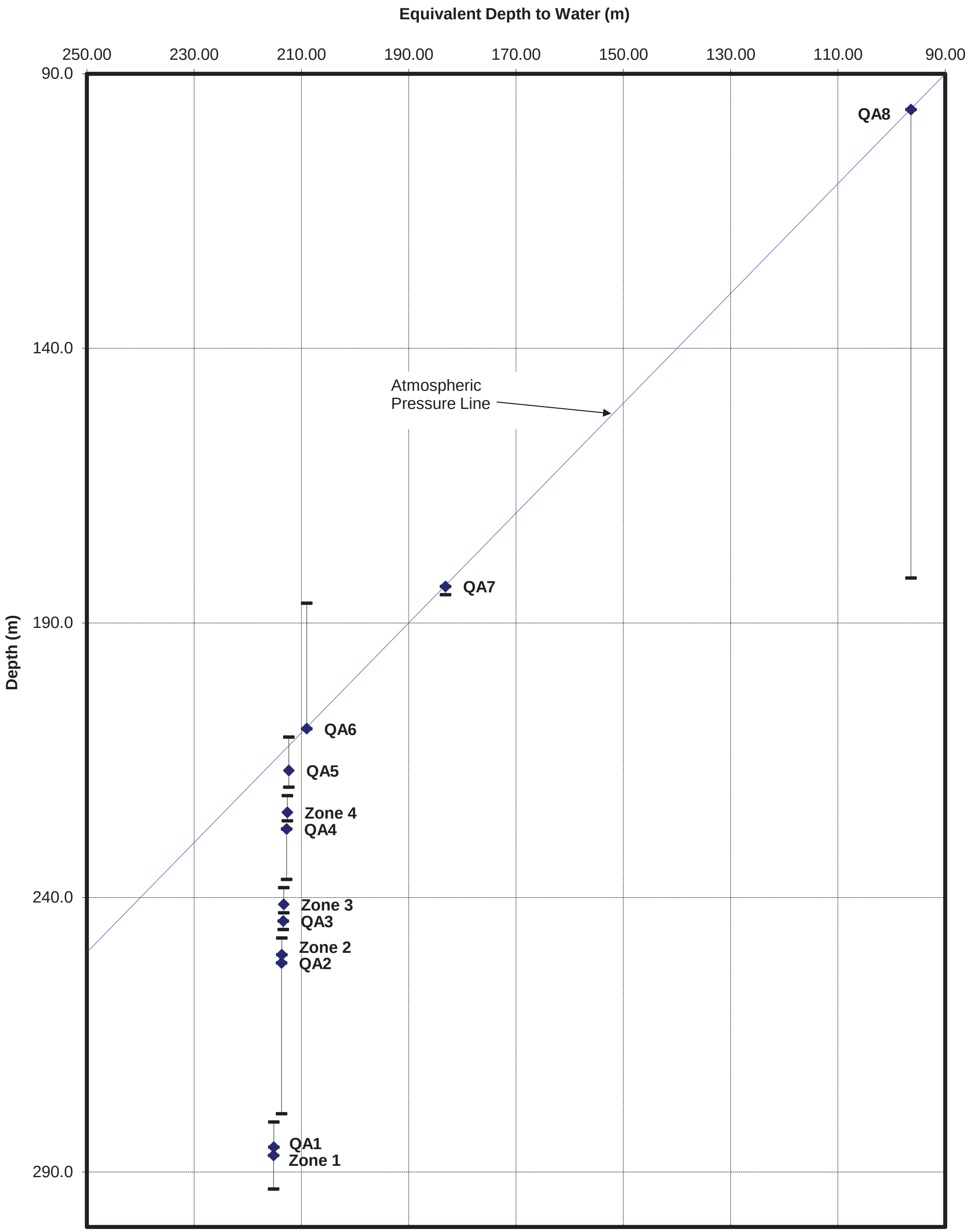
Summary Completion Log

Job No: WB950
Well: BH5



Piezometric Profile
Monitoring Well: BH5-WB

Profile Date: June 8/2015
Comments: Pre-Inflation Profile



Client: Lorax
Site: Coffee Creek
Datum: Ground Surface

Figure 3

Plot By:____Date:____
Checked By:____Date:____
Westbay Project: WB950

Westbay Instruments

Westbay Piezometric Pressures/Levels

PRE-INFLATION

Field Data and Calculation Sheet

Well No.: BHS-WB
Datum: —
Elev. G.S.: —
Height of Westbay above G.S.: —
Elev. top of Westbay Casing: —
Reference Elevation: GS
Borehole angle: 90

Probe Type: EMS
Serial No.: 2499
Probe Range: 250
Westbay Casing Type: 38
Sampler Valve Position: C

Date: June 8th /2015
Client: LORAX
Job No.: 950
Location: Coffee Creek
Weather:
Operator: DL

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure ______ Finish: ______
Temp ______ ______
Time ______ ______

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 12.71 psi

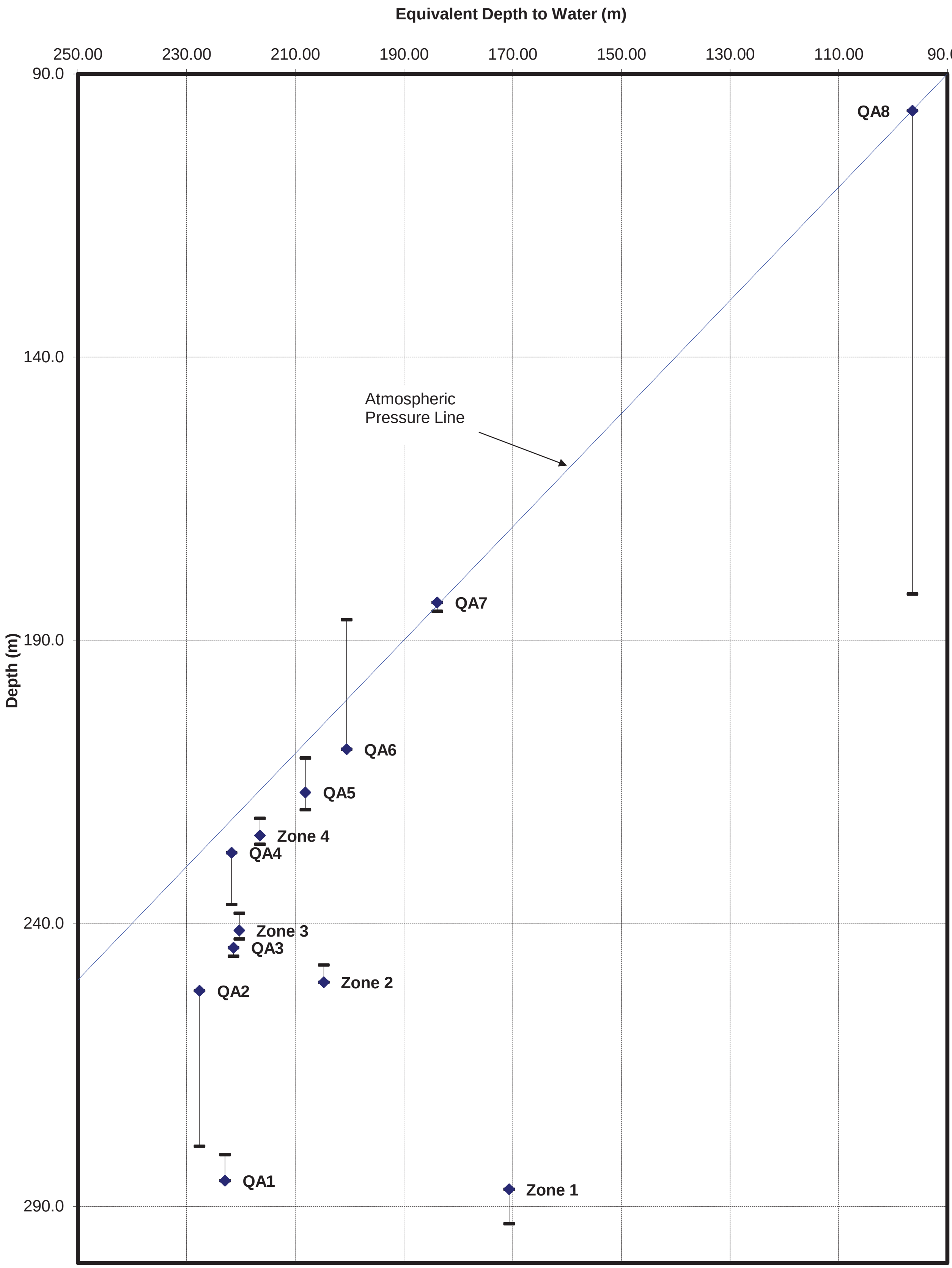
DATA TRANSPOSED FROM FIELD NOTES BOOK #3 JUNE 8

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
1	286.88	—	—	99.59	114.78	0938	—	99.60	72.1	215.2	
2	285.46	—	—	97.47	112.71	940	—	97.47	71.42	215.1	
3	251.93	—	—	50.33	67.05	944	—	50.33	38.8	213.9	
4	250.41	—	—	48.21	64.97	946	—	48.21	37.3	213.7	
5	244.31	—	—	39.68	56.66	950	—	39.69	31.4	213.4	
6	241.27	—	—	35.41	52.47	952	—	35.41	28.4	213.3	
7	227.55	—	—	16.20	33.75	955	—	16.20	15.0	212.8	
8	224.50	—	—	13.07	29.58	957	—	13.08	12.0	212.6	
9	216.88	—	—	13.06	19.15	959	—	13.06	4.6	212.4	
10	209.26	—	—	13.05	13.05	1001	—	12.99	Air	Air	
11	183.36	—	—	13.00	13.01	1004	—	12.87	Air	Air	
12	96.50	—	—	12.88	12.87	1009	—	12.88	Air	Air	

Notes: w = 1.422psi / m of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH5-WB

Profile Date: June 09 /2015
Comments: Post-Inflation Profile



Client: Lorax
Site: Coffee Creek
Datum: Ground Surface

Figure 4

Plot By:____Date:______
Checked By:____Date:_____
Westbay Project:WB950

Westbay Instruments

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: BH5
Datum: GL TOP OF HQ
Elev. G.S.:
Height of Westbay above G.S.: -0,99 m
Elev. top of Westbay Casing:
Reference Elevation: -0,56 m
Borehole angle: VERTICAL

Probe Type: EMS
Serial No.: 2499
Probe Range: 0-250
Westbay Casing Type: MP38
Sampler Valve Position: C

Date: 9
Client:
Job No.: 95
Location: K AK
Weather:
Operator: V

HQ -0,33 m HW

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

DTW ≈ 222 m

P_{atm} 12,69 psi

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 9; Temp 1,6; Time 1
Finish: 1 9; 0.8; 16 5

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)			
1	287.0	286.8		103.10	178.32	1532	5,4				
					178.33	1533	4.8	103,13	116.48	170.5	
1	287.0	286.8		103.15	178.11	1538	3.0				Beep 287,4 counter
					178.10	1539	2.8	103.16		170.7	
2	285.5	285.3		101,02	101.62	1541	2.6				Possible Squeeze 10?
					101.60	1542	2.4	101,02	62.52	223.0	
3	251.9	251.7		53.90	47.27	1548	1,9				
					47.27	1549	1,6	53.90	24.32	227.6	
4	250.4	250.4		52.45		1551	1,5				TIGHT.
					77.61	55	1.4				
					77.60	1553	1,4	52.46	45.65	204.7	
5	244.3	244.1		4	45.36	1558	—				Beep 248.6
					45.33	1600	1.2	43.23	22.95	221.3	
6	241.3	241.1		38.98	42.50	1602	1,2				Beep 241.6
					42.49	1603	1.2	38.98	21.0	220.3	

Notes: w = 1.422psi / m of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

PAGE 2

Westbay Instruments

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

POST INFLATION

Well No.: BHS
Datum:
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle:

Probe Type: EMS
Serial No.: 2221
Probe Range:
Westbay Casing Type:
Sampler Valve Position:

Date: 09 June 2015
Client:
Job No.:
Location:
Weather:
Operator:

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure ______ Finish: ______
Temp ______ ______
Time ______ ______

P_{atm} ______ psi

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
7	227.6	227.3		19.78	20.95	1607	1.2				
					20.94	1608	1.1	19.78	5.80	221.8	
8	224.5	224.3		15.49	24.09	1611	1.0				Beep 225.0
					24.09	1612	1.0	15.49	8.02	216.5	
9	216.9	216.7		13.04	25.14	1616	1.0				
					25.14	1617	1.0	13.03	8.76	208.1	
10	209.3	209.1		13.01	25.06	1621	1.0				
					25.05	1622	1.0	13.01	8.69	200.6	
11	183.4	183.2		12.97	11.97	1625	1.0				
					11.98	1626	1.0	12.97			IN AIR
12	96.5	96.4		12.84	12.79	1630	0.9				
					12.79	1631	0.8	12.82			IN AIR
PA =	12.69 psi										
	T = 0.8										
	@ 1635										

Notes: w = 1.422psi / m of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Westbay System Completion Log

Company: Lorax

Well: BH5-WB

Site: Coffee Creek

Project: 950

WB #: 950

Author: AB

Well Information

Reference Datum: ______ ~~ft.~~ m

Elevation of Datum: – ~~ft.~~

WB Tubing Top: ______ ~~ft.~~ m

WB Tubing Length: ______ ~~ft.~~ m

Borehole Depth: 293 ~~ft.~~ m

Borehole Inclination:

Borehole Diameter: 4.5 in.

Well Description:

Other References:

File Information

File Name: ______________________

File Date: ______________________

Report Date: ______________________

Comments

Installation sign-off Information

Borehole condition confirmed.(Client)	(method) Sound	Date: 05/06/15
WB System design & preparation.(Client / WB)	By: AB LF	Date: 05 06 15
WB System design checked. (Client / WB)	By: AB LF	Date: [illegible]/06/15
WB System and borehole approved to install. (Client)	By: [illegible signature]	Date: 05/06/15

Westbay Completion Log
Lorax

Job No: WB950
Well: BH5-WB

Scale: Meters 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
111			
110		W020105 - MP38 Tubing 2 (5F/1.5M)	
109		W020105 - MP38 Tubing 2 (5F/1.5M)	
108		W020105 - MP38 Tubing 2 (5F/1.5M)	
107		W020105 - MP38 Tubing 2 (5F/1.5M)	
106		W020105 - MP38 Tubing 2 (5F/1.5M)	
105		W020102 - MP38Tubing 3 (2F/0.6M)	
104		W020105 - MP38 Tubing 2 (5F/1.5M)	
103		W020110 - MP38 Tubing 1 (10F/3M)	
102		W020110 - MP38 Tubing 1 (10F/3M)	
101		W020110 - MP38 Tubing 1 (10F/3M)	
100		W020110 - MP38 Tubing 1 (10F/3M)	
99		W020110 - MP38 Tubing 1 (10F/3M)	
98		W020110 - MP38 Tubing 1 (10F/3M)	
97		W020110 - MP38 Tubing 1 (10F/3M)	
96		W020110 - MP38 Tubing 1 (10F/3M)	
95		W020110 - MP38 Tubing 1 (10F/3M)	
94		W020110 - MP38 Tubing 1 (10F/3M)	
93		W020110 - MP38 Tubing 1 (10F/3M)	
92		W020110 - MP38 Tubing 1 (10F/3M)	
91		W020110 - MP38 Tubing 1 (10F/3M)	
90		W020110 - MP38 Tubing 1 (10F/3M)	
89		W020110 - MP38 Tubing 1 (10F/3M)	
88		W020110 - MP38 Tubing 1 (10F/3M)	
87		W020110 - MP38 Tubing 1 (10F/3M)	
86		W020110 - MP38 Tubing 1 (10F/3M)	
85		W020110 - MP38 Tubing 1 (10F/3M)	
84		W020110 - MP38 Tubing 1 (10F/3M)	
83		W020110 - MP38 Tubing 1 (10F/3M)	
82		W020110 - MP38 Tubing 1 (10F/3M)	
81		W020110 - MP38 Tubing 1 (10F/3M)	
80		W020110 - MP38 Tubing 1 (10F/3M)	
79		W020110 - MP38 Tubing 1 (10F/3M)	
78		W020110 - MP38 Tubing 1 (10F/3M)	
77		W020110 - MP38 Tubing 1 (10F/3M)	
76		W020110 - MP38 Tubing 1 (10F/3M)	
75		W0228 - MP38 Packer - 74mm (5F/1.5M)	
		W0205 - MP38 Measurement Port	
74		W020110 - MP38 Tubing 1 (10F/3M)	

Transcribed from Field Note Book #2

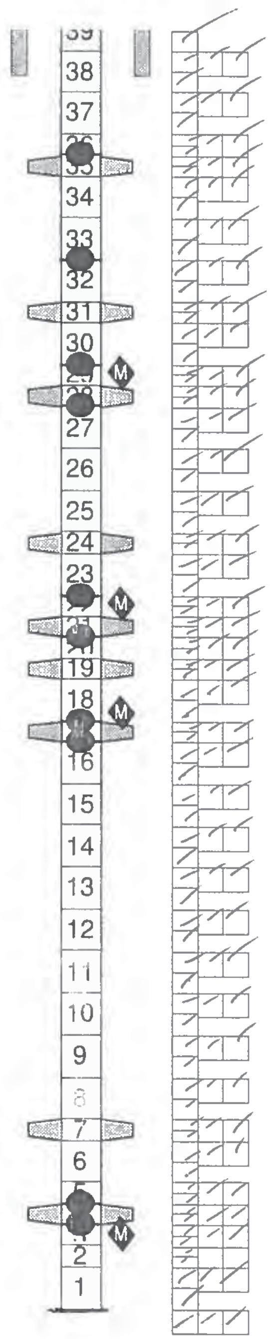
Westbay Completion Log
Lorax

Job No: WB950
Well: BH5-WB

Scale (Meters): 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200

WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
73		W020110 - MP38 Tubing 1 (10F/3M)	
72		W020110 - MP38 Tubing 1 (10F/3M)	
71		W020110 - MP38 Tubing 1 (10F/3M)	
70		W020110 - MP38 Tubing 1 (10F/3M)	
69		W020110 - MP38 Tubing 1 (10F/3M)	
68		W020110 - MP38 Tubing 1 (10F/3M)	
67		W020110 - MP38 Tubing 1 (10F/3M)	
66		W020110 - MP38 Tubing 1 (10F/3M)	
65		W020110 - MP38 Tubing 1 (10F/3M)	
64		W020110 - MP38 Tubing 1 (10F/3M)	
63		W020110 - MP38 Tubing 1 (10F/3M)	
62		W020110 - MP38 Tubing 1 (10F/3M)	
61		W020110 - MP38 Tubing 1 (10F/3M)	
60		W020110 - MP38 Tubing 1 (10F/3M)	
59		W020110 - MP38 Tubing 1 (10F/3M)	
58		W020110 - MP38 Tubing 1 (10F/3M)	
57		W020110 - MP38 Tubing 1 (10F/3M)	
56		W020110 - MP38 Tubing 1 (10F/3M)	
55		W020110 - MP38 Tubing 1 (10F/3M)	
54		W020110 - MP38 Tubing 1 (10F/3M)	
53		W020110 - MP38 Tubing 1 (10F/3M)	
52		W020110 - MP38 Tubing 1 (10F/3M)	
51		W020110 - MP38 Tubing 1 (10F/3M)	
50		W020110 - MP38 Tubing 1 (10F/3M)	
49		W020110 - MP38 Tubing 1 (10F/3M)	
48		W020110 - MP38 Tubing 1 (10F/3M)	
47		W020110 - MP38 Tubing 1 (10F/3M)	
		[illegible]	
		W0238 - MP38 Packer - 74mm (5F/1.5M)	
		W0205 - MP38 Measurement Port	
		W020105 - MP38 Tubing 2 (5F/1.5M)	
44		W0238 - MP38 Packer - 74mm (5F/1.5M)	
43		W020110 - MP38 Tubing 1 (10F/3M)	
42		W020110 - MP38 Tubing 1 (10F/3M)	
41		W020110 - MP38 Tubing 1 (10F/3M)	
40		W020110 - MP38 Tubing 1 (10F/3M)	

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers



200
210
220
230
240
250
260
270
280
290
300

W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020105 - MP38 Tubing 2 (5F/1.5M)
W0205 - MP38 Measurement Port
W0238 - MP38 Packer - 74mm (5F/1.5M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W0205 - MP38 Measurement Port
W020110 - MP38 Tubing 1 (10F/3M)
W0238 - MP38 Packer - 74mm (5F/1.5M)
W020110 - MP38 Tubing 1 (10F/3M)
W0205 - MP38 Measurement Port
W020105 - MP38 Tubing 2 (5F/1.5M)
W0238 - MP38 Packer - 74mm (5F/1.5M)
W0205 - MP38 Measurement Port
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W0238 - MP38 Packer - 74mm (5F/1.5M)
W020110 - MP38 Tubing 1 (10F/3M)
W0205 - MP38 Measurement Port
W020105 - MP38 Tubing 2 (5F/1.5M)
W0238 - MP38 Packer - 74mm (5F/1.5M)
W0205 - MP38 Measurement Port
W020105 - MP38 Tubing 2 (5F/1.5M)
W0238 - MP38 Packer - 74mm (5F/1.5M)
W020110 - MP38 Tubing 1 (10F/3M)
W0205 - MP38 Measurement Port
W0238 - MP38 Packer - 74mm (5F/1.5M)
W0205 - MP38 Measurement Port
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W020110 - MP38 Tubing 1 (10F/3M)
W0238 - MP38 Packer - 74mm (5F/1.5M)
W020110 - MP38 Tubing 1 (10F/3M)
W020105 - MP38 Tubing 2 (5F/1.5M)
W0205 - MP38 Measurement Port
W0238 - MP38 Packer - 74mm (5F/1.5M)
W0205 - MP38 Measurement Port
W020105 - MP38 Tubing 2 (5F/1.5M)
W020105 - MP38 Tubing 2 (5F/1.5M)
W020110 - MP38 Tubing 1 (10F/3M)
W0203 - MP38 End Cap

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-5

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 8/2015

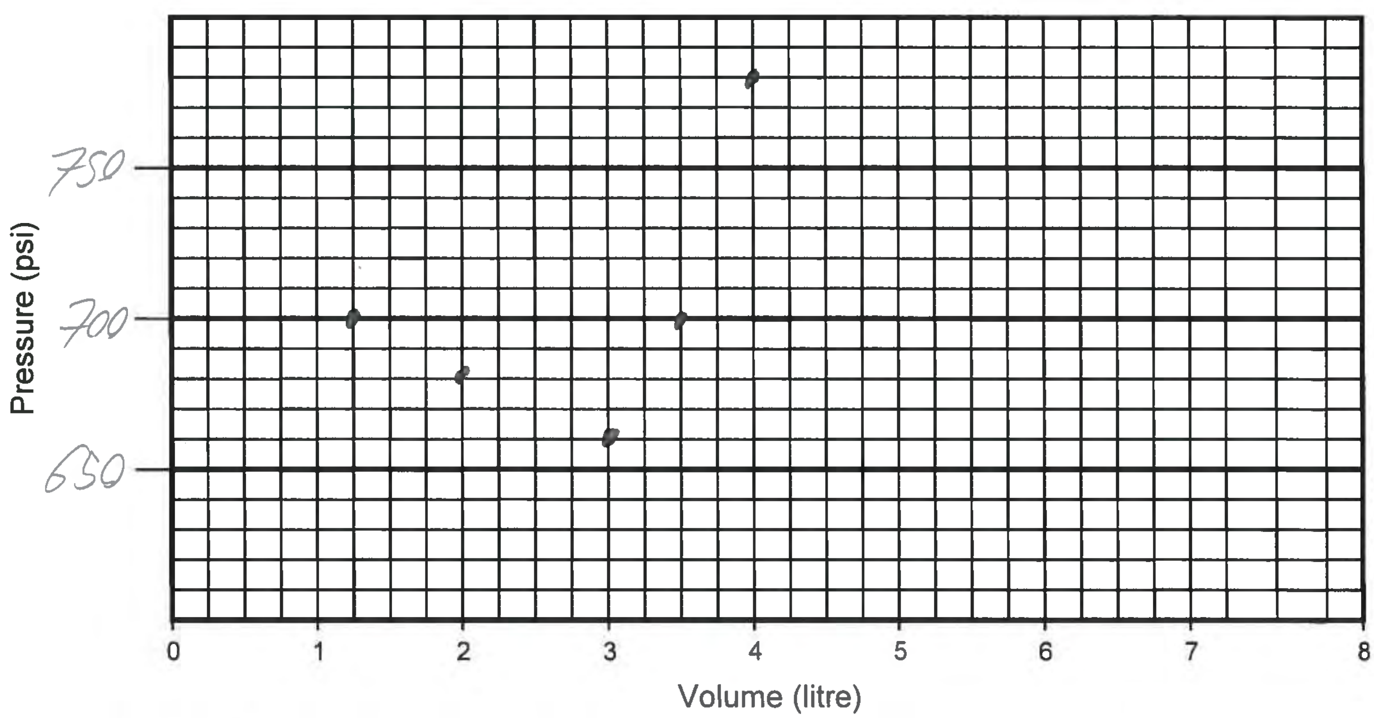
Packer No. P1 Depth (m): ________ Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 780 psi Tool Pressure, P_T: 850 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 183 psi

Volume, litres	1	2	3	3.5	4	~~4~~	3.5			
Pressure, psi	700	680	660	700	780	/	Ø			
Volume, litres										
Pressure, psi										



Comments: Transcribed from field note book #3 Time - 1300

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BHS-W13

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 8

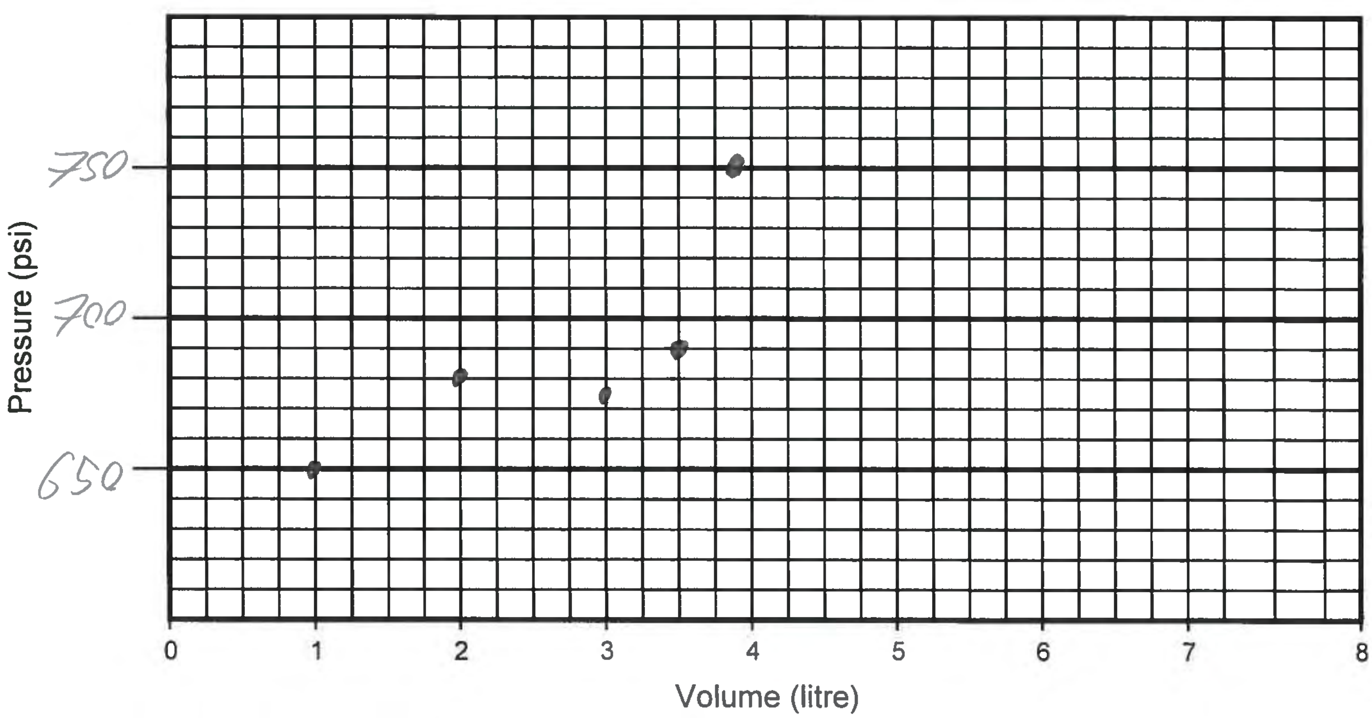
Packer No. P2 Depth (m): — Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 750 psi Tool Pressure, P_T: 850 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 153 psi

Volume, litres	1	2	3	3.5	3.8	—	3.3			
Pressure, psi	650	680	670	690	750	—	0			
Volume, litres										
Pressure, psi										



Comments: Transcribed from Field Note Book #3 Time - 1330

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-5-W13

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 8/15

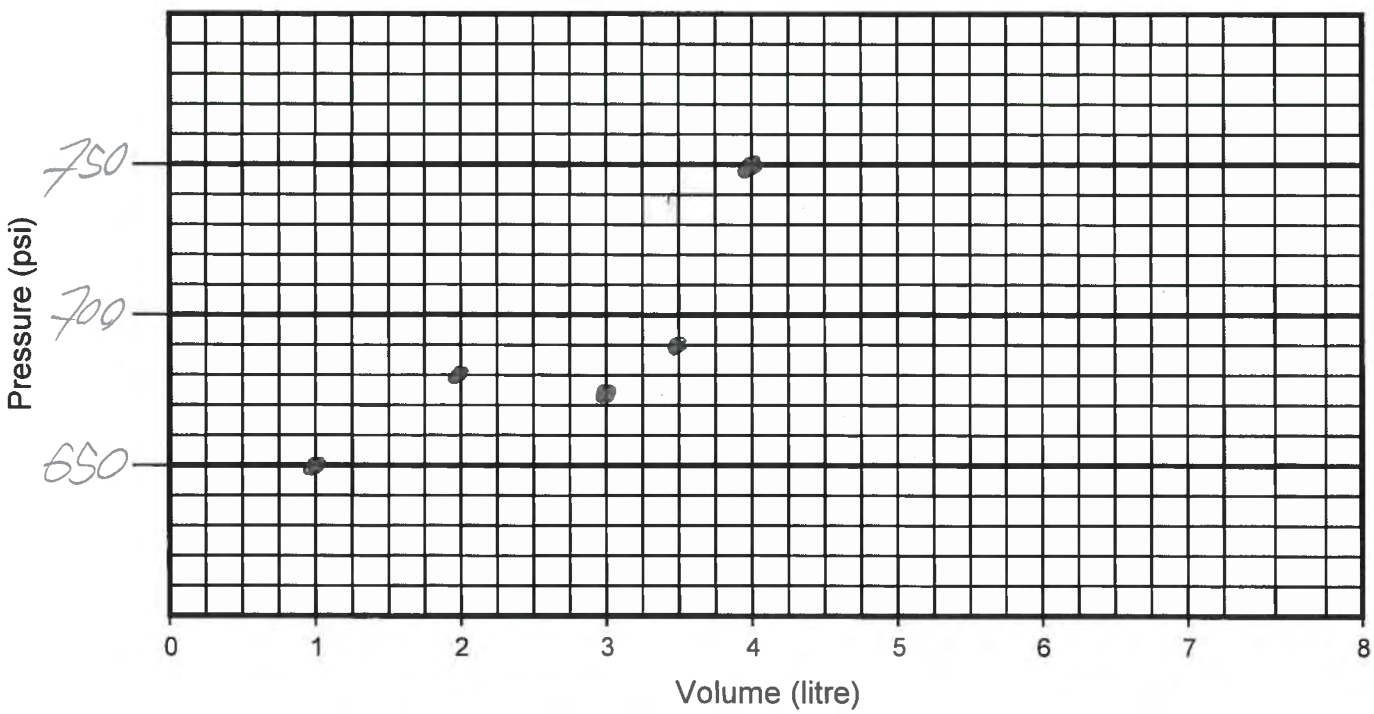
Packer No. P3 Depth (m): — Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 750 psi Tool Pressure, P_T: 850 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 153 psi

Volume, litres	1	2	3	3.5	3.8	—	3.3			
Pressure, psi	650	680	670	690	750	—	Ø			
Volume, litres										
Pressure, psi										



Comments: Transcribed from Field Notebook #3 Time - 1405

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

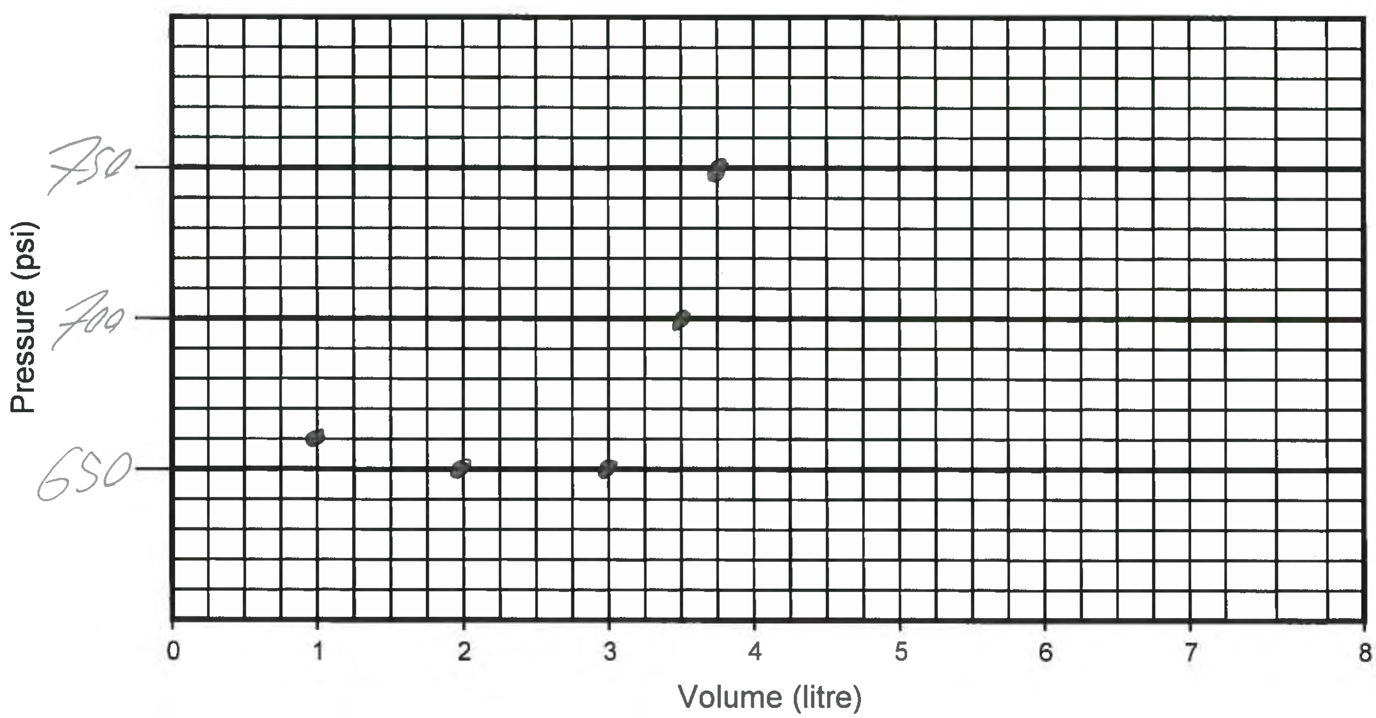
Project:	LORAX Environmental Services Ltd.	Project No.:	WB950	Well No.:	BH-5
Location:	Coffee Creek, Kaminak Gold Project	Completed by:	DL	Date Inflated:	June 8
Packer No.	P4	Depth (m):	—	Inflation Tool No.:	3/98

Packer Valve Pressure, P_V: 150 psi   Final Line Pressure, P_L: 750 psi   Tool Pressure, P_T: 750 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 153 psi

Volume, litres	1	2	3	3.5	3.7	—	3.2		
Pressure, psi	660	650	650	700	750	—	Ø		
Volume, litres									
Pressure, psi									



Comments: Transcribed from field Notebook #3   Time - 1430

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BHS_WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 8/15

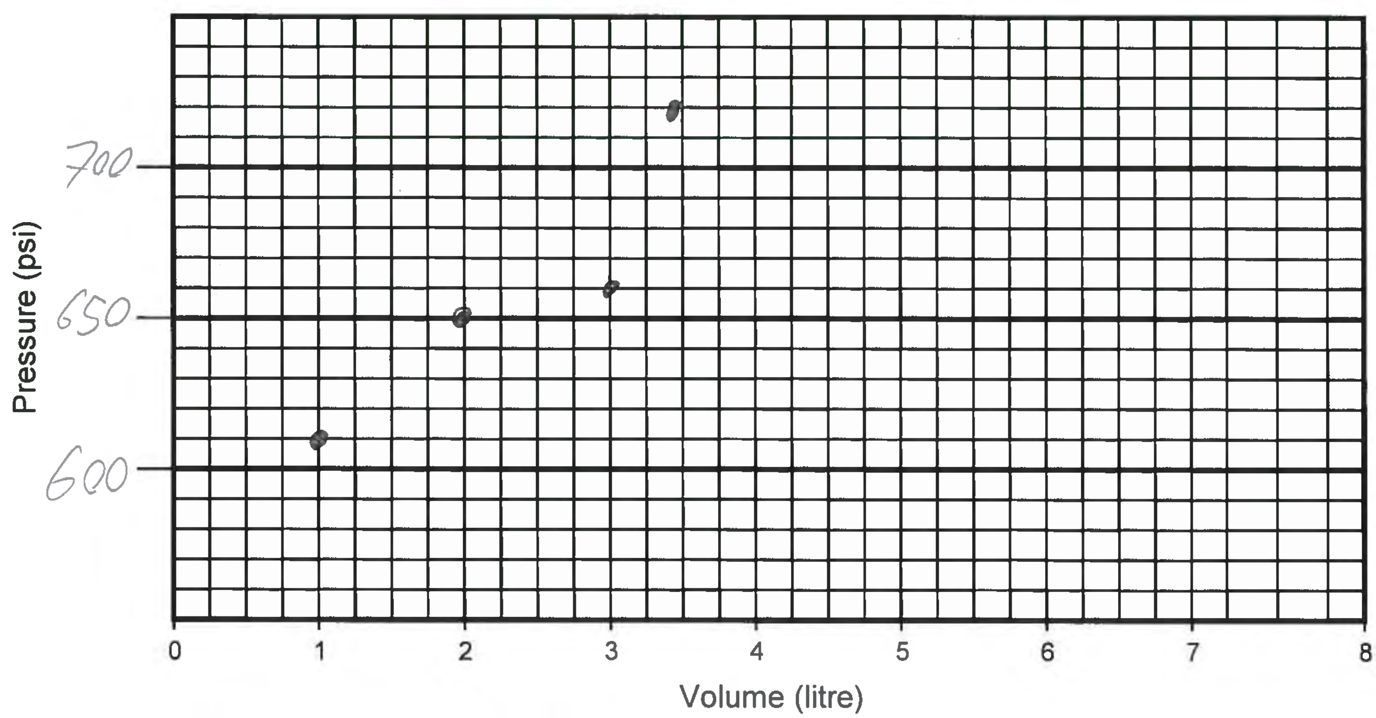
Packer No. P5 Depth (m): ______ Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 720 psi Tool Pressure, P_T: 750 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 123 psi

Volume, litres	1	2	3	3.4	/	3.0				
Pressure, psi	610	650	660	720	/	0				
Volume, litres										
Pressure, psi										



Comments: Transcribed from field Note Book #3 Time - 1500

Westbay Instruments

Sheet____of____

Westbay Packer Inflation Record

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-5 WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 8/15

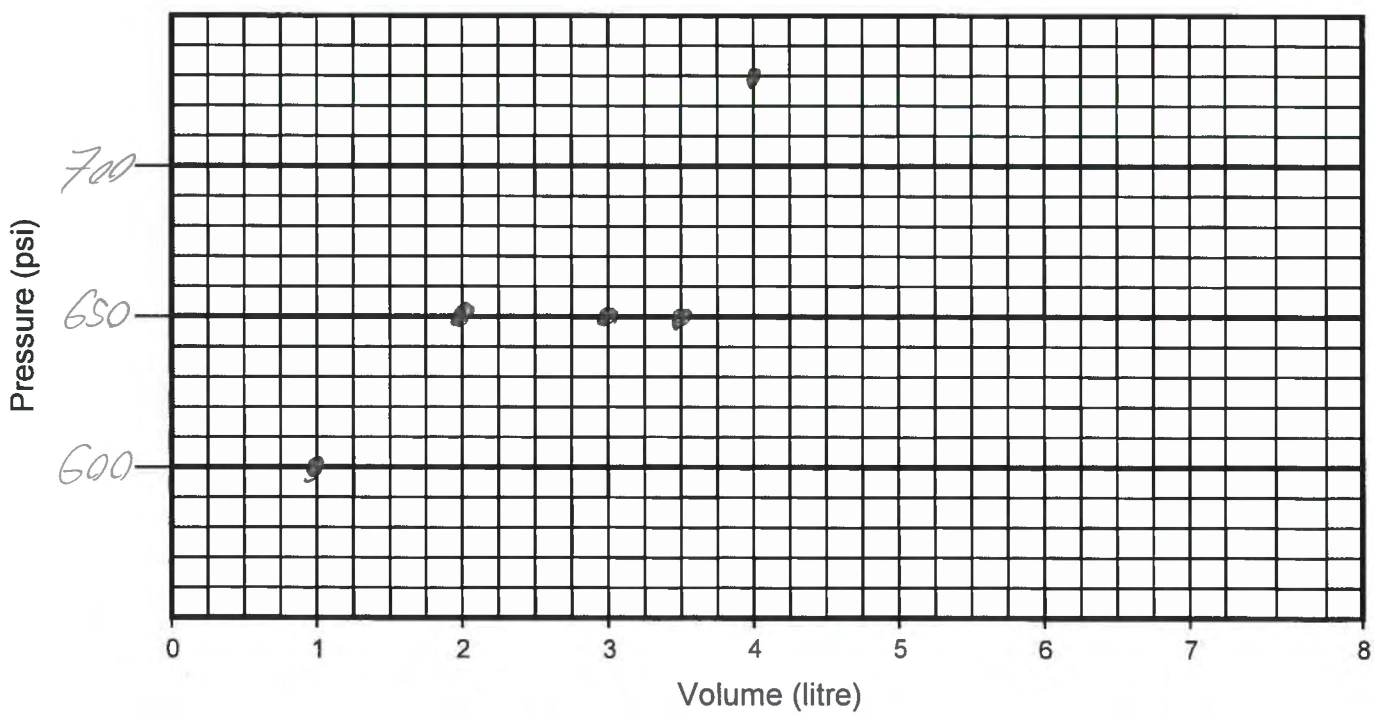
Packer No. P6 Depth (m): ______ Inflation Tool No.: 3/58

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 730 psi Tool Pressure, P_T: 850 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 133 psi

Volume, litres	1	2	3	3.5	4	/	3.5			
Pressure, psi	600	650	650	650	730	/	Ø			
Volume, litres										
Pressure, psi										



Comments: Transcribed from field Notebook #3 Time - 1515

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BHS_W13

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 8/15

Packer No. P7 Depth (m): — Inflation Tool No.: 3198

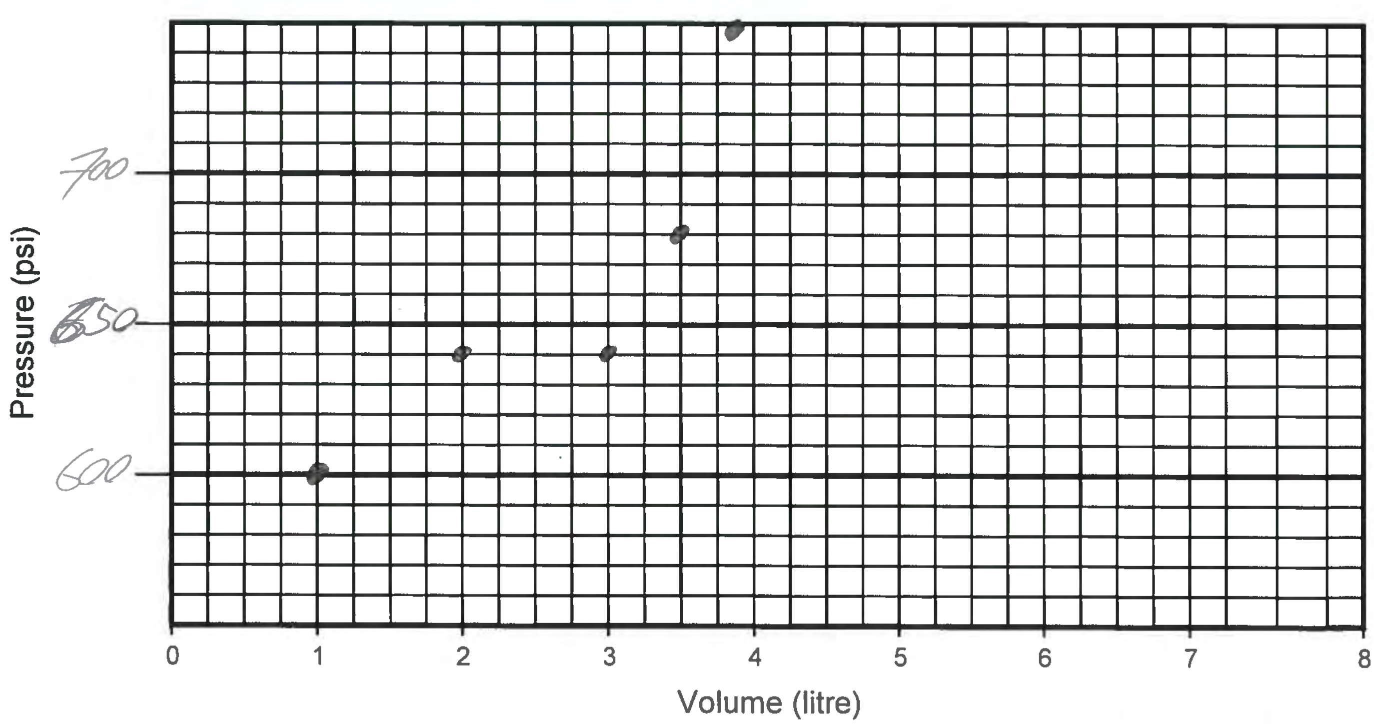
Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 750 psi Tool Pressure, P_T: 750 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 153 psi

Volume, litres	1	2	3	3.5	3.8	/	3.3			
Pressure, psi	600	640	640	680	750	/	0			

Volume, litres										
Pressure, psi										



Comments: Transcribed from field notebook #3 Time - 1540

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BHS_WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: JUNE 8 15

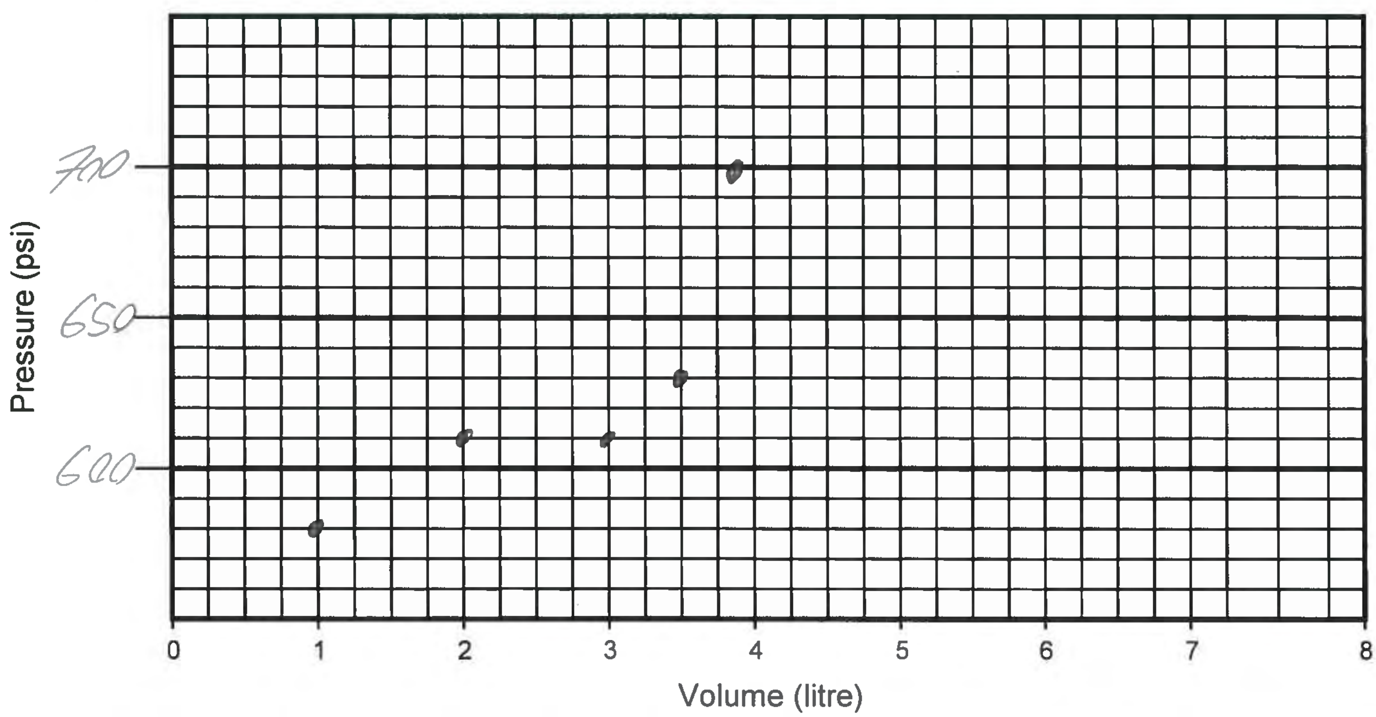
Packer No. P8 Depth (m): ____ Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 700 psi

Borehole Water Level: 213 (m) = 303 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 153 psi

Volume, litres	1	2	3	3.5	3.8	/	3.4			
Pressure, psi	570	610	610	630	700	/	Ø			
Volume, litres										
Pressure, psi										



Comments: Transcribed from Field Note Book #3 Time - 1600

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH5_WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 9/15

Packer No. P9 Depth (m): ____ Inflation Tool No.: 3198

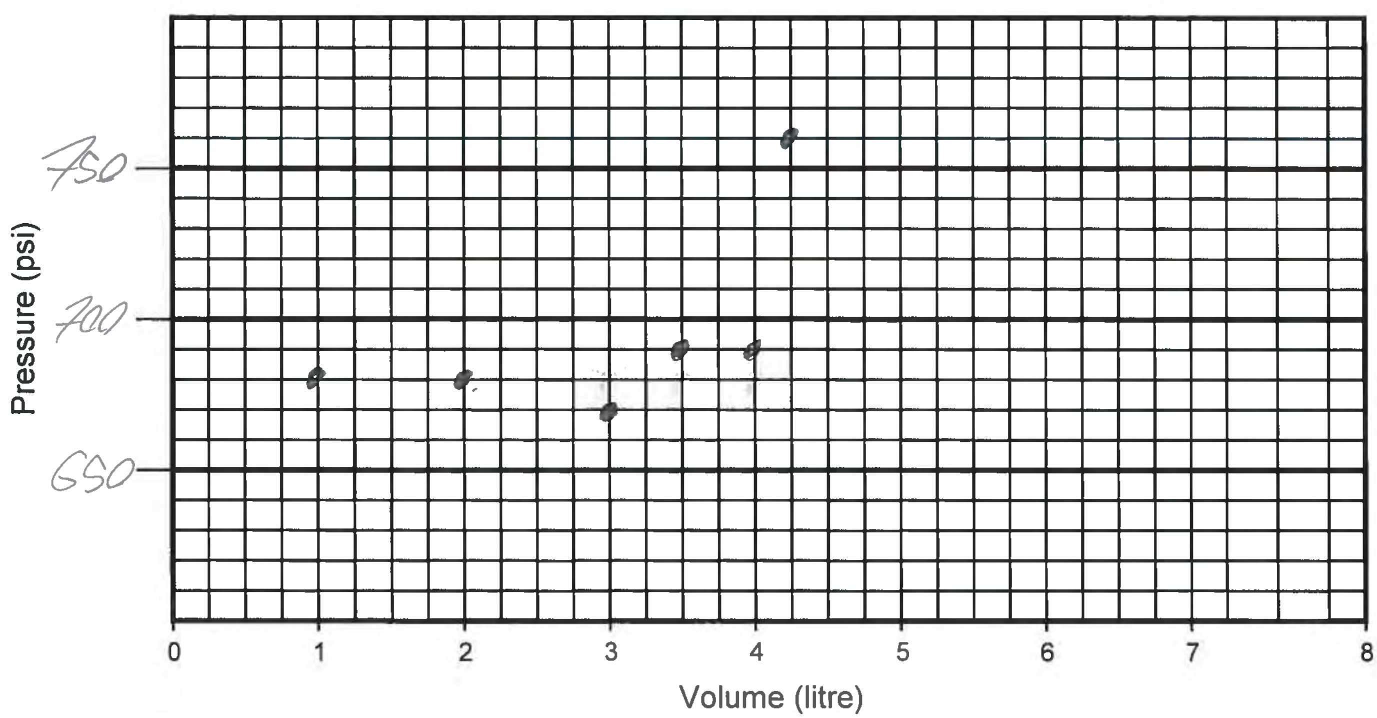
Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 760 psi Tool Pressure, P_T: 700 psi

Borehole Water Level: 209 (m) = 292 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 202 psi

Volume, litres	1	2	3	3.5	4	4.25	/	3.8		
Pressure, psi	680	680	670	690	690	760	/	Ø		

Volume, litres										
Pressure, psi										



Comments: Transcribed from field Note Book #3 Time -

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH5_WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 9/15

Packer No. P10 Depth (m): ________ Inflation Tool No.: 3198

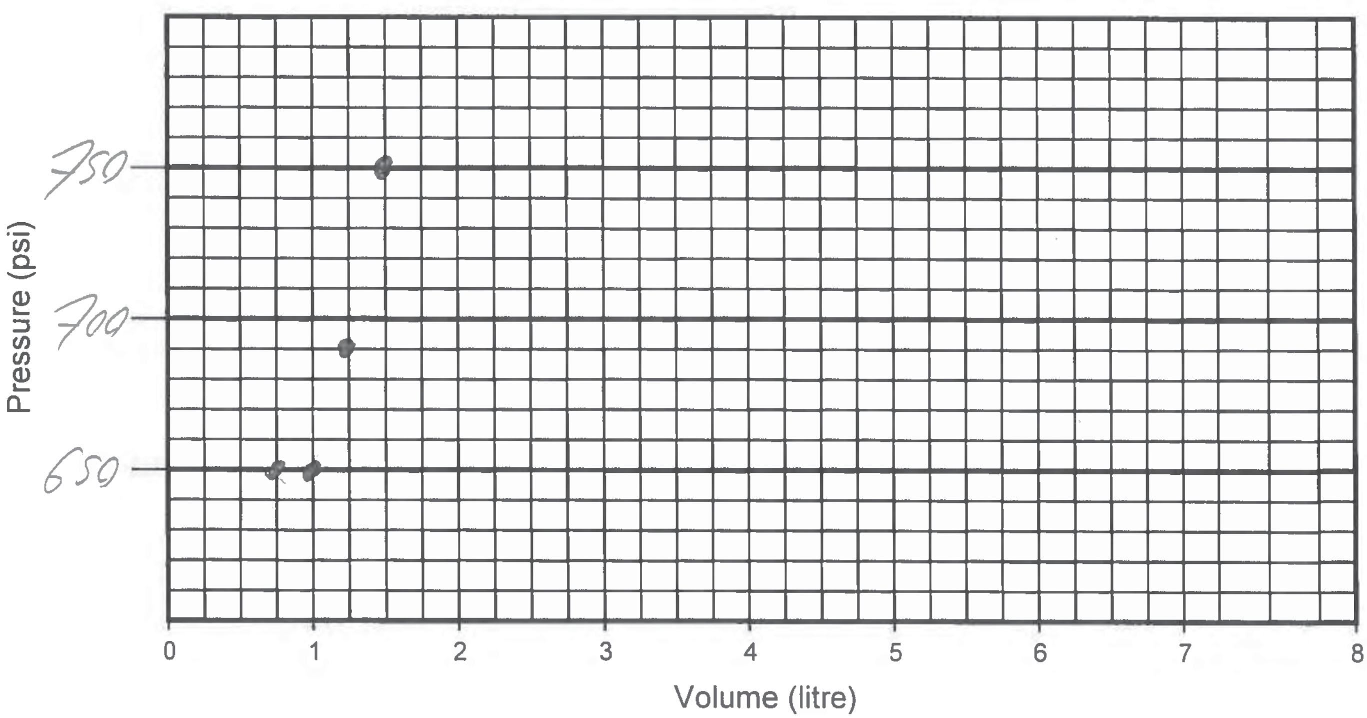
Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 750 psi Tool Pressure, P_T: 700 psi

Borehole Water Level: 185 (m) = 263 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 163 psi

Volume, litres	.75	1	1.25	1.5	/	1.0			
Pressure, psi	650	650	690	750	/	Ø			

Volume, litres									
Pressure, psi									



Comments: Transcribed from Field Note Book #3 Time -

Sheet____of____

Westbay Instruments

Westbay Packer Inflation Record

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH5_WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 9/15

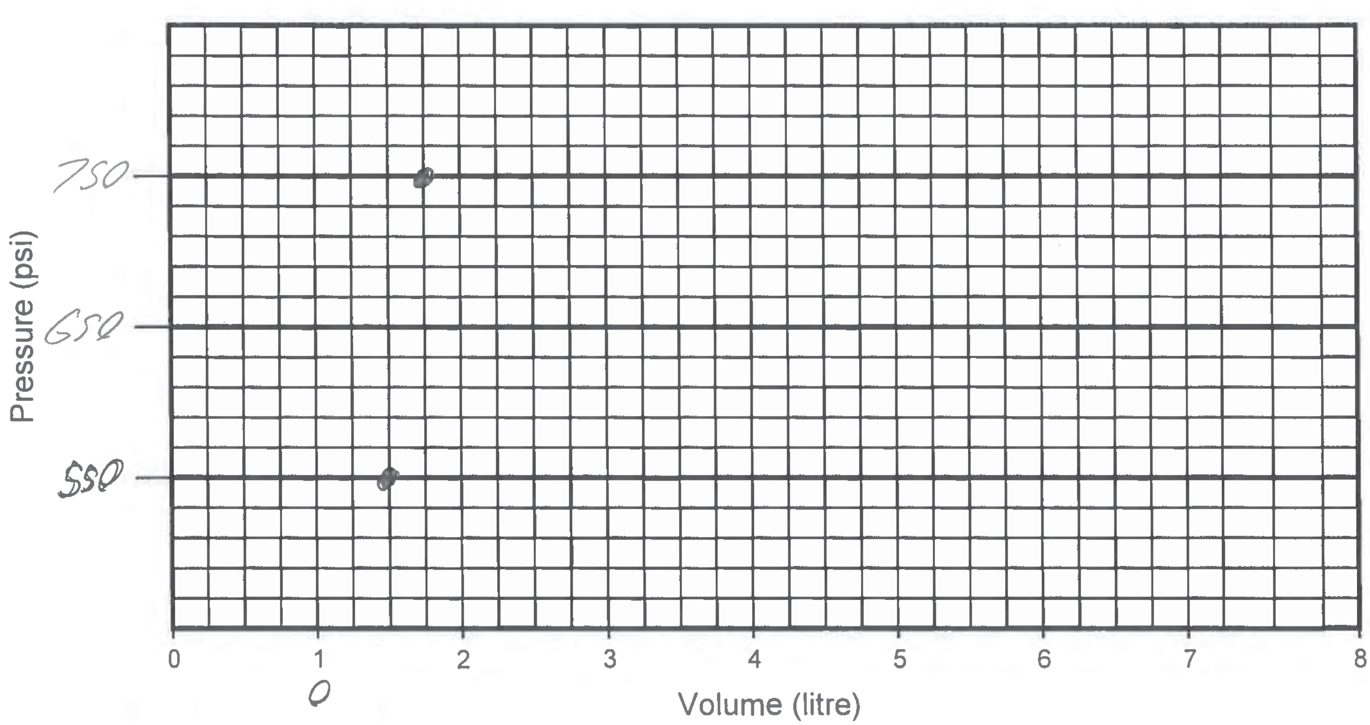
Packer No. P11 Depth (m): Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 750 psi Tool Pressure, P_T: 700 psi

Borehole Water Level: 181 (m) = 257 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 157 psi

Volume, litres	1.0	1.5	1.75	/	1.25					
Pressure, psi	0	550	750	/	0					
Volume, litres										
Pressure, psi										



Comments: Transcribed from field notes Book #3 Time - 0940

Packer/Rev deflated Add 250ml

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH5_WB

Location: Coffee Creek, Kaminak Gold Project Completed by: DL Date Inflated: June 9/15

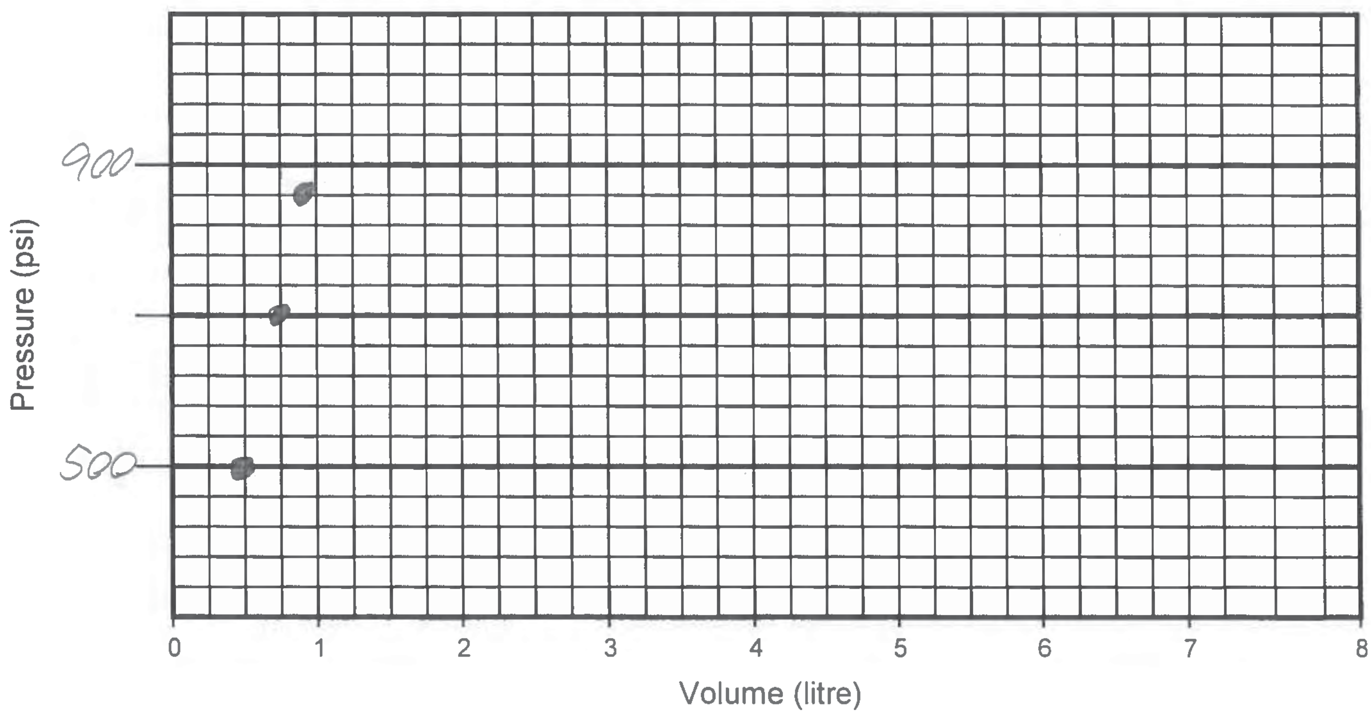
Packer No. P12 Depth (m): 94.9 Inflation Tool No.: 3198

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 875 psi Tool Pressure, P_T: 700 psi

Borehole Water Level: 94 (m) = 133 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 158 psi

Volume, litres	0	0.5	0.75	0.9	/	0.25				
Pressure, psi	0	550	760	875	/	0				
Volume, litres										
Pressure, psi										



Comments: Transcribed from field Note Book #3 Time -

Packer then deflated

APPENDIX D: MONITORING WELL: BH8-WB

As-Built Key Components Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 2 pages
Summary Completion Log	- 2 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (May 5)	- 1 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (May 5)	- 1 page
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 5 pages
Westbay System Packer Inflation Records	- 6 pages

Table 4: BH8-WB As-Built Packer and Port Summary

AB, 01/06/2015

Port No.	Zone	Measurement Port Depth, (m)	Pumping Port Depth, (m)	Depth to top of Packer, (m)	Top of Zone (m)	Bottom of Zone (m)	Comments
1		115.48		113.96	115.3	65.7	
2		109.39		107.86	109.2	114.4	
3		88.97		87.44	88.7	108.3	
4		82.87		81.35	82.6	87.8	
5		80.74		79.21	80.5	81.7	
6		76.17	74.64	74.64	75.9	79.6	
7							
8							
9							
10							
11							
12							
13							
14							
15							

Note 1: All depth measurements in meters below datum (GS).
Note 2: All depth measurements use 'Nominal' tubing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All depth measurements to upper edge of Westbay System coupling item.

Table 5: BH8-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
50	203							-1.91
48	20102			202				-1.86
47	20102			202				-1.25
46	20102			202				-0.64
45	20110			202				-0.03
44	20110			202		216	3.6	3.02
43	20110			202				6.06
42	20110			202				9.11
41	20110			202				12.16
40	20110			202				15.21
39	20110			202				18.26
38	20110			202				21.30
37	20110			202				24.35
36	20110			202				27.40
35	20110			202				30.45
34	20110			202				33.50
33	20110			202				36.54
32	20110			202				39.59
31	20110			202				42.64
30	20110			202				45.69
29	20110			202				48.73
28	20110			202				51.78
27	20110			202				54.83
26	20110			202				57.88
25	20110			202				60.93
24	20110			202				63.97
23	20110			202				67.02
22	20110			202				70.07
21	20105			202				73.12
20	238	Packer	19216	224				74.64
19	20110	Measurement Port		205	8451			76.17
18	238	Packer	19212	202				79.21
17	20102	Measurement Port		205	8452			80.74
16	238	Packer	19214	202				81.35
15	20105	Measurement Port		205	8441	216	83.5	82.87
14	20110			202				84.39
13	238	Packer	19213	202				87.44
12	20110	Measurement Port		205	8449			88.97
11	20102			202				92.01
10	20110			202				92.62
9	20110			202				95.67
8	20110			202				98.72
7	20110			202				101.77

Table 5: BH8-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
6	20110			202				104.81
5	238	Packer	19215	202				107.86
4	20105	Measurement Port		205	8443	216	110.0	109.39
3	20110			202				110.91
2	238	Packer	19211	202				113.96
1	20105	Measurement Port		205	8442			115.48
0	203							117.01

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

Qty	Component
(2)	0203 - MP38 End Cap
(5)	020102 - MP38 Casing 3 (2F/0.6M)
(33)	020110 - MP38 Casing 1 (10F/3M)
(4)	020105 - MP38 Casing 2 (5F/1.5M)
(6)	0238 - MP38 Packer - 74mm (5F/1.5M)
(41)	0202 - MP38 Regular Coupling
(1)	0224 - MP38 Pumping Port
(6)	0205 - MP38 Measurement Port
(3)	0216 - Magnetic Location Collar

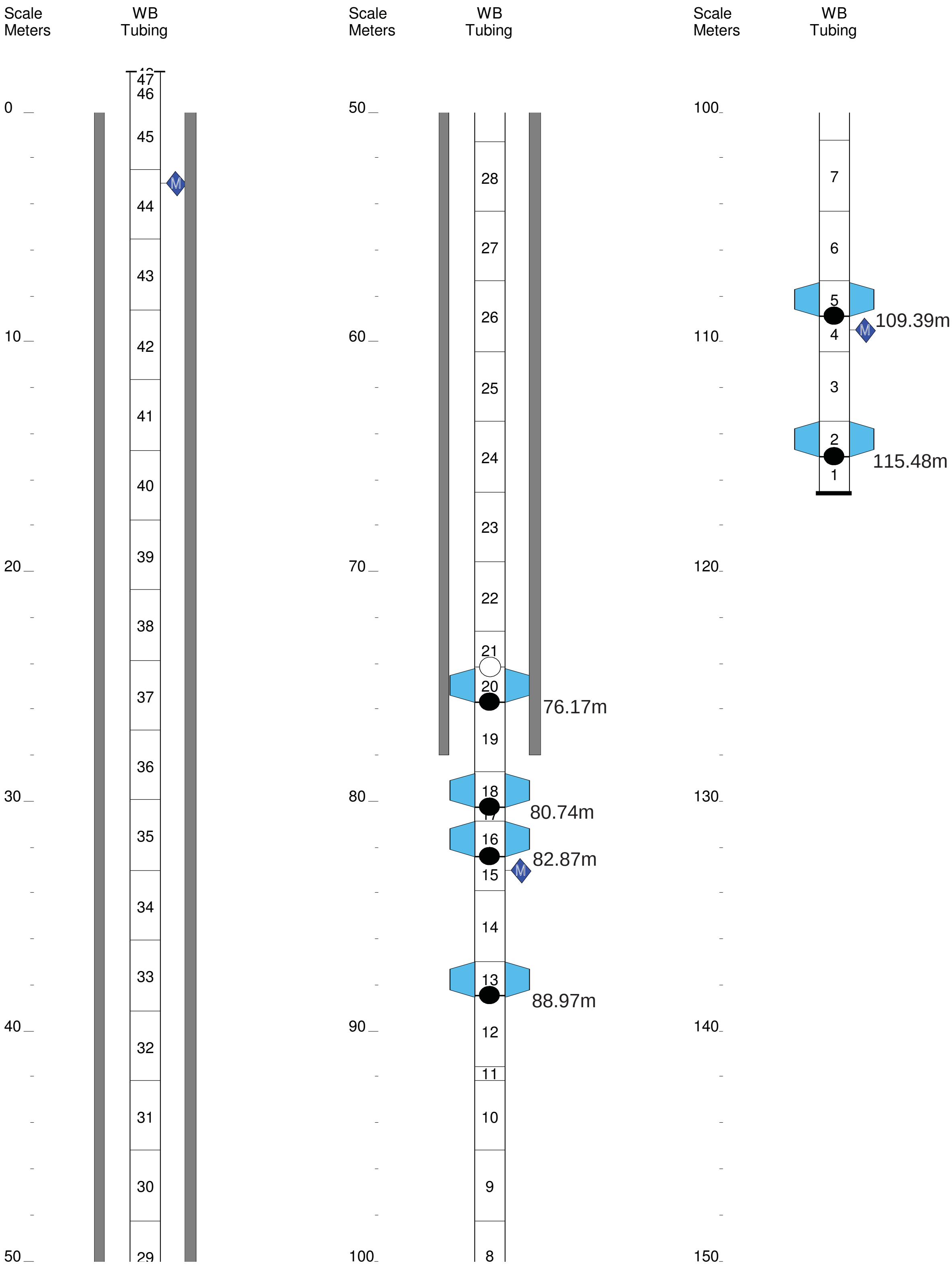
Geology

Backfill/Casing

Mild Steel

Summary Completion Log
LORAX

Job No: WB950
Well: BH8-WB



PRE-INFLATION OF 4 BOTTOM PACKERS

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH8-WB
Datum: GS
Elev. G.S.: ø
Height of Westbay above G.S.: ~~[illegible]~~ 1.67m
Elev. top of Westbay Casing: ø
Reference Elevation: ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS 2499
Probe Range: 250 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May 5/15
Client: LoRAK
Job No.: WB950
Location: Coffee
Weather: cool-clear
Operator: Name REDACTED

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 13.30 psi

Ambient Reading (P_{atm}) (pressur

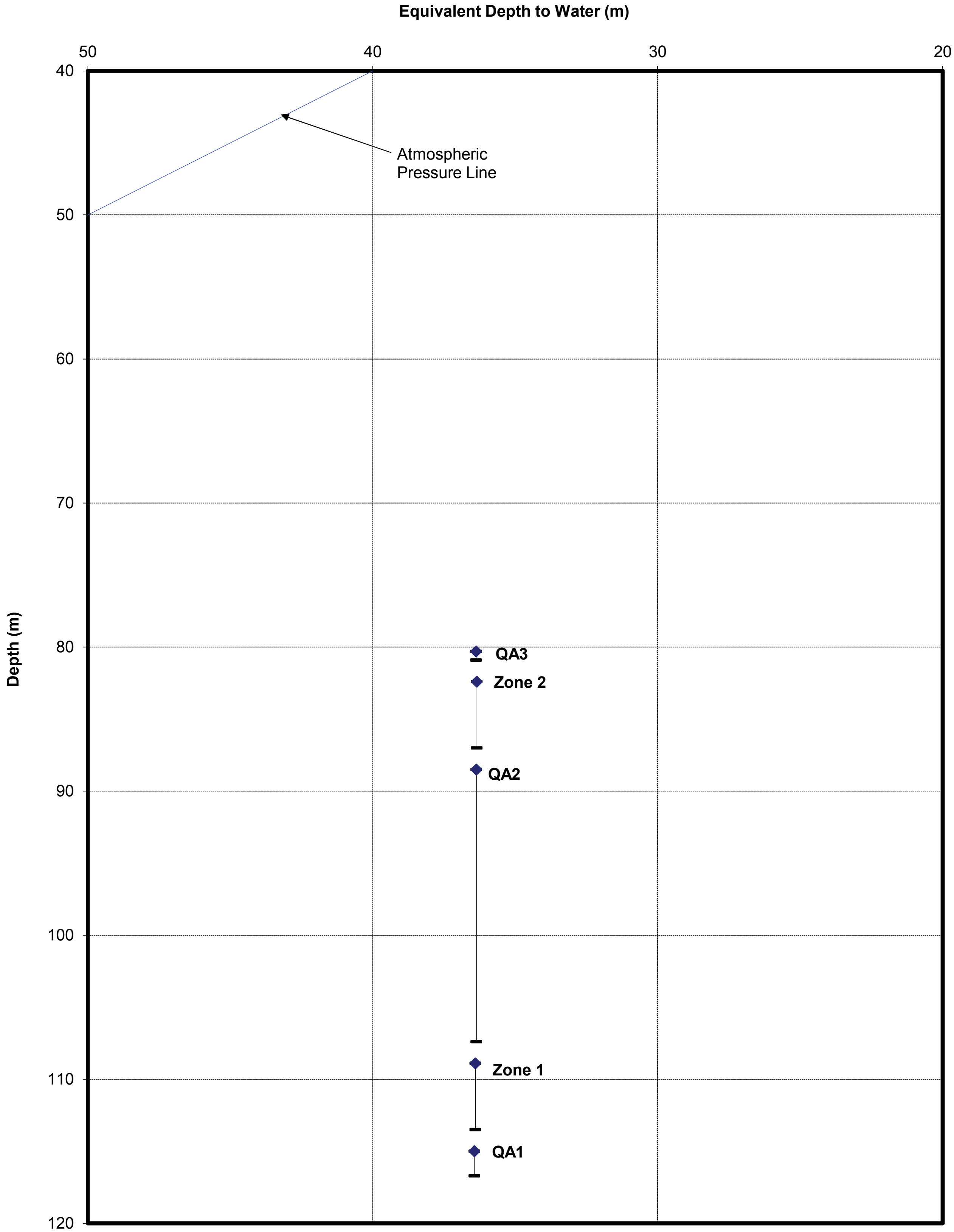
	Start	Finish
Pressure	13.30 psi	13.37 psi
Temp	7.57 °C	0.11 °C
Time	10:31 am	10:58 am

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
											Zones
1	115.0	115.6	-	181.47	125.02	10:41	1.96	181.48	78.6	36.4	QA1
2	108.9	109.5	-	172.63	116.40	10:45	1.68	172.60	72.5	36.4	Zone1
3	88.5	89.1	-	142.95	87.44	10:48	1.43	142.95	52.1	36.4	QA2
4	82.4	83.0	-	134.10	78.79	10:49	1.17	134.09	46.1	36.3	Zone2
5	80.3	80.8	-	131.01	75.76	10:52	0.84	131.01	43.9	36.4	QA3
6	75.7	76.3	-	124.36	69.25	10:54	0.69	124.36	39.7	36.4	QA4

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH8-WB

Profile Date: May 5, 2015
Comments: Pre-Inflation Profile



Client: LORAX
Site: Coffee Creek
Datum: GS

Figure 3

Plot By:____Date:____
Checked By:____Date:____
Westbay Project: WB950

Westbay Instruments

Post INFLATION

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: BH8-WB
Datum: GS
Elev. G.S.: ø
Height of Westbay above G.S.: ~~2.14m~~ 1.67m
Elev. top of Westbay Casing: ø
Reference Elevation: ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS 2499
Probe Range: 250psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May 5/15
Client: LORAX
Job No.: WB 950
Location: Coffee
Weather: Cool-Clear
Operator: ___

Name REC

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 13.34 psi

Ambient Reading (P_{atm}) (pressure, temperature, time)

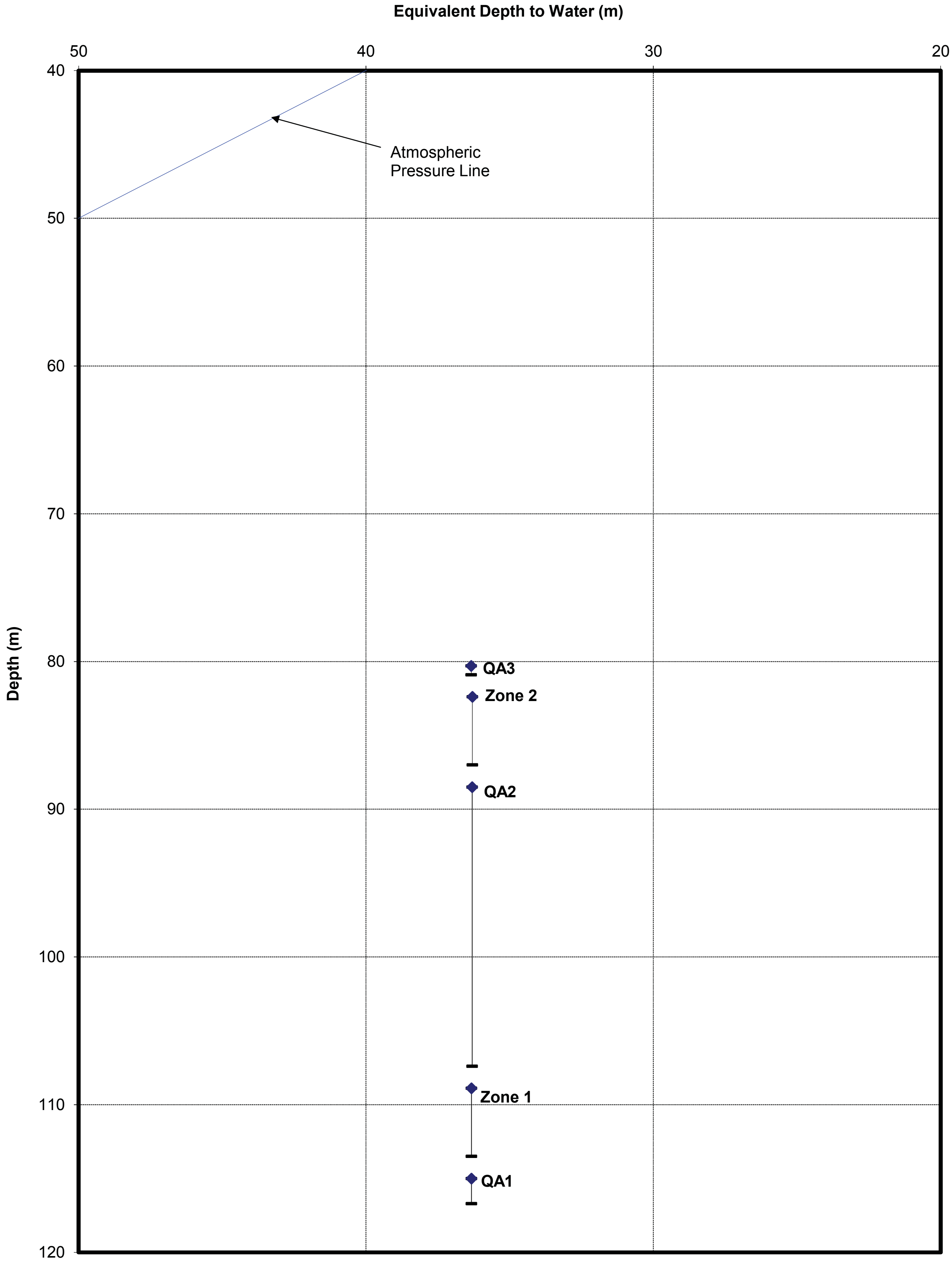
	Start	Finish
Pressure	13.34 psi	13.32 psi
Temp	13.80 °C	0.89 °C
Time	2:48 pm	3:18 pm

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
											Zones
1	115.0	115.5	–	120.60	125.21	3:02	4.17	120.62	78.7	36.3	QA1
2	108.9	109.4	–	111.78	116.54	~~2:58~~ 3:03	2.98	111.80	72.6	36.3	Zone 1
3	88.5	89.0	–	82.15	87.57	3:07	2.11	82.16	52.2	36.3	QA2
4	82.4	82.9	–	73.31	78.90	3:10	1.47	73.31	46.1	36.3	Zone 2
5	80.3	80.8	–	70.20	75.86	3:12	1.22	70.22	44.0	36.3	QA3
6	75.7	76.2	–	63.55	69.36	3:13	1.00	63.55	39.4	36.3	QA4

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH8-WB

Profile Date: May 5, 2015
Comments: Post-Inflation Profile



Client: LORAX
Site: Coffee
Datum: GS

Figure 4

Plot By:____Date:______
Checked By:____Date:_____
Westbay Project: WB950

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH8-WB
Datum: GS
Elev. G.S.: Ø
Height of Westbay above G.S.: 1.67 m
Elev. top of Westbay Casing: Ø
Reference Elevation: Ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS 2499
Probe Range: 250 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May 9/15
Client: CoRAL
Job No.: WB950
Location: Coffee
Weather: warm-clear
Operator: _ Name REC

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

	Start	Finish
Pressure	13.29 psi	13.28 psi
Temp	18.40 °C	23.7 °C
Time	4:42 pm	5:05 pm

P_{atm} 13.29 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
1	115.0	114.7	-	121.56	125.06	4:51	8.29	121.56			QA1
2	108.9	108.6	-	112.72	116.40	4:53	5.62	112.75			Zone 1
3	88.5	88.2	-	93.10	87.47	4:55	3.47	83.11			QA2
4	82.4	82.1	-	79.25	78.82	4:57	2.70	79.25			Zone 2
5	80.3	80.0	-	71.16	75.79	4:58	2.09	71.16			QA3
6	75.7	75.3	-	64.52	69.30	5:00	1.57	64.52			QA4

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Westbay Completion Log

Company: LORAX
Well: BH8-WB
Site: Coffee
Project: Coffee

Job No: WB950
Author: ML

Well Information

Reference Datum: Ground Surface
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 116.59 m.

Borehole Depth: ~~120.00~~ 116.7 mx m.
Borehole Inclination: Vertical
Borehole Diameter: 114.00 mm

Well Description:
Permafrost
Other References:

File Information

File Name: BH8-WB2.WWD
Report Date: Sun May 03 21:22:20 2015

File Date: May 02 20:58:29 2015

Comments

Zero reference is ground surface - ML
Filter socks not to be used - ML

Log Information

Borehole condition confirmed.	(method) TAG	Date: May 4/15
MP well design & preparation.	By: Name REDACTED	Date: May 4/15
MP well design checked.	By:	Date: May 4/15
MP well and borehole approved to install.	By:	Date: May 4, 15

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

(2) 0203 - MP38 End Cap

(5) 020102 - MP38 Casing 3 (2F/0.6M)

(33) 020110 - MP38 Casing 1 (10F/3M)

(4) 020105 - MP38 Casing 2 (5F/1.5M)

(6) 0238 - MP38 Packer - 74mm (5F/1.5M)

(41) 0202 - MP38 Regular Coupling

(1) 0224 - MP38 Pumping Port

(6) 0205 - MP38 Measurement Port

(3) 0216 - Magnetic Location Collar

Geology

Backfill/Casing

Mild Steel

Westbay Completion Log
LORAX

Job No: WB950
Well: BH8-WB

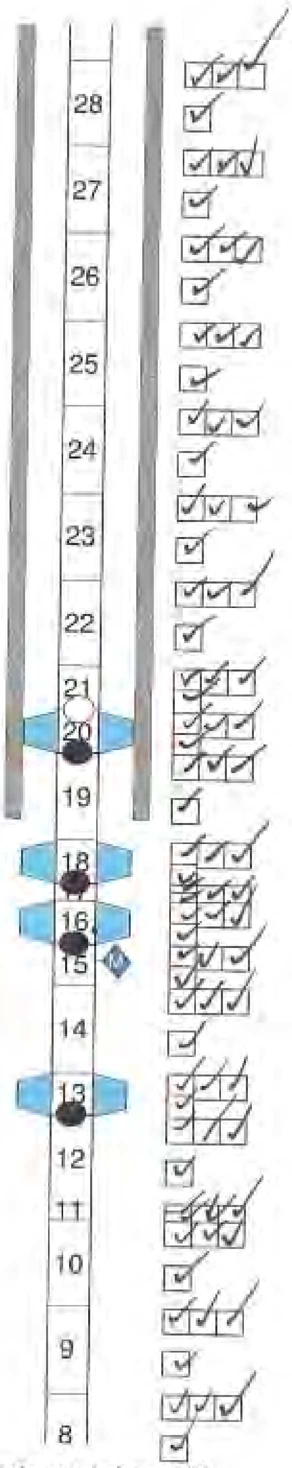
Stickup is 1.67m above zero (GS) - without WB coupling.

Finish lowering at 13:50 May 4/15. well set at depth on bottom of bore hole.

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
	47			
0	46	☑☑☑		
	45	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	44	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	43	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
10	42	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	41	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	40	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
20	39	☑	020110 - MP38 Casing 1 (10F/3M)	12:50
		☑☑☑		
	38	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	37	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
30	36	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	35	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	34	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	33	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
40	32	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	31	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
	30	☑	020110 - MP38 Casing 1 (10F/3M)	
		☑☑☑		
50	29	☑	020110 - MP38 Casing 1 (10F/3M)	

Westbay Completion Log
LORAX

Job No: WB950
Well: BH8-WB



Scale Meters	WB Tubing	WB Tubing Description	Serial Numbers
50			12:00
	28	020110 - MP38 Casing 1 (10F/3M)	
	27	020110 - MP38 Casing 1 (10F/3M)	
60	26	020110 - MP38 Casing 1 (10F/3M)	
	25	020110 - MP38 Casing 1 (10F/3M)	
	24	020110 - MP38 Casing 1 (10F/3M)	11:37
	23	020110 - MP38 Casing 1 (10F/3M)	
70	22	020110 - MP38 Casing 1 (10F/3M)	
	21, 20	020105 - MP38 Casing 2 (5F/1.5M) 0224 - MP38 Pumping Port 0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19216 - 140 psi: 8451
	19	020110 - MP38 Casing 1 (10F/3M)	
80	18, 17	0238 - MP38 Packer - 74mm (5F/1.5M) 020102 - MP38 Casing 3 (2F/0.6M)	19212 - 150 psi: 8452
	16, 15	0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port 020105 - MP38 Casing 2 (5F/1.5M)	19214 - 150 psi: 8441
	14	020110 - MP38 Casing 1 (10F/3M)	
	13	0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19213 - 140 psi: 8449
90	12	020110 - MP38 Casing 1 (10F/3M)	
	11	020102 - MP38 Casing 3 (2F/0.6M)	
	10	020110 - MP38 Casing 1 (10F/3M)	
	9	020110 - MP38 Casing 1 (10F/3M)	
100	8	020110 - MP38 Casing 1 (10F/3M)	10:21

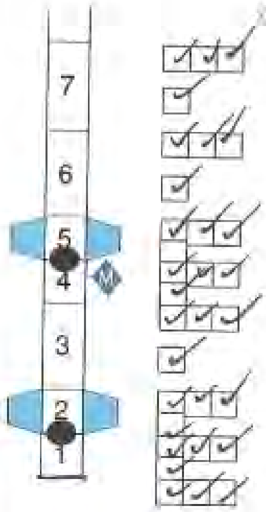
Sun May 03 21:22:00 2015

Westbay Completion Log
LORAX

Job No: WB950
Well: BH8-WB

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers

100



020110 - MP38 Casing 1 (10F/3M)

020110 - MP38 Casing 1 (10F/3M)

0238 - MP38 Packer - 74mm (5F/1.5M) — 19215 - 150 psi 8443
0205 - MP38 Measurement Port
020105 - MP38 Casing 2 (5F/1.5M)

110

020110 - MP38 Casing 1 (10F/3M)

0238 - MP38 Packer - 74mm (5F/1.5M) — 19211 - 145 psi 8442
0205 - MP38 Measurement Port
020105 - MP38 Casing 2 (5F/1.5M)
0203 - MP38 End Cap

0945 start lowering
May 4, 2015.

120

Borehole water level ~126 ft. TOC
Joint test tool: 200 psi
Inflation tool: 400 psi May 4+5, 2015

130

Hydraulic Integrity Test

135.60 ft at 4:10 pm May 5/15
135.55 ft at 4:15 pm
135.53 ft at 4:25 pm
135.53 ft at 4:30 pm
140
135.53 ft at 4:40 pm
135.53 ft at 4:45 pm
135.53 ft at 5:00 pm

Westbay Casing is water tight.
[signature]

150

Westbay Instruments

Sheet____of____

Westbay Packer Inflation Record

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH8-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED ate Inflated: May 5/15

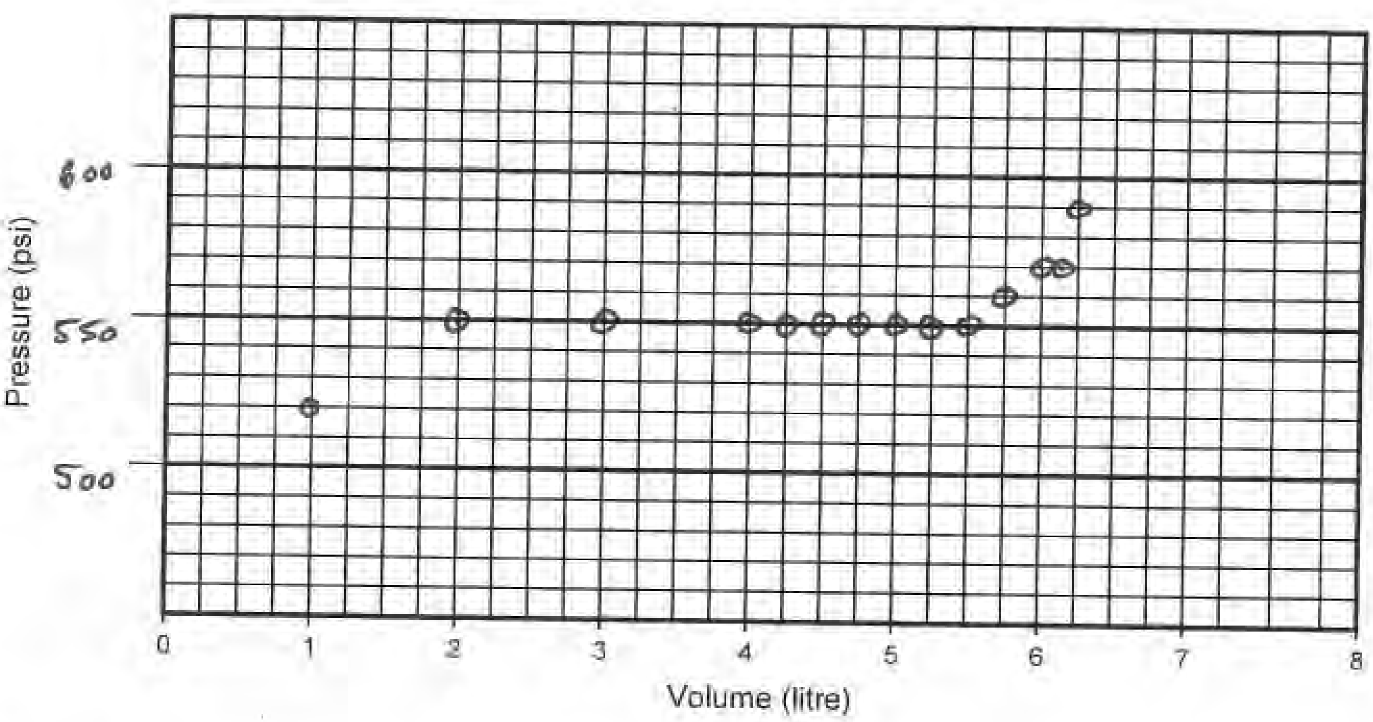
Packer No. 1, comp 2 SN# 19211 Depth (m): [illegible] nflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 590 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 38.4 (m) = 55 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 100 psi

Volume, litres	1.0	2.0	3.0	4.0	4.25	4.5	4.75	5.0	5.25	5.5
Pressure, psi	520	550	550	550	550	550	550	550	550	550
Volume, litres	5.75	6.0	6.1	/	6.25	/	5.8			
Pressure, psi	560	570	570	/	590	/	∅			



Comments: Time - 12:23 pm

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH8-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 5/15

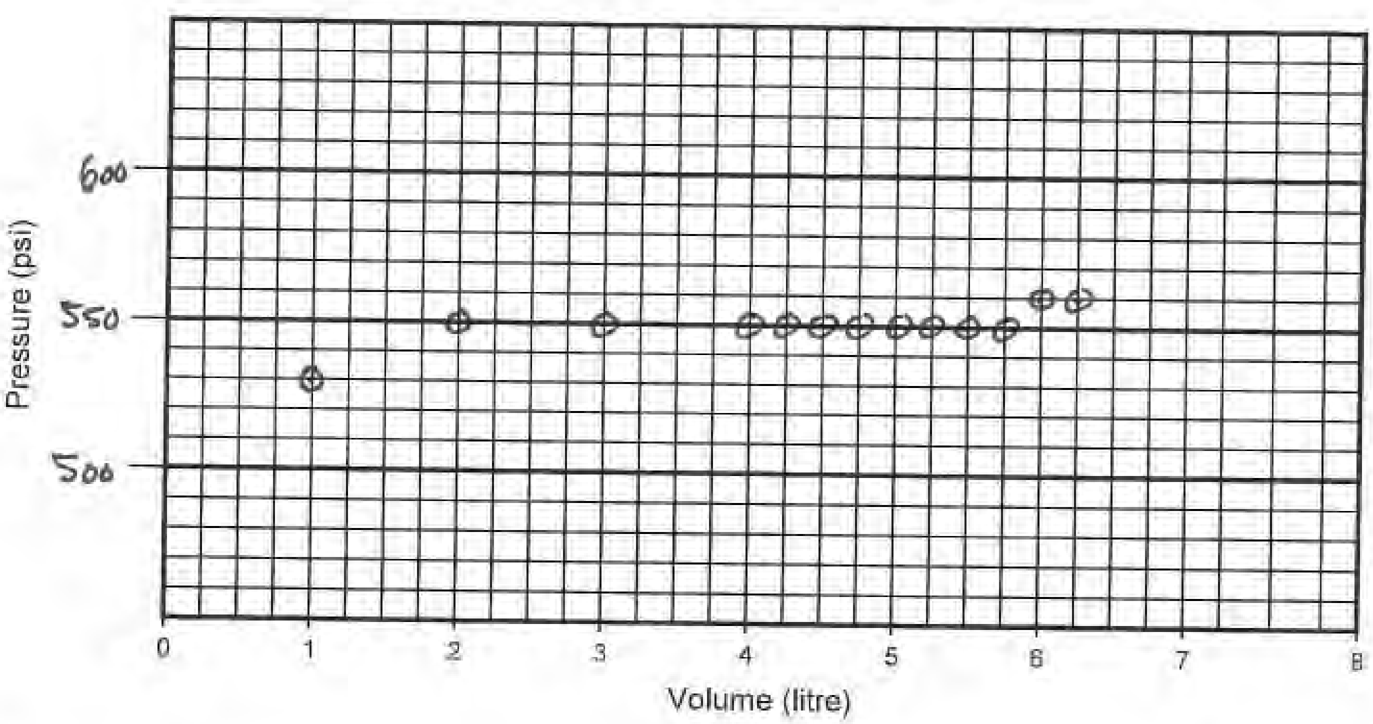
Packer No. 2, comp 5 SN# 19215 Depth (m): 108.9 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 560 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 38.4 (m) = 55 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 65 psi

Volume, litres	1.0	2.0	3.0	4.0	4.25	4.5	4.75	5.0	5.25	5.5
Pressure, psi	530	550	550	550	550	550	550	550	550	550
Volume, litres	5.75	6.0	6.25	/	5.9					
Pressure, psi	550	560	560	/	ø					



Comments: ____________ Time - 12:51 pm

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH8-WB

Location: Coffee Creek, Kaminak Gold Project Completed by Name REDACTED Date Inflated: May 5/15

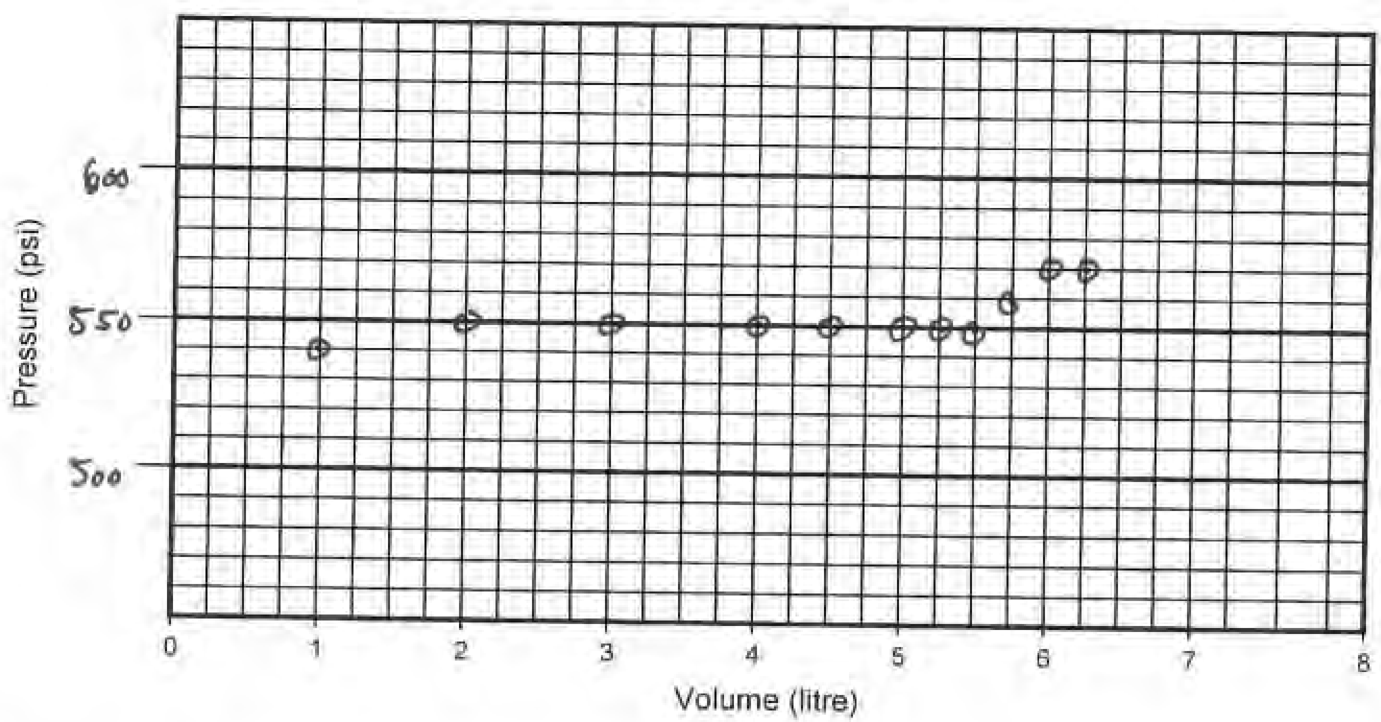
Packer No. 3, comp 13 SN# 19213 Depth (m): 80.2 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 570 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 38.4 (m) = 55 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 85 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	5.0	5.25	5.5	5.75	6.0
Pressure, psi	540	550	550	550	550	550	550	550	560	570
Volume, litres	6.25	/	5.9							
Pressure, psi	570	/	0							



Comments: Time - 1:21 pm

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH8-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 5/15

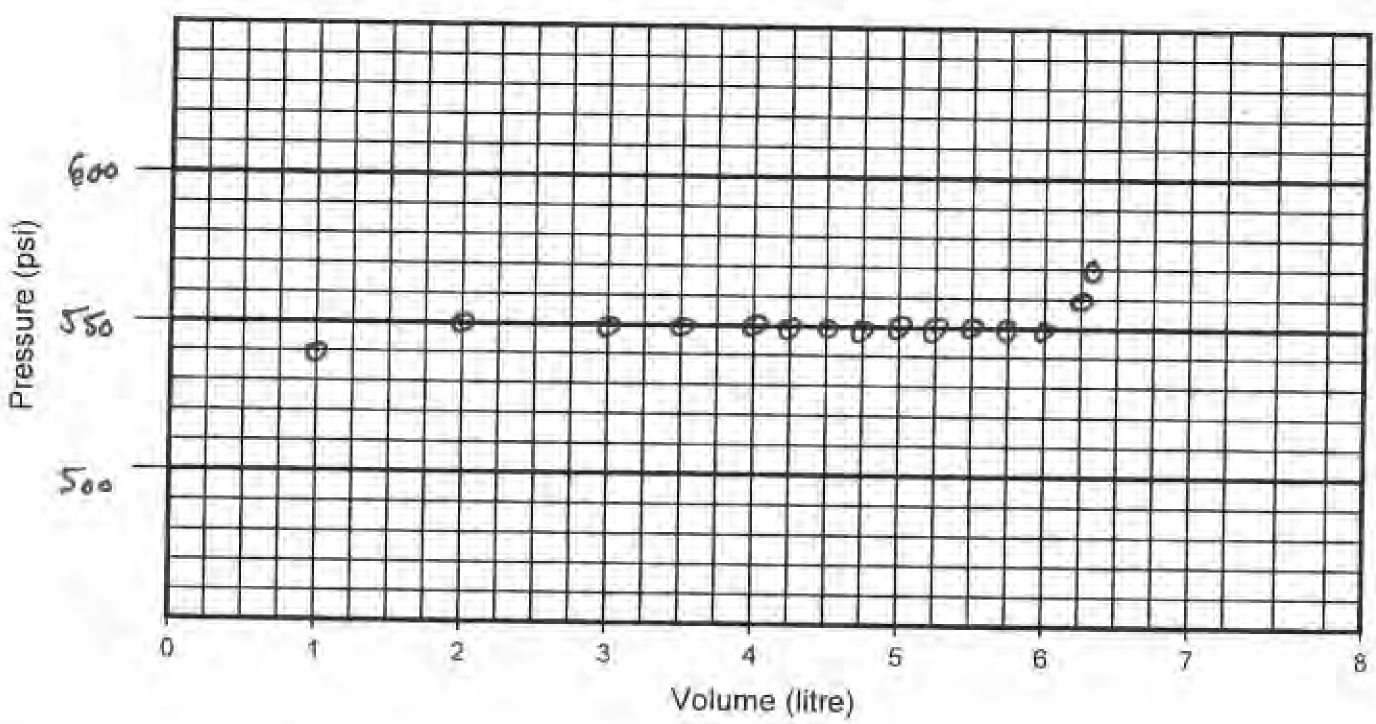
Packer No. 4, comp 16 SN# 19214 Depth (m): 82.4 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 570 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 38.4 (m) = 55 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 75 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.5	4.75	5.0	5.25
Pressure, psi	540	550	550	550	550	550	550	550	550	550
Volume, litres	5.5	5.75	6.0	6.25	6.35	/	6.0			
Pressure, psi	550	550	550	560	570	/	0			



Comments: Squeeze relief? Time - 1:56 pm

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH8-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED te Inflated: May 4/15

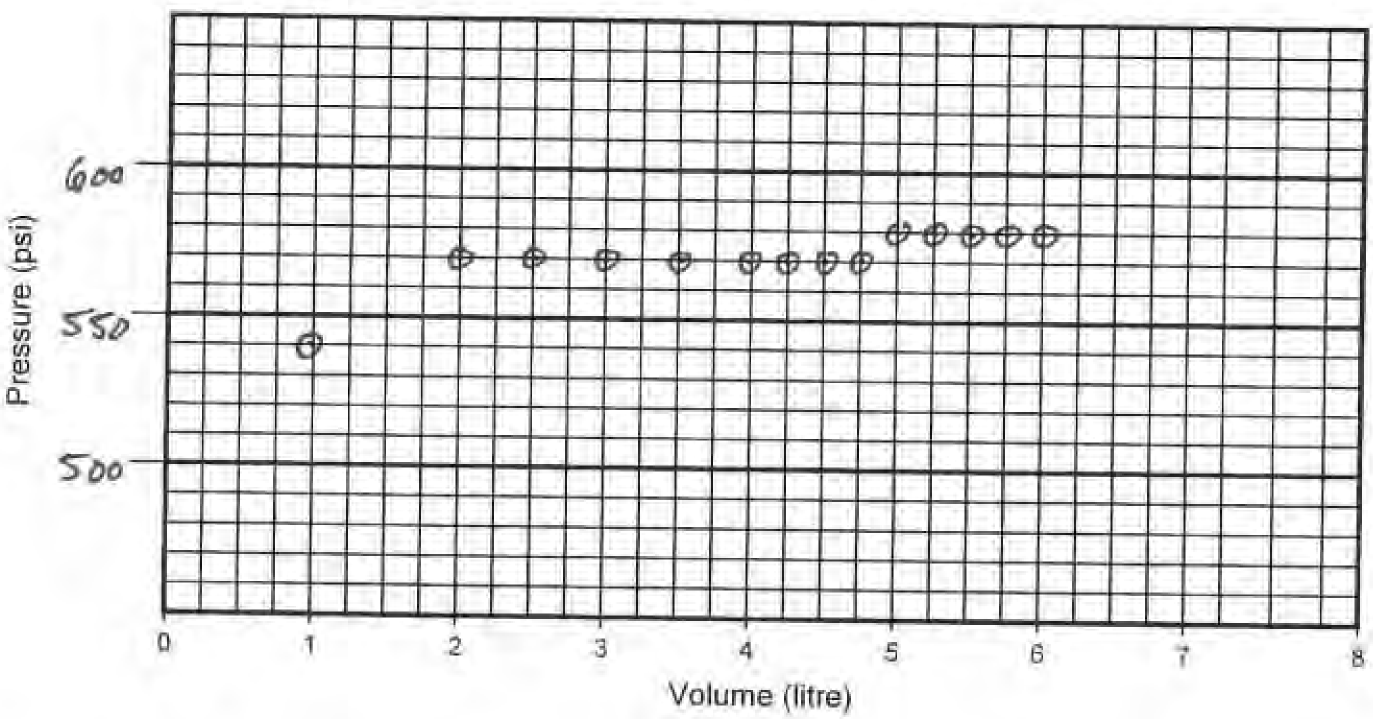
Packer No. 5, comp 18 SN# 19212 Depth (m): ________ ation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 580 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 38.4 (m) = 55 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 85 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0	4.25	4.5	4.75	5.0
Pressure, psi	540	570	570	570	570	570	570	570	570	580
Volume, litres	5.25	5.5	5.75	6.0	/	5.7				
Pressure, psi	580	580	580	580	/	ø				



Comments: 4.5-in BH Time - 6:02 pm

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH8-WB

Location: Coffee Creek, Kaminak Gold Project Completed b Name REDACTED Date Inflated: May 4/15

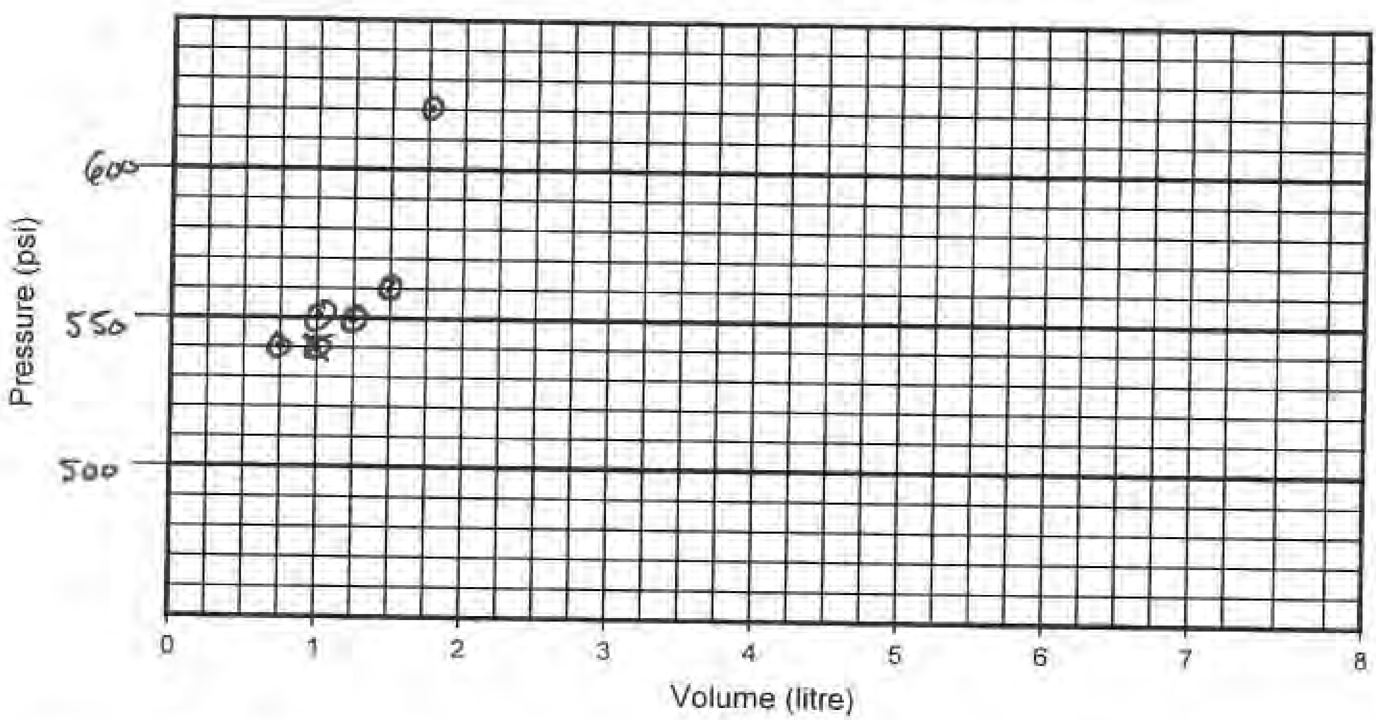
Packer No. 6, comp 20 SN# 19216 Depth (m): 70.7 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 620 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 38.4 (m) = 55 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 135 psi

Volume, litres	0.75	1.0	1.25	1.5	1.75	/	1.4			
Pressure, psi	540	550	550	560	620	/	ø			
Volume, litres										
Pressure, psi										



Comments: In HQ surface casing Time - 6:16 pm

APPENDIX E: MONITORING WELL: BH10-WB

As-Built Key Components Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 1 page
Summary Completion Log	- 2 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (May 24)	- 1 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (May 24)	- 1 page
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 5 pages
Westbay System Packer Inflation Records	- 5 pages

Table 4: BH10-WB As-Built Packer and Port Summary

AB, 01/06/2015

Port No.	Zone	Measurement Port Depth, (m)	Pumping Port Depth, (m)	Depth to top of Packer, (m)	Top of Zone (m)	Bottom of Zone (m)	Comments
1	1	61.0		59.5	60.8	65.7	
2	QA 1	32.0		30.5	31.8	59.9	
3	2	25.9		24.4	25.7	30.9	
4	QA 2	13.7		12.2	13.5	24.8	
5	QA 3	9.2	7.6	7.6	8.9	12.6	
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Note 1: All depth measurements in meters below datum (GS).
Note 2: All depth measurements use 'Nominal' tubing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All depth measurements to upper edge of Westbay System coupling item.

Table 5: BH10-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
28	20102			203				-1.07
27	20102			202				-0.59043
26	20105			202				0.019141
25	20110			202		216	2.1	1.5431
24	20110			202				4.5909
23	238	Packer	19225	224	8712			7.6388
22	20110	Measurement Port		205	8456			9.1627
21	238	Packer	19224	202				12.211
20	20105	Measurement Port		205	8458			13.734
19	20110			202				15.258
18	20110			202				18.306
17	20110			202				21.354
16	238	Packer	19201	202				24.402
15	20110	Measurement Port		205	8457	216	26.5	25.926
14	20105			202				28.974
13	238	Packer	19208	202				30.498
12	20110	Measurement Port		205	8459			32.022
11	20110			202				35.069
10	20110			202				38.117
9	20110			202				41.165
8	20110			202				44.213
7	20110			202				47.261
6	20110			202				50.309
5	20110			202				53.357
4	20110			202				56.404
3	238	Packer	19205	202				59.452
2	20105	Measurement Port		205	8478	216	61.6	60.976
1	20110			202				62.5
0	203			202				65.548

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

- (2) 0203 - MP38 End Cap
- (3) 020102 - MP38 Casing 3 (2F/0.6M)
- (4) 020105 - MP38 Casing 2 (5F/1.5M)
- (17) 020110 - MP38 Casing 1 (10F/3M)
- (5) 0238 - MP38 Packer - 74mm (5F/1.5M)
- (22) 0202 - MP38 Regular Coupling
- (1) 0224 - MP38 Pumping Port
- (5) 0205 - MP38 Measurement Port
- (3) 0216 - Magnetic Location Collar

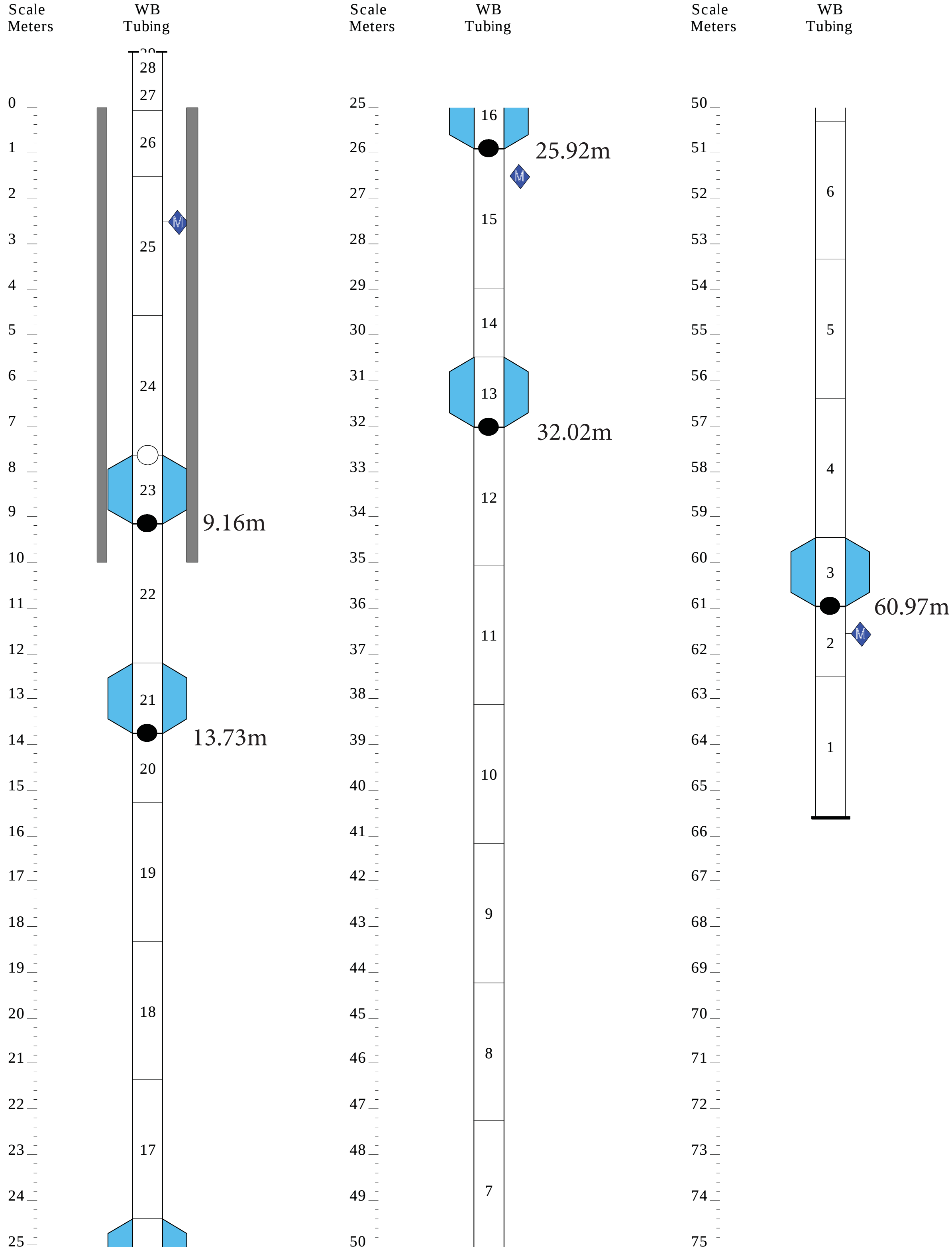
Geology

Backfill/Casing

Mild Steel

Summary Completion Log
LORAX

Job No: WB950
Well: BH10-WB



Westbay Piezometric Pressures/Levels

Pre-Inflation Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH-10
Datum: —
Elev. G.S.: —
Height of Westbay above G.S.: —
Elev. top of Westbay Casing: —
Reference Elevation: —
Borehole angle: —

Probe Type: EMS
Serial No.: 2499
Probe Range: 250
Westbay Casing Type: MP38
Sampler Valve Position: C

Date: May 24, 2015
Client: ZORAX
Job No.: 950
Location: Callie Creek
Weather: Sunny Warm
Operator: AB

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure ______ Temp ______ Time ______ Finish: ______

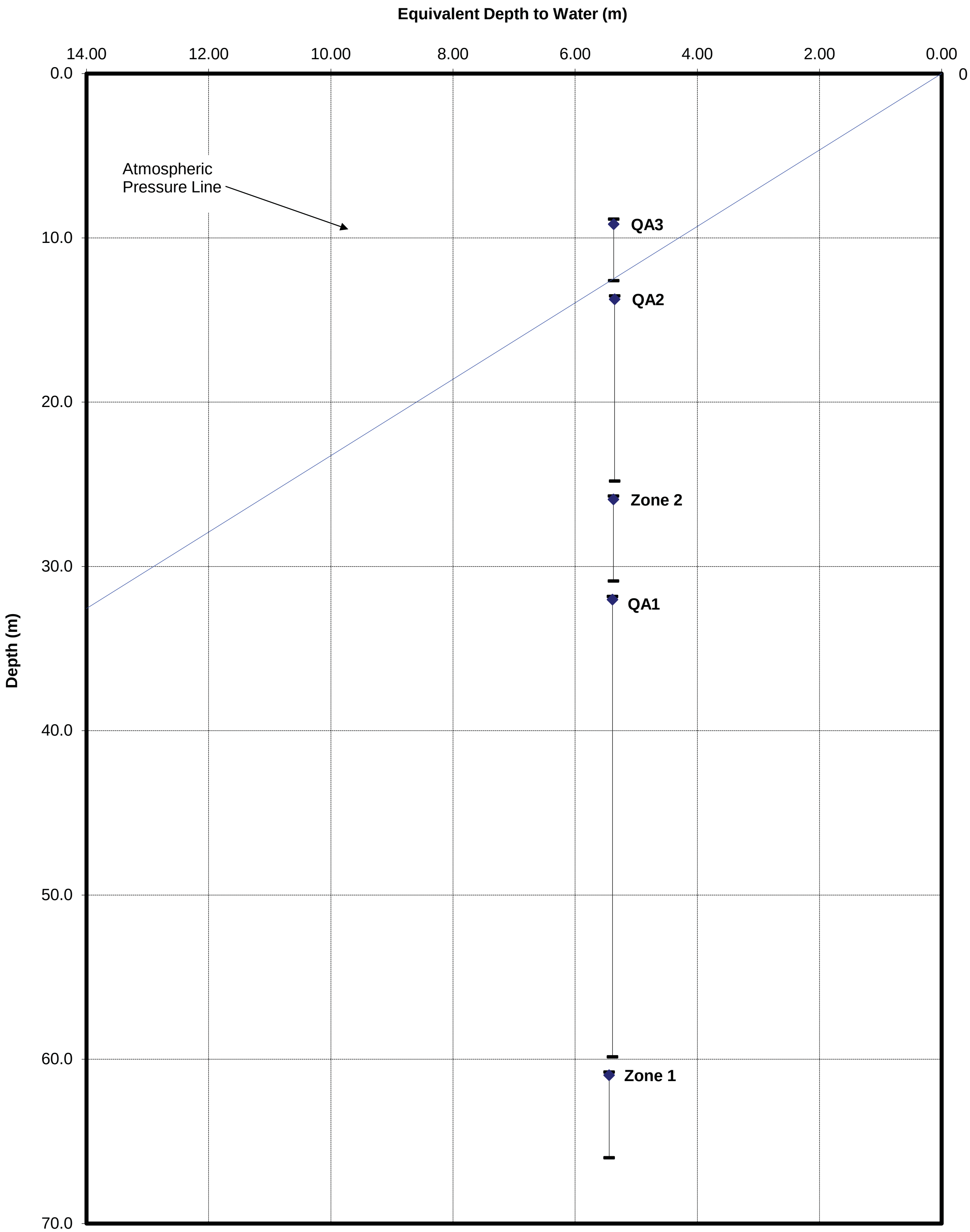
P_{atm} 13.46 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
1	61	61.2		74.53	92.42	11:38	4.24	74.54	55.51	5.4	
2	32.5	32.3		32.41	51.33	11:42	2.24	32.42	26.63	5.8	
3	26.5	26.2		23.54	47.68	11:45	1.62	23.54	20.54	5.9	
4	14.5	13.7		13.48	25.37	11:50	1.33	13.48	8.37	6.12	
5	10.0	9.1		13.47	18.85	11:53	1.26	13.48	3.79	6.20	

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH10-WB

Profile Date: May 24, 2015
Comments: Pre-Inflation Profile



Client: LORAX Environmental Ltd.
Site: Coffee Creek
Datum: Ground Surface

Figure 3

Plot By:____Date:____
Checked By:____Date:____
Westbay Project: WB950

Westbay Piezometric Pressures/Levels

Post-deflation

Field Data and Calculation Sheet

Well No.: BH-10
Datum: –
Elev. G.S.: –
Height of Westbay above G.S.: –
Elev. top of Westbay Casing: –
Reference Elevation: –
Borehole angle: –

Probe Type: EMS
Serial No.: 2499
Probe Range: 250
Westbay Casing Type: [illegible]38
Sampler Valve Position: C

Date:
Client: LORAX
Job No.: 950
Location: [illegible]
Weather:
Operator: [illegible]

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure ______ Temp ______ Time ______
Finish: 13.46

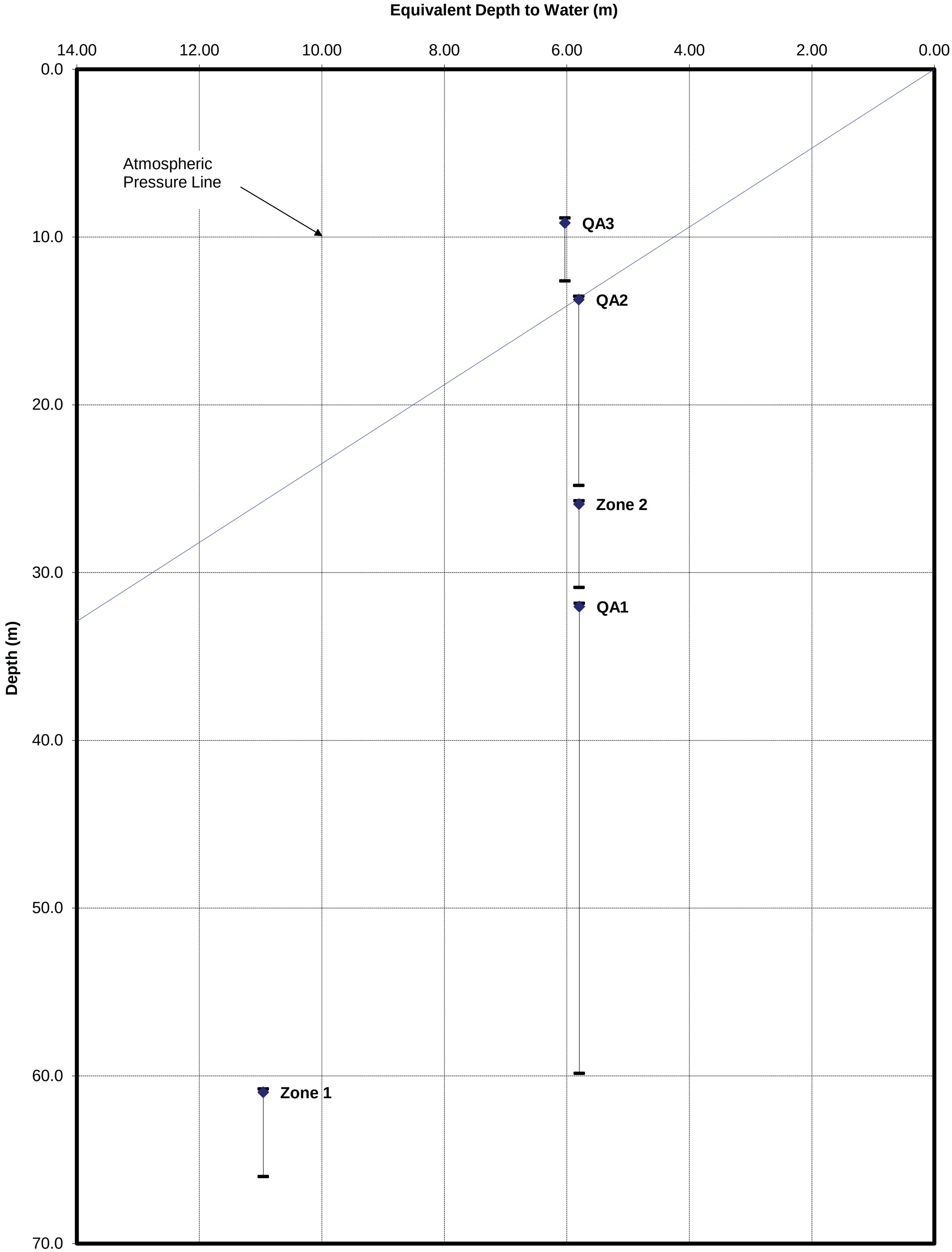
P_{atm} 13.46 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
1	60.97	61.1		75.19	85.74	13:50	5.60	75.20	50.82	10.14	
2	32.0	32.1		33.08	51.91	13:54	2.77	33.09	27.03	4.96	
3	25.92	26.1		24.20	49.23	13:56	2.37	24.20	20.93	4.99	
4	13.73	13.8		13.46	25.89	13:59	2.26	13.48	8.74	4.98	
5	9.16	9.2		13.44	17.07	14:01	2.17	13.49	3.94	5.21	

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH10-WB

Profile Date: May 24, 2015
Comments: Post-Inflation Profile



Client: LORAX Environmental Ltd.
Site: Coffee Creek
Datum: Ground Surface

Figure 4

Plot By:____Date:______
Checked By:____Date:_____
Westbay Project:WB950

Westbay System Completion Log

Company: LORAX
Well: BH-10
Site: Coffee Creek
Project: —

WB #: 950
Author: AB

Well Information

Reference Datum: 65 ft.
Elevation of Datum: — ft.
WB Tubing Top: ______ ft.
WB Tubing Length: 85 ft.

Borehole Depth: 202 ft.
Borehole Inclination:
Borehole Diameter: 4.5 in.

Well Description:

Other References:

File Information

File Name: ______
Report Date: ______

File Date: ______

Comments

Installation sign-off Information

Borehole condition confirmed.(Client)	(method) Gaivo	Date: 24/05/2015
WB System design & preparation.(Client / WB)	By: AB	Date: 24/05/2015
WB System design checked. (Client / WB)	By: AB	Date: 24/05/2015
WB System and borehole approved to install. (Client)	By: [signature]	Date: 24/05/2015

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

Qty	Component
(2)	0203 - MP38 End Cap
(3)	020102 - MP38 Casing 3 (2F/0.6M)
(4)	020105 - MP38 Casing 2 (5F/1.5M)
(17)	020110 - MP38 Casing 1 (10F/3M)
(5)	0238 - MP38 Packer - 74mm (5F/1.5M)
(22)	0202 - MP38 Regular Coupling
(1)	0224 - MP38 Pumping Port
(5)	0205 - MP38 Measurement Port
(3)	0216 - Magnetic Location Collar

Geology

Backfill/Casing

Mild Steel

Westbay Instruments

Westbay System Completion Log

Sheet 1 of 3

Project: Loray

WB#: 950

Location: Coffee Creek

Hole No.: BH-10

Installed by: AB

Hole Depth: 65.8m

WB Depth: 65.6m

Hole Diameter: 4.5"

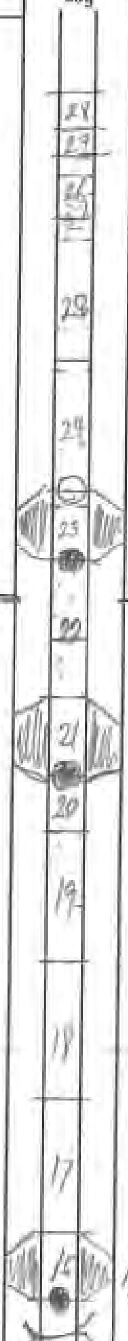
Date Installed: 24/5/2015

Measurement Datum: GS

Datum Elevation: —

Date Drawn: —

Scale, (m/ft)	Component Description	Depth Log	WB Tubing Log	Serial No.	Final Packer Pressure/Volume	Comments	Joint Install	Joint Test
	2							
	2						✓	✓
0	5						✓	✓
10	10							
20	10						✓	✓
	224			8712			✓	✓
	238			19225				
30	205			8456			✓	✓
	10							
40							✓	✓
	238			19224			✓	✓
	205			8458				
50	5							
	10							
60							✓	✓
	10							
70							✓	✓
	10							
80							✓	✓
	238			19201				
	205			8457			✓	✓
90								



WB Tubing | WB Packer | Magnetic Collar | Filter Sleeve | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments

Westbay System Completion Log

Sheet 2 of 3

Project: Lorax WB#: 950

Location: Coffee Creek Hole No.: BH-10 Installed by: AB

Hole Depth: 65.8m WB Depth: 65.6m Hole Diameter: 4.5" Date Installed: 24/05/2015

Measurement Datum: GS Datum Elevation: — Date Drawn:

Scale (m/ft)	Component Description	Depth Log	WB Tubing Log	Serial No.	Final Packer Pressure/Volume	Comments	Joint Install	Joint Test
90	10		15				/	/
	5		14				/	/
100	238 205		13	19208 8459			/	/
110	10		12				/	/
120	10		11				/	/
130	10		10				/	/
140	10		9				/	/
150	10		8				/	/
160	10		7				/	/
170	10		6				/	/
180	10		5				/	/
190			4					

Legend: WB Tubing; WB Packer; Magnetic Collar; Filter Sleeve; Measurement Port Coupling; Pumping Port Coupling; Regular Coupling

Westbay Instruments

Westbay System Completion Log

Sheet 3 of 3

Project: Lorax

WB#.: 950

Location: Coffee Creek

Hole No.: BH-10

Installed by: AB

Hole Depth: 65.8m

WB Depth: 65.6m

Hole Diameter: 4.5"

Date Installed: 24/5/2015

Measurement Datum: GS

Datum Elevation: —

Date Drawn: —

Scale, (m/ft)	Component Description	Depth Log	WB Tubing Log	Serial No.	Final Packer Pressure/Volume	Comments	Joint Install	Joint Test
	5		4				/	/
200	238 205		3	19205 8478			/	/
	5		2				/	/
210	10		1					
							/	/
220								
230								
240								
250								

WB Tubing | WB Packer | Magnetic Collar | Filter Sleeve | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments

Sheet____of____

Westbay Packer Inflation Record

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-10

Location: Coffee Creek, Kaminak Gold Project Completed by: AB Date Inflated: 24/05/2015

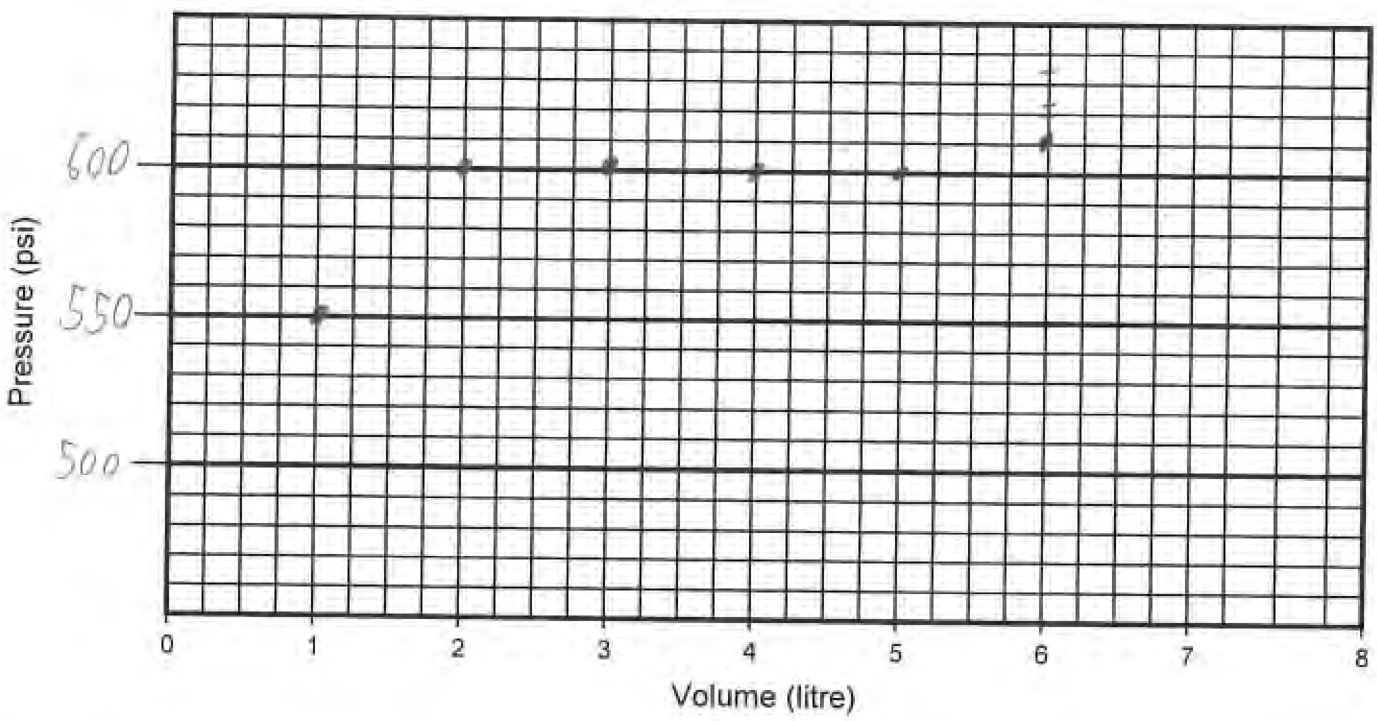
Packer No. 1 19205 Depth (m): — Inflation Tool No.: ______

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 625 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 3 (m) = 4.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 131 psi

Volume, litres	1	2	3	4	5	6	/	5.6		
Pressure, psi	550	600	600	600	600	625	/	[illegible]		
Volume, litres										
Pressure, psi										



Comments: ______ Time - 12:15

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-10

Location: Coffee Creek, Kaminak Gold Project Completed by: AB Date Inflated: 24/05/2015

Packer No. 2 19208 Depth (m): — Inflation Tool No.: —

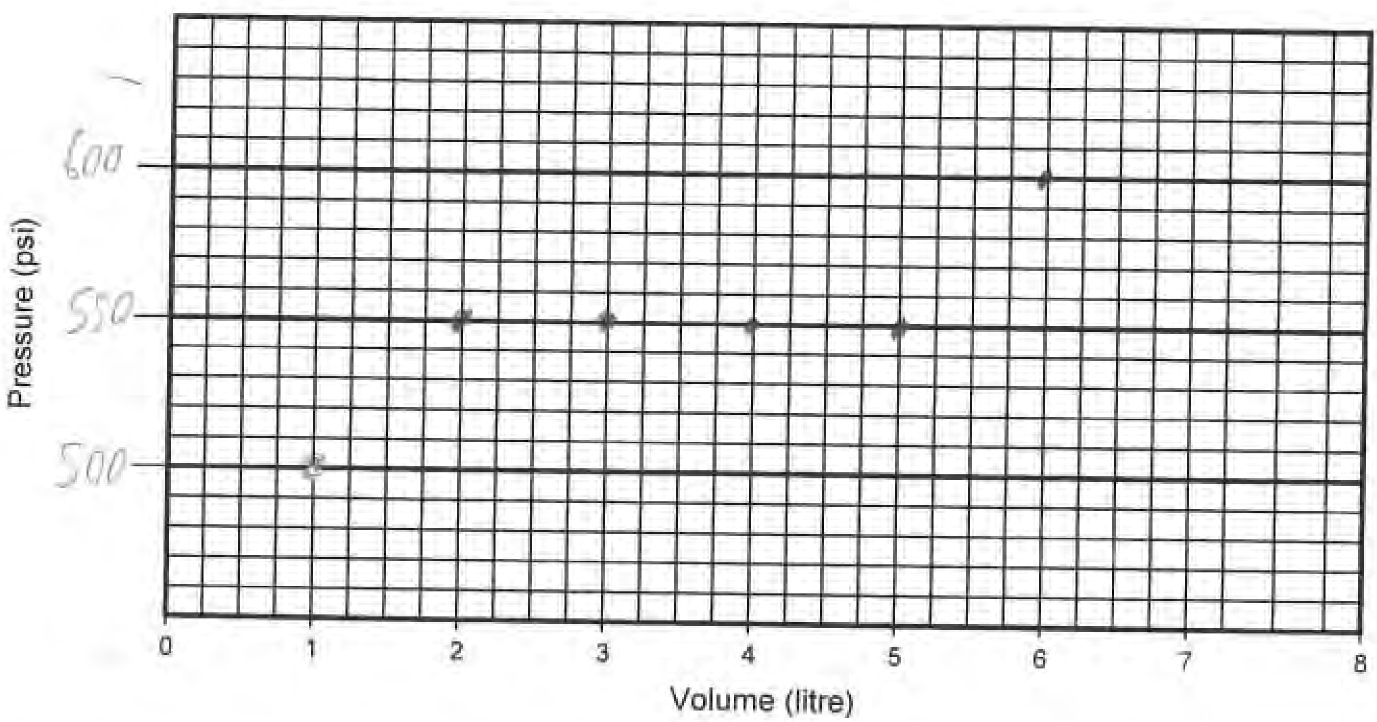
Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 800 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 8 (m) = 11.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 121 psi

Volume, litres	1	2	3	4	5	6	/	5.6		
Pressure, psi	500	550	550	550	550	600	/	0		

Volume, litres										
Pressure, psi										



Comments: Time - 12:35

Westbay Instruments

Sheet____of____

Westbay Packer Inflation Record

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-10

Location: Coffee Creek, Kaminak Gold Project Completed by: AB Date Inflated: 24/05/2015

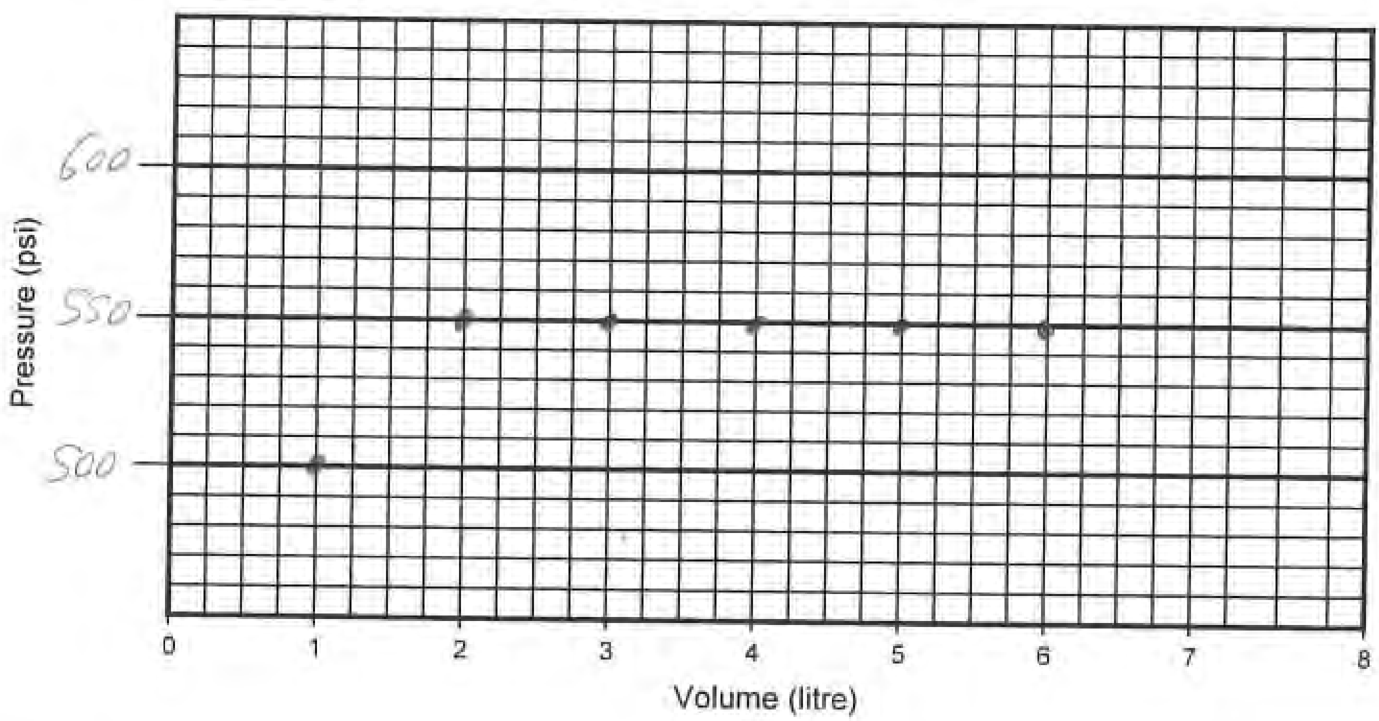
Packer No. 3 19201 Depth (m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 575 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 8 (m) = 11 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 86 psi

Volume, litres	1	2	3	4	5	6	6.25	/	5.8	
Pressure, psi	500	550	550	550	550	550	575	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Time - 12:51

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH-10

Location: Coffee Creek, Kaminak Gold Project Completed by: AB Date Inflated: 24/05/2015

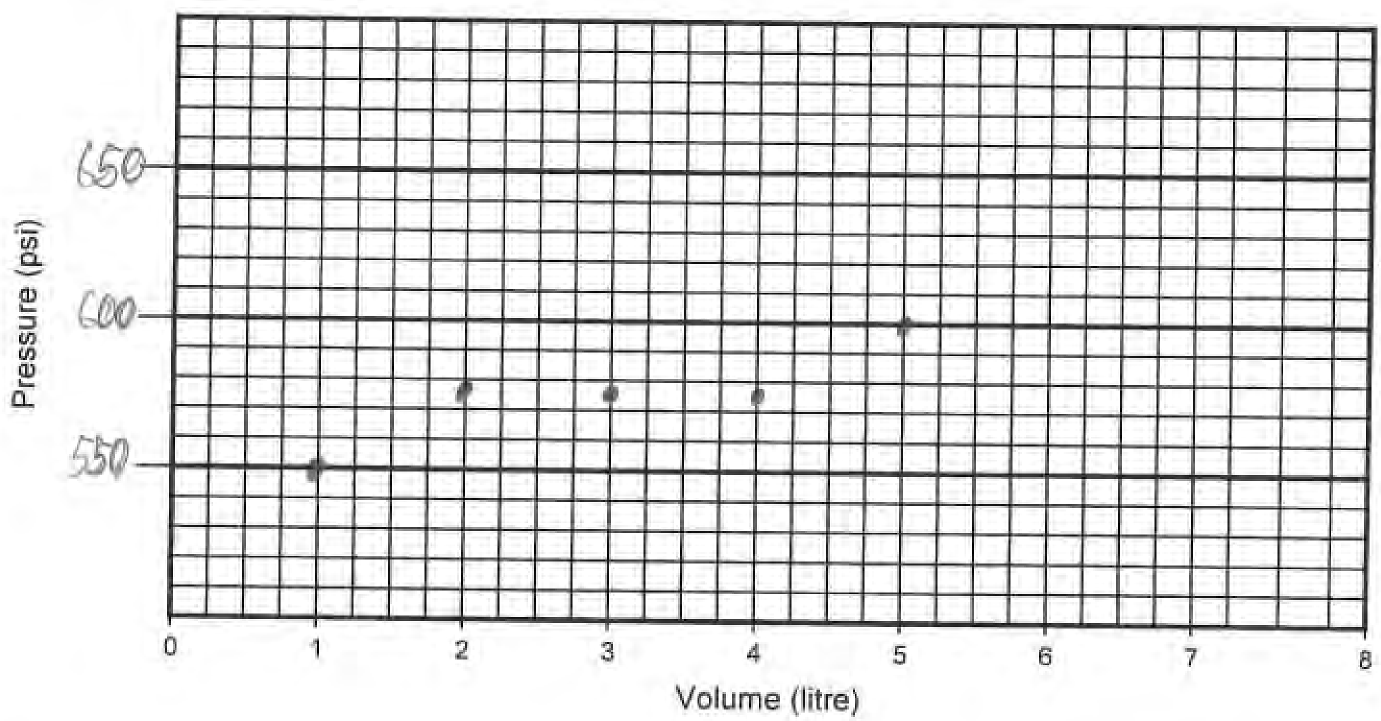
Packer No. 4 19224 Depth (m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 610 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 8 (m) = 11.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 116 psi

Volume, litres	1	2	3	4	5	5.25	/	4.P		
Pressure, psi	550	575	575	575	600	610	/	Ø		
Volume, litres										
Pressure, psi										



Comments: Time - 13:05

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: Coffee Creek   Project No.: WB950   Well No.: BH-10

Location: Coffee Creek   Completed by: AB   Date Inflated: 24/05/2015

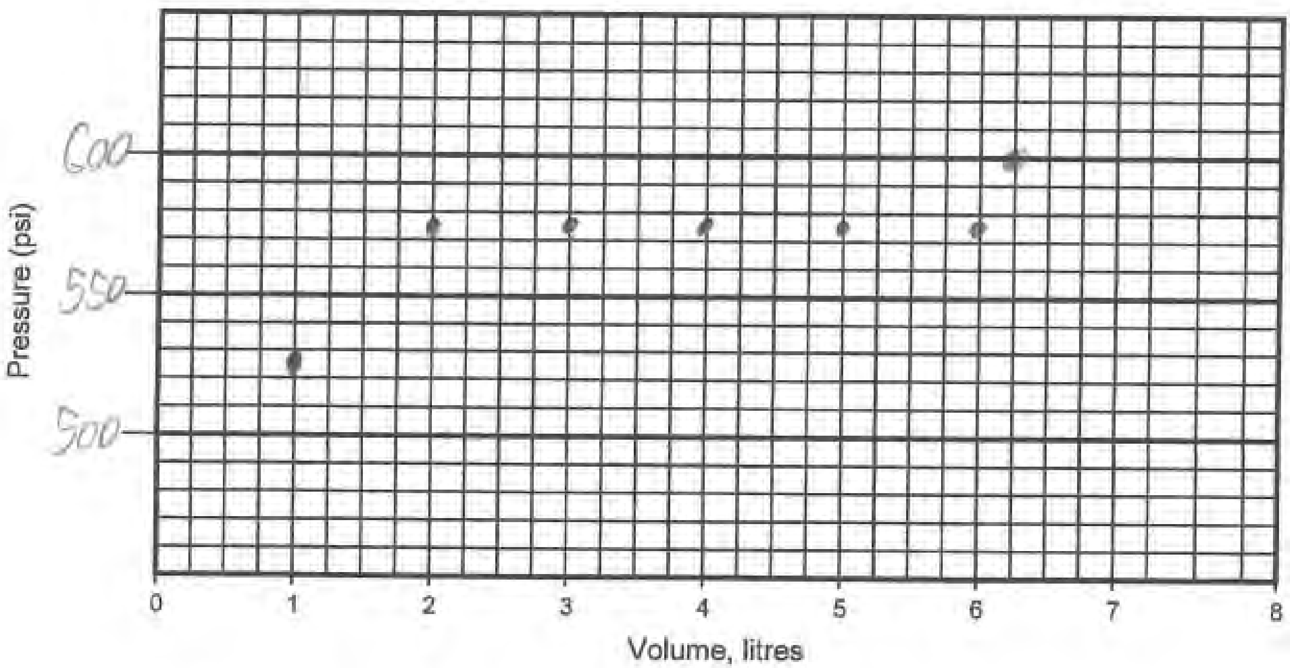
Packer No. 19225   Depth (ft / m): —   Inflation Tool No.: —

Packer Valve Pressure, P_V: 145 psi   Final Line Pressure, P_L: 600 psi   Tool Pressure, P_T: 350 psi

Borehole Water Level: 8 (ft / m) = 11.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 115 psi

Volume, litres	1	2	3	4	5	6	6.25	/	5.8	
Pressure, psi	525	575	575	575	575	575	600	/	Ø	
Volume, litres										
Pressure, psi										



Comments: 5" Surface Casing   Time - 13:22

APPENDIX F: MONITORING WELL: BH12-WB

Table 4: BH12-WB As-Built Packer and Port Summary

AB, 01/06/2015

Port No.	Zone	Measurement Port Depth, (m)	Pumping Port Depth, (m)	Depth to top of Packer, (m)	Top of Zone (m)	Bottom of Zone (m)	Comments
1		97.799		96.275	97.6	99.7	
2		94.142		92.618	93.9	96.7	
3		88.046		86.522	87.8	93.0	
4		81.95		80.426	81.7	86.9	
5		51.472		49.948	51.2	80.8	
6		46.9		45.376	46.7	50.3	
7		36.233		34.709	36.0	45.8	
8		31.661	30.137	30.137	31.4	35.1	
9							
10							
11							
12							
13							
14							
15							

Note 1: All depth measurements in meters below datum (GS).
Note 2: All depth measurements use 'Nominal' tubing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All depth measurements to upper edge of Westbay System coupling item.

Table 5: BH12-WB As-Built Summary

AB ,01/06/2015

Item No.	Component P/N	Component Description	Component S/N	Coupling P/N	Coupling S/N	Accessory P/N	Accessory Depth (m)	Final Position (m)
42	203							-0.99912
41	20102			202				-0.95126
40	20110			202				-0.34169
39	20110			202		216	3.3	2.7062
38	20110			202				5.754
37	20110			202				8.8019
36	20110			202				11.85
35	20110			202				14.898
34	20110			202				17.945
33	20110			202				20.993
32	20110			202				24.041
31	20110			202				27.089
30	238	Packer	19237	224	8714			30.137
29	20110	Measurement Port		205	8450			31.661
28	238	Packer	19234	202				34.709
27	20110	Measurement Port		205	8454			36.233
26	20110			202				39.28
25	20110			202				42.328
24	238	Packer	19236	202				45.376
23	20110	Measurement Port		205	8455	216	47.5	46.9
22	238	Packer	19233	202				49.948
21	20110	Measurement Port		205	8453			51.472
20	20105			202				54.52
19	20110			202				56.044
18	20110			202				59.091
17	20110			202				62.139
16	20110			202				65.187
15	20110			202				68.235
14	20110			202				71.283
13	20110			202				74.331
12	20110			202				77.379
11	238	Packer	19231	202				80.426
10	20105	Measurement Port		205	8445	216	82.6	81.95
9	20110			202				83.474
8	238	Packer	19232	202				86.522
7	20110	Measurement Port		205	8444			88.046
6	20105			202				91.094
5	238	Packer	19238	202				92.618
4	20105	Measurement Port		205	8447	216	94.7	94.142
3	20102			202				95.666
2	238	Packer	19235	202				96.275
1	20105	Measurement Port		205	8446			97.799
0	203							99.323

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

(2) 0203 - MP38 End Cap

(2) 020102 - MP38 Casing 3 (2F/0.6M)

(26) 020110 - MP38 Casing 1 (10F/3M)

(8) 0238 - MP38 Packer - 74mm (5F/1.5M)

(5) 020105 - MP38 Casing 2 (5F/1.5M)

(32) 0202 - MP38 Regular Coupling

(1) 0224 - MP38 Pumping Port

(8) 0205 - MP38 Measurement Port

(4) 0216 - Magnetic Location Collar

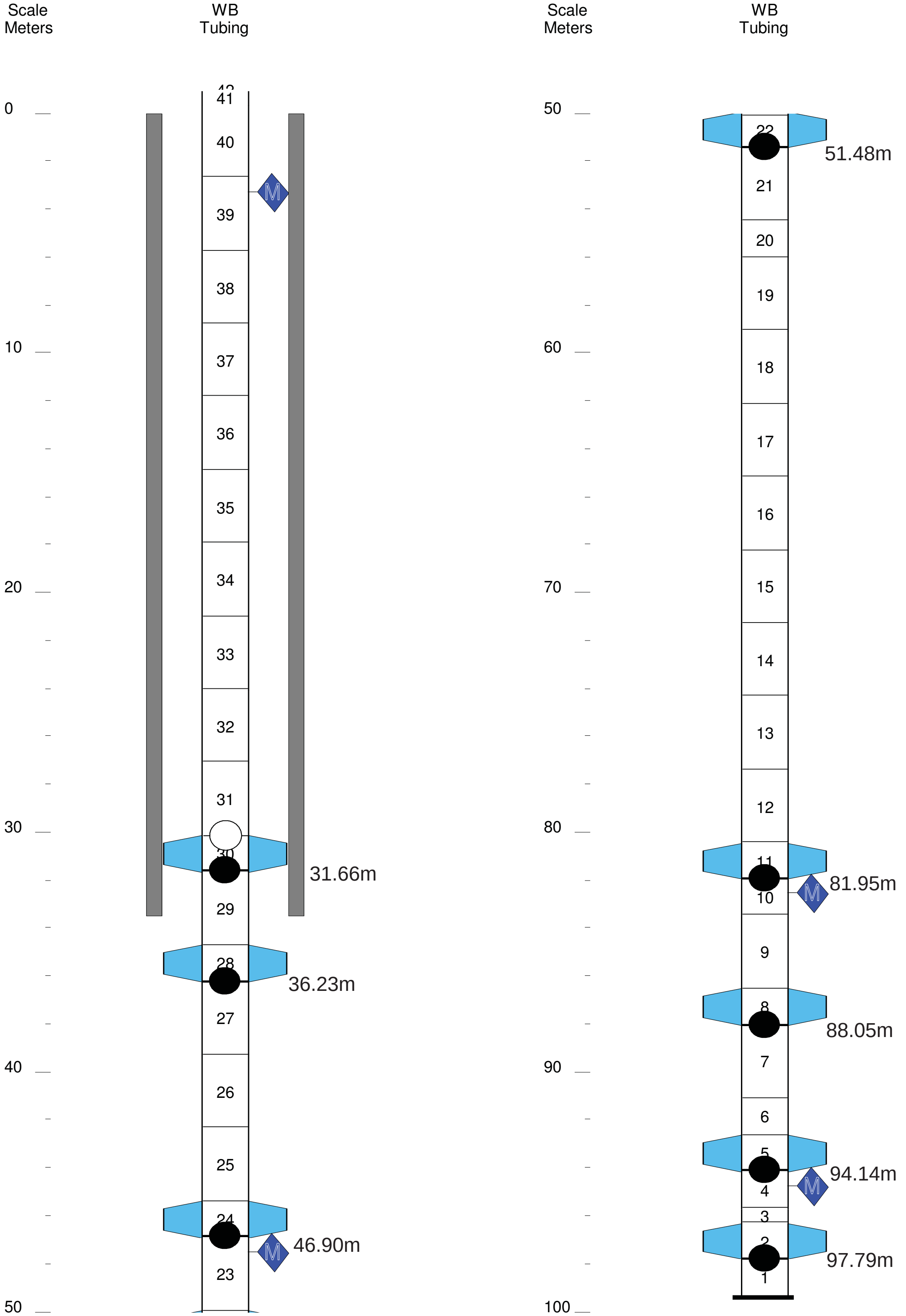
Geology

Backfill/Casing

Mild Steel

Summary Completion Log
LORAX

Job No: WB950
Well: BH12-WB



PRE - INFLATION

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Westbay Instruments

Well No.: BH12-WB
Datum: GS
Elev. G.S.: Ø
Height of Westbay above G.S.: 0.95m
Elev. top of Westbay Casing: Ø
Reference Elevation: Ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2499
Probe Range: 250 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May/12/15
Client: LORAX
Job No.: WB950
Location: Coffee
Weather: Night - cold - clear
Operator: M.L.

Ambient Reading (P_{atm}) (pressure, temperature, time)

	Start	Finish
Pressure	13.73 psi	13.74
Temp	~~2:47 am~~ 17.14°C	0.95
Time	2:47am	3:12 am

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 13.73 psi

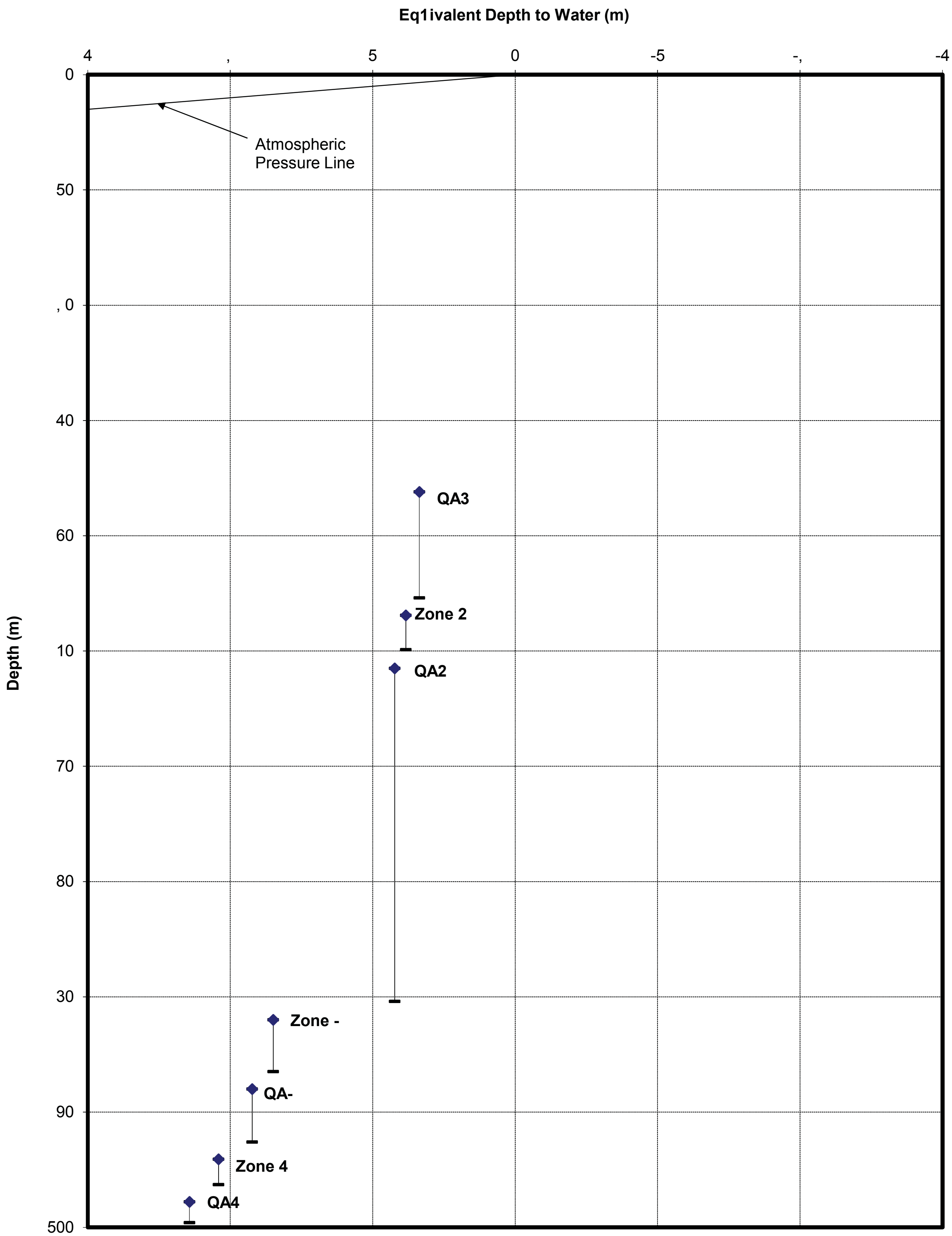
WB water level ~ 33m

Port No	Port Position From Log ~~ft~~ m	Port Position From Cable ~~ft~~ m	True Port Depth "Dp" ~~ft~~	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port ~~ft~~ m H = (P2-Patm)/w	Piez. Level Outside Port ~~ft~~ m Dz = Dp - H	Comments: Zones
1	97.8	98.0	–	105.95	149.55	2:59	2.89	105.95	95.5	2.3	QA1
2	94.1	94.3	–	100.87	144.58	3:00	2.62	100.88	92.0	2.1	Zone 1
3	88.0	88.2	–	92.37	136.24	3:02	2.25	92.37	86.2	1.8	QA2
4	82.0	82.2	–	83.85	127.92	3:03	2.03	83.85	80.3	1.7	Zone 2
5	51.5	51.6	–	40.67	85.76	3:05	1.69	40.68	50.6	0.8	QA3
6	46.9	47.0	–	34.10	79.33	3:06	1.46	34.10	46.1	0.8	Zone 3
7	36.2	36.3	–	18.66	64.25	3:07	1.25	18.66	35.5	0.7	QA4
8	31.7	31.8	–	13.95	57.90	3:09	1.13	13.82	31.0	0.7	QA5

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH4- FWB

Profile Date: May 5, 2, 051
Comments: Pre-Inflation Profile



Client: LORAX
Site: Coffee Creek
Datum: GS

uig1re 2

Plot By:____Date:____
Checked By:____Date:____
Westbay Project: WB910

POST INFLATION

Westbay Instruments

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: BH12-WB
Datum: GS
Elev. G.S.: ø
Height of Westbay above G.S.: 0.
Elev. top of Westbay Casing: ø
Reference Elevation: ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2499
Probe Range: 250 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: May 14/15
Client: LORAX
Job No.: WB 950
Location: Coffee
Weather: Warm-Clear
Operator: M.L.

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 13.66 psi

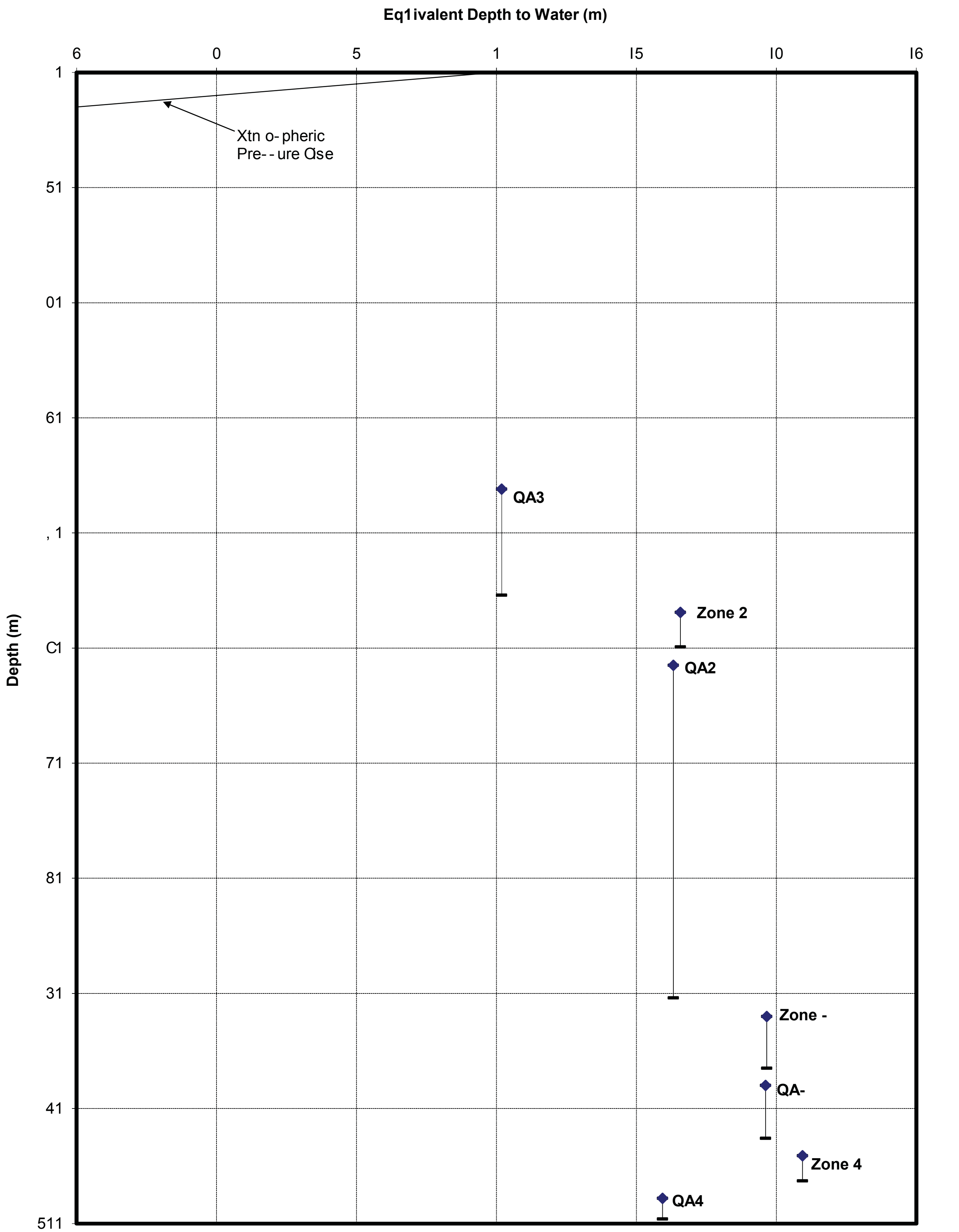
Ambient Reading (P_{atm}) (pressure, temperature, time)
Start: Pressure 13.66 psi; Temp 22.36 °C; Time 1:36 pm
Finish: 13.65 psi; 1.43 °C; 1:58 pm

Port No.	Port Position From Log ~~ft~~ m	Port Position From Cable ~~ft~~ m	True Port Depth "Dp" ~~ft~~	Field Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp (°C)	Inside Casing (P1)	Pressure Head Outside Port ~~ft~~ m H = (P2-Patm)/w	Piez. Level Outside Port ~~ft~~ m Dz = Dp - H	Comments
											Zones
1	97.8	98.0	-	135.19	154.42	1:40	10.51	135.21	99.0	-1.2	QA1
2	94.1	94.3	-	130.13	150.58	1:44	5.30	130.14	96.3	-2.2	Zone1
3	88.0	88.2	-	121.60	141.53	1:46	4.13	121.61	89.9	-1.9	QA2
4	82.0	82.1	-	113.05	133.01	1:48	3.23	113.06	83.9	-1.9	Zone2
5	51.5	51.6	-	69.74	88.69	1:50	2.62	69.76	52.8	-1.3	QA3
6	46.9	47.0	-	63.16	82.22	1:51	2.03	63.16	48.2	-1.3	Zone3
7	36.2	36.3	-	47.66	65.19	1:53	1.63	47.66	36.2	0.0	QA4
8	31.7	31.8	-	41.01	57.09	1:55	1.27	41.02	30.5	1.2	QA5

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: BH4- RWB

Profile Date: May 5, 2015C
mon n est-: Po-tIlsflatios Profile



mliest: CRAXS
kite: moffee
Datun : Gk

uig1re 3

Plot By:____Date:______
mhecdeWBy:____Date:_____
b e-tj ay Pro9ect: b B4C1

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)

(2) 0203 - MP38 End Cap

(2) 020102 - MP38 Casing 3 (2F/0.6M)

(26) 020110 - MP38 Casing 1 (10F/3M)

(8) 0238 - MP38 Packer - 74mm (5F/1.5M)

(5) 020105 - MP38 Casing 2 (5F/1.5M)

(32) 0202 - MP38 Regular Coupling

(1) 0224 - MP38 Pumping Port

(8) 0205 - MP38 Measurement Port

(4) 0216 - Magnetic Location Collar

Geology

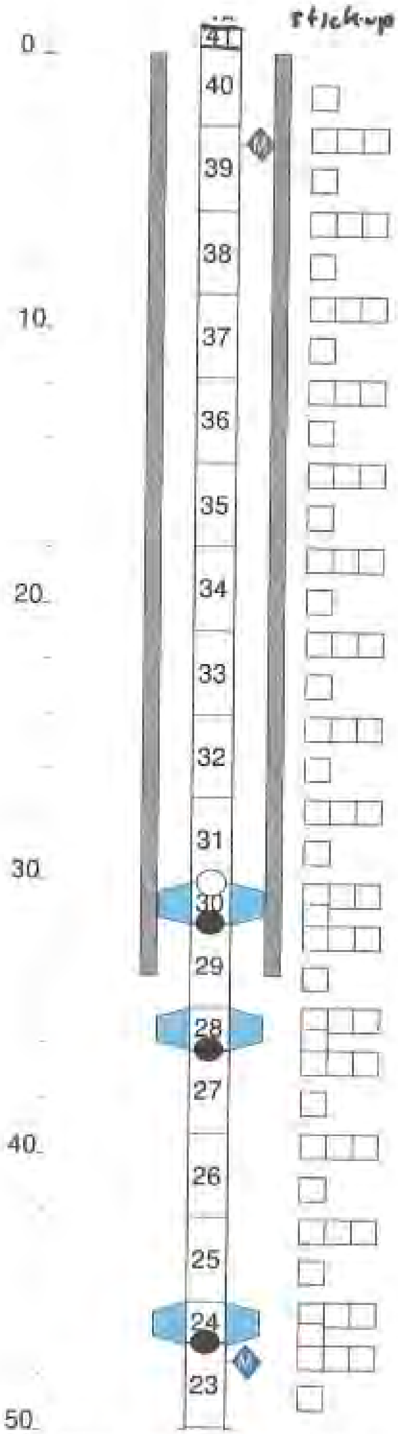
Backfill/Casing

Mild Steel

Westbay Completion Log
LORAX

Job No: WB950
Well: BH12-WB

stickup 0.95m from zero (GS)



WB Tubing	WB Tubing Description	Serial Numbers
41		
40	020110 - MP38 Casing 1 (10F/3M)	
39	020110 - MP38 Casing 1 (10F/3M)	
38	020110 - MP38 Casing 1 (10F/3M)	
37	020110 - MP38 Casing 1 (10F/3M)	
36	020110 - MP38 Casing 1 (10F/3M)	
35	020110 - MP38 Casing 1 (10F/3M)	
34	020110 - MP38 Casing 1 (10F/3M)	
33	020110 - MP38 Casing 1 (10F/3M)	
32	020110 - MP38 Casing 1 (10F/3M)	
31	020110 - MP38 Casing 1 (10F/3M)	8714
30	0224 - MP38 Pumping Port 0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19237-140psi 8450
29	020110 - MP38 Casing 1 (10F/3M)	
28	0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19234-140psi 8454
27	020110 - MP38 Casing 1 (10F/3M)	
26	020110 - MP38 Casing 1 (10F/3M)	
25	020110 - MP38 Casing 1 (10F/3M)	
24	0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19236-145psi 8455
23	020110 - MP38 Casing 1 (10F/3M)	

Finish lowering at 2:15am on May 12, 2015.

Hydraulic Integrity Test

34.306 m at 3:22 am
34.304 m at 3:30 am
34.304 m at 3:40 am
34.304 m at 3:55 am
34.304 m at 4:00 am

westbay Casing is water tight.

[illegible]

Westbay Completion Log
LORAX

Job No: WB950
Well: BH12-WB

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
50				
	22		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19233 - 145 psi 8453
	21		020110 - MP38 Casing 1 (10F/3M)	
	20		020105 - MP38 Casing 2 (5F/1.5M)	
	19		020110 - MP38 Casing 1 (10F/3M)	
60				
	18		020110 - MP38 Casing 1 (10F/3M)	
	17		020110 - MP38 Casing 1 (10F/3M)	
	16		020110 - MP38 Casing 1 (10F/3M)	
70	15		020110 - MP38 Casing 1 (10F/3M)	12:35 am
	14		020110 - MP38 Casing 1 (10F/3M)	
	13		020110 - MP38 Casing 1 (10F/3M)	
80	12		020110 - MP38 Casing 1 (10F/3M)	
	11		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19231 - 150 psi 8445
	10		020105 - MP38 Casing 2 (5F/1.5M)	
	9		020110 - MP38 Casing 1 (10F/3M)	
	8		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19232 - 140 psi 8444
90	7		020110 - MP38 Casing 1 (10F/3M)	
	6		020105 - MP38 Casing 2 (5F/1.5M)	
	5		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19238 - 145 psi 8447
	4		020105 - MP38 Casing 2 (5F/1.5M)	
	3		020102 - MP38 Casing 3 (2F/0.6M)	
	2		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19235 - 150 psi 8446
100	1		020105 - MP38 Casing 2 (5F/1.5M) 0203 - MP38 End Cap	

Pre-Inflation Profile May 12/15
- measure mnts recorded, calculations completed
- confirm M-port position and function

Tue May 12 21:52:28 2015

Start lowering at 11:50pm on May 11, 2015.

Borehole water level: 1.61 m below surface casing.

Joint test tool: 200 psi

Inflation tool on May 12/15: 400 psi

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by Name REDACTED Date Inflated: May 14/15

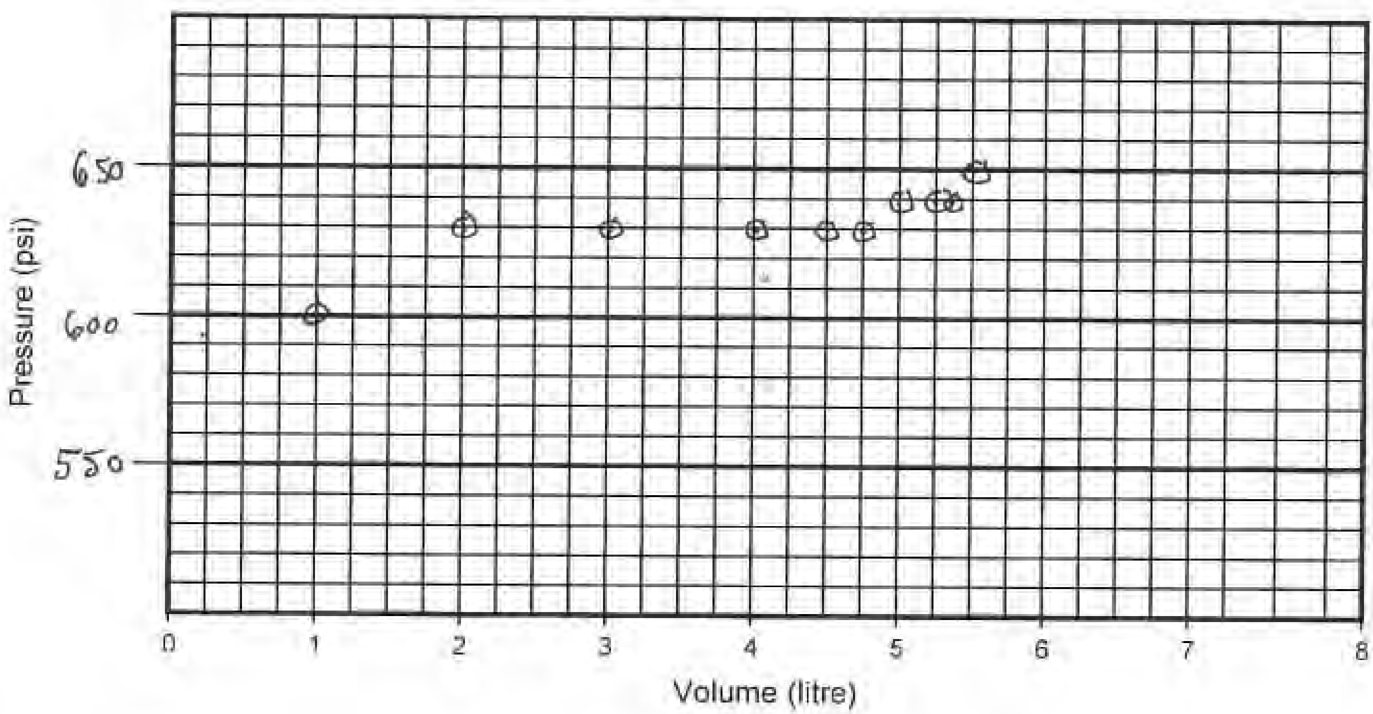
Packer No. 1, comp 2 SN# 19235 Depth (m): ______ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 100 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.35	5.5
Pressure, psi	600	630	630	630	630	630	640	640	640	650
Volume, litres	/	5.0								
Pressure, psi	/	0								



Comments: ______ Time - 10:35 am

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by Name REDACTED Date Inflated: May 14/15

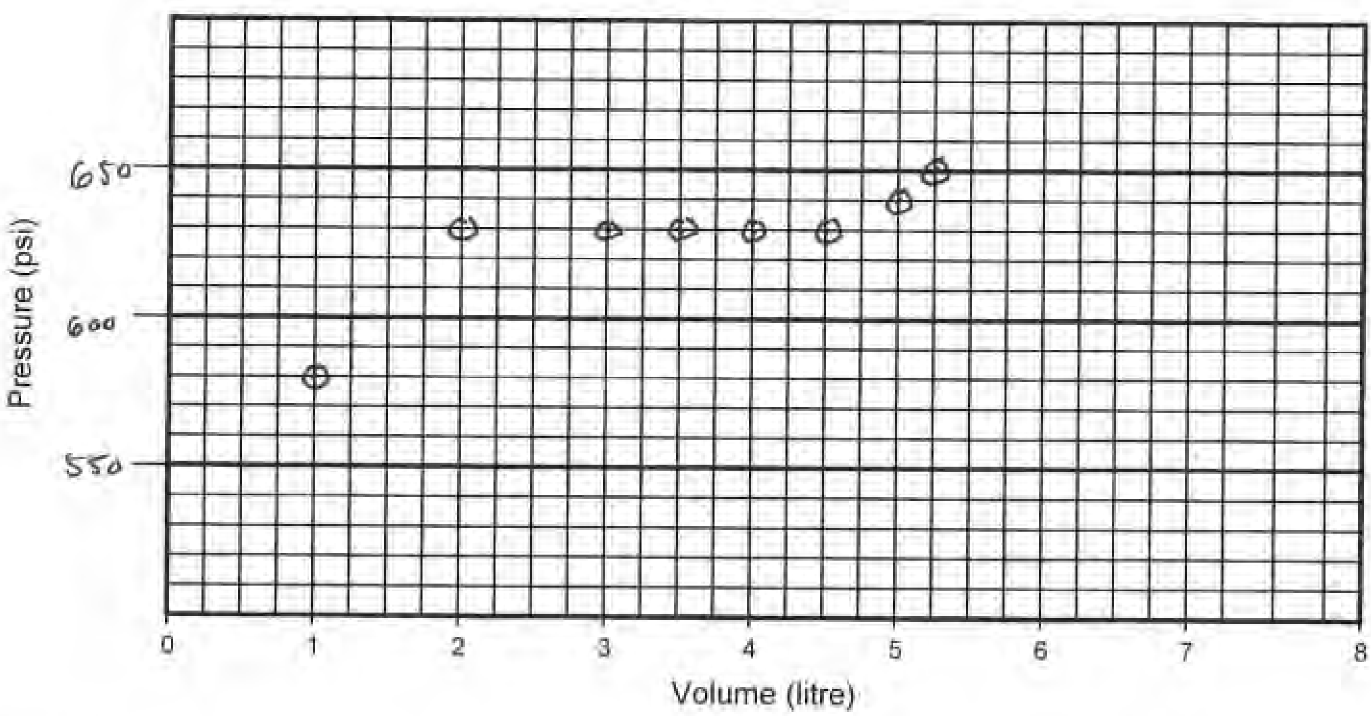
Packer No. 2, comp 5 SN# 19238 Depth (m): ________ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 105 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.5	5.0	5.25	/	4.75
Pressure, psi	580	630	630	630	630	630	640	650	/	Ø
Volume, litres										
Pressure, psi										



Comments: ______________________ Time - 10:55 am

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May/14/15

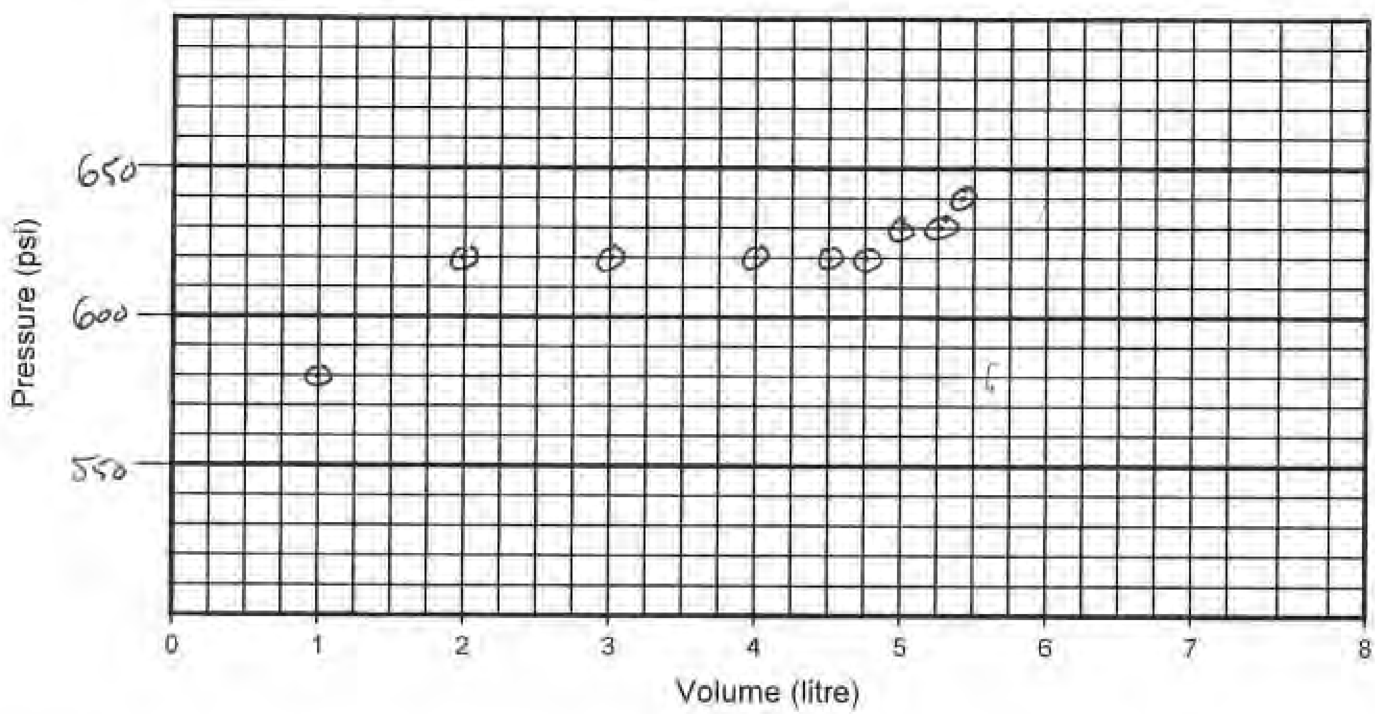
Packer No. 3, comp 8 SN# 19232 Depth (m): ____ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 640 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 100 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.4	/
Pressure, psi	580	620	620	620	620	620	630	630	640	/
Volume, litres	5.0									
Pressure, psi	Ø									



Comments: Time - 11:27 am

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 14/15

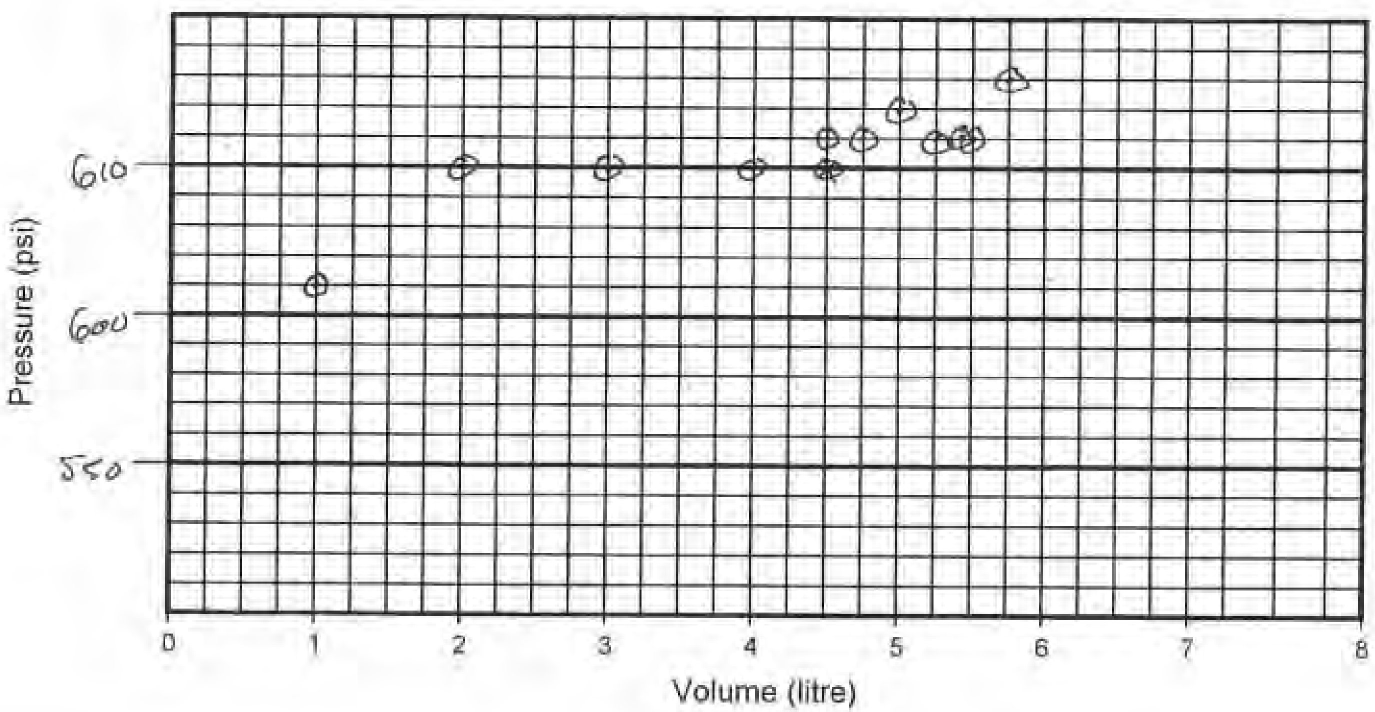
Packer No. 4, comp 11 SN# 19231 Depth (m): ____ Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: ____ psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 130 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.4	5.5
Pressure, psi	610	650	650	650	660	660	670	660	660	660
Volume, litres	5.75	—	5.25							
Pressure, psi	680	/	Ø							



Comments: Time - 12:00 pm

Sheet ___ of ___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed b Name REDACTED te Inflated: May/14/15

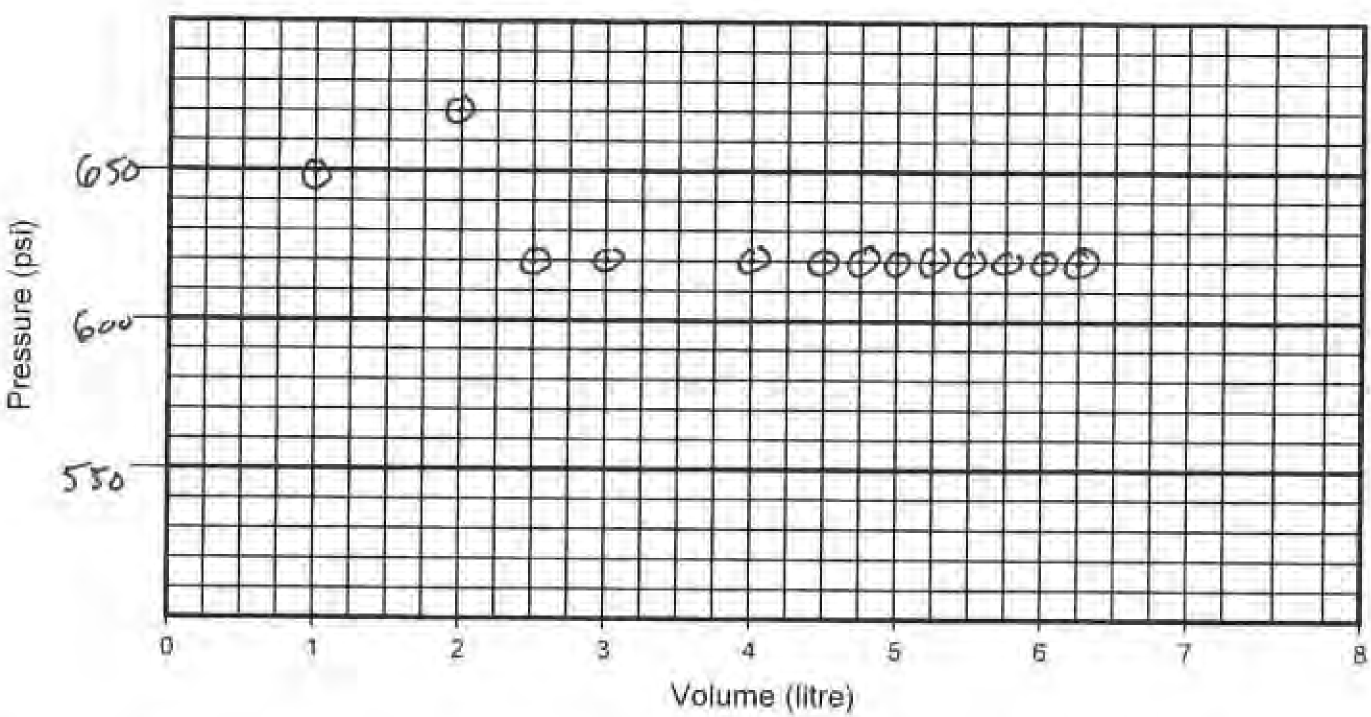
Packer No.: 5, comp# 22 SN# 19233 Depth (m): ________ ...lation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 620 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 75 psi

Volume, litres	1.0	2.0	/	1.5	/	2.5	3.0	4.0	4.5	4.75
Pressure, psi	650	670	/	ϕ	/	620	620	620	620	620
Volume, litres	5.0	5.25	5.5	5.75	6.0	6.25	/	5.75		
Pressure, psi	620	620	620	620	620	620	/	ϕ		



Comments: After 2C bring tool up and change 90 micron filter. Time - 12:45pm

Sheet___of___

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by Name REDACTED ate Inflated: May 14/15

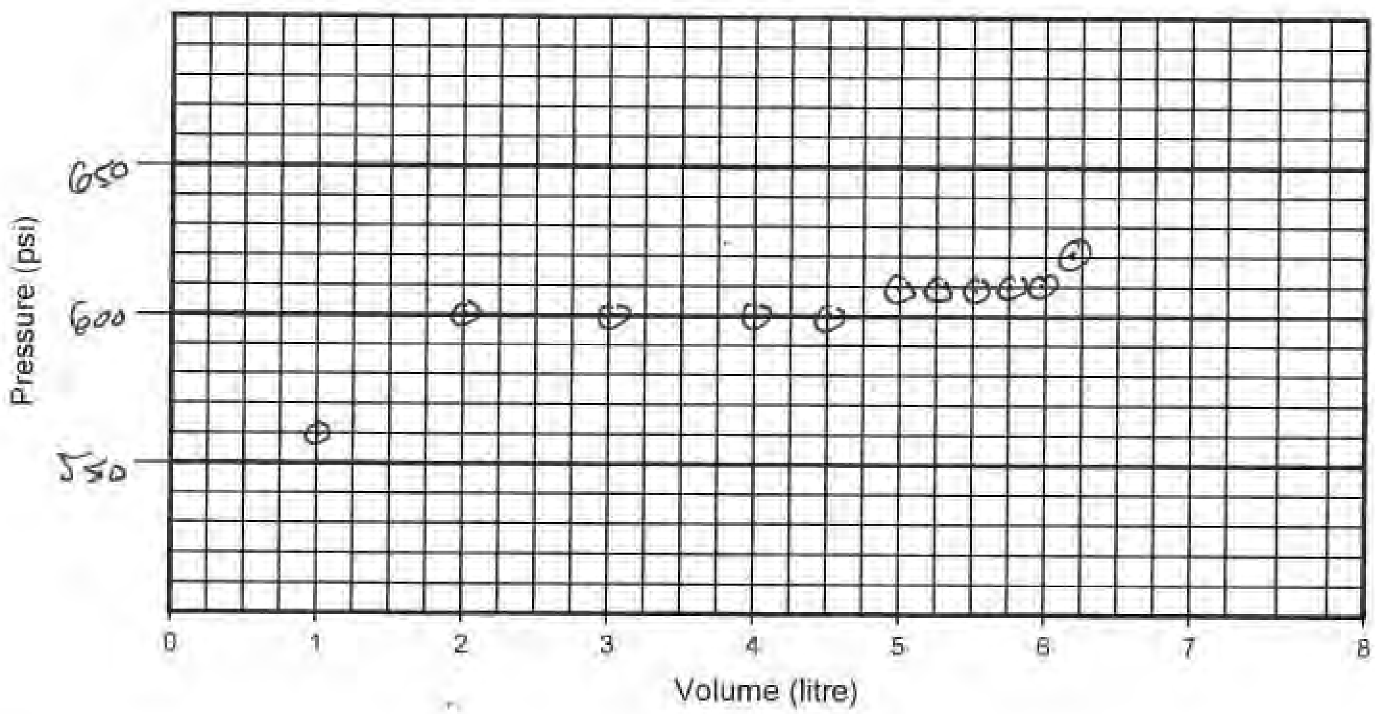
Packer No. 6 comp # 24 SN# 19236 Depth (m): nflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 620 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 75 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	4.75	5.0	5.25	5.5	5.75
Pressure, psi	560	600	600	600	600	600	610	610	610	610
Volume, litres	6.0	6.2	/	5.75						
Pressure, psi	610	620	/	Ø						



Comments: Time - 1:10 pm

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED Date Inflated: May 12/15

Packer No. 7, comp #28 SN# 19234 Depth (m): ______ Inflation Tool No.: 3197

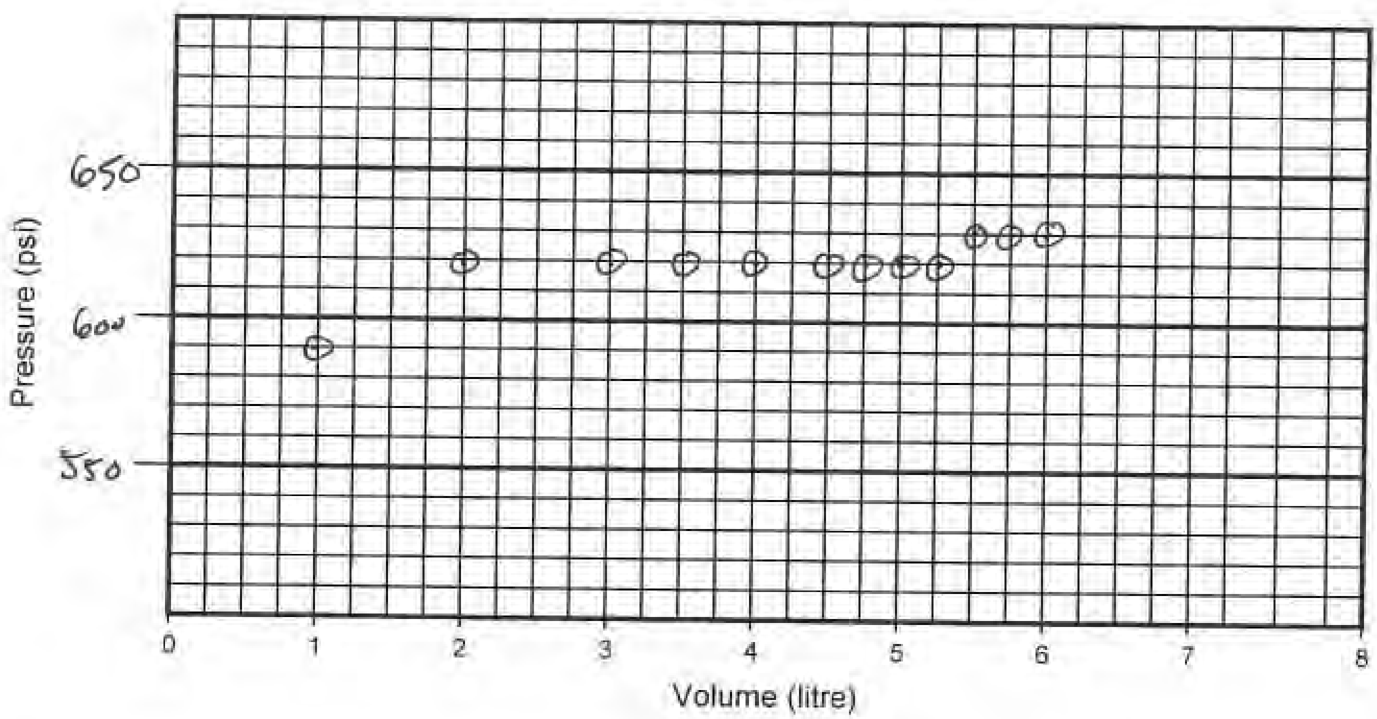
Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 640 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 100 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.5	4.75	5.0	5.25	5.5
Pressure, psi	590	620	620	620	620	620	620	620	630	640

Volume, litres	5.75	6.0	/	5.5						
Pressure, psi	640	640	/	Ø						



Comments: Time - 5:19 am

Sheet____of____

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Environmental Services Ltd. Project No.: WB950 Well No.: BH12-WB

Location: Coffee Creek, Kaminak Gold Project Completed by: Name REDACTED ate Inflated: May/12/15

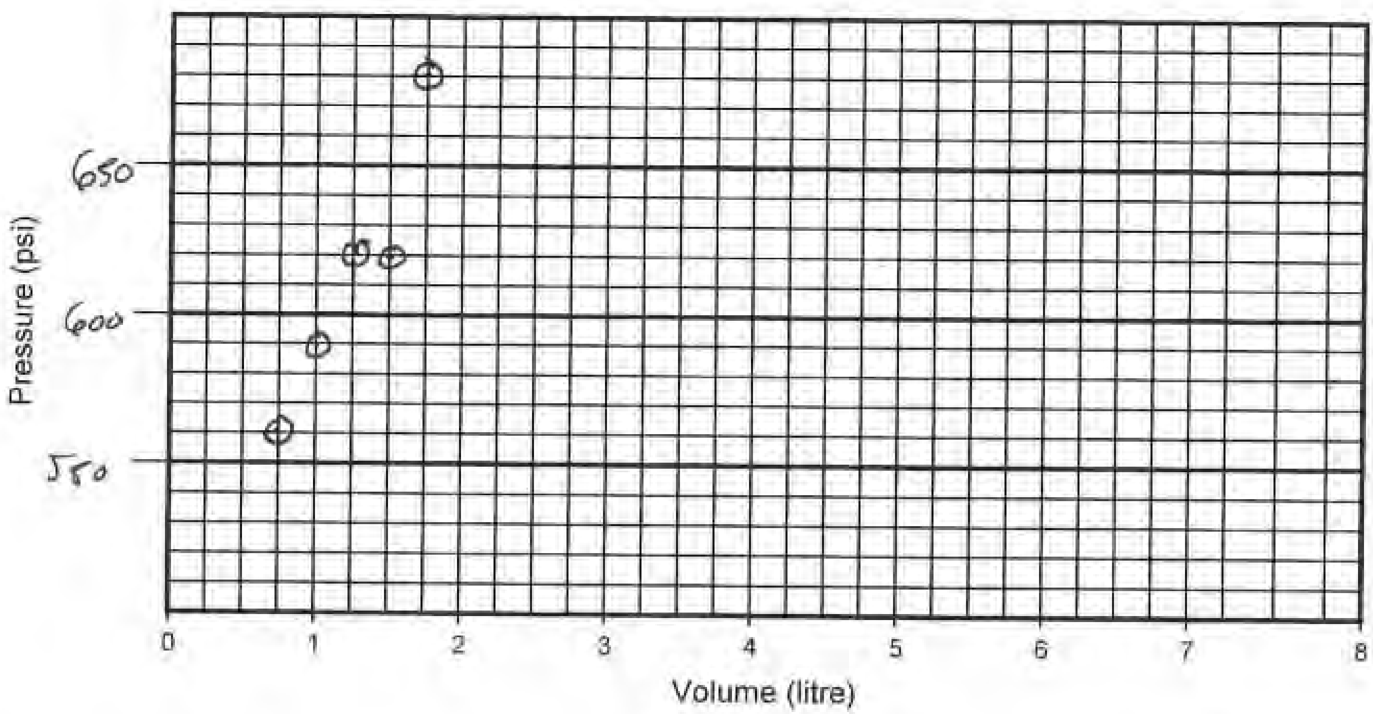
Packer No. 8, comp# 30 SN#19237 Depth (m): ________ ...flation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 680 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 140 psi

Volume, litres	0.75	1.0	1.25	1.5	1.75	/	1.3			
Pressure, psi	560	590	620	620	680	/	Ø			
Volume, litres										
Pressure, psi										



Comments: In HQ Time - 5:32 am

Appendices

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Appendix 3-D:
Lorax Hydrogeological Installation Methods

Appendix 3-D: Hydrogeological Instrument Installation Methods

This appendix outlines the field methods used during the 2014 and 2015 field programs undertaken by Lorax at the Coffee Gold Project.

1. Conventional Monitoring Wells

Two types of conventional monitoring wells have been installed on the Coffee Gold property: (i) deep wells over 150 metres below ground surface, penetrating permafrost; and (ii) shallow wells less than 10 metres deep (typically 5 metres or less) screening overburden and weathered bedrock. The deep wells were installed diamond drillholes in the 2014 campaign; the shallow wells were installed in 2015 RC holes.

The installation methods for the deep conventional monitoring wells evolved throughout the 2014 program as different challenges were encountered. The first monitoring wells were installed with 2” Schedule 40 PVC; however, the program switched to using Schedule 80 PVC after problems with casing collapse were encountered during grouting. The following general procedure was followed during monitoring well installations:

1. Once the hole target depth was reached, the drillers tripped out all of the rods to remove the core barrel. The rods were tripped back in to the end of the hole with a the first rod having had its threaded end cut off.
2. The hole was flushed for about one half hour with clean water, to remove the bulk of the polymer.
3. The rods were raised a few metres above the intended elevation of the bentonite seal. The hole was sounded with a tag line.
4. Threaded PVC was lowered down the hole through the rods.
5. With the PVC sting at the bottom of the hole, but held under tension, 10/20 filter sand was slowly poured down the annulus between the rods and the PVC. The accumulating sand pack was regularly tagged to ensure sand was not bridging in the rods. In some cases, finer sand (20/40) was emplaced for the last several feet. The sand pack was ultimately built up to be at least 1 metre higher than the top of the slotted PVC.
6. Depending on the condition of the hole, coated ¼” bentonite pellets were emplaced either open hole or through the rods. If emplaced through the rods, the pellets were added very slowly to the annulus. In some cases, water was flushed down the hole

via a hoseline propped over the annulus, so that the moving water would help flush the pellets through the annulus between the rods and the PVC.

7. After one quarter bucket of pellets had been added, the PVC was disconnected from the wireline and cut if required so that the swivel could be reattached to the rod string. The PVC was fitted with a J plug prior to the swivel being reattached. Water was injected at low pressure through the swivel while the rods were turned manually for about 20 minutes. After 20 minutes, the level of the bentonite was tagged, and another ¼ bucket of pellets were added, flushed and tagged in the same manner as above. Problems were encountered emplacing and sounding the depth of the bentonite pellet seal at MW14-03A. Eventually two batches of Quick-Grout were tremied in followed by cement grout.
8. Once all pellets were emplaced and had a chance to swell (~1 hour) the rest of the annulus was grouted with a cement bentonite mix. Sometimes the holes were grouted through the rods, with the rods being raised as successive cement batches were emplaced. Other times, the cement was emplaced via a ¾" tremie line. Cement was mixed in a hopper according to the following recipe: 10 gallons water, 2-2.5 bags of cement (20 kg each) and 4-5 cups of betta-gel bentonite powder.
9. Once the hole had been grouted and rig moved off of the pad, any remaining open annulus was filled with bentonite chips/pellets. The hole was completed with an 8" steel monument cemented in place.

Numerous issues were encountered during the monitoring well installations. As indicated above, some were caused by grouting, but many problems arose from bentonite bridging in the rods since the annular space between the 2" PVC and the HQ rods was limited and ground conditions would not permit open hole completions. For this reason, the last well pair completed with the skid rig (MW14-06A/B) was advanced using PQ tools to allow for more annular space. Unfortunately, this well pair collapsed over the 2014/2015 winter, prior to water quality samples being collected. Another unforeseen incident occurred at MW14-02B. This hole was drilled to ~200 metres and was intended to be installed as a deep well. Unfortunately, the rods string fell down the hole during the (deep) installation, and the PVC string was severed with a portion being left down hole. Once the rods and majority of PVC had been extracted, the bentonite pellets were added to the hole to seal off the lower portion, and the hole was completed as a shallow well.

The shallow conventional monitoring wells were installed in 2015 without incident. 4.5" ODEX casing was advanced to target depth. The hammer was extracted and the 2" PVC string (either Sched. 80 or Sched. 40) was lowered by hand down hole. Filter sand was emplaced as the ODEX casing was withdrawn. Bentonite pellets were emplaced in the upper portion of the annulus and the well head was completed with an 8” monument and cemented at surface.

2. Thermistors and Vibrating Wire Piezometers

For the most part, holes completed with thermistor strings were also equipped with VWP sensors. VWP installations require a specific grout density/consistency, while this is less important in installations of stand-alone thermistors.

The only stand-alone thermistor installed by Lorax is located in Supremo (MW14-04T). The hole was advanced HQ to 301 metres after which all rods were tripped out. The rods were tripped back in without the core barrel. The 13-point, pre-fabricated thermistor string was taped to a ¾” Sched. 80 PVC sacrificial standpipe and lowered down the hole. The hole was grouted through the rods which were progressively removed as the batches were emplaced. The grout recipe was the same as what was used at the conventional monitoring wells (see above). Unfortunately, partway through grouting the rods seized in the hole (end of rods at 167.5 metres) and could not be withdrawn without back reaming. To avoid potential damage to the thermistor string, the hole was not back reamed and the partial rod string was left down hole. It appears that the rods seized in the hole precisely at the permafrost boundary. The thermistor string was wired into a dedicated RST DT2040 datalogger and programmed to log every four hours.

Vibrating wire piezometers were installed in one 2014 diamond drillhole (MW4-07T) and several 2015 RC holes. The 2014 VWP installation occurred in a similar fashion as the thermistor installation described above, however grout was emplaced through a second, ¾” Sched. 80 tremie pipe. In addition, a different grout recipe was used, based on the water-cement-bentonite ratio of 2.5:1.0:0.3 suggested by Mikkelson (2002); however, a higher proportion of bentonite was used to create the pancake-batter-like consistency recommended for VWP installations. The grout recipe consisted of 40 kg water mixed with 8 kg bentonite and 16 kg cement. Once grouting was completed, a steel enclosure was mounted on top of the surface casing and the thermistor/VWP strings were wired into a dedicated DT2040 datalogger and programmed to log every four hours.

The 2015 VWP/thermistors were installed in a similar fashion as the 2014 instruments, but with minor modifications to the protocol. The instruments were taped to a 1” Sched. 80 PVC sacrificial riser pipe which also served as the tremie line for the grout. The grout mixture was also slightly modified to suit a different bentonite product and achieve the same desired consistency of pancake batter that forms craters on its surface. The approximate grout recipe was 33 gallons of water, ~25-50 lbs of Quick-Gel bentonite and 110 lbs of cement. A weighing additive, Barite, was added to cement mix to overcome the artesian pressures encountered at MW15-04T. All thermistors/VWPs were wired into dedicated RST dataloggers and programmed to log every one to four hours.

3. Westbay Systems

An introduction to the Westbay system is provided in Section 3 of the main report. Westbay technology was selected as an alternative to conventional monitoring well technology so as to alleviate the installation, sampling and ice-jacking challenges encountered with the 2014 conventional monitoring wells. Westbay field technician were onsite during the May/June 2015 field program to conduct the installations with assistance from Lorax and Northspan personnel. There were concerns about artesian groundwater undermining the surface casing at some of the installations and for this reason, the surface casing was cemented in a several locations prior to advancing the drillhole open hole. The general procedure followed during the Westbay installation was as follows

1. Upon reaching the target hole depth, the drill string was tripped out and a combination of 10’ and 5’ HQ rods were tripped in, either to the end of hole if ground conditions were questionable or, if conditions permitted, to a target depth usually a few metres below the depth of permafrost.
2. The Westbay casing and packer system was installed through the HQ rods to target depth. Every joint was pressure tested to ensure leakproofness.
3. If HQ rods were installed to the bottom of the hole, they were pulled back to the target depth (below permafrost) with the Westbay installation in place.
4. Once their position was finalized, the HQ rods were secured at the surface casing using a specially modified sub with flanges.
5. The sealing packers (one in the bottom of the HQ, one a set distance below) were inflated by injecting a 3:1 dilution of propylene glygol through valved ports in the casing, using a Westbay-supplied packer inflation tool.
6. The diluted glycol solution was pumped into both the annulus between the HQ rods and the Westbay tubing and inside the tubing via a trash pump.
7. Time permitting, the the remaining packers isolating the sampling zones were inflated following the same procedure in (5). In some cases, the rig was first moved off of the drill pad and this step was done at a later date.
8. At valley borehole locations, coated ¼” bentonite Pel-Plug pellets were emplaced between the surface casing and the HQ rods, presumably settling on top of the first packer in contact with the borehole wall. This was to prevent potential artesian flow from daylighting between the HQ rods and surface casing. The depth of the bentonite seal was not tagged.
9. All the Westbay installations were competed with an 8” well monument cemented in place.

Appendix 3-E: Lorax Hydraulic Testing Methods and Results

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Appendix 3-E: Hydraulic Testing Methods and Results

1. *Overview*

Hydraulic testing has been undertaken at the Coffee Gold project in multiple field investigations advanced by multiple consultants. This appendix summarizes the field and analytical methods used to obtain and interpret hydraulic testing information collected during the 2014 and 2014 Lorax field programs. Other consultants have used similar methods for tests they have conducted on the property; the reader is referred to EBA (2013) and SRK (2015) for a description of these tests. The SRK report has been appended to this baseline report as Appendix 3-G. A table summarizing hydraulic testing results from all consultants is provided at the end of this discussion, along with supporting graphs from the Lorax tests. Graphs for hydraulic tests performed by EBA (2013) and SRK (2015) are found within their respective reports.

2. *Field Methods*

2.1 *Packer Tests*

Bedrock hydraulic testing occurred primarily during drilling in the form of packer tests (both step tests and constant rate injection tests). Most of the Lorax packer tests were performed during the 2014 field program which utilized diamond drill rigs. One packer test, a shut-in test, was performed on an artesian during the 2015 field program. This test is discussed separately.

2.1.1 *Injection Tests*

Packer testing was conducted on the deep borehole advanced at each of the drilling locations in 2014. The test equipment utilized a single-packer setup and the testing occurred as the borehole was drilled. The depth of the first test interval was selected based on inferences of groundwater level and, later, permafrost depth, with the intent to only test saturated and non-frozen portions of the borehole.

Two different types of packer testing equipment were utilized during the program: a hydraulic packer manufactured by Inflatable Packers Inc. and a pneumatic packer manufactured by RST Instruments. The different packer setups utilize different mechanisms to seal the rods and inflate the packers, but the testing procedure once the packer system has been deployed is essentially the same. The general packer testing procedure followed during the 2014 hydrogeology field program is summarized as follows:

1. Prior to testing, the borehole was flushed with the bit located at the bottom of hole in order to remove the bulk of drilling additives. The flushing time was variable throughout the program. Near the end of the program flushing times were generally limited to one half to one full hour so as to limit potential destabilization of the hole.
2. After flushing, a selected number of rods were pulled to expose the target bedrock test interval. The length of the test section was subject to the discretion of the supervising hydrogeologist and ranged anywhere between 5.5 and 60 m. Shorter intervals were attempted in areas where the ground was inferred to be permeable, ground conditions permitting, while longer intervals were selected in tighter ground.
3. The packer tool was lowered down the hole and inflated. At surface, hoseline was directed from the pump to the flow skid (an assembly with a pressure guage, flow meter and bypass valve for controlling delivery flow rates) and from the flow skid to the rods. A bypass hose was also connected from the flow skid back to the pump to recirculate water.
4. The injection test was initiated by introducing flow to the test interval. This was accomplished by progressively closing the bypass valve on the flow skid until an appropriate, measurable pressure of water was delivered to formation.
5. The pressure and flow rate were monitored throughout the test. At the discretion of the supervising hydrogeologist, the injection pressure was either (i) maintained for an extended period, typically 20 minutes or longer (constant head injection test), or, (ii) increased and subsequently decreased through a series of several steps lasting several minutes each (step injection test, also commonly referred to as a lugeon test).

2.1.2 *Shut-In Tests*

A shut-in test was performed during the June 2015 field program on MW14-04T, an artesian hole in Halfway Creek. The hole was advanced open hole using an RC rig, and therefore utilized a slightly different pneumatic packer assembly than the 2014 packer tests which utilized a diamond rig. The general procedure followed during the 2015 airlift recovery tests are as follows:

1. The hole was advanced to total depth, at which point the entire drill stem was removed.

2. A single pneumatic P-sized packer (RST Instruments) was lowered down the hole to the target depth (~12 metres above the end of hole) on a 1.25" riser pipe. The packer was inflated and a valved T-juntion with an inline pressure gauge was coupled to the top of the riser pipe.
3. The valve was closed and pressure was monitored until a stabilized 'shut-in'pressure was achieved.
4. The valve was opened and the artesian flow rate was measured using a graduated bucket until readings stabilized.
5. The valve was closed again and pressure buildup was monitored until pressure stabilized.

2.2 *Airlift Recovery Tests*

Airlifting recovery tests were performed during the 2015 field program. An airlift recovery test is essentially a constant head pump test followed by a recovery period where the water level is monitored. Typically, one airlift recovery test was performed on one hole per drilling location. The general procedures followed during the airlift recovery tests are as follows:

1. Once the borehole was advanced to target depth, the rod string was pulled back approximately 5 feet from the bottom of the hole. The water level was measured prior to onset of airlifting.
2. The hole was airlifted for approximately 1 hour using the blowdown method. The blowdown method involves injecting air both reverse circulation and direct circulation, so that all water produced by the hole is forced up the annulus between the rods and borehole wall and educted via the bypass cyclone. Flow was measured at the bypass cyclone using a graduated bucket, typically more frequently at the beginning with longer time steps at the end.
3. Upon cessation of airlifting, the time was noted and the drill head was quickly disconnected from the top of the rod string. A pre-programmed levelogger was lowered down the hole and manual water level readings were recorded. The period of water level data collection lasted anywhere from 20 minutes to over two hours, allowing sufficient time for the water level to stabilize or recover within 95% of the initial, pre-test reading.

2.3 *Slug Testing*

A limited number of slug tests were performed on completed conventional monitoring wells. The most successful test was completed on MW14-06A; two other tests were attempted on shallow overburden/active zone wells however these tests could not be interpreted. The general procedure followed during the slug tests are as follows:

1. A static water level was measured in the well prior to slug testing.
2. A pre-programmed levelogger was deployed in the well, set to record water level changes on a rapid interval.
3. A solid PVC slug was slowly lowered down the hole on a metered tag line. Once the slug approached the water level, it was rapidly introduced to the water column, displacing the water level upward.
4. The water level was monitored periodically with a water level tape as it fell back to its original static level prior to slug introduction (*i.e*. hence the name 'falling head test').
5. Once the water level recovered to within 95% of the original displacement, the slug was removed quickly from the water column, initiating a 'rising head test'. This caused the water level to be displaced downwards before recovering back to its original static level.
6. Once the rising head test had run to completion, the slug and logger were extracted from the well.

2.4 *Pulse Testing*

Pulse testing is specialized hydraulic test performed on Westbay installations. It is similar to a conventional slug test but the displaced volume of water is generally much smaller. As a result, it is best suited to less permeable formations. Three pulse tests were performed on three zones of MW15-06WB. The following procedure was followed during pulse testing:

1. A Westbay sampling bottle was attached to the Westbay probe and a vaccuum was applied to the sampling container using a hand pump.
2. The Westbay probe and sampling container were lowered down the Westbay casing and docked in to the port of the zone to be tested.
3. The pressure in the sampling zone was measured by the probe via an interface at surface (MAGI). The probe was programmed to log pressure measurements at rapid intervals via a laptop connected to the MAGI.
4. The port valve was opened and water from the target zone passively drained into the sample bottle due to pressure differences between the formation and

the (evacuated) sample container. Only a small amount of water was removed from zone so that the resultant pressure drop in the monitoring zone would comprimise the integrity of installation.

5. The valve was closed and the recovery of pressure is the zone was monitored as it recovered back to static, similar to a rising head test. Once this had occurred, logging was stopped and all the instrumentation tripped out.

3. *Analytical Methods*

Table 1 summarizes the analytical methods utilized for the different test methods. The methods are described in more detail below.

Table -1:
Coffee Creek hydraulic testing analytical methods

Test Method	Test Type	Analytical Method(s)
Packer Test	Constant Rate Injection Test	Thiem (1906)
Packer Test	Lugeon Test (Step Injection Test)	Thiem (1906)
Packer Test	Shut-in Test	Thiem (1906)
Airlift Test	Recovery Test	Cooper-Jacob (1946)
Slug Test	Rising/Falling Head Tests, Pulse Test	Hvorslev (1951)

3.1 *Theim Method*

3.1.1 *Constant Head Injection Tests & Step Injection Tests*

Both constant head injection and step injection tests involve injecting water under constant pressure into a portion of a borehole that has been isolated by one or more packers. During the execution of each stage, both water pressure (*P*) and flow rate (*Q*) values are recorded every minute. Average values for pressure (in metres of water) and flow uptake can be subsequently used to compute zone transmissivity and hence, hydraulic conductivity, according to the Thiem (1906) equation:

$$T = K \cdot b = \frac{Q ln\left(\frac{R}{r}\right)}{2\pi(P)}$$

Eq. 1

Where:

T = transmissivity of the test interval [L^2/t]

K = hydraulic conductivity [L/t]

b = test interval length [L]

Q = injection rate [L^3/t]

R = radius of influence [L]

r = radius of borehole [L]

P = net injection pressure [L] (*i.e*. injection pressure minus head losses due to friction).

For constant rate tests, the average *K* value is calculated using last few measurements of stabilized pressure (*P*) and flow readings (*Q*). For step tests, a plot of stabilized flow rate versus ascending and descending injection pressure can suggest whether the formation is swelling, fracture/fault gouge is flushing out, among other phenomena. Hydraulic conductivity is calculated from the steps which are deemed to be most representative of the formation. Depending on the phenomena observed, this could be anywhere between one and all of the steps (Quiñones-Rozo, 2010).

The radius of influence of a packer test is limited to a small volume of rock around the hole. Bliss and Rushton (1984) estimated the radius of influence for a test interval length of 3 metres to be 9 metres around the hole. For the tests conducted in this study, the radius of influence (*R*) is assumed to be equal to the test interval length.

3.1.2 *Shut-In Test*

A shut-in test is a special form of a 'constant head' packer test performed on artesian drill holes. There are two phases of data collection during the test. The first phase measures flow rates through time after the hole is vented after a brief 'shut-in' period. The hole is then 'shut-in' again, and pressure buildup is monitored through time. The data are analysed by Theim method (1906) outlined in Equation 1 with following guidance:

$$P = H_o - H$$

Eq. 2

Where:

H_o = pressure in the test zone when the drop-pipe valve is first closed

H = height of the drop pipe above datum

Q = stabilized flow rate when the valve is opened.

3.2 *Theis Method*

3.2.1 *Airlift Recovery Test*

An airlift recovery test is essentially a pumping test where the head is the hole is kept constant (from airlifting) as opposed to the flow rate being kept constant. Once airlifting has ceased, the recovery of the water level in the hole can be analysed to provide an estimate of hydraulic conductivity using a graphical method developed by Cooper and Jacob (1946).

Residual drawdown (Δs) is plotted versus log-time and a straight-line is plotted through the portion of the data representing radial flow to the borehole. The slope of the straight line, expressed as Δs for one logarithmic cycle of the time is equal to the following:

$$\Delta s = \frac{2.3Q}{4\pi T}$$

Eq. (3)

Where:

T = transmissivity of the test interval [L^2/t] = Kb

Q = stabilized airlift yield [L^3/t]

Δs = residual drawdown over one log-cycle of time [L], as computed from the following:

$$\Delta s = H_{max} - H_t$$

Eq. (3)

Where:

H_{max} = maximum depth to water at the end of pumping [L]

H_t = depth to water at a given time since cessation of pumping [L].

The equation is re-arranged to solve for transmissivity (T), from which hydraulic conductivity (K) can be computed by dividing by the test interval thickness (b). For the Lorax tests conducted in this study, the test interval thickness is assumed to equal the entire saturated thickness of the hole.

The method outline above is applicable when the following condition has been met:

$$t_p, t' > \frac{25 r_c^2}{T}$$

Eq. (4)

Where:

r_c^2 = radius of the borehole

t_p = total pumping time

t' = total recovery time

This condition arises from original simplification of the Cooper-Jacob method from the original Theis curve-matching method (1935). The Cooper-Jacob simplification applies when the Theis 'well function' is sufficiently small, *i.e*. when the radius is sufficiently small and pumping/recovery times are sufficiently large such that well bore storage effects are overcome. Two tests, both performed on MW15-01WB, failed to meet this criterion.

3.3 *Hvorslev Method*

3.3.1 *Slug Test*

The rate of water level recovery measured during a slug test is proportional to the hydraulic conductivity of the formation. The displacement in the well is normalized to the initial displacement arising from the slug addition/removal. A log-normal plot of normalized displacement versus time is created and a best-fit line is drawn through the data. The hydraulic conductivity is plotted as follows:

$$K = \frac{r_c^2 \cdot \ln(\frac{R_e}{r_w})}{2 \cdot B \cdot T_0}$$

Eq. (5)

Where:

K = hydraulic conductivity [L/T]

r_c = effective radius of well casing [L]

R_e = effective radius of slug test [L]

r_w = effective radius of well screen, *i.e*. diameter of the drilled hole [L]

B = formation thickness [L]

T_o = 'basic time lag', *i.e*. time at which normalized head of 0.368 occurs [T]

For the purposes of the analysis, it is assumed that R_e and B are assumed to equal the entire length of the well screen. T_o is estimated derived from the best-fit line applied to the data.

3.3.2 *Pulse Tests and Monitoring Well Recovery*

The Hvorslev method was applied to a conventional slug test at MW14-06A where a solid PVC slug was introduced/withdrawn from the water column. This method was also applied to pulse tests performed on MW15-06WB and to water level recovery after sampling at MW14-05B. During a pulse test, the water level recovery is not measured in a typical fashion since the water level does not recover inside a riser pipe; however, a value of r_c must be used to solve Equation 5. For pulse tests, a value for r_c is computed that is equivalent to the radius of an imaginary pipe whose volume equals the extracted volume initiating the head loss and whose length is equivalent to the head drop. The radius of the well is equal to the actual radius of the tested Westbay zone.

4. *Results*

A complete summary of hydraulic testing results performed by all consultants at the Coffee Gold site is provided in Table 2. This table differs from Table 2 in the main text in that it includes tests unwittingly attempted on unsaturated intervals by Lorax and SRK, which have been deemed not valid for subsequent interpretation.

Table 2
Complete hydraulic testing results for the Coffee Gold project

Hole ID	Consultant	Azimuth	Dip	Test Interval (m AH)		Test Interval[1] (v m bgs)		Test Method	Test Type[2]	Analysis Type[3]	K[4] (m/s)	Mean K by hole[5] (m/s)	Geologic Unit[6]	Comments
				From	To	From	To							
Supremo														
CFD-0334	EBA	275	-45	121	138	97	117	Packer	Lugeon	Thiem	5E-09 U		GN	Test likely in unsaturated zone.
MW14-01A	Lorax	0	-90	137	148	137	148	Packer	CRI	Thiem	3E-08 U		GN	Test not valid (unsaturated test interval).
MW14-01A	Lorax	0	-90	155	166	155	166	Packer	CRI	Thiem	4E-08		GN	
MW14-01A	Lorax	0	-90	179	202	179	202	Packer	CRI	Thiem	3E-08	4E-08	GN/BFS/GN	
MW14-04T	Lorax	0	-90	182	202	182	202	Packer	CRI	Thiem	2E-10		BFS	
MW14-04T	Lorax	0	-90	164	202	164	202	Packer	Lugeon	Thiem	6E-10		GN/BFS	
MW14-04T	Lorax	0	-90	203	232	203	232	Packer	Lugeon	Thiem	1E-09		BFS/GN	
MW14-04T	Lorax	0	-90	233	256	233	256	Packer	Lugeon	Thiem	4E-09		GN	
MW14-04T	Lorax	0	-90	251	280	251	280	Packer	CRI	Thiem	3E-10		GN	
MW14-04T	Lorax	0	-90	281	301	281	301	Packer	CRI	Thiem	*4E-11*	4.5E-10	GN	Negligible flow into test interval.
MW14-06A	Lorax	0	-90	197	216	197	216	Slug Test	Rising head	Hvorslev	1E-07	1.0E-07	GN	Hvorslev and CBP methods provide similar results
MW15-06T	Lorax	0	-90	281	286	281	286	Westbay	Pulse Test	Hvorslev	1E-09		GN	supported by Cooper-Jacob and Papadopulos-Cooper methods
MW15-06T	Lorax	0	-90	238	243	238	243	Westbay	Pulse Test	Hvorslev	2E-07		GN	supported by Cooper-Jacob and Papadopulos-Cooper methods
MW15-06T	Lorax	0	-90	227	237	227	237	Westbay	Pulse Test	Hvorslev	1E-08	1E-08	GN	supported by Cooper-Jacob and Papadopulos-Cooper methods
CFD-0318	EBA	175	-45	146	151	89	91	Packer	Lugeon	Thiem	5E-07		Dikes/GN	
CFD-0318	EBA	175	-45	174	180	105	108	Packer	Lugeon	Thiem	1E-06		Amph	
CFD-0318	EBA	175	-45	195	200	118	122	Packer	Lugeon	Thiem	5E-08	3E-07	GN	
CFD-0319	EBA	0	-45	67	74	50	55	Packer	Lugeon	Thiem	2E-08 U		GN	Test quality poor (EBA, 2013); test likely in unsaturated zone
CFD-0319	EBA	0	-45	112	125	76	83	Packer	Lugeon	Thiem	7E-08	7E-08	GN/Dikes	
CFD-0336	EBA	275	-50	67	84	59	69	Packer	Lugeon	Thiem	2E-08 U		GN/BtS	Test likely in unsaturated zone.
CFD-0323	EBA	280	-70	103	139	93	118	Packer	Lugeon	Thiem	4E-08	4E-08	GN/BtS	
IFSPD124	SRK	270	-50	45	152	36	125	Slug Test	Falling Head Slug	Hvorslev	2E-07	2E-07	GN	T5 structure; static WL 20.6 (perched); possibly perched, but valid short-term
IFSPD110a	SRK	270	-50	237	266	200	220						GN/CB	T3 structure; static WL 167.2 m bgs; near water table - questionable
IFSPD110a	SRK	270	-50	266	302	220	239	Slug Test	Falling Head Slug	Hvorslev	2E-07	2E-07	GN	T3 structure; static WL 179.8 m bgs
IFSPD062	SRK	270	-50	175	221	146	181	Packer	CRI				GN	T1/T2 structure, static WL 123.3 m bgs; very near water table, questionable
CFD-0324	EBA	280	-45	68	81	54	60	Packer	Lugeon	Thiem	4E-08		BtS_Carb	
CFD-0324	EBA	280	-45	117	141	72	105	Packer	Lugeon	Thiem	1E-07	7E-08	BtS_Carb	
CFD-0327	EBA	275	-60	94	119	73	86	Packer	Lugeon	Thiem	5E-08	5E-08	GN	
MW14-02B	Lorax	0	-90	85	104	85	104	Packer	CRI	Thiem	5E-09		GN	
MW14-02B	Lorax	0	-90	103	125	103	125	Packer	CRI	Thiem	8E-08		GN	
MW14-02B	Lorax	0	-90	130	137	130	137	Packer	CRI	Thiem	3E-08		SZ/BFS	Rock type associated with Shear Zone is Chloritic Talc Schist??
MW14-02B	Lorax	0	-90	139	152	139	152	Packer	CRI	Thiem	1E-07		BFS/CB	
MW14-02B	Lorax	0	-90	157	173	157	173	Packer	CRI	Thiem	1E-08		CB/HAR/CB	
MW14-02B	Lorax	0	-90	181	200	181	200	Packer	CRI	Thiem	1E-08	3E-08	BFS	

Hole ID	Consultant	Azimuth	Dip	Test Interval (m AH)		Test Interval[1] (v m bgs)		Test Method	Test Type[2]	Analysis Type[3]	K[4] (m/s)	Mean K by hole[5] (m/s)	Geologic Unit[6]	Comments
				From	To	From	To							
Latte														
MW14-03A	Lorax	0	-90	82	110	82	110	Packer	CRI	Thiem	4E-08 U		CB/D/BFS	Test not valid (unsaturated test interval)
MW14-03A	Lorax	0	-90	112	140	112	140	Packer	CRI	Thiem	5E-09 U		M/BFS	Test not valid (partially unsaturated test interval)
MW14-03A	Lorax	0	-90	133	155	133	155	Packer	CRI	Thiem			BFS/CB/BFS	Test abandoned (could not fill rods). Potentially unsaturated test interval.
MW14-03A	Lorax	0	-90	157	199	157	199	Packer	CRI	Thiem	5E-09	5E-09	BFS/SZ/BFS	Rock type associated with Shear Zone is Biotite Schist
SRK-15D-15P	SRK	0	-90	200	274	200	274	Airlift	Airlift Recovery	Theis Recovery	3E-07	3E-07	GN/BtS/Cl-LiB	StaticWL 122.3
Kona														
MW14-05A	Lorax	0	-90	111	140	111	140	Packer	CRI	Thiem	1E-09 U		GR	Test not valid (partially unsaturated test interval)
MW14-05A	Lorax	0	-90	156	179	156	179	Packer	CRI	Thiem	*4E-11*		GR	Test abandoned (no flow)
MW14-05A	Lorax	0	-90	183	200	183	200	Packer	CRI	Thiem	3E-09		GR	
MW14-05A	Lorax	0	-90	201	221	201	221	Packer	CRI	Thiem	1E-09		GR	
MW14-05A	Lorax	0	-90	156	221	156	221	Packer	CRI	Thiem	1E-09	7E-10	GR	
MW14-05B	Lorax	0	-90	180	159	139	118	Slug Test	Rising Head Test	Hvorslev	5E-10	5E-10	GR	Recovery after GW sampling in August 2015
SRK-15D-14P	SRK	345	-70	175	216	173	212	Packer	CRI/FH Slug	Hvorslev	1E-07	1E-07	GN	Static WL 124.7 m bgs; constant-rate injection/ falling-head slug
Double Double														
SRK-15D-16P	SRK	165	-70	136	148	137	150	Packer	CRI/FH Slug	Cooper-Jacob/Theis	2E-07		CB/dyke	Static WL 65.8 m bgs
SRK-15D-16P	SRK	165	-70	164	212	167	214	Packer	Airlift Recovery	Theis Recovery	1E-07	2E-07	dyke/GN	Static WL 61.5 m bgs
Valley														
MW14-07T	Lorax	0	-90	64	89	64	89	Packer	Lugeon	Thiem	3E-08		GR	
MW14-07T	Lorax	0	-90	83	125	83	125	Packer	Lugeon	Thiem	1E-08	2E-08	GR	
MW15-05T	Lorax	125	-80	52	84	51	83	Airlift	Airlift Recovery	Cooper-Jacob	3E-06	3E-06	GR	
MW15-01WB	Lorax	0	-90	82	90	82	90	Airlift	Airlift Recovery	Cooper-Jacob	(2E-06)		GN	Pumping was not carried out long enough to overcome well-bore storage effects
MW15-01WB	Lorax	0	-90	82	102	82	102	Airlift	Airlift Recovery	Cooper-Jacob	'(1E-7 to 6E-8)		GN	Pumping was not carried out long enough to overcome well-bore storage effects
MW15-03T	Lorax	39	-80	33	98	32	97	Airlift	Airlift Recovery	Cooper-Jacob	3E-07	3E-07	BN/BtS	
MW15-04T	Lorax	40	-80	41	53	40	53	Packer	Shut-In/ CH	Lugeon	4E-06	4E-06	GN	Evaluated as one-step packer test

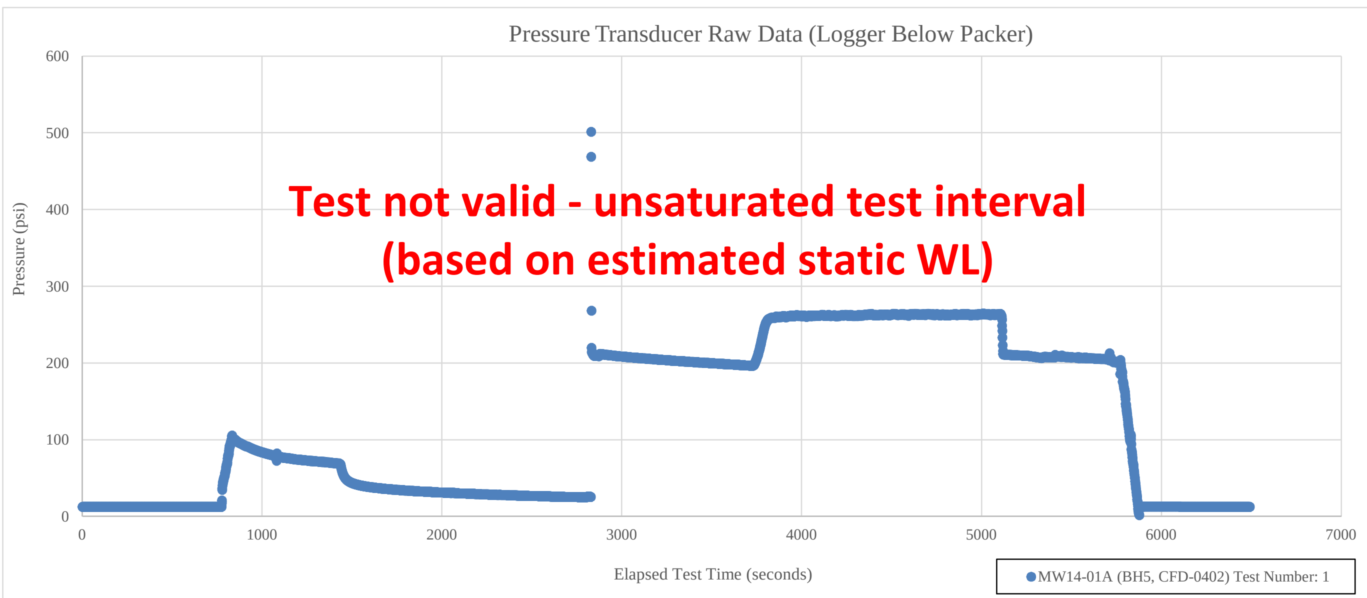
Notes:
m AH = metres along hole, v mbgs = vertical metres below ground surface, K = hydraulic conductivity
1. Depth below ground surface for inclined tests has been caculated by Lorax to take surface topography into account.
2. CRI = constant rate injection, FH = falling head test
3. Theim (1906); Cooper-Jacob (1946), Hvorslev (1951), Theis (1935)
4. *Italicised* values are an inferred upper value computed based on injection pressures and resolution of flow gauge
5. Multiple tests at valley drillholes and pit structures (SRK tests) averaged arithmetically; all other holes with multiple tests averaged geometrically
6. Tests straddling two or more geologic units denoted by a '/' (*e.g.* BFS/CB). Amph = Amphibole rich rock, BtS = Biotite Schist, BFS = Biotite Feldspar Schist, CB = Crackle Breccia, Carb = Carbonates, D = Dacite, GN = Gneiss, GR = Granite, HAR = Hydrothermally Altered Rock, M = Metacarbonate, SZ = Shear Zone, Cl-LiB = Chlorite limonite breccia

Borehole: MW14-01A (BH5, CFD-0402)		**Test Number:** 1		**Tester:** LF/MS	
Date: 12-Aug-14		**Start Time:** 8:10 PM		**Stop Time:** 10:15 PM	
Test Number: 1		**Geology:**		**Height of P gauge (mags):** 1.8	
Depth to bit (m AH): 136		**Length of Packer (m):** 1.25		**Pipe Stickup (mags):** 3	
Interval (Top) (m AH): 137.25		**Interval Bottom (m AH):** 148		**Target Interval description:**	
Packer type (pneumatic/hydraulic): hydraulic		**Hole dip:** 90		**Hydraulic packer sink time:** n/a	
Rod Type: HQ		**Type of water used:** Fresh			
Rod ID (mm): 77.8		**Additives used (type):** G-Stop in unsat. Zone			
Hole Diamter (mm): 96					
transducer SN: 301401 (Troll 700)		**packer inflation pressure (psi):** 650		**open hole static WL (mbgs):** >113	
seal test successful: yes		**test type:** constant rate injection			

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	536.4			
1	541.8	5.4	50	Pressure oscillatory (30-70 psi)
2	546.4	4.6	50	
4	555.14	4.4	50	
5	559.34	4.2	50	
6	563.44	4.1	50	
7	567.48	4.0	50	
8	571.54	4.1	50	
9	575.58	4.0	50	
10	579.42	3.8	50	
12	587.2	3.9	50	
14	594.86	3.8	50	
16	602.48	3.8	50	
18	610.2	3.9	50	
20	617.6	3.7	50	
	AVERAGE:	**3.82**	**50**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-01A (BH5, CFD-0402)		
Borehole Angle:	90	[degrees]	
Test Number:	1		
Start of Test Interval:	137.25	[mbgs]	
End of Test Interval:	148	[mbgs]	
Test Type:	constant rate injection		
Packer System:	hydraulic		
Date:	12-Aug-14		

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	3.82	[L/min]	collected in field
injection flow rate (Q)	6.4E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	138.3	[mbgs]	in pressure transducer holder below single packer
pipe stickup	3.00	[mags]	collected in field
pressure head	196.74	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	12.81	[psi]	assumed
pressure head	129.32	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	9.02	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.33	[mags]	collected in field
depth to water	149.26	[mbtp]	Estimated from the closest static WL at MW14-01B on 8-Sept-2014 at 12:55 PM.
Water Level 2 (manual)	148.93	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.03	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.27	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.80	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	185.6	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	263.52	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	67	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	46.9	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	10.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	10.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	5.4	[-]	calculated
Is packer test interval in the unsaturated zone	TRUE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0088	[m/s]	flow rate divided by cross-sectional area
Reynold's number	528.0	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	3.0E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	2.7E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

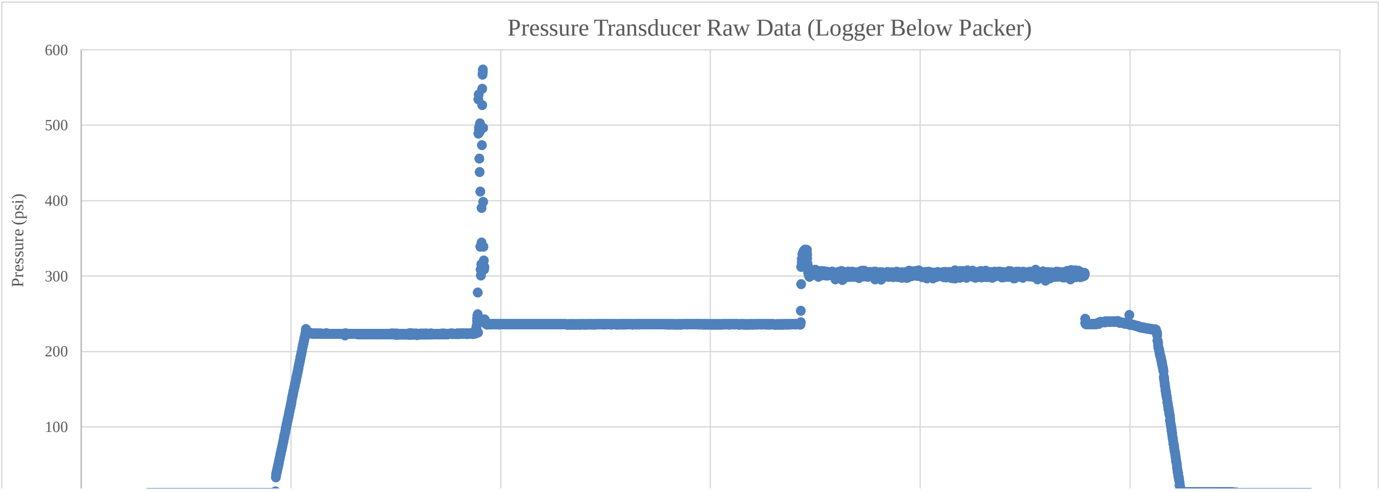
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-01A (BH5, CFD-0402)	**Test Number:** 2	**Tester:** MS
Date: 13-Aug-14	**Start Time:** 12:21 AM	**Stop Time:** 13:57 AM
Test Number: 2	**Geology:**	**Height of P gauge (mags):** 1.8
Depth to bit (m AH): 154	**Length of Packer (m):** 1.25	**Pipe Stickup (mags):** 3
Interval (Top) (m AH): 155.25	**Interval Bottom (m AH):** 166	**Target Interval description:**
Packer type (pneumatic/hydraulic): hydraulic	**Hole dip:** 90	**Hydraulic packer sink time:** n/a
Rod Type: HQ	**Type of water used:** Fresh	
Rod ID (mm): 77.8	**Additives used (type):** G-Stop in unsat. Zone	
Hole Diamter (mm): 96		
transducer SN: 301401 (Troll 700)	**packer inflation pressure (psi):**	**open hole static WL (mbgs):**
seal test successful: yes	**test type:** constant rate injection	

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	838.00		50	
1	844.40	6.4	50	
2	850.00	5.6	50	
3	856.10	6.1	50	
4	861.90	5.8	50	
5	867.70	5.8	50	
6	873.50	5.8	50	
7	879.40	5.9	50	
8	885.60	6.2	50	
9	891.20	5.6	50	
10	897.20	6.0	50	
11	903.20	6.0	50	
12	909.40	6.2	50	
13	915.30	5.9	50	
14	921.00	5.7	50	
15	927.10	6.1	50	
16	933.10	6.0	50	
17	939.20	6.1	50	
18	945.30	6.1	50	
19	951.00	5.7	50	
20	957.20	6.2	50	
	AVERAGE:	**5.96**	**50.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-01A (BH5, CFD-0402)
Borehole Angle:	90 [degrees]
Test Number:	2
Start of Test Interval:	155.25 [mbgs]
End of Test Interval:	166 [mbgs]
Test Type:	constant rate injection
Packer System:	hydraulic
Date:	13-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	5.96	[L/min]	collected in field
injection flow rate (Q)	9.9E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	156.3	[mbgs]	in pressure transducer holder below single packer
pipe stickup	3.00	[mags]	collected in field
pressure head	236.44	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	12.81	[psi]	assumed
pressure head	157.24	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	-0.90	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.33	[mags]	collected in field
depth to water	149.26	[mbtp]	Estimated from the closest static WL at MW14-01B on 8-Sept-2014 at 12:55 PM.
Water Level 2 (manual)	148.93	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.07	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.42	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.80	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	185.4	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	302.59	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	66	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	46.5	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	10.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	10.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	5.4	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0137	[m/s]	flow rate divided by cross-sectional area
Reynold's number	822.8	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	4.6E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	4.3E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

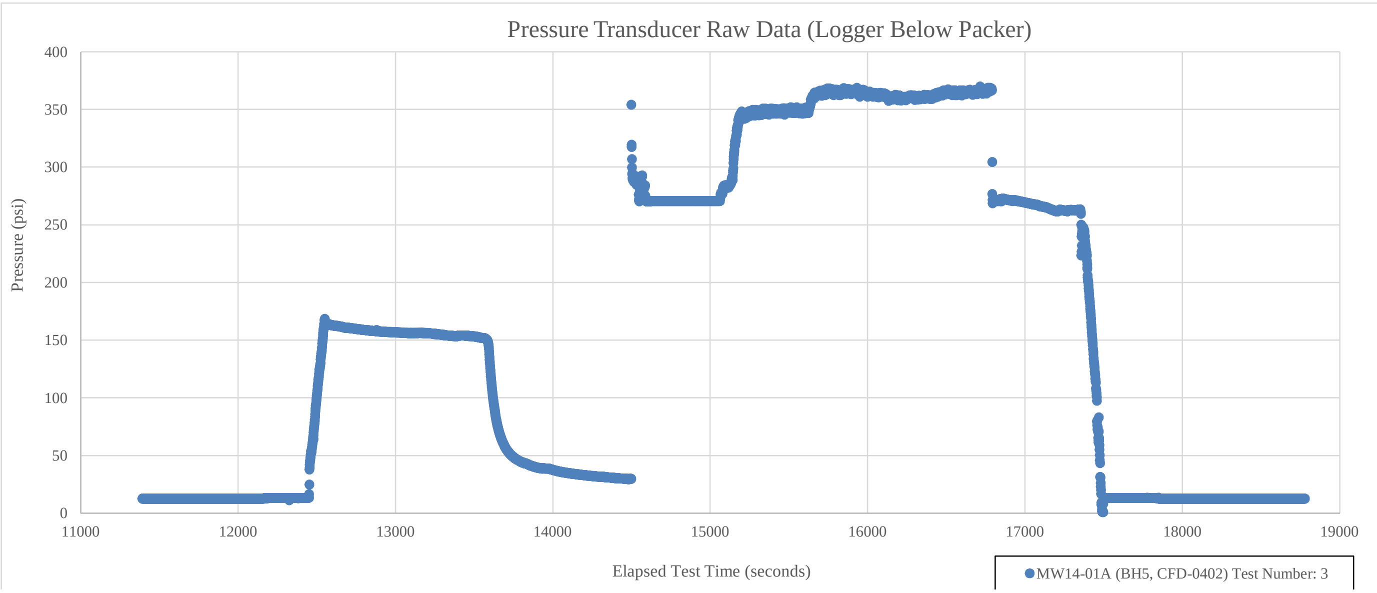
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-01A (BH5, CFD-0402)	**Test Number:**	3	**Tester:**	LF
Date:	13-Aug-14	**Start Time:**	12:00 PM	**Stop Time:**	4:00 PM
Test Number:	3	**Geology:**		**Height of P gauge (mags):**	1.8
Depth to bit (m AH):	178	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	3
Interval (Top) (m AH):	179.25	**Interval Bottom (m AH):**	202	**Target Interval description:**	
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90	**Hydraulic packer sink time:**	n/a
Rod Type:	HQ	**Type of water used:**	Fresh		
Rod ID (mm):	77.8	**Additives used (type):**	G-Stop in unsat. Zone		
Hole Diamter (mm):	96				
transducer SN:	301401 (Troll 700)	**packer inflation pressure (psi):**	550	**open hole static WL (mbgs):**	
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	459.0		80	
1	467.0	8.0	80	Pump knocking (large P gauge oscillating between 70 and 120; small P gauge oscillating between 30 and 140)
2	474.0	7.0	80	
3	481.1	7.1	80	
4	488.0	6.9	80	
5	494.9	6.9	80	
6	501.8	6.9	80	
8	516.7	7.5	80	
10	533.6	8.4	80	
12	550.6	8.5	80	
14	567.3	8.3	80	
16	584.4	8.6	80	
18	602.2	8.9	80	
20	619.8	8.8	80	
22	637.8	9.0	80	
24	655.7	9.0	80	
26	673.9	9.1	80	
	AVERAGE:	**9.0**	**80**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-01A (BH5, CFD-0402)
Borehole Angle: 90 [degrees]
Test Number: 3
Start of Test Interval: 179.25 [mbgs]
End of Test Interval: 202 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 13-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	9.02	[L/min]	collected in field
injection flow rate (Q)	1.5E-04	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	180.3	[mbgs]	in pressure transducer holder below single packer
pipe stickup	3.00	[mags]	collected in field
pressure head	29.96	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	12.78	[psi]	assumed
pressure head	12.08	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	168.26	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.33	[mags]	collected in field
depth to water	149.26	[mbtp]	Estimated from the closest static WL at MW14-01B on 8-Sept-2014 at 12:55 PM.
Water Level 2 (manual)	148.93	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.16	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.63	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.80	[vertical mags]	collected in field
analog pressure gauge reading	80.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	206.2	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	365.63	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	336	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	236.0	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	22.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	22.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.2	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0208	[m/s]	flow rate divided by cross-sectional area
Reynold's number	1245.7	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	7.1E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	3.1E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-02B (BH-09, CFD-0418)
Date: 20-Aug-14
Test Number: 1
Depth to bit (m AH): 83
Interval (Top) (m AH): 84.50
Packer type (pneumatic/hydraulic): pneumatic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

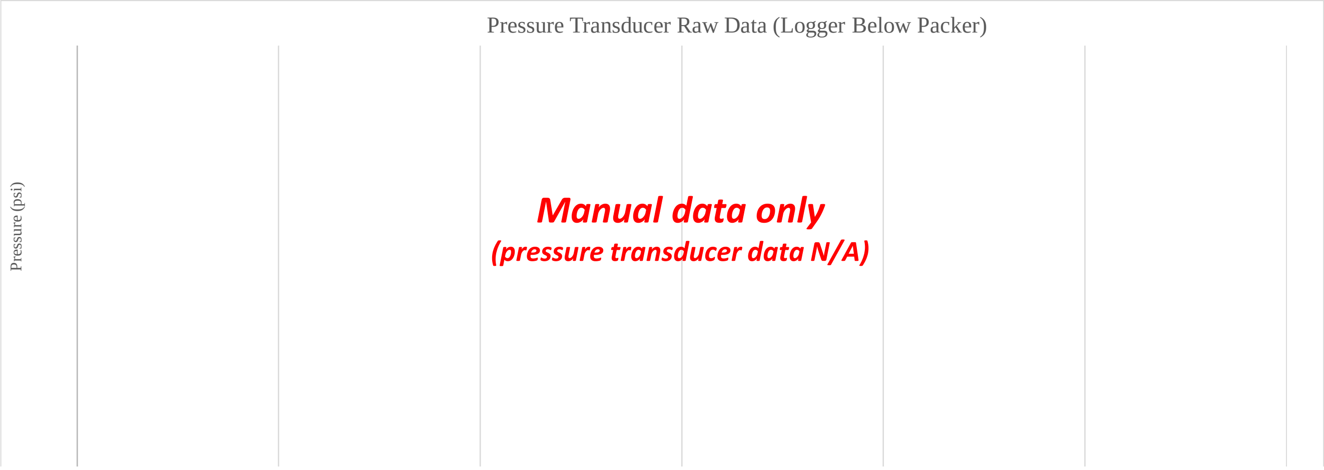
Test Number: 1
Start Time:
Geology: gneiss
Length of Packer (m): 1.50
Interval Bottom (m AH): 104
Hole dip: 90
Type of water used: Fresh
Additives used (type): G-Stop in unsat. Zone
packer inflation pressure (psi): 375
test type: constant rate injection

Tester: MS
Stop Time:
Height of P gauge (mags): 1.83
Pipe Stickup (mags): 2.93
Target Interval description:
Hydraulic packer sink time: n/a
open hole static WL (mbgs): n/a

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	14.0			
1	14.5	0.50	30	approx. 30 mL/min leakage from stuffing assembly
2	14.5	0.00	30	
3	15.0	0.50	30	
4	15.0	0.00	30	
5	15.0	0.00	30	
6	15.5	0.50	30	
7	15.5	0.00	30	
8	15.5	0.00	30	
9	15.5	0.00	30	
10	16.0	0.50	30	
11	16.0	0.00	30	
12	16.0	0.00	30	
13	16.5	0.50	30	
14	16.5	0.00	30	
15	17.0	0.50	30	
16	17.0	0.00	30	
17	17.0	0.00	30	
18	17.5	0.50	30	
19	17.5	0.00	30	
20	17.5	0.00	30	
	AVERAGE:	**0.19**	**30**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-02B (BH-09, CFD-0418)
Borehole Angle: 90 [degrees]
Test Number: 1
Start of Test Interval: 84.50 [mbgs]
End of Test Interval: 104 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 20-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.19	[L/min]	collected in field
injection flow rate (Q)	3.2E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.93	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.27	[mags]	collected in field
depth to water	13.60	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	12.33	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.83	[vertical mags]	collected in field
analog pressure gauge reading	30.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	35.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	19.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	19.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.0	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0004	[m/s]	flow rate divided by cross-sectional area
Reynold's number	26.9	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	8.8E-08	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	4.5E-09	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

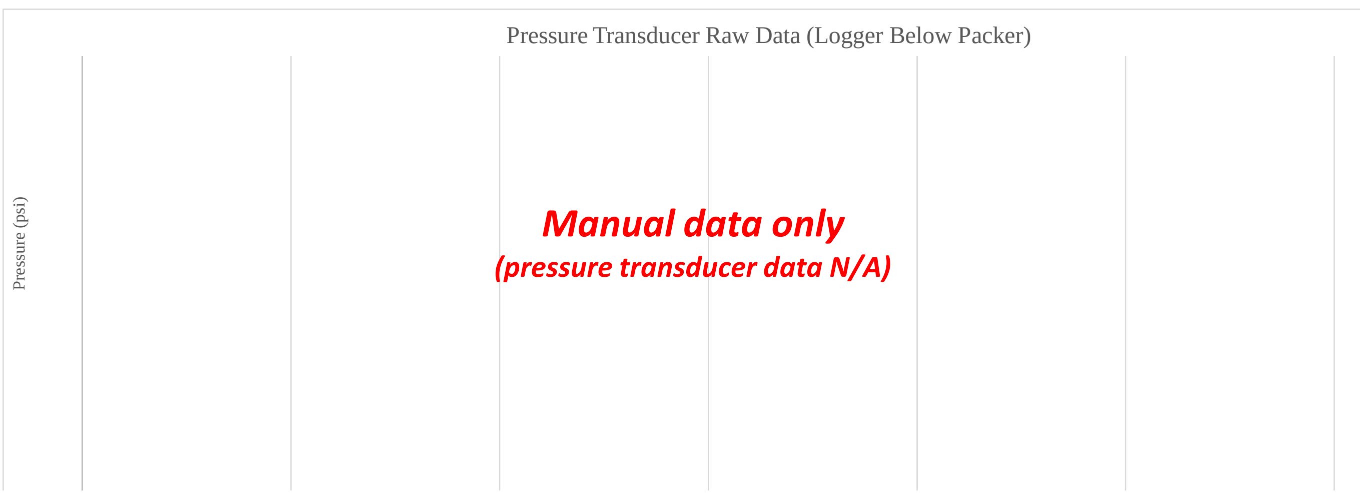
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-02B (BH-09, CFD-0418)	**Test Number:**	2	**Tester:**	MS/CB
Date:	21-Aug-14	**Start Time:**	9:40 PM	**Stop Time:**	10:00 PM
Test Number:	2	**Geology:**	gneiss	**Height of P gauge (mags):**	1.83
Depth to bit (m AH):	101	**Length of Packer (m):**	1.50	**Pipe Stickup (mags):**	2.93
Interval (Top) (m AH):	102.50	**Interval Bottom (m AH):**	125	**Target Interval description:**	broken rock / rock fragment
Packer type (pneumatic/hydraulic):	pneumatic	**Hole dip:**	90		
Rod Type:	HQ	**Type of water used:**	Fresh	**Hydraulic packer sink time:**	n/a
Rod ID (mm):	77.8	**Additives used (type):**	G-Stop in unsat. Zone		
Hole Diamter (mm):	96				
transducer SN:	n/a	**packer inflation pressure (psi):**	425	**open hole static WL (mbgs):**	n/a
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3095			
1	3099	4.00	30	
2	3105	6.00	30	
3	3108	3.00	30	
4	3112	4.00	30	
5	3116	4.00	30	
6	3120	4.00	30	
7	3124	4.00	30	
8	3129	5.00	30	
9	3133	4.00	30	
10	3137	4.00	30	
11	3141	4.00	30	
12	3145	4.00	30	
13	3149	4.00	30	
14	3153	4.00	30	
15	3157	4.00	30	
16	3162	5.00	30	
17	-	-	30	
18	3170	4.00	30	
19	3174	4.00	30	
20	3178	4.00	30	
	AVERAGE:	**4.13**	**30**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-02B (BH-09, CFD-0418)
Borehole Angle: 90 [degrees]
Test Number: 2
Start of Test Interval: 102.50 [mbgs]
End of Test Interval: 125 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 21-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	4.13	[L/min]	collected in field
injection flow rate (Q)	6.9E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.93	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.27	[mags]	collected in field
depth to water	13.60	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	12.33	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.04	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.01	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.83	[vertical mags]	collected in field
analog pressure gauge reading	30.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	35.2	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	22.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	22.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.2	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0095	[m/s]	flow rate divided by cross-sectional area
Reynold's number	569.9	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	1.9E-06	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	8.5E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-02B (BH-09, CFD-0418)
Date: 22-Aug-14
Test Number: 3
Depth to bit (m AH): 128
Interval (Top) (m AH): 129.50
Packer type (pneumatic/hydraulic): pneumatic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

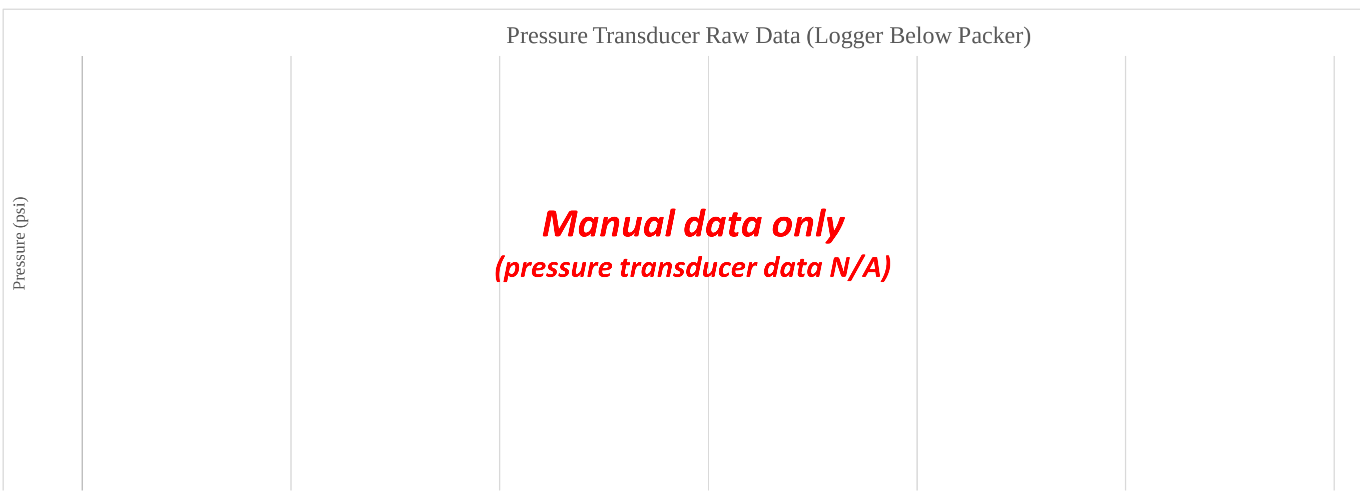
Test Number: 3
Start Time: 2:20 AM
Geology: shear zone/biotite-feldspar schist
Length of Packer (m): 1.50
Interval Bottom (m AH): 137
Hole dip: 90
Type of water used: Fresh
Additives used (type): G-Stop in unsat. Zone
packer inflation pressure (psi): -
test type: constant rate injection

Tester: MS/CB
Stop Time: 2:45 AM
Height of P gauge (mags): 1.83
Pipe Stickup (mags): 2.93
Target Interval description: broken rock 132 - 134 m
Hydraulic packer sink time: n/a
open hole static WL (mbgs): near top of rods

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3089.0			
1	3090.0	1.00	40	
2	-	-	40	
3	3092.0	1.00	40	
4	3093.0	1.00	40	
5	3094.0	1.00	40	
6	3095.0	1.00	40	
7	3096.0	1.00	40	
8	3097.0	1.00	40	
9	3098.0	1.00	40	
10	3099.0	1.00	40	
11	3100.0	1.00	40	
12	3101.0	1.00	40	
13	3102.0	1.00	40	
14	3102.5	0.50	40	
15	3103.0	0.50	40	
16	3104.0	1.00	40	
17	3104.5	0.50	40	
18	3105.0	0.50	40	
19	3106.0	1.00	40	
20	3106.5	0.50	40	
	AVERAGE:	**0.69**	**40**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-02B (BH-09, CFD-0418)
Borehole Angle: 90 [degrees]
Test Number: 3
Start of Test Interval: 129.50 [mbgs]
End of Test Interval: 137 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 22-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.69	[L/min]	collected in field
injection flow rate (Q)	1.1E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.93	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.27	[mags]	collected in field
depth to water	13.60	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	12.33	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.83	[vertical mags]	collected in field
analog pressure gauge reading	40.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	42.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	7.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	7.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	5.1	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0016	[m/s]	flow rate divided by cross-sectional area
Reynold's number	94.98	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	2.2E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	2.9E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-02B (BH-09, CFD-0418)
Date: 22-Aug-14
Test Number: 4
Depth to bit (m AH): 137
Interval (Top) (m AH): 138.50
Packer type (pneumatic/hydraulic): pneumatic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: 2031684
seal test successful: yes

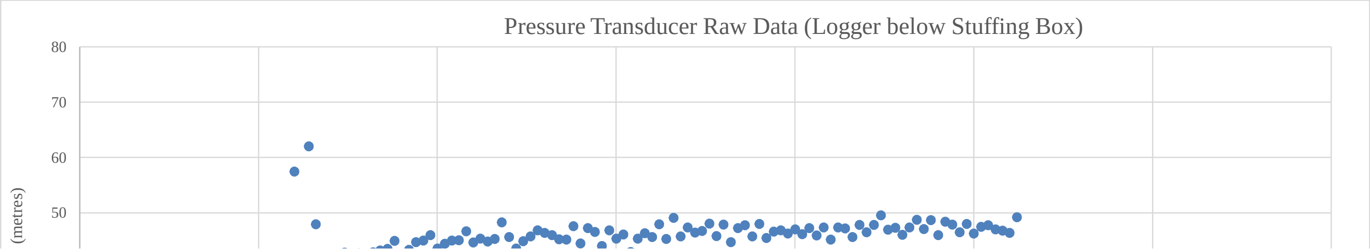
Test Number: 4
Start Time: 10:20 AM
Geology: biotite-feldspar schist/crackle breccia
Length of Packer (m): 1.50
Interval Bottom (m AH): 152
Hole dip: 90
Type of water used: Fresh
Additives used (type): G-Stop in unsat. Zone
packer inflation pressure (psi): 525
test type: constant rate injection

Tester: RC
Stop Time: 10:52 AM
Height of P gauge (mags): 1.83
Pipe Stickup (mags): 3.12
Target Interval description: Low RQD, altered
Hydraulic packer sink time: n/a
open hole static WL (mbgs): 0.38

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3190.00		42	
1	3196.50	6.50	43	Small leak at top of casing. Constant pressure for intervals.
2	3203.00	6.50	45	
3	3209.50	6.50	45	
4	3216.00	6.50	45	
5	3222.50	6.50	45	
6	3229.00	6.50	46	
7	3235.25	6.25	45	
8	3241.50	6.25	45	
9	3247.25	5.75	45	
10	3253.00	5.75	45	
11	3259.00	6.00	46	
12	3265.00	6.00	45	
13	3270.50	5.50	46	
14	3276.00	5.50	46	
15	3281.50	5.50	47	
16	3287.00	5.50	47	
17	3292.50	5.50	46	
18	3298.00	5.50	47	
19	3303.50	5.50	47	
20	3309.00	5.50	47	
21	3314.50	5.50	46	
22	3320.00	5.50	47	
23	3325.25	5.25	46	
24	3330.50	5.25	47	
25	3335.75	5.25	47	
26	3341.00	5.25	47	
27	3346.50	5.50	47	
28	3352.00	5.50	47	
29	3357.25	5.25	47	
30	3362.50	5.25	47	
	AVERAGE:	**5.31**	**46.9**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-02B (BH-09, CFD-0418)
Borehole Angle: 90 [degrees]
Test Number: 4
Start of Test Interval: 138.50 [mbgs]
End of Test Interval: 152 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 22-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	5.31	[L/min]	collected in field
injection flow rate (Q)	8.9E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	3.12	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.27	[mags]	collected in field
depth to water	13.60	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	12.33	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.06	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.02	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.83	[vertical mags]	collected in field
analog pressure gauge reading	46.9	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	47.0	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	13.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	13.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	5.6	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0122	[m/s]	flow rate divided by cross-sectional area
Reynold's number	734.0	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	1.7E-06	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.3E-07	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

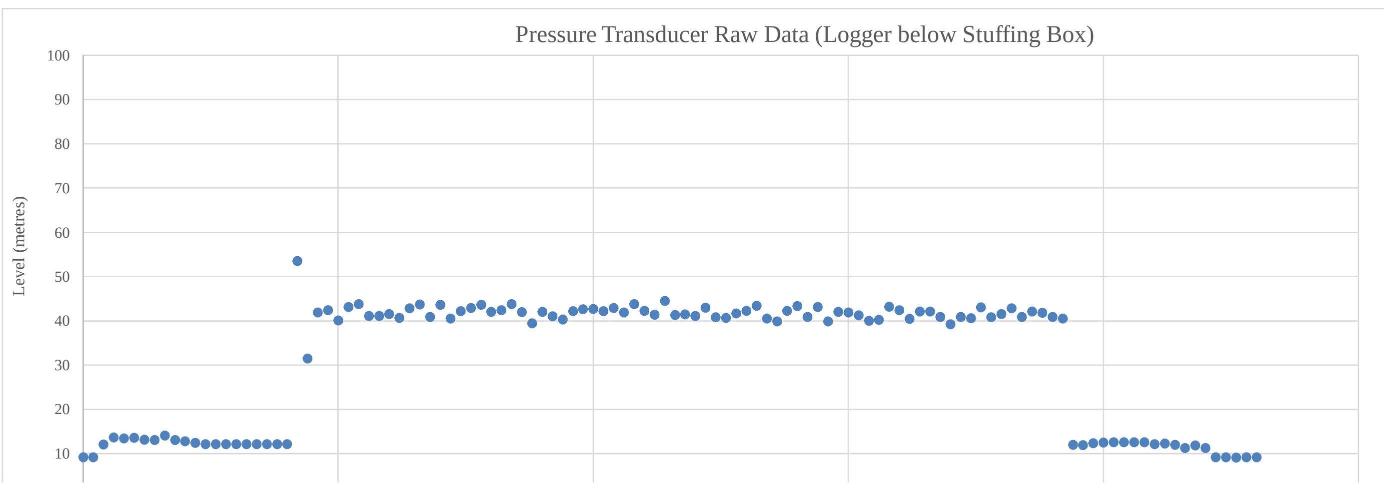
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-02B (BH-09, CFD-0418)	**Test Number:**	5	**Tester:**	RC
Date:	22-Aug-14	**Start Time:**	5:52 PM	**Stop Time:**	6:14 PM
Test Number:	5	**Geology:**	crackle breccia/hydrothermally altered/crackle breccia	**Height of P gauge (mags):**	1.83
Depth to bit (m AH):	155			**Pipe Stickup (mags):**	2.74
Interval (Top) (m AH):	156.50	**Length of Packer (m):**	1.50	**Target Interval description:**	Competent Gneiss
Packer type (pneumatic/hydraulic):	pneumatic	**Interval Bottom (m AH):**	173		
Rod Type:	HQ	**Hole dip:**	90	**Hydraulic packer sink time:**	n/a
Rod ID (mm):	77.8	**Type of water used:**	Fresh		
Hole Diamter (mm):	96	**Additives used (type):**	G-Stop in unsat. Zone		
transducer SN:	2031684	**packer inflation pressure (psi):**	575	**open hole static WL (mbgs):**	1.36
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3427.00		40	
1	3427.50	0.50	42	Constant pressure for intervals.
2	3428.00	0.50	41	
3	3428.75	0.75	42	
4	3429.50	0.75	42	
5	3430.00	0.50	41	
6	3430.50	0.50	42	
7	3431.25	0.75	41	
8	3432.00	0.75	41	
9	3432.50	0.50	42	
10	3433.00	0.50	40	
11	3433.75	0.75	40	
12	3434.50	0.75	42	
13	3435.00	0.50	40	
14	3435.50	0.50	41	
15	3436.25	0.75	40	
16	3437.00	0.75	41	
17	3437.50	0.50	40	
18	3438.00	0.50	40	
19	3438.75	0.75	40	
20	3439.50	0.75	40	
	AVERAGE:	**0.63**	**40.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-02B (BH-09, CFD-0418)
Borehole Angle: 90 [degrees]
Test Number: 5
Start of Test Interval: 156.50 [mbgs]
End of Test Interval: 173 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 22-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.63	[L/min]	collected in field
injection flow rate (Q)	1.0E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.74	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.27	[mags]	collected in field
depth to water	13.60	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	12.33	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.83	[vertical mags]	collected in field
analog pressure gauge reading	40.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	42.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	16.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	16.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	5.8	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0014	[m/s]	flow rate divided by cross-sectional area
Reynold's number	86.3	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	2.3E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.4E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-02B (BH-09, CFD-0418)
Date: 23-Aug-14
Test Number: 6
Depth to bit (m AH): 179
Interval (Top) (m AH): 180.50
Packer type (pneumatic/hydraulic): pneumatic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

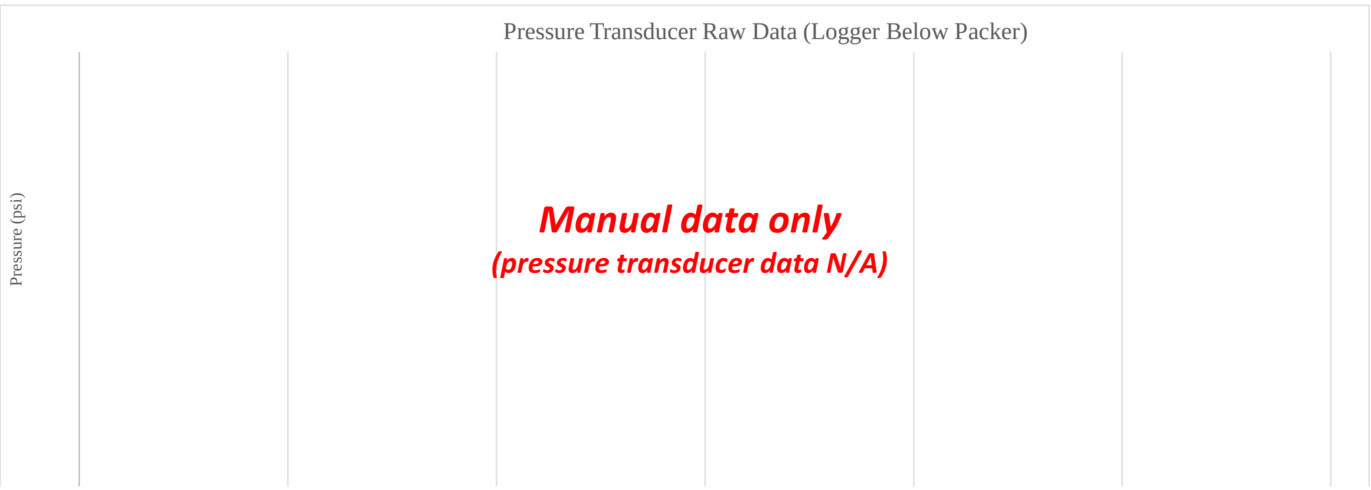
Test Number: 6
Start Time: 4:40 AM
Geology: biotite-feldspar schist
Length of Packer (m): 1.50
Interval Bottom (m AH): 200
Hole dip: 90
Type of water used: Fresh
Additives used (type): G-Stop in unsat. Zone
packer inflation pressure (psi): -
test type: constant rate injection

Tester: MS/CB
Stop Time: 5:03 AM
Height of P gauge (mags): 1.83
Pipe Stickup (mags): 2.93
Target Interval description:
Hydraulic packer sink time: n/a
open hole static WL (mbgs): n/a

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3485.0		35	
1	3486.0	1.00	35	
2	3487.0	1.00	35	
3	3488.0	1.00	35	
4	3489.0	1.00	35	
5	3490.0	1.00	35	
6	3491.0	1.00	35	
7	3492.0	1.00	35	
8	3492.5	0.50	35	
9	3493.0	0.50	35	
10	3493.5	0.50	35	
11	3494.0	0.50	35	
12	3494.5	0.50	35	
13	3495.0	0.50	35	
14	3495.5	0.50	35	
15	3496.0	0.50	35	
16	3496.5	0.50	35	
17	3497.0	0.50	35	
18	3497.5	0.50	35	
19	3498.0	0.50	35	
20	3498.5	0.50	35	
	AVERAGE:	**0.50**	**35**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-02B (BH-09, CFD-0418)
Borehole Angle: 90 [degrees]
Test Number: 6
Start of Test Interval: 180.50 [mbgs]
End of Test Interval: 200 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 23-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.50	[L/min]	collected in field
injection flow rate (Q)	8.3E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.93	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.00	[mags]	collected in field
depth to water	4.89	[mbtp]	Static WL in MW14-02A on 1-Sept-14 at 15:00
Water Level 2 (manual)	3.90	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.83	[vertical mags]	collected in field
analog pressure gauge reading	35.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	30.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	19.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	19.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.0	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0012	[m/s]	flow rate divided by cross-sectional area
Reynold's number	69.1	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	2.6E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.3E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

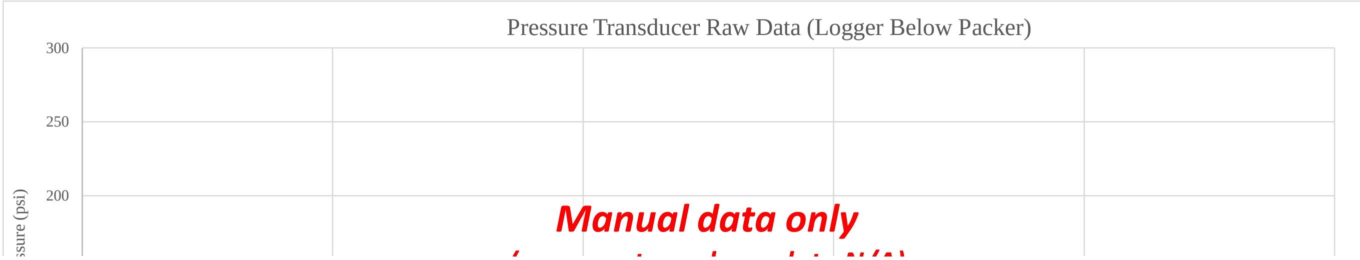
Borehole:	MW14-03A (BH-03, CFD-0432)	**Test Number:**	1	**Tester:**	CB
Date:	31-Aug-14	**Start Time:**	5:25 PM	**Stop Time:**	6:15 PM
Test Number:	1	**Geology:**	crackle breccia/dacite/biotite-feldspar schist	**Height of P gauge (mags):**	1.52
Depth to bit (m AH):	80			**Pipe Stickup (mags):**	2.41
Interval (Top) (m AH):	81.50	**Length of Packer (m):**	1.50	**Target Interval description:**	
Packer type (pneumatic/hydraulic):	pneumatic	**Interval Bottom (m AH):**	110	**Hydraulic packer sink time:**	n/a
Rod Type:	HQ	**Hole dip:**	90		
Rod ID (mm):	77.8	**Type of water used:**	Fresh		
Hole Diamter (mm):	96	**Additives used (type):**			
transducer SN:	n/a	**packer inflation pressure (psi):**		**open hole static WL (mbgs):**	n/a
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3520			Test started at approx. 17:25
1	3531	11.0		
2	3541	10.0		
3	3558	17.0		
4	3573	15.0		
5	3582	9.0		
6	3595	13.0		
7	3605	10.0		
8		-		Test stopped at approx. 17:33
-		-		
30	3700	-	30	Test started at approx. 17:45
31	3709	9.0	30	
32	3719	10.0	30	Pressure fluctuating 25-35 psi
33	3727	8.0	30	
34	3738	11.0	30	
35	3747	9.0	30	
36	3757	10.0	30	
37	3767	10.0	30	
38	3776	9.0	30	
39	3786	10.0	30	
40	3795	9.0	30	
41	3805	10.0	30	
42	3815	10.0	30	
43	3824	9.0	30	
44	3834	10.0	30	
45	3844	10.0	30	
46	3854	10.0	30	
47	3863	9.0	30	
48	3873	10.0	30	
49	3883	10.0	30	
50	3893	10.0	30	
	AVERAGE:	**9.75**	**30**	

Test not valid - unsaturated test interval (based on estimated static WL)

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-03A (BH-03, CFD-0432)
Borehole Angle: 90 [degrees]
Test Number: 1
Start of Test Interval: 81.50 [mbgs]
End of Test Interval: 110 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 31-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	9.75	[L/min]	collected in field
injection flow rate (Q)	1.6E-04	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.41	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.97	[mags]	collected in field
depth to water	133.64	[mbtp]	Static WL in MW14-03B on 13-Oct-2014 at 15:41
Water Level 2 (manual)	132.67	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.18	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.06	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.52	[vertical mags]	collected in field
analog pressure gauge reading	30.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	155.0	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	28.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	28.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.4	[-]	calculated
Is packer test interval in the unsaturated zone?	TRUE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0225	[m/s]	flow rate divided by cross-sectional area
Reynold's number	1347.0	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	1.1E-06	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	3.7E-08	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

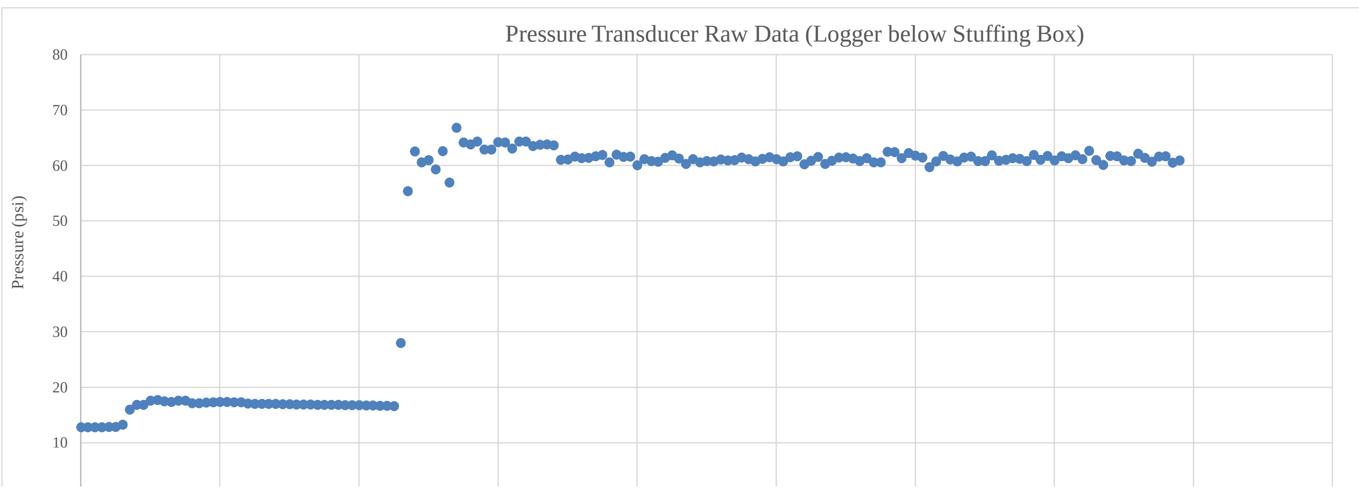
Borehole:	MW14-03A (BH-03, CFD-0432)	**Test Number:**	2	**Tester:**	RC
Date:	31-Aug-14	**Start Time:**	4:55 PM	**Stop Time:**	6:00 PM
Test Number:	2	**Geology:**	metacarbonate/biotite-feldspar schist	**Height of P gauge (mags):**	1.52
Depth to bit (m AH):	110			**Pipe Stickup (mags):**	2.44
Interval (Top) (m AH):	111.50	**Length of Packer (m):**	1.50	**Target Interval description:**	Low RQD, altered
Packer type (pneumatic/hydraulic):	pneumatic	**Interval Bottom (m AH):**	140		
Rod Type:	HQ	**Hole dip:**	90	**Hydraulic packer sink time:**	n/a
Rod ID (mm):	77.8	**Type of water used:**	Fresh		
Hole Diamter (mm):	96	**Additives used (type):**	G-Stop		
transducer SN:	2031684	**packer inflation pressure (psi):**	525	**open hole static WL (mbgs):**	45.83
seal test successful:	yes	**test type:**	constant rate injection		

Test not valid - partially unsaturated test interval (based on estimated static WL)

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	3909.0		42	Water level taken after a minute of filling the rods. Depth to water table likely greater than 48.27 mbtop.
1	3910.5	1.50	41	
2	3912.0	1.50	42	
3	3913.5	1.50	41	
4	3915.0	1.50	42	Constant pressure for intervals.
5	3916.5	1.50	42	
6	3918.0	1.50	42	
7	3919.5	1.50	42	
8	3921.0	1.50	43	
9	3922.3	1.25	42	
10	3923.5	1.25	41	
11	3925.0	1.50	42	
12	3926.5	1.50	42	
13	3927.8	1.25	42	
14	3929.0	1.25	43	
15	3930.3	1.25	44	
16	3931.5	1.25	43	
17	3933.0	1.50	43	
18	3934.5	1.50	44	
19	3935.8	1.25	44	
20	3937.0	1.25	44	
	AVERAGE:	**1.31**	**43.6**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-03A (BH-03, CFD-0432)
Borehole Angle: 90 [degrees]
Test Number: 2
Start of Test Interval: 111.50 [mbgs]
End of Test Interval: 140 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 31-Aug-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	1.31	[L/min]	collected in field
injection flow rate (Q)	2.2E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.44	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.97	[mags]	collected in field
depth to water	133.64	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	132.67	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.52	[vertical mags]	collected in field
analog pressure gauge reading	43.6	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	164.8	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	28.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	28.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.4	[-]	calculated
Is packer test interval in the unsaturated zone?	TRUE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0030	[m/s]	flow rate divided by cross-sectional area
Reynold's number	181.3	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	1.3E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	4.7E-09	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-03A (BH-03, CFD-0432)
Date: 1-Sep-14
Test Number: 3
Depth to bit (m AH): 131
Interval (Top) (m AH): 132.50
Packer type (pneumatic/hydraulic): pneumatic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

Test Number: 3
Start Time: n/a
Geology: biotite-feldspar schist /crackle breccia/biotite-feldspar schist
Length of Packer (m): 1.50
Interval Bottom (m AH): 155
Hole dip: 90
Type of water used: Fresh
Additives used (type): G-Stop
packer inflation pressure (psi): 550
test type: constant rate injection

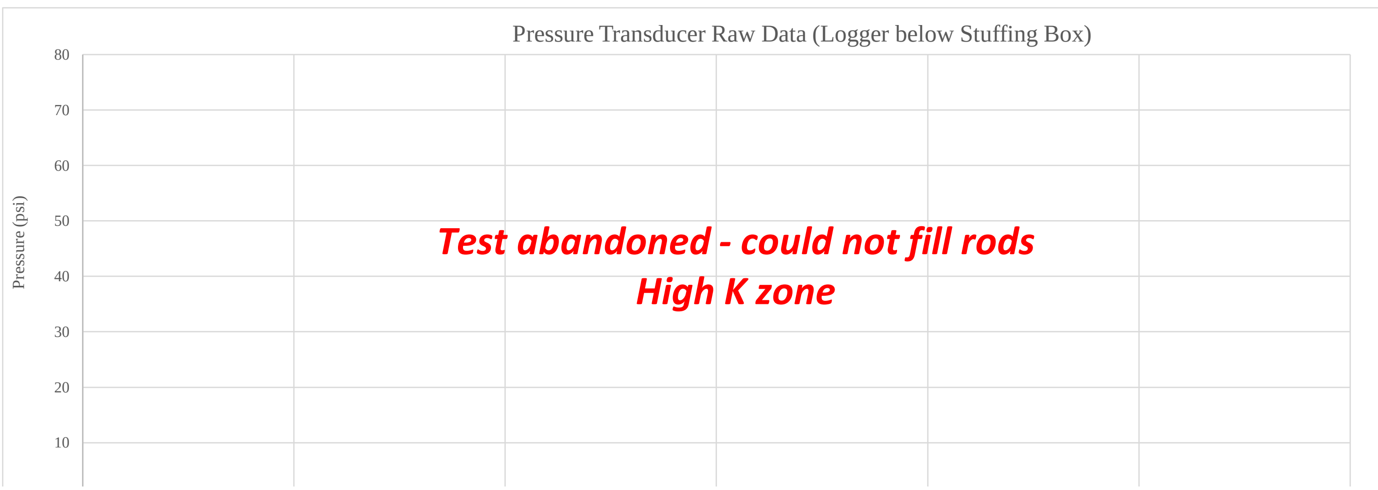
Tester: RC
Stop Time: n/a
Height of P gauge (mags): 1.52
Pipe Stickup (mags): 2.38
Target Interval description: crackle breccia 143 - 145.1 m
Hydraulic packer sink time: n/a
open hole static WL (mbgs): 131.98

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
1	30.0	30.00	1	estimated
2	60.0	30.00	1	estimated
3	90.0	30.00	1	estimated
4	120.0	30.00	1	estimated
	AVERAGE:	**30.00**	**1.0**	

Test abandoned - could not fill rods
High K zone

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-03A (BH-03, CFD-0432)
Borehole Angle:	90 [degrees]
Test Number:	3
Start of Test Interval:	132.50 [mbgs]
End of Test Interval:	155 [mbgs]
Test Type:	constant rate injection
Packer System:	pneumatic
Date:	1-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	30.00	[L/min]	collected in field
injection flow rate (Q)	5.0E-04	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.38	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.97	[mags]	collected in field
depth to water	133.64	[mbtp]	Static WL in MW14-03B on 13-Oct-2014 at 15:41
Water Level 2 (manual)	132.67	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	1.47	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.44	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.52	[vertical mags]	collected in field
analog pressure gauge reading	1.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	133.0	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	22.5	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	22.5	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.2	[-]	calculated
Is packer test interval in the unsaturated zone?	TRUE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0691	[m/s]	flow rate divided by cross-sectional area
Reynold's number	4144.7	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Turbulent	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	3.7E-06	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.6E-07	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-03A (BH-03, CFD-0432)
Date: 5-Sep-14
Test Number: 4
Depth to bit (m AH): 155
Interval (Top) (m AH): 156.50
Packer type (pneumatic/hydraulic): pneumatic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

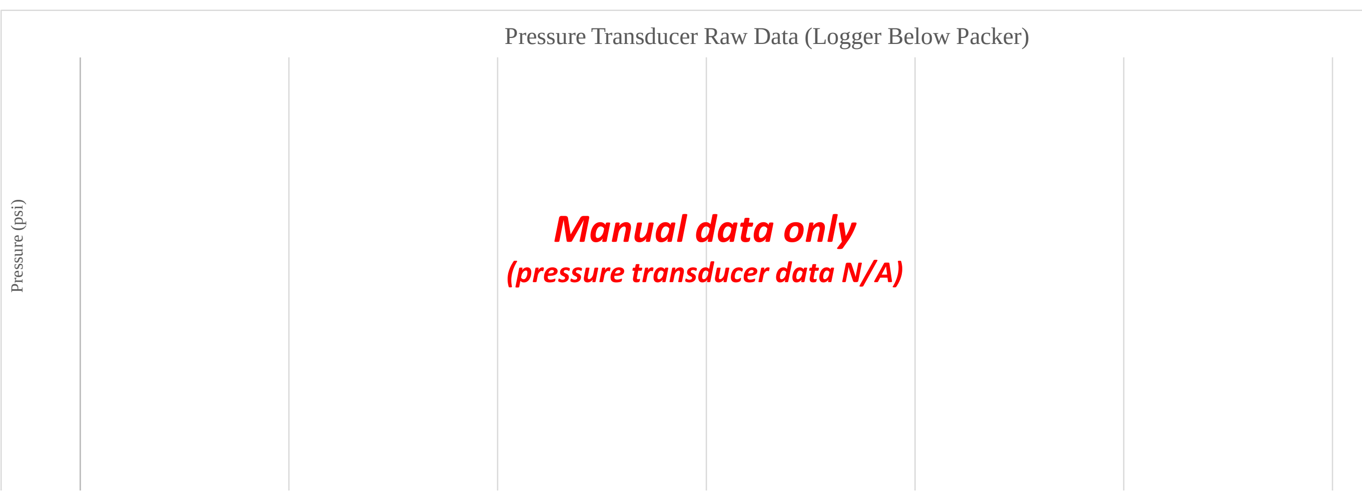
Test Number: 4
Start Time: 10:23 PM
Geology: biotite-feldspar schist/shear zone/biotite-feldspar schist
Length of Packer (m): 1.50
Interval Bottom (m AH): 198.5
Hole dip: 90
Type of water used: Fresh
Additives used (type):
packer inflation pressure (psi): 600
test type: constant rate injection

Tester: CB
Stop Time: 10:44 PM
Height of P gauge (mags): 1.52
Pipe Stickup (mags): 2.41
Target Interval description: shear zone 188.3 - 194.7
Hydraulic packer sink time: n/a
open hole static WL (mbgs): n/a

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	7675		60	
1	7677.5	2.5	60	
2	7680	2.5	60	
3	7682	2.0	60	
4	7684.5	2.5	60	
5	7687	2.5	60	
6	7689.5	2.5	60	
7	7692	2.5	60	Decreased pressure as was a little above 60
8	7694	2.0	60	
9	7696	2.0	60	
10	7697.5	1.5	60	
11	7699.5	2.0	60	
12	7702	2.5	60	
13	7704	2.0	60	
14	7706	2.0	60	
15	7708.5	2.5	60	
16	7710.5	2.0	60	
17	7713	2.5	60	
18	7715	2.0	60	
19	7717	2.0	60	
20	7719	2.0	60	
	AVERAGE:	**2.15**	**60.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-03A (BH-03, CFD-0432)
Borehole Angle: 90 [degrees]
Test Number: 4
Start of Test Interval: 156.50 [mbgs]
End of Test Interval: 199 [mbgs]
Test Type: constant rate injection
Packer System: pneumatic
Date: 5-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	2.15	[L/min]	collected in field
injection flow rate (Q)	3.6E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.41	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.97	[mags]	collected in field
depth to water	133.64	[mbtp]	Static WL in MW14-03B on 13-Oct-2014 at 15:41
Water Level 2 (manual)	132.67	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.01	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	1.52	[vertical mags]	collected in field
analog pressure gauge reading	60.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	176.4	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	42.0	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	42.0	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.8	[-]	calculated
Is packer test interval in the unsaturated zone?	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.005	[m/s]	flow rate divided by cross-sectional area
Reynold's number	297.0	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	2.2E-07	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	5.2E-09	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-04T (BH-06, CFD-0439)
Date: 9-Sep-14
Test Number: 1
Depth to bit (m AH): 181
Interval (Top) (m AH): 182.25
Packer type (pneumatic/hydraulic): hydraulic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: 301401 (Troll 700)
seal test successful: yes

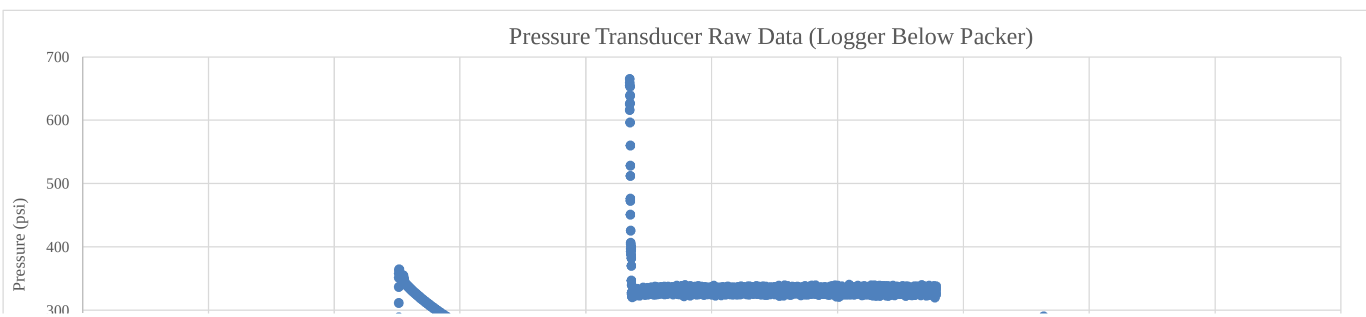
Test Number: 1
Start Time: 5:20 PM
Geology:
Length of Packer (m): 1.25
Interval Bottom (m AH): 202
Hole dip: 90
Type of water used: Fresh
Additives used (type): G-Stop in unsat. Zone
packer inflation pressure (psi): 500
test type: constant rate injection

Tester: JY
Stop Time: 6:49 PM
Height of P gauge (mags): 2.0
Pipe Stickup (mags): 2.5
Target Interval description:
Hydraulic packer sink time: n/a
open hole static WL (mbgs): n/a

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	929		0	Started test at 17:20
0.5	929	0	0	
2.5	934.6	2.80	50	
3.5	934.775	0.17	50	
5	935.05	0.18		
6	935.175	0.13	50	
7	935.18	0.005		
10	935.55	0.12	50	
15	935.95	0.08	50	
20	936.25	0.06	50	
25	936.57	0.06	50	
30	936.88	0.06	50	17:50 - test stopped (shear pin did not
0				17:54 - shear pin blew
0.5	942.55		50	
1	943.35	1.60	50	
1.5	943.87	1.04	60	
2	944.32	0.90	60	
3	944.66	0.34	60	
4	944.77	0.11	60	
5	944.88	0.11		
7	945.08	0.10	55	
10	945.39	0.10	60	
16	945.9	0.08	55	
20	946.17	0.07	60	
26	946.71	0.09	60	
30	946.92	0.05	60	
36	947.24	0.05	55	
40	947.44	0.05	55	18:34 - test end
	AVERAGE:	**0.05**	**56.7**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-04T (BH-06, CFD-0439)
Borehole Angle:	90 [degrees]
Test Number:	1
Start of Test Interval:	182.25 [mbgs]
End of Test Interval:	202 [mbgs]
Test Type:	constant rate injection
Packer System:	hydraulic
Date:	9-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.05	[L/min]	collected in field
injection flow rate (Q)	8.7E-07	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	183.3	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.50	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.33	[mags]	collected in field
depth to water	158.08	[mbtp]	Estimated from the closest static WL at MW14-01B (accounts for elevation difference).
Water Level 2 (manual)	157.75	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.00	[vertical mags]	collected in field
analog pressure gauge reading	56.7	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	199.6	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	19.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	19.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.0	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0001	[m/s]	flow rate divided by cross-sectional area
Reynold's number	7.2	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	4.2E-09	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	2.1E-10	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

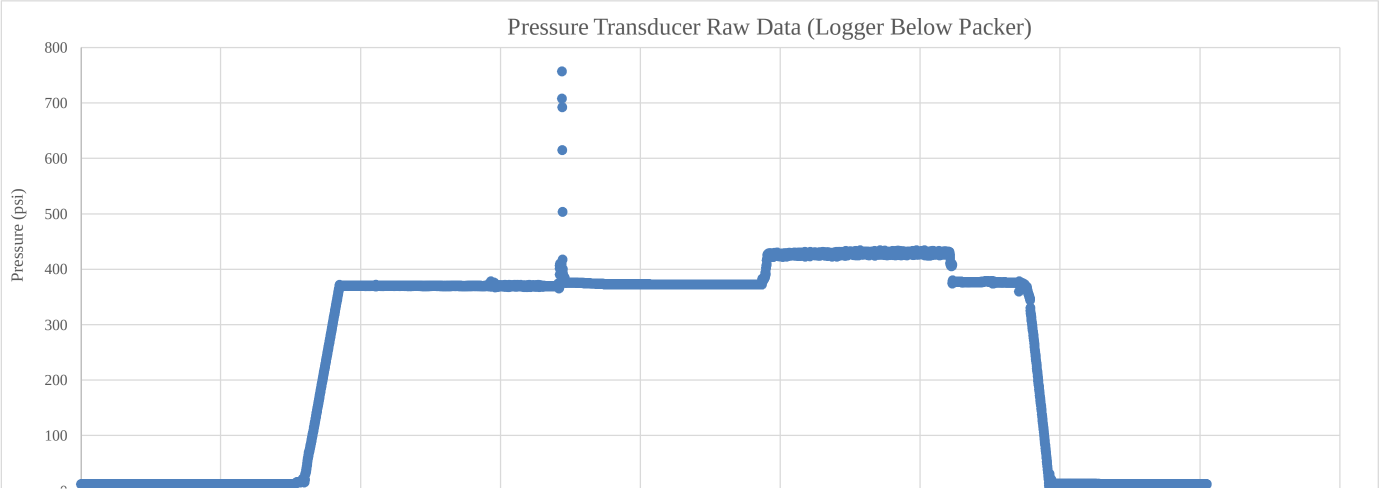
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-04T (BH-06, CFD-0439)	**Test Number:**	5	**Tester:**	MS
Date:	10-Sep-14	**Start Time:**	11:06 PM	**Stop Time:**	12:00 AM
Test Number:	5	**Geology:**		**Height of P gauge (mags):**	2.0
Depth to bit (m AH):	250	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	2.5
Interval (Top) (m AH):	251.25	**Interval Bottom (m AH):**	280	**Target Interval description:**	
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90	**Hydraulic packer sink time:**	n/a
Rod Type:	HQ	**Type of water used:**	Fresh		
Rod ID (mm):	77.8	**Additives used (type):**	G-Stop in unsat. Zone		
Hole Diamter (mm):	96				
transducer SN:	301401 (Troll 700)	**packer inflation pressure (psi):**	500	**open hole static WL (mbgs):**	n/a
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	519.50		50	11:29
1	519.72	0.22	50	
2	519.90	0.18	50	
3	519.98	0.08	50	
4	520.10	0.12	50	
5	520.20	0.10	50	
6	520.30	0.10	50	
7	520.40	0.10	50	
8	520.50	0.10	50	
9	520.60	0.10	50	
10	520.70	0.10	50	
11	520.80	0.10	50	
12	520.90	0.10	50	
13	520.98	0.08	50	
14	521.06	0.08	50	
15	521.13	0.07	50	
16	521.22	0.09	50	
17	521.30	0.08	50	
18	521.40	0.10	50	
19	521.50	0.10	50	
20	521.60	0.10	50	
	AVERAGE:	**0.094**	**50**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-04T (BH-06, CFD-0439)
Borehole Angle: 90 [degrees]
Test Number: 5
Start of Test Interval: 251.25 [mbgs]
End of Test Interval: 280 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 10-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.09	[L/min]	collected in field
injection flow rate (Q)	1.6E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.50	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.33	[mags]	collected in field
depth to water	158.08	[mbtp]	Estimated from the closest static WL at MW14-01B (accounts for elevation difference).
Water Level 2 (manual)	157.75	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.01	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.00	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	194.9	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	28.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	28.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.4	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0002	[m/s]	flow rate divided by cross-sectional area
Reynold's number	13.0	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	8.2E-09	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	2.8E-10	[m/s]	equivalent to T divided by test interval

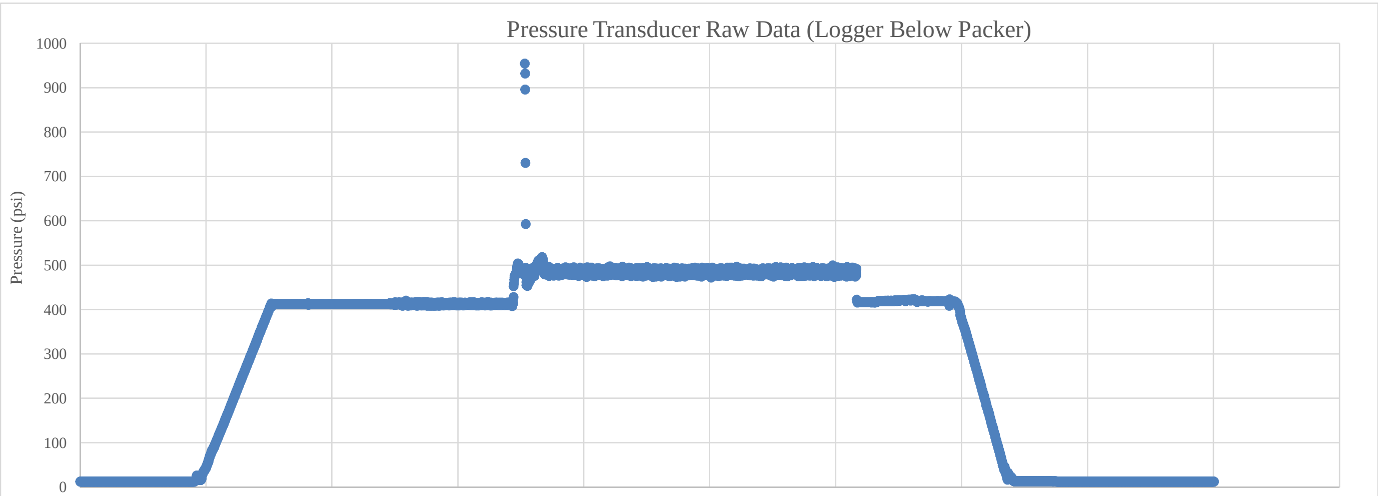
mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-04T (BH-06, CFD-0439)	**Test Number:**	6	**Tester:**	MS
Date:	11-Sep-14	**Start Time:**	5:30 AM	**Stop Time:**	6:28 AM
Test Number:	6	**Geology:**		**Height of P gauge (mags):**	2.0
Depth to bit (m AH):	280	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	2.5
Interval (Top) (m AH):	281.25	**Interval Bottom (m AH):**	301	**Target Interval description:**	
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90	**Hydraulic packer sink time:**	n/a
Rod Type:	HQ	**Type of water used:**	Fresh		
Rod ID (mm):	77.8	**Additives used (type):**	G-Stop in unsat. Zone		
Hole Diamter (mm):	96				
transducer SN:	301401 (Troll 700)	**packer inflation pressure (psi):**	500	**open hole static WL (mbgs):**	n/a
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	607.30		70	
1	607.51	0.21	70	
2	607.78	0.27	70	
3	607.98	0.20	70	
4	608.16	0.18	70	
5	608.38	0.22	70	
6	608.55	0.17	70	
7	608.71	0.16	70	
8	608.85	0.14	70	
9	609.04	0.19	70	
10	609.20	0.16	70	
11	609.32	0.12	70	
12	609.50	0.18	70	
13	609.61	0.11	70	
14	609.83	0.22	70	
15	609.90	0.07	70	**Flow rates during the constant rate injection test are within the range measured during leak testing. Therefore test not analyzed.**
16	610.10	0.20	70	
17	610.15	0.05	70	
18	610.20	0.05	70	
19	610.31	0.11	70	
20	610.44	0.13	70	
	AVERAGE:	**0.12**	**70**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-04T (BH-06, CFD-0439)
Borehole Angle: 90 [degrees]
Test Number: 6
Start of Test Interval: 281.25 [mbgs]
End of Test Interval: 301 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 11-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.12	[L/min]	collected in field
injection flow rate (Q)	2.1E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.50	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	-	[mags]	collected in field
depth to water	-	[mbtp]	Static WL in MW14-02B on 26-Aug-2014 at 20:00
Water Level 2 (manual)	#VALUE!	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.01	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.00	[vertical mags]	collected in field
analog pressure gauge reading	70.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	#VALUE!	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	19.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	19.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.0	[-]	calculated
Is packer test interval in the unsaturated zone	#VALUE!	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0003	[m/s]	flow rate divided by cross-sectional area
Reynold's number	17.1	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	#VALUE!	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	#VALUE!	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.

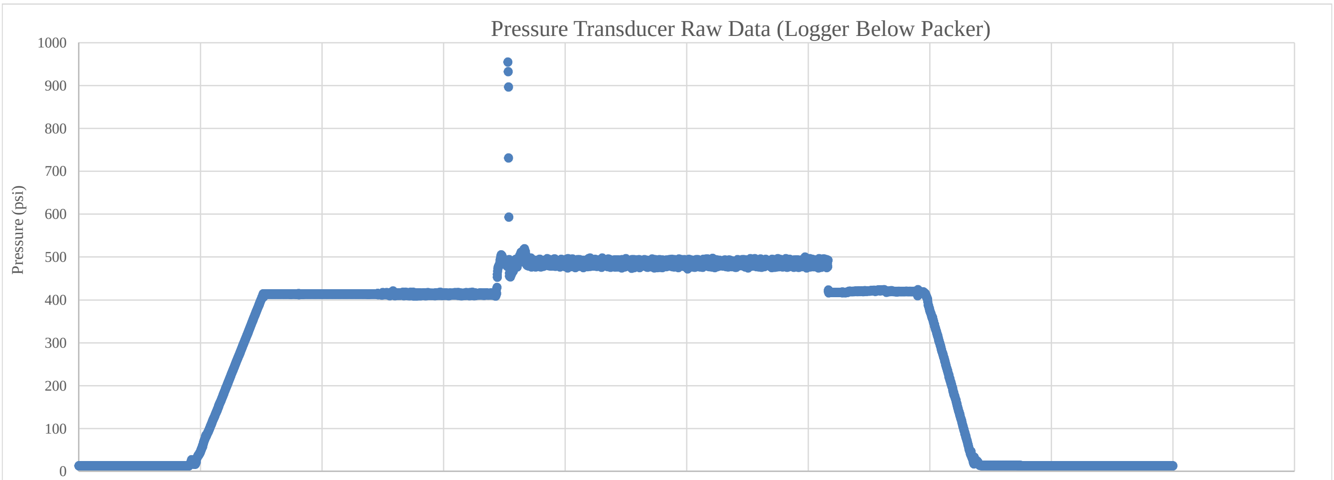
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-04T (BH-06, CFD-0439)	**Test Number:**	6	**Tester:**	MS
Date:	11-Sep-14	**Start Time:**	5:30 AM	**Stop Time:**	6:28 AM
Test Number:	6	**Geology:**		**Height of P gauge (mags):**	2.0
Depth to bit (m AH):	280	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	2.5
Interval (Top) (m AH):	281.25	**Interval Bottom (m AH):**	301	**Target Interval description:**	
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90	**Hydraulic packer sink time:**	n/a
Rod Type:	HQ	**Type of water used:**	Fresh		
Rod ID (mm):	77.8	**Additives used (type):**	G-Stop in unsat. Zone		
Hole Diamter (mm):	96				
transducer SN:	301401 (Troll 700)	**packer inflation pressure (psi):**	500	**open hole static WL (mbgs):**	n/a
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	607.30		70	
1	607.51	0.21	70	
2	607.78	0.27	70	
3	607.98	0.20	70	
4	608.16	0.18	70	
5	608.38	0.22	70	
6	608.55	0.17	70	
7	608.71	0.16	70	
8	608.85	0.14	70	
9	609.04	0.19	70	
10	609.20	0.16	70	
11	609.32	0.12	70	
12	609.50	0.18	70	
13	609.61	0.11	70	
14	609.83	0.22	70	
15	609.90	0.07	70	**Flow rates during the constant rate injection test are within the range measured during leak testing. Therefore test not analyzed.**
16	610.10	0.20	70	
17	610.15	0.05	70	
18	610.20	0.05	70	
19	610.31	0.11	70	
20	610.44	0.13	70	
	AVERAGE:	**0.12**	**70**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-04T (BH-06, CFD-0439)	
Borehole Angle:	90	[degrees]
Test Number:	6	
Start of Test Interval:	281.25	[mbgs]
End of Test Interval:	301	[mbgs]
Test Type:	constant rate injection	
Packer System:	hydraulic	
Date:	11-Sep-14	

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.01	[L/min]	collected in field
injection flow rate (Q)	1.7E-07	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.50	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	0.33	[mags]	collected in field
depth to water	158.08	[mbtp]	Estimated from the closest static WL at MW14-01B (accounts for elevation difference).
Water Level 2 (manual)	157.75	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.00	[vertical mags]	collected in field
analog pressure gauge reading	70.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	209.0	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	19.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	19.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.0	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0000	[m/s]	flow rate divided by cross-sectional area
Reynold's number	1.4	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	7.6E-10	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	3.9E-11	[m/s]	equivalent to T divided by test interval

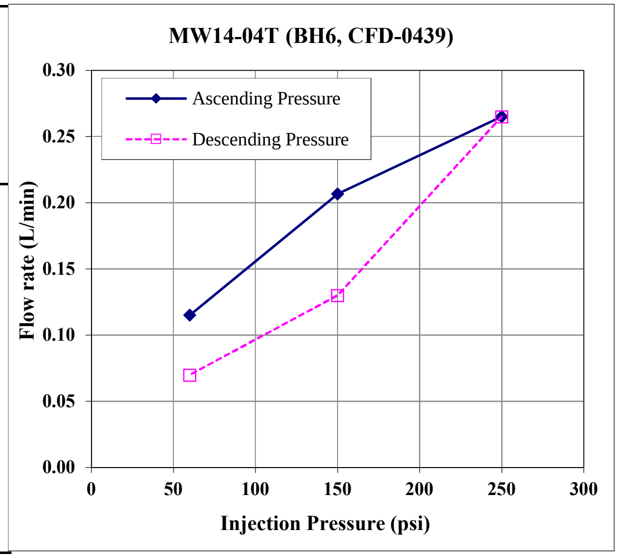
mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Location: **MW14-04T (BH6, CFD-0439)** **Lugeon Test**

Test Interval: **164.3-202** **(m bgs)**

Injection Pressure (Pi) (psi)	Net Injection Pressure (H) (m)	Stabilized Flow Rate (Q) (m^3/min)	Stabilized Flow Rate (Q) (L/min)
60	201.9	0.00012	0.12
150	265.3	0.00021	0.21
250	335.6	0.00027	0.27
150	265.3	0.00013	0.13
60	202.0	0.00007	0.07
-	-	-	-
-	-	-	-



T=Qln(R/r_b)/2ΠH

T = transmissivity [L^2/t]
Q = flow rate [L^3/t]
R = radius of influence (assumed to equal packer interval length, b) [L]
r_b = radius of borehole [L]
H= net injection pressure [L]

K=T/b

K = hydraulic conductivity [L/t]
b = packer interval length [L]

Pressure Interval	T (m^2/s)	K (m/s)	Flow Descriptor
60 psi	1.0E-08	2.7E-10	Laminar
150 psi	1.4E-08	3.7E-10	Laminar
250 psi	1.4E-08	3.7E-10	Laminar
150 psi	8.7E-09	2.3E-10	Laminar
60 psi	6.1E-09	1.6E-10	Laminar
-	-	-	-
-	-	-	-

Test Geometry	
0.0778	inside diameter of HQ rod
2	height of pressure gauge above ground
202	depth to bottom of packer
157.75	depth to pre-test water level
0.048	radius of drillhole (HQ)

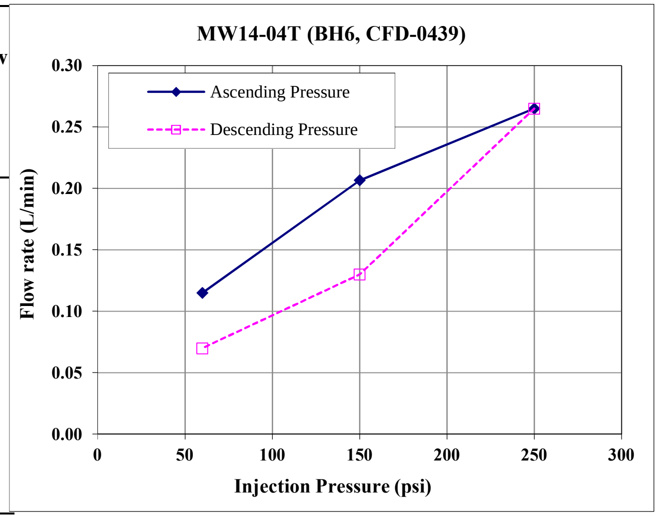
Packer Test Results

Pressure Interval	T (m^2/s)	K (m/s)
Avg(ascending)	1.3E-08	3.3E-10
Avg(descending)	9.6E-09	2.5E-10
Average	1.1E-08	2.8E-10

Location: **MW14-04T (BH6, CFD-0439)** **Lugeon Test**

Test Interval: **164.3-182.3 (m bgs)**

Injection Pressure (Pi) (psi)	Net Injection Pressure (H) (m)	Stabilized Flow Rate (Q) (m^3/min)	Stabilized Flow Rate (Q) (L/min)
60	201.9	0.00012	0.12
150	265.3	0.00021	0.21
250	335.6	0.00027	0.27
150	265.3	0.00013	0.13
60	202.0	0.00007	0.07
-	-	-	-
-	-	-	-



$T=Q\ln(R/r_b)/2\Pi H$

T = transmissivity [L^2/t]
Q = flow rate [L^3/t]
R = radius of influence (assumed to equal packer interval length, b) [L]
r_b = radius of borehole [L]
H= net injection pressure [L]

K=T/b

K = hydraulic conductivity [L/t]
b = packer interval length [L]

Pressure Interval	T (m^2/s)	K (m/s)	Flow Descriptor
60 psi	9.0E-09	5.0E-10	Laminar
150 psi	1.2E-08	6.8E-10	Laminar
250 psi	1.2E-08	6.9E-10	Laminar
150 psi	7.7E-09	4.3E-10	Laminar
60 psi	5.4E-09	3.0E-10	Laminar
-	-	-	-
-	-	-	-

Test Geometry	
0.0778	inside diameter of HQ rod
2	height of pressure gauge above ground
182.3	depth to bottom of packer
157.75	depth to pre-test water level
0.048	radius of drillhole (HQ)

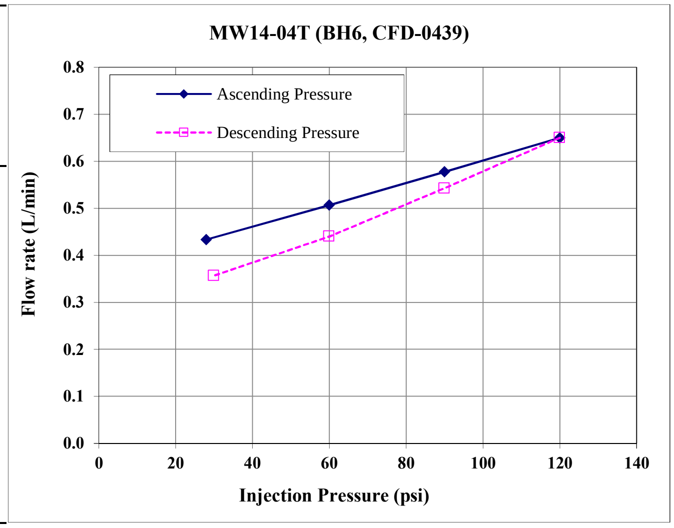
Packer Test Results

Pressure Interval	T (m^2/s)	K (m/s)
Avg(ascending)	1.1E-08	6.2E-10
Avg(descending)	8.5E-09	4.7E-10
Average	9.4E-09	5.2E-10

Location: MW14-04T (BH6, CFD-0439) **Lugeon Test**

Test Interval: 203.3-232 (m bgs)

Injection Pressure (Pi) (psi)	Net Injection Pressure (H) (m)	Stabilized Flow Rate (Q) (m^3/min)	Stabilized Flow Rate (Q) (L/min)
28	179.4	0.00043	0.43
60	201.9	0.00051	0.51
90	223.0	0.00058	0.58
120	244.1	0.00065	0.65
90	223.0	0.00054	0.54
60	201.9	0.00044	0.44
30	180.8	0.00036	0.36



$T=Q\ln(R/r_b)/2\Pi H$

T = transmissivity [L^2/t]
Q = flow rate [L^3/t]
R = radius of influence (assumed to equal packer interval length, b) [L]
r_b = radius of borehole [L]
H= net injection pressure [L]

K=T/b

K = hydraulic conductivity [L/t]
b = packer interval length [L]

Pressure Interval	T (m^2/s)	K (m/s)	Flow Descriptor
28 psi	4.1E-08	1.4E-09	Laminar
60 psi	4.3E-08	1.5E-09	Laminar
90 psi	4.4E-08	1.5E-09	Laminar
120 psi	4.5E-08	1.6E-09	Laminar
90 psi	4.1E-08	1.4E-09	Laminar
60 psi	3.7E-08	1.3E-09	Laminar
30 psi	3.3E-08	1.2E-09	Laminar

Test Geometry	
0.0778	inside diameter of HQ rod
2	height of pressure gauge above ground
232	depth to bottom of packer
157.75	depth to pre-test water level
0.048	radius of drillhole (HQ)

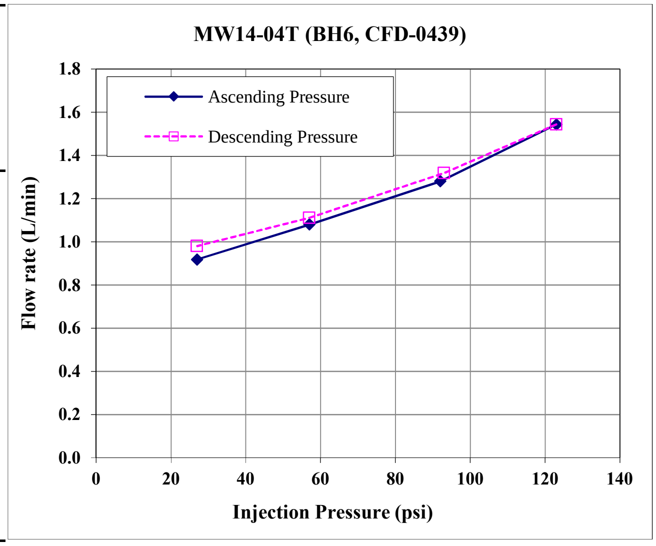
Packer Test Results

Pressure Interval	T (m^2/s)	K (m/s)
Avg(ascending)	4.3E-08	1.5E-09
Avg(descending)	3.9E-08	1.4E-09
Average	4.1E-08	1.4E-09

Location: MW14-04T (BH6, CFD-0439) **Lugeon Test**

Test Interval: 233.3-256 (m bgs)

Injection Pressure (Pi) (psi)	Net Injection Pressure (H) (m)	Stabilized Flow Rate (Q) (m^3/min)	Stabilized Flow Rate (Q) (L/min)
27	178.7	0.00092	0.92
57	199.8	0.00108	1.08
92	224.4	0.00128	1.28
123	246.2	0.00154	1.54
93	225.1	0.00132	1.32
57	199.8	0.00111	1.11
27	178.7	0.00098	0.98



$T = Q\ln(R/r_b)/2\Pi H$

T = transmissivity [L^2/t]
Q = flow rate [L^3/t]
R = radius of influence (assumed to equal packer interval length, b) [L]
r_b = radius of borehole [L]
H= net injection pressure [L]

K=T/b

K = hydraulic conductivity [L/t]
b = packer interval length [L]

Pressure Interval	T (m^2/s)	K (m/s)	Flow Descriptor
27 psi	8.4E-08	3.7E-09	Laminar
57 psi	8.8E-08	3.9E-09	Laminar
92 psi	9.3E-08	4.1E-09	Laminar
123 psi	1.0E-07	4.5E-09	Laminar
93 psi	9.6E-08	4.2E-09	Laminar
57 psi	9.1E-08	4.0E-09	Laminar
27 psi	9.0E-08	3.9E-09	Laminar

Test Geometry	
0.0778	inside diameter of HQ rod
2	height of pressure gauge above ground
256	depth to bottom of packer
157.75	depth to pre-test water level
0.048	radius of drillhole (HQ)

Packer Test Results

Pressure Interval	T (m^2/s)	K (m/s)
Avg(ascending)	9.2E-08	4.1E-09
Avg(descending)	9.5E-08	4.2E-09
Average	9.2E-08	4.1E-09

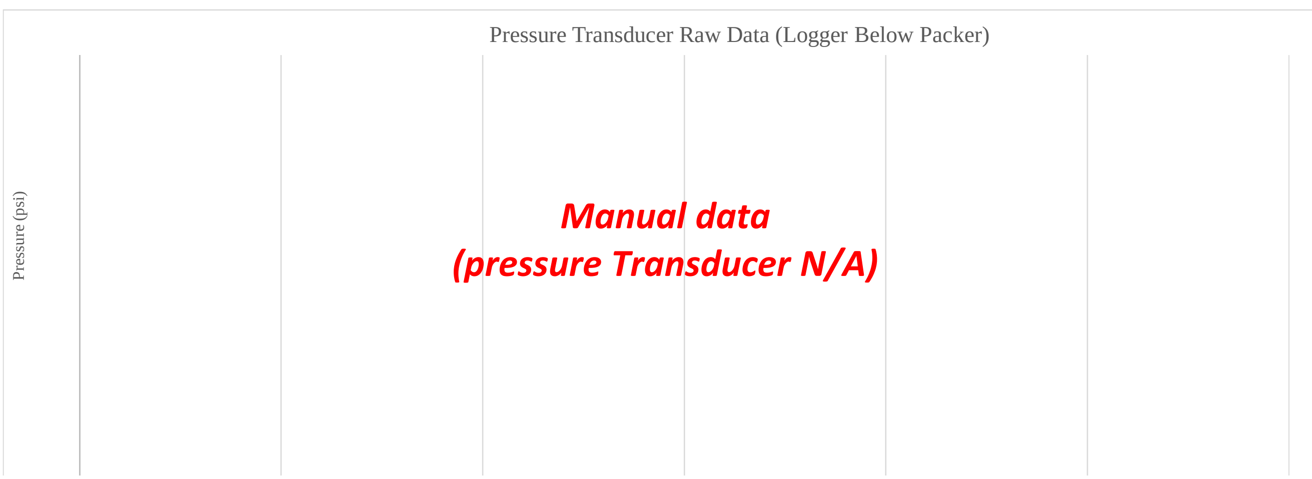
Borehole:	MW14-05A (BH-11A, CFD-0444)	**Test Number:**	1	**Tester:**	RC/LF
Date:	14-Sep-14	**Start Time:**	5:10 PM	**Stop Time:**	5:43 PM
Test Number:	1	**Geology:**	competent granite	**Height of P gauge (mags):**	2.07
Depth to bit (m AH):	110.05	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	2.38
Interval (Top) (m AH):	111.30	**Interval Bottom (m AH):**	140	**Target Interval description:**	
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90	**Hydraulic packer sink time:**	1 min 40 sec
Rod Type:	HQ	**Type of water used:**	Fresh		
Rod ID (mm):	77.8	**Additives used (type):**			
Hole Diamter (mm):	96				
transducer SN:	n/a	**packer inflation pressure (psi):**	500	**open hole static WL (mbgs):**	2.69 (likely not static)
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	615.95		50	
1	616.15	0.20	51	
2	616.37	0.22	52	
3	616.55	0.18	55	
4	616.77	[illegible]	[illegible]	
5	616.96	0.19	53	
6	617.15	0.19	53	
7	617.35	0.20	54	
8	617.52	0.17	53	
9	617.66	0.14	53	
10	617.78	0.12	52	
11	618.06	0.28	53	
12	618.38	0.32	52	
13	618.69	0.31	51	
14	619.00	0.31	52	
15	619.28	0.28	52	
16	619.54	0.26	53	
17	619.82	0.28	52	
18	620.09	0.27	54	
19	620.36	0.27	53	
20	620.61	0.25	53	
	AVERAGE:	**0.28**	**52.5**	

Test not valid - partially unsaturated test interval (based on estimated static WL)

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-05A (BH-11A, CFD-0444)	
Borehole Angle:	90	[degrees]
Test Number:	1	
Start of Test Interval:	111.30	[mbgs]
End of Test Interval:	140.0	[mbgs]
Test Type:	constant rate injection	
Packer System:	hydraulic	
Date:	14-Sep-14	

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.28	[L/min]	collected in field
injection flow rate (Q)	4.7E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.38	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.11	[mags]	collected in field
depth to water	133.20	[mbtp]	Static WL in MW14-05A on 11-Oct-14 at 15:45
Water Level 2 (manual)	132.09	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.02	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	52.5	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	171.0	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	28.7	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	28.7	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.4	[-]	calculated
Is packer test interval in the unsaturated zone	TRUE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0007	[m/s]	flow rate divided by cross-sectional area
Reynold's number	39.10	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	2.8E-08	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	9.8E-10	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-05A (BH-11A, CFD-0444)
Date: 15-Sep-14
Test Number: 2
Depth to bit (m AH): 155
Interval (Top) (m AH): 156.25
Packer type (pneumatic/hydraulic): hydraulic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

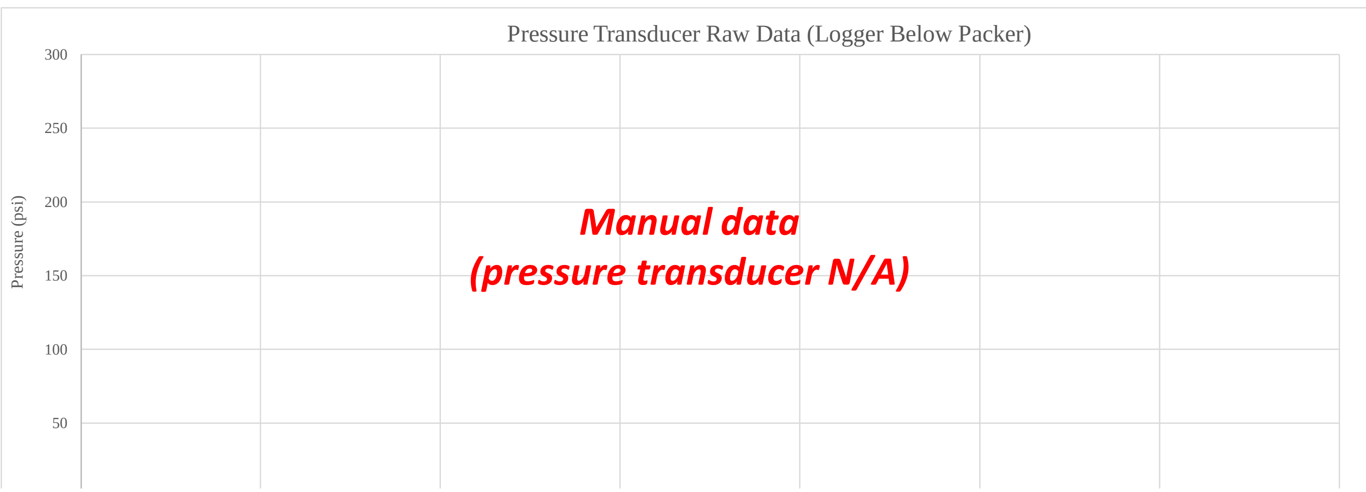
Test Number: 2
Start Time: 6:33 AM
Geology: granite
Length of Packer (m): 1.25
Interval Bottom (m AH): 179
Hole dip: 90
Type of water used: Fresh
Additives used (type):
packer inflation pressure (psi): 750
test type: constant rate injection

Tester: CB/MS
Stop Time: 6:40 AM
Height of P gauge (mags): 2.07
Pipe Stickup (mags):
Target Interval description: altered/broken granite 166.6-174 and 176-179 m
Hydraulic packer sink time:
open hole static WL (mbgs):

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	644.925		50	
1	644.925	0.00	50	
2	644.925	0.00	50	
3	644.925	0.00	50	
4	644.925	0.00	50	
5	644.925	0.00	50	
6	644.925	0.00	50	
7	644.925	0.00	50	
				Test terminated - no flow.
	AVERAGE:	**0.00**	**50.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-05A (BH-11A, CFD-0444)
Borehole Angle: 90 [degrees]
Test Number: 2
Start of Test Interval: 156.25 [mbgs]
End of Test Interval: 179.0 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 15-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.00	[L/min]	collected in field
injection flow rate (Q)	0.0E+00	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	0.00	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	-	[mags]	collected in field
depth to water	-	[mbtp]	
Water Level 2 (manual)	#VALUE!	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	#VALUE!	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	22.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	22.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.2	[-]	calculated
Is packer test interval in the unsaturated zone	#VALUE!	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0000	[m/s]	flow rate divided by cross-sectional area
Reynold's number	0.00	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	#VALUE!	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	#VALUE!	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-05A (BH-11A, CFD-0444)
Date: 15-Sep-14
Test Number: 2
Depth to bit (m AH): 155
Interval (Top) (m AH): 156.25
Packer type (pneumatic/hydraulic): hydraulic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

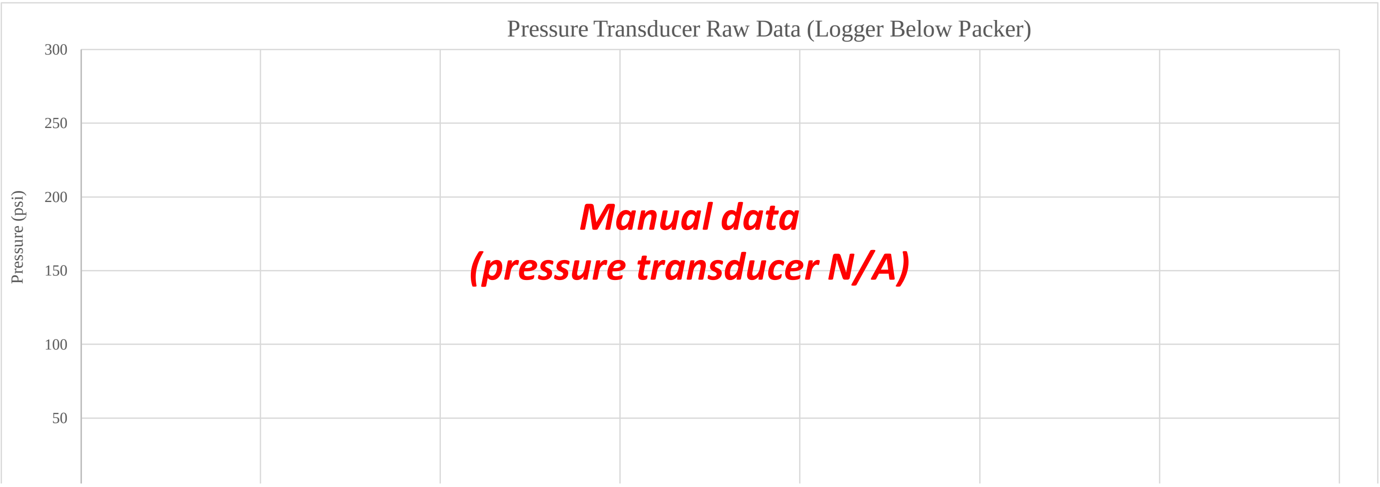
Test Number: 2
Start Time: 6:33 AM
Geology: granite
Length of Packer (m): 1.25
Interval Bottom (m AH): 179
Hole dip: 90
Type of water used: Fresh
Additives used (type):
packer inflation pressure (psi): 750
test type: constant rate injection

Tester: CB/MS
Stop Time: 6:40 AM
Height of P gauge (mags): 2.07
Pipe Stickup (mags):
Target Interval description: altered/broken granite 166.6-174 and 176-179 m
Hydraulic packer sink time:
open hole static WL (mbgs):

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	644.925		50	
1	644.925	0.00	50	
2	644.925	0.00	50	
3	644.925	0.00	50	
4	644.925	0.00	50	
5	644.925	0.00	50	
6	644.925	0.00	50	
7	644.925	0.00	50	
				Test terminated - no flow.
	AVERAGE:	**0.00**	**50.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-05A (BH-11A, CFD-0444)
Borehole Angle: 90 [degrees]
Test Number: 2
Start of Test Interval: 156.25 [mbgs]
End of Test Interval: 179.0 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 15-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.01	[L/min]	collected in field
injection flow rate (Q)	1.7E-07	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	0.00	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.11	[mags]	collected in field
depth to water	133.20	[mbtp]	
Water Level 2 (manual)	132.09	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.00	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	169.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	22.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	22.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.2	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0000	[m/s]	flow rate divided by cross-sectional area
Reynold's number	1.38	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	9.7E-10	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	4.2E-11	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-05A (BH-11A, CFD-0444)
Date: 15-Sep-14
Test Number: 3
Depth to bit (m AH): 182
Interval (Top) (m AH): 183.25
Packer type (pneumatic/hydraulic): hydraulic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96

transducer SN: n/a
seal test successful: yes

Test Number: 3
Start Time: 3:05 PM
Geology: granite
Length of Packer (m): 1.25
Interval Bottom (m AH): 200
Hole dip: 90
Type of water used: Fresh
Additives used (type):

packer inflation pressure (psi): 500
test type: constant rate injection

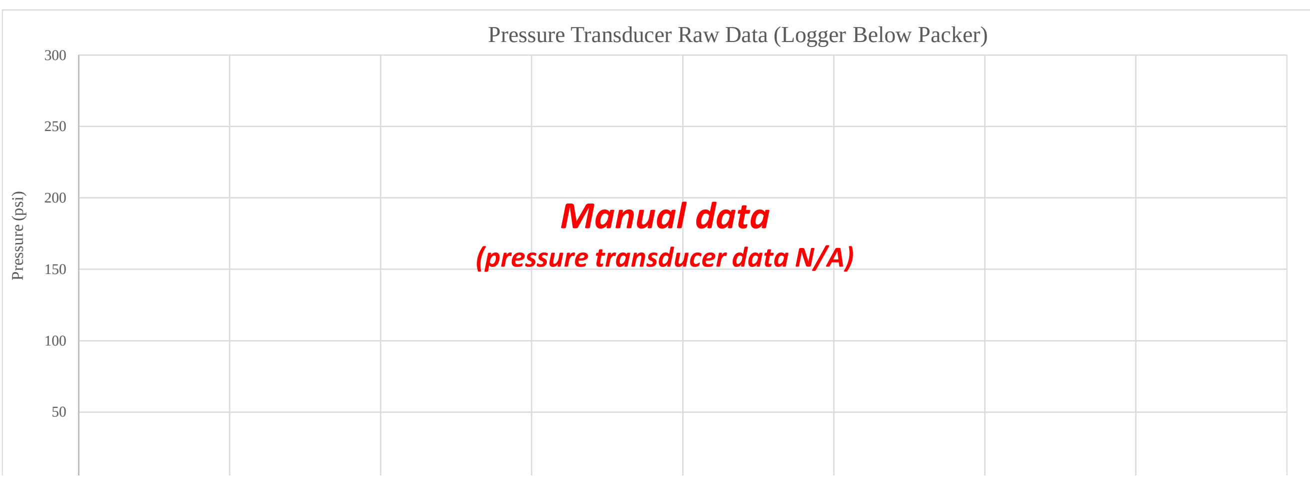
Tester: RC
Stop Time: 3:33 PM
Height of P gauge (mags): 2.07
Pipe Stickup (mags): 2.41
Target Interval description: low RQD from 183.3 to
Hydraulic packer sink time: 2 min 50 sec

open hole static WL (mbgs): 3.38 (likely not static)

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	651.50		50	
1	652.31	0.81	48	
2	653.06	0.75	48	
3	653.75	0.69	49	
4	654.43	0.68	47	
5	655.10	0.67	46	
6	655.75	0.65	45	
7	656.45	0.70	46	
8	657.03	0.58	46	
9	657.67	0.64	45	
10	658.24	0.57	47	
11	658.93	0.69	45	
12	659.55	0.62	45	
13	660.18	0.63	46	
14	660.79	0.61	45	
15	661.42	0.63	47	
16	662.03	0.61	48	
17	662.65	0.62	50	
18	663.26	0.61	50	
19	663.87	0.61	50	
20	664.49	0.62	50	
	AVERAGE:	**0.62**	**47.9**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-05A (BH-11A, CFD-0444)
Borehole Angle: 90 [degrees]
Test Number: 3
Start of Test Interval: 183.25 [mbgs]
End of Test Interval: 200.0 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 15-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.62	[L/min]	collected in field
injection flow rate (Q)	1.0E-05	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.41	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.11	[mags]	collected in field
depth to water	133.20	[mbtp]	Static WL in MW14-05A on 11-Oct-14 at 15:45
Water Level 2 (manual)	132.09	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.04	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	47.9	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	167.8	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	16.8	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	16.8	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	5.9	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0014	[m/s]	flow rate divided by cross-sectional area
Reynold's number	85.35	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	5.7E-08	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	3.4E-09	[m/s]	equivalent to T divided by test interval

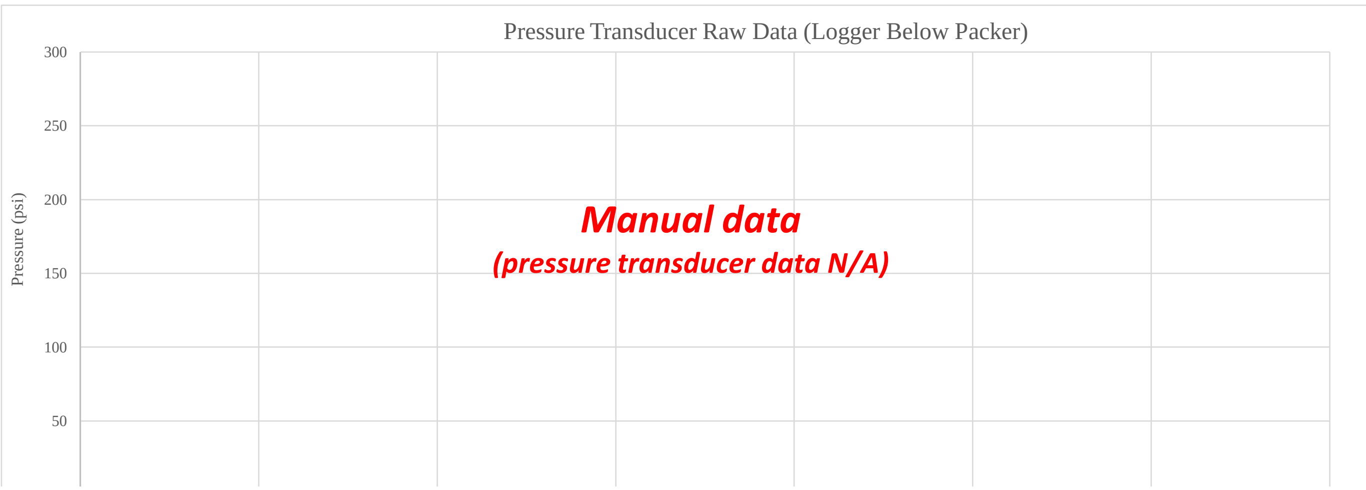
mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-05A (BH-11A, CFD-0444)	**Test Number:**	4	**Tester:**	CB/MS
Date:	16-Sep-14	**Start Time:**	1:20 AM	**Stop Time:**	1:40 AM
Test Number:	4	**Geology:**		**Height of P gauge (mags):**	2.07
Depth to bit (m AH):	200	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	2.39
Interval (Top) (m AH):	201.25	**Interval Bottom (m AH):**	220.5	**Target Interval description:**	altered/broken granite from ~209-212 and218-220m
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90		
Rod Type:	HQ	**Type of water used:**	Fresh		
Rod ID (mm):	77.8	**Additives used (type):**			
Hole Diamter (mm):	96			**Hydraulic packer sink time:**	
transducer SN:	n/a	**packer inflation pressure (psi):**	500	**open hole static WL (mbgs):**	
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	672.50		50	
1	672.87	0.37	50	
2	673.21	0.34	50	
3	673.55	0.34	50	
4	673.89	0.34	50	
5	674.20	0.31	50	
6	674.53	0.33	50	
7	674.85	0.32	50	
8	675.16	0.31	50	
9	675.48	0.32	50	
10	675.78	0.30	50	
11	676.09	0.31	50	
12	676.40	0.31	50	
13	676.70	0.30	50	
14	677.00	0.30	50	
15	677.30	0.30	50	
16	677.60	0.30	50	
17	677.90	0.30	50	
18	678.20	0.30	50	
19	678.50	0.30	50	
20	678.80	0.30	50	
	AVERAGE:	**0.30**	**50.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-05A (BH-11A, CFD-0444)
Borehole Angle: 90 [degrees]
Test Number: 4
Start of Test Interval: 201.25 [mbgs]
End of Test Interval: 220.5 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 16-Sep-14

Steady State Equation: $T = \frac{Q * \ln (R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.30	[L/min]	collected in field
injection flow rate (Q)	5.0E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.39	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.11	[mags]	collected in field
depth to water	133.20	[mbtp]	Static WL in MW14-05A on 11-Oct-14 at 15:45
Water Level 2 (manual)	132.09	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.02	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	169.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	19.3	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	19.3	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.0	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0007	[m/s]	flow rate divided by cross-sectional area
Reynold's number	41.45	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	2.8E-08	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.5E-09	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole: MW14-05A (BH-11A, CFD-0444)
Date: 16-Sep-14
Test Number: 5
Depth to bit (m AH): 155
Interval (Top) (m AH): 156.25
Packer type (pneumatic/hydraulic): hydraulic
Rod Type: HQ
Rod ID (mm): 77.8
Hole Diamter (mm): 96
transducer SN: n/a
seal test successful: yes

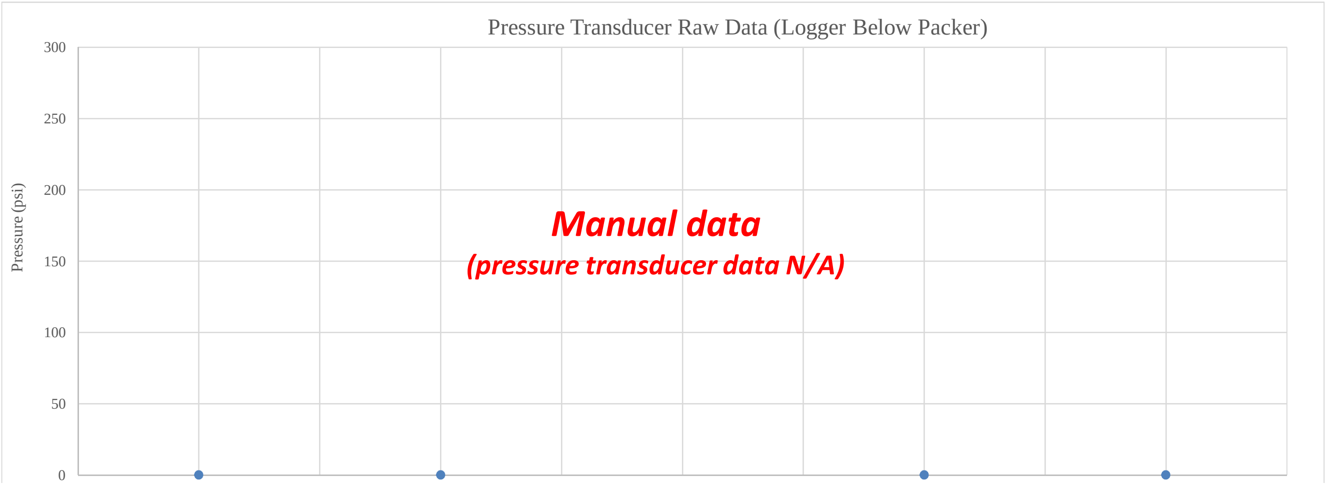
Test Number: 5
Start Time: 2:35 AM
Geology:
Length of Packer (m): 1.25
Interval Bottom (m AH): 220.5
Hole dip: 90
Type of water used: Fresh
Additives used (type):
packer inflation pressure (psi): 500
test type: constant rate injection

Tester: CB/MS
Stop Time: 2:56 AM
Height of P gauge (mags): 2.07
Pipe Stickup (mags): 2.39
Target Interval description: see Tests 2, 3 & 4
Hydraulic packer sink time:
open hole static WL (mbgs):

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	687.00		50	
1	687.65	0.65	50	
2	688.28	0.63	50	
3	688.95	0.67	50	
4	689.64	0.69	50	
5	690.25	0.61	50	
6	690.89	0.64	50	
7	691.50	0.61	50	
8	692.14	0.64	50	
9	692.74	0.60	50	
10	693.31	0.57	50	Decreased press. a little as it had risen a little above 50
11	693.75	0.44	50	
12	694.32	0.57	50	
13	694.90	0.58	50	
14	695.49	0.59	50	
15	696.07	0.58	50	
16	696.65	0.58	50	
17	697.22	0.57	50	
18	697.81	0.59	50	
19	698.37	0.56	50	
20	698.96	0.59	50	
	AVERAGE:	**0.58**	**50.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole: MW14-05A (BH-11A, CFD-0444)
Borehole Angle: 90 [degrees]
Test Number: 5
Start of Test Interval: 156.25 [mbgs]
End of Test Interval: 220.5 [mbgs]
Test Type: constant rate injection
Packer System: hydraulic
Date: 16-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.58	[L/min]	collected in field
injection flow rate (Q)	9.6E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.39	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.11	[mags]	collected in field
depth to water	133.20	[mbtp]	Static WL in MW14-05A on 11-Oct-14 at 15:45
Water Level 2 (manual)	132.09	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.04	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	169.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	64.3	[m]	collected in field
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	64.3	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	7.2	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0013	[m/s]	flow rate divided by cross-sectional area
Reynold's number	79.98	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	6.5E-08	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.0E-09	[m/s]	equivalent to T divided by test interval

mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

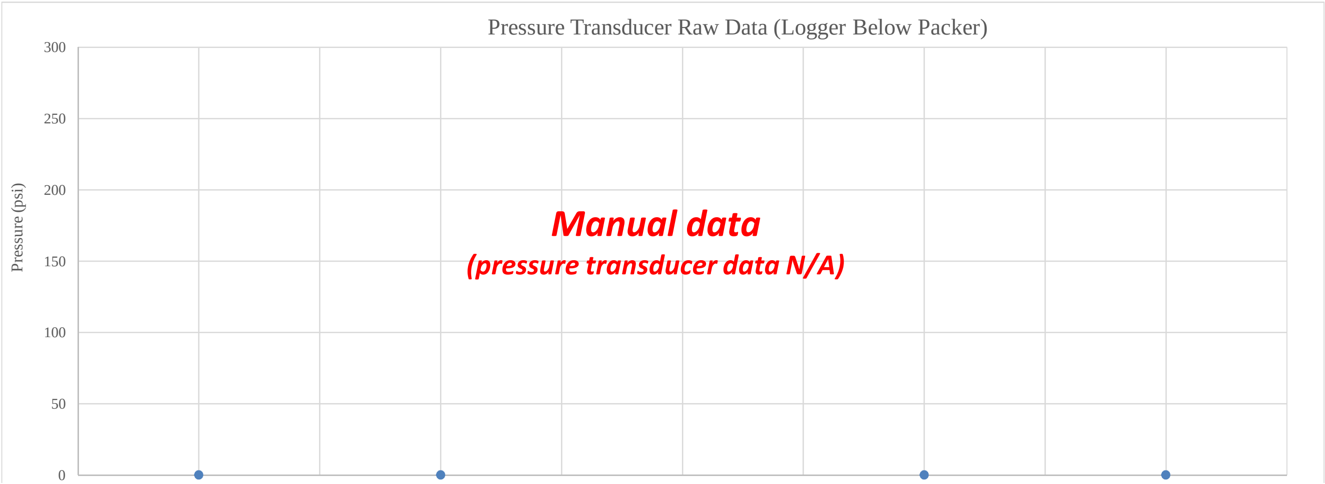
1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Borehole:	MW14-05A (BH-11A, CFD-0444)	**Test Number:**	5	**Tester:**	CB/MS
Date:	16-Sep-14	**Start Time:**	2:35 AM	**Stop Time:**	2:56 AM
Test Number:	5	**Geology:**		**Height of P gauge (mags):**	2.07
Depth to bit (m AH):	155	**Length of Packer (m):**	1.25	**Pipe Stickup (mags):**	2.39
Interval (Top) (m AH):	156.25	**Interval Bottom (m AH):**	220.5	**Target Interval description:**	see Tests 2, 3 & 4
Packer type (pneumatic/hydraulic):	hydraulic	**Hole dip:**	90		
Rod Type:	HQ	**Type of water used:**	Fresh	**Hydraulic packer sink time:**	
Rod ID (mm):	77.8	**Additives used (type):**			
Hole Diamter (mm):	96				
transducer SN:	n/a	**packer inflation pressure (psi):**	500	**open hole static WL (mbgs):**	
seal test successful:	yes	**test type:**	constant rate injection		

Time Elapsed (min)	Flowmeter Reading (L)	Flow Rate (L/min)	Pressure (psi)	Comments
0	687.00		50	
1	687.65	0.65	50	
2	688.28	0.63	50	
3	688.95	0.67	50	
4	689.64	0.69	50	
5	690.25	0.61	50	
6	690.89	0.64	50	
7	691.50	0.61	50	
8	692.14	0.64	50	
9	692.74	0.60	50	
10	693.31	0.57	50	Decreased press. a little as it had risen a little above 50
11	693.75	0.44	50	
12	694.32	0.57	50	
13	694.90	0.58	50	
14	695.49	0.59	50	
15	696.07	0.58	50	
16	696.65	0.58	50	
17	697.22	0.57	50	
18	697.81	0.59	50	
19	698.37	0.56	50	
20	698.96	0.59	50	
	AVERAGE:	**0.58**	**50.0**	

Notes:

highlighted cells indicate period of test used for stabilized P and Q readings.



Borehole:	MW14-05A (BH-11A, CFD-0444)
Borehole Angle:	90 [degrees]
Test Number:	5
Start of Test Interval:	156.25 [mbgs]
End of Test Interval:	220.5 [mbgs]
Test Type:	constant rate injection
Packer System:	hydraulic
Date:	16-Sep-14

Steady State Equation: $T = \frac{Q * \ln(R_i/R_{ew})}{2*(pi)*H}$ (Thiem, 1906)[1]

Flow Rate			
injection flow rate (Q)	0.58	[L/min]	collected in field
injection flow rate (Q)	9.6E-06	[m^3/s]	calculated
Water Level			
[pressure transducer data used to estimate static WL]			
pressure transducer depth[2]	-	[mbgs]	in pressure transducer holder below single packer
pipe stickup	2.39	[mags]	collected in field
pressure head	-	[psi]	pressure transducer reading, psi absolute
atmospheric pressure	-	[psi]	assumed
pressure head	#VALUE!	[vertical m H2O]	corrected for atmospheric pressure
Water Level 1 (pressure transducer)	#VALUE!	[vertical mbgs]	calculated
[if pressure transducer data not available]			
pipe stickup	1.11	[mags]	collected in field
depth to water	133.20	[mbtp]	Static WL in MW14-05A on 11-Oct-14 at 15:45
Water Level 2 (manual)	132.09	[vertical mbgs]	calculated
Excess Pressure Head (based on surface readings)[3]			
friction losses (hose to swivel)[4]	0.00	[m]	computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm
friction losses (packer mandrel)[5]	0.04	[m]	IPI hydraulic packer manual or from Darcy-Weisbach equation (pneumatic packer)
most reliable static water level measurement	manual	transducer/manual	transducer (water level 1) or manual (water level 2)
analog pressure gauge height above ground	2.07	[vertical mags]	collected in field
analog pressure gauge reading	50.0	[psi]	collected in field
Exess Pressure Head (most reliable static WL)	169.3	[m]	H, calculated: static WL plus injection pressure, relative to ground surface
Excess Pressure Head Check (based on pressure transducer readings only)			
stabilized pressure[6]	-	[psi]	pressure transducer reading, psi absolute
differential pressure[7]	#VALUE!	[psi]	difference between injection pressure and static WL pressure
Excess Pressure Head (transducer readings)	#VALUE!	[m]	H, calculated - convert differential pressure to m H2O
Other Data			
radius of wellbore (R_w)	0.048	[m]	1/2 of the ID of open HQ borehole
length of test interval	45.0	[m]	adjusted for overlap with Test 4 (ie. subtracted interval portion that overlaps)
skin	0	[-]	assumed
effective wellbore radius (R_{ew})	0.048	[m]	$R_w$exp(Skin)
radius of influence (R_i)	45.0	[m]	assumed (equivalent to length of test interval)
$\ln(R_i/R_{ew})$	6.8	[-]	calculated
Is packer test interval in the unsaturated zone	FALSE	[TRUE/FALSE]	tests in the unsaturated zone are not considered reliable
Flow velocity in open borehole	0.0013	[m/s]	flow rate divided by cross-sectional area
Reynold's number	79.98	[-]	flow velocity x borehole diameter / kinematic viscosity of H2O (at approx. 4°C)
Is flow laminar (Reynold's No. <2040) or turbulent (>2040)	Laminar	[TRUE/FALSE]	results based on turbulent flow should be considered very approximate
Calculated Result			
Transmissivity -- T	6.2E-08	[m^2/s]	Thiem equation; uses excess pressure head based on most reliable of surface (manual) or transducer readings
Hydraulic Conductivity -- K	1.4E-09	[m/s]	equivalent to T divided by test interval

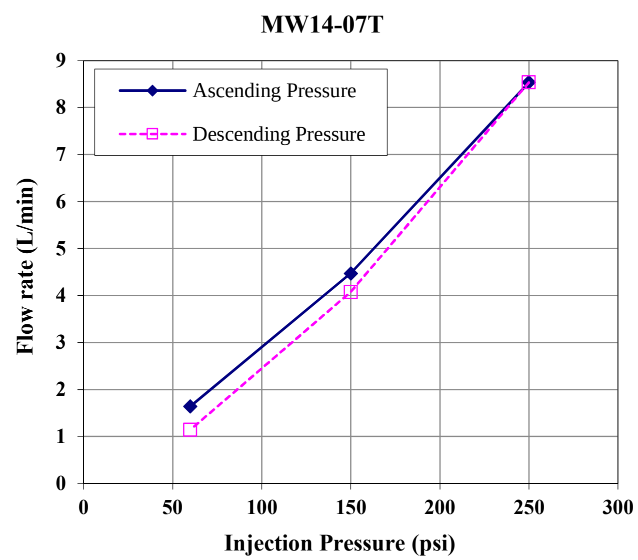
mbtp = metres below top of pipe, mags = metres above ground surface, mbgs = metres below ground surface

1. Thiem, G., 1906. Hydrologische Methoden; Gebhardt, Leipzig.
2. For hydraulic packer, transducer positioned 43" below bottom of packer in gauge holder; for pneumatic packer it is located just below stuffing box.
3. Data from analog pressure gauge read at surface used to guide test during injection and to confirm pressure transducer data
4. Computed from http://www.tasonline.co.za/toolbox/pipe/velfirc.htm assuming rubber lined pipe, 5 m length, ID 19 mm
5. IPI hydraulic packer manual or Darcy-Weisbach equation as provided in http://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss for the pneumatic packer.
6. Estimated stabilized pressure at end of injection period
7. Differential pressure eliminates absolute gauge effect, does not need to be corrected for atmospheric

Location: **MW14-07T / BH1 / CFD-0462** **LUGEON TEST**

Test Interval: **64.4-89** **(m bgs)**

Injection Pressure (Pi) (psi)	Net Injection Pressure (H) (m)	Stabilized Flow Rate (Q) (m^3/min)	Stabilized Flow Rate (Q) (L/min)
60	43.8	0.0016	1.6
150	106.9	0.0045	4.5
250	176.8	0.0085	8.5
150	106.9	0.0041	4.1
60	43.8	0.0011	1.1
-	-	-	-
-	-	-	-



$T=Q\ln(R/r_b)/2\pi H$

T = transmissivity [L^2/t]
Q = flow rate [L^3/t]
R = radius of influence (assumed to equal packer interval length, b) [L]
r_b = radius of borehole [L]
H= net injection pressure [L]

K=T/b

K = hydraulic conductivity [L/t]
b = packer interval length [L]

Pressure Interval	T (m^2/s)	K (m/s)	Flow Descriptor
60 psi	6.2E-07	2.5E-08	Laminar
150 psi	6.9E-07	2.8E-08	Laminar
250 psi	8.0E-07	3.2E-08	Laminar
150 psi	6.3E-07	2.6E-08	Laminar
60 psi	4.3E-07	1.8E-08	Laminar
-	-	-	-
-	-	-	-

Test Geometry (m)	
0.0778	inside diameter of HQ rod
1.7000	height of pressure gauge above ground
60 psi	depth to bottom of packer
0.0000	depth to pre-test water level
0.0480	radius of drillhole (HQ)

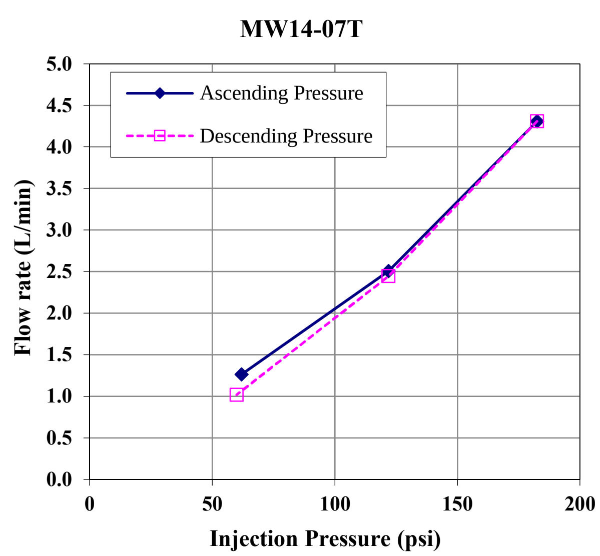
Packer Test Results

Pressure Interval	T (m^2/s)	K (m/s)
Avg. (ascending)	7.0E-07	2.9E-08
Avg. (descending)	6.2E-07	2.5E-08
Avg. (overall)	6.4E-07	2.6E-08

Location: **MW14-07T / BH1 / CFD-0462** **Lugeon Test**

Test Interval: **83.2-124.7 (m bgs)**

Injection Pressure (Pi) (psi)	Net Injection Pressure (H) (m)	Stabilized Flow Rate (Q) (m^3/min)	Stabilized Flow Rate (Q) (L/min)
62	45.2	0.0013	1.3
122	87.3	0.0025	2.5
182.5	129.7	0.0043	4.3
122	87.3	0.0024	2.4
60	43.8	0.0010	1.0
-	-	-	-
-	-	-	-



$T = Q\ln(R/r_b)/2\Pi H$

T = transmissivity [L^2/t]

Q = flow rate [L^3/t]

R = radius of influence (assumed to equal packer interval length, b) [L]

r_b = radius of borehole [L]

H= net injection pressure [L]

K=T/b

K = hydraulic conductivity [L/t]

b = packer interval length [L]

Pressure Interval	T (m^2/s)	K (m/s)	Flow Descriptor
62 psi	5.0E-07	1.2E-08	Laminar
122 psi	5.2E-07	1.2E-08	Laminar
182.5 psi	6.0E-07	1.4E-08	Laminar
122 psi	5.0E-07	1.2E-08	Laminar
60 psi	4.2E-07	1.0E-08	Laminar
-	-	-	-
-	-	-	-

Test Geometry (m)	
0.0778	inside diameter of HQ rod
1.7000	height of pressure gauge above ground
124.6600	depth to bottom of packer
0.0000	depth to pre-test water level
0.0480	radius of drillhole (HQ)

Packer Test Results

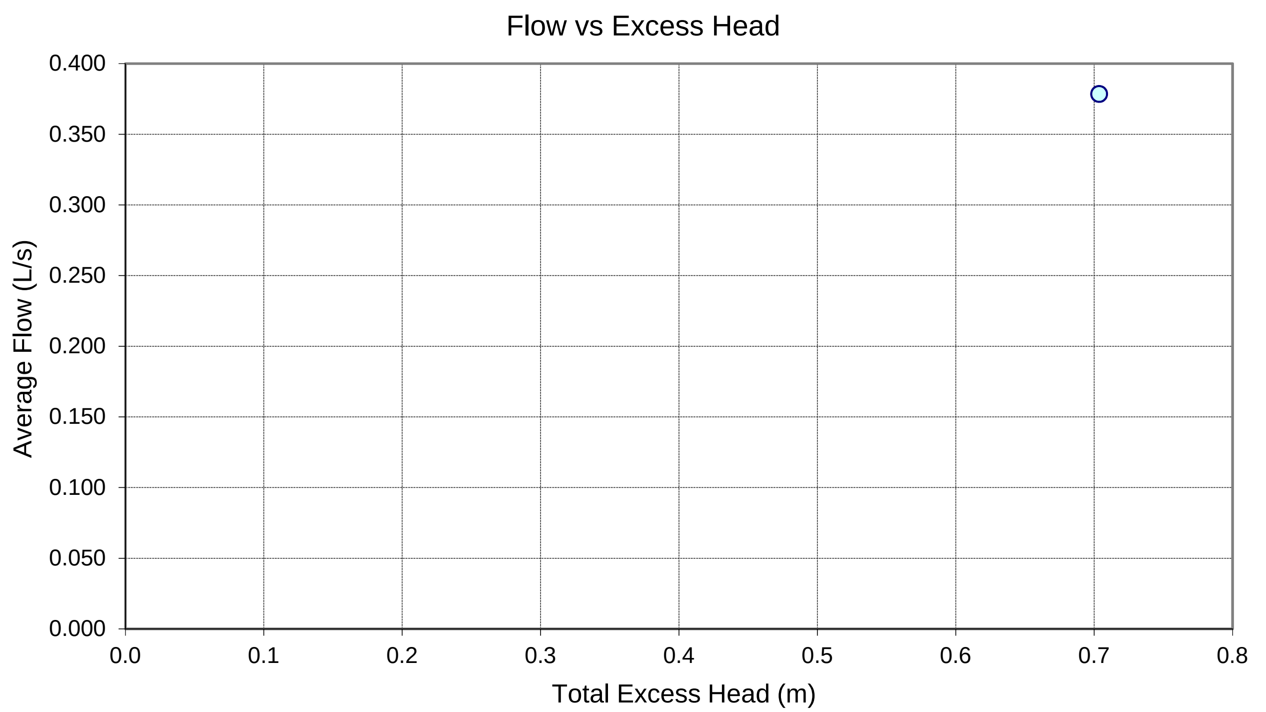
Pressure Interval	T(m^2/s)	K(m/s)
Avg. (ascending)	5.4E-07	1.3E-08
Avg. (descending)	5.1E-07	1.2E-08
Avg. (overall)	5.1E-07	1.2E-08

PACKER TESTING - CONSTANT HEAD TEST

Date of Test:	13-May-15	Apparent Current Depth of Drill Hole (m):			53.34
Drill Hole No:	**MW15-04T**	Test Section from (m):	34.75	to:	53.34
Test No:	#1	Length of Test Section (m):			18.59
Packer Type:	single	Static Groundwater Level (vertical m below datum):			0.00
Inflation Pressure (kPa):	350 psi	Height of Gauge (m above datum):			0.00
Casing Details:	n/a	Drill Hole Dip (deg from horizontal):			80
Diameter of Drill Hole (mm):	114.3	Vertical Depth of Drill Hole (m):			52.53
ID of Drilling Rods (mm):		Vertical Depth of Test Section Centre (m):			43.37

If groundwater level is unknown during the test use depth of test center section

	Injection		Cummulative	Friction Head Loss		Total Excess	Injection	
Stage	Duration	Pressure	Consumption	Packer	Hose	Head	Rate	Note
no.	min	kPa	liters	m	m	m	L/s	
zero		0	0.0	0	0	0	0.00	
#1	10	6.90	227.1	0.00	0.00	0.70	0.38	
#2								
#3								poor
#2								seal
#1							rough estimate only	

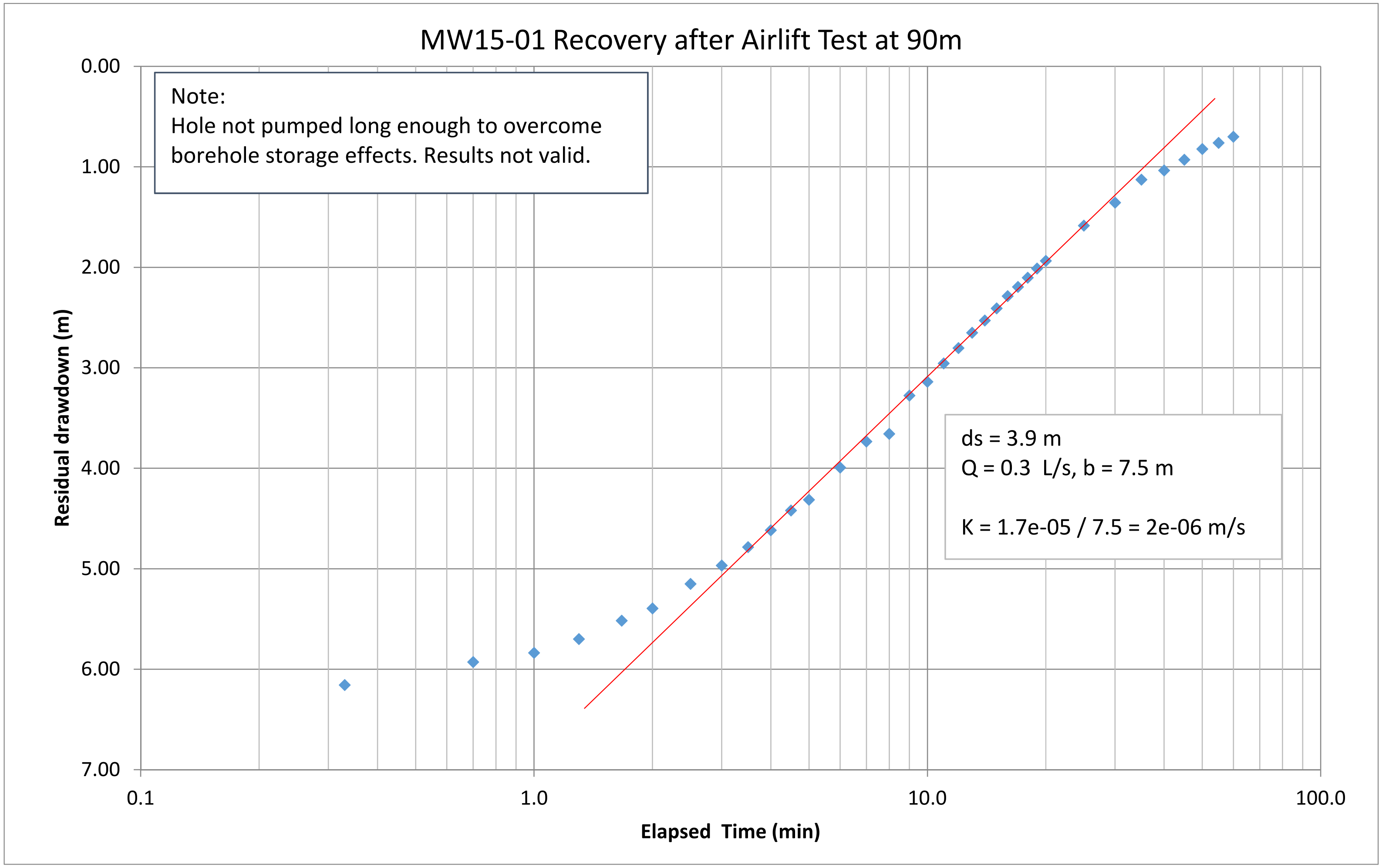


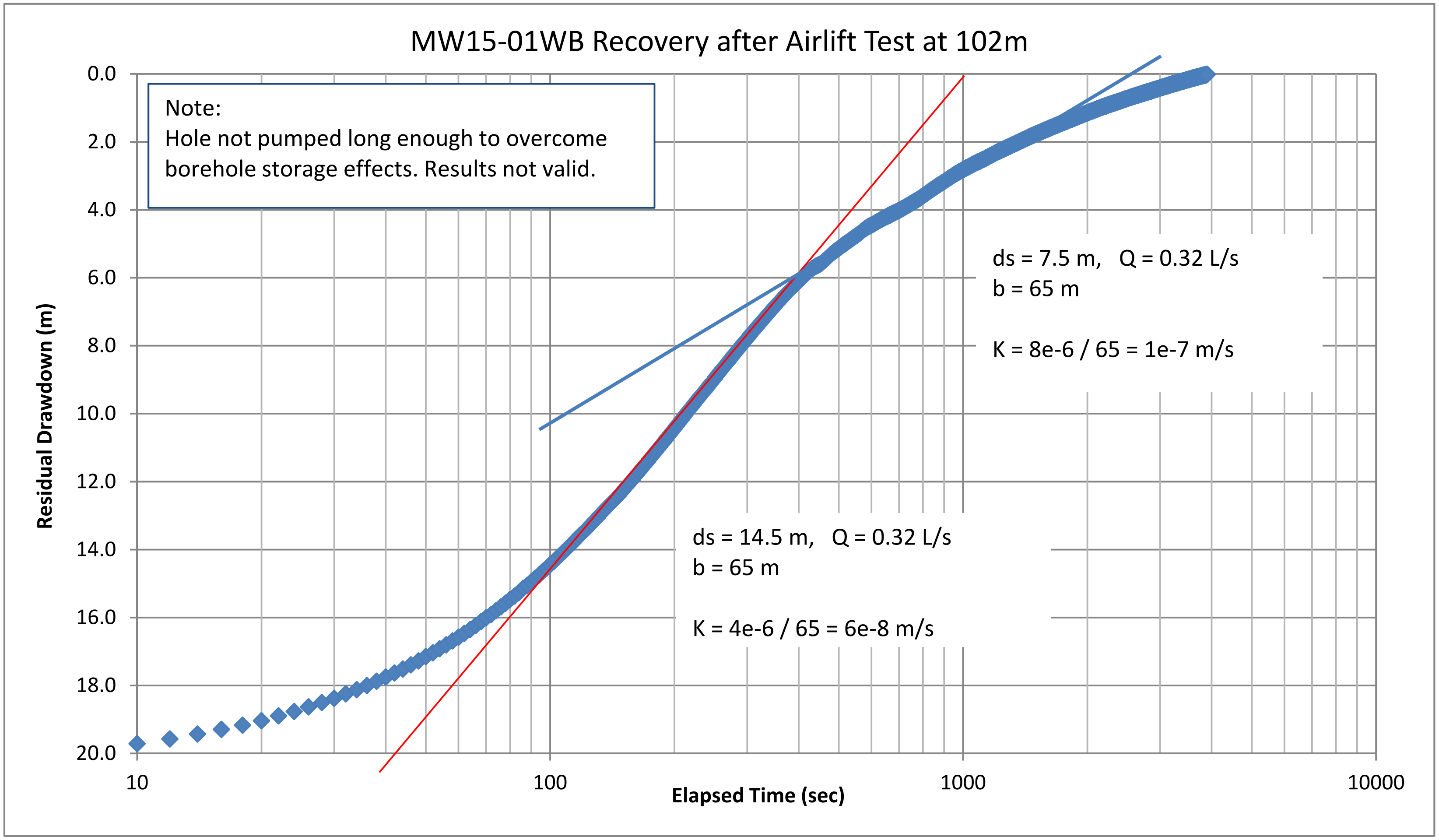
Bulk K (m/s)	Stage no.					Average K	Lugeon
	#1	#2	#3	#2 back	#1 back		
	2.7E-05					**2.7E-05**	

LORAX ENVIRONMENTAL

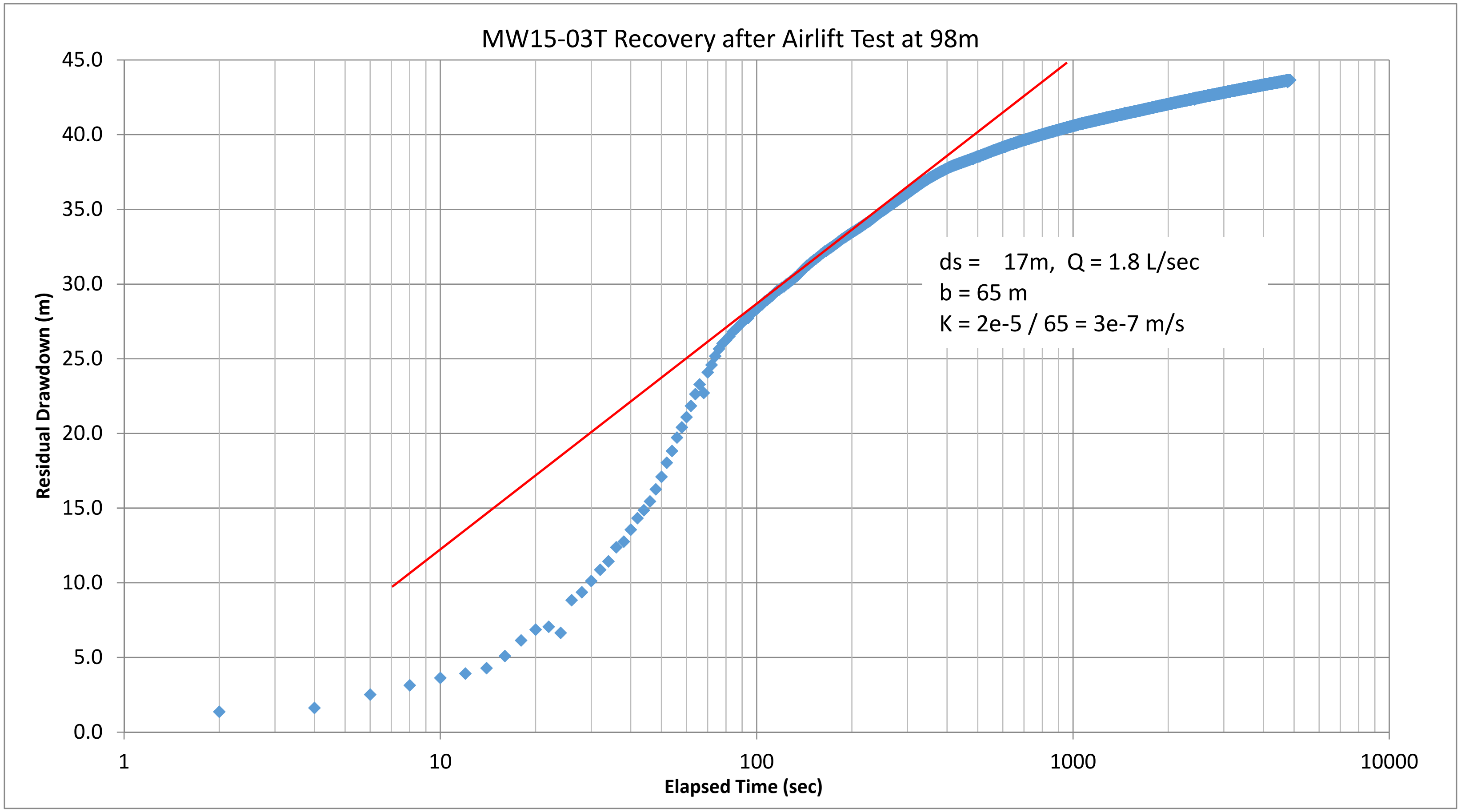
2289 Burrard St., Vancouver, B.C.

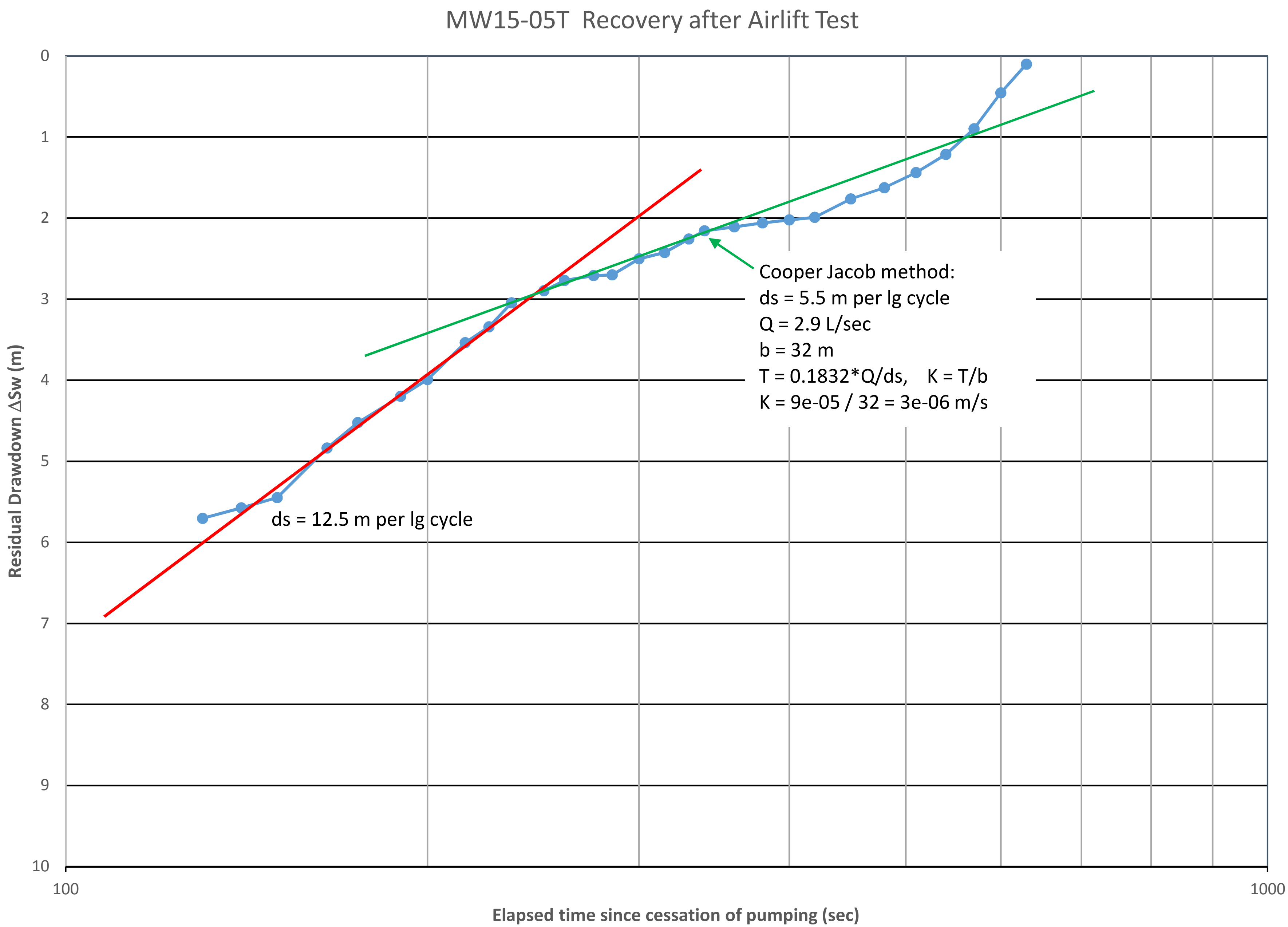
PROJ. NO.:	A362-4		
PROJECT:	Coffee Creek Gold Project		
DETAILS:	Shut-in Test in MW15-04T (BH-04)		
ENG.	LF	Checked:	
DATE	18-Feb-16	Figure:	


MW15-01 Recovery after Airlift Test at 90m
Note:
Hole not pumped long enough to overcome borehole storage effects. Results not valid.
ds = 3.9 m
Q = 0.3 L/s, b = 7.5 m
K = 1.7e-05 / 7.5 = 2e-06 m/s
Residual drawdown (m)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
0.1
1.0
10.0
100.0
Elapsed Time (min)



MW15-01WB Recovery after Airlift Test at 102m
Note:
Hole not pumped long enough to overcome borehole storage effects. Results not valid.
ds = 7.5 m, Q = 0.32 L/s
b = 65 m
K = 8e-6 / 65 = 1e-7 m/s
ds = 14.5 m, Q = 0.32 L/s
b = 65 m
K = 4e-6 / 65 = 6e-8 m/s
Residual Drawdown (m)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
Elapsed Time (sec)
10
100
1000
10000

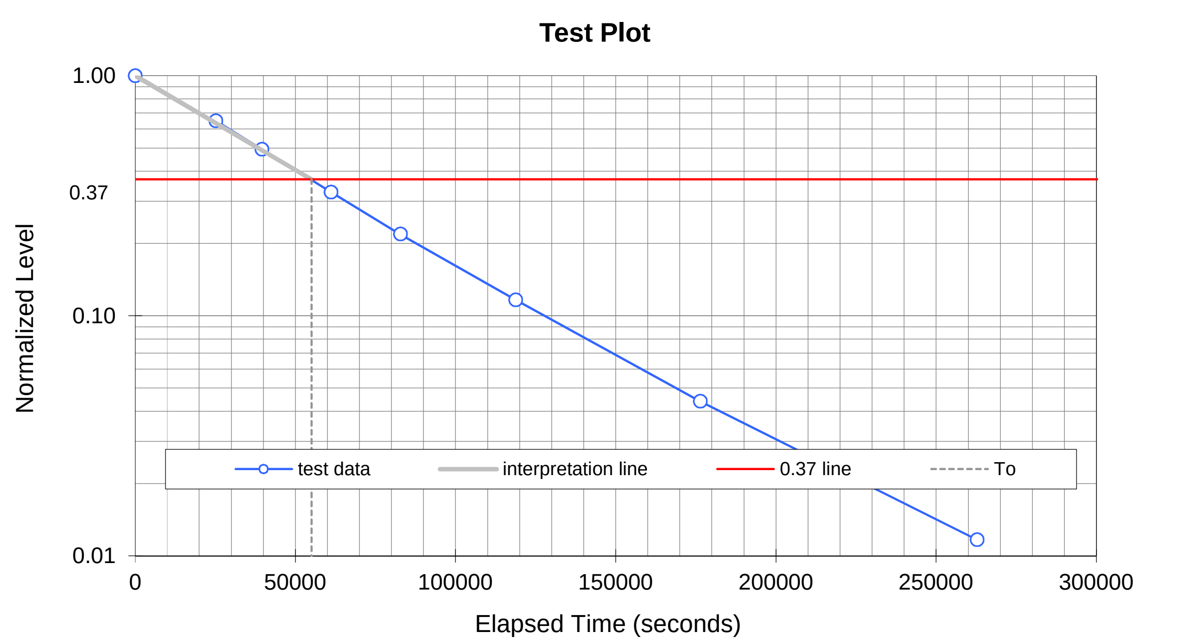

MW15-03T Recovery after Airlift Test at 98m
Residual Drawdown (m)
Elapsed Time (sec)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1
10
100
1000
10000
ds = 17m, Q = 1.8 L/sec
b = 65 m
K = 2e-5 / 65 = 3e-7 m/s


MW15-05T Recovery after Airlift Test
Residual Drawdown ΔSw (m)
Elapsed time since cessation of pumping (sec)
0
1
2
3
4
5
6
7
8
9
10
100
1000
Cooper Jacob method:
ds = 5.5 m per lg cycle
Q = 2.9 L/sec
b = 32 m
T = 0.1832*Q/ds, K = T/b
K = 9e-05 / 32 = 3e-06 m/s
ds = 12.5 m per lg cycle

Falling Head Test - Hvorslev Solution

Date:	August 9, 2015		Time Initiated:	11:00	**Well:**	**MW14-05B**
Borehole Diameter (mm):		96	Riser ID (mm):	50	Screen Length (m):	20.50
Static Level H (mbrp) :		135.00	Initial Level H_0 (mbrp):	145.00	**T_o (sec) =**	**55000**
Screen at impervious boundary: Yes = 1, No=0		0			**K (m/s) =**	**4.7E-10**

Clock Time	Elapsed Time (sec)	Elapsed Time (min)	Depth to Water (h) (mbrp)	Drawdown H - h (m)	Normalized Level $(H-h)/(H-H_0)$	Comments
11:00	0	0.0	145.000	10.000	1.00	
						Recovery after purging and sampling
	25200	420.0	141.481	6.481	0.65	
	39600	660.0	139.938	4.938	0.49	DTW recorded with data logger
	61200	1020.0	138.269	3.269	0.33	
	82800	1380.0	137.185	2.185	0.22	
	118800	1980.0	136.164	1.164	0.12	
	176400	2940.0	135.440	0.440	0.04	
	262800	4380.0	135.117	0.117	0.01	

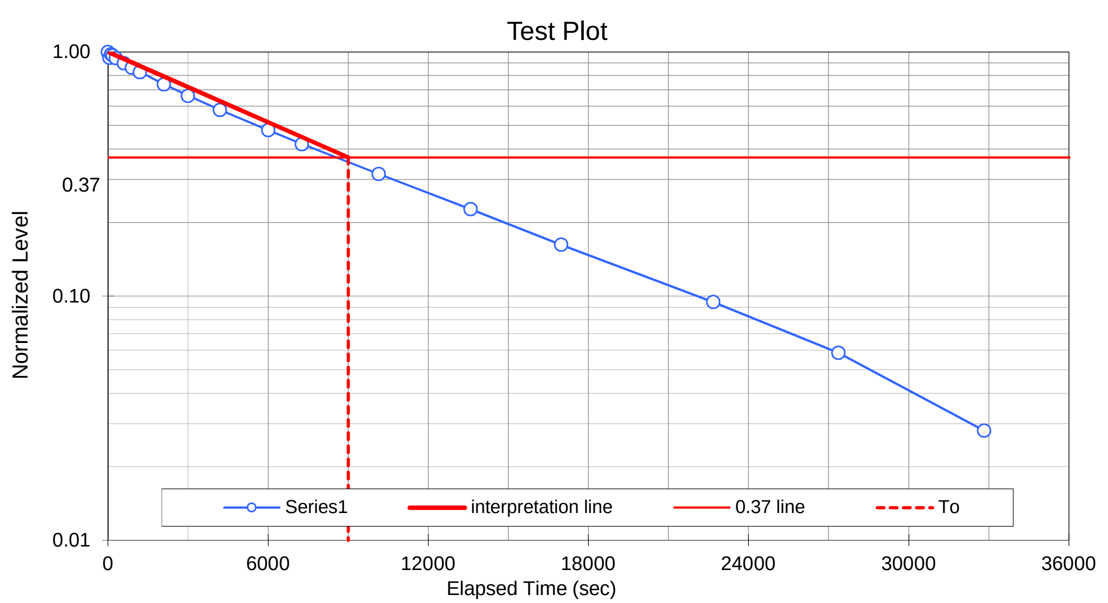


LORAX ENVIRONMENTAL 2289 Burrard St., Vancouver, B.C.	Project No.:	A362-4		
	Project:	Coffee Creek Gold Project		
	Details:	Recovery after GW Sampling in MW14-05B		
	Eng.:	VS	Checked:	
	Date:	18-Feb-16	Figure No:	

Hvorslev Method - Falling Head Test

Date:	September 1, 2014	Time Initiated:	12:00	Well:	**MW14-06A**
Effective Screen Radius (mm)	61	Riser Radius (mm):	25	Screen Length (m):	18.00
Static Level H (mbrp) :	0.00	Initial Level H_0 (mbrp):	1.00	**T_o (sec) =**	**9000**
Aquifer Thickness (m):	20.0			**K (m/s) =**	**1.1E-08**

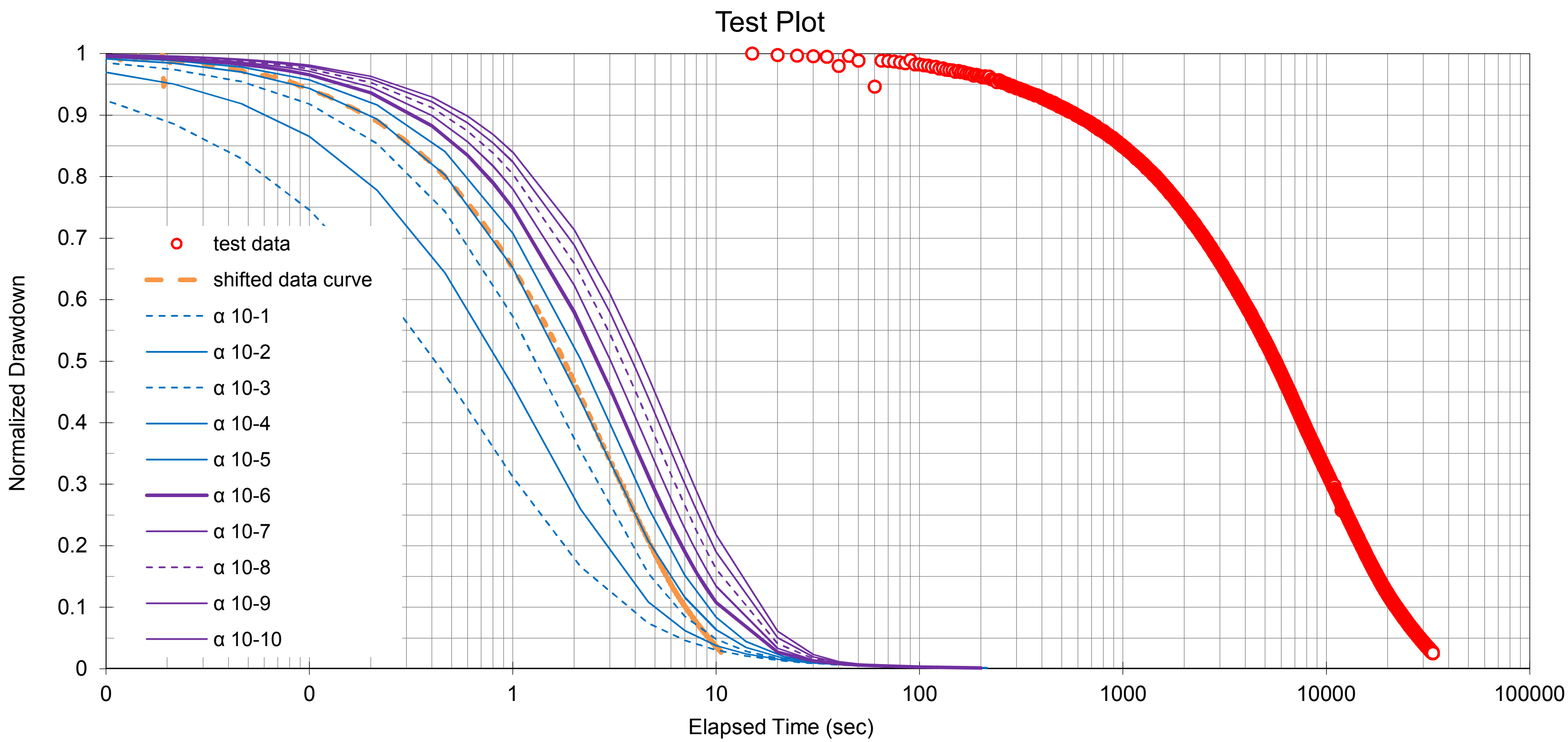
Clock Time	Elapsed Time (sec)	Elapsed Time (min)	Depth to Water (h) (mbrp)	Drawdown H - h (m)	Normalized Level (H-h)/(H-H_0)	Comments
	0	0.0	1.000	1.00	1.00	
	60	1.00	0.95	0.946	0.946	
	120	2.00	0.98	0.978	0.978	Solid slug
	180	3.00	0.97	0.966	0.966	data logger was
	300	5.00	0.94	0.943	0.943	used to record
	600	10.00	0.90	0.899	0.899	the response
	900	15.00	0.86	0.861	0.861	
	1200	20.00	0.83	0.827	0.827	Actual static level
	2100	35.00	0.74	0.737	0.737	below 150 mTOC
	3000	50.00	0.66	0.661	0.661	
	4200	70.00	0.58	0.579	0.579	
	6000	100.00	0.48	0.478	0.478	
	7260	121.00	0.42	0.419	0.419	
	10140	169.00	0.32	0.316	0.316	
	13590	226.50	0.23	0.227	0.227	
	16980	283.00	0.16	0.162	0.162	
	22680	378.00	0.09	0.094	0.094	
	27360	456.00	0.06	0.059	0.059	
	32820	547.00	0.03	0.028	0.028	



LORAX ENVIRONMENTAL	Project No.:	A362-4		
	Project:	Coffee Creek Gold Project		
	Details:	Falling head test in MW14-06A		
2289 Burrard St., Vancouver, B.C.	Eng.:	VS	Checked:	
	Date:	18-Feb-16	Figure No:	

Papadopulos-Cooper Type Curve Method - Slug Test Evaluation

Date :	September 1, 2014	Time Initiated :	12:00			Well :	MW14-06A
Screen Radius rs (mm) :	61.0	Riser Radius rc (mm) :	25.0	Time correction :	0.00032	type curve α :	1.E-04
Static Level Ho (m TOC) :	0.00	Initial Test Level H (m TOC) :	1.00	t_o (sec) =	3125.00	**T (m^2/s) =**	**2.00E-07**
Aquifer Thickness b (m) :	20.0	Screen Length (m) :	18.00	**S (-) =**	**1.68E-05**	**K (m/s) =**	**1.1E-08**



Note:

Actual static level @ 160 m TOC

Data logger readings not converted to DTW

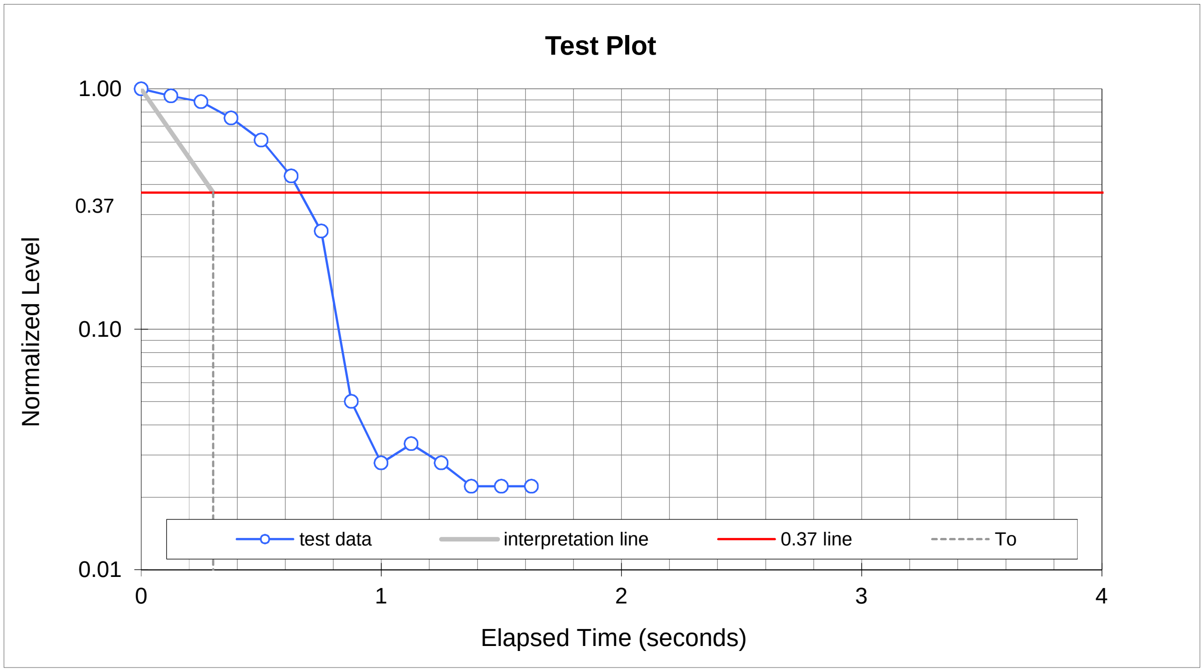
LORAX ENVIRONMENTAL

2289 Burrard St., Vancouver, B.C.

Project No.:	A362-4		
Project:	Coffee Creek Gold Project		
Details:	Falling head test in MW14-06A		
Eng.:	VS	Checked:	
Date:	2/18/2016	Figure No:	

Falling Head Test - Hvorslev Solution

Date:	September 7, 2015		Time Initiated:	10:30	**Well:**	**MW15-2 AZ**
Borehole Diameter (mm):		114	Riser ID (mm):	50	Screen Length (m):	13.00
Static Level H (mbrp) :		0.00	Initial Level H_0 (mbrp):	0.90	**T_o (sec) =**	**0.3**
Screen at impervious boundary: Yes = 1, No=0		0			**K (m/s) =**	**1.2E-04**
Clock Time	Elapsed Time (sec)	Elapsed Time (min)	Depth to Water (h) (mbrp)	Drawdown H - h (m)	Normalized Level $(H-h)/(H-H_0)$	Comments
10:30	0	0.0	0.900	0.900	1.00	
	0.125	0.0	0.840	0.840	0.93	
	0.25	0.0	0.795	0.795	0.88	screened across
	0.375	0.0	0.680	0.680	0.76	sandpack
	0.5	0.0	0.550	0.550	0.61	
	0.625	0.0	0.390	0.390	0.43	**very fast response**
	0.75	0.0	0.230	0.230	0.26	**due to sandpack**
	0.875	0.0	0.045	0.045	0.05	**high K and storage**
	1	0.0	0.025	0.025	0.03	
	1.125	0.0	0.030	0.030	0.03	
	1.25	0.0	0.025	0.025	0.03	
	1.375	0.0	0.020	0.020	0.02	
	1.5	0.0	0.020	0.020	0.02	**K value is not**
	1.625	0.0	0.020	0.020	0.02	**valid for the tested**
						formation

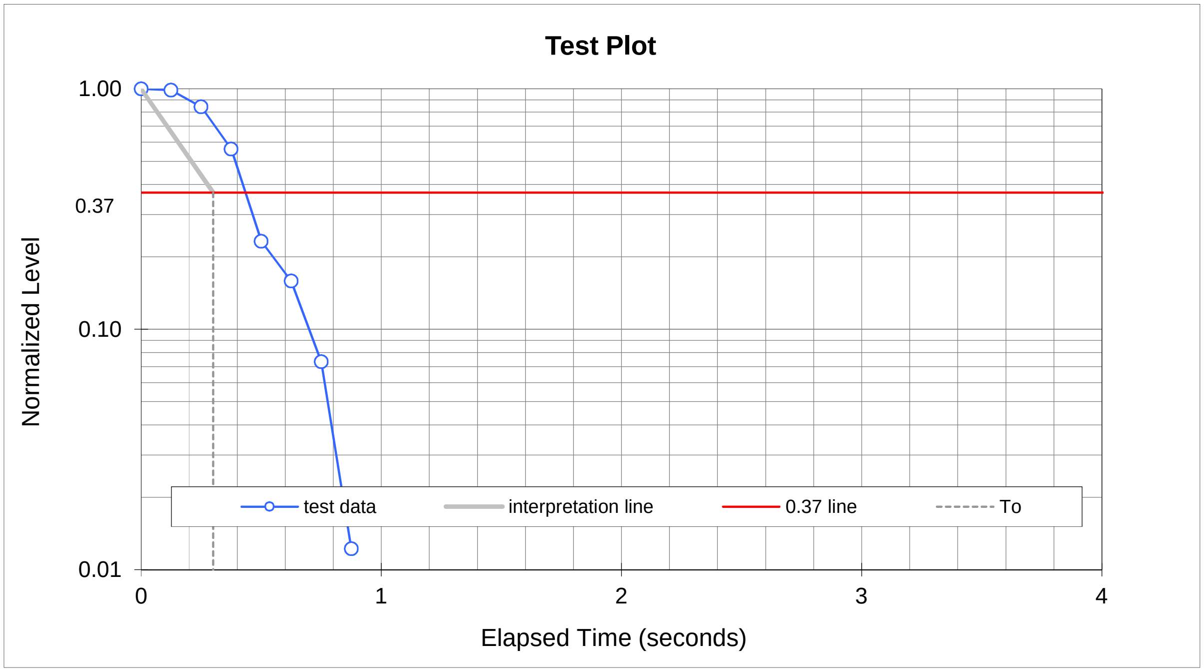


LORAX ENVIRONMENTAL	Project No.:	A362-4		
	Project:	Coffee Creek Gold		
	Details:	Stug Test in MW15-2 AZ		
2289 Burrard St., Vancouver, B.C.	Eng.:	VS	Checked:	
	Date:	18-Feb-16	Figure No:	

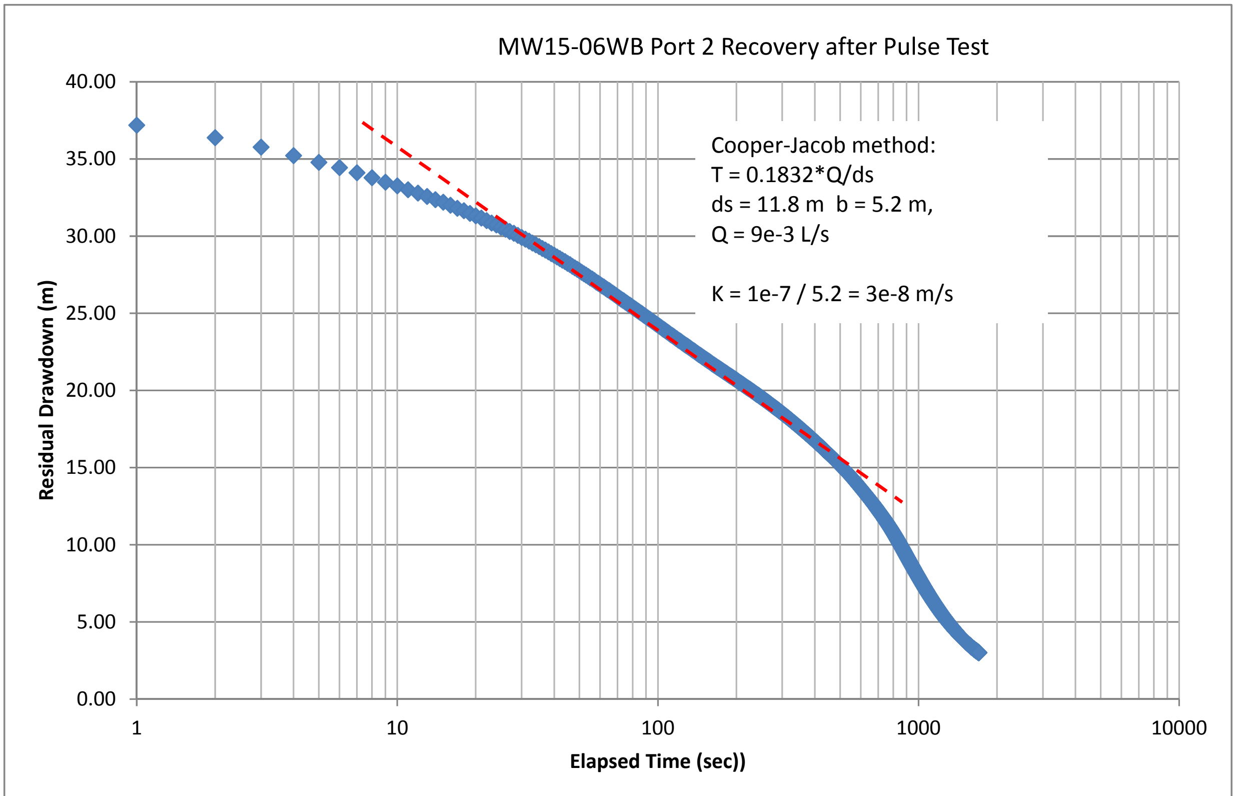
Falling Head Test - Hvorslev Solution

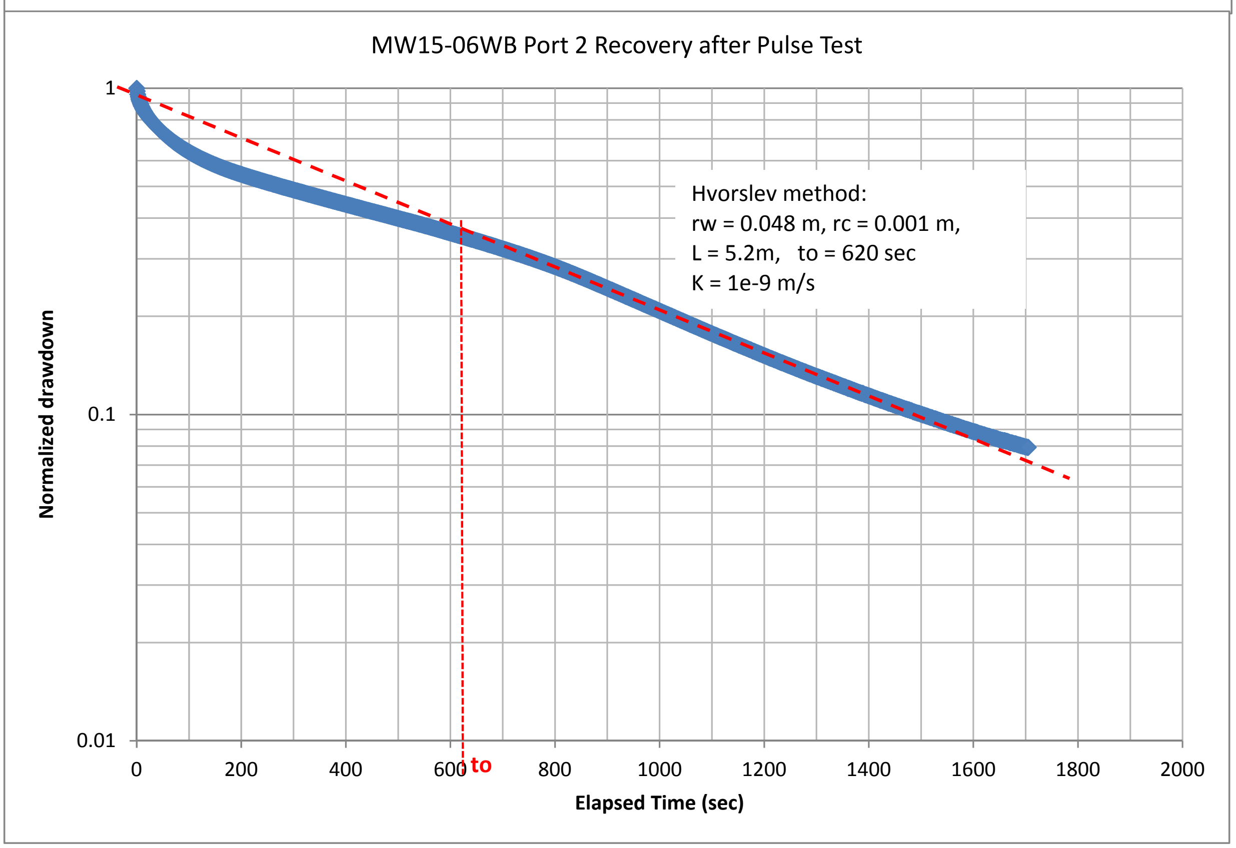
Date:	September 4, 2015		Time Initiated:	10:30	**Well:**	**MW15-3 AZ**	
Borehole Diameter (mm):		114	Riser ID (mm):	50	Screen Length (m):	13.00	
Static Level H (mbrp) :		0.00	Initial Level H_0 (mbrp):	0.82	**T_o (sec) =**	**0.3**	
Screen at impervious boundary: Yes = 1, No=0		0			**K (m/s) =**	**1.2E-04**	

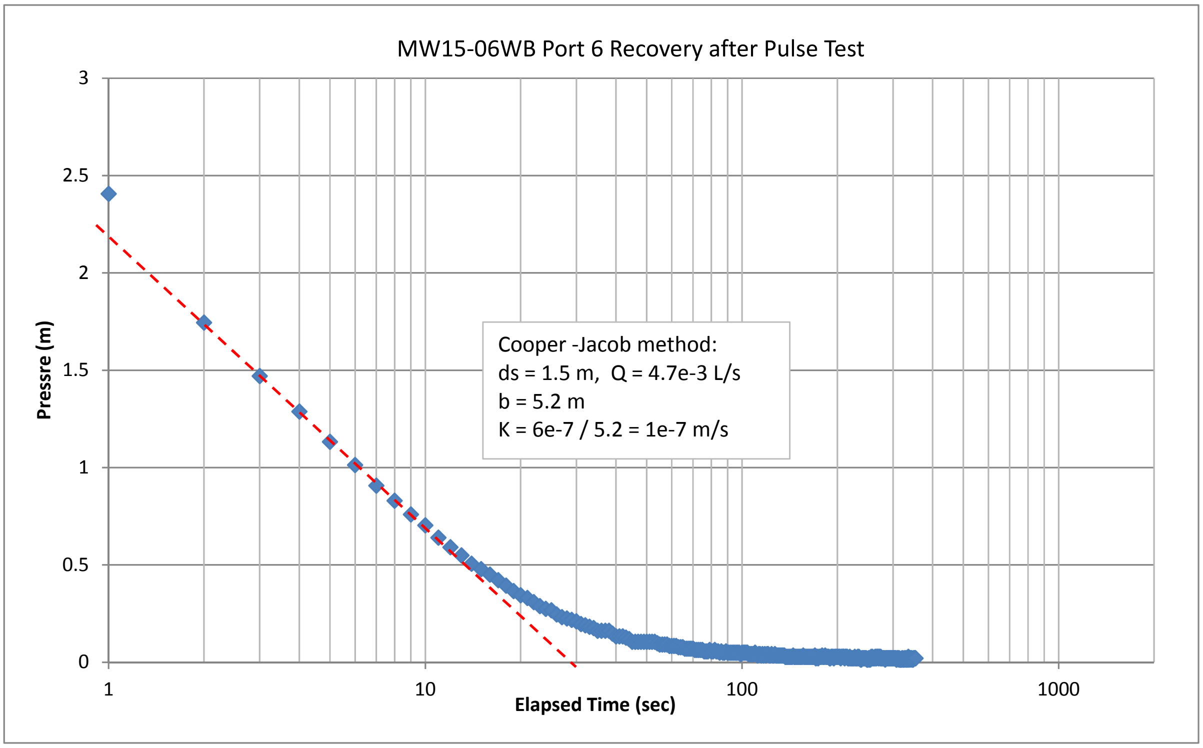
Clock Time	Elapsed Time (sec)	Elapsed Time (min)	Depth to Water (h) (mbrp)	Drawdown H - h (m)	Normalized Level $(H-h)/(H-H_0)$	Comments
10:30	0	0.0	0.820	0.820	1.00	
	0.125	0.002	0.810	0.810	0.99	
	0.25	0.004	0.690	0.690	0.84	screened across sandpack
	0.375	0.006	0.460	0.460	0.56	
	0.5	0.008	0.190	0.190	0.23	
	0.625	0.010	0.130	0.130	0.16	
	0.75	0.013	0.060	0.060	0.07	**very fast response due to K and storage of sandpack**
	0.875	0.015	0.010	0.010	0.01	
						screened across water level
						Not valid for the tested aquifer

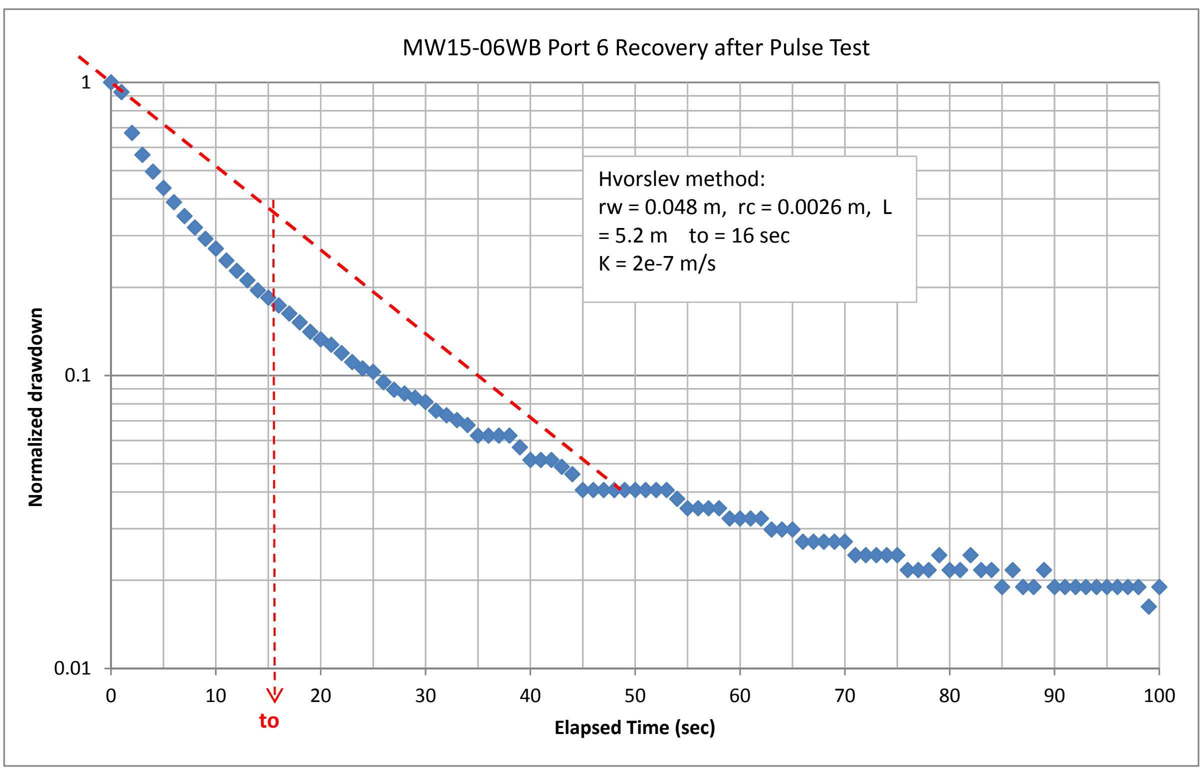


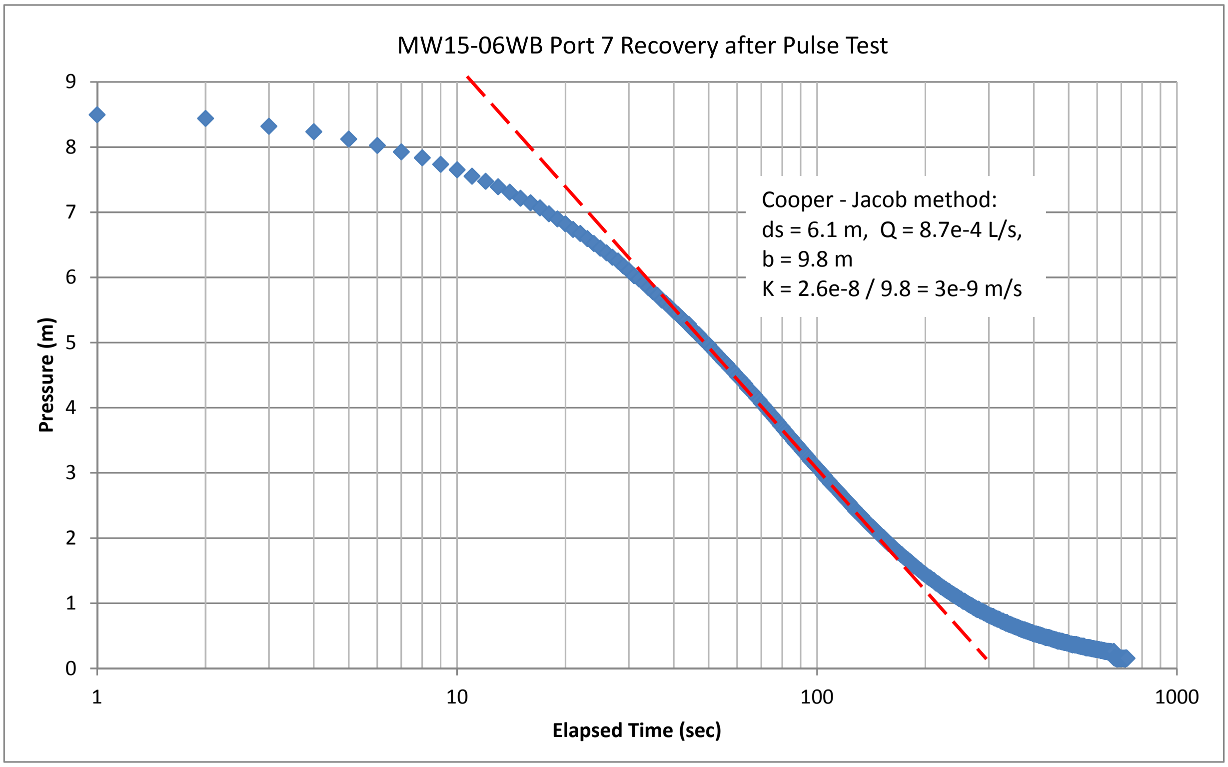
LORAX ENVIRONMENTAL	Project No.:	A362-4		
	Project:	Coffee Creek Gold Project		
	Details:	Stug Test in MW15-3 AZ		
2289 Burrard St., Vancouver, B.C.	Eng.:	VS	Checked:	
	Date:	18-Feb-16	Figure No:	

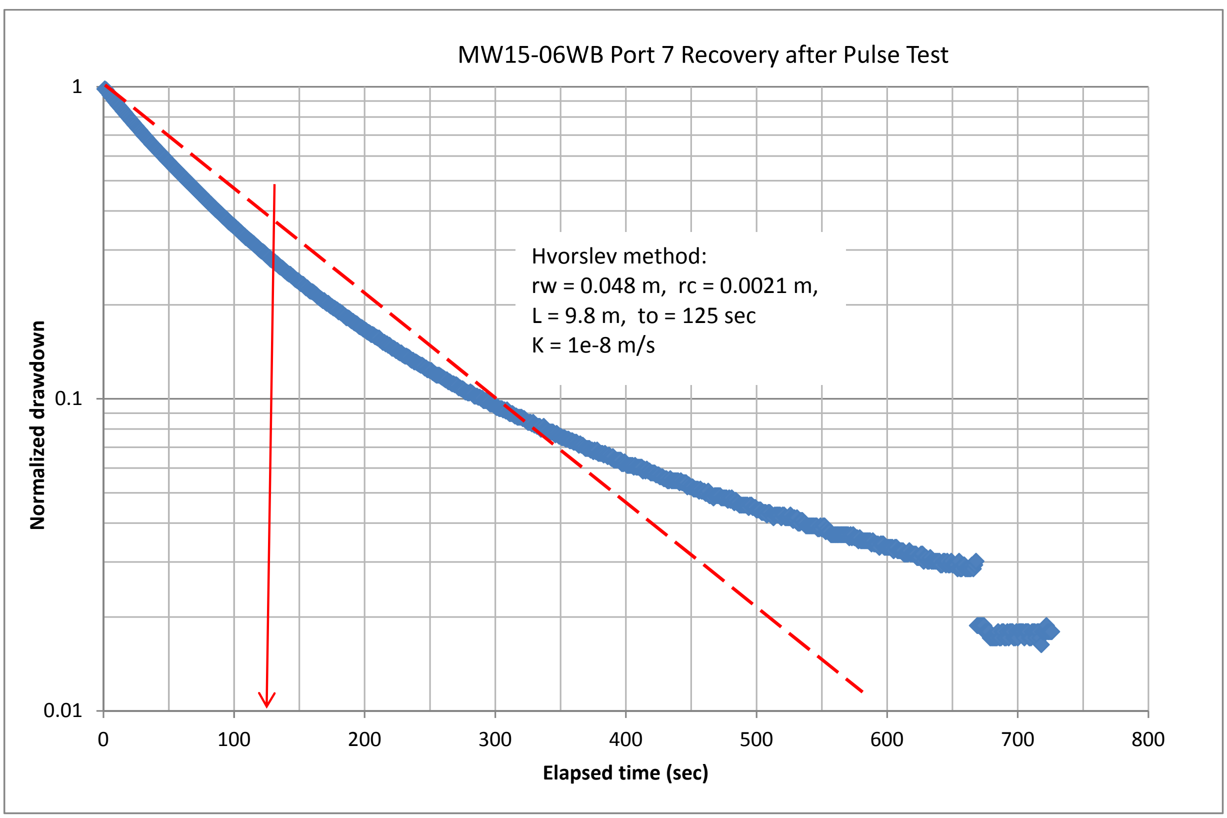

MW15-06WB Port 2 Recovery after Pulse Test
Cooper-Jacob method:
T = 0.1832*Q/ds
ds = 11.8 m b = 5.2 m,
Q = 9e-3 L/s
K = 1e-7 / 5.2 = 3e-8 m/s
Residual Drawdown (m)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1
10
100
1000
10000
Elapsed Time (sec))


MW15-06WB Port 2 Recovery after Pulse Test
Hvorslev method:
rw = 0.048 m, rc = 0.001 m,
L = 5.2m, to = 620 sec
K = 1e-9 m/s
Normalized drawdown
1
0.1
0.01
0
200
400
600
to
800
1000
1200
1400
1600
1800
2000
Elapsed Time (sec)


MW15-06WB Port 6 Recovery after Pulse Test
Pressre (m)
Elapsed Time (sec)
Cooper -Jacob method:
ds = 1.5 m, Q = 4.7e-3 L/s
b = 5.2 m
K = 6e-7 / 5.2 = 1e-7 m/s
3
2.5
2
1.5
1
0.5
0
1
10
100
1000


MW15-06WB Port 6 Recovery after Pulse Test
Normalized drawdown
Elapsed Time (sec)
Hvorslev method:
rw = 0.048 m, rc = 0.0026 m, L = 5.2 m to = 16 sec
K = 2e-7 m/s
to
1
0.1
0.01
0
10
20
30
40
50
60
70
80
90
100


MW15-06WB Port 7 Recovery after Pulse Test
Pressure (m)
Elapsed Time (sec)
Cooper - Jacob method:
ds = 6.1 m, Q = 8.7e-4 L/s,
b = 9.8 m
K = 2.6e-8 / 9.8 = 3e-9 m/s
0
1
2
3
4
5
6
7
8
9
1
10
100
1000


MW15-06WB Port 7 Recovery after Pulse Test
Normalized drawdown
Elapsed time (sec)
Hvorslev method:
rw = 0.048 m, rc = 0.0021 m,
L = 9.8 m, to = 125 sec
K = 1e-8 m/s
1
0.1
0.01
0
100
200
300
400
500
600
700
800

Appendix 3-F:
Monitoring Well Development and Sampling Methods

GOLDCORP

Appendix 3-F: Well Development and Groundwater Sampling Methods

1. Introduction

Well development and groundwater sampling methods implemented at the Coffee Gold Project are described in the following document.

Nineteen groundwater monitoring wells were installed at the Coffee Gold Project in 2014 and 2015. Monitoring wells installed in 2014 (MW14-02A, MW14-02B, MW14-03A, MW14-03B, MW14-05A, MW14-05B, MW14-06A and MW14-06B) were all completed as conventional installations in boreholes drilled with a hydraulic diamond drill. Monitoring wells installed in 2015 consisted of conventional wells in the shallow groundwater system (MW15-01AZ, MW15-02AZ, MW15-03AZ, MW15-04AZ and MW15-05AZ) and Westbay system installations in the deeper groundwater system (MW15-01WB, MW15-02WB, MW15-03WB, MW15-04WB, MW15-05WB, and MW15-06WB). All monitoring wells installed in 2015 were drilled with a reverse circulation drill with the exception of MW15-06WB which was drilled with a hydraulic diamond drill. Well completion details for the conventional monitoring wells and Westbay installations are presented in Table 3-2 and Table 3-3 in the main report, respectively. The location of monitoring wells is shown in Figure 3-1 in the main report. Borehole and monitoring well completion logs are provided in Appendix 3-A. Details regarding drilling and installation methods used in 2014 and 2015 are presented in Appendix 3-D.

2. Well Development

The purpose of well development is to remove drilling artifacts to facilitate sampling of representative formation water. Specific well development and groundwater sampling methods were employed depending on the type of well installation and depth to groundwater, and are described below.

2.1. 2014 Well Development Program

Well development was conducted between September 24 and October 9, 2014. Details regarding the development of the MW14-series monitoring wells are presented in Table 1. Water levels at MW14-02A and MW14-02B were shallow and the screened interval sufficiently permeable to support development using conventional equipment (inertial pump actuated with a Hydrolift II). Deep water levels (>100 metres) observed in the remaining monitoring wells required the use of a custom made bailer-winch system shown in Photograph 1.

Monitoring wells MW14-02A and MW14-02B were developed by purging with inertial pumps at flow rates ranging from 1 to 2 L/min. Both wells were developed by pumping until the purge water was clear (sediment free) and a minimum of two well volumes (volume of water in the well casing plus water in the sand pack) had been removed.

Monitoring wells MW14-03A, MW14-03B, MW14-05A, MW14-05B and MW14-06A were developed by purging with the bailer-winch system. Average flow rates ranged from 0.14 to 0.32 L/min. A total of 0.5 to 1.4 well volumes was purged from these wells during development in 2014. The initial purge water at MW14-03A was more viscous than typical and was characterized as having a stringy/goopy consistency due to the presence of drilling additives.

Several monitoring wells were affected by water freezing inside the well casing. Significant ice buildup occurred inside the well casing at shallow depths (<20 m) at MW14-03A, MW14-05A and MW14-06A during purging and development with the bailer-winch system. Ice buildup resulted in difficulty inserting and extracting the bailer from the wells and ultimately led to the suspension of purging and development at MW14-03A, MW14-05A and MW14-06A. Monitoring well MW14-06B could not be developed as a result of the water column freezing after installation.

Photograph 1: Bailer-winch system used to develop monitoring wells MW14-03A, MW14-03B, MW14-05A, MW14-05B and MW14-06A. System setup pictured at MW14-06A.

Table 1:
2014 Monitoring Well Development

Monitoring Well ID	Development Method	Well Volume[1]	Volume Purged	Well Volumes Purged
		L	L	
MW14-02A	IP	428	1040	2.4
MW14-02B	IP	297	638	2.1
MW14-03A	BW	228	328	1.4
MW14-03B	BW	54	77	1.4
MW14-05A	BW	198	104	0.5
MW14-05B	BW	161	153	1.0
MW14-06A	BW	313	195	0.6
MW14-06B[2]	-	-	-	-

Notes:
BW = bailer-winch system, IP = inertial pump actuated with a Hydrolift II
1. Volume of water in well casing and sand pack (based on pre-development water levels).
2. MW14-06B started freezing and was blocked by ice before it could be developed.

2.2. 2015 Well Development Program

The 2015 well development program was conducted between May 29 and June 21, 2015, with the exception of shallow groundwater monitoring well MW15-05AZ, which was dry at the time. This well was subsequently developed on September 6, 2015. Several different development methods (i.e., inertial pump, air lift, and Westbay sampler) were used depending on the well type and depth to water. Details regarding the development of the MW14-series and MW15-series monitoring wells conducted in 2015 are presented in Table 2.

Table 2:
2015 Monitoring Well Development

Monitoring Well ID	Development Method	Well Volume[1]	Volume Purged	Well Volumes Purged	Comments
		L	L		
MW14-02A	-	-	-	-	Development completed in 2014.
MW14-02B	IP	285	825	2.9	Well development conducted in 2015 due to sediment observed in purge water. Well purged at flow rates of 2.3 - 4 L/min.
MW14-03A	AL	142	628	4.4	
MW14-03B	AL	50	-	-	Water column air lifted, however no discharge at surface due to low static submergence (~11%).
MW14-05A	AL	213	550	2.6	
MW14-05B	AL	113	44	0.4	Water column air lifted, however very little discharge at surface with decreasing yields due to low static submergence (~24%).
MW14-06A	well damaged[2]	-	-	-	
MW14-06B	well damaged[2]	-	-	-	
MW15-01AZ	-	-	-	-	Dry in June 2015. Frozen in July, August and September 2015.
MW15-02AZ	IP	19.3	250	13	
MW15-03AZ	IP	16	784	49	
MW15-04AZ	-	-	-	-	Dry in June, July, August and September 2015.
MW15-05AZ	IP	1.7	200	118	Dry in June, July and August. Developed September 2015.
MW15-01WB	WB	44	47	1.1	Sample Zone/Port 4 developed
MW15-02WB	WB	44	43.8	1.0	Sample Zone/Port 3 developed
MW15-03WB	WB	31	32.6	1.1	Sample Zone/Port 3 developed
MW15-04WB	WB	18	22.5	1.3	Sample Zone/Port 4 developed
MW15-05WB	WB	31	34.5	1.1	Sample Zone/Port 3 developed
MW15-06WB	WB	28	32.5	1.2	Sample Zone/Port 6 developed

Notes:
IP = inertial pump activated with a Hydrolift II; AL = air-lift pumping
WB = Westbay sampler probe equipped with 4 sample bottles (total volume ~1 L) was used for purging/development

1. Volume of water in well casing and sand pack (based on water levels prior to well development). For Westbay wells the well volume corresponds with the zone volume of the developed sample zone/port.
2. Well casing collapsed near surface, likely due to freeze/thaw action in the active layer. Consequently, the well could not be developed.

Well development of MW14-series monitoring wells (MW14-03A, MW14-03B, MW14-05A and MW14-05B) with deep water levels was resumed in 2015, after difficulties with freezing caused well development to be suspended in 2014. The purge water at these wells remained slightly cloudy (non-mineral in nature) with a slight yellow colour due to the suspected influence of drilling additives. Well development of the MW14-03A, MW14-03B, MW14-05A and MW14-05B was conducted by air-lift surging up to eight times, followed by air lift pumping. Air lift surging is conducted by repeatedly lifting the water column (without actually discharging water at the surface) and then allowing the water to fall back down to the bottom of the well which causes the water to move in and out of the screen and filter pack. This movement entrains fines into the well and allows subsequent removal of fines by air-lift pumping. Air-lift pumping was conducted until the discharge water became clear and colourless or there was no noticeable improvement in cloudiness (turbidity) and colour, and field chemistry (pH and electrical conductivity) stabilized.

Air lift pumping was not successful at MW14-03B and MW14-05B due to low water levels and low static submergence of the air line. The water column was lifted at MW14-03B, however no discharge was observed at surface, while MW14-05B was characterized by very low discharge at surface with decreasing yields. Consequently, well development at MW14-03B and MW14-05B was suspended until water levels rose sufficiently to permit air lift pumping. Monitoring wells MW14-06A and MW14-06B could not be developed in June 2015 due to damaged well casing. Freeze/thaw action in the active layer was suspected of having collapsed the well casing. Additional well development (by purging with an inertial pump) was conducted at MW14-02B after sediment was observed in purge water. An additional 2.9 well volumes were purged at MW14-02B.

The shallow groundwater monitoring wells (MW15-02AZ, MW15-03AZ and MW15-05AZ) were developed by pumping with an inertial pump equipped with a surge block and actuated by a Hydrolift II. The shallow groundwater wells were pumped until the purge water became clear, or there was no noticeable improvement in turbidity. A total of 13 to 118 well volumes were purged from MW15-02AZ, MW15-03AZ and MW15-05AZ during well development.

The Westbay system installations (MW15-01WB to MW15-06WB) were developed by purging with the Westbay sampler. All Westbay installations consist of several sample zones (and corresponding ports), however only one zone was developed at each installation, as summarized in Table 2. The sample zone that was developed was selected based on consideration of field observations, spot air lift testing during drilling, location of suspected features, zone volumes, and the expected performance and connection of sample zones to the groundwater flow system. The selected sample zones were developed by purging a minimum of one zone volume (water volume in the borehole annulus between the packers that delimit the sample zone) to remove mixed borehole water which remained in the sample zone after installation. Due to tight bedrock at MW15-06WB, three sample zones (Ports 2, 6 and 7) were selected for potential development based on field observations during drilling and examination of drill core. All three sample zones selected for potential development were pulse tested (Table 4-2 in the report and Appendix 3-E) with the Westbay sampler to identify the zone with the highest yield. MW15-06WB sample zone/port 6 was determined to have the highest yield during pulse testing and was subsequently developed. A total of 1 to 1.3 zone volumes were purged from MW15-01WB, MW15-02WB, MW15-03WB, MW15-04WB, MW15-05WB and MW15-06WB during well development (Table 2).

3. Groundwater Sampling Methods

Monitoring events were conducted in September/October 2014, May/June 2015, July 2015, August 2015 and September 2015. All new monitoring wells installed in 2014 and 2015 were sampled for groundwater quality with the exception of MW14-06A, MW14-06B, MW15-01AZ and MW15-04AZ which could not be sampled due to damage or water limitations (*e.g.,* frozen or dry) (Table 3). Monitoring wells MW14-06A and MW14-06B were not sampled in 2014 or 2015. Both wells were frozen in 2014 and resulted in damaged casing which precluded their sampling in 2015. Freeze/thaw action was suspected of having collapsed the well casing near ground surface at MW14-06A (4.9 metres below top of casing (mbtoc)) and MW14-06B (3 mbtoc). Shallow groundwater monitoring wells MW15-01AZ and MW15-04AZ were not sampled in 2015 as they were dry or frozen. Table 3 presents a summary of the 2014 and 2105 groundwater sampling programs, including sampling methods used at each monitoring well.

Groundwater sampling was conducted in accordance with methods outlined in the BC Field Sampling Manual (BC MWLAP, 2003). Sampling was conducted using several different types of pumps. The pump employed at each well depended on the type of well installation, permeability of the geological unit being sampled, and depth to groundwater. Inertial pumps actuated with a Hydrolift-II and peristaltic pumps were used to sample groundwater wherever possible, primarily at monitoring wells screened in permeable formations. In contrast, bladder pumps were used to collect groundwater samples from deep wells screened in low permeability bedrock which would not permit sampling with conventional methods (*e.g.,* inertial pump). Bladder pumps were dedicated to specific monitoring wells, however pumps were deployed and pulled from the wells during every sampling event to prevent potential damage as a result of freezing inside wells installed through permafrost. The Westbay sampler was used to collect groundwater samples from the Westbay installations.

Table 3:
Summary of 2014 and 2015 Groundwater Sampling Programs

Station	Sept./Oct. 2014	May/Jun. 2015	Jul. 2015	Aug. 2015	Sept. 2015	Sample Count
MW14-02A	IP	IP	IP	IP	IP	5
MW14-02B	IP	IP	IP	IP	IP	5
MW14-03A	BP	BP	BP	BP	BP	5
MW14-03B	BP	BP	BP	BP	BP	5
MW14-05A	BP	BP	BP	BP	BP	5
MW14-05B	BP	BP	BP	BP	BP	5
MW14-06A	frozen[1]	damaged[2]	decommissioned[3]			
MW14-06B	frozen[1]	damaged[2]	decommissioned[3]			
MW15-01AZ	-	dry	frozen	frozen	frozen	0
MW15-01WB (Port 4)	-	WB	WB	WB	WB	4
MW15-02AZ	-	PP	PP	PP	PP	4
MW15-02WB (Port 3)	-	WB	WB	WB	WB	4
MW15-03AZ	-	PP	PP	PP	PP	4
MW15-03WB (Port 6)	-	WB	WB	WB	WB	4
MW15-04AZ	-	dry	dry	dry	dry	0
MW15-04WB (Port 4)	-	WB	WB	WB	WB	4
MW15-05AZ	-	dry	dry	dry	PP	1
MW15-05WB (Port 3)	-	WB	WB	WB	WB	4
MW15-06WB (Port 6)	-	WB	WB	WB	WB	4

Notes:
BP = bladder pump, IP = inertial pump actuated with a Hydrolift-II, PP = peristaltic pump, WB = Westbay sampler
1. *Water inside monitoring well had started freezing at the time of sampling.*
2. *Monitoring well casing collapsed near surface, likely due to freeze/thaw action in the active layer. Consequently, well screen could not be accessed.*
3. *Monitoring well decommissioned by Kaminak.*

During groundwater purging, field parameters were continuously monitored with a multi-parameter probe (YSI 556 MPS or YSI Professional Plus) coupled to an in-line flow-through cell. Field parameters were monitored to ensure sample representativeness and to provide reliable field-based estimates of temperature, pH, specific conductance, dissolved oxygen (DO), and oxidation-reduction potential (ORP) of the groundwater. The multi-parameter probes were calibrated (pH 4 and 7, electrical conductivity 1413 µS/cm, DO water-saturated air, and ORP 240 mV) prior to use in the field on a daily or bi-daily basis as needed. Low-flow sampling methods were employed, and groundwater samples were collected after water levels in monitoring wells and purge water field parameters had stabilized.

Artesian conditions at MW14-02A and MW14-02B resulted in the top of the water column freezing inside the well casing installed through permafrost. Consequently, both wells required de-icing prior to groundwater sampling. MW14-02A and MW14-02B were deiced down to a depth of approximately 33 to 34 metres below ground surface using a hot water power washer equipped with high-pressure hoses and a drain jetting nozzle. De-icing water was sourced from the camp water supply well and stored in a large 1 m^3 plastic container. A sample from the camp water supply well was collected (CAMP15-1) on July 18, 2015 to characterize de-icing water quality (Appendix 5-A). Water discharged from the well casing during de-icing was captured at the surface with a flow manifold and conveyed to a second empty 1 m^3 plastic container for storage. De-icing discharge water was captured and recycled to minimize water use and to facilitate accounting of the volume of water injected into the well (upon break through) to ensure adequate purging prior to sampling. To ensure the integrity of the well casing, the temperature of the discharge water was controlled and limited to a maximum of 23°C. Due to long water columns at MW14-02A (~ 183 to 197 m) and MW14-02B (~ 127 to 138 m) and relatively permeable geology at both wells, groundwater sampling was conducted after the injected de-icing water and a minimum of one well volume had been purged and purge water field parameters had stabilized. Following the initial removal of de-icing water and a well volume, MW14-02A and MW14-02B were purged approximately 1 to 21 additional sand pack volumes (volume of water in the sand pack) in 2014 and 2015. The MW14-02B Aug. 2015 groundwater sample was collected after purging the volume of water inside the well casing, in addition to approximately 0.3 sand pack volumes.

Monitoring well MW14-05B was characterized by low yields and low water levels which presented challenges for the equipment capabilities and sampling procedures. A modified purging/sampling procedure was employed at MW14-05B to obtain the most representative groundwater samples. The amount of purged groundwater was maximized by drawing the water level down to the lowest possible level (pump elevation). The well was then allowed to recover for a day. This ensured the greatest displacement and the largest buffer between ‘old’ residual standing water and ‘new’ formation water. To ensure the collection of representative groundwater (formation water) a sufficient amount of water was purged from each well to remove residual water inside the bladder pump and tubing prior to sampling.

The Westbay installations (MW15-01WB to MW15-06WB) were sampled in June 2015 after purging 1 to 1.3 sample zone volumes (22.5 – 47 L) during well development. Subsequent groundwater sampling was conducted after purging a minimum of 4 L. Since Westbay samples zones are isolated (i.e. not in direct contact) from atmospheric conditions, collecting representative groundwater samples does not require the use of typical sampling methods whereby large volumes of water are purged. The exterior of the Westbay bottles was rinsed with de-ionized water prior to decanting the sample into the lab supplied bottles. The inside of the Westbay sampler probe and bottles was decontaminated between monitoring wells by rinsing with dilute nitric acid followed by three rinses with de-ionized water.

The purge water at MW15-06WB remained slightly cloudy, foamy and yellowish in colour after well development and following groundwater sampling in June 2015 due to the suspected presence of drilling additives. Consequently, additional purging/development was conducted at MW15-06WB in July and August 2015. MW15-06WB was purged until there was no noticeable improvement in purge water cloudiness, foaminess and colour prior to groundwater sampling. A total of 2.9 and 2.1 sample zone volumes, representing 81 L and 59 L were purged over the course of almost 2 weeks in July and August 2015, respectively. Prior to sampling in September 2015, a total of 6.5 zone volumes (~180 L) were purged, including well development and sampling.

Groundwater samples were collected and preserved in the field with the appropriate laboratory supplied bottles and preservatives. Samples analyzed for dissolved parameters were filtered in the field with disposable in-line 0.45 micron filters, with the exception of groundwater samples collected from Westbay installations which were filtered in the lab. Quality control sampling was conducted in the field and included the collection of field blanks, a trip blank, and field replicate samples. Field replicates were collected concurrently with groundwater sampling, at the same time and location, using the same sampling procedures and equipment, and by the same person. Field blanks were collected at the monitoring wells or back in camp where water samples were processed using laboratory supplied de-ionized water, bottles, and preservatives. A trip blank supplied by the laboratory was brought out to the field during monitoring activities and subsequently shipped back to the laboratory with groundwater samples collected at the site. After collection, samples were kept cool in the field and during shipping by being stored in a fridge and/or inside coolers with ice packs until delivery to the laboratory. Groundwater samples were submitted for chemical analysis to the ALS Environmental (ALS) laboratory in Burnaby, BC in 2014, and to the Maxxam Analytics (Maxxam) laboratory in Burnaby, BC in 2015. Groundwater samples were analyzed for the following parameters:

- Physical parameters
- Anions
- Nutrients
- Organic and inorganic carbon
- Total metals
- Dissolved metals

Groundwater quality parameters and the corresponding detection limits for the data collected in 2014 and 2015 are presented in Table 4 and Table 5, respectively.

Table 4: Groundwater Quality Parameters and Detection Limits (ALS 2014)

Parameter	Symbol	Unit	Detection Limit
Physical Properties			
Conductivity	EC	uS/cm	2
Hardness (as CaCO3)	H	mg/L	0.5
pH	pH	pH	0.1
Total Suspended Solids	TSS	mg/L	3
Total Dissolved Solids	TDS	mg/L	20
Turbidity	-	NTU	0.1
Anions and Nutrients			
Alkalinity, Total (as CaCO3)	-	mg/L	1
Ammonia, Total (as N)	NH_3	mg/L	0.005
Chloride	Cl	mg/L	0.5
Fluoride	F	mg/L	0.02
Nitrate	NO_2	mg/L	0.005
Nitrite	NO_3	mg/L	0.001
Total Kjeldahl Nitrogen	TKN	mg/L	0.05
Total Nitrogen	N	mg/L	0.05
Phosphorus	P	mg/L	0.002
Sulfate	SO_4	mg/L	0.5
Sulphide	S	mg/L	0.002
Organic/Inorganic Carbon			
Dissolved Organic Carbon	DOC	mg/L	0.5
Total Organic Carbon	TOC	mg/L	0.5
Total and Dissolved Metals			
Aluminum	Al	mg/L	0.0030 [1] / 0.0010 [2]
Antimony	Sb	mg/L	0.0001
Arsenic	As	mg/L	0.0001
Barium	Ba	mg/L	0.00005
Beryllium	Be	mg/L	0.0001
Bismuth	Bi	mg/L	0.0005
Boron	B	mg/L	0.01
Cadmium	Cd	mg/L	0.00001
Calcium	Ca	mg/L	0.05
Chromium	Cr	mg/L	0.0001
Cobalt	Co	mg/L	0.0001
Copper	Cu	mg/L	0.0005 [1] / 0.0002 [2]
Iron	Fe	mg/L	0.01
Lead	Pb	mg/L	0.00005
Lithium	Li	mg/L	0.0005
Magnesium	Mg	mg/L	0.1
Manganese	Mn	mg/L	0.00005
Mercury	Hg	mg/L	0.0001 [1] / 0.0005 [2]
Molybdenum	Mo	mg/L	0.00005
Nickel	Ni	mg/L	0.0005
Phosphorus	P	mg/L	0.05
Potassium	K	mg/L	0.1
Selenium	Se	mg/L	0.0001
Silicon	Si	mg/L	0.05
Silver	Ag	mg/L	0.00001
Sodium	Na	mg/L	0.05
Strontium	Sr	mg/L	0.0002
Sulphur	S	mg/L	0.5
Thallium	Tl	mg/L	0.00001
Tin	Sn	mg/L	0.0001
Titanium	Ti	mg/L	0.01
Uranium	U	mg/L	0.00001
Vanadium	V	mg/L	0.001
Zinc	Zn	mg/L	0.0030 [1] / 0.0010 [2]

Notes:
1. Detection Limit for Total Metal
2. Detection Limit for Dissolved Metal

Table 5:
Groundwater Quality Parameters and Detection Limits (Maxxam 2015)

Parameter	Symbol	Unit	Detection Limit
Physical Properties			
Conductivity	EC	µS/cm	1.0
Hardness (CaCO3)	H	mg/L	0.50
pH	pH	pH	N/A
Total Suspended Solids	TSS	mg/L	1.0
Total Dissolved Solids	TDS	mg/L	10
Turbidity	-	NTU	0.10
Anions and Nutrient			
Alkalinity (Total as $CaCO_3$)	-	mg/L	0.50
Alkalinity (PP as $CaCO_3$)	-	mg/L	0.50
Ammonia, Total (as N)	NH_3	mg/L	0.0050
Chloride	Cl	mg/L	0.50
Fluoride	F	mg/L	0.010
Nitrate	NO_2	mg/L	0.0020
Nitrite	NO_3	mg/L	0.0020
Nitrate plus Nitrite	-	mg/L	0.0020
Total Nitrogen	N	mg/L	0.020
Total Total Kjeldahl Nitrogen	TKN	mg/L	0.020
Phosphorus	P	mg/L	0.0020
Dissolved Sulphate	SO_4	mg/L	0.50
Sulphide	S	mg/L	0.0050
Inorganics			
Bicarbonate	HCO_3	mg/L	0.50
Carbonate	CO_3	mg/L	0.50
Hydroxide	OH	mg/L	0.50
Organic/Inorganic Carbon			
Dissolved Organic Carbon	DOC	mg/L	0.50
Total Organic Carbon	TOC	mg/L	0.50
Total and Dissolved Metals			
Aluminum	Al	µg/L	0.50
Antimony	Sb	µg/L	0.020
Arsenic	As	µg/L	0.020
Barium	Ba	µg/L	0.020
Beryllium	Be	µg/L	0.010
Bismuth	Bi	µg/L	0.0050
Boron	B	µg/L	10
Cadmium	Cd	µg/L	0.0050
Calcium	Ca	mg/L	0.050
Chromium	Cr	µg/L	0.10
Cobalt	Co	µg/L	0.0050
Copper	Cu	µg/L	0.050
Iron	Fe	µg/L	1.0
Lead	Pb	µg/L	0.0050
Lithium	Li	µg/L	0.50
Magnesium	Mg	mg/L	0.050
Manganese	Mn	µg/L	0.050
Mercury	Hg	µg/L	0.0020
Molybdenum	Mo	µg/L	0.050
Nickel	Ni	µg/L	0.020
Phosphorus	P	µg/L	2.0
Potassium	K	mg/L	0.050
Selenium	Se	µg/L	0.040
Silicon	Si	µg/L	50
Silver	Ag	µg/L	0.0050
Sodium	Na	mg/L	0.050
Strontium	Sr	µg/L	0.050
Sulphur	S	mg/L	3.0
Thallium	Tl	µg/L	0.0020
Tin	Sn	µg/L	0.20
Titanium	Ti	µg/L	0.50
Uranium	U	µg/L	0.0020
Vanadium	V	µg/L	0.20
Zinc	Zn	µg/L	0.10
Zirconium	Zr	µg/L	0.10

Appendix 3-G: SRK Hydrogeological Field Investigations Report Coffee Gold Project

GOLDCORP

Hydrogeologic Investigations Report
Coffee Project
Yukon

Report Prepared for

Kaminak Gold Corporation

Report Prepared by

SRK Consulting (U.S.), Inc.
SRK Project Number 338600.020
December 18, 2015

Hydrogeologic Investigations Report
Coffee Project
Yukon

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SRK Project Number 338600.020

December 18, 2015

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Appendices

1 Hydraulic Testing in Core Holes at Coffee Project

In June and July 2015, SRK conducted a limited hydrogeological investigation at the Coffee project, including 10 tests of mineralized fracture zones in six HQ (96 mm) core holes. The objectives of the fracture-zone hydraulic tests were to provide hydraulic-conductivity and water level data within the principal structures that will be mined in the open pits. The structures were inadequately tested during previous packer testing programs (Lorax, 2014, and Tetra Tech, 2014).

The test data will be incorporated by Lorax into a groundwater-flow model that will be used for an assessment of post-mining conditions.

Other tasks of the hydrogeological investigation included installing thermistors and transducers at six sites in support of geotechnical studies.

1.1 Test Procedures

Testing was done across mineralized fracture zones identified using Kaminak's geological database and 3-D model. Three hydro holes were selected by SRK for testing (SRK-15D-14P, 15P, and 16P) which were drilled across Kona, Double-Double, and Latte, respectively (Figure 1). Tests were also done in three previously planned resource drillholes at Supremo. Most fracture-zone testing was done using a packer to isolate the test interval, however, some tests were configured relative to overlying permafrost so that the packer could be omitted.

Airlift-recovery tests, slug tests, and inflow tests were done in the SRK 2015 program. The hydraulic tests were conducted in the core holes at irregular intervals, as geological targets were recognized in the core. Figures below show the targeted fracture zones that were tested. The specific geological targets consisted of fracture zones cutting schist and gneiss, and generally exhibited hydraulic conductivity values significantly higher than the enclosing rock.

An International Packer, Inc. (IPI) standard wireline packer system (SWPS) was used for all packer testing in the 2015 program. The SWPS device is designed to deploy by dropping the assembly down the drill rod from the surface and allowing it to lock into a standard HQ core barrel. The SWPS system contains a rubber gland that extends through the drill bit into the open borehole, and inflates with water. A transducer is housed in a chamber below the packer gland, within the test interval.

The packer testing was carried out using a "single packer" arrangement: the hole was drilled to the bottom of the test interval, and the rods were removed to the top of the interval. The packer was deployed at the bottom of the rods to isolate the open interval between the bottom of the hole and the packer. A packer was not used in every test; it was sometimes omitted where the bottom of permafrost defined the top of a test interval.

Airlift tests, whether packer-isolated or not, are performed by "pumping" water from the test interval by means of injected air. At Coffee the airlifting was accomplished with a heli-portable air compressor, which, in most cases delivered more air than could be easily applied. Airlift tests are considered to be more accurate in higher transmissivity intervals than slug tests or constant-inflow tests. Airlift tests, however, require a fairly deep submergence of the airline (static water level above the bottom of the airline), and this condition was sometimes not achievable due to deep static levels.

Constant inflow tests were done where low submergence rendered airlifting ineffective. The inflow or "pump-in tests" were done either at a constant rate, allowing the water level in the well casing to vary with time, or at a constant head (usually the top of casing), allowing the inflow rate to vary with time. In the first case, the pumping data can be analyzed with a Cooper and Jacob (1946) technique and the recovery data with the Hvorslev (1951) method (sometimes). In the second case the pumping data are analyzed using the Jacob-Lohman (1952) method, and the recovery data more effectively with the Hvorslev method.

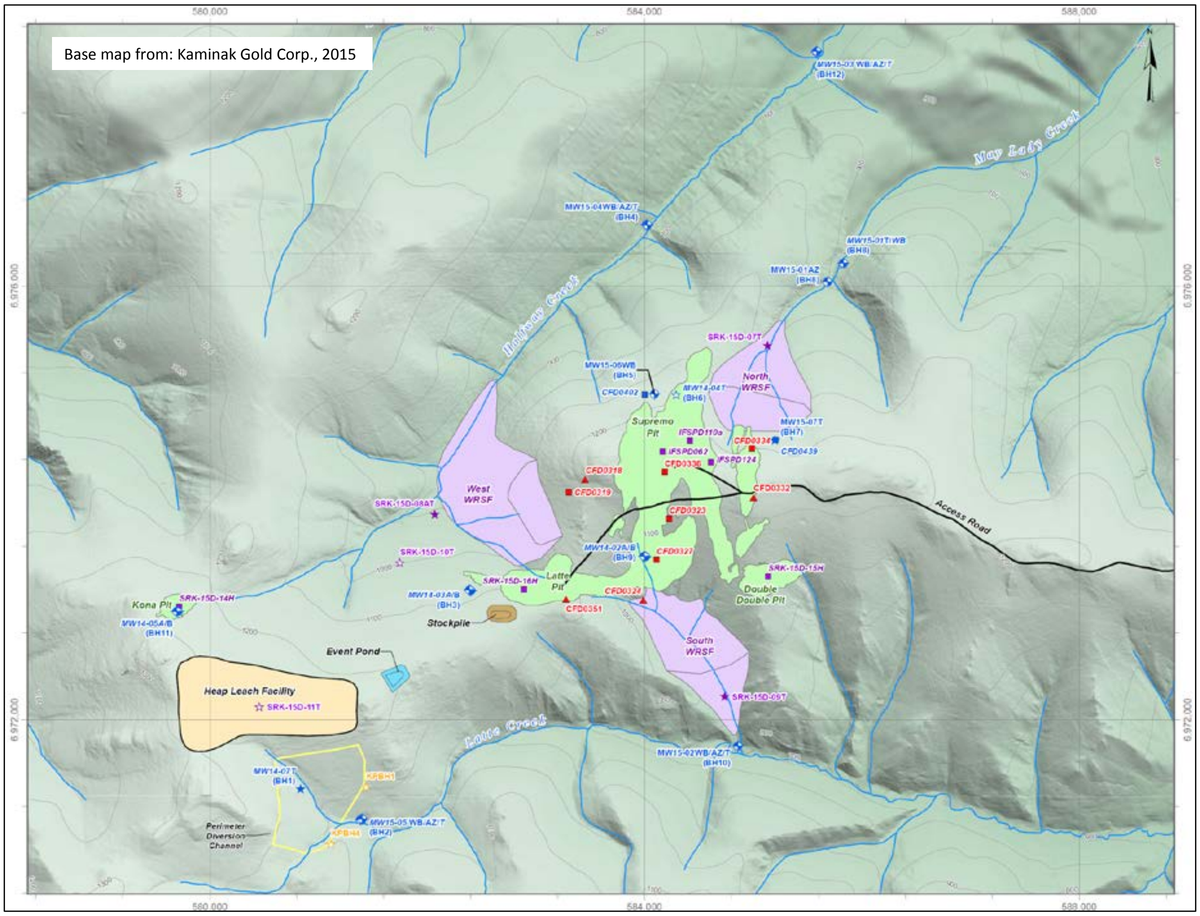

Figure 1. Locations of 2015 Packer Test Holes and Thermistor-Installation Holes

1.2 Specific Tests

The test core hole at Latte was drilled vertically; at Kona and Double-Double holes were drilled at -70°. At Supremo three exploration holes were each drilled at -45°.

In nearly all cases the testing was complicated by a combination of deep permafrost and deep groundwater levels in the fracture zones. Several tests were found to be invalid because the test interval may have spanned the deep water table. It should also be noted, however, that each of the remaining valid tests could be questioned because of the possible, but undetectable presence of some permafrost across parts of the test zones. If present in the test interval, the permafrost would result in an incorrectly low calculation of hydraulic conductivity.

<u>SRK-15D-16P (Double-Double)</u>

The Double-Double drill site (Figure 1) was fairly low in elevation, so that the upper test (136 to 148 m downhole) was well positioned below the water table. As a result of the southern aspect of the drill site, the test was also positioned below a fairly shallow permafrost. The hole was drilled in a southerly direction at an inclination of -70°.

The rods were raised to the top of the fracture zone intersection at 136 m (downhole), and the packer was set and inflated below the bit. After water levels equilibrated and with a transducer down hole, a constant-head injection test was conducted by filling the drill rods to the top and maintaining that level while monitoring inflow volumes for a period of 63 minutes. The water level was then allowed to recover for an equal period of time.

Inflow rates were analyzed (Appendix A, Figure A1) by the Jacob-Lohman method, yielding a K value of 3.5E-07 m/s. Water-level recovery was analyzed both by the Theis-recovery method (Theis, 1935) as shown in Figure A2, and as falling-head slug data (the Hvorslev method – Figure A3), which methods returned K values of 2.3E-07 and 2.9E-07 m/s, respectively. The Theis analysis is judged the most reliable of the three.

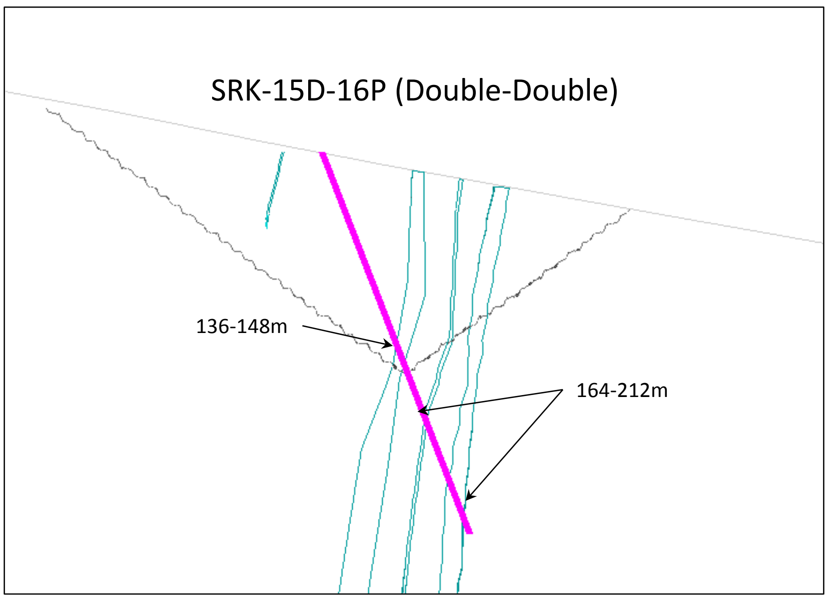

Figure 2: Test Intervals and Fracture-Zones at Double-Double Test Hole

A second, lower-zone test was done across a depth interval of 164 to 212 m, taking in two zones of fracturing. The packer was set at the top of the zone, including a transducer in the housing below the packer element. The interval was airlift-pumped for 93 minutes at a rate which declined to approximately 0.3 L/s at the end of the pumping period. The water levels were allowed to recover for a period of 95 minutes. Theis analysis of the water level recovery (Figure A4 in Appendix A) yields a K value of 1.1E-07 m/s. It is important to note that the test results across the interval 164 to 212 provide an average K value for both fractured and unfractured material.

SRK-15D-15P (Latte)

Latte also lies low on the hill, so that water depths were favorable. The hole was drilled vertically. The drill site has a northern aspect, and as a consequence, the first test interval at Latte (115 to 205 m) responded as though it was entirely in frozen ground. Water remained in the hole nearly at top of casing after drilling had stopped, and did not recover at all after being blown out with an airlift. Consequently, the data (Figure A5) cannot be analyzed for K value or for static water level.

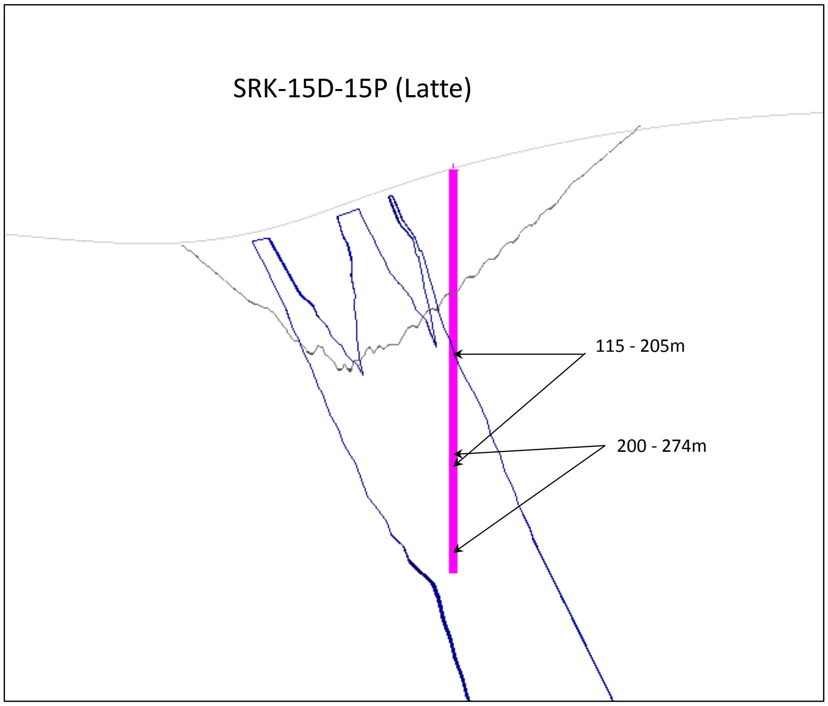

Figure 3: Test Intervals and Fracture-Zones at Latte Test Hole

The second, lower test was done across a depth interval of 200 to 274 m, however, because of the apparent frozen conditions to at least 205 m (see above), the analysis assumes an effective interval from 205 to 274 m. The packer was set at the top of the zone (although probably unnecessarily), and the interval was airlift-pumped for 90 minutes at a rate which declined to 0.32 L/s at the end of the pumping period. The water levels were allowed to recover for several hours. Theis analysis of the water level recovery (Figure A6 in Appendix A) yields a K value of 3.5E-07 m/s.

SRK-15D-14P (Kona)

The hole was drilled to the north at an inclination of -70°. No test was possible in the upper zone at Kona because of a combination of a deep permafrost floor (about 100 m vertically below ground) and a static water level at 124.7 mbgs. A packer was set above a lower zone at 175 to 214 m downhole, which was then tested by holding the water at the top of casing for 30 minutes. The recovery data were then analyzed by the Hvorslev method as a falling-head slug test (Figure A7).

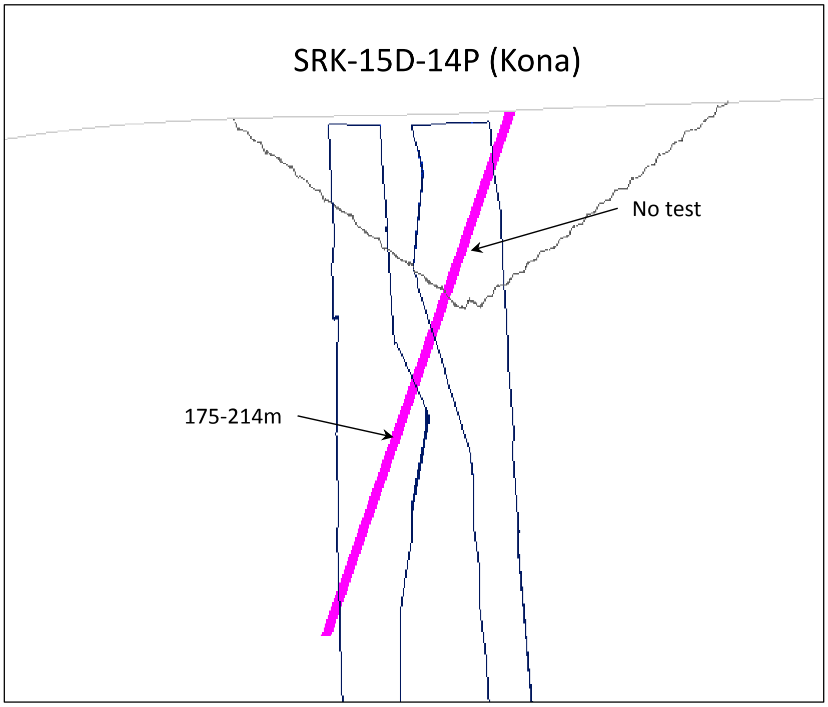

Figure 4: Test Intervals and Fracture-Zones at Kona Test Hole

The lower zone yielded an intermediate K value of 1.4E-07 m/s. It is worth noting that the drillers reported very-rapid draining of fluids from the rods when the bottom of permafrost was breached, indicating a highly transmissive zone higher in the hole.

IFSPD-062 (Supremo, T2)

IFSPD-062 was drilled near the top of Supremo Hill, toward the west at an inclination of -45°. The test interval at 175 to 221 m downhole spanned the T1-T2 vein structure. Calculations showed the packer to be set just one half meter below the static water level, which limits the reliability of the test results. In any case, a constant-rate inflow test was run for 60 minutes at a rate of 1.07 l/s.

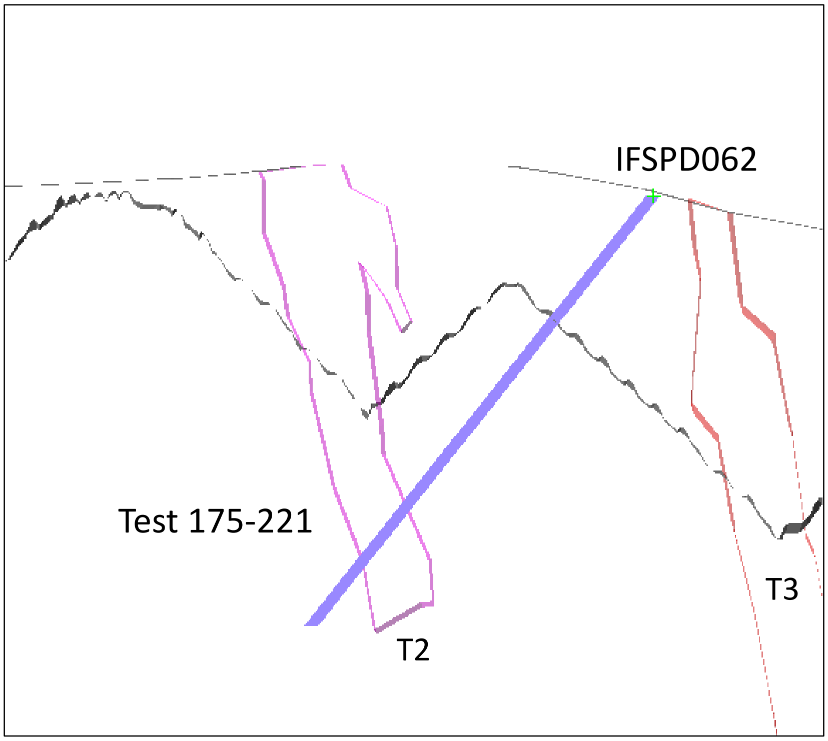

Figure 5: Test Intervals and Fracture-Zones at IFSPD062 (Supremo)

The water level rise during the inflow was analyzed by the Cooper-Jacob method (Figure A8), which indicated a K value of 2.8E-06 m/s. It is important to note that the driller reported short intervals between 180 m and 200 m that “went dry” while drilling, and other intervals in the same span that retained drilling fluids. If the intervals truly did lose water, then it is unlikely that a static water level at 174 m downhole could be real. The validity of the test and the relatively-high K value, therefore, can be questioned.

IFSPD-110a (Supremo, T3-T4)

IFSPD-110a was drilled from the top of Supremo hill, toward the west at an inclination of -45°. Three zones were tested, although the upper zone test, from 80 to 119 m, is judged invalid because it was conducted partly above the water table.

The intermediate test at 237 m to 266 m downhole was conducted very near the water table, as at IFSPD-062, above. With the packer set at 237 m, across the upper part of the T3 vein structure, a constant-rate injection was conducted for 100 minutes at 1.4 L/s. The inflow raised the water level in the rods just 0.25 m. Recovery following the inflow was analyzed as a falling-head slug test (Figure A9), and yielded a K value of 1.6E-06 m/s. As with the test at IFSPD-062, the validity of the test is somewhat questionable because of the uncertain water table during the test.

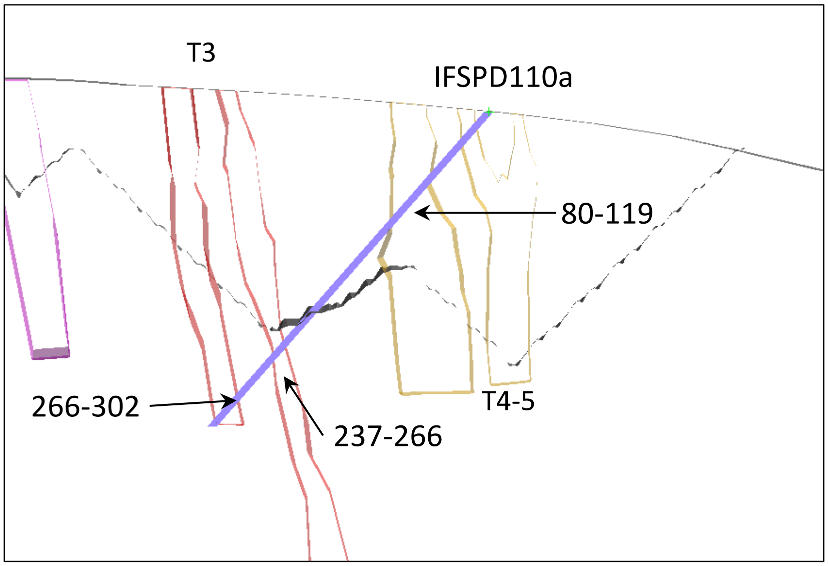

Figure 6: Test Intervals and Fracture-Zones at IFSPD110a (Supremo)

A third packer test was run at the bottom of the hole, from 266 to 302 m downhole. With the packer set at 266 m, across the lower part of the T3 vein structure, the static water level was 10 m above the transducer. A constant-rate injection was conducted for 60 minutes at 0.97 L/s. The inflow raised the water level in the rods about 130 m. Recovery following the inflow was analyzed as a falling-head slug test (Figure A10), and yielded a K value of 1.8E-07 m/s.

IFSPD-124

IFSPD-124 was drilled from the top of the hill, toward the west at an inclination of -45°. The apparent static water level in the core hole at the time of the test was at about 24 meters below ground surface (mbgs), which is higher than expected from nearby holes. It is possible that the water table through this interval represents a perched groundwater, floored by permafrost.

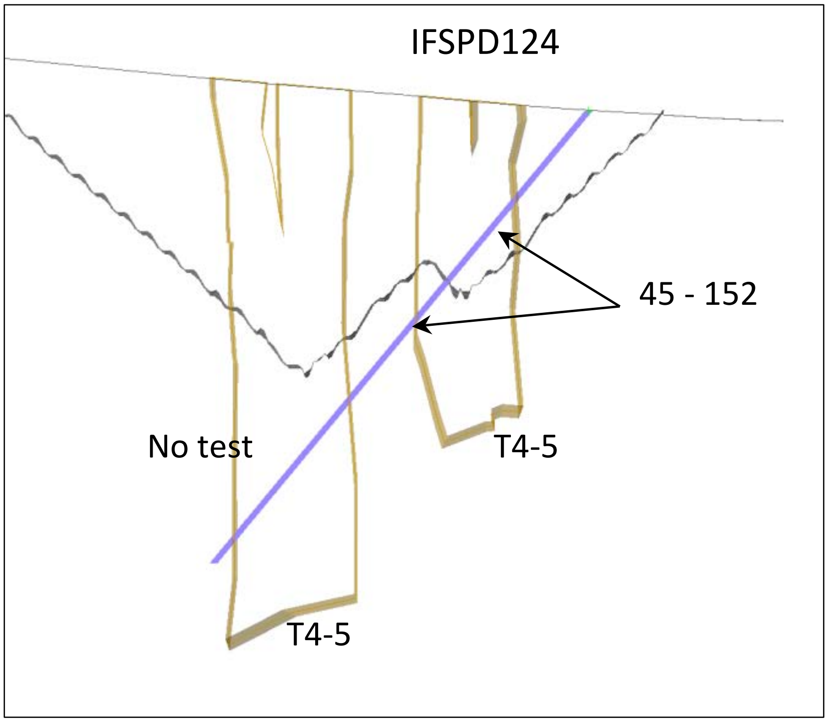

Figure 7: Test Intervals and Fracture-Zones at IFSPD124 (Supremo)

A single test was conducted across the downhole interval 45 to 152 m. A packer was not inflated during the test. A constant-rate injection was conducted for 60 minutes at 0.27 L/s. The inflow raised the water level in the rods about 10 m. Recovery following the inflow was analyzed as a falling-head slug test (Figure A11), and yielded a K value of 2.0E-07 m/s.

The high water table in this test interval might represent perched conditions, which would suggest that the test was conducted in a pocket of fractured rock unconnected to the deeper aquifer. However, the fractured rocks exposed in the test responded to the test in a reasonable way. Because of the very-low stress and short term of the test, the results probably can be used to characterize the fractured-rock pocket, even if it is bounded.

A second test was not conducted at IFSPD-124.

1.3 Summary of Hydraulic Conductivity Testing in Fracture Zones

SRK judges that the results of eight of the packer tests are valid and representative. The other two tests were set up above static water. Hydraulic conductivity values from the valid tests (Table 1.3.1) range narrowly, from 1.2E-07 m/s to 2.8 E-06 m/s, with an arithmetic mean value of 7.0E-07 m/s. (An arithmetic mean rather than a geometric mean is recommended for the fracture zone tests, because the values represent uni-directional flow in planar features rather than radial groundwater flow.)

The mean K value from the fracture zone tests is significantly higher than the geometric mean value obtained by previous programs from packer testing in the wall rocks. The Lorax (2014) packer testing in wall rocks found a geometric mean value of 8.9E-09 m/s for wall rock tested in six core holes. (A total of 19 valid tests were done. Results of multiple tests in individual holes were averaged before a geometric mean value was calculated between the six holes.) Tetra Tech in 2013 found a geometric mean value of 4.6E-08 m/s, for 11 packer tests in seven core holes in the wall rocks.

Table 1: Summary of 2015 Packer Test Results

Test Hole	Location	Test Interval		Measured K		Notes
		Top	Bottom	(m/day)	(m/s)	
SRK-15D-14P	Kona	175.4	216	1.2E-02	1.4E-07	constant-rate injection/ falling-head slug
SRK-15D-15P	Latte	115	205	--	--	Frozen, no water flow
SRK-15D-15P	Latte	200	274	3.0E-02	3.5E-07	airlift-recovery test
SRK-15D-16P	Double Double	136	148	2.0E-02	2.3E-07	constant-rate injection/ falling-head slug
SRK-15D-16P	Double Double	164	212	1.0E-02	1.2E-07	airlift-recovery test
IFSPD124	Supremo-T5	45	152	1.7E-02	2.0E-07	Possibly perched, but valid short-term
IFSPD110a	Supremo-T3	80	119	--	--	Above water table - do not use
IFSPD110a	Supremo-T3	237	266	1.4E-01	1.6E-06	Near water table -
IFSPD110a	Supremo-T3	266	302	1.6E-02	1.8E-07	falling-head slug test
IFSPD062	Supremo-T1, T2	175	221	2.4E-01	2.8E-06	constant-rate injection - very near water table

Note: Test interval depths are down-hole measures

2 Thermistor Installations

Thermistors and vibrating-wire transducers (VBW's) were installed in HQ core holes at the three waste rock dump locations (as proposed at the time of drilling) and at BH-07 to replace a malfunctioning 2014 piezometer. Two 25 m thermistors (SRK-15D-10T and SRK-15D-13T) were also installed to support the site geotechnical evaluation. Locations and general descriptions of the installations are shown in Table 2.

At each location the hole was drilled to depth, and with the core rods left in the ground, a PVC guide pipe was lowered through the rods with instrument cables attached using Zip Ties. The core rods were then removed, and the core hole backfilled from bottom up by pumping through the PVC guide pipe. Grout consisted of a neat cement mixture of 28% portland cement and 5% bentonite by weight.

Table 2: Locations of Hydro/Geotech Thermistor Installations

SRK # Kaminak #	Easting UTM7-NAD83	Northing UTM7-NAD83	Elevation (mamsl)	Borehole Depth (mbgs)	Location	Number of Thermistor Nodes	Number of VBW's
SRK-15D-07T CFD0600	585124.35	6975415.07	948.85	149	North Dump	16	2
SRK-15D-08T CFD0595	582056.87	6973890.98	925.11	149	Original West Dump	16	2
SRK-15D-09T CFD0599	584734.33	6972215.37	784.25	101	South Dump	13	1
SRK-15D-10T CFD0593	581752.35	6973455.02	1008.19	26	Original West Dump	10	0
SRK-15D-13T CFD0594	582825.05	6972903.76	1136.89	26	Infastructure	10	0
SRK-15D-14H CFD0596	585198.39	6974582.93	1183.14	268	Supremo T7	13	2

2.1 SRK-15D-07T (CFD 0600)

SRK-15D-07T was drilled at the North waste rock facility, at an elevation of 949 mamsl. The core hole was drilled vertically to a depth of 149 mbgs. Vibrating wire transducers were installed at two depths as shown in Table 3. A string of thermistors was installed with node locations as shown in Table 3 and on Figure 8.

The temperature curves in Figure 8 shows that permafrost exists beneath the North waste rock facility to a depth of approximately 80 mbgs. Nodes 10 and 11 in the string report anomalously warm temperatures, relative to nodes above and below. It is possible that the two nodes are malfunctioning. However, it is also possible that nodes 10 and 11 are properly recording ground temperatures that have been affected by flow of groundwater along fractures, from either below, or from above (surface water). Additional data collection through four quarters will help to resolve the anomaly.

Table 3. Instrument Locations in SRK-15D-07T

SRK-15D-07 (CFD 0600)		Depth (mbgs)
VBW1		149.24
VBW2		103.6
Stickup (m ags**)**		3.00
Node	**Location on Cable**	**Depth (mbgs)**
1	1	0.7
2	2.5	2.2
3	4	3.7
4	5.5	5.2
5	7	6.7
6	8.5	8.2
7	10	9.7
8	13	12.7
9	18	17.7
10	25	24.7
11	35	34.7
12	50	49.7
13	70	69.7
14	90	89.7
15	110	109.7
16	130	129.7

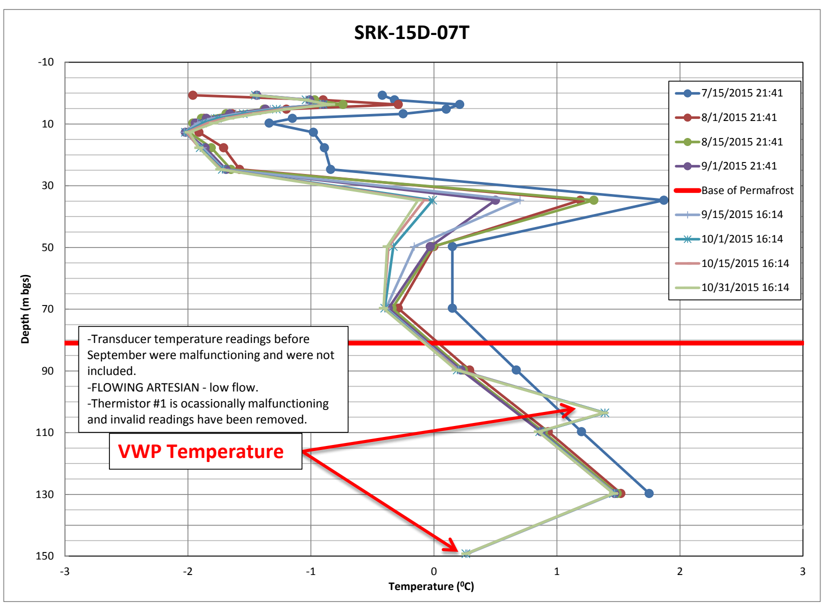

Figure 8: Downhole Temperatures in SRK-15D-07 through 9/1/2015

2.2 SRK-15D-08T (CDF 0595)

SRK-15D-08T was drilled at the originally proposes West waste rock facility location, at an elevation of 925 mamsl. The core hole was also drilled vertically to a depth of 149 mbgs. Vibrating wire transducers were installed at two depths as shown in Table 4. A string of thermistors was installed with node locations as shown in Table 4 and Figure 9. The thermistor string was ordered before drilling began, and was too long for the core hole drilled. Consequently, the first six nodes of the string were trimmed off, and data collection begins with node 7.

The latest temperature readings in Figure 9 suggest a permafrost depth of about 74 mbgs. Note also that the two sets of temperatures recorded by the vibrating-wire transducers appear not to agree with the trend from the thermistor string. The VBW temperature sensors in all cases are considered to be less-well calibrated than the thermistor sensors.

Table 4: Instrument Locations in SRK-15D-08T

SRK-15D-08 (CDF 0595)		Depth (mbgs)
VBW1		149.24
VBW2		103.60
Stickup (m ags)		3.30
Node	**Location on Cable**	**Depth (mbgs)**
1	1	-8.0
2	2.5	-6.5
3	4	-5.0
4	5.5	-3.5
5	7	-2.0
6	8.5	-0.5
7	10	1.0
8	13	4.0
9	18	9.0
10	25	16.0
11	35	26.0
12	50	41.0
13	70	61.0
14	90	81.0
15	110	101.0
16	130	121.0

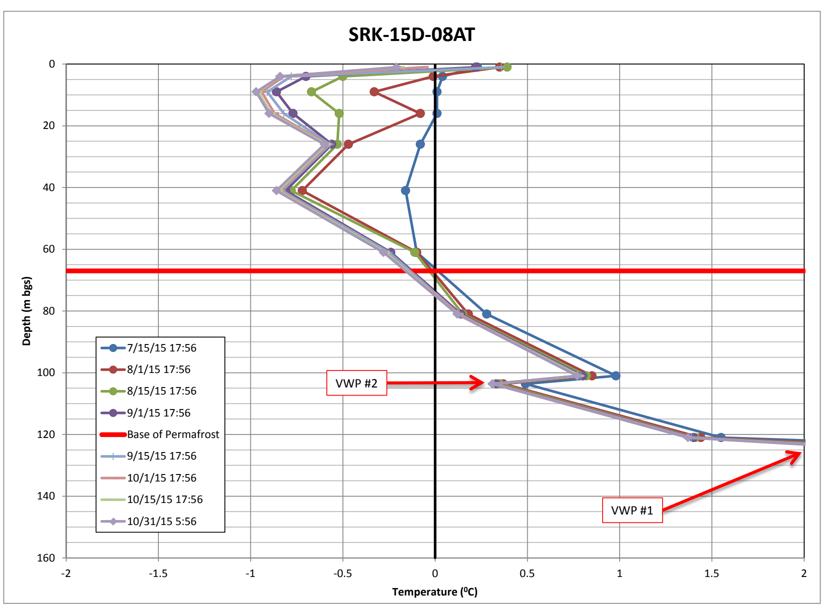

Figure 9: Downhole Temperatures in SRK-15D-08T through 9/1/2015

2.3 SRK-15D-09T (CFD 0599)

SRK-15D-09T was drilled at the South waste rock facility, at an elevation of 784 mamsl. The core hole was drilled vertically to a depth of 101 mbgs. Vibrating wire transducers were installed at just one depth, as shown in Table 5. A string of thermistors was installed with node locations as shown in Table 5 and Figure 10.

The temperature curve in Figure 10 shows that permafrost does not exist at South dump least in the area of SRK-15D-09T. Temperatures remain above zero for the length of the thermistor string. Nodes 10 and 11 in the string report anomalous temperatures relative to nodes above and below. Wide (22°C) swings in temperature from July through October, including temperatures of -10°C, suggest that the two nodes are malfunctioning rather than recording real groundwater temperatures. (These cannot be air temperatures, because the nodes are well below static water levels.)

Table 5: Instrument Locations in SRK-15D-09T

SRK-15D-09 (CFD 0599)		**Depth (mbgs)**
VBW1		99.70
VBW2		--
Stickup (m ags)		2.90
Node	**Location on Cable**	**Depth (mbgs)**
1	1	-1.9
2	2.5	-0.4
3	4	1.1
4	5.5	2.6
5	7	4.1
6	10	7.1
7	13	10.1
8	18	15.1
9	25	22.1
10	35	32.1
11	50	47.1
12	80	77.1
13	100	97.1

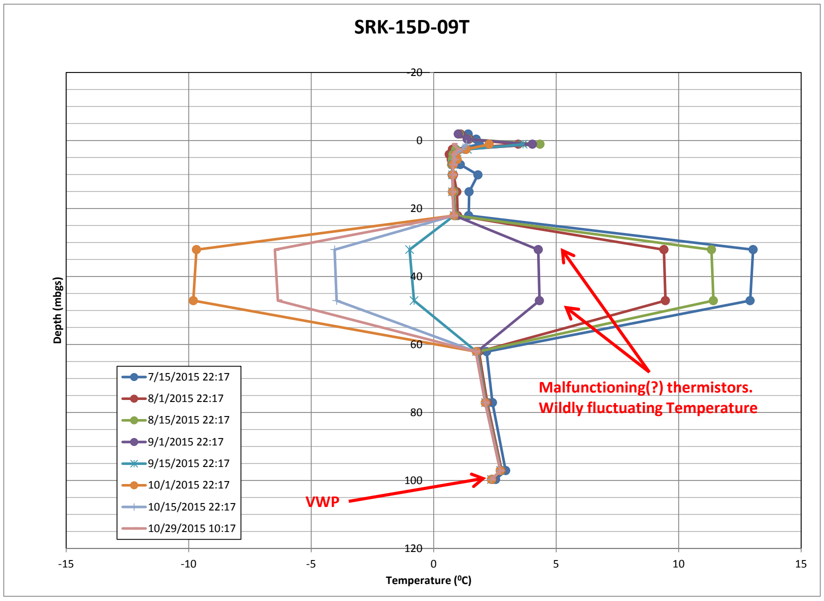

Figure 10: Downhole Temperatures in SRK-15D-09T through 9/1/2015

2.4 SRK-15D-10T (CFD 0593)

SRK-15D-10T was drilled in the vicinity of the originally proposed West waste rock dump, at an elevation of 1,008 mamsl. The core hole was drilled vertically to a depth of just 26 mbgs. Vibrating wire transducers were not installed in the core hole. A string of thermistors was installed with node locations as shown in Table 6 and Figure 11. The temperature curve shown in Figure 11, recorded September 10, 2015, shows permafrost from about 3 mbgs to the end of hole.

Table 6: Instrument Locations in SRK-15D-10T

SRK-15D-10T (CFD 0593)		Depth (mbgs)
VBW1		--
VBW2		--
Stickup (m ags)		1.50
Node	**Location on Cable**	**Depth (mbgs)**
1	2	0.5
2	4.5	3.0
3	7	5.5
4	9.5	8.0
5	14.5	13.0
6	17	15.5
7	19.5	18.0
8	22	20.5
9	24.5	23.0
10	27	25.5

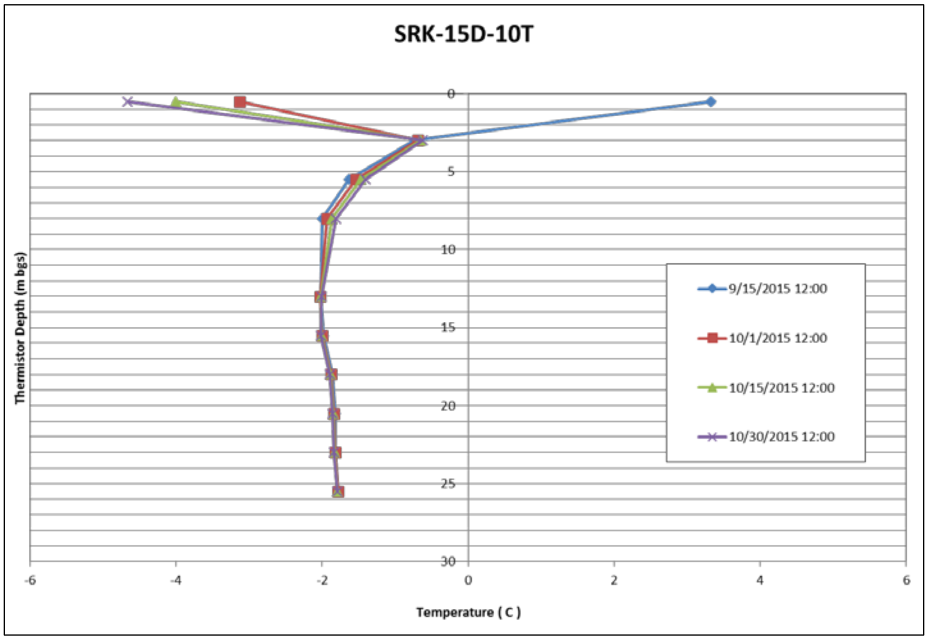

Figure 11: Downhole Temperatures in SRK-15D-10T through 10//302015

2.5 SRK-15D-13T (CFD 0594)

SRK-15D-13T was drilled in an area of the originally planned infrastructure, at an elevation of 1,137 mamsl. The core hole was drilled vertically to a depth of 26 mbgs. Vibrating wire transducers were not installed in the core hole. A string of thermistors was installed with node locations as shown in Table 7 and Figure 12. The temperature curve shown in Figure 12, recorded October 29, 2015, shows that very slight permafrost conditions may exist from about 3 mbgs to the end of hole.

Table 7: Instrument Locations in SRK-15D-13T

SRK-15D-13T (CFD 0594)		Depth (mbgs)
VBW1		--
VBW2		--
Stickup (m ags)		1.50
Node	**Location on Cable**	**Depth (mbgs)**
1	2	0.5
2	4.5	3.0
3	7	5.5
4	9.5	8.0
5	14.5	13.0
6	17	15.5
7	19.5	18.0
8	22	20.5
9	24.5	23.0
10	27	25.5

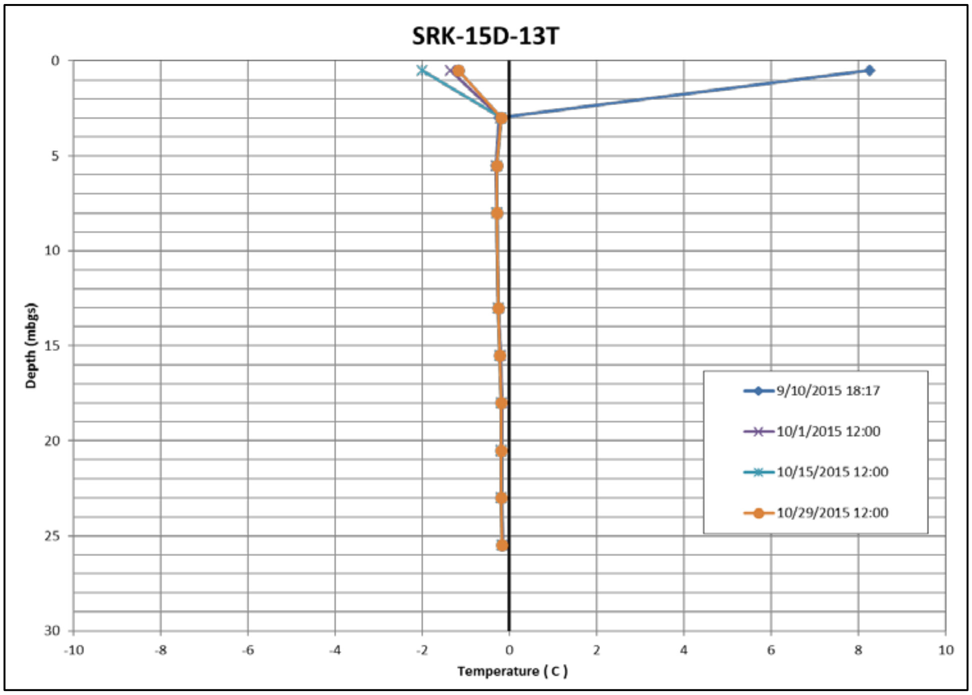

Figure 12: Downhole Temperatures in SRK-15D-13T through 10/29/2015

2.6 SRK-15D-14H (MW15-007T; CFD0596)

SRK-15D-14H was a hydrogeology hole drilled to replace a collapsed 2014 piezometer at BH-07. The piezometer consists of 13 thermistor nodes and 2 vibrating wire piezometers detailing a temperature profile to 267.75 mbgs (Table 8 and Figure 13).

As seen in Figure 13, Thermistor bead #11, at a depth of 151 mbgs, has readings that appear to be about 3°C too high relative to the trend of the other thermistors. The temperature in bead #11 increased from early July to late July, and appears to be declining. As with the other transducers that show anomalous readings, additional data through several seasons will help to determine the cause. The permafrost extends from approximately 0.75 m to about 125 mbgs.

Transducers are functioning properly and indicate a downward vertical pressure gradient at about 145 mbgs.

Table 8: Instrument Locations in SRK-15D-14H

SRK-15D-07T (CFD-596)		Depth (mbgs)
VBW1		267.75
VBW2		239.00
Stickup (m ags)		3.30
Node	**Location on Cable**	**Depth (mbgs)**
1	6	7.0
2	7	8.0
3	10	11.0
4	25	26.0
5	40	41.0
6	55	56.0
7	85	86.0
8	105	106.0
9	120	121.0
10	135	136.0
11	150	151.0
12	165	166.0
13	180	181.0

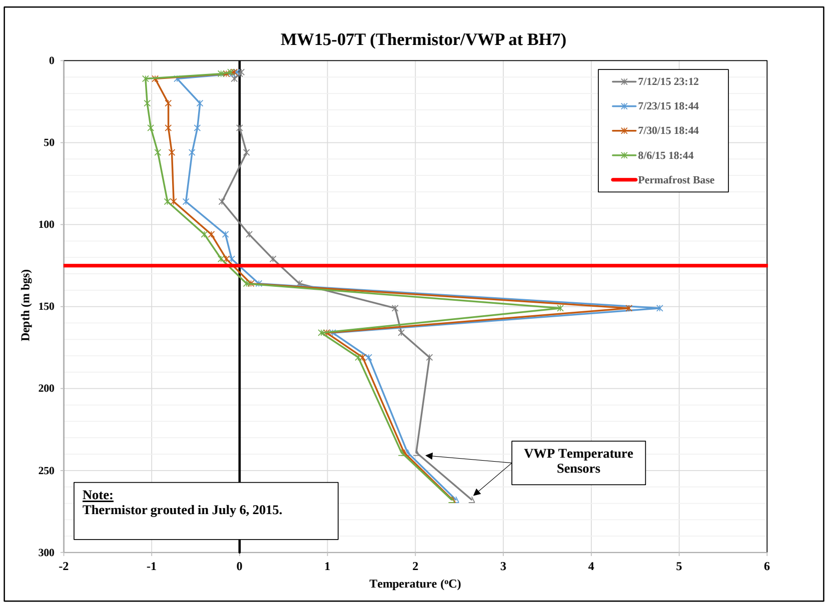

Figure 13: Downhole Temperatures in SRK-15D-14H (MW15-07T) through 8/6/2015

3 Water levels

Transducer pairs installed in piezometer SRK-15D-08T at the originally proposed West waste rock facility and in replacement well MW15-07T both show strong downward vertical gradients (Table 9).

The water levels at MW15-07T, high on the flank of Supremo hill, are at about 145 mbgs. That depth is about 10 m below the floor of permafrost. At SRK-15D-08T, near the valley bottom in upper Halfway Creek, are artesian with as much as 4.5 m of head above ground surface at a transducer depth of 104 mbgs.

No pressure readings are available from the transducers in SRK-15D-07T as of the writing of this report. Flowing artesian conditions (low volume but relatively high pressure) were reported during installation.

Table 9: Water Levels from VBW's in 2015 Geotech Holes

Location	VBW Depth (mbgs)	Water level on 8/7 (mbgs)	Vertical Gradient	Trend 8/7/2015
MW15-07T	239.0	145.3	downward	rising
	267.75	147.23		rising
SRK-15D-09T	99.7	10.06	--	rising
SRK-15D-08T	103.6	-4.53	downward	rising
	149.24	-0.135		rising

Drilling in the fracture zones at Double-Double show an upward gradient, from 65.75 mbgs at a depth of 148 m, to 61.5 mbgs at a depth of 212 m (Table 10).

Water levels in the Supremo holes were generally quite deep, ranging from 123.3 mbgs to 179.8 mbgs, although a perched zone was also encountered at about 24 mbgs. A downward vertical gradient is suggested by the water levels estimated during two tests in IFSPD-110a.

At Latte, a gradient could not be measured because of probable frozen conditions in the upper hole. The deeper zone, from 205 m to 274 m showed a water table (122 mbgs) that rises above the floor of the permafrost by at least 83 m.

The water level in the fracture zone at Kona was estimated to be 124.7 mbgs. The floor of the permafrost was at 99 mbgs, with over 25 m of unsaturated conditions between.

Table 10: Water Levels Estimated during 2015 Packer Tests

Test Hole	Location	Open Interval		Approx. W.L.	Vertical Gradient
		Top	Bottom	Vertical mbgs	
SRK-15D-14P	Kona	175.4	216	124.7	--
SRK-15D-15P	Latte	115	205	--	--
SRK-15D-15P	Latte	200	274	122.3	--
SRK-15D-16P	Double Double	136	148	65.8	upward
SRK-15D-16P	Double Double	164	212	61.5	
IFSPD124	Supremo-T5	45	152	20.6	(perched)
IFSPD110a	Supremo-T3	80	119	--	--
IFSPD110a	Supremo-T3	237	266	167.2	downward
IFSPD110a	Supremo-T3	266	302	179.8	
IFSPD062	Supremo-T1, T2	175	221	123.3	--

4 References

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Lorax Environmental, 2014, Coffee Creek Hydrogeological Drilling Program – Program Summary. Technical Memorandum presented to: Kaminak Gold Corp., October.

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Theis, C.V., (1935) The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage. Trans, Amer. Geophys. Union, vol. 16.

5 Date and Signature Page

Signed on this 18 Day of December, 2015.

Prepared by

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Principal Consultant (Hydrogeology)

Reviewed by

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any oth

Michael Levy, P.E., P.G.
Principal Consultant (Geotechnics)

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted industry practices.

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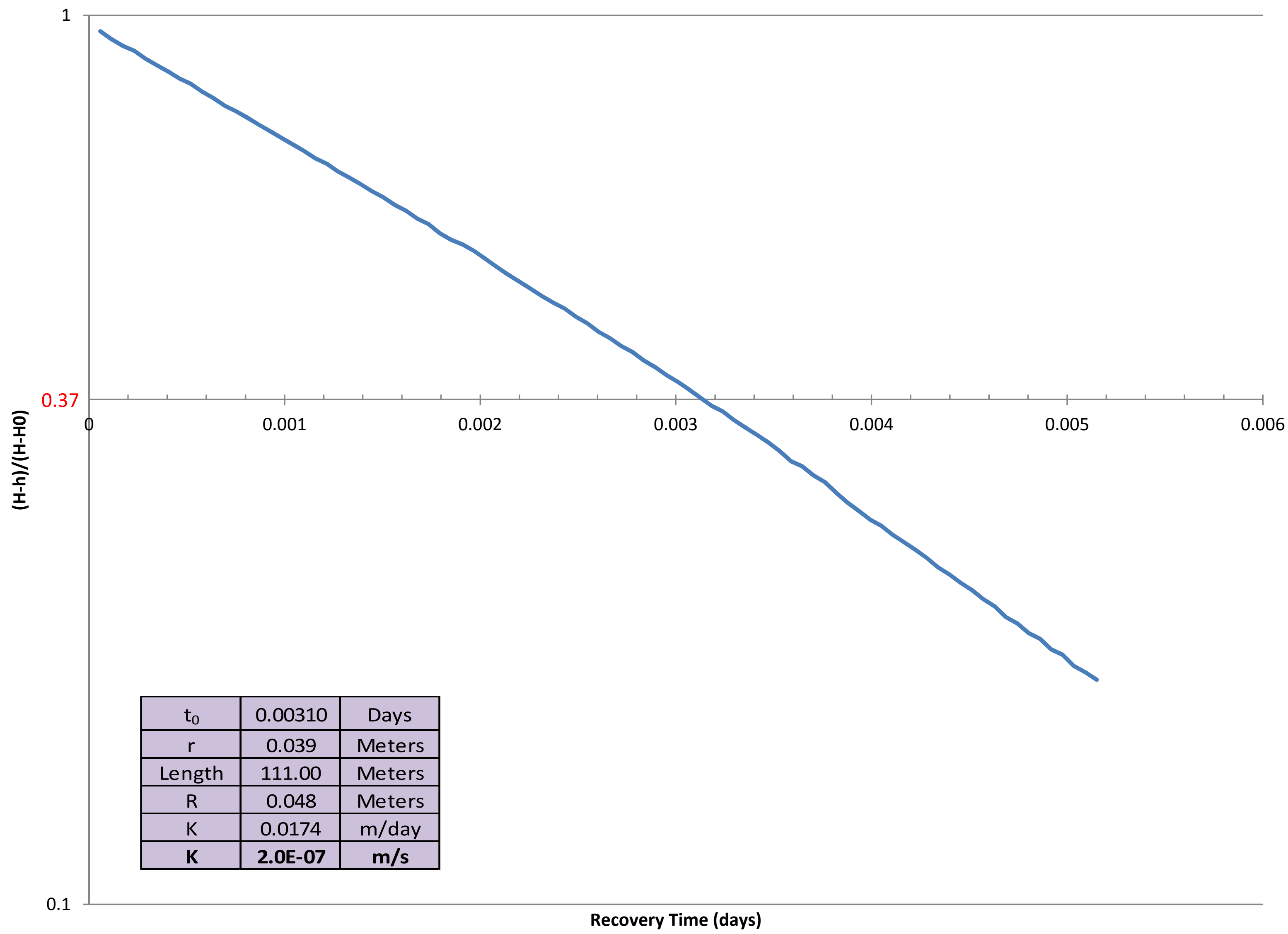
Appendices

Appendix A: Packer Test Analyses

IFSPD-124 (45 – 152 m)
Falling-head slug: Hvorslev analysis

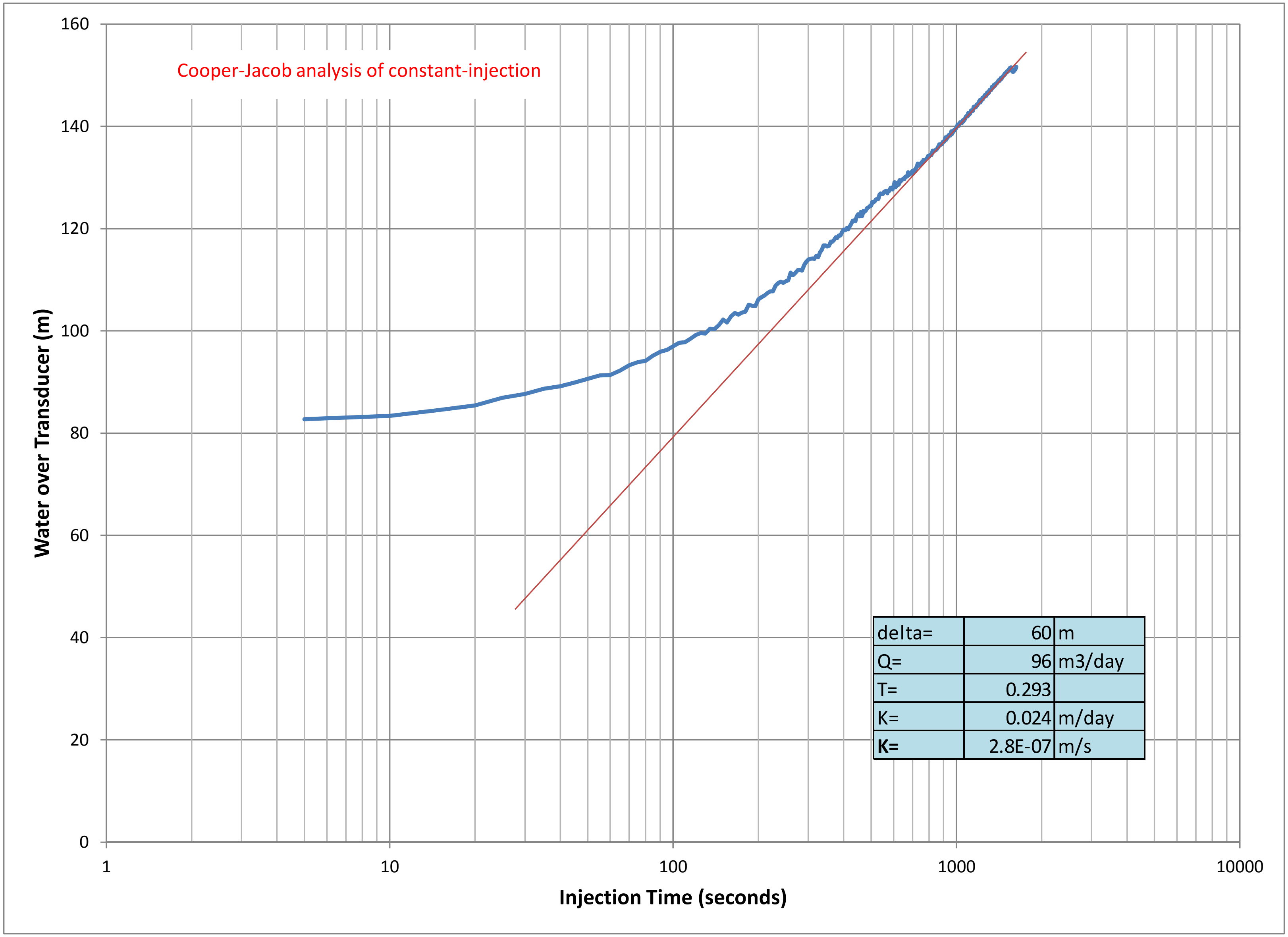
srk consulting



t_0	0.00310	Days
r	0.039	Meters
Length	111.00	Meters
R	0.048	Meters
K	0.0174	m/day
K	**2.0E-07**	**m/s**

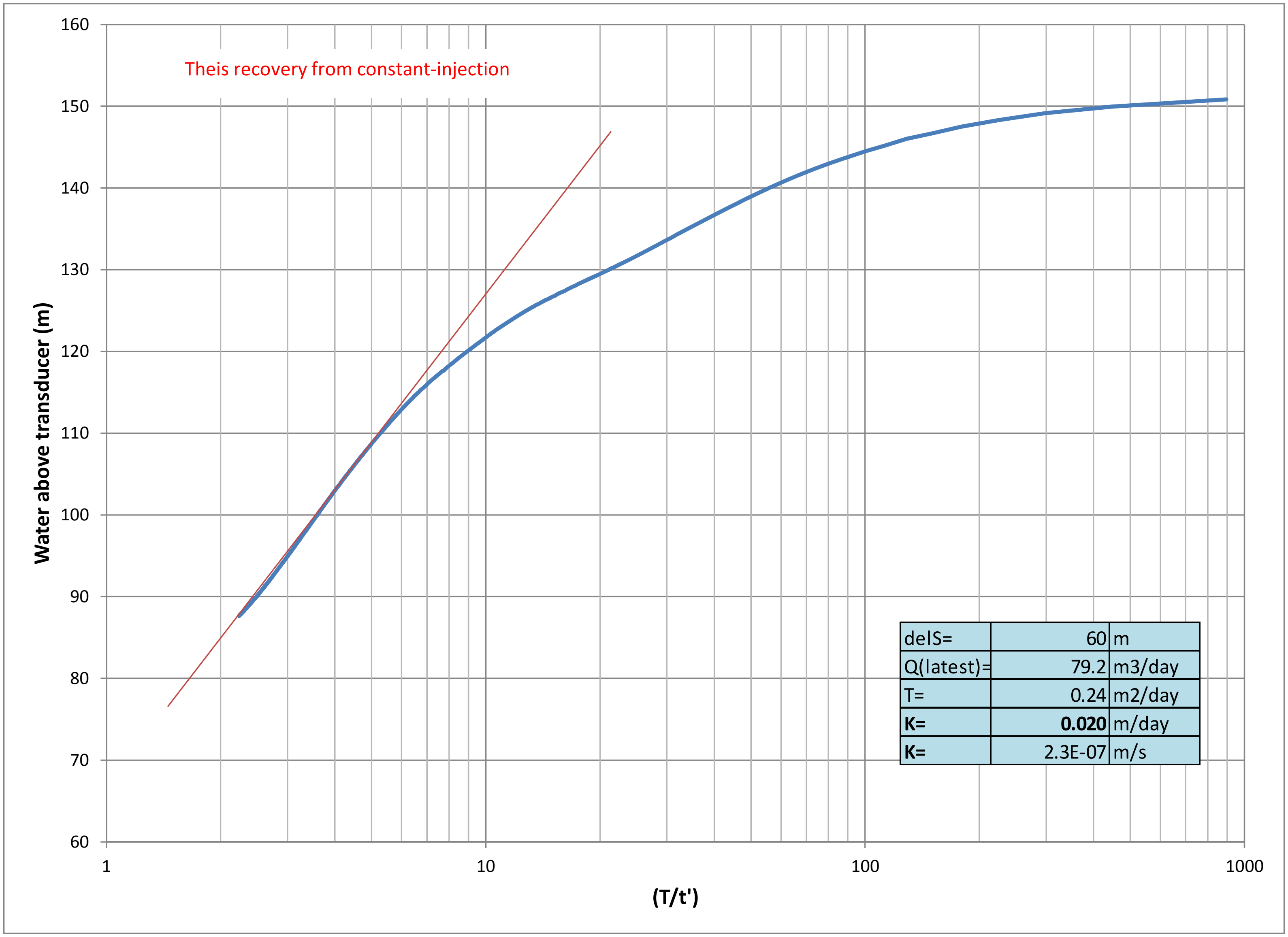
SRK15D-16P (136 – 148 m)
Constant Injection: Cooper Jacob analysis

srk consulting



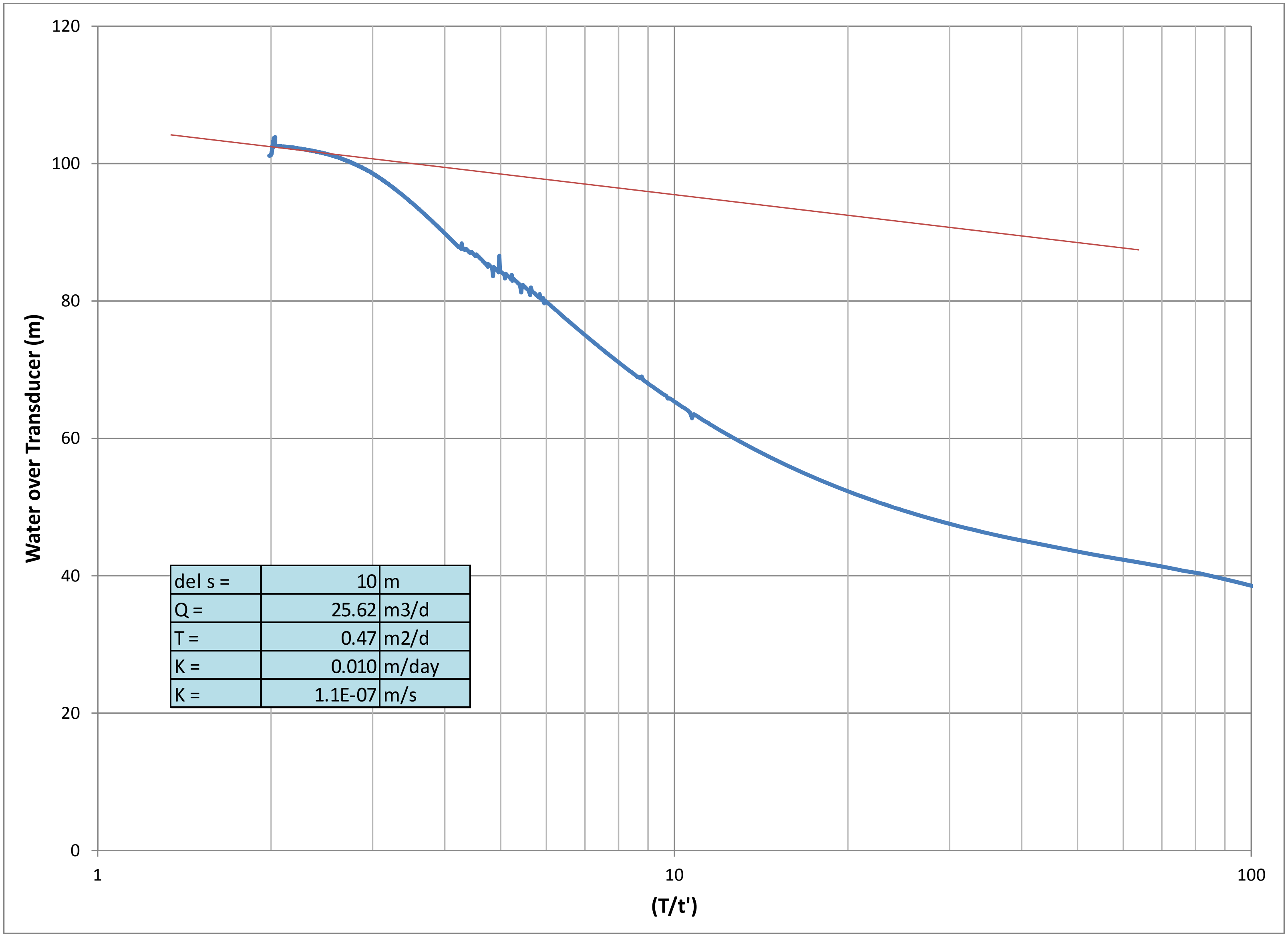
SRK15D-16P (136 – 148 m)
Constant Injection: Theis recovery analysis

srk consulting



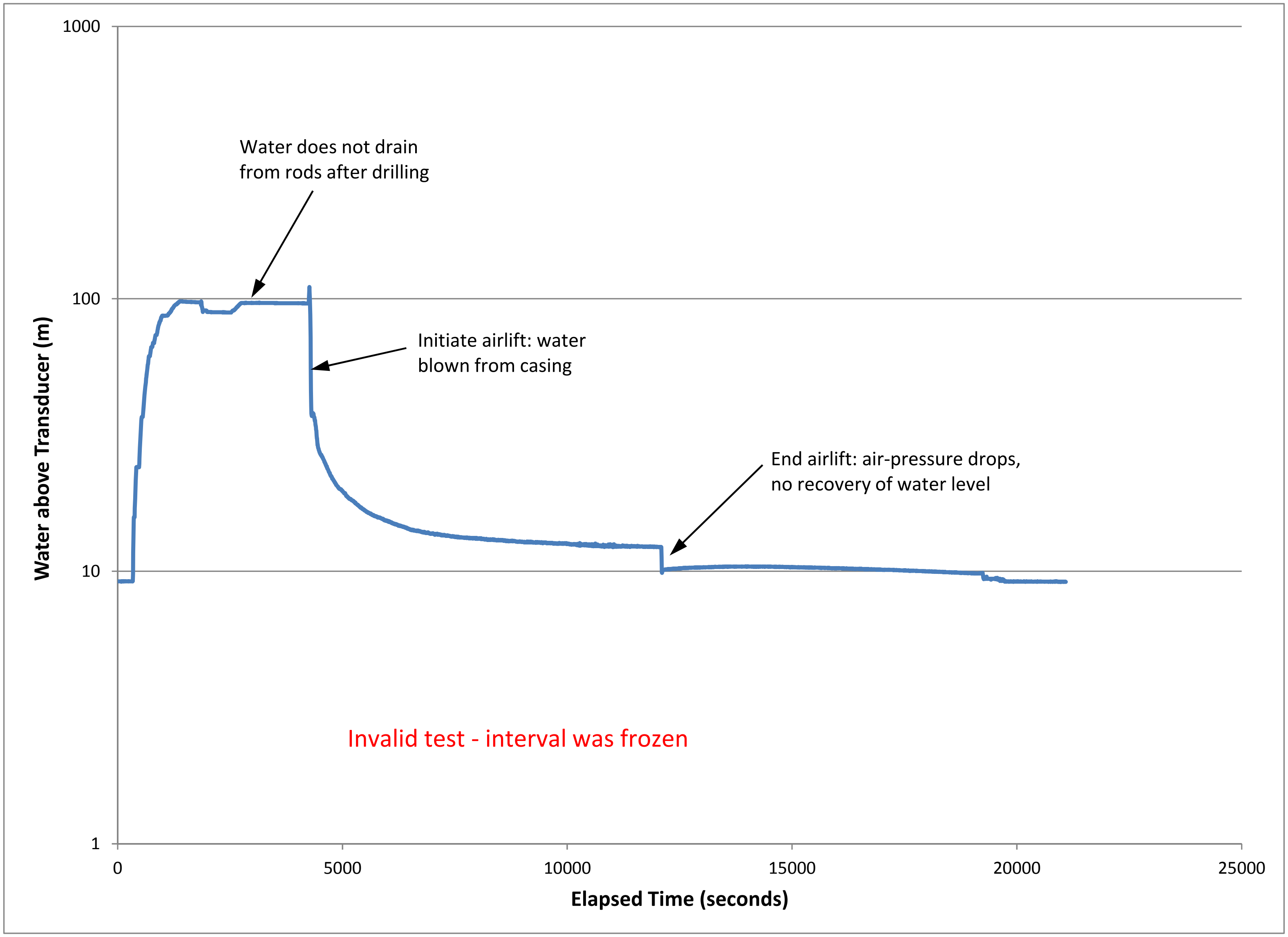
SRK15D-16P (164 – 212 m)
Constant-drawdown Airlift: Theis recovery analysis

srk consulting



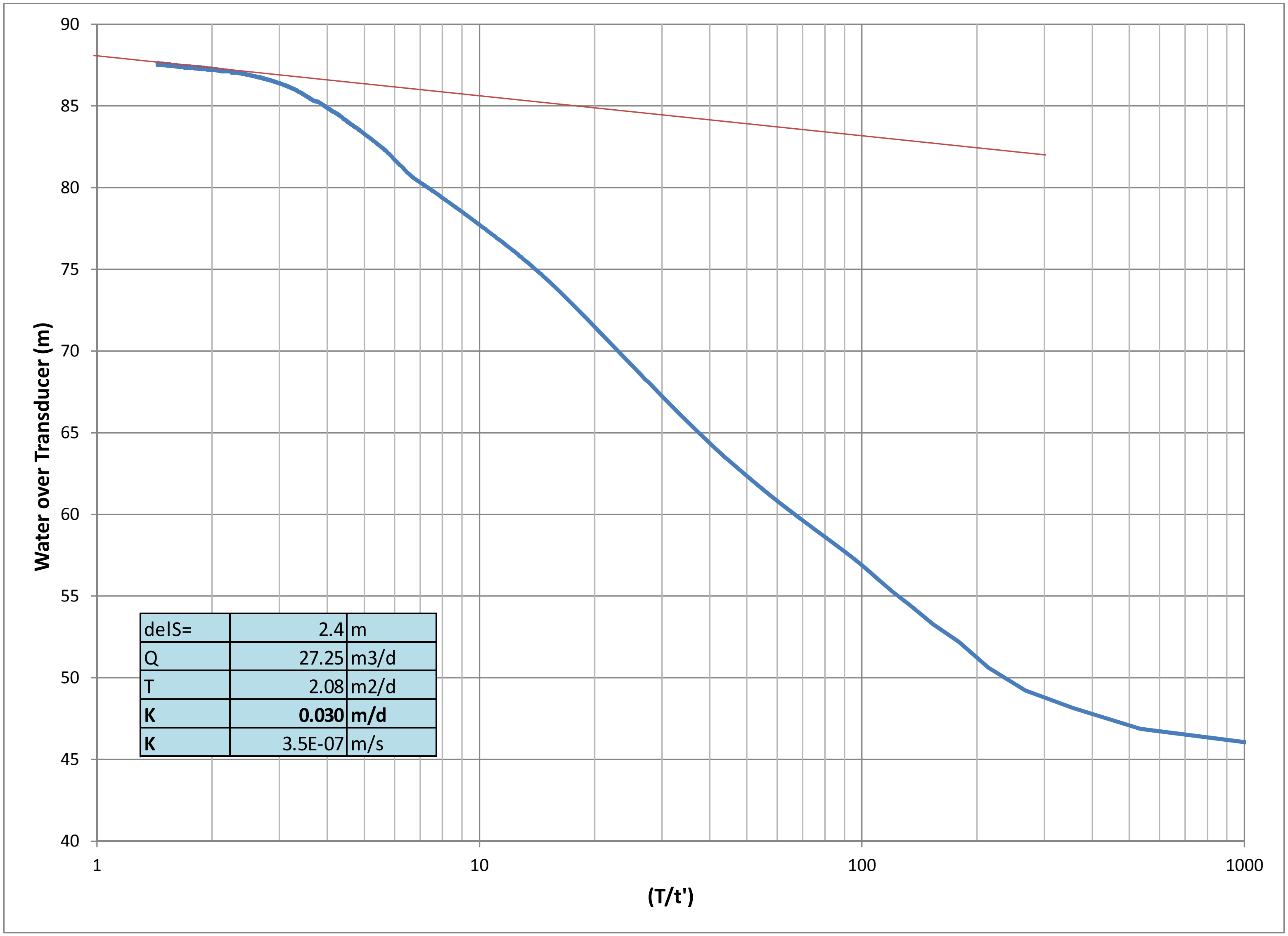
SRK15D-15P (115 – 205 m)
Constant-drawdown Airlift: Invalid Test

srk consulting



SRK15D-15P (200 – 274 m)
Constant-drawdown Airlift: Theis recovery analysis

srk consulting

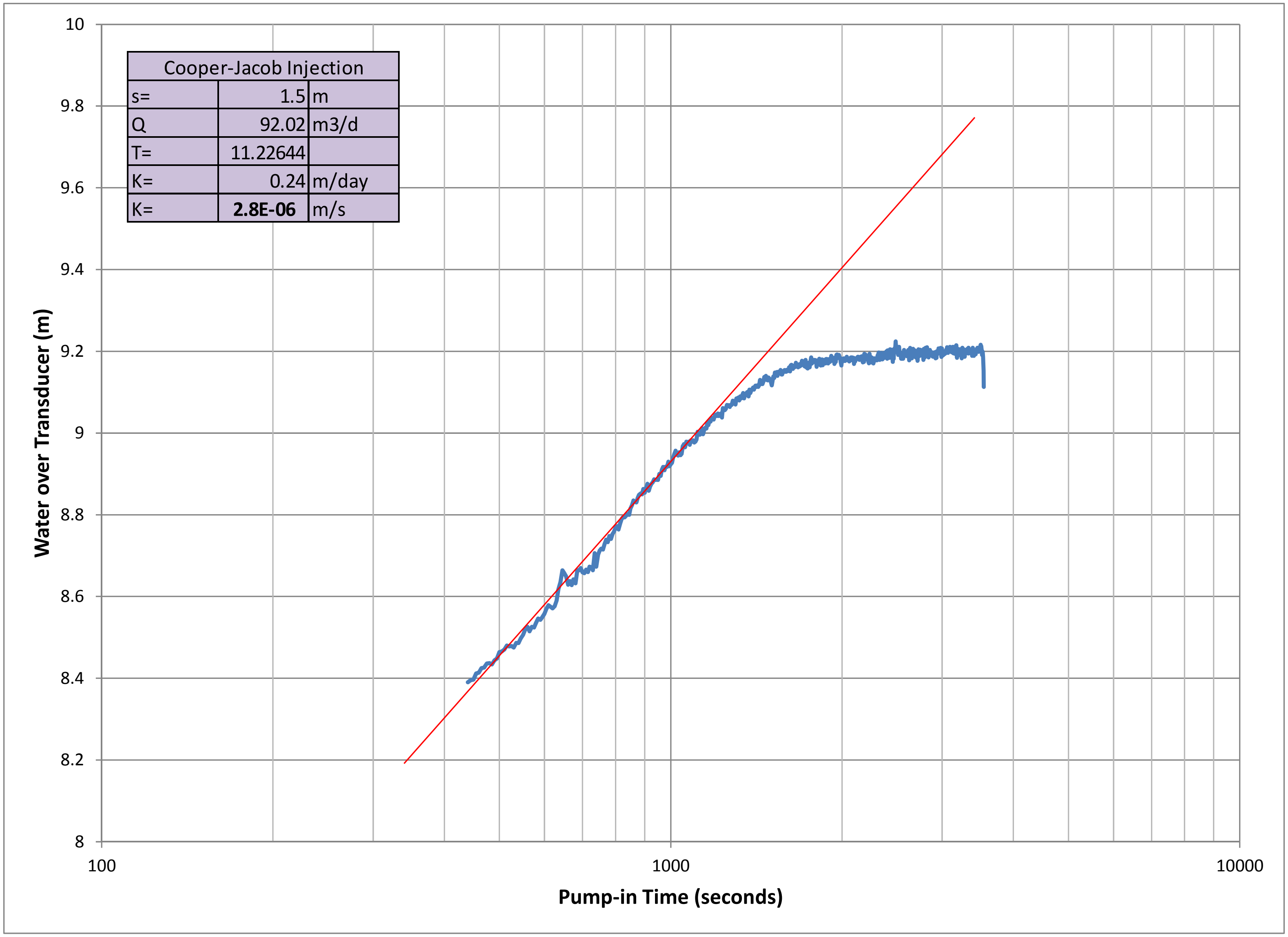


delS=	2.4	m
Q	27.25	m3/d
T	2.08	m2/d
K	**0.030**	**m/d**
K	3.5E-07	m/s

IFSPD-062 (175 – 221 m)
Constant- injection: Cooper-Jacob analysis

srk consulting

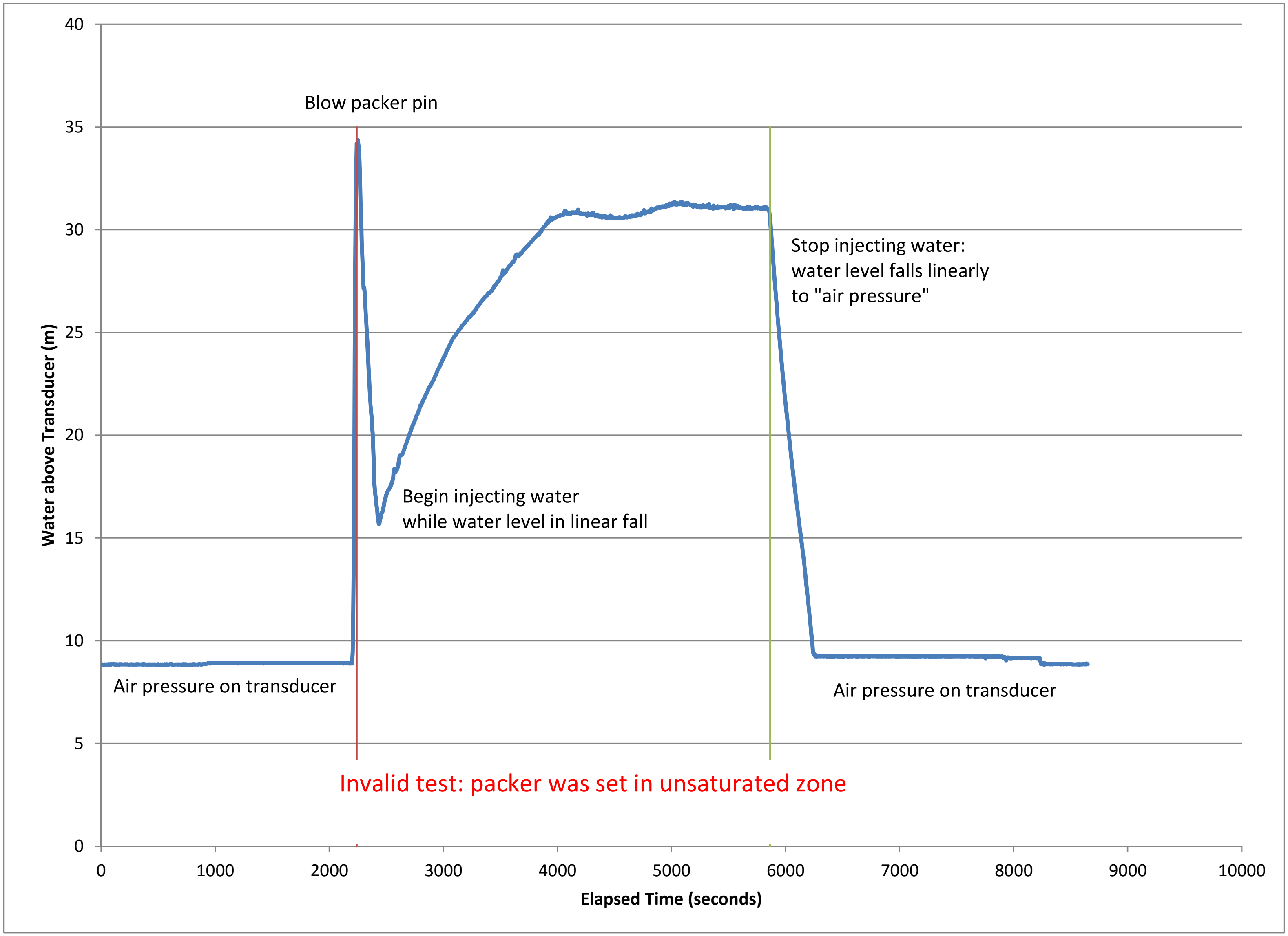
Cooper-Jacob Injection		
s=	1.5	m
Q	92.02	m3/d
T=	11.22644	
K=	0.24	m/day
K=	**2.8E-06**	m/s



IFSPD-110a (80 – 119 m)

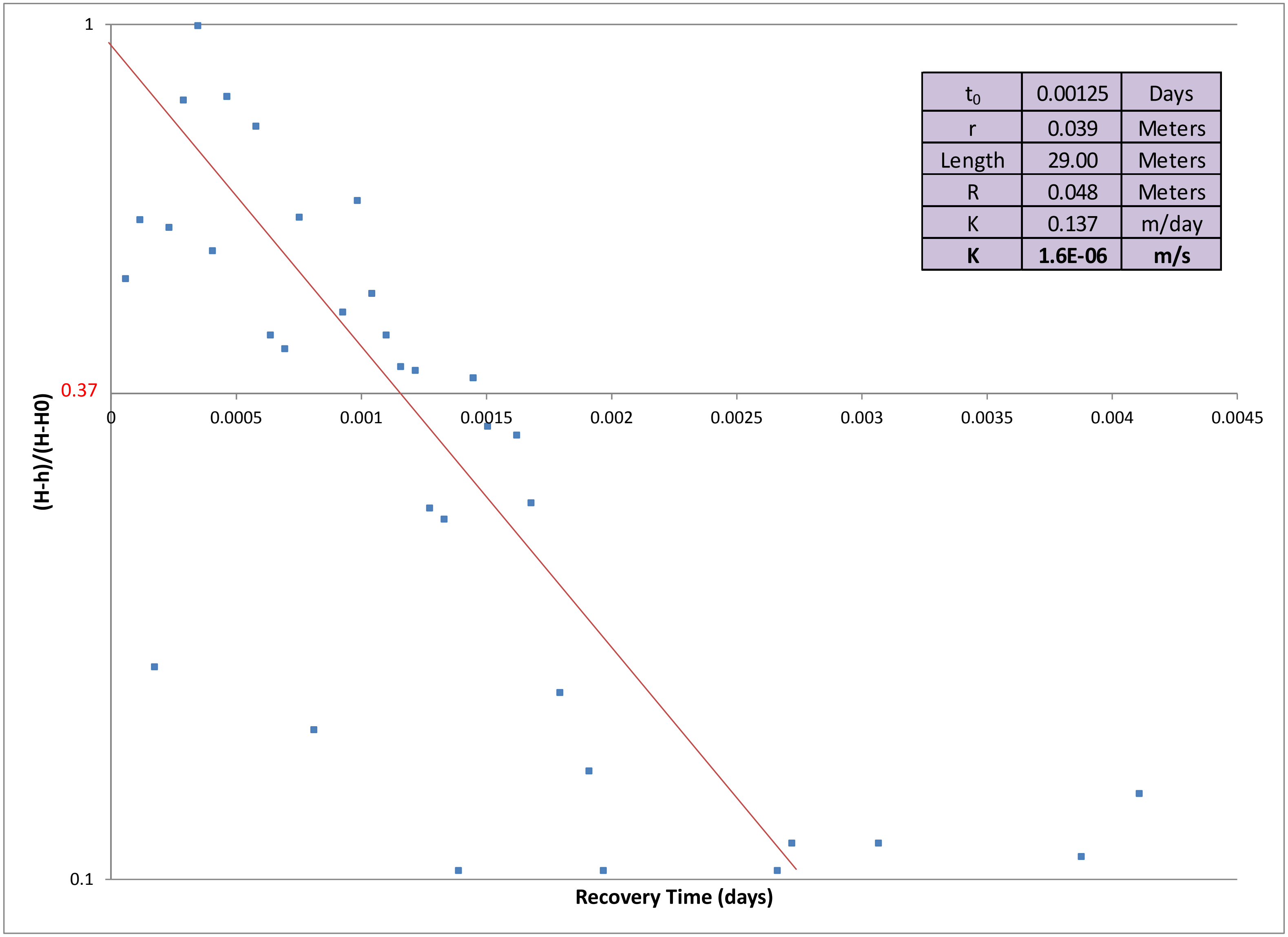
Constant-injection: Invalid Test

srk consulting



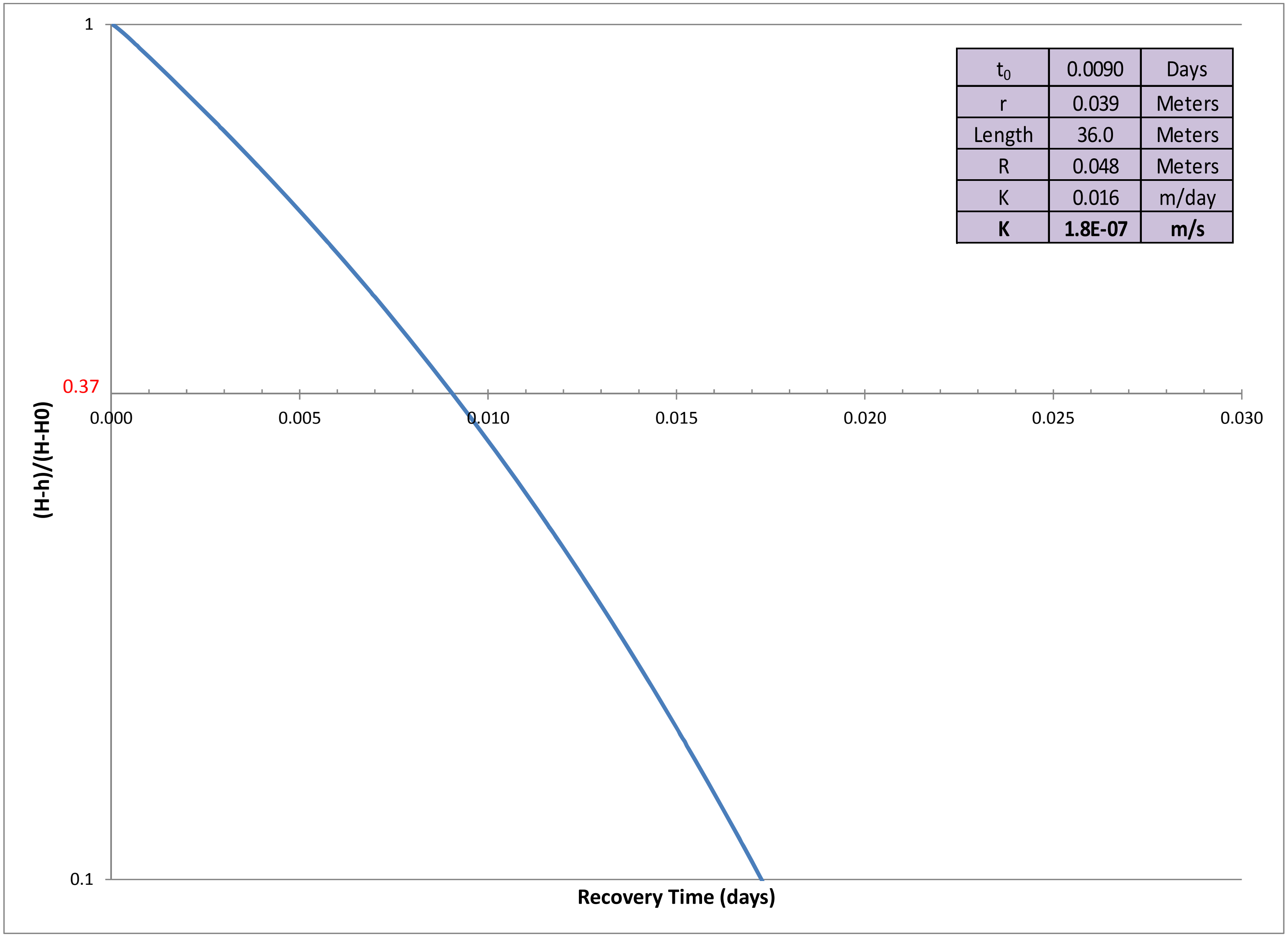
IFSPD-110a (237 – 266 m)
Falling-head slug: Hvorslev analysis

srk consulting



t_0	0.00125	Days
r	0.039	Meters
Length	29.00	Meters
R	0.048	Meters
K	0.137	m/day
K	**1.6E-06**	**m/s**

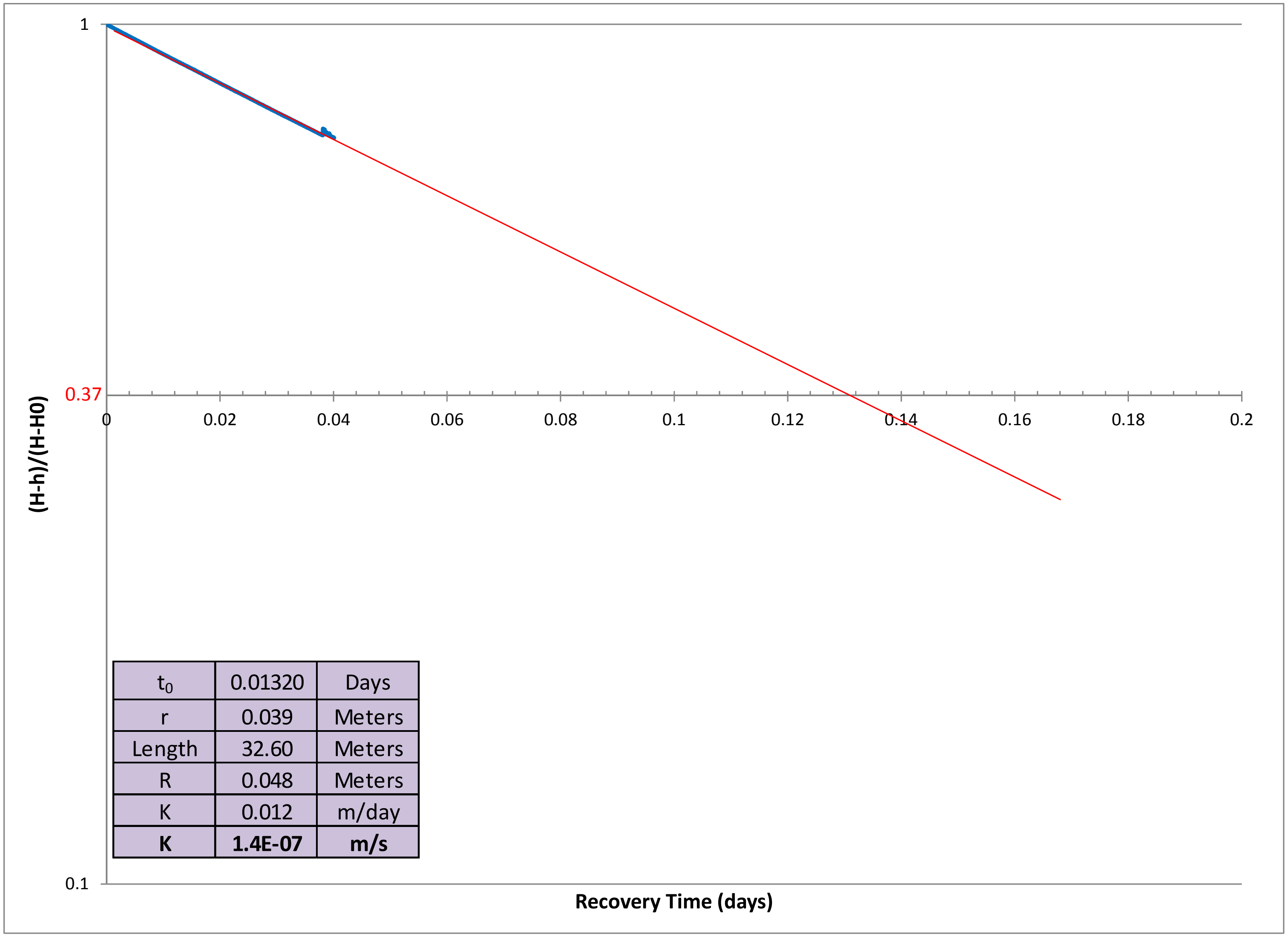
IFSPD-110a (266 – 302 m)
Falling-head slug: Hvorslev analysis



t_0	0.0090	Days
r	0.039	Meters
Length	36.0	Meters
R	0.048	Meters
K	0.016	m/day
K	**1.8E-07**	**m/s**

SRK15D-14P (175.5 – 216 m)
Falling-head slug: Hvorslev analysis

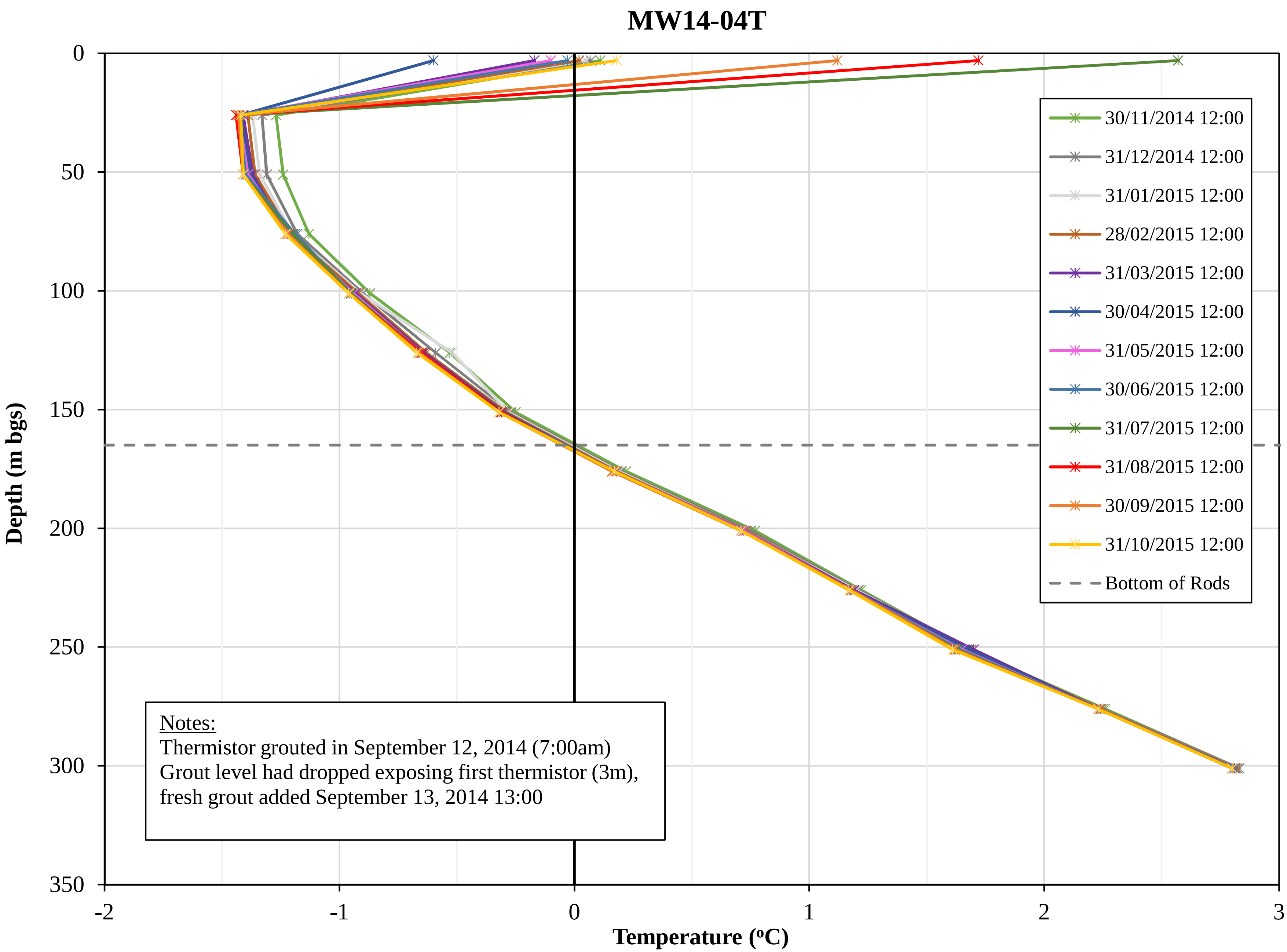
srk consulting

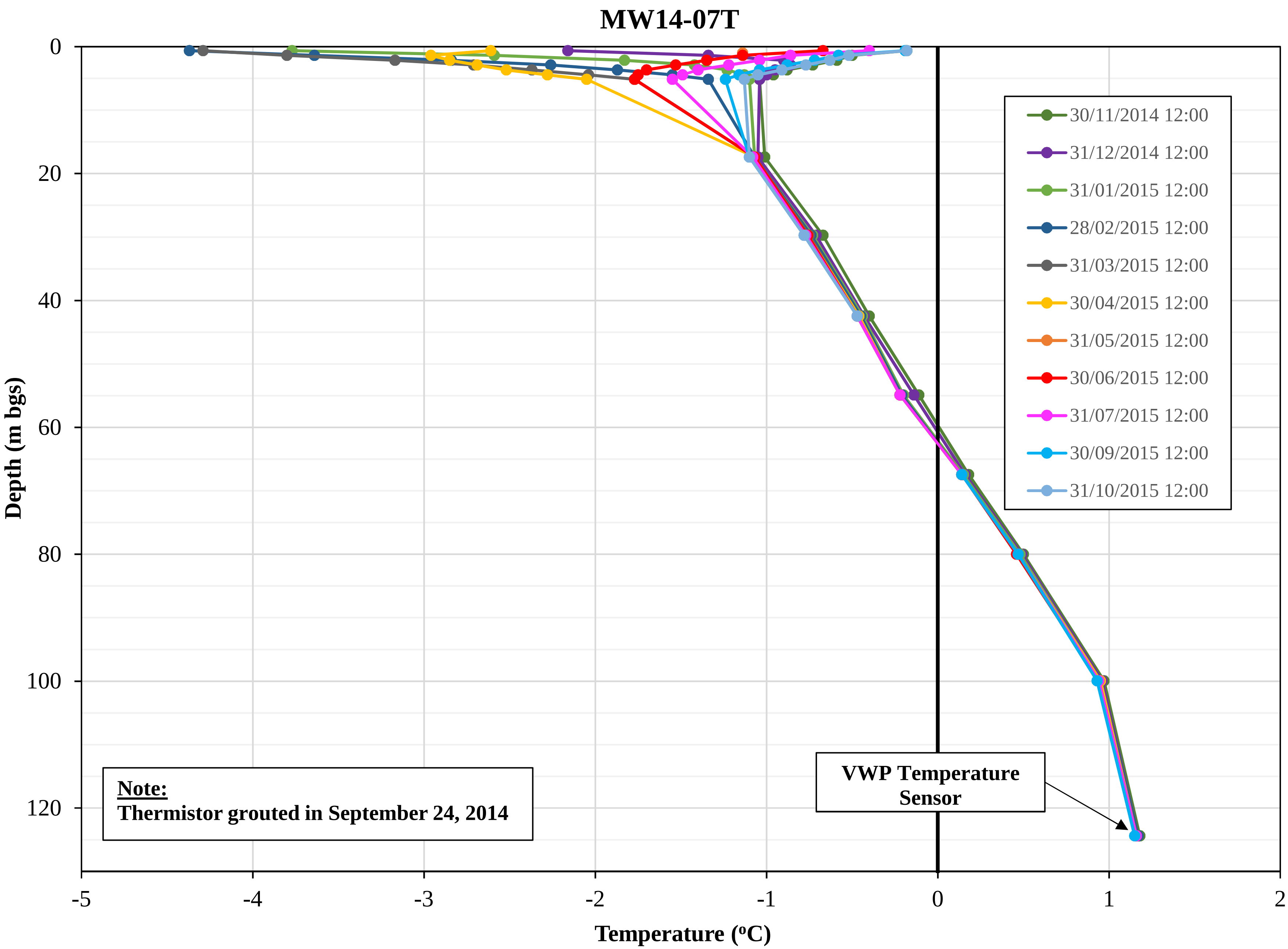


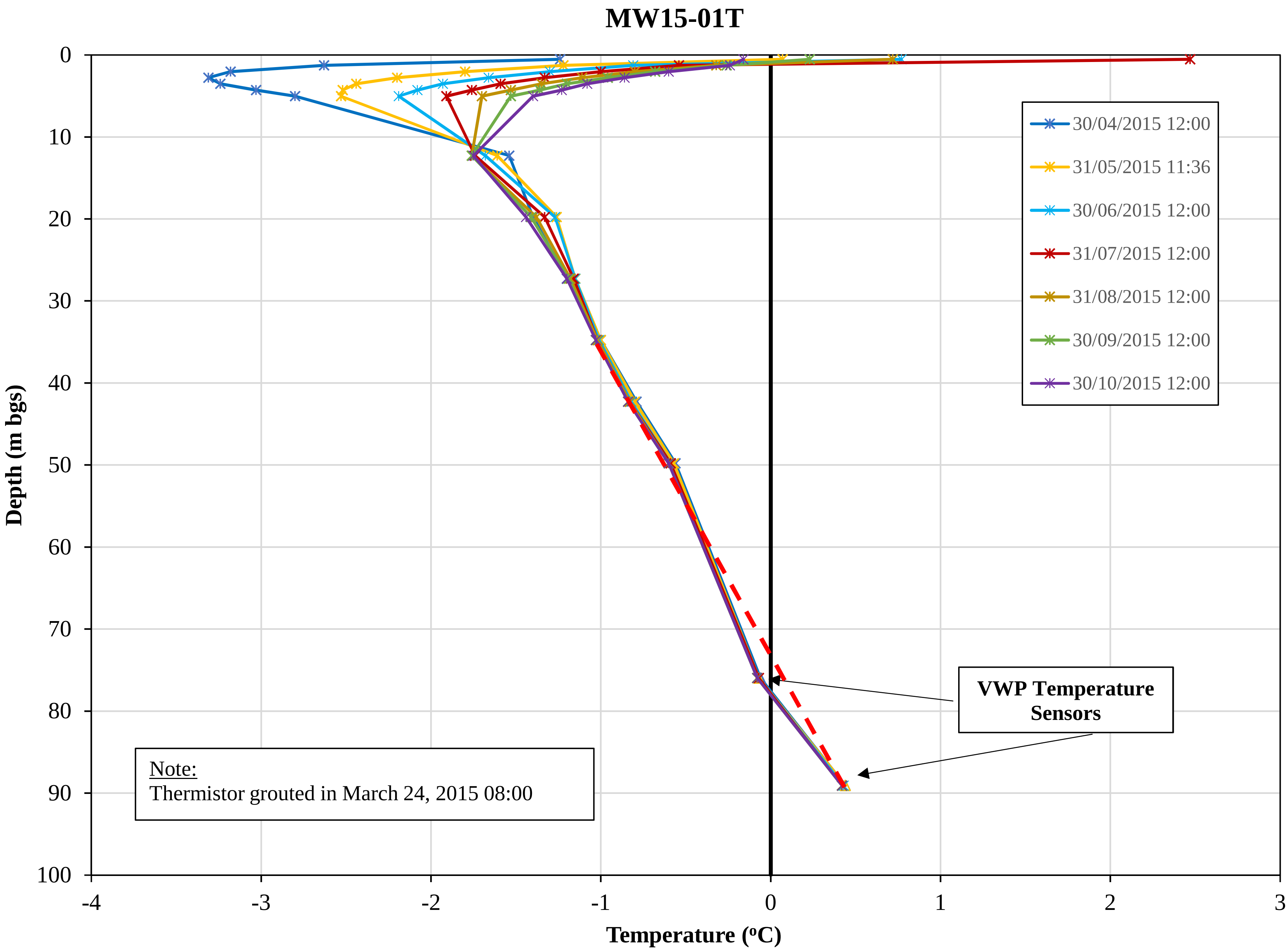
t_0	0.01320	Days
r	0.039	Meters
Length	32.60	Meters
R	0.048	Meters
K	0.012	m/day
K	**1.4E-07**	**m/s**

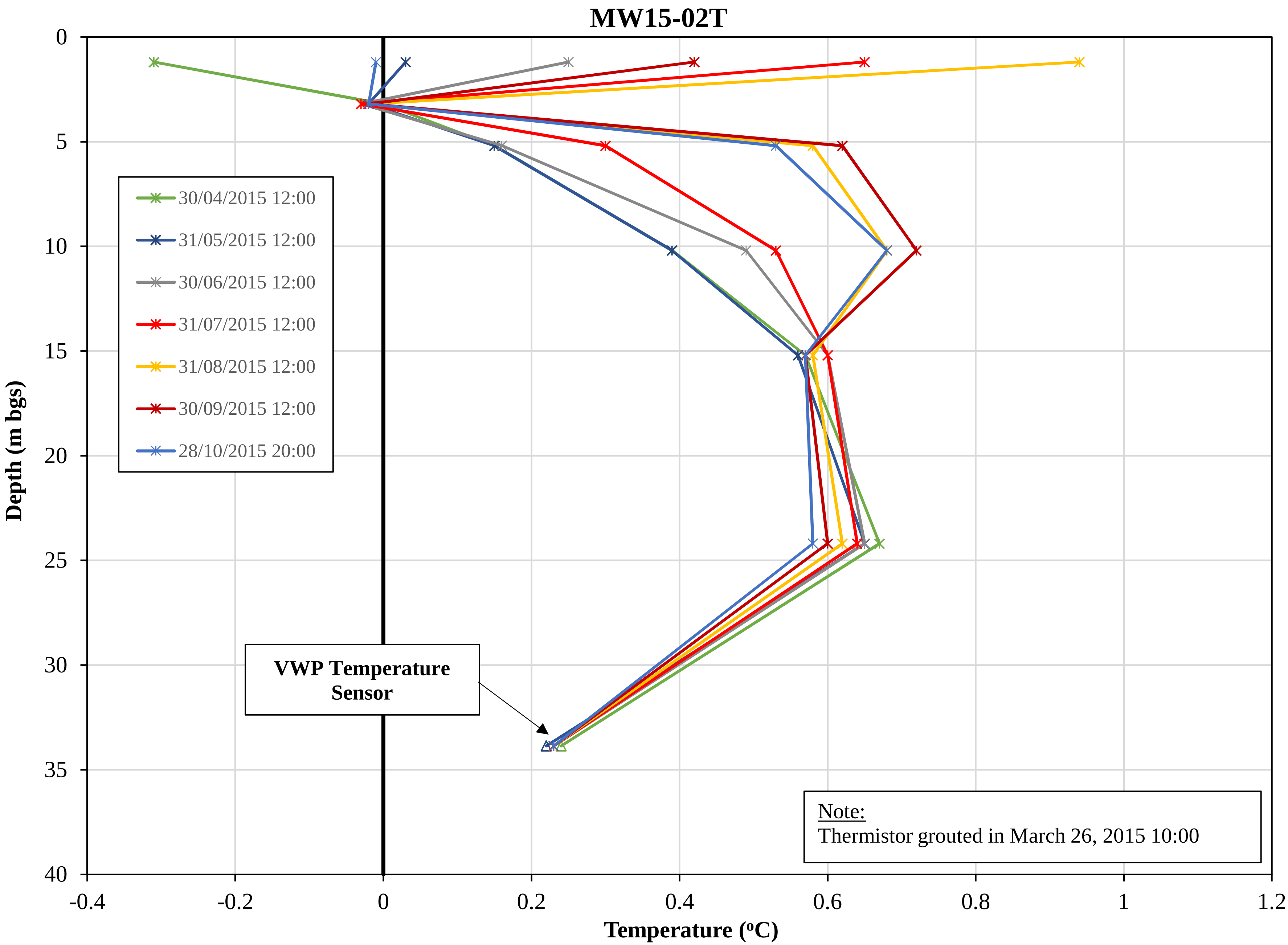
Appendix 4-A: Thermistor Profiles All Stations

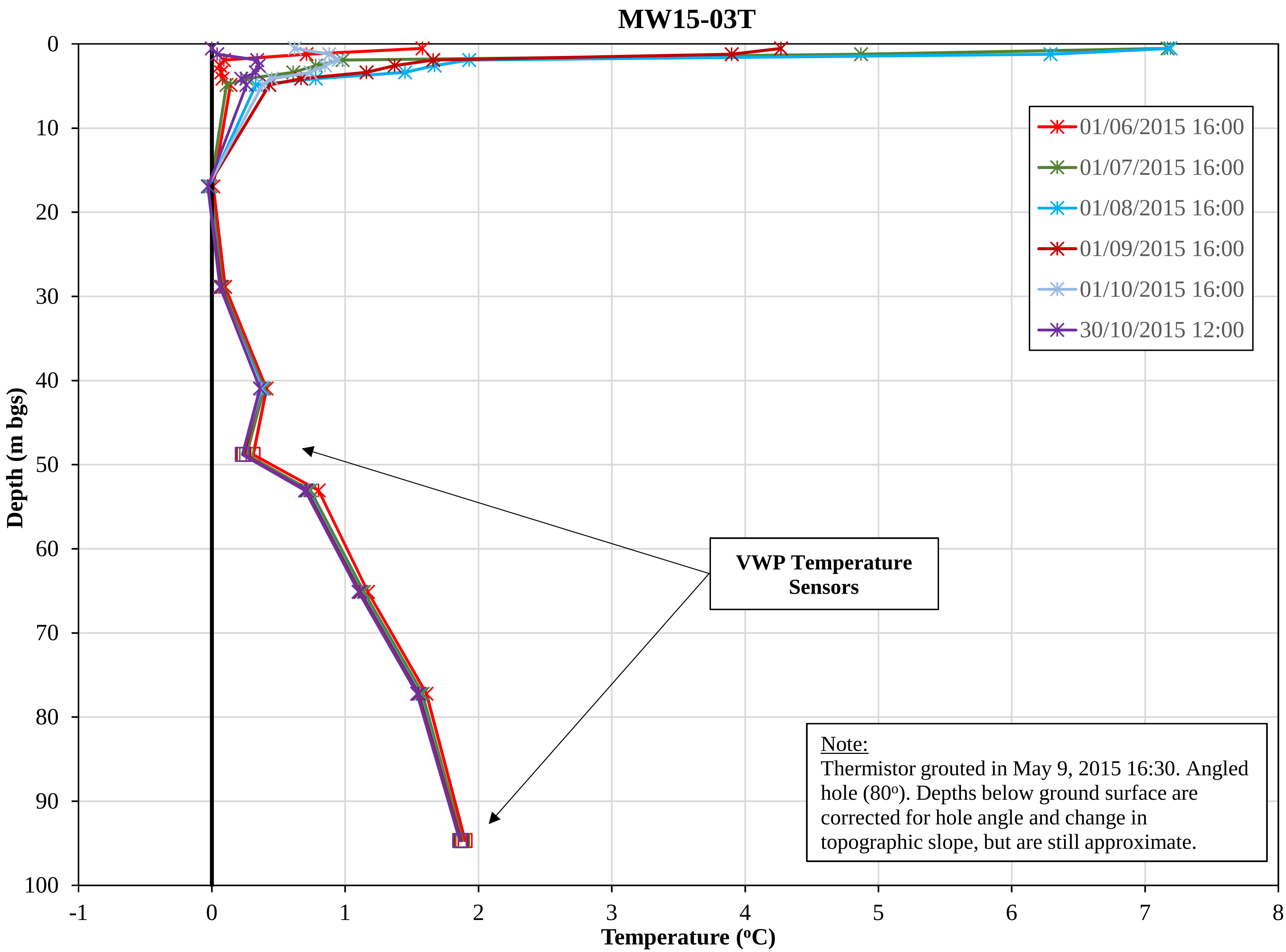
GOLDCORP

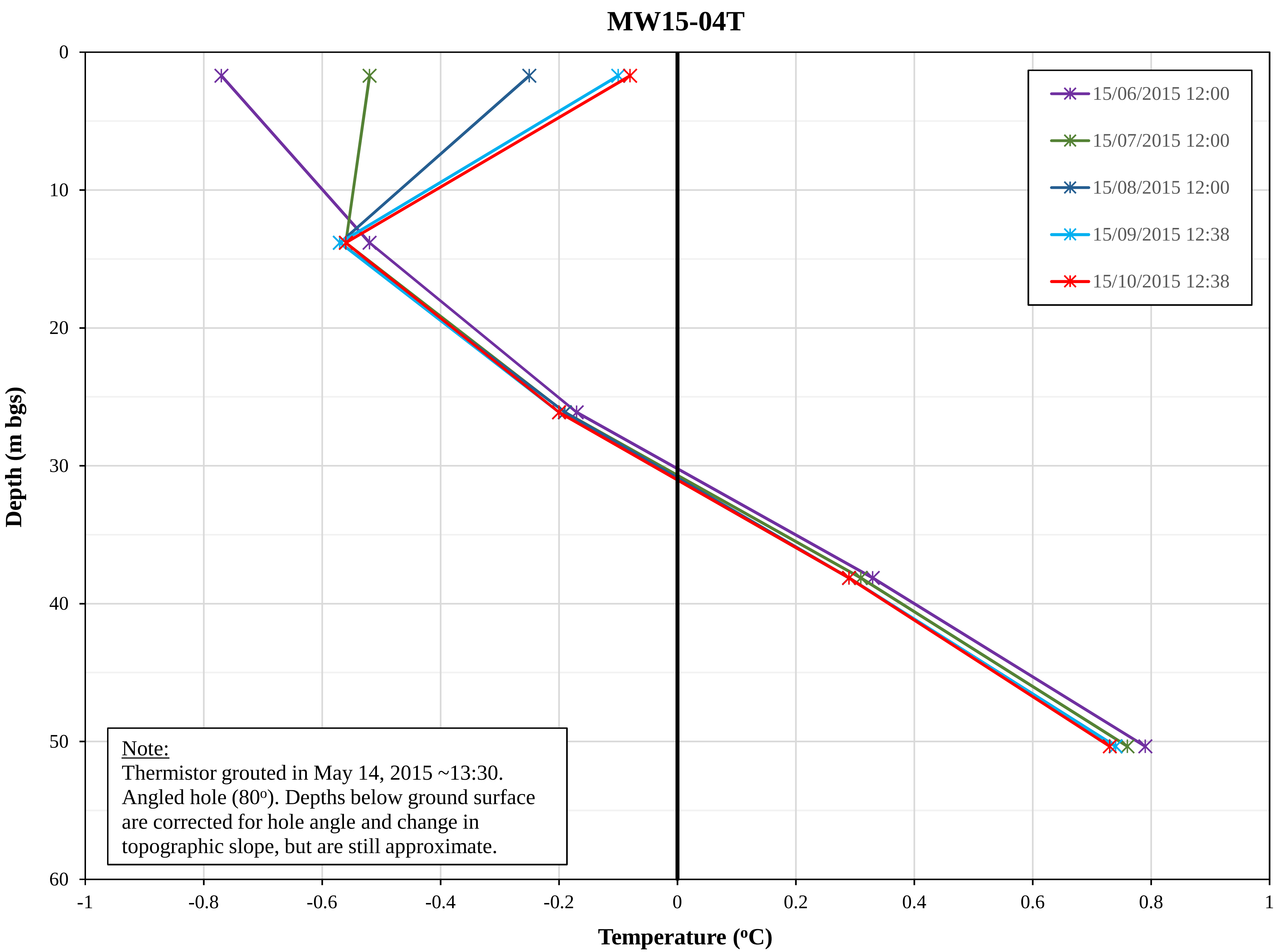

MW14-04T
Depth (m bgs)
Temperature (ºC)
0
50
100
150
200
250
300
350
-2
-1
0
1
2
3
30/11/2014 12:00
31/12/2014 12:00
31/01/2015 12:00
28/02/2015 12:00
31/03/2015 12:00
30/04/2015 12:00
31/05/2015 12:00
30/06/2015 12:00
31/07/2015 12:00
31/08/2015 12:00
30/09/2015 12:00
31/10/2015 12:00
Bottom of Rods
Notes:
Thermistor grouted in September 12, 2014 (7:00am)
Grout level had dropped exposing first thermistor (3m),
fresh grout added September 13, 2014 13:00

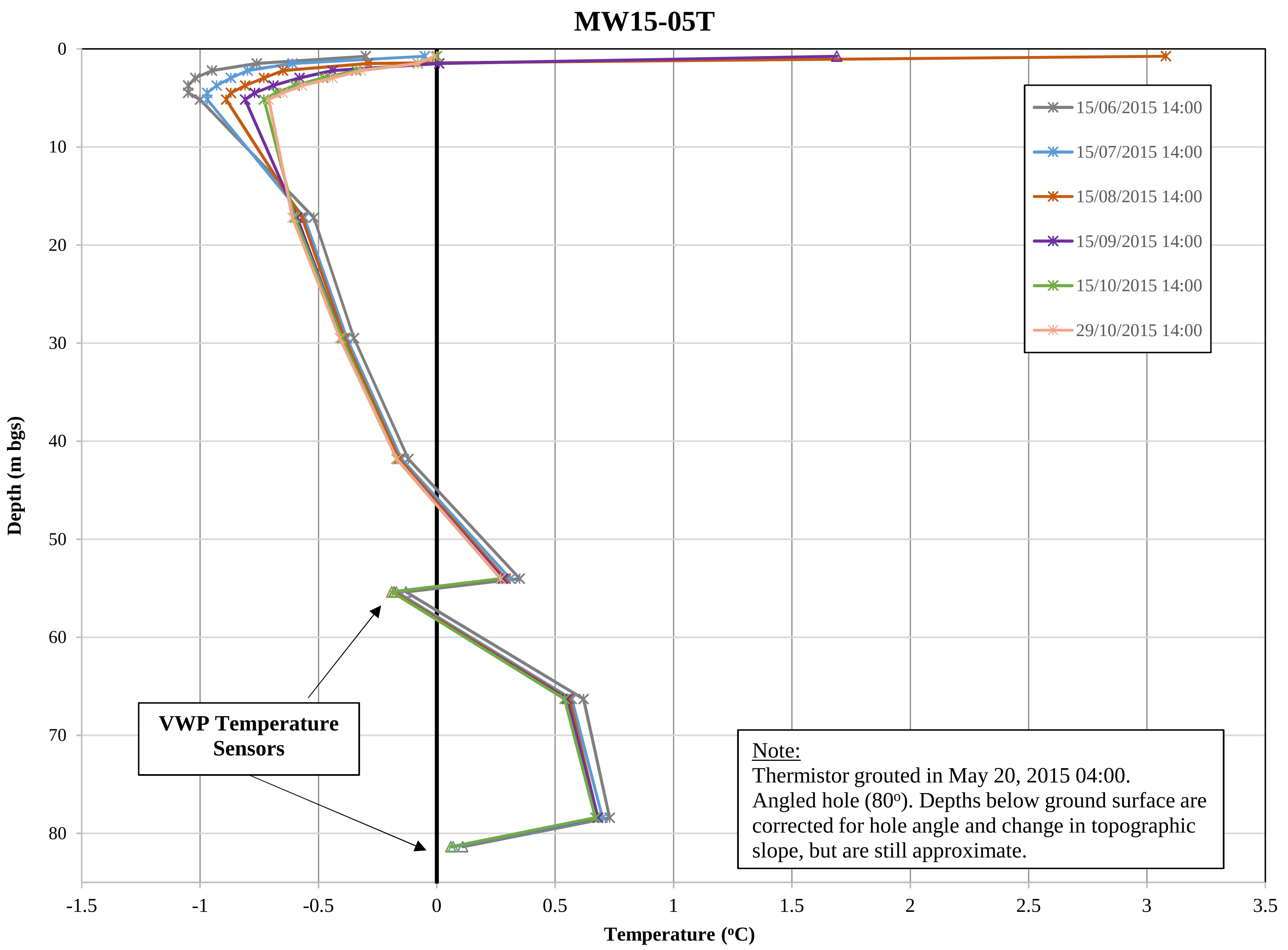

MW14-07T
Depth (m bgs)
Temperature (ºC)
0
20
40
60
80
100
120
-5
-4
-3
-2
-1
0
1
2
30/11/2014 12:00
31/12/2014 12:00
31/01/2015 12:00
28/02/2015 12:00
31/03/2015 12:00
30/04/2015 12:00
31/05/2015 12:00
30/06/2015 12:00
31/07/2015 12:00
30/09/2015 12:00
31/10/2015 12:00
Note:
Thermistor grouted in September 24, 2014
VWP Temperature Sensor

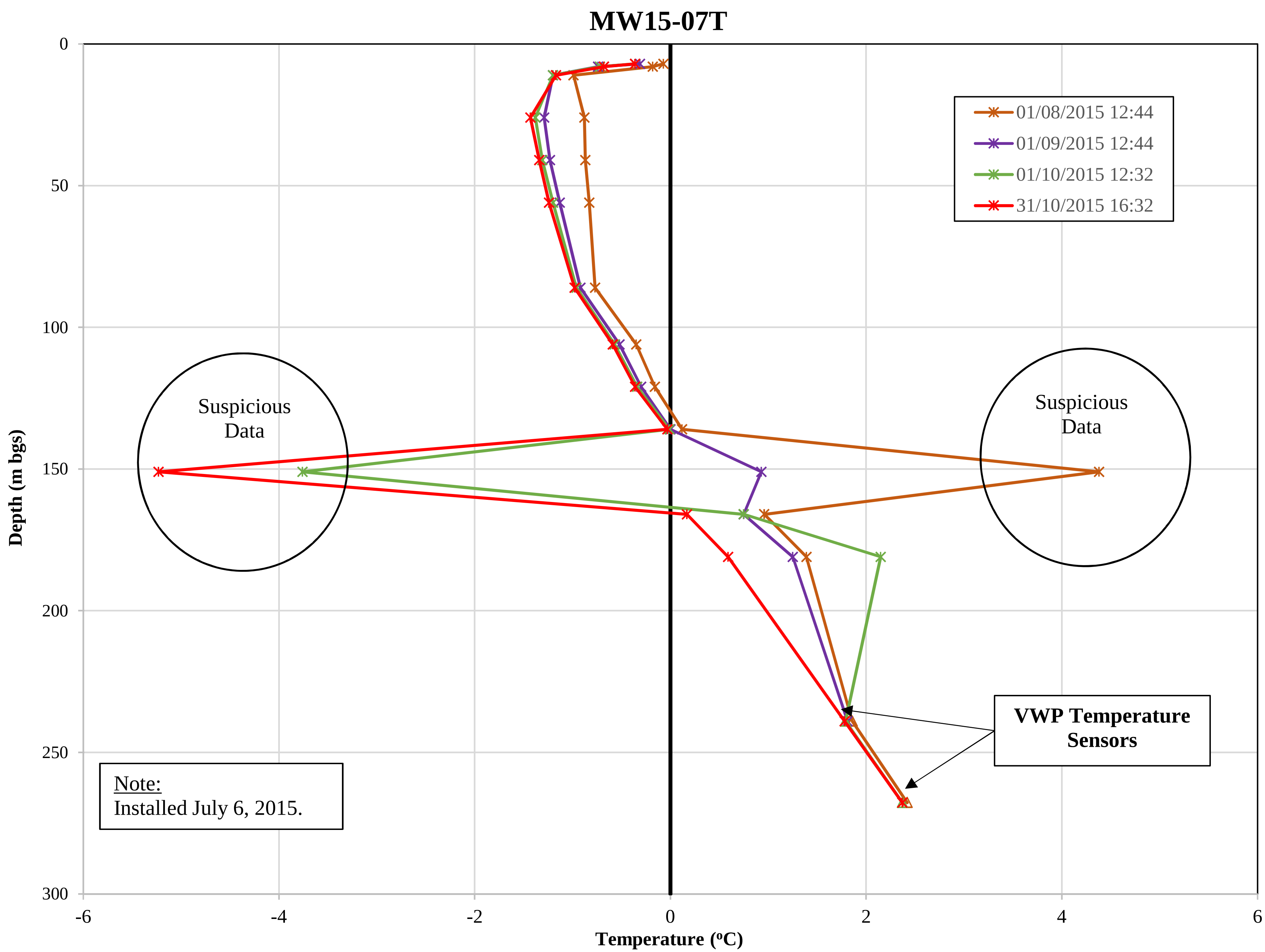

MW15-01T
Depth (m bgs)
Temperature (ºC)
0
10
20
30
40
50
60
70
80
90
100
-4
-3
-2
-1
0
1
2
3
30/04/2015 12:00
31/05/2015 11:36
30/06/2015 12:00
31/07/2015 12:00
31/08/2015 12:00
30/09/2015 12:00
30/10/2015 12:00
VWP Temperature Sensors
Note:
Thermistor grouted in March 24, 2015 08:00

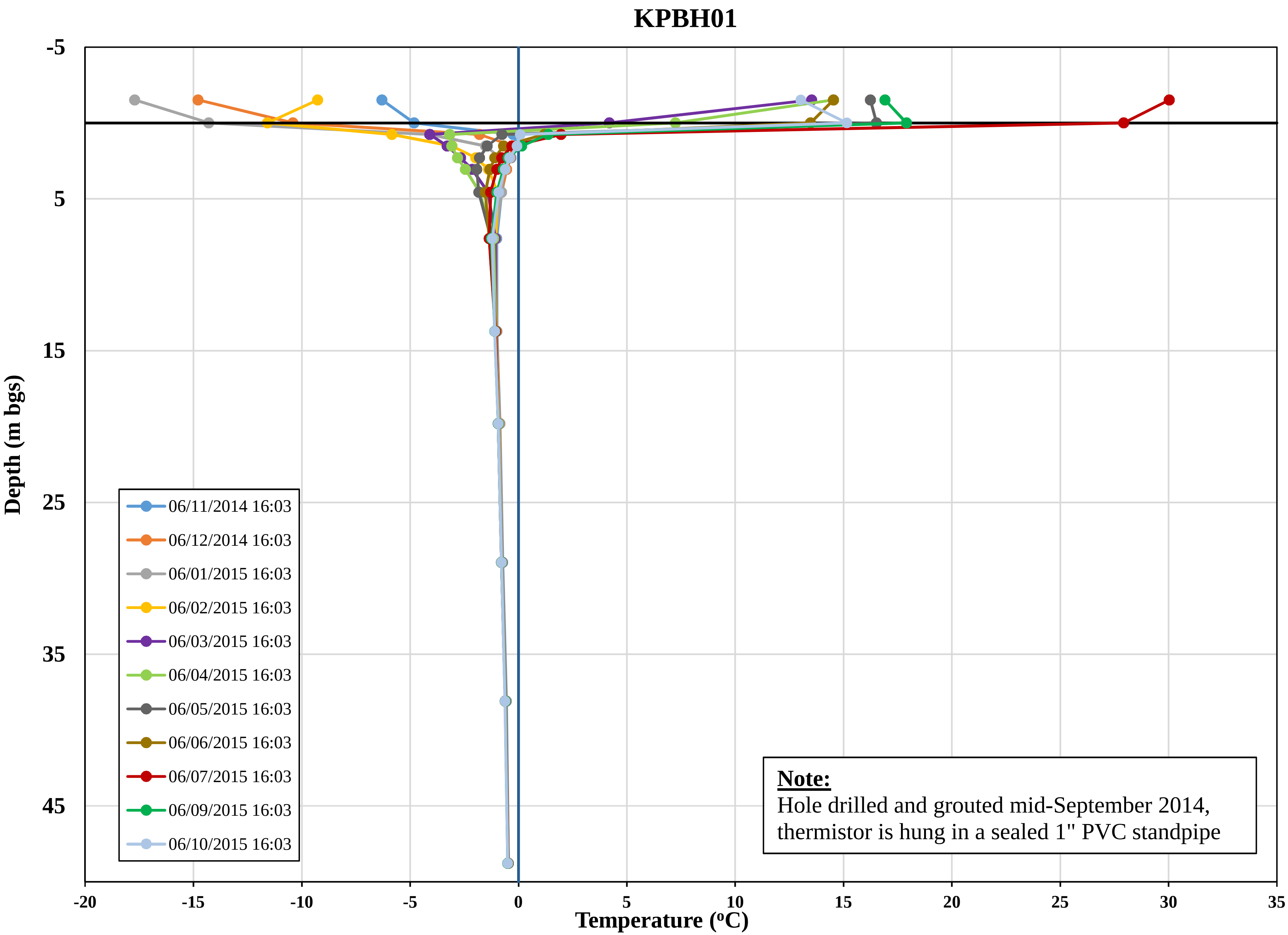

MW15-02T
Depth (m bgs)
Temperature (ºC)
30/04/2015 12:00
31/05/2015 12:00
30/06/2015 12:00
31/07/2015 12:00
31/08/2015 12:00
30/09/2015 12:00
28/10/2015 20:00
VWP Temperature Sensor
Note:
Thermistor grouted in March 26, 2015 10:00
0
5
10
15
20
25
30
35
40
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2

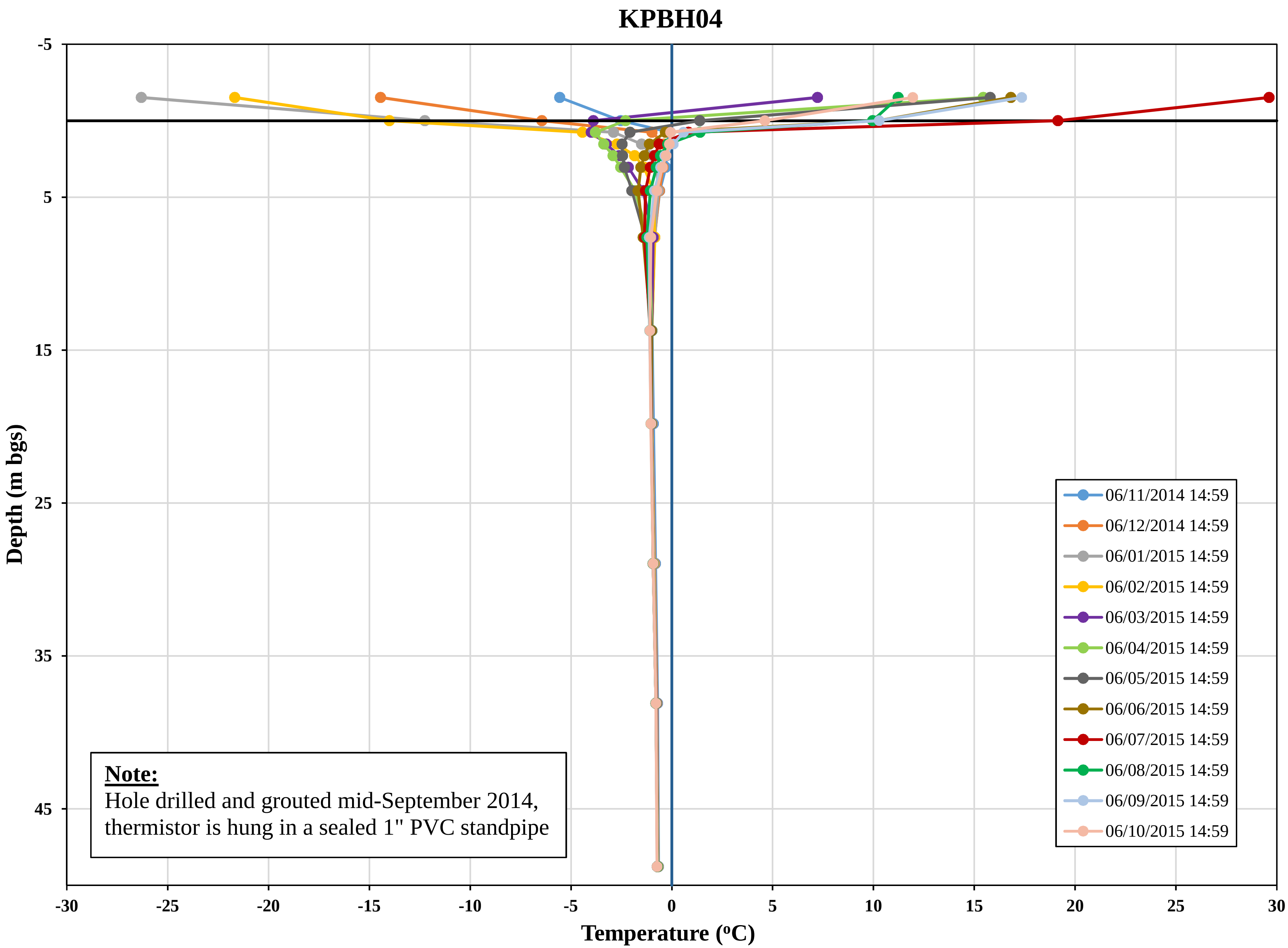

MW15-03T
Depth (m bgs)
Temperature (°C)
01/06/2015 16:00
01/07/2015 16:00
01/08/2015 16:00
01/09/2015 16:00
01/10/2015 16:00
30/10/2015 12:00
VWP Temperature Sensors
Note:
Thermistor grouted in May 9, 2015 16:30. Angled hole (80°). Depths below ground surface are corrected for hole angle and change in topographic slope, but are still approximate.

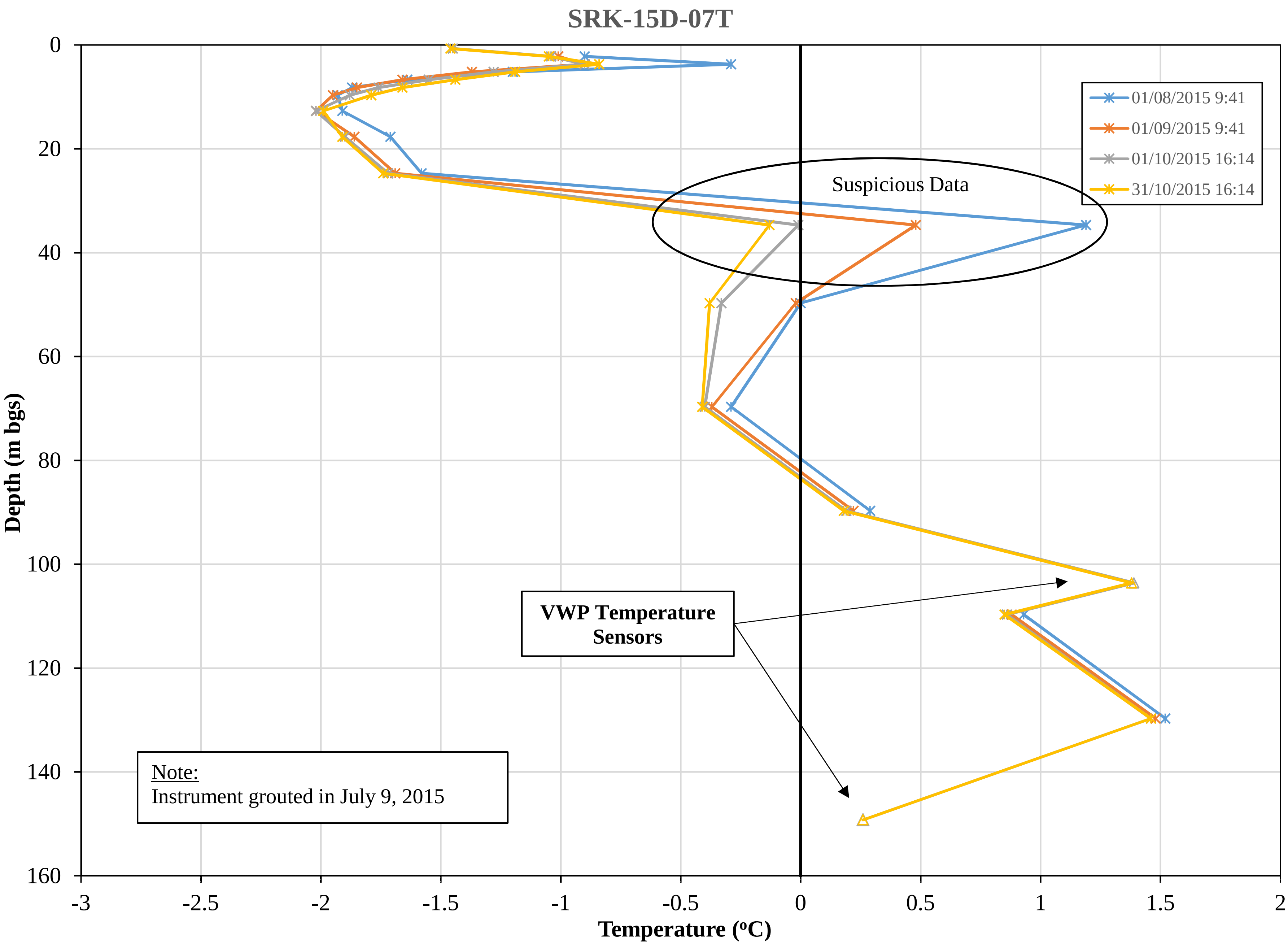

MW15-04T
Depth (m bgs)
Temperature (°C)
0
10
20
30
40
50
60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
15/06/2015 12:00
15/07/2015 12:00
15/08/2015 12:00
15/09/2015 12:38
15/10/2015 12:38
Note:
Thermistor grouted in May 14, 2015 ~13:30.
Angled hole (80°). Depths below ground surface
are corrected for hole angle and change in
topographic slope, but are still approximate.

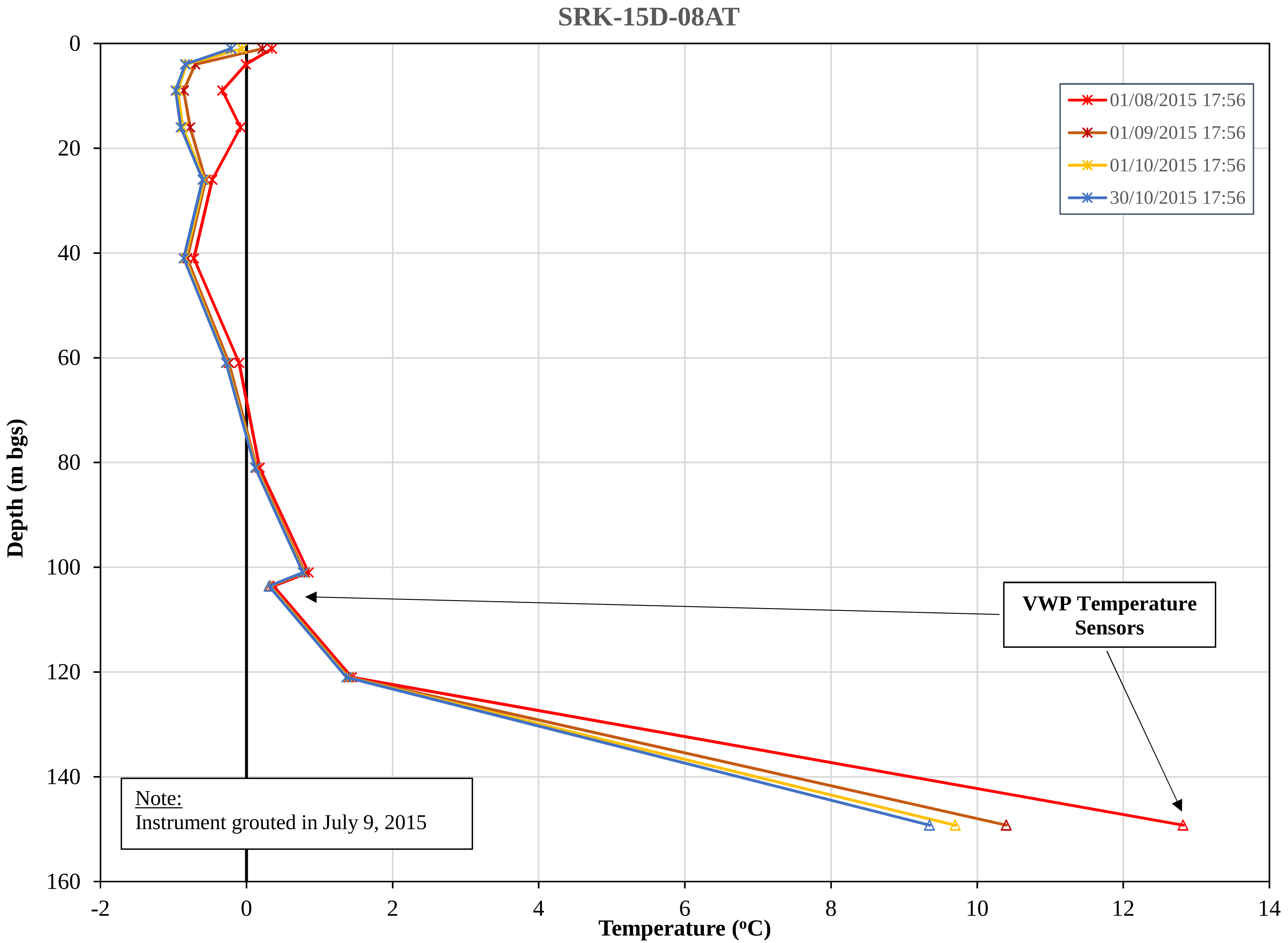

MW15-05T
Depth (m bgs)
Temperature (ºC)
15/06/2015 14:00
15/07/2015 14:00
15/08/2015 14:00
15/09/2015 14:00
15/10/2015 14:00
29/10/2015 14:00
VWP Temperature Sensors
Note:
Thermistor grouted in May 20, 2015 04:00.
Angled hole (80º). Depths below ground surface are corrected for hole angle and change in topographic slope, but are still approximate.

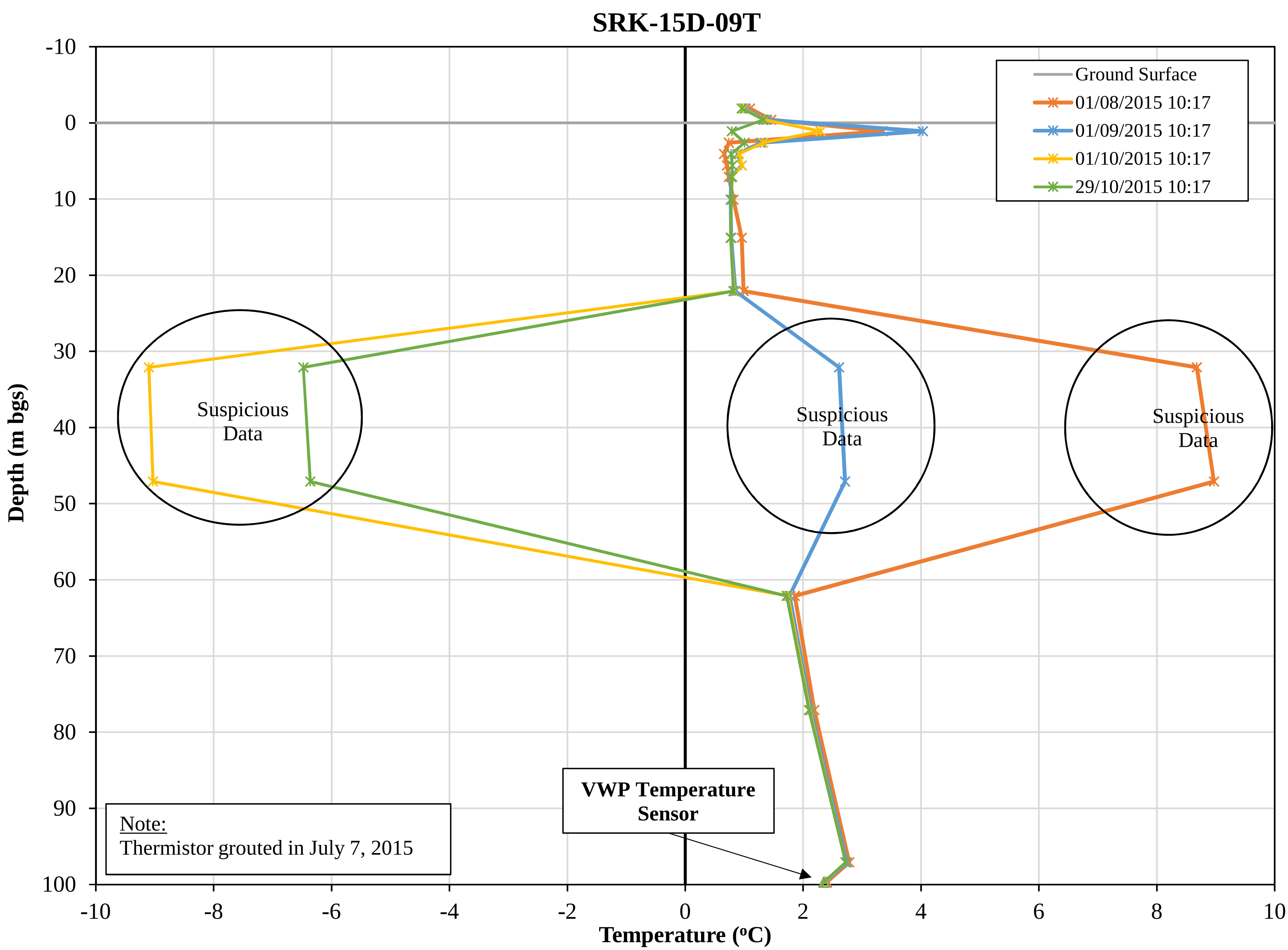

MW15-07T
Depth (m bgs)
Temperature (ºC)
0
50
100
150
200
250
300
-6
-4
-2
0
2
4
6
01/08/2015 12:44
01/09/2015 12:44
01/10/2015 12:32
31/10/2015 16:32
Suspicious Data
Suspicious Data
VWP Temperature Sensors
Note:
Installed July 6, 2015.

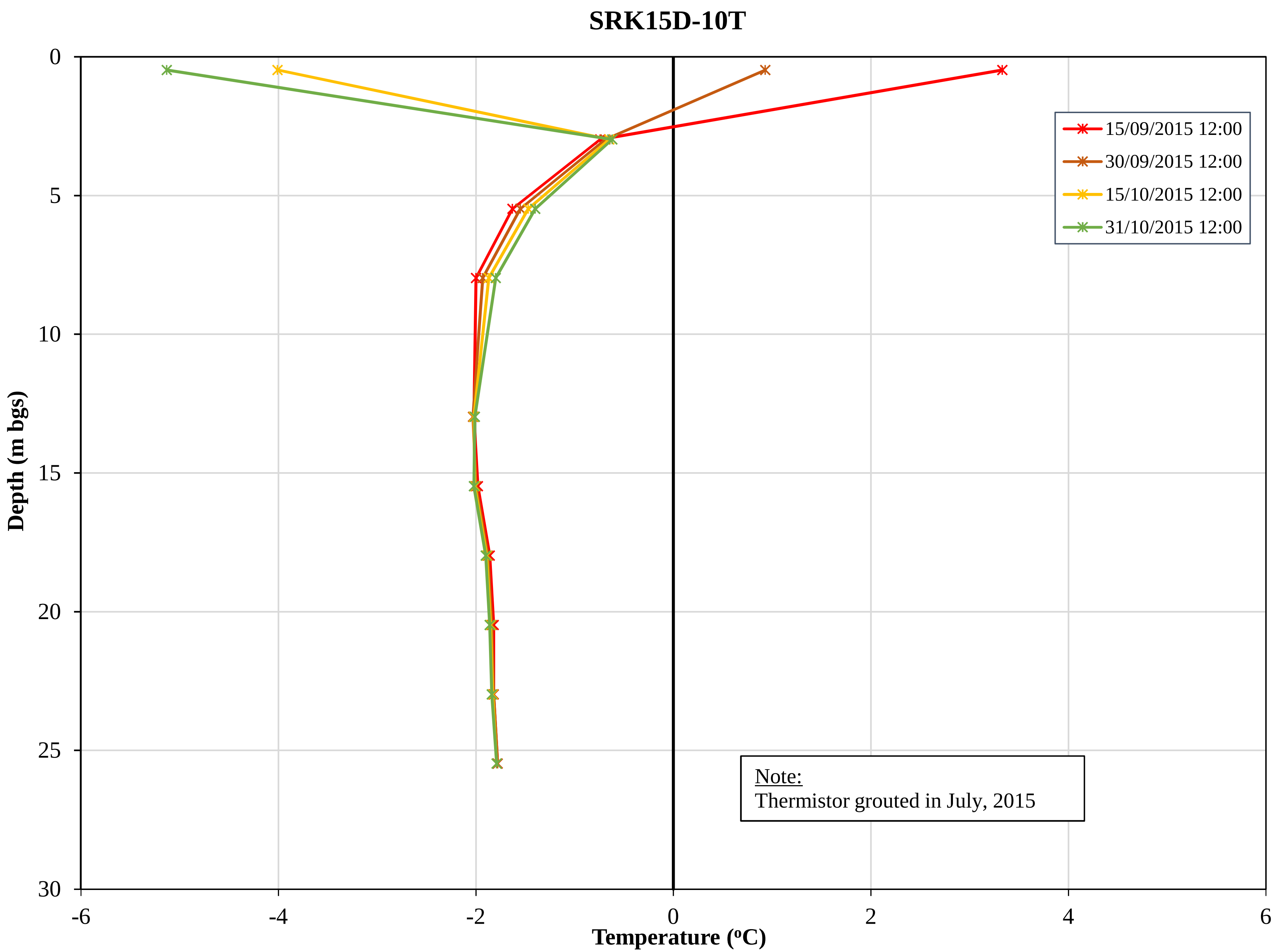

KPBH01
Depth (m bgs)
-5
5
15
25
35
45
-20
-15
-10
-5
0
5
10
15
20
25
30
35
Temperature (°C)
06/11/2014 16:03
06/12/2014 16:03
06/01/2015 16:03
06/02/2015 16:03
06/03/2015 16:03
06/04/2015 16:03
06/05/2015 16:03
06/06/2015 16:03
06/07/2015 16:03
06/09/2015 16:03
06/10/2015 16:03
Note:
Hole drilled and grouted mid-September 2014, thermistor is hung in a sealed 1" PVC standpipe

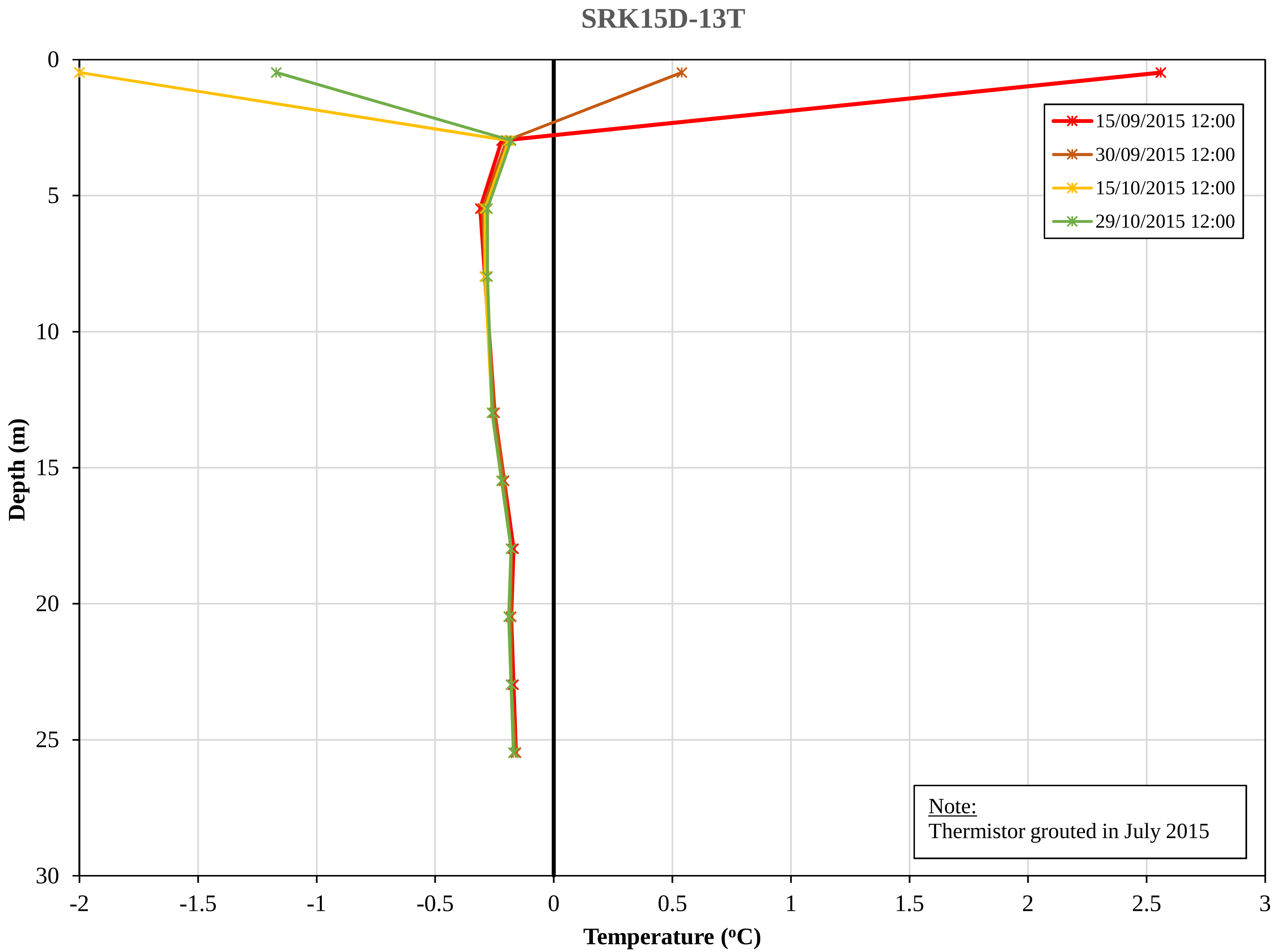

KPBH04
Depth (m bgs)
Temperature (ºC)
-5
5
15
25
35
45
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
06/11/2014 14:59
06/12/2014 14:59
06/01/2015 14:59
06/02/2015 14:59
06/03/2015 14:59
06/04/2015 14:59
06/05/2015 14:59
06/06/2015 14:59
06/07/2015 14:59
06/08/2015 14:59
06/09/2015 14:59
06/10/2015 14:59
Note:
Hole drilled and grouted mid-September 2014,
thermistor is hung in a sealed 1" PVC standpipe


SRK-15D-07T
Depth (m bgs)
Temperature (ºC)
0
20
40
60
80
100
120
140
160
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
01/08/2015 9:41
01/09/2015 9:41
01/10/2015 16:14
31/10/2015 16:14
Suspicious Data
VWP Temperature Sensors
Note:
Instrument grouted in July 9, 2015


SRK-15D-08AT
Depth (m bgs)
Temperature (ºC)
01/08/2015 17:56
01/09/2015 17:56
01/10/2015 17:56
30/10/2015 17:56
VWP Temperature Sensors
Note:
Instrument grouted in July 9, 2015
0
20
40
60
80
100
120
140
160
-2
0
2
4
6
8
10
12
14

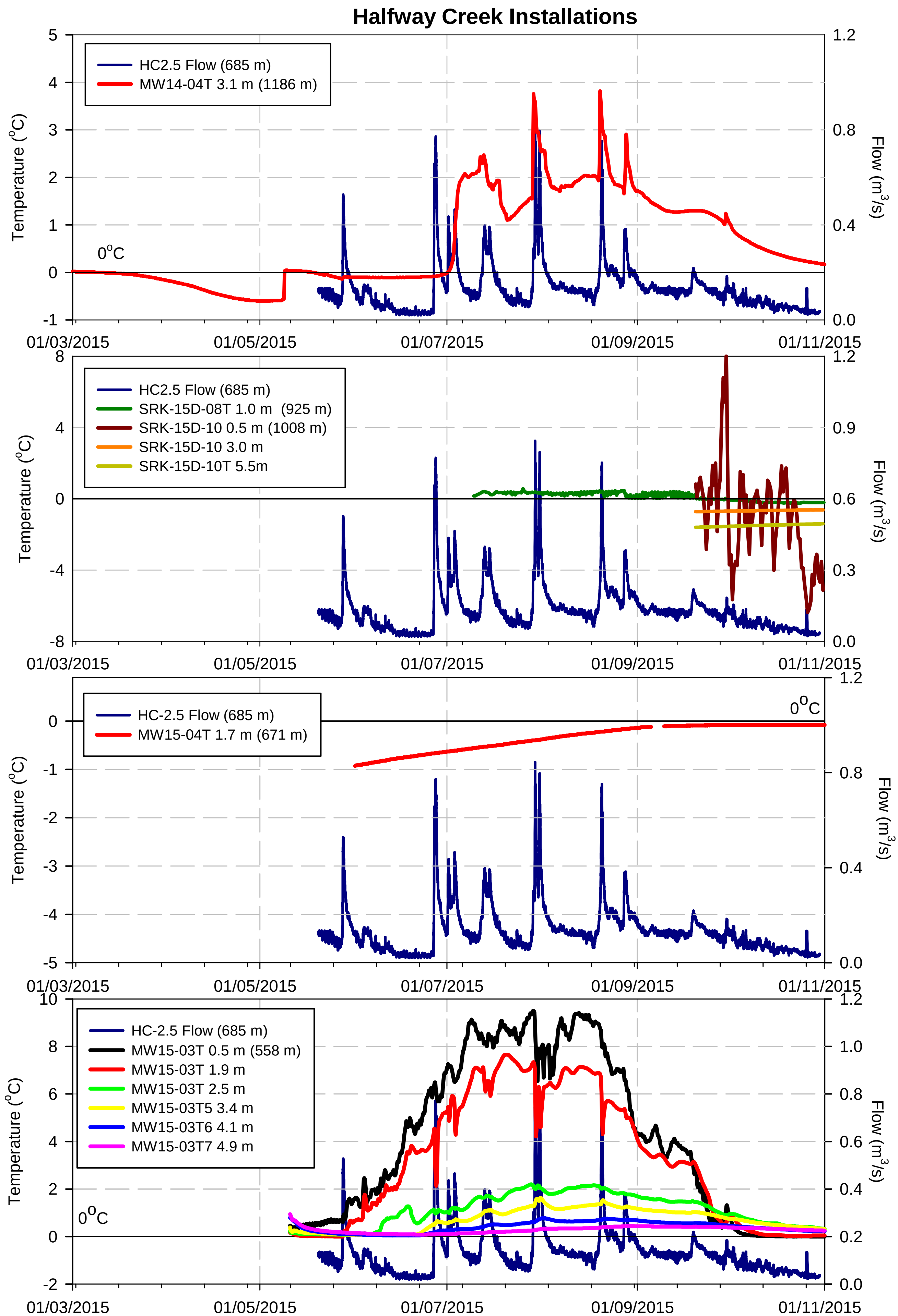

SRK-15D-09T
Ground Surface
01/08/2015 10:17
01/09/2015 10:17
01/10/2015 10:17
29/10/2015 10:17
Suspicious Data
Suspicious Data
Suspicious Data
VWP Temperature Sensor
Note:
Thermistor grouted in July 7, 2015
Depth (m bgs)
Temperature (ºC)
-10
0
10
20
30
40
50
60
70
80
90
100
-10
-8
-6
-4
-2
0
2
4
6
8
10


SRK15D-10T
Depth (m bgs)
Temperature (ºC)
0
5
10
15
20
25
30
-6
-4
-2
0
2
4
6
15/09/2015 12:00
30/09/2015 12:00
15/10/2015 12:00
31/10/2015 12:00
Note:
Thermistor grouted in July, 2015

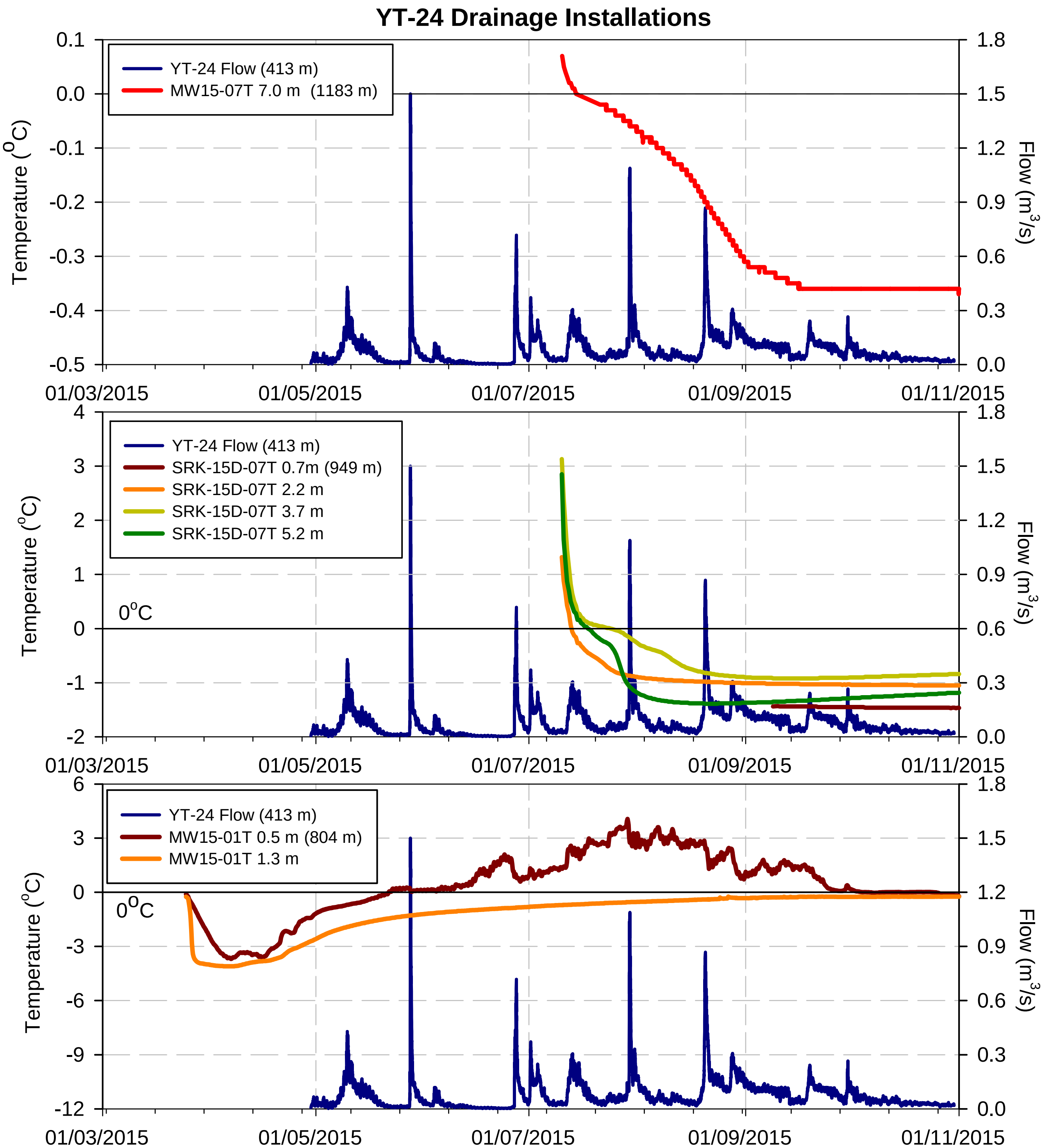

SRK15D-13T
Depth (m)
0
5
10
15
20
25
30
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
Temperature (°C)
15/09/2015 12:00
30/09/2015 12:00
15/10/2015 12:00
29/10/2015 12:00
Note:
Thermistor grouted in July 2015

Appendix 4-B: Shallow Thermistor Sensor 2015 Time Series Data

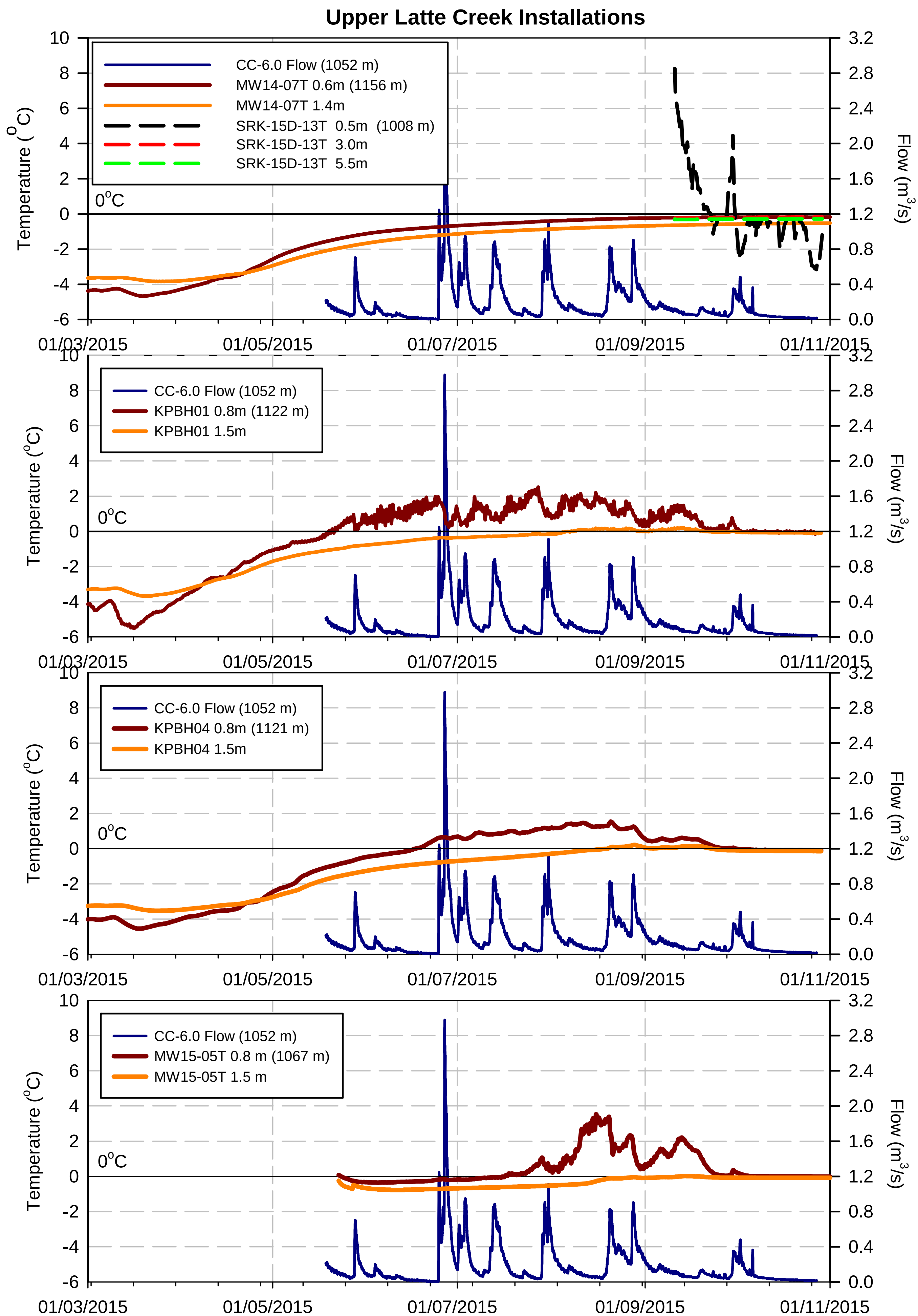
GOLDCORP



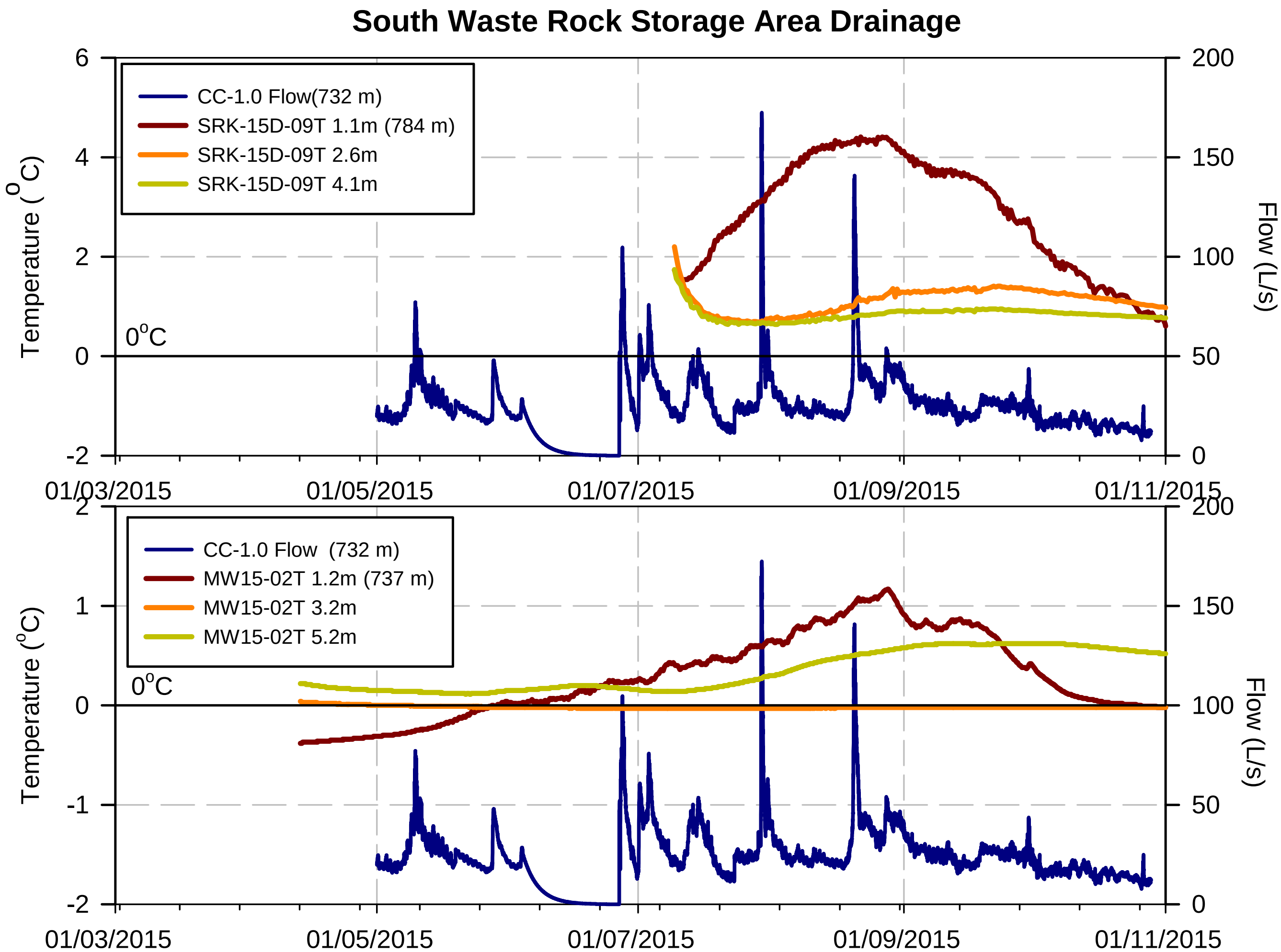
Halfway Creek Installations
HC2.5 Flow (685 m)
MW14-04T 3.1 m (1186 m)
0°C
Temperature (°C)
Flow (m³/s)
01/03/2015
01/05/2015
01/07/2015
01/09/2015
01/11/2015
HC2.5 Flow (685 m)
SRK-15D-08T 1.0 m (925 m)
SRK-15D-10 0.5 m (1008 m)
SRK-15D-10 3.0 m
SRK-15D-10T 5.5m
HC-2.5 Flow (685 m)
MW15-04T 1.7 m (671 m)
HC-2.5 Flow (685 m)
MW15-03T 0.5 m (558 m)
MW15-03T 1.9 m
MW15-03T 2.5 m
MW15-03T5 3.4 m
MW15-03T6 4.1 m
MW15-03T7 4.9 m



YT-24 Drainage Installations
YT-24 Flow (413 m)
MW15-07T 7.0 m (1183 m)
Temperature (°C)
Flow (m3/s)
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
1.8
1.5
1.2
0.9
0.6
0.3
0.0
01/03/2015
01/05/2015
01/07/2015
01/09/2015
01/11/2015
YT-24 Flow (413 m)
SRK-15D-07T 0.7m (949 m)
SRK-15D-07T 2.2 m
SRK-15D-07T 3.7 m
SRK-15D-07T 5.2 m
0°C
4
3
2
1
0
-1
-2
YT-24 Flow (413 m)
MW15-01T 0.5 m (804 m)
MW15-01T 1.3 m
6
3
0
-3
-6
-9
-12



Upper Latte Creek Installations
CC-6.0 Flow (1052 m)
MW14-07T 0.6m (1156 m)
MW14-07T 1.4m
SRK-15D-13T 0.5m (1008 m)
SRK-15D-13T 3.0m
SRK-15D-13T 5.5m
0°C
Temperature (°C)
Flow (m³/s)
01/03/2015
01/05/2015
01/07/2015
01/09/2015
01/11/2015
CC-6.0 Flow (1052 m)
KPBH01 0.8m (1122 m)
KPBH01 1.5m
CC-6.0 Flow (1052 m)
KPBH04 0.8m (1121 m)
KPBH04 1.5m
CC-6.0 Flow (1052 m)
MW15-05T 0.8 m (1067 m)
MW15-05T 1.5 m



South Waste Rock Storage Area Drainage
CC-1.0 Flow(732 m)
SRK-15D-09T 1.1m (784 m)
SRK-15D-09T 2.6m
SRK-15D-09T 4.1m
0°C
Temperature (°C)
Flow (L/s)
6
4
2
0
-2
200
150
100
50
0
01/03/2015
01/05/2015
01/07/2015
01/09/2015
01/11/2015
CC-1.0 Flow (732 m)
MW15-02T 1.2m (737 m)
MW15-02T 3.2m
MW15-02T 5.2m
0°C
Temperature (°C)
Flow (L/s)
2
1
0
-1
-2
200
150
100
50
0
01/03/2015
01/05/2015
01/07/2015
01/09/2015
01/11/2015

Appendix 5-A: Groundwater Quality Data

GOLDCORP

Station	Sample ID	Sample Date	Analytical Laboratory	Lab Job ID	Lab Sample ID	Field Paramaters	pH (field)	Specific Conductance (field)	DO (field)	ORP (field)	Temperature (field)	Physical Properties	Conductivity (lab)
							pH	uS/cm	mg/L	ORP mV	°C		uS/cm
Camp	FB-2	18/07/15	Maxxam	B562572	MS4334								1.2
Camp	FB-3	12/08/15	Maxxam	B569424	MW5163								1
Camp	TRIP BLANK	11/09/15	Maxxam	B579224	NC4792								<1.0
Camp Water Supply	CAMP15-1	18/07/15	Maxxam	B562572	MS4333								566
MW14-02A	MW14-02A	28/09/14	ALS	L1525019	L1525019-1		8.23	349.3	9.19	162.5	0.5		390
MW14-02A	MW14-02A	12/06/15	Maxxam	B550137	ML4991		7.34	400	12.07	98.5	1.41		392
MW14-02A	MW14-02A	16/07/15	Maxxam	B562572	MS4331		7.84	389	9.94	46.5	1.8		390
MW14-02A	MW14-02A	06/08/15	Maxxam	B569424	MW5112		7.58	361	10.05	152.4	1.33		380
MW14-02A	MW14-02A	04/09/15	Maxxam	B578440	NC0866		7.74	380	9.75	213.3	1.38		385
MW14-02A	MW14-100	04/09/15	Maxxam	B578440	NC0868								389
MW14-02B	F-BLANK-1	28/09/14	ALS	L1525019	L1525019-3								<2
MW14-02B	MW14-02B	28/09/14	ALS	L1525019	L1525019-2		7.63	495.5	5.18	-185.1	0.6		508
MW14-02B	F-DUP-1	28/09/14	ALS	L1525019	L1525019-4								514
MW14-02B	MW14-02B	12/06/15	Maxxam	B550137	ML4992		7.57	497.3	6.73	15.9	1.3		503
MW14-02B	MW14-02B	16/07/15	Maxxam	B562572	MS4332		7.62	508	4.73	31.8	3.15		507
MW14-02B	MW14-02B	06/08/15	Maxxam	B569424	MW5113		7.56	481	4.9	137.3	2		504
MW14-02B	MW14-02B	04/09/15	Maxxam	B578440	NC0867		7.51	509	6.2	137.4	1.6		492
MW14-03A	MW14-03A	12/10/14	ALS	L1533094	L1533094-2		9.27	950	0.21	46.4	0.7		887
MW14-03A	MW14-03A	22/06/15	Maxxam	B553846	MN4268			1620	0.21		1.89		1570
MW14-03A	MW14-03A	12/07/15	Maxxam	B559978	MR0624		7.44	1562	0.31	-106.3	1.1		1580
MW14-03A	MW14-03A	07/08/15	Maxxam	B569424	MW5114		7.41	1376	2.6	-151.9	1.1		1570
MW14-03A	MW14-50	07/08/15	Maxxam	B569424	MW5119								1550
MW14-03A	MW14-03A	06/09/15	Maxxam	B578440	NC0876		7.36	1583	2.08	-137.6	0.9		1540
MW14-03B	MW14-03B	06/10/14	ALS	L1530127	L1530127-1		7.35	1582	0.07	88.7	0.5		1490
MW14-03B	MW14-03B	22/06/15	Maxxam	B553846	MN4269		7.36	1717	0.14	48.1	1.2		1800
MW14-03B	MW14-03B	12/07/15	Maxxam	B559978	MR0625		7.45	1711	0.19	-109	0.99		1700
MW14-03B	MW14-03B	07/08/15	Maxxam	B569424	MW5115		7.37	1604	0.14	-52.3	1.42		1710
MW14-03B	MW14-03B	06/09/15	Maxxam	B578440	NC0877		7.16	1707	0.23	-53.6	1.06		1700
MW14-03B	MW14-200	06/09/15	Maxxam	B578440	NC0878								1730
MW14-05A	MW14-05A	02/10/14	ALS	L1529013	L1529013-1		7.2	286.9	1.82	124.5	-0.1		316
MW14-05A	FB-23/06/15	23/06/15	Maxxam	B553846	MN4273								1.2
MW14-05A	MW14-05A	23/06/15	Maxxam	B553846	MN4272		6.94	349.9	0.88	3.8	1.6		343
MW14-05A	MW14-05A	13/07/15	Maxxam	B559978	MR0626		6.49	365	0.11	-117.3	1.56		358
MW14-05A	MW14-05A	08/08/15	Maxxam	B569424	MW5116		7.29	329	1.22	-149.5	1.9		367
MW14-05A	MW14-05A	07/09/15	Maxxam	B578440	NC0908		7.00	379.4	2.08	-122.1	0.9		357
MW14-05B	MW14-05B	03/10/14	ALS	L1529013	L1529013-2		9.45	488.6	0.73	91.3	0.1		520
MW14-05B	MW14-05B	24/06/15	Maxxam	B554336	MN7151		7.67	569	4.47	101.6	4.6		589

Sample ID	Sample Date	pH (lab)	Total Hardness (CaCO3)	Dissolved Hardness (CaCO3)	Total Suspended Solids	Total Dissolved Solids	Turbidity	Inorganics	Alkalinity (Total as CaCO3)	Alkalinity (PP as CaCO3)	Bicarbonate (HCO3)	Carbonate (CO3)	Hydroxide (OH)	Bromide (Br)	Fluoride (F)
		pH	mg/L	mg/L	mg/L	mg/L	NTU		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
FB-2	18/07/15	5.75	<0.50	<0.50	<1.0	<10	<0.10		<0.50	<0.50	<0.50	<0.50	<0.50		<0.010
FB-3	12/08/15	5.44	<0.50	<0.50	<1.0	<10	<0.10		<0.50	<0.50	<0.50	<0.50	<0.50		<0.010
TRIP BLANK	11/09/15	5.43	<0.50	<0.50	<1.0	<10	<0.10		<0.50	<0.50	<0.50	<0.50	<0.50		<0.010
CAMP15-1	18/07/15	8.11	293	294	5.1	286	14.7		287	<0.50	350	<0.50	<0.50		0.072
MW14-02A	28/09/14	7.95	203		<3	264	0.3		163						0.093
MW14-02A	12/06/15	8.14	255	200	<1.0	222	0.27		150	<0.50	183	<0.50	<0.50		0.088
MW14-02A	16/07/15	8.16	180	188	<1.0	182	0.28		150	<0.50	183	<0.50	<0.50		0.091
MW14-02A	06/08/15	8.17	211	205	<1.0	257	0.26		147	<0.50	180	<0.50	<0.50		0.089
MW14-02A	04/09/15	8.14	188	185	<1.0	224	<0.10		145	<0.50	177	<0.50	<0.50		0.09
MW14-100	04/09/15	8.21	194	189	<1.0	240	0.49		145	<0.50	177	<0.50	<0.50		0.091
F-BLANK-1	28/09/14	5.57	<0.5		<3	<20	<0.1		<1						<0.02
MW14-02B	28/09/14	8.02	283		<3	348	0.34		209						0.102
F-DUP-1	28/09/14	7.92	282		<3	347	0.43		209						0.102
MW14-02B	12/06/15	8.15	191	242	6.3	282	2.78		189	<0.50	231	<0.50	<0.50		0.1
MW14-02B	16/07/15	8.19	254	256	<1.0	254	0.26		190	<0.50	232	<0.50	<0.50		0.11
MW14-02B	06/08/15	8.12	280	275	1.8	374	0.43		191	<0.50	233	<0.50	<0.50		0.11
MW14-02B	04/09/15	8.19	257	249	7.1	328	2.32		184	<0.50	224	<0.50	<0.50		0.11
MW14-03A	12/10/14	7.84	351		100	1060	76.2		243						0.232
MW14-03A	22/06/15	8.05	897	928	25	1110	21.8		477	<0.50	582	<0.50	<0.50		0.2
MW14-03A	12/07/15	7.65	863	860	31.2	1120	20.3		467	<0.50	570	<0.50	<0.50		0.19
MW14-03A	07/08/15	8.03	893	924	23.2	1180	35.9		486	<0.50	592	<0.50	<0.50		0.2
MW14-50	07/08/15	8.04	890	916	22.7	1170	44.7		483	<0.50	590	<0.50	<0.50		0.2
MW14-03A	06/09/15	8	875	826	22.5	1140	0.35		495	<0.50	604	<0.50	<0.50		0.21
MW14-03B	06/10/14	7.83	801		24	1240	28.3		476						<0.2
MW14-03B	22/06/15	8.12	951	1070	5.2	1330	5.03		579	<0.50	706	<0.50	<0.50		0.3
MW14-03B	12/07/15	7.71	900	907	5.4	1160	6.87		516	<0.50	629	<0.50	<0.50		0.26
MW14-03B	07/08/15	8.09	1030	1090	3.8	1370	4.6		533	<0.50	650	<0.50	<0.50		0.27
MW14-03B	06/09/15	7.95	987	998	3.5	1330	3.06		529	<0.50	646	<0.50	<0.50		0.26
MW14-200	06/09/15	7.98	990	1000	2.8	1330	3.32		538	<0.50	657	<0.50	<0.50		0.26
MW14-05A	02/10/14	7.93	116		58	249	64.7		127						0.163
FB-23/06/15	23/06/15	6.15	<0.50	<0.50	<1.0	<10	<0.10		0.71	<0.50	0.87	<0.50	<0.50		<0.010
MW14-05A	23/06/15	7.85	142	154	5.2	204	5.2		155	<0.50	189	<0.50	<0.50		0.22
MW14-05A	13/07/15	7.43	146	144	7.7	186	13.1		164	<0.50	200	<0.50	<0.50		0.21
MW14-05A	08/08/15	8	162	154	9.8	264	15.3		182	<0.50	222	<0.50	<0.50		0.23
MW14-05A	07/09/15	7.72	153	144	9.6	230	9.7		167	<0.50	204	<0.50	<0.50		0.21
MW14-05B	03/10/14	8.09	152		120	342	139		151						0.157
MW14-05B	24/06/15	7.92	140	140	64.3	420	38		182	<0.50	222	<0.50	<0.50		0.41

Sample ID	Sample Date	Dissolved Chloride (Cl)	Organic / Inorganic Carbon	Dissolved Organic Carbon (C)	Total Organic Carbon (C)	Anions and Nutrients	Total Phosphorus (P)	Dissolved Phosphorus (P)	Total Ammonia (N)	Total Total Kjeldahl Nitrogen (Calc)	Nitrate plus Nitrite (N)	Nitrate (N)	Nitrite (N)	Total Nitrogen (N)	Dissolved Nitrogen (N)
		mg/L		mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
FB-2	18/07/15	<0.50		<0.50	<0.50		<0.0050	<0.0020	0.01	<0.050	<0.0020	<0.0020	<0.0020	<0.050	
FB-3	12/08/15	<0.50		<0.50	<0.50		<0.0050	<0.0050	<0.0050	<0.020	<0.0020	<0.0020	<0.0020	<0.020	
TRIP BLANK	11/09/15	<0.50		<0.50	<0.50		<0.0020	<0.0020	0.0094	0.033	<0.0020	<0.0020	<0.0020	0.033	
CAMP15-1	18/07/15	1.5		5.46	7.02		<0.0050	0.0028	0.034	0.48	<0.0020	<0.0020	<0.0020	0.481	
MW14-02A	28/09/14	<0.5		0.55	0.55		0.005	0.0075	0.0673	0.213		0.155	<0.001	0.379	0.346
MW14-02A	12/06/15	0.7		0.83	1.48		0.0183	0.0138	0.0052	0.06	0.138	0.138	<0.0020	0.198	
MW14-02A	16/07/15	<0.50		1.28	1.64		0.0184	0.0175	0.011	<0.050	0.166	0.166	<0.0020	0.166	
MW14-02A	06/08/15	<0.50		<0.50	<0.50		0.0197	0.0187	<0.0050	<0.020	0.16	0.16	<0.0020	0.152	
MW14-02A	04/09/15	0.56		0.63	0.64		0.0192	0.0159	0.015	<0.020	0.16	0.16	<0.0020	0.159	
MW14-100	04/09/15	<0.50		0.59	0.51		0.0157	0.0192	0.021	0.18	0.113	0.161	<0.0020	0.293	
F-BLANK-1	28/09/14	<0.5		<0.5	<0.5		<0.002	<0.002	<0.005	<0.05		<0.005	<0.001	<0.05	<0.05
MW14-02B	28/09/14	<0.5		1.63	1.56		<0.002	0.0033	<0.005	0.142		0.0138	0.0015	0.155	0.163
F-DUP-1	28/09/14	<0.5		1.37	1.48		0.0025	0.0028	<0.005	0.145		0.0164	0.002	0.156	0.155
MW14-02B	12/06/15	<0.50		0.87	0.77		0.0095	0.0092	0.0094	0.053	0.107	0.107	<0.0020	0.16	
MW14-02B	16/07/15	<0.50		0.99	1.76		0.0129	0.0066	0.0067	0.099	0.1	0.0981	0.0022	0.199	
MW14-02B	06/08/15	<0.50		<0.50	0.84		0.0147	0.0112	0.006	0.025	0.109	0.109	<0.0020	0.134	
MW14-02B	04/09/15	0.65		0.62	0.83		0.0136	0.0114	0.02	0.425	0.108	0.135	<0.0020	0.532	
MW14-03A	12/10/14	8.17		79.1	216		0.721	0.437	0.82	37.7		<0.005	0.0053	37.9	6.66
MW14-03A	22/06/15	1.6		4.8	6.08		0.0547	0.0404	0.02	0.75	0.0035	<0.0020	0.0022	0.753	
MW14-03A	12/07/15	1.3		7.48	9.01		0.0887	0.0697	0.021	0.46	0.0031	0.0031	<0.0020	0.46	
MW14-03A	07/08/15	1.2		3.7	4.3		0.0817	0.0714	0.012	0.282	<0.0020	<0.0020	<0.0020	0.282	
MW14-50	07/08/15	1		4.1	3.6		0.0808	0.0714	0.014	0.254	<0.0020	<0.0020	<0.0020	0.254	
MW14-03A	06/09/15	1.3		3.5	3.8		0.0884	0.0772	0.022	0.285	<0.0020	<0.0020	<0.0020	0.285	
MW14-03B	06/10/14	<5		18.8	32.6		0.0119	0.0124	0.255	4.1		<0.05	<0.01	4.46	1.7
MW14-03B	22/06/15	2.3		4.77	4.77		0.0368	0.0271	0.033	0.56	<0.0020	<0.0020	<0.0020	0.556	
MW14-03B	12/07/15	1.8		3.93	5.06		0.045	0.0336	0.043	0.3	0.0045	0.0045	<0.0020	0.303	
MW14-03B	07/08/15	1.8		2.4	1.8		0.0349	0.0297	0.024	0.343	0.0021	0.0021	<0.0020	0.345	
MW14-03B	06/09/15	1.6		2.5	1.9		0.031	0.0282	0.076	0.259	0.0048	0.0048	<0.0020	0.264	
MW14-200	06/09/15	2		2	1.9		0.0316	0.0277	0.051	0.159	0.0021	0.0035	<0.0020	0.161	
MW14-05A	02/10/14	1.2		17	26.5		0.178	0.111	0.0194	2.06		<0.005	<0.001	2.17	0.63
FB-23/06/15	23/06/15	<0.50		<0.50	<0.50		<0.0050	0.0036	0.0092	<0.050	<0.0020	<0.0020	<0.0020	<0.050	
MW14-05A	23/06/15	0.87		4.39	4.34		0.717	0.653	0.013	0.39	0.0025	<0.0020	0.0021	0.397	
MW14-05A	13/07/15	1.1		6.04	6.34		0.697	0.669	0.011	0.44	0.0047	0.0023	0.0024	0.446	
MW14-05A	08/08/15	1.3		5.6	4.9		0.64	0.622	0.0078	0.538	<0.0020	<0.0020	0.0021	0.538	
MW14-05A	07/09/15	1.2		4.5	4.3		0.754	0.738	0.1	0.321	0.0059	<0.0020	0.004	0.327	
MW14-05B	03/10/14	3.35		21.8	34.8		0.125	0.0594	0.0227	2.55		<0.005	<0.001	2.73	0.76
MW14-05B	24/06/15	4.9		23.7	23.2		0.224	0.144	0.017	0.95	0.003	<0.0020	0.003	0.95	

Sample ID	Sample Date	Dissolved Sulphate (SO4)	Sulphide	Total Metals	Total Aluminum (Al)	Total Antimony (Sb)	Total Arsenic (As)	Total Barium (Ba)	Total Beryllium (Be)	Total Bismuth (Bi)	Total Boron (B)	Total Cadmium (Cd)	Total Calcium (Ca)	Total Chromium (Cr)
		mg/L	mg/L		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L
FB-2	18/07/15	<0.50	0.0069		8.12	<0.020	0.024	0.033	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10
FB-3	12/08/15	<0.50	0.0089		<0.50	<0.020	<0.020	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10
TRIP BLANK	11/09/15	0.78	0.006		<0.50	<0.020	<0.020	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10
CAMP15-1	18/07/15	21.3	<0.0050		5.81	0.935	0.995	205	0.011	<0.0050	<10	0.244	64.7	0.11
MW14-02A	28/09/14	55.4	<0.002		7.5	0.85	68.4	13.4	<0.1	<0.5	<10	<0.01	44.6	0.65
MW14-02A	12/06/15	56.5	0.0056		59.9	7.07	38	51.3	0.02	0.0106	<10	<0.0050	49.5	0.22
MW14-02A	16/07/15	54.5	0.0068		12.9	0.748	47.4	13.1	<0.010	<0.0050	<10	<0.0050	39.6	0.4
MW14-02A	06/08/15	57.6	0.0063		16.1	0.734	55.2	13.9	<0.010	<0.0050	<10	<0.0050	46.1	0.58
MW14-02A	04/09/15	52.8	0.0113		3.72	0.745	59	10.3	<0.010	<0.0050	<10	<0.0050	39.4	0.51
MW14-100	04/09/15	55.9	<0.0050		3.79	0.797	59.1	10.5	<0.010	<0.0050	<10	<0.0050	40.7	0.52
F-BLANK-1	28/09/14	<0.5	<0.002		<3	<0.1	<0.1	<0.05	<0.1	<0.5	<10	<0.01	<0.05	<0.1
MW14-02B	28/09/14	85.5	<0.002		6.3	3.25	19.4	54	<0.1	<0.5	<10	<0.01	61.4	0.51
F-DUP-1	28/09/14	85.5	<0.002		4.5	2.87	20	53	<0.1	<0.5	<10	<0.01	60.8	0.5
MW14-02B	12/06/15	84.3	0.0061		13	0.86	54.4	14.6	<0.010	<0.0050	<10	<0.0050	41.9	0.58
MW14-02B	16/07/15	82.3	0.0069		12.5	6.39	37.2	57.9	<0.010	<0.0050	<10	<0.0050	52.3	<0.10
MW14-02B	06/08/15	87.3	0.0053		15.3	5.96	39.2	55.3	<0.010	<0.0050	<10	<0.0050	59.7	0.17
MW14-02B	04/09/15	83.7	0.0076		21.8	6.37	42	44.6	0.013	<0.0050	<10	0.013	52.3	0.37
MW14-03A	12/10/14	269	<0.02		337	0.99	59.8	381	<0.1	<0.5	<10	0.072	72.5	8.36
MW14-03A	22/06/15	482	0.0999		6.05	0.979	46	141	0.013	0.008	<10	0.007	133	<0.10
MW14-03A	12/07/15	450	0.116		24.5	0.754	65	132	0.013	<0.0050	<10	0.0065	140	0.27
MW14-03A	07/08/15	455	0.12		9.08	0.591	68	99.5	0.012	0.0076	<10	<0.0050	130	<0.10
MW14-50	07/08/15	458	0.12		27	0.592	68.7	96.8	0.015	<0.0050	<10	0.0109	131	0.13
MW14-03A	06/09/15	411	0.147		5.29	0.356	75.3	118	0.018	<0.0050	10	<0.0050	126	<0.10
MW14-03B	06/10/14	476	0.0064		665	0.21	3.57	90.5	<0.1	<0.5	16	0.021	118	2.5
MW14-03B	22/06/15	502	0.0252		18.4	0.136	7.68	91.7	<0.010	0.006	<10	0.067	120	0.3
MW14-03B	12/07/15	511	0.0239		26.4	0.129	9.72	87.6	<0.010	<0.0050	<10	0.106	133	0.55
MW14-03B	07/08/15	515	0.0229		15.9	0.111	8.23	70	<0.010	0.0139	<10	0.056	130	0.14
MW14-03B	06/09/15	490	0.0253		4.38	0.1	8.13	68.2	<0.010	<0.0050	<10	0.051	118	<0.10
MW14-200	06/09/15	535	0.0249		4.08	0.101	7.94	69.4	<0.010	<0.0050	<10	0.049	119	<0.10
MW14-05A	02/10/14	31.9	<0.002		1250	0.39	571	95.9	0.14	<0.5	12	0.039	35.8	10.3
FB-23/06/15	23/06/15	<0.50	<0.0050		0.55	<0.020	<0.020	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10
MW14-05A	23/06/15	25.5	0.031		89.5	0.789	1910	99.7	0.03	0.008	<10	0.015	42.6	0.22
MW14-05A	13/07/15	20.2	0.0642		116	0.748	1670	95.8	0.027	0.0095	<10	0.0499	46.7	0.43
MW14-05A	08/08/15	13.1	0.171		69.7	0.746	1710	108	0.024	0.0105	<10	0.0705	47.8	0.35
MW14-05A	07/09/15	17.3	0.12		22.8	0.561	1810	123	0.023	<0.0050	<10	0.024	46.6	0.2
MW14-05B	03/10/14	109	<0.002		3840	0.34	145	186	0.15	<0.5	15	0.049	48.1	12.8
MW14-05B	24/06/15	107	<0.0050		945	1.16	148	111	0.067	0.019	11	0.14	43.1	1.85

Sample ID	Sample Date	Total Cobalt (Co)	Total Copper (Cu)	Total Iron (Fe)	Total Lead (Pb)	Total Lithium (Li)	Total Magnesium (Mg)	Total Manganese (Mn)	Total Mercury (Hg)	Total Molybdenum (Mo)	Total Nickel (Ni)	Total Phosphorus (P)	Total Potassium (K)	Total Selenium (Se)	Total Silicon (Si)
		ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L
FB-2	18/07/15	<0.0050	<0.050	4.6	<0.0050	<0.50	<0.050	0.057	<0.0020	<0.050	0.11	90.6	<0.050	<0.040	<50
FB-3	12/08/15	<0.0050	<0.050	<1.0	<0.0050	<0.50	<0.050	<0.050	<0.0020	<0.050	<0.020	<2.0	<0.050	<0.040	<50
TRIP BLANK	11/09/15	<0.0050	0.069	<1.0	<0.0050	<0.50	<0.050	<0.050	<0.0020	<0.050	<0.020	<2.0	<0.050	<0.040	<50
CAMP15-1	18/07/15	0.405	<0.050	1420	<0.0050	4.29	31.9	632	<0.0020	1.97	2.86	16.5	2.12	1.18	4580
MW14-02A	28/09/14	0.13	<0.5	<10	<0.05	7.01	21.4	17.5	<0.01	4.56	<0.5	<50	3.61	0.28	6350
MW14-02A	12/06/15	2.81	0.368	42.4	0.159	7.53	31.9	687	0.0038	7.53	16.7	8.1	3.77	0.267	6050
MW14-02A	16/07/15	0.0233	<0.050	14.1	<0.0050	7.73	19.7	7.69	0.0043	3.09	0.278	28	2.67	0.235	6400
MW14-02A	06/08/15	0.0332	0.183	20.7	0.0148	8.79	23.4	7.59	0.0032	3.57	0.354	7.3	3.34	0.251	6760
MW14-02A	04/09/15	0.019	0.075	1.1	<0.0050	7.72	21.7	2.63	0.0041	3.28	0.075	10.6	2.75	0.274	5610
MW14-100	04/09/15	0.017	0.091	1.2	<0.0050	7.96	22.5	2.8	0.0041	3.2	0.067	9.1	2.8	0.298	5720
F-BLANK-1	28/09/14	<0.1	<0.5	<10	<0.05	<0.5	<0.1	<0.05	<0.01	<0.05	<0.5	<50	<0.1	<0.1	<50
MW14-02B	28/09/14	0.62	<0.5	<10	<0.05	7.65	30.5	161	0.017	5.43	2.49	<50	3.73	0.34	6230
F-DUP-1	28/09/14	0.63	<0.5	<10	<0.05	6.87	30.7	156	0.017	4.89	2.47	<50	3.66	0.33	6240
MW14-02B	12/06/15	0.0385	0.538	38	0.0472	7.06	21	10.6	0.0054	3.5	0.24	9.6	3	0.232	5920
MW14-02B	16/07/15	1.57	0.143	20	0.0142	7.72	29.9	714	0.008	6.9	8.77	69	3.63	0.248	6440
MW14-02B	06/08/15	1.45	0.264	24.2	0.0434	8.55	31.7	667	0.0035	6.61	9.22	6.5	3.71	0.271	6270
MW14-02B	04/09/15	1.75	0.981	101	0.113	8.23	30.7	560	0.0036	6.06	12	7.1	3.35	0.296	5790
MW14-03A	12/10/14	0.81	8.91	371	0.184	10.2	46.9	15.5	8.68	12.8	3.41	644	10.4	2.61	6870
MW14-03A	22/06/15	2.42	0.63	7680	0.076	27.4	137	794	0.0254	4.56	2.56	53.9	8.99	0.065	6090
MW14-03A	12/07/15	2.05	0.887	9580	0.128	26.9	125	963	0.0284	5.22	1.5	123	8.58	0.118	6840
MW14-03A	07/08/15	1.73	0.44	8400	0.0491	24.9	138	748	0.0118	2.92	0.616	65.3	8.4	<0.040	7300
MW14-50	07/08/15	1.66	1.06	8610	0.124	29.7	137	742	0.0116	3.1	0.804	157	8.47	<0.040	7310
MW14-03A	06/09/15	1.51	0.726	8370	0.564	29.9	136	795	0.0112	4.11	0.772	74.8	8.82	<0.040	6660
MW14-03B	06/10/14	2.14	1.93	646	0.175	20.9	139	242	0.879	2.76	5.55	<50	7.78	1.07	6650
MW14-03B	22/06/15	6.9	5.38	1670	0.201	22.9	158	3090	0.0309	8.75	20.6	42.9	8.25	0.28	5350
MW14-03B	12/07/15	6.78	4.39	2280	0.297	20.8	138	3240	0.017	8.71	18.3	70.8	7.5	0.2	6460
MW14-03B	07/08/15	6.94	3.47	1320	0.172	22.8	171	3030	0.0304	6.95	19.5	53.5	8.07	0.146	6350
MW14-03B	06/09/15	6.94	2.36	1070	0.164	27	168	3180	0.0201	7.65	18.3	34.6	8.46	0.15	5380
MW14-200	06/09/15	6.93	2.62	1100	0.178	26.4	168	3140	0.0211	7.86	18.7	35.1	8.7	0.153	5470
MW14-05A	02/10/14	0.83	7.85	1360	1.27	28.5	6.12	338	0.01	8.88	2.41	113	12.6	0.6	14500
FB-23/06/15	23/06/15	<0.0050	<0.050	<1.0	<0.0050	<0.50	<0.050	<0.050	<0.0020	<0.050	0.131	<2.0	<0.050	<0.040	<50
MW14-05A	23/06/15	1.13	1.77	2080	0.317	25.9	8.72	1320	0.003	3.65	1.31	84.5	5.14	0.149	13700
MW14-05A	13/07/15	0.89	3.19	2660	0.742	27.4	7.12	1080	0.0024	4.05	1.6	128	5.22	0.147	13700
MW14-05A	08/08/15	0.948	1.86	3080	0.372	35.3	10.3	1160	<0.0020	4.89	1.92	247	8.03	0.108	13900
MW14-05A	07/09/15	1.04	0.467	3790	0.154	28.1	8.95	1620	<0.0020	4.27	0.659	92.1	5.62	0.102	13400
MW14-05B	03/10/14	1.53	12.9	2610	2.36	32.6	8.01	341	0.019	18.2	9.4	112	15.8	0.5	19900
MW14-05B	24/06/15	2.15	13.4	1370	1.94	35.7	7.79	612	0.0054	27.3	10.1	176	14.3	0.403	12300

Sample ID	Sample Date	Total Silver (Ag)	Total Sodium (Na)	Total Strontium (Sr)	Total Sulphur (S)	Total Thallium (Tl)	Total Tin (Sn)	Total Titanium (Ti)	Total Uranium (U)	Total Vanadium (V)	Total Zinc (Zn)	Total Zirconium (Zr)	Dissolved Metals	Dissolved Aluminum (Al)
		ug/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L
FB-2	18/07/15	<0.0050	0.146	<0.050	<3.0	<0.0020	<0.20	<0.50	0.0037	<0.20	0.65	<0.10		23.4
FB-3	12/08/15	<0.0050	<0.050	<0.050	<3.0	<0.0020	<0.20	<0.50	<0.0020	<0.20	<0.10	<0.10		<0.50
TRIP BLANK	11/09/15	<0.0050	<0.050	<0.050	<3.0	<0.0020	<0.20	<0.50	<0.0020	<0.20	<0.10	<0.10		<0.50
CAMP15-1	18/07/15	<0.0050	4.39	392	6.9	0.0317	<0.20	<0.50	8.2	0.57	4.39	0.19		8.54
MW14-02A	28/09/14	<0.01	5.28	341	18.7	0.041	<0.1	<10	62.7	<1	<3			5.7
MW14-02A	12/06/15	0.0093	3.68	509	26.6	0.0883	<0.20	1.76	85.8	0.49	2.05	<0.10		14.5
MW14-02A	16/07/15	<0.0050	2.77	325	14.5	0.0223	<0.20	<0.50	47.7	<0.20	2.62	<0.10		8.65
MW14-02A	06/08/15	0.0096	5.01	402	17.9	0.0454	<0.20	0.84	50.6	0.29	1.23	<0.10		17.4
MW14-02A	04/09/15	<0.0050	3.09	381	19.6	0.028	<0.20	<0.50	49.6	0.23	0.33	<0.10		3.96
MW14-100	04/09/15	<0.0050	3.14	391	19.7	0.04	<0.20	<0.50	50.3	<0.20	0.31	<0.10		4.44
F-BLANK-1	28/09/14	<0.01	<0.05	<0.2	<0.5	<0.01	<0.1	<10	<0.01	<1	<3			<1
MW14-02B	28/09/14	0.011	4.42	514	28.7	0.026	<0.1	<10	91.9	<1	11.9			1
F-DUP-1	28/09/14	<0.01	4.37	467	29	0.021	<0.1	<10	81.6	<1	11			<1
MW14-02B	12/06/15	0.0092	3.23	380	17.8	0.0445	<0.20	<0.50	52.7	0.24	4.15	<0.10		3.19
MW14-02B	16/07/15	<0.0050	3.72	463	26	0.0507	<0.20	<0.50	73.3	<0.20	5.49	<0.10		15.1
MW14-02B	06/08/15	0.0054	3.68	474	25.5	0.27	<0.20	1	75.9	0.32	3.4	<0.10		2.16
MW14-02B	04/09/15	<0.0050	3.55	483	28.7	0.288	<0.20	0.62	78.2	0.23	4.06	<0.10		1.57
MW14-03A	12/10/14	0.632	66.9	762	85.6	0.151	0.76	13	13.6	2.1	8			14
MW14-03A	22/06/15	<0.0050	28.2	4490	169	0.033	<0.20	0.68	58.2	0.25	1.69	1.49		5.35
MW14-03A	12/07/15	0.0115	27.1	4490	145	0.0163	<0.20	1.98	50.9	0.51	2.51	2.7		20.2
MW14-03A	07/08/15	0.0058	27.6	4240	166	0.0377	<0.20	0.62	49.4	0.29	2.46	2.58		52.8
MW14-50	07/08/15	0.0063	28.5	4240	167	0.0088	<0.20	<0.50	48.9	0.33	8.34	2.88		43.5
MW14-03A	06/09/15	0.008	28.3	4760	164	0.011	<0.20	<0.50	47	0.42	1.11	3.15		3.44
MW14-03B	06/10/14	0.652	25.3	2530	156	0.058	0.2	23	59.9	1.4	8.4			4.9
MW14-03B	22/06/15	0.063	27.2	2990	170	0.276	<0.20	0.72	35	0.29	2.21	0.35		18.9
MW14-03B	12/07/15	0.0348	23.9	2850	155	0.148	<0.20	0.95	35.2	0.23	10.2	0.41		14.1
MW14-03B	07/08/15	0.0325	27.1	2960	198	0.143	<0.20	<0.50	39	<0.20	11.8	0.33		7.11
MW14-03B	06/09/15	0.034	26.8	3490	193	0.193	<0.20	<0.50	41.3	<0.20	1.07	0.33		2.81
MW14-200	06/09/15	0.033	27.3	3490	194	0.206	<0.20	<0.50	41.7	<0.20	1.01	0.27		2.88
MW14-05A	02/10/14	0.609	15.4	342	10.7	0.045	1.1	33	4.99	<1	99.1			38.8
FB-23/06/15	23/06/15	<0.0050	<0.050	<0.050	<3.0	<0.0020	<0.20	<0.50	<0.0020	<0.20	<0.10	<0.10		0.56
MW14-05A	23/06/15	0.04	12.4	336	8.6	0.01	<0.20	2.76	26.4	0.31	14.8	0.11		7.95
MW14-05A	13/07/15	0.0397	11.7	323	5.6	0.0211	0.2	3.88	26.8	0.33	16.7	0.17		24.2
MW14-05A	08/08/15	0.016	18.4	498	7.5	0.0197	0.47	2.03	24.3	0.25	19.1	0.18		8.88
MW14-05A	07/09/15	0.006	12.4	356	6.5	0.002	0.2	1.09	36.5	<0.20	4.56	0.12		4
MW14-05B	03/10/14	5.55	43.7	621	35.8	0.133	1.65	133	6.91	2.1	40.1			52
MW14-05B	24/06/15	0.302	72.8	701	40.5	0.119	0.92	50.1	16.6	2.56	34.3	0.59		18.5

Sample ID	Sample Date	Dissolved Antimony (Sb)	Dissolved Arsenic (As)	Dissolved Barium (Ba)	Dissolved Beryllium (Be)	Dissolved Bismuth (Bi)	Dissolved Boron (B)	Dissolved Cadmium (Cd)	Dissolved Calcium (Ca)	Dissolved Chromium (Cr)	Dissolved Cobalt (Co)	Dissolved Copper (Cu)	Dissolved Iron (Fe)	Dissolved Lead (Pb)
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L
FB-2	18/07/15	<0.020	0.024	0.068	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10	0.0062	1.85	19.9	0.0069
FB-3	12/08/15	<0.020	<0.020	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10	<0.0050	<0.050	<1.0	<0.0050
TRIP BLANK	11/09/15	<0.020	<0.020	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10	<0.0050	<0.050	<1.0	<0.0050
CAMP15-1	18/07/15	1.01	0.617	202	<0.010	<0.0050	<10	0.211	64.6	0.12	0.446	<0.050	9.2	<0.0050
MW14-02A	28/09/14	0.92	71.1	14.2	<0.1	<0.5	<10	<0.01	45.7	0.49	0.11	<0.2	<10	<0.05
MW14-02A	12/06/15	0.784	53.8	13.4	<0.010	<0.0050	<10	<0.0050	45.8	0.51	0.0356	0.232	14	0.0206
MW14-02A	16/07/15	0.719	52.4	12.9	<0.010	<0.0050	<10	<0.0050	40.7	0.45	0.0194	<0.050	2.9	<0.0050
MW14-02A	06/08/15	0.7	51.9	13.8	<0.010	<0.0050	<10	0.006	46.1	0.6	0.0419	0.305	26.6	0.0291
MW14-02A	04/09/15	0.697	53.8	9.88	<0.010	<0.0050	<10	<0.0050	40.3	0.47	0.014	0.065	<1.0	<0.0050
MW14-100	04/09/15	0.708	54.7	10.1	<0.010	<0.0050	<10	<0.0050	40.5	0.49	0.013	0.056	<1.0	<0.0050
F-BLANK-1	28/09/14	<0.1	<0.1	<0.05	<0.1	<0.5	<10	<0.01	<0.05	<0.1	<0.1	<0.2	<10	<0.05
MW14-02B	28/09/14	3.27	20.4	54.7	<0.1	<0.5	<10	<0.01	61.8	0.41	0.62	<0.2	<10	<0.05
F-DUP-1	28/09/14	2.89	20.5	54.2	<0.1	<0.5	<10	<0.01	61.4	0.42	0.62	<0.2	<10	<0.05
MW14-02B	12/06/15	6.56	34	45	<0.010	<0.0050	<10	<0.0050	52.4	0.12	2.47	0.081	7.3	0.0114
MW14-02B	16/07/15	6.6	37.4	57.7	<0.010	<0.0050	<10	<0.0050	52.3	<0.10	1.57	<0.050	9.8	<0.0050
MW14-02B	06/08/15	5.89	39.3	52.2	<0.010	<0.0050	<10	<0.0050	57.5	0.17	1.46	0.082	4.8	0.0098
MW14-02B	04/09/15	5.97	38.8	40.5	<0.010	<0.0050	<10	0.008	52.2	0.24	1.53	0.074	1.5	0.009
MW14-03A	12/10/14	0.99	60	364	<0.1	<0.5	15	0.067	69.3	5.46	0.75	2.82	18	0.09
MW14-03A	22/06/15	1.02	49.4	143	0.012	<0.0050	12	<0.0050	135	<0.10	2.46	0.175	7330	0.162
MW14-03A	12/07/15	0.698	58.6	128	<0.010	<0.0050	<10	0.0121	138	0.3	2.03	0.417	9370	0.0778
MW14-03A	07/08/15	0.586	68.9	98	0.016	<0.0050	<10	0.0545	135	0.21	1.75	1.65	8760	0.14
MW14-50	07/08/15	0.595	71.9	103	0.017	0.0111	18	0.014	137	0.22	1.88	1.53	8880	0.205
MW14-03A	06/09/15	0.313	75.7	103	0.013	<0.0050	<10	<0.0050	124	<0.10	1.32	0.068	7560	0.006
MW14-03B	06/10/14	0.15	1.68	84	<0.1	<0.5	<10	0.012	114	0.12	1.92	0.6	22	<0.05
MW14-03B	22/06/15	0.134	8.7	99	<0.010	<0.0050	12	0.0223	138	0.14	7.55	1.58	1770	0.0798
MW14-03B	12/07/15	0.103	9.2	87.8	<0.010	<0.0050	<10	0.0628	127	0.16	7	0.941	2140	0.0615
MW14-03B	07/08/15	0.091	8.21	74.7	<0.010	0.0129	<10	0.0184	133	<0.10	7.2	1.11	1340	0.0338
MW14-03B	06/09/15	0.087	7.63	61.8	<0.010	<0.0050	<10	0.008	129	<0.10	6.14	0.489	1010	0.022
MW14-200	06/09/15	0.085	7.76	64.1	<0.010	<0.0050	<10	<0.0050	131	<0.10	6.11	0.434	1020	0.015
MW14-05A	02/10/14	0.29	578	63.5	<0.1	<0.5	<10	0.018	36.6	6.25	0.57	3.83	266	0.114
FB-23/06/15	23/06/15	<0.020	0.047	0.127	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10	<0.0050	<0.050	<1.0	<0.0050
MW14-05A	23/06/15	0.688	1860	98.4	0.026	<0.0050	<10	<0.0050	47.1	<0.10	1.17	0.152	1920	0.0483
MW14-05A	13/07/15	0.664	1680	93.4	0.016	<0.0050	<10	0.0115	43.8	0.2	0.933	1.16	2380	0.257
MW14-05A	08/08/15	0.476	1480	109	0.015	0.0089	<10	<0.0050	47.2	0.17	0.742	0.18	2940	0.0112
MW14-05A	07/09/15	0.407	1700	118	0.02	<0.0050	<10	<0.0050	43.2	0.12	0.85	0.053	3590	0.007
MW14-05B	03/10/14	0.22	143	97.2	<0.1	<0.5	10	0.027	48.6	3.19	0.76	5.27	96	0.073
MW14-05B	24/06/15	1.17	135	83.6	<0.010	<0.0050	13	0.0423	45.8	0.17	0.955	2.48	69.2	0.0788

Sample ID	Sample Date	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)	Dissolved Manganese (Mn)	Dissolved Mercury (Hg)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Phosphorus (P)	Dissolved Potassium (K)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)
		ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L
FB-2	18/07/15	<0.50	<0.050	0.301	<0.0020	<0.050	1.17	179	<0.050	<0.040	<50	<0.0050	0.382	0.061
FB-3	12/08/15	<0.50	<0.050	<0.050	<0.0020	<0.050	<0.020	<2.0	<0.050	<0.040	<50	<0.0050	<0.050	<0.050
TRIP BLANK	11/09/15	<0.50	<0.050	<0.050	<0.0020	<0.050	<0.020	<2.0	<0.050	<0.040	<50	<0.0050	<0.050	<0.050
CAMP15-1	18/07/15	4.47	32.1	624	<0.0020	2.09	3.02	82.2	2.27	0.724	4700	<0.0050	4.83	400
MW14-02A	28/09/14	7.79	21.6	17	<0.01	4.88	<0.5	<50	3.63	0.25	6410	<0.01	5.18	378
MW14-02A	12/06/15	6.45	20.8	10.7	0.0035	3.19	0.348	53	2.94	0.255	6070	0.0053	3.17	361
MW14-02A	16/07/15	7.74	20.9	7.88	0.0042	3.04	0.327	12.8	2.98	0.241	6580	<0.0050	3.03	372
MW14-02A	06/08/15	8.06	21.8	6.82	0.0025	3.14	0.419	11.1	2.94	0.218	6050	0.0135	4.69	353
MW14-02A	04/09/15	7.42	20.5	2.42	0.004	2.78	0.086	7.4	2.86	0.229	6160	<0.0050	2.87	362
MW14-100	04/09/15	7.66	21.4	2.46	0.0038	2.84	0.082	6.9	2.83	0.237	6350	<0.0050	2.89	352
F-BLANK-1	28/09/14	<0.5	<0.1	<0.05	<0.01	<0.05	<0.5	<50	<0.1	<0.1	<50	<0.01	<0.05	<0.2
MW14-02B	28/09/14	7.59	31.2	162	<0.01	4.96	2.5	<50	3.74	0.31	6270	<0.01	4.53	494
F-DUP-1	28/09/14	7.19	31.1	159	<0.01	4.55	2.4	<50	3.69	0.33	6270	<0.01	4.56	459
MW14-02B	12/06/15	6.75	27.1	621	0.0021	7.45	14.7	6.6	3.25	0.277	6090	<0.0050	3.21	441
MW14-02B	16/07/15	7.08	30.3	710	0.0042	6.84	8.85	117	3.67	0.264	6420	<0.0050	3.73	469
MW14-02B	06/08/15	7.63	31.9	645	<0.0020	6.42	9.29	7.5	3.61	0.274	6130	<0.0050	3.73	462
MW14-02B	04/09/15	7.52	28.8	511	0.0027	5.72	10.6	5.2	3.47	0.278	6430	<0.0050	3.28	454
MW14-03A	12/10/14	10.8	43.2	9.52	0.554	12.9	2.79	440	9.19	2.61	5910	<0.01	69.7	742
MW14-03A	22/06/15	31.3	143	815	0.0068	4.82	2.36	42.7	9.39	0.097	8050	0.0079	28.3	5130
MW14-03A	12/07/15	27.2	125	954	0.0098	5.14	1.35	118	8.31	0.043	7100	0.0082	26.8	4570
MW14-03A	07/08/15	32.3	142	754	0.0021	2.95	0.846	144	8.25	<0.040	7320	0.0135	29	4380
MW14-50	07/08/15	31.4	139	797	0.0039	3.41	0.935	195	8.91	<0.040	7270	0.0077	28	4550
MW14-03A	06/09/15	26.6	125	653	0.003	3.19	0.343	57.2	8.38	<0.040	7080	0.01	26.1	4440
MW14-03B	06/10/14	21	125	233	0.041	2.54	4.46	<50	6.9	1.13	4950	<0.01	25.9	2540
MW14-03B	22/06/15	24.6	176	3490	0.0049	9.53	22	69.9	9.18	0.249	7250	0.0121	30	3620
MW14-03B	12/07/15	21.1	143	3300	0.0066	8.76	18.5	50.2	7.7	0.169	5980	0.0056	24.5	2950
MW14-03B	07/08/15	26.6	184	3210	0.0028	7.38	20.4	38.2	8.46	0.143	6290	0.0138	29.8	3010
MW14-03B	06/09/15	23	164	2920	0.0047	6.77	16.6	29.4	8.42	0.123	6070	0.007	26.8	3380
MW14-200	06/09/15	24.9	163	2890	0.0033	6.86	16.6	27.4	8.51	0.131	6300	0.006	25.6	3400
MW14-05A	02/10/14	27.6	5.97	302	<0.01	8.6	1.39	87	12.3	0.59	12500	<0.01	15	330
FB-23/06/15	23/06/15	0.62	<0.050	<0.050	<0.0020	<0.050	0.068	<2.0	<0.050	<0.040	<50	<0.0050	<0.050	<0.050
MW14-05A	23/06/15	30	8.9	1390	<0.0020	3.8	1.25	89.7	5.34	0.103	14800	0.0054	13.5	375
MW14-05A	13/07/15	27.9	8.42	1170	<0.0020	4.14	1.39	124	5.92	0.1	13400	<0.0050	23.2	353
MW14-05A	08/08/15	34.3	8.87	1100	<0.0020	4.83	1.38	112	7.12	0.071	13700	<0.0050	15.9	437
MW14-05A	07/09/15	28.4	8.86	1600	<0.0020	3.71	0.544	84.2	5.45	0.068	14100	<0.0050	12.2	334
MW14-05B	03/10/14	32.7	7.48	187	<0.01	18.5	4.5	71	14.2	0.57	12000	0.084	44.5	632
MW14-05B	24/06/15	36	6.28	414	<0.0020	28.9	7.23	112	14	0.421	10600	0.0067	76.4	719

Sample ID	Sample Date	Dissolved Sulphur (S)	Dissolved Thallium (Tl)	Dissolved Tin (Sn)	Dissolved Titanium (Ti)	Dissolved Uranium (U)	Dissolved Vanadium (V)	Dissolved Zinc (Zn)	Dissolved Zirconium (Zr)	Filter and HNO3 Preservation (Metals)
		mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
FB-2	18/07/15	<3.0	<0.0020	<0.20	0.64	0.0066	<0.20	1.26	<0.10	LAB
FB-3	12/08/15	<3.0	<0.0020	<0.20	<0.50	<0.0020	<0.20	<0.10	<0.10	LAB
TRIP BLANK	11/09/15	<3.0	<0.0020	<0.20	<0.50	<0.0020	<0.20	<0.10	<0.10	LAB
CAMP15-1	18/07/15	8.2	0.0332	<0.20	<0.50	8	<0.20	11.5	0.17	LAB
MW14-02A	28/09/14	18.7	0.041	<0.1	<10	70.4	<1	1.6		FIELD
MW14-02A	12/06/15	17.7	0.0555	<0.20	<0.50	46.4	0.25	3.37	<0.10	FIELD
MW14-02A	16/07/15	17.4	0.0217	<0.20	<0.50	48	<0.20	2.26	<0.10	FIELD
MW14-02A	06/08/15	17.6	0.0486	<0.20	0.65	48.1	0.3	3.83	<0.10	FIELD
MW14-02A	04/09/15	18.2	0.024	<0.20	<0.50	44.6	<0.20	0.27	<0.10	FIELD
MW14-100	04/09/15	18.6	0.035	<0.20	<0.50	45.4	<0.20	0.54	<0.10	FIELD
F-BLANK-1	28/09/14	<0.5	<0.01	<0.1	<10	<0.01	<1	<1		
MW14-02B	28/09/14	29	0.025	<0.1	<10	92.5	<1	10.3		FIELD
F-DUP-1	28/09/14	29	0.022	<0.1	<10	83.3	<1	10.3		FIELD
MW14-02B	12/06/15	24.6	0.0784	<0.20	<0.50	72.2	0.36	1.92	<0.10	FIELD
MW14-02B	16/07/15	26.1	0.0536	<0.20	<0.50	76.8	<0.20	3.78	<0.10	FIELD
MW14-02B	06/08/15	26.8	0.267	<0.20	<0.50	79.9	0.31	3.86	<0.10	FIELD
MW14-02B	04/09/15	26.7	0.249	<0.20	<0.50	72.2	<0.20	2.19	<0.10	FIELD
MW14-03A	12/10/14	83.3	0.136	0.59	<10	12.8	1.4	7.9		FIELD
MW14-03A	22/06/15	182	0.0176	<0.20	<0.50	69.3	0.23	1.68	2.39	FIELD
MW14-03A	12/07/15	156	0.0037	<0.20	0.6	49.3	0.48	4.35	3.07	FIELD
MW14-03A	07/08/15	166	0.0263	<0.20	0.69	50.1	0.41	16.2	2.96	FIELD
MW14-50	07/08/15	162	0.01	<0.20	0.86	53.7	0.34	16.2	3.1	FIELD
MW14-03A	06/09/15	153	0.003	<0.20	<0.50	43.6	<0.20	0.29	3.39	FIELD
MW14-03B	06/10/14	139	0.044	<0.1	<10	57.5	<1	5.4		FIELD
MW14-03B	22/06/15	198	0.132	<0.20	<0.50	43.3	0.26	10.1	0.44	FIELD
MW14-03B	12/07/15	164	0.0793	<0.20	<0.50	37.9	0.21	9.45	0.44	FIELD
MW14-03B	07/08/15	200	0.11	<0.20	<0.50	40.5	<0.20	6.03	0.33	FIELD
MW14-03B	06/09/15	193	0.135	<0.20	<0.50	37.5	<0.20	0.75	0.34	FIELD
MW14-200	06/09/15	191	0.14	<0.20	<0.50	38.2	<0.20	0.85	0.3	FIELD
MW14-05A	02/10/14	10.7	0.01	0.57	<10	4.04	<1	42.5		FIELD
FB-23/06/15	23/06/15	<3.0	<0.0020	<0.20	<0.50	<0.0020	<0.20	0.16	<0.10	LAB
MW14-05A	23/06/15	9.4	0.0048	<0.20	<0.50	32.5	<0.20	11.2	<0.10	FIELD
MW14-05A	13/07/15	6.8	0.0085	<0.20	0.88	28.6	0.24	7.63	0.14	FIELD
MW14-05A	08/08/15	5.1	0.0114	<0.20	<0.50	25.4	<0.20	0.92	0.14	FIELD
MW14-05A	07/09/15	6.6	<0.0020	<0.20	<0.50	32.4	<0.20	0.71	0.12	FIELD
MW14-05B	03/10/14	36.1	0.02	0.7	<10	5.95	<1	3.8		FIELD
MW14-05B	24/06/15	39.8	0.0456	0.4	0.87	16.2	1.25	4.31	0.25	FIELD

Station	Sample ID	Sample Date	Analytical Laboratory	Lab Job ID	Lab Sample ID	Field Paramaters	pH (field)	Specific Conductance (field)	DO (field)	ORP (field)	Temperature (field)	Physical Properties	Conductivity (lab)
							pH	uS/cm	mg/L	ORP mV	°C		uS/cm
MW14-05B	MW14-05B	14/07/15	Maxxam	B560161	MR1584		7.72	709	0.45	-91	1.4		736
MW14-05B	MW14-05B	09/08/15	Maxxam	B569424	MW5117		7.43	696	0.44	-51.3	1.48		756
MW14-05B	FB-4	08/09/15	Maxxam	B579224	NC4791								1.1
MW14-05B	MW14-05B	08/09/15	Maxxam	B579224	NC4789		7.24	607	0.96	-65.4	4.37		583
MW15-01WB	MW15-01WB/BH8-WB	07/06/15	Maxxam	B549739	ML2152		6.95	2229	6.83	32.8	3.4		2130
MW15-01WB	MW15-01WB	08/07/15	Maxxam	B558595	MQ2530		7.85	2269	8.96	22.6	4.7		2200
MW15-01WB	MW15-01WB	10/08/15	Maxxam	B569424	MW5120		7.01	2160	7.96	37.5	9.2		2180
MW15-01WB	MW15-01WB	03/09/15	Maxxam	B578440	NC0865		6.78	2215			6.86		2190
MW15-02AZ	MW15-02 AZ/BH10-AZ	31/05/15	Maxxam	B546672	MJ5444		7.32	874.4	6.43	21.3	1.2		926
MW15-02AZ	MW15-02AZ	11/07/15	Maxxam	B559978	MR0622		7.54	800	8.2	41.3	1.95		792
MW15-02AZ	MW15-40AZ	11/07/15	Maxxam	B559978	MR0623								792
MW15-02AZ	MW15-02AZ	12/08/15	Maxxam	B569424	MW5162		7.41	767	6.8	48.1	1.08		738
MW15-02AZ	MW15-02AZ	07/09/15	Maxxam	B578440	NC0910		7.49	728	7.37	143.3	1.76		747
MW15-02WB	MW15-02 WB/BH10-WB	01/06/15	Maxxam	B546672	MJ5445		7.27	889		75	3.2		889
MW15-02WB	MW15-02WB	11/07/15	Maxxam	B559978	MR0621		7.44	884	9.22	-17.4	6.7		816
MW15-02WB	MW15-02WB	12/08/15	Maxxam	B569424	MW5161		7.3	898	7.45	9.3	3.18		866
MW15-02WB	MW15-02WB	07/09/15	Maxxam	B578440	NC0909		7.47	863	5.26	117.4	4.52		865
MW15-03AZ	MW15-03AZ	16/06/15	Maxxam	B551383	MM1021		6.64	322	0.34	107.7	2.79		323
MW15-03AZ	MW15-21	16/06/15	Maxxam	B551383	MM1022								319
MW15-03AZ	MW15-03AZ	09/07/15	Maxxam	B558921	MQ4540		6.99	307.5	0.57	79.9	2.2		308
MW15-03AZ	MW15-03AZ	10/08/15	Maxxam	B569424	MW5157		7.02	217	1.42	73	2.54		212
MW15-03AZ	MW15-03AZ	04/09/15	Maxxam	B578440	NC0874		7.07	213	1.17	91.6	1.65		212
MW15-03WB	MW15-03WB	16/06/15	Maxxam	B551383	MM1020		7.65	1907			7.55		1900
MW15-03WB	MW15-03WB	09/07/15	Maxxam	B558921	MQ4541		7.42	1914	8.69	-26.8	4.2		1870
MW15-03WB	MW15-03WB	10/08/15	Maxxam	B569424	MW5121		7.49	1978	9.28	7.1	4.84		1840
MW15-03WB	MW15-03WB	04/09/15	Maxxam	B578440	NC0873		7.37	1883	6.05	15.5	4.47		1840
MW15-04WB	MW15-04WB	14/06/15	Maxxam	B551383	MM1018		8.32	648.2	12.74	72.6			667
MW15-04WB	MW15-20	14/06/15	Maxxam	B551383	MM1019								670
MW15-04WB	MW15-04WB	10/07/15	Maxxam	B558916	MQ4530		7.28	665	7.75	169.6	7.35		661
MW15-04WB	MW15-30WB	10/07/15	Maxxam	B558916	MQ4532								656
MW15-04WB	MW15-04WB	11/08/15	Maxxam	B569424	MW5158		7.23	688	11.19	97.7	3.15		639
MW15-04WB	MW15-04WB	05/09/15	Maxxam	B578440	NC0875		6.32	665	4.76	187.1	5.84		657
MW15-05AZ	MW15-05AZ	06/09/15	Maxxam	B578440	NC0907		5.76	28	7.89	97.6	1.07		28.2
MW15-05WB	MW15-05WB	18/06/15	Maxxam	B553846	MN4270		7.35	306	13.07	192.9	7.95		298
MW15-05WB	MW15-05WB	10/07/15	Maxxam	B558916	MQ4531		7.62	304	11.61	0.2	4.63		296
MW15-05WB	MW15-05WB	11/08/15	Maxxam	B569424	MW5159		7.63	300	11.92	39.3	3.98		287
MW15-05WB	MW15-60	11/08/15	Maxxam	B569424	MW5160								290
MW15-05WB	MW15-05WB	06/09/15	Maxxam	B578440	NC0906		6.55	291	9.95	74.9	5.3		291
MW15-06WB	MW15-06WB	21/06/15	Maxxam	B553846	MN4271		7.21	456	5.69	17.7	6.56		425
MW15-06WB	MW15-06WB	21/07/15	Maxxam	B562572	MS4335		8	607	9.16	-50.2	4.6		608
MW15-06WB	MW15-06WB	09/08/15	Maxxam	B569424	MW5118		7.71	601	6.67	-25.6	7.66		636
MW15-06WB	MW15-06WB	08/09/15	Maxxam	B579224	NC4790		7.68	671	6.09	-8.7	4.85		662

Notes:

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[1] *Reportable detection limit (RDL) presented are the lowest reported detection limits for a given parameters, although in some cases the detection limit was raised by the analytical laboratory (e.g., due to sample matrix effects).*

Sample ID	Sample Date	pH (lab)	Total Hardness (CaCO3)	Dissolved Hardness (CaCO3)	Total Suspended Solids	Total Dissolved Solids	Turbidity	Inorganics	Alkalinity (Total as CaCO3)	Alkalinity (PP as CaCO3)	Bicarbonate (HCO3)	Carbonate (CO3)	Hydroxide (OH)	Bromide (Br)	Fluoride (F)
		pH	mg/L	mg/L	mg/L	mg/L	NTU		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW14-05B	14/07/15	8.04	147	134	14.7	484	14		192	<0.50	234	<0.50	<0.50		0.38
MW14-05B	09/08/15	8.03	154	148	7	579	7.85		196	<0.50	239	<0.50	<0.50		0.36
FB-4	08/09/15	5.08	<0.50	<0.50	<1.0	<10	<0.10		<0.50	<0.50	<0.50	<0.50	<0.50		<0.010
MW14-05B	08/09/15	7.9	148	150	11	402	9.03		197	<0.50	240	<0.50	<0.50		0.28
MW15-01WB/BH8-WB	07/06/15	7.9	1460	1470	2.5	1800	3.52		556	<0.50	678	<0.50	<0.50		0.057
MW15-01WB	08/07/15	7.95	1400	1410	2.5	1690	4.31		554	<0.50	676	<0.50	<0.50		0.044
MW15-01WB	10/08/15	7.75	1450	1330	3	1890	5.93		565	<0.50	689	<0.50	<0.50		0.058
MW15-01WB	03/09/15	7.85	1360	1390	2.7	1940	5.11		547	<0.50	668	<0.50	<0.50		0.06
MW15-02 AZ/BH10-AZ	31/05/15	8.08	493	513	<1.0	640	0.19		264	<0.50	322	<0.50	<0.50		0.1
MW15-02AZ	11/07/15	8.04	410	417	<1.0	484	0.11		239	<0.50	291	<0.50	<0.50		0.088
MW15-40AZ	11/07/15	7.83	411	412	<1.0	500	0.15		242	<0.50	295	<0.50	<0.50		0.087
MW15-02AZ	12/08/15	8.06	408	405	<1.0	500	<0.10		234	<0.50	286	<0.50	<0.50		0.097
MW15-02AZ	07/09/15	8.16	394	383	<1.0	514	0.24		231	<0.50	281	<0.50	<0.50		0.11
MW15-02 WB/BH10-WB	01/06/15	7.99	464	514	<1.0	634	1.33		245	<0.50	299	<0.50	<0.50		0.17
MW15-02WB	11/07/15	7.66	462	458	<1.0	602	1.97		206	<0.50	251	<0.50	<0.50		0.2
MW15-02WB	12/08/15	7.95	486	466	1.1	636	2.24		224	<0.50	274	<0.50	<0.50		0.21
MW15-02WB	07/09/15	8.16	465	456	<1.0	610	0.21		247	<0.50	301	<0.50	<0.50		0.12
MW15-03AZ	16/06/15	7.97	151	151	<1.0	216	0.24		108	<0.50	132	<0.50	<0.50		0.048
MW15-21	16/06/15	7.96	148	158	<1.0	202	0.27		107	<0.50	130	<0.50	<0.50		0.047
MW15-03AZ	09/07/15	7.82	139	141	<1.0	184	<0.10		110	<0.50	134	<0.50	<0.50		0.057
MW15-03AZ	10/08/15	7.71	108	107	<1.0	150	0.51		80.3	<0.50	97.9	<0.50	<0.50		0.059
MW15-03AZ	04/09/15	7.86	99	96.6	<1.0	140	0.29		82.3	<0.50	100	<0.50	<0.50		0.063
MW15-03WB	16/06/15	8.02	1030	1010	3.6	1520	3.81		150	<0.50	183	<0.50	<0.50		0.13
MW15-03WB	09/07/15	7.98	929	935	2.9	1400	4.48		152	<0.50	185	<0.50	<0.50		0.14
MW15-03WB	10/08/15	7.98	937	911	1.8	1550	4.55		151	<0.50	184	<0.50	<0.50		0.15
MW15-03WB	04/09/15	8.03	921	937	1.7	1670	4.91		146	<0.50	178	<0.50	<0.50		0.14
MW15-04WB	14/06/15	8.26	335	338	<1.0	446	0.2		233	<0.50	284	<0.50	<0.50		0.096
MW15-20	14/06/15	8.22	339	346	<1.0	480	0.14		234	<0.50	285	<0.50	<0.50		0.094
MW15-04WB	10/07/15	8.1	329	326	<1.0	396	0.12		234	<0.50	285	<0.50	<0.50		0.1
MW15-30WB	10/07/15	8.15	327	330	<1.0	402	<0.10		234	<0.50	285	<0.50	<0.50		0.11
MW15-04WB	11/08/15	8.07	351	355	<1.0	452	0.24		227	<0.50	277	<0.50	<0.50		0.11
MW15-04WB	05/09/15	8.06	330	339	<1.0	444	0.14		232	<0.50	283	<0.50	<0.50		0.11
MW15-05AZ	06/09/15	6.76	9.97	10.4	1.5	22	11.3		9.09	<0.50	11.1	<0.50	<0.50		0.036
MW15-05WB	18/06/15	8.15	140	151	<1.0	170	1.01		146	<0.50	179	<0.50	<0.50		0.26
MW15-05WB	10/07/15	7.98	132	134	<1.0	162	0.27		145	<0.50	177	<0.50	<0.50		0.28
MW15-05WB	11/08/15	7.98	136	139	<1.0	189	<0.10		140	<0.50	171	<0.50	<0.50		0.3
MW15-60	11/08/15	8	141	140	1.6	184	0.13		144	<0.50	175	<0.50	<0.50		0.3
MW15-05WB	06/09/15	7.98	133	146	<1.0	186	0.17		138	<0.50	168	<0.50	<0.50		0.3
MW15-06WB	21/06/15	8.03	175	195	15.8	306	25.1		164	<0.50	200	<0.50	<0.50		0.063
MW15-06WB	21/07/15	7.97	288	299	4.6	330	6.95		224	<0.50	273	<0.50	<0.50		0.073
MW15-06WB	09/08/15	8.01	335	317	3.7	416	3.21		241	<0.50	294	<0.50	<0.50		0.082
MW15-06WB	08/09/15	8.15	329	370	2.3	382	3.15		258	<0.50	315	<0.50	<0.50		0.11

Notes:

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Sample ID	Sample Date	Dissolved Chloride (Cl)	Organic / Inorganic Carbon	Dissolved Organic Carbon (C)	Total Organic Carbon (C)	Anions and Nutrients	Total Phosphorus (P)	Dissolved Phosphorus (P)	Total Ammonia (N)	Total Total Kjeldahl Nitrogen (Calc)	Nitrate plus Nitrite (N)	Nitrate (N)	Nitrite (N)	Total Nitrogen (N)	Dissolved Nitrogen (N)
		mg/L		mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW14-05B	14/07/15	5.9		21.7	24.6		0.208	0.179	0.024	0.44	0.0046	<0.0020	0.0037	0.448	
MW14-05B	09/08/15	5.9		28	30		0.213	0.197	<0.0050	0.316	0.0024	<0.0020	0.0024	0.318	
FB-4	08/09/15	<0.50		<0.50	<0.50		<0.0050	<0.0020	0.0085	0.041	<0.0020	<0.0020	<0.0020	0.041	
MW14-05B	08/09/15	3.1		14	15		0.246	0.227	0.016	0.289	<0.0020	<0.0020	<0.0020	0.289	
MW15-01WB/BH8-WB	07/06/15	0.69		32.7	36.5		0.0139	0.01	0.015	0.043	<0.0020	<0.0020	<0.0020	0.043	
MW15-01WB	08/07/15	0.81		38.4	284		0.0517	0.0041	0.016	0.069	<0.0020	<0.0020	<0.0020	0.069	
MW15-01WB	10/08/15	0.75		120	490		0.111	0.0178	0.0052	0.35	<0.0020	<0.0020	<0.0020	0.35	
MW15-01WB	03/09/15	1.7		35	32		0.0138	0.0159	0.015	0.035	0.0048	0.0048	<0.0020	0.04	
MW15-02 AZ/BH10-AZ	31/05/15	0.84		3.86	3.77		<0.0050	<0.0050	0.01	0.147	0.232	0.232	<0.0020	0.379	
MW15-02AZ	11/07/15	0.5		5.62	6.29		<0.0050	<0.0050	0.016	0.22	0.436	0.436	<0.0020	0.654	
MW15-40AZ	11/07/15	0.58		5.28	6.24		<0.0050	<0.0050	0.01	0.19	0.437	0.437	<0.0020	0.626	
MW15-02AZ	12/08/15	0.87		4.5	4.7		<0.0050	<0.0050	<0.0050	0.109	0.531	0.531	<0.0020	0.641	
MW15-02AZ	07/09/15	1.1		5.5	5.4		<0.0050	<0.0050	0.025	0.153	0.495	0.544	<0.0020	0.694	
MW15-02 WB/BH10-WB	01/06/15	0.93		29.9	42.4		0.0847	0.0042	0.011	0.129	<0.0020	<0.0020	<0.0020	0.129	
MW15-02WB	11/07/15	0.58		14.7	74.2		<0.0050	0.0024	0.018	0.17	<0.0020	<0.0020	<0.0020	0.165	
MW15-02WB	12/08/15	<0.50		190	230		0.0085	0.0062	0.012	0.37	0.003	0.003	<0.0020	0.37	
MW15-02WB	07/09/15	1.2		9.4	14		<0.0050	0.0034	0.018	0.103	0.14	0.138	0.0026	0.243	
MW15-03AZ	16/06/15	0.78		7.87	8.32		<0.0050	<0.0050	0.0087	0.227	0.0255	0.0255	<0.0020	0.253	
MW15-21	16/06/15	0.52		7.81	7.39		<0.0050	<0.0050	0.025	0.209	0.0263	0.0263	<0.0020	0.235	
MW15-03AZ	09/07/15	0.72		7.11	7.12		<0.0050	0.0057	0.02	0.18	0.0294	0.0294	<0.0020	0.207	0.236
MW15-03AZ	10/08/15	<0.50		8.8	10		<0.0050	<0.0050	0.0065	0.231	0.15	0.15	<0.0020	0.381	
MW15-03AZ	04/09/15	0.76		10	11		<0.0050	<0.0050	0.025	0.309	0.146	0.166	<0.0020	0.455	
MW15-03WB	16/06/15	9.1		220	12.1		<0.0050	0.0048	0.012	0.036	0.0076	0.0076	<0.0020	0.044	
MW15-03WB	09/07/15	8.9		362	311		0.0897	0.0361	0.92	0.098	<0.0020	<0.0020	<0.0020	0.098	0.23
MW15-03WB	10/08/15	9.1		340	280		0.0323	0.0385	0.0093	0.45	<0.0020	<0.0020	<0.0020	0.45	
MW15-03WB	04/09/15	8.7		8.5	8.3		<0.0050	0.0032	0.039	0.047	0.003	0.003	<0.0020	0.05	
MW15-04WB	14/06/15	<0.50		268	1080		0.105	0.0951	0.022	<0.20	0.156	0.139	0.0167	<0.20	
MW15-20	14/06/15	<0.50		219	1310		0.401	0.022	0.012	<0.20	0.158	0.141	0.017	<0.20	
MW15-04WB	10/07/15	0.68		93.6	8.99		<0.0050	0.0069	0.019	0.15	0.0809	0.0702	0.0107	0.227	
MW15-30WB	10/07/15	0.67		10.3	63.8		<0.0050	0.0043	0.02	0.088	0.0874	0.0777	0.0097	0.175	
MW15-04WB	11/08/15	<0.50		150	120		0.0056	0.0074	0.015	0.061	0.24	0.228	0.0116	0.301	
MW15-04WB	05/09/15	0.84		7	130		<0.0050	0.0043	0.019	0.044	0.222	0.215	0.0065	0.266	
MW15-05AZ	06/09/15	0.52		13	13		0.0245	0.0134	0.61	0.77	0.012	0.01	0.002	0.782	
MW15-05WB	18/06/15	0.64		371	771		0.0761	0.0358	0.0067	0.082	<0.0020	<0.0020	<0.0020	0.082	
MW15-05WB	10/07/15	<0.50		138	335		0.0744	0.0143	0.016	0.085	<0.0020	<0.0020	<0.0020	0.085	
MW15-05WB	11/08/15	<0.50		9.5	330		0.0654	0.0125	<0.0050	0.32	<0.0020	<0.0020	<0.0020	0.32	
MW15-60	11/08/15	<0.50		11	410		0.121	0.0112	<0.0050	0.37	<0.0020	<0.0020	<0.0020	0.37	
MW15-05WB	06/09/15	0.75		270	24		0.0124	0.0297	0.14	0.027	0.0022	0.0031	<0.0020	0.229	
MW15-06WB	21/06/15	8.8		34.4	48.6		0.0505	0.0317	0.59	6	0.0101	<0.0020	0.0101	6.01	
MW15-06WB	21/07/15	2.1		69.2	15.8		0.0247	0.0308	0.23	2.4	0.0028	<0.0020	0.0024	2.36	
MW15-06WB	09/08/15	1.7		17	33		0.0316	0.027	0.098	1.26	<0.0020	<0.0020	<0.0020	1.26	
MW15-06WB	08/09/15	1.5		39	130		0.0519	0.0463	0.047	0.597	0.002	<0.0020	0.003	0.599	

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Sample ID	Sample Date	Dissolved Sulphate (SO4)	Sulphide	Total Metals	Total Aluminum (Al)	Total Antimony (Sb)	Total Arsenic (As)	Total Barium (Ba)	Total Beryllium (Be)	Total Bismuth (Bi)	Total Boron (B)	Total Cadmium (Cd)	Total Calcium (Ca)	Total Chromium (Cr)
		mg/L	mg/L		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L
MW14-05B	14/07/15	158	0.0443		334	0.912	129	93.4	0.016	0.0057	18	0.0815	47.4	1.2
MW14-05B	09/08/15	170	0.12		108	0.642	141	83	0.015	<0.0050	26	0.0356	49	0.58
FB-4	08/09/15	<0.50	0.0061		1.29	<0.020	0.022	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10
MW14-05B	08/09/15	99.6	0.0887		68.9	0.635	176	81.5	<0.010	0.007	12	0.046	45.5	1.73
MW15-01WB/BH8-WB	07/06/15	906	<0.0050		4.17	0.742	34.5	10.1	0.041	<0.0050	<10	0.0211	283	0.21
MW15-01WB	08/07/15	954	0.0074		11.9	0.585	31	10.7	0.038	<0.0050	<10	0.0476	246	0.23
MW15-01WB	10/08/15	880	0.0057		49	0.376	34.7	11.4	0.04	<0.0050	<10	0.108	251	1.48
MW15-01WB	03/09/15	841	0.0094		5.1	0.321	39.8	8.96	0.045	<0.0050	<10	0.026	222	0.46
MW15-02 AZ/BH10-AZ	31/05/15	245	0.0054		8.38	0.434	1.1	95.8	<0.010	<0.0050	<10	0.0089	130	0.11
MW15-02AZ	11/07/15	190	<0.0050		10.3	0.14	0.948	87.6	<0.010	<0.0050	<10	0.0146	109	0.17
MW15-40AZ	11/07/15	185	0.006		8.17	0.143	0.831	94.4	<0.010	<0.0050	<10	0.0209	114	0.13
MW15-02AZ	12/08/15	163	0.0077		8.95	0.153	1.03	82.8	<0.010	<0.0050	<10	0.0056	106	0.15
MW15-02AZ	07/09/15	154	<0.0050		6.95	0.152	1.04	74.9	<0.010	<0.0050	<10	<0.0050	104	0.12
MW15-02 WB/BH10-WB	01/06/15	242	0.006		6.19	0.343	2.44	26.3	<0.010	<0.0050	<10	0.0478	129	2.1
MW15-02WB	11/07/15	234	0.0051		22.9	0.128	2.68	23	0.013	<0.0050	<10	0.0348	128	0.37
MW15-02WB	12/08/15	236	0.0095		8.86	0.128	2.99	24	0.015	<0.0050	<10	0.0342	134	0.62
MW15-02WB	07/09/15	202	0.0054		1.84	0.082	0.581	38.9	<0.010	<0.0050	<10	0.011	128	0.15
MW15-03AZ	16/06/15	53	<0.0050		47.2	0.15	0.45	38	<0.010	<0.0050	<10	0.0118	41	0.19
MW15-21	16/06/15	57.7	0.0065		34.4	0.141	0.445	38.1	0.011	<0.0050	<10	0.0104	40	0.14
MW15-03AZ	09/07/15	51	0.0065		25.5	0.128	0.409	29.5	<0.010	<0.0050	<10	0.0185	37.7	0.2
MW15-03AZ	10/08/15	25.4	0.0061		32.8	0.203	0.525	30	0.013	<0.0050	<10	0.016	29.3	0.3
MW15-03AZ	04/09/15	21.7	0.0073		19.4	0.188	0.515	25.8	0.016	<0.0050	<10	0.011	26	0.22
MW15-03WB	16/06/15	951	0.0128		54.5	0.076	0.525	17	0.017	<0.0050	18	0.0096	182	1.37
MW15-03WB	09/07/15	938	<0.0050		30	0.091	0.611	13.9	0.01	<0.0050	31	0.0258	155	0.74
MW15-03WB	10/08/15	939	<0.0050		9.55	0.046	0.719	11.4	<0.010	<0.0050	25	0.0186	156	0.48
MW15-03WB	04/09/15	873	0.0052		6.88	0.059	0.447	10.4	0.011	<0.0050	31	0.022	151	0.3
MW15-04WB	14/06/15	125	<0.0050		8.95	2.86	1.65	35.4	<0.010	<0.0050	<10	0.0605	73.2	0.3
MW15-20	14/06/15	130	0.0074		11.8	2.91	1.69	34.8	<0.010	<0.0050	<10	0.0572	75.4	0.28
MW15-04WB	10/07/15	129	0.0072		7.77	2.88	1.39	34.5	<0.010	<0.0050	<10	0.0611	71.2	0.4
MW15-30WB	10/07/15	130	0.0086		7.62	3.37	1.25	38.2	<0.010	<0.0050	<10	0.0353	71.4	0.12
MW15-04WB	11/08/15	130	<0.0050		23.8	2.69	1.65	37.6	<0.010	<0.0050	<10	0.125	75.7	1.02
MW15-04WB	05/09/15	120	0.0088		5.75	2.69	1.2	33.3	0.012	<0.0050	<10	0.042	69.3	0.21
MW15-05AZ	06/09/15	<0.50	<0.0050		201	0.088	3.03	18.5	0.03	<0.0050	<10	0.022	2.73	0.8
MW15-05WB	18/06/15	14	0.0091		7.11	0.371	1.25	3.97	<0.010	<0.0050	<10	0.041	44.3	0.5
MW15-05WB	10/07/15	12.1	0.0051		29.7	0.348	1.25	5.44	<0.010	<0.0050	<10	0.0683	41.1	2.67
MW15-05WB	11/08/15	12.2	<0.0050		2.56	0.202	0.927	1.65	<0.010	<0.0050	<10	0.0135	42.8	0.3
MW15-60	11/08/15	13.1	<0.0050		20.4	0.212	0.957	1.91	<0.010	<0.0050	<10	0.0158	44.5	0.4
MW15-05WB	06/09/15	12	0.0076		1.43	0.186	0.891	1.01	<0.010	<0.0050	<10	<0.0050	42	0.13
MW15-06WB	21/06/15	44.4	0.0054		814	1.25	11.7	44.3	0.031	0.005	<10	0.053	42.6	2.49
MW15-06WB	21/07/15	101	0.0134		275	2.3	12.5	39.2	<0.010	<0.0050	<10	0.0635	65.1	1.86
MW15-06WB	09/08/15	106	0.0114		151	2.63	21.2	41.8	<0.010	<0.0050		0.0407	74.5	1.13
MW15-06WB	08/09/15	116	0.0069		58.7	0.673	22.8	52.5	<0.010	<0.0050	<10	0.026	73.4	0.59

Notes:

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[1] *Reportable detection limit (RDL) presented are the lowest reported detection limits for a given parameters, although in some cases the detection limit was raised by the analytical laboratory (e.g., due to sample matrix effects).*

Sample ID	Sample Date	Total Cobalt (Co)	Total Copper (Cu)	Total Iron (Fe)	Total Lead (Pb)	Total Lithium (Li)	Total Magnesium (Mg)	Total Manganese (Mn)	Total Mercury (Hg)	Total Molybdenum (Mo)	Total Nickel (Ni)	Total Phosphorus (P)	Total Potassium (K)	Total Selenium (Se)	Total Silicon (Si)
		ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L
MW14-05B	14/07/15	1.59	5.86	969	1.23	34.1	6.83	734	0.0062	22	7.87	187	12.3	0.408	11800
MW14-05B	09/08/15	1.4	2.07	1290	0.525	37.9	7.72	935	0.0056	16.1	5.33	161	10.8	0.356	12800
FB-4	08/09/15	<0.0050	<0.050	<1.0	<0.0050	<0.50	<0.050	0.152	<0.0020	<0.050	<0.020	4.3	<0.050	<0.040	<50
MW14-05B	08/09/15	1.51	2.56	1900	0.427	34.9	8.47	1240	0.0039	9.09	4.23	173	9.95	0.17	14200
MW15-01WB/BH8-WB	07/06/15	0.88	0.459	384	0.123	22	184	377	<0.0020	0.788	1.91	4.4	4.96	0.106	8960
MW15-01WB	08/07/15	0.765	0.862	510	4.83	23.4	192	373	<0.0020	0.864	2.03	14.9	5.09	1.65	8170
MW15-01WB	10/08/15	0.77	0.605	620	0.211	26.5	200	382	<0.0020	0.776	2.39	209	5.13	0.07	8530
MW15-01WB	03/09/15	0.701	0.301	520	0.167	25.7	197	368	<0.0020	0.788	1.73	18.1	5.26	0.135	6760
MW15-02 AZ/BH10-AZ	31/05/15	0.186	1.19	6.4	0.0094	4.09	41	19.8	<0.0020	0.436	1.09	39.7	7.14	1.26	5200
MW15-02AZ	11/07/15	0.0261	1.03	8.4	0.0135	3.85	33.2	0.31	0.0028	0.348	0.479	8.2	5.43	0.182	5040
MW15-40AZ	11/07/15	0.0244	1.01	7.1	0.0145	3.73	30.5	0.244	0.0029	0.352	0.539	26.8	5.16	0.185	5530
MW15-02AZ	12/08/15	0.049	1.12	6.8	0.01	4.03	34.8	8.32	0.0023	0.367	0.674	32.1	6.11	0.193	5380
MW15-02AZ	07/09/15	0.1	0.994	12.6	<0.0050	3.77	32.4	28.7	<0.0020	0.418	0.69	5.2	6.87	0.162	5560
MW15-02 WB/BH10-WB	01/06/15	0.154	1.44	324	0.311	3.73	34.6	94.1	<0.0020	1.17	2.54	8.1	8.43	0.344	5090
MW15-02WB	11/07/15	0.106	0.293	397	0.24	3.91	34.5	105	<0.0020	0.69	1.04	46.7	8.5	0.113	4910
MW15-02WB	12/08/15	0.13	0.248	412	0.362	4.57	36.9	110	<0.0020	0.708	1.24	27.9	9.07	0.139	5560
MW15-02WB	07/09/15	0.074	1.81	16.7	0.023	3.85	35.2	37.9	<0.0020	0.56	1.56	6.9	11	0.12	5200
MW15-03AZ	16/06/15	0.0612	1.39	30.1	0.0311	0.7	11.9	55.5	0.0067	0.442	1.05	22	1.82	0.045	5030
MW15-21	16/06/15	0.0589	1.28	23.5	0.0216	<0.50	11.8	56.1	<0.0020	0.444	1.06	4.4	1.84	0.052	5010
MW15-03AZ	09/07/15	0.0709	1.44	17.4	0.0129	0.56	11	214	<0.0020	0.465	1.25	7.9	1.82	<0.040	4670
MW15-03AZ	10/08/15	0.0583	1.94	23.3	0.0136	0.85	8.44	66.4	0.0028	0.497	1.1	40.9	1.59	0.055	4970
MW15-03AZ	04/09/15	0.058	1.99	14	<0.0050	0.8	8.27	105	0.0026	0.528	1.15	7	1.5	0.058	4690
MW15-03WB	16/06/15	0.187	0.232	533	0.0361	12.1	140	89.6	<0.0020	0.848	2.96	83	9.03	<0.040	8600
MW15-03WB	09/07/15	0.102	0.362	586	0.0656	10	132	76.1	<0.0020	0.916	1.64	47.8	8.14	0.108	7530
MW15-03WB	10/08/15	0.068	0.325	553	0.0308	12.1	133	76.5	<0.0020	0.817	1.6	37.3	8.14	0.073	8010
MW15-03WB	04/09/15	0.064	0.238	557	0.036	12	132	75.5	<0.0020	0.962	1.24	12.9	8.59	0.109	7010
MW15-04WB	14/06/15	0.221	2.15	23.1	0.491	6.88	36.9	118	<0.0020	2.58	0.934	49.6	4.65	0.43	5680
MW15-20	14/06/15	0.22	2.11	20.1	0.48	6.47	36.6	119	<0.0020	2.47	0.875	59.9	4.57	0.349	5790
MW15-04WB	10/07/15	0.255	1.18	21.1	0.293	6.04	36.7	121	<0.0020	2.41	1.17	39.6	4.3	0.153	5490
MW15-30WB	10/07/15	0.243	1.08	12.6	0.513	7.19	36.1	119	<0.0020	2.66	0.798	29.5	3.96	0.06	5560
MW15-04WB	11/08/15	0.241	2.85	43.1	0.293	7.01	39.4	110	<0.0020	2.57	1.58	119	4.9	0.477	5930
MW15-04WB	05/09/15	0.218	1.07	17	0.367	7.33	38.2	106	<0.0020	2.59	0.688	16.9	3.98	0.403	5440
MW15-05AZ	06/09/15	2.7	2.03	1360	0.06	<0.50	0.766	620	0.0057	0.276	1.33	21.1	0.123	0.052	6010
MW15-05WB	18/06/15	0.072	0.607	13.7	0.15	12.9	7.06	14.5	<0.0020	0.646	0.235	66.2	1.66	0.374	9670
MW15-05WB	10/07/15	0.125	0.551	47.5	0.104	11.7	7.08	7.43	<0.0020	0.969	2.26	91.6	1.45	0.444	8580
MW15-05WB	11/08/15	0.058	0.116	7.3	0.019	12.5	7.01	4.45	<0.0020	0.564	0.448	21.2	0.792	0.104	8980
MW15-60	11/08/15	0.0656	0.411	14.3	0.0281	12	7.3	4.9	<0.0020	0.631	0.489	59.8	0.857	0.111	9780
MW15-05WB	06/09/15	0.055	0.118	3.2	0.009	12.2	6.97	6.25	<0.0020	0.682	0.247	18.2	0.693	<0.040	9410
MW15-06WB	21/06/15	1.35	2.94	1610	0.663	7.09	16.7	850	1.54	16	6.06	83.9	10.4	0.47	5870
MW15-06WB	21/07/15	2.13	1.38	507	0.263	11.1	30.5	2300	0.091	34.5	4.18	99.8	7.22	0.475	7040
MW15-06WB	09/08/15	2.58	0.952	269	0.124	11.4	36.3	3410	0.281	42.6	3.34	54.1	6.51	0.414	6520
MW15-06WB	08/09/15	2.95	1.09	780	0.063	11.9	35.4	5430	0.0942	80.4	2.7	46.8	6.42	0.147	5550

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Sample ID	Sample Date	Total Silver (Ag)	Total Sodium (Na)	Total Strontium (Sr)	Total Sulphur (S)	Total Thallium (Tl)	Total Tin (Sn)	Total Titanium (Ti)	Total Uranium (U)	Total Vanadium (V)	Total Zinc (Zn)	Total Zirconium (Zr)	Dissolved Metals	Dissolved Aluminum (Al)
		ug/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L
MW14-05B	14/07/15	0.111	91.5	722	50.9	0.0486	0.83	13	18.4	1.55	34.5	0.42		28.5
MW14-05B	09/08/15	0.0406	112	693	59.9	0.0201	0.64	3.88	14.8	1.23	6.49	0.3		12.4
FB-4	08/09/15	<0.0050	<0.050	<0.050	<3.0	<0.0020	<0.20	<0.50	<0.0020	0.23	0.14	<0.10		0.67
MW14-05B	08/09/15	0.128	62.3	600	30.7	0.008	0.94	3.96	9.67	0.96	7.84	0.34		6.82
MW15-01WB/BH8-WB	07/06/15	0.01	26.2	3000	294	0.0347	<0.20	<0.50	490	<0.20	58	0.72		<0.50
MW15-01WB	08/07/15	<0.0050	26.8	2700	296	0.0172	<0.20	<0.50	542	<0.20	84.2	0.38		3.92
MW15-01WB	10/08/15	<0.0050	28.8	2700	304	0.0297	<0.20	3.26	548	<0.20	138	0.59		5.67
MW15-01WB	03/09/15	<0.0050	27.2	3020	316	0.045	<0.20	<0.50	598	<0.20	110	0.42		14.3
MW15-02 AZ/BH10-AZ	31/05/15	<0.0050	5.87	1260	83.1	0.0059	<0.20	<0.50	29.3	<0.20	1.01	0.16		3.65
MW15-02AZ	11/07/15	<0.0050	4.64	1060	55.9	0.0072	<0.20	<0.50	23.5	0.29	1.72	0.17		14.8
MW15-40AZ	11/07/15	<0.0050	4.38	981	50.7	0.0057	<0.20	<0.50	25.2	0.21	1.39	0.16		12.2
MW15-02AZ	12/08/15	<0.0050	5.05	959	56.1	0.0026	<0.20	<0.50	24.7	0.43	1.24	0.16		8.74
MW15-02AZ	07/09/15	<0.0050	4.77	996	58	0.003	<0.20	<0.50	27.7	<0.20	0.2	0.15		3.62
MW15-02 WB/BH10-WB	01/06/15	<0.0050	8.32	954	81.5	0.0071	<0.20	<0.50	36.4	<0.20	35.6	0.91		6.92
MW15-02WB	11/07/15	<0.0050	9.12	949	82.6	0.0164	<0.20	1.16	31.8	0.22	18.2	0.84		4.2
MW15-02WB	12/08/15	<0.0050	10.1	917	83.7	0.0057	<0.20	0.56	31	0.23	28.1	0.67		4.8
MW15-02WB	07/09/15	<0.0050	6.22	916	80.2	0.017	<0.20	<0.50	31.4	<0.20	10.2	0.13		1.92
MW15-03AZ	16/06/15	<0.0050	4	307	17.4	0.0028	<0.20	0.74	35.4	0.2	7.96	0.3		38.1
MW15-21	16/06/15	<0.0050	3.92	301	17.1	0.0029	<0.20	0.57	37	<0.20	0.71	0.28		30.5
MW15-03AZ	09/07/15	<0.0050	3.72	280	14.7	0.0023	<0.20	1.69	36.3	0.2	0.57	0.27		24.6
MW15-03AZ	10/08/15	0.0056	3.38	210	8	0.0052	<0.20	0.72	17.9	0.27	6.03	0.41		26.3
MW15-03AZ	04/09/15	<0.0050	3.29	212	7.6	0.003	<0.20	0.7	18.6	<0.20	0.37	0.4		18.6
MW15-03WB	16/06/15	<0.0050	76.5	9260	341	0.0172	<0.20	1.03	8.56	<0.20	16.5	0.11		35.6
MW15-03WB	09/07/15	0.0074	71	8840	310	0.006	<0.20	0.85	7.39	<0.20	27	0.1		7.69
MW15-03WB	10/08/15	<0.0050	71.9	8040	329	0.0061	<0.20	<0.50	8.51	<0.20	51.2	<0.10		3.72
MW15-03WB	04/09/15	<0.0050	73.9	9280	328	0.008	<0.20	<0.50	8.02	<0.20	46.3	<0.10		3.53
MW15-04WB	14/06/15	<0.0050	5.95	783	40.6	0.0116	<0.20	<0.50	176	0.25	44.6	0.26		44.1
MW15-20	14/06/15	<0.0050	5.98	789	40.9	0.0099	<0.20	0.57	176	0.26	42.5	0.27		44.1
MW15-04WB	10/07/15	0.0051	5.98	792	38.2	0.0093	<0.20	<0.50	170	0.29	17.9	0.27		21
MW15-30WB	10/07/15	0.0076	5.92	764	39.1	0.0105	<0.20	<0.50	192	0.29	3.3	0.24		3.2
MW15-04WB	11/08/15	<0.0050	6.4	788	41.7	0.0109	<0.20	0.82	157	0.33	122	0.24		11.3
MW15-04WB	05/09/15	<0.0050	6.05	846	43.2	0.01	<0.20	<0.50	167	0.21	23	0.24		3.47
MW15-05AZ	06/09/15	0.005	1.16	16.2	<3.0	0.008	<0.20	2.94	0.811	2.97	0.99	1.2		189
MW15-05WB	18/06/15	<0.0050	8.88	138	4	0.007	<0.20	<0.50	71.7	<0.20	64.7	<0.10		4.1
MW15-05WB	10/07/15	0.0078	9.11	140	3.9	0.0031	<0.20	1.24	69.5	0.21	102	<0.10		3.1
MW15-05WB	11/08/15	<0.0050	9.36	138	3.8	<0.0020	<0.20	<0.50	72.9	<0.20	20.3	<0.10		1.7
MW15-60	11/08/15	<0.0050	9.65	137	3.9	<0.0020	<0.20	0.69	73.3	<0.20	26.3	<0.10		23.1
MW15-05WB	06/09/15	<0.0050	9.16	145	4.2	<0.0020	<0.20	<0.50	76.9	<0.20	12.5	<0.10		4.49
MW15-06WB	21/06/15	0.228	21.9	246	15.4	0.061	0.2	41.9	46.1	1.98	269	0.67		888
MW15-06WB	21/07/15	0.0748	10.9	413	30.7	0.024	<0.20	16.1	96.5	0.5	604	0.65		8.4
MW15-06WB	09/08/15	0.0524	9.74	442	32.5	0.053	<0.20	7.78	103	0.49	172	0.81		7.18
MW15-06WB	08/09/15	0.036	8.43	444	33.6	0.033	<0.20	3.17	95	<0.20	85.1	0.62		67.5

Notes:

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1

Sample ID	Sample Date	Dissolved Antimony (Sb)	Dissolved Arsenic (As)	Dissolved Barium (Ba)	Dissolved Beryllium (Be)	Dissolved Bismuth (Bi)	Dissolved Boron (B)	Dissolved Cadmium (Cd)	Dissolved Calcium (Ca)	Dissolved Chromium (Cr)	Dissolved Cobalt (Co)	Dissolved Copper (Cu)	Dissolved Iron (Fe)	Dissolved Lead (Pb)
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L
MW14-05B	14/07/15	0.86	117	78	<0.10	<1.0	<50	0.031	42.7	<1.0	1.14	1.02	638	<0.20
MW14-05B	09/08/15	0.672	145	84.1	<0.010	<0.0050	25	0.017	46.6	0.31	1.25	0.293	1180	0.0283
FB-4	08/09/15	<0.020	<0.020	<0.020	<0.010	<0.0050	<10	<0.0050	<0.050	<0.10	<0.0050	<0.050	<1.0	<0.0050
MW14-05B	08/09/15	0.572	161	77.2	<0.010	<0.0050	11	<0.0050	46	0.47	1.25	0.122	1610	0.01
MW15-01WB/BH8-WB	07/06/15	0.808	23.9	11.1	0.033	<0.0050	<10	0.0141	266	<0.10	0.888	0.098	2.8	<0.0050
MW15-01WB	08/07/15	0.626	22.2	11.2	<0.010	<0.0050	<10	0.0485	244	<0.10	0.794	0.348	2.6	0.0235
MW15-01WB	10/08/15	0.395	29	9.93	0.022	0.0114	12	0.0607	228	<0.10	0.704	0.191	24.9	<0.0050
MW15-01WB	03/09/15	0.347	42.2	9.23	0.038	<0.0050	<10	0.046	250	0.94	0.664	0.413	558	0.225
MW15-02 AZ/BH10-AZ	31/05/15	0.435	1.1	91.7	<0.010	<0.0050	<10	0.009	135	0.14	0.207	1.28	4.9	<0.0050
MW15-02AZ	11/07/15	0.147	0.917	89.9	<0.010	<0.0050	<10	0.125	111	0.2	0.0388	1.34	10.7	0.021
MW15-40AZ	11/07/15	0.14	0.905	85.5	<0.010	<0.0050	<10	0.0283	110	0.15	0.0294	1.09	11.2	0.0085
MW15-02AZ	12/08/15	0.14	1.12	81.3	<0.010	<0.0050	<10	0.007	125	0.2	0.0699	1.33	9	0.0069
MW15-02AZ	07/09/15	0.145	0.978	71.5	<0.010	<0.0050	<10	<0.0050	101	<0.10	0.088	0.947	5.2	<0.0050
MW15-02 WB/BH10-WB	01/06/15	0.375	2.5	26.6	0.019	<0.0050	<10	0.042	144	1.92	0.184	0.692	362	0.312
MW15-02WB	11/07/15	0.123	1.92	22.7	<0.010	<0.0050	<10	0.0345	130	<0.10	0.0957	0.199	13.7	0.0078
MW15-02WB	12/08/15	0.143	2.48	23.5	<0.010	<0.0050	<10	0.0267	129	<0.10	0.135	0.249	3.9	0.0052
MW15-02WB	07/09/15	0.076	0.498	39.5	<0.010	<0.0050	<10	0.011	125	0.18	0.068	1.66	13.8	0.021
MW15-03AZ	16/06/15	0.153	0.431	37.9	<0.010	<0.0050	<10	0.012	40.6	0.16	0.0611	1.37	12.3	0.0196
MW15-21	16/06/15	0.158	0.411	39.7	<0.010	<0.0050	<10	0.0122	41.4	0.1	0.0597	1.54	11.1	<0.0050
MW15-03AZ	09/07/15	0.137	0.446	30.1	<0.010	<0.0050	<10	0.0258	38.7	0.21	0.0861	1.74	21.3	0.0257
MW15-03AZ	10/08/15	0.197	0.552	29.4	0.013	<0.0050	<10	0.0108	28.4	0.28	0.0601	1.98	19.5	0.0113
MW15-03AZ	04/09/15	0.178	0.477	24.5	0.011	<0.0050	<10	0.01	25.9	0.17	0.05	1.73	9.3	0.005
MW15-03WB	16/06/15	0.096	0.268	17.6	<0.010	<0.0050	42	<0.0050	172	<0.10	0.123	0.074	11.4	<0.0050
MW15-03WB	09/07/15	0.099	0.474	14.4	<0.010	<0.0050	33	0.0481	160	<0.10	0.0867	0.238	5.6	<0.0050
MW15-03WB	10/08/15	0.058	0.485	11.8	<0.010	0.0148	38	0.014	156	<0.10	0.0656	0.145	5.6	<0.0050
MW15-03WB	04/09/15	0.042	0.413	10.4	<0.010	<0.0050	29	0.01	160	0.22	0.055	0.087	569	0.02
MW15-04WB	14/06/15	3.02	1.54	33.3	<0.010	<0.0050	<10	0.0487	73.1	<0.10	0.221	2.26	6.4	0.337
MW15-20	14/06/15	2.87	1.51	32.4	<0.010	<0.0050	<10	0.0539	76.4	<0.10	0.227	2.12	8.9	0.32
MW15-04WB	10/07/15	2.97	1.37	31.9	<0.10	<1.0	<50	0.081	70	<1.0	<0.50	1.31	12.4	<0.20
MW15-30WB	10/07/15	3.05	1.32	32.3	<0.10	<1.0	<50	0.037	71.7	<1.0	<0.50	0.96	5.4	0.31
MW15-04WB	11/08/15	2.79	1.32	33.8	<0.010	<0.0050	<10	0.0999	78.8	<0.10	0.225	1.22	6.7	0.149
MW15-04WB	05/09/15	2.56	1.32	32.7	<0.010	<0.0050	<10	0.042	74.1	0.37	0.202	1.09	13	0.366
MW15-05AZ	06/09/15	0.084	2.28	18.8	0.026	0.005	<10	0.022	2.93	0.7	2.49	1.86	931	0.033
MW15-05WB	18/06/15	0.403	1.27	4	<0.010	<0.0050	<10	0.029	47.4	<0.10	0.037	0.363	2.3	0.013
MW15-05WB	10/07/15	<0.50	0.88	2.1	<0.10	<1.0	<50	0.019	42	<1.0	<0.50	<0.20	<5.0	<0.20
MW15-05WB	11/08/15	0.217	0.971	1.97	<0.010	<0.0050	<10	0.0159	44.5	<0.10	0.0571	0.083	2.7	0.0104
MW15-60	11/08/15	0.222	0.958	1.91	<0.010	<0.0050	<10	0.0159	44.7	<0.10	0.0451	0.102	3.3	0.0122
MW15-05WB	06/09/15	0.252	1.19	2.47	<0.010	<0.0050	<10	0.023	45.5	0.41	0.057	0.243	11.1	0.044
MW15-06WB	21/06/15	1.29	12.9	48	0.037	0.006	<10	0.046	49.1	1.99	1.43	2.89	1640	0.527
MW15-06WB	21/07/15	2.45	10.3	39.1	<0.010	<0.0050	<10	0.0131	65.6	<0.10	2.14	0.193	56.9	0.023
MW15-06WB	09/08/15	2.84	20.2	41.5	<0.010	<0.0050	<10	0.0217	71.8	<0.10	2.49	0.629	73.5	0.0172
MW15-06WB	08/09/15	0.764	25.8	56.1	<0.010	<0.0050	<10	0.037	82.5	0.66	3.22	1.23	849	0.098

Notes:

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Sample ID	Sample Date	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)	Dissolved Manganese (Mn)	Dissolved Mercury (Hg)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Phosphorus (P)	Dissolved Potassium (K)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)
		ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L
MW14-05B	14/07/15	32.8	6.6	685	<0.010	20	6.3		12.2	0.42	10200	<0.020	92.5	665
MW14-05B	09/08/15	34.3	7.71	933	0.0029	16.1	4.79	161	11.3	0.318	12700	<0.0050	116	701
FB-4	08/09/15	<0.50	<0.050	0.169	<0.0020	0.052	<0.020	3.2	<0.050	<0.040	<50	<0.0050	<0.050	<0.050
MW14-05B	08/09/15	34.2	8.4	1260	<0.0020	8.31	2.93	160	10	0.157	14400	<0.0050	62.1	596
MW15-01WB/BH8-WB	07/06/15	25.9	195	382	<0.0020	0.843	1.78	<2.0	5.27	0.091	7820	<0.0050	27.6	2990
MW15-01WB	08/07/15	25.8	194	375	<0.0020	1.04	2.31	6.4	5.53	0.126	7870	<0.0050	27.6	2690
MW15-01WB	10/08/15	25.7	185	372	<0.0020	0.936	2.24	68.3	5.19	0.075	7950	<0.0050	25.9	2660
MW15-01WB	03/09/15	22.8	186	357	<0.0020	1.01	2.38	20	5.43	0.11	8250	0.006	26.1	2770
MW15-02 AZ/BH10-AZ	31/05/15	4.35	42.5	21	<0.0020	0.436	1.26	7.1	7.41	1.1	5740	<0.0050	6.04	1150
MW15-02AZ	11/07/15	3.71	33.8	1	0.0028	0.354	0.682	36.3	5.36	0.169	5180	<0.0050	4.75	1070
MW15-40AZ	11/07/15	3.91	33.3	0.269	0.0029	0.343	0.552	11.2	5.39	0.177	5130	<0.0050	4.66	1070
MW15-02AZ	12/08/15	4.27	43.1	12.9	<0.0020	0.362	0.722	50.7	7.51	0.199	5020	<0.0050	6.09	1170
MW15-02AZ	07/09/15	4.22	31.8	28.5	<0.0020	0.38	0.649	4.1	6.65	0.161	5890	<0.0050	4.67	943
MW15-02 WB/BH10-WB	01/06/15	4.42	37.5	98.2	<0.0020	1.31	2.16	15.6	9.28	0.373	5880	<0.0050	9.45	932
MW15-02WB	11/07/15	3.64	32.7	101	<0.0020	0.68	0.885	17.3	7.96	0.102	5430	<0.0050	8.69	943
MW15-02WB	12/08/15	4.12	35.2	111	<0.0020	0.851	1.37	30.5	8.8	0.169	5140	<0.0050	9.4	952
MW15-02WB	07/09/15	4.45	35.2	36.4	<0.0020	0.525	1.46	5	10.8	0.126	5250	<0.0050	6.09	963
MW15-03AZ	16/06/15	1.33	12.1	55.2	<0.0020	0.451	1.08	26.8	1.78	0.052	5300	<0.0050	4.16	303
MW15-21	16/06/15	2.45	13.2	57.6	<0.0020	0.42	1.12	7.2	1.89	0.064	5810	<0.0050	4.37	319
MW15-03AZ	09/07/15	<0.50	10.9	225	<0.0020	0.47	1.4	78.8	1.86	0.041	4810	<0.0050	3.89	290
MW15-03AZ	10/08/15	0.77	8.75	67.7	0.0028	0.502	1.07	26.3	1.65	0.055	5050	<0.0050	3.39	220
MW15-03AZ	04/09/15	1.13	7.73	102	0.0026	0.467	1.02	5.5	1.53	0.044	5250	<0.0050	3.07	198
MW15-03WB	16/06/15	12.2	141	84.2	<0.0020	0.981	2.01	10.1	8.87	<0.040	10300	<0.0050	75.7	9250
MW15-03WB	09/07/15	10	130	78.9	<0.0020	1.04	1.56	52.8	8.97	0.432	6990	0.0069	71.1	9090
MW15-03WB	10/08/15	12.5	126	78.1	<0.0020	0.976	1.58	13.7	8.04	0.09	8060	0.006	68.4	8190
MW15-03WB	04/09/15	11.2	131	73.5	<0.0020	0.851	1.1	9.6	8.62	<0.040	8230	0.006	71.9	9210
MW15-04WB	14/06/15	7.37	37.7	115	<0.0020	2.55	0.804	23.8	4.16	0.246	6370	<0.0050	6.05	782
MW15-20	14/06/15	6.91	37.7	116	<0.0020	2.4	0.795	30.4	4.55	0.265	6270	<0.0050	5.96	794
MW15-04WB	10/07/15	6.7	36.7	123	<0.010	2.6	1.2		4.47	0.2	5550	<0.020	6.61	777
MW15-30WB	10/07/15	7	36.6	119	<0.010	2.3	<1.0		4.05	0.13	5680	<0.020	5.92	776
MW15-04WB	11/08/15	6.73	38.4	109	<0.0020	2.56	0.99	102	4.38	0.251	5890	<0.0050	6.15	783
MW15-04WB	05/09/15	6.98	37.4	105	<0.0020	2.6	0.986	21.8	4.43	0.335	6320	<0.0050	5.94	804
MW15-05AZ	06/09/15	0.69	0.747	617	0.0054	0.248	1.23	13.3	0.12	0.069	6040	<0.0050	1.14	15.4
MW15-05WB	18/06/15	14.2	8.02	13.4	<0.0020	0.698	0.217	66.7	1.8	0.372	10200	<0.0050	10.4	147
MW15-05WB	10/07/15	11.9	6.99	4.6	<0.010	<1.0	<1.0		0.964	0.12	8720	<0.020	9.06	138
MW15-05WB	11/08/15	13	7	5.36	<0.0020	0.635	0.345	42.4	1.07	0.138	8860	<0.0050	9.22	140
MW15-60	11/08/15	13	6.97	4.02	<0.0020	0.721	0.365	105	1.03	0.128	8910	<0.0050	9.16	140
MW15-05WB	06/09/15	12.1	7.9	7.09	<0.0020	1.85	0.607	44.4	1.33	0.102	9880	<0.0050	9.88	150
MW15-06WB	21/06/15	5.28	17.6	913	0.368	17.7	5.99	50.3	11.2	0.319	6380	0.22	23.3	301
MW15-06WB	21/07/15	8.36	32.9	2390	0.022	37.6	3.1	24.6	7.57	0.502	6540	<0.0050	11.9	417
MW15-06WB	09/08/15	10.7	33.4	3400	0.0544	45.6	2.72	7.1	6.27	0.349	6090	0.0113	9.08	434
MW15-06WB	08/09/15	12.4	39.9	5810	0.0952	87.4	3.44	46.4	7.18	0.172	6030	0.027	9.55	487

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Sample ID	Sample Date	Dissolved Sulphur (S)	Dissolved Thallium (Tl)	Dissolved Tin (Sn)	Dissolved Titanium (Ti)	Dissolved Uranium (U)	Dissolved Vanadium (V)	Dissolved Zinc (Zn)	Dissolved Zirconium (Zr)	Filter and HNO3 Preservation (Metals)
		mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
MW14-05B	14/07/15	51.7	<0.050	<5.0	<5.0	16.2	<5.0	16.5	<0.50	FIELD
MW14-05B	09/08/15	59.1	0.0124	0.34	<0.50	15.1	1.12	1.53	0.32	FIELD
FB-4	08/09/15	<3.0	<0.0020	<0.20	0.6	0.019	<0.20	0.1	<0.10	LAB
MW14-05B	08/09/15	31.7	<0.0020	0.3	<0.50	9.43	0.85	0.89	0.33	FIELD
MW15-01WB/BH8-WB	07/06/15	287	0.038	<0.20	<0.50	589	<0.20	53.9	0.69	LAB
MW15-01WB	08/07/15	294	0.0201	<0.20	<0.50	530	<0.20	128	0.49	LAB
MW15-01WB	10/08/15	295	0.0273	<0.20	<0.50	542	<0.20	167	0.53	LAB
MW15-01WB	03/09/15	310	0.036	<0.20	0.58	535	0.28	181	0.41	LAB
MW15-02 AZ/BH10-AZ	31/05/15	81.7	0.007	<0.20	<0.50	26.4	0.26	0.55	0.19	FIELD
MW15-02AZ	11/07/15	59.8	0.0059	<0.20	<0.50	23.9	0.29	8.64	0.19	FIELD
MW15-40AZ	11/07/15	59	0.0049	<0.20	<0.50	23.6	0.27	1.75	0.17	FIELD
MW15-02AZ	12/08/15	67.6	0.0044	<0.20	0.55	24.4	0.39	1.55	0.2	FIELD
MW15-02AZ	07/09/15	58.4	0.004	<0.20	<0.50	23.9	<0.20	0.8	0.13	FIELD
MW15-02 WB/BH10-WB	01/06/15	76	0.008	<0.20	0.91	37.4	0.31	36.8	0.76	LAB
MW15-02WB	11/07/15	82.3	0.0112	0.73	<0.50	31.9	<0.20	16.9	0.67	LAB
MW15-02WB	12/08/15	78.8	0.0057	<0.20	<0.50	33.2	<0.20	44.5	0.58	LAB
MW15-02WB	07/09/15	80.9	0.015	<0.20	<0.50	28.2	<0.20	10.1	0.13	LAB
MW15-03AZ	16/06/15	18	0.0024	<0.20	<0.50	35.4	<0.20	7.61	0.32	FIELD
MW15-21	16/06/15	18.2	<0.0020	<0.20	<0.50	37.4	<0.20	3.15	0.26	FIELD
MW15-03AZ	09/07/15	15	0.0021	<0.20	0.56	34.3	0.23	3.75	0.31	FIELD
MW15-03AZ	10/08/15	8.4	0.0045	<0.20	0.53	18.2	0.24	3.28	0.44	FIELD
MW15-03AZ	04/09/15	7.6	0.002	<0.20	<0.50	17.2	0.27	0.41	0.34	FIELD
MW15-03WB	16/06/15	348	<0.0020	<0.20	<0.50	8.4	<0.20	4.92	<0.10	LAB
MW15-03WB	09/07/15	294	0.0062	<0.20	<0.50	7.86	<0.20	47.5	<0.10	LAB
MW15-03WB	10/08/15	320	0.0061	<0.20	<0.50	9.09	<0.20	107	<0.10	LAB
MW15-03WB	04/09/15	309	0.007	<0.20	<0.50	7.57	<0.20	39.9	<0.10	LAB
MW15-04WB	14/06/15	45.9	0.0068	<0.20	<0.50	176	0.25	24	0.26	LAB
MW15-20	14/06/15	42.3	0.0078	<0.20	<0.50	176	0.25	29.4	0.26	LAB
MW15-04WB	10/07/15	44.9	<0.050	<5.0	<5.0	161	<5.0	35.9	<0.50	LAB
MW15-30WB	10/07/15	41.6	<0.050	<5.0	<5.0	169	<5.0	9.6	<0.50	LAB
MW15-04WB	11/08/15	41.3	0.0114	<0.20	<0.50	161	0.28	57.6	0.23	LAB
MW15-04WB	05/09/15	44.4	0.008	<0.20	<0.50	154	<0.20	42.7	0.21	LAB
MW15-05AZ	06/09/15	<3.0	0.008	<0.20	1.96	0.899	1.51	1.1	1.18	FIELD
MW15-05WB	18/06/15	4.6	0.009	<0.20	<0.50	70.9	<0.20	60.7	<0.10	LAB
MW15-05WB	10/07/15	4.5	<0.050	<5.0	<5.0	66.3	<5.0	37.8	<0.50	LAB
MW15-05WB	11/08/15	3.5	0.0027	<0.20	<0.50	70	<0.20	45.8	<0.10	LAB
MW15-60	11/08/15	3.6	<0.0020	<0.20	<0.50	71.6	<0.20	40.1	<0.10	LAB
MW15-05WB	06/09/15	4.4	<0.0020	<0.20	<0.50	74.8	<0.20	97	<0.10	LAB
MW15-06WB	21/06/15	16.7	0.0567	<0.20	43.5	54.8	2.07	162	0.69	LAB
MW15-06WB	21/07/15	33.2	0.0261	<0.20	<0.50	100	<0.20	253	0.46	LAB
MW15-06WB	09/08/15	31.1	0.0487	<0.20	<0.50	103	<0.20	20.9	0.62	LAB
MW15-06WB	08/09/15	36.9	0.034	0.24	3.7	100	<0.20	159	0.63	LAB

Notes:

Samples and sample data with RED text are not considered to be representative of formation water (See Appendix 5-D for discussion).

[1] Reportable detection limit (RDL) presented are the lowest reported detection limits for a given parameters, although in some cases the detection limit was raised by the analytical laboratory (e.g., due to sample matrix effects).

Appendix 5-B: Groundwater Quality Summary Statistics

GOLDCORP

Station		MW14-02A					MW14-02B					MW14-03A					MW14-03B					MW14-05A				
Lithology		Gniess					Schist					Schist					Schist					Granite				
Number of Samples		5					5					4					4					4				
Statistic		<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max
Field Parameters																										
pH (field)	pH	0	7.3	7.7	7.7	8.2	0	7.5	7.6	7.6	7.6	0	7.4	7.4	7.4	7.4	0	7.2	7.3	7.4	7.5	0	6.5	6.9	7.0	7.3
Specific Conductance (field)	uS/cm	0	350	380	380	400	0	480	500	500	510	0	1400	1500	1600	1600	0	1600	1700	1700	1700	0	330	360	360	380
DO (field)	mg/L	0	9.2	10	9.9	12	0	4.7	5.5	5.2	6.7	0	0.21	1.3	1.2	2.6	0	0.14	0.18	0.17	0.23	0	0.11	1.1	1.1	2.1
ORP (field)	ORP mV	0	47	130	150	210	0	-190	27	32	140	0	-150	-130	-140	-110	0	-110	-42	-53	48	0	-150	-96	-120	3.8
Temperature (field)	°C	0	0.50	1.3	1.4	1.8	0	0.60	1.7	1.6	3.2	0	0.90	1.2	1.1	1.9	0	0.99	1.2	1.1	1.4	0	0.90	1.5	1.6	1.9
Physical Properties																										
Conductivity (lab)	uS/cm	0	380	390	390	390	0	490	500	500	510	0	1500	1600	1600	1600	0	1700	1700	1700	1800	0	340	360	360	370
pH (lab)	pH	0	8.0	8.1	8.1	8.2	0	8.0	8.1	8.2	8.2	0	7.7	7.9	8.0	8.1	0	7.7	8.0	8.0	8.1	0	7.4	7.8	7.8	8.0
Total Hardness (CaCO3)	mg/L	0	180	210	200	260	0	190	250	260	280	0	860	880	880	900	0	900	970	970	1000	0	140	150	150	160
Dissolved Hardness (CaCO3)	mg/L	0	190	190	190	210	0	240	260	250	280	0	830	880	890	930	0	910	1000	1000	1100	0	140	150	150	150
Total Suspended Solids	mg/L	5	<1.0	1.4	1	<3.0	2	<1.0	3.8	3.0	7.1	0	23	25	24	31	0	3.5	4.5	4.5	5.4	0	5.2	8.1	8.7	9.8
Total Dissolved Solids	mg/L	0	180	230	220	260	0	250	320	330	370	0	1100	1100	1100	1200	0	1200	1300	1300	1400	0	190	220	220	260
Turbidity	NTU	1	<0.10	0.24	0.27	0.3	0	0.26	1.2	0.43	2.8	0	0.35	20	21	36	0	3.1	4.9	4.8	6.9	0	5.2	11	11	15
Inorganics																										
Alkalinity (Total as CaCO3)	mg/L	0	150	150	150	160	0	180	190	190	210	0	470	480	480	500	0	520	540	530	580	0	160	170	170	180
Alkalinity (PP as CaCO3)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Bicarbonate (HCO3)	mg/L	0	180	180	180	180	0	220	230	230	230	0	570	590	590	600	0	630	660	650	710	0	190	200	200	220
Carbonate (CO3)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Hydroxide (OH)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Bromide (Br)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (F)	mg/L	0	0.088	0.090	0.090	0.093	0	0.10	0.11	0.11	0.11	0	0.19	0.20	0.20	0.21	0	0.26	0.27	0.27	0.30	0	0.21	0.22	0.22	0.23
Dissolved Chloride (Cl)	mg/L	3	<0.50	0.55	0.50	0.70	3	<0.50	0.53	0.50	0.65	3	1.2	1.4	1.3	1.6	3	1.6	1.9	1.8	2.3	0	0.87	1.1	1.2	1.3
Organic / Inorganic Carbon																										
Dissolved Organic Carbon (C)	mg/L	1	<0.50	0.76	0.63	1.3	1	<0.50	0.92	0.87	1.6	1	3.5	4.9	4.3	7.5	1	2.4	3.4	3.2	4.8	0	4.4	5.1	5.1	6.0
Total Organic Carbon (C)	mg/L	1	<0.50	0.96	0.64	1.6	1	0.77	1.2	0.84	1.8	1	3.8	5.8	5.2	9.0	1	1.8	3.4	3.3	5.1	0	4.3	5.0	4.6	6.3
Anions and Nutrients																										
Total Phosphorus (P)	mg/L	0	0.0050	0.016	0.018	0.020	0	<0.0020	0.011	0.013	0.015	0	0.055	0.078	0.085	0.089	0	0.031	0.037	0.036	0.045	0	0.64	0.70	0.71	0.75
Dissolved Phosphorus (P)	mg/L	0	0.0075	0.015	0.016	0.019	0	0.0033	0.0083	0.0092	0.011	0	0.040	0.065	0.071	0.077	0	0.027	0.030	0.029	0.034	0	0.62	0.67	0.66	0.74
Total Ammonia (N)	mg/L	1	<0.0050	0.021	0.011	0.067	1	<0.0050	0.0094	0.0067	0.020	1	0.012	0.019	0.021	0.022	1	0.024	0.044	0.038	0.076	0	0.0078	0.033	0.012	0.10
Total Total Kjeldahl Nitrogen (Calc)	mg/L	3	<0.020	0.073	0.050	0.21	3	0.025	0.15	0.099	0.43	3	0.28	0.44	0.37	0.75	3	0.26	0.37	0.32	0.56	0	0.32	0.42	0.42	0.54
Nitrate plus Nitrite (N)	mg/L	0	0.14	0.16	0.16	0.17	0	0.10	0.11	0.11	0.11	0	<0.0020	0.0027	0.0026	0.0035	0	<0.0020	0.0034	0.0033	0.0048	1	<0.0020	0.0038	0.0036	0.0059
Nitrate (N)	mg/L	0	0.14	0.16	0.16	0.17	0	0.014	0.093	0.11	0.14	0	<0.0020	0.0023	0.0020	0.0031	0	<0.0020	0.0034	0.0033	0.0048	3	<0.0020	0.0021	0.0020	0.0023
Nitrite (N)	mg/L	5	<0.0010	0.0018	0.0020	<0.0020	5	0.0015	0.0019	0.0020	0.0022	5	<0.0020	0.0021	0.0020	0.0022	5	<0.0020	0.0020	0.0020	<0.0020	0	0.0021	0.0027	0.0023	0.0040
Total Nitrogen (N)	mg/L	0	0.15	0.21	0.17	0.38	0	0.13	0.24	0.16	0.53	0	0.28	0.45	0.37	0.75	0	0.26	0.37	0.32	0.56	0	0.33	0.43	0.42	0.54
Dissolved Nitrogen (N)	mg/L	0	0.35	0.35	0.35	0.35	0	0.16	0.16	0.16	0.16	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Sulphate (SO4)	mg/L	0	53	55	55	58	0	82	85	84	87	0	410	450	450	480	0	490	500	510	520	0	13	19	19	26
Sulphide	mg/L	1	<0.0020	0.0064	0.0063	0.011	1	<0.0020	0.0056	0.0061	0.0076	1	0.100	0.12	0.12	0.15	1	0.023	0.024	0.025	0.025	0	0.031	0.097	0.092	0.17
Total Metals																										
Total Aluminum (Al)	ug/L	0	3.7	20	13	60	0	6.3	14	13	22	0	5.3	11	7.6	25	0	4.4	16	17	26	0	23	75	80	120
Total Antimony (Sb)	ug/L	0	0.73	2.0	0.75	7.1	0	0.86	4.6	6.0	6.4	0	0.36	0.67	0.67	0.98	0	0.10	0.12	0.12	0.14	0	0.56	0.71	0.75	0.79
Total Arsenic (As)	ug/L	0	38	54	55	68	0	19	38	39	54	0	46	64	67	75	0	7.7	8.4	8.2	9.7	0	1700	1800	1800	1900
Total Barium (Ba)	ug/L	0	10	20	13	51	0	15	45	54	58	0	100	120	130	140	0	68	79	79	92	0	96	110	100	120
Total Beryllium (Be)	ug/L	4	<0.010	0.030	0.010	<0.10	4	<0.010	0.029	0.010	<0.10	4	0.012	0.014	0.013	0.018	4	<0.010	0.010	0.010	<0.010	0	0.023	0.026	0.026	0.030
Total Bismuth (Bi)	ug/L	4	<0.0050	0.11	0.0050	<0.50	4	<0.0050	0.10	0.0050	<0.50	4	<0.0050	0.0064	0.0063	0.0080	4	<0.0050	0.0075	0.0055	0.014	1	<0.0050	0.0083	0.0088	0.011
Total Boron (B)	ug/L	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10	4	<10	10	10	<10
Total Cadmium (Cd)	ug/L	5	<0.0050	0.0060	0.0050	<0.010	5	<0.0050	0.0076	0.0050	0.013	5	<0.0050	0.0059	0.0058	0.0070	5	0.051	0.070	0.062	0.11	0	0.015	0.040	0.037	0.071
Total Calcium (Ca)	mg/L	0	39	44	45	50	0	42	54	52	61	0	130	130	130	140	0	120	130	130	130	0	43	46	47	48
Total Chromium (Cr)	ug/L	0	0.22	0.47	0.51	0.65	0	<0.10	0.35	0.37	0.58	0	<0.10	0.14	0.10	0.27	0	<0.10	0.27	0.22	0.55	0	0.20	0.30	0.29	0.43
Total Cobalt (Co)	ug/L	0	0.019	0.60	0.033	2.8	0	0.039	1.1	1.5	1.8	0	1.5	1.9	1.9	2.4	0	6.8	6.9	6.9	6.9	0	0.89	1.0	0.99	1.1
Total Copper (Cu)	ug/L	2	<0.050	0.24	0.18	<0.50	2	0.14	0.49	0.50	0.98	2	0.44	0.67	0.68	0.89	2	2.4	3.9	3.9	5.4	0	0.47	1.8	1.8	3.2
Total Iron (Fe)	ug/L	1	1.1	18	14	42	1	<10	39	24	100	1	7700	8500	8400	9600	1	1100	1600	1500	2300	0	2100	2900	2900	3800
Total Lead (Pb)	ug/L	3	<0.0050	0.047	0.015	0.16	3	0.014	0.054	0.047	0.11	3	0.049	0.20	0.10	0.56	3	0.16	0.21	0.19	0.30	0	0.15	0.40	0.34	0.74
Total Lithium (Li)	ug/L	0	7.0	7.8	7.7	8.8	0	7.1	7.8	7.7	8.6	0	25	27	27	30	0	21	23	23	27	0	26	29	28	35
Total Magnesium (Mg)	mg/L	0	20	24	22	32	0	21	29	31	32	0	130	130	140	140	0	140	160	160	170	0	7.1	8.8	8.8	10
Total Manganese (Mn)	ug/L	0	2.6	140	7.7	690	0	11	420	560	710	0	750	830	790	960	0	3000	3100	3100	3200	0	1100	1300	1200	1600
Total Mercury (Hg)	ug/L	1	0.0032	0.0051	0.0041	<0.010	1	0.0035	0.0075	0.0054	0.017	1	0.011	0.019	0.019	0.028	1	0.017	0.025	0.025	0.031	2	<0.0020	0.0024	0.0022	0.0030
Total Molybdenum (Mo)	ug/L	0	3.1	4.4	3.6	7.5	0	3.5	5.7	6.1	6.9	0	2.9	4.2	4.3	5.2	0	7.0	8.0	8.2	8.8	0	3.7	4.2	4.2	4.9
Total Nickel (Ni)	ug/L	1	0.075	3.6	0.35	17	1	0.24	6.5	8.8	12	1	0.62	1.4	1.1	2.6	1	18	19	19	21	0	0.66	1.4	1.5	1.9
Total Phosphorus (P)	ug/L	1	7.3	21	11	<50	1	6.5	28	9.6	69	1	54	79	70	120	1	35	50	48	71	0	85	140	110	250
Total Potassium (K)	mg/L	0	2.7	3.2	3.3	3.8	0	3.0	3.5	3.6	3.7	0	8.4	8.7	8.7	9.0	0	7.5	8.1	8.2	8.5	0	5.1	6.0	5.4	8.0
Total Selenium (Se)	ug/L	0	0.24	0.26	0.27	0.28	0	0.23	0.28	0.27	0.34	0	<0.040	0.066	0.053	0.12	0	0.15	0.19	0.18	0.28	0	0.10	0.13	0.13	0.15
Total Silicon (Si)	ug/L	0	5600	6200	6400	6800	0	5800	6100	6200	6400	0	6100	6700	6800	7300	0	5400	5900	5900	6500	0	13000	14000	14000	14000
Total Silver (Ag)	ug/L	3	<0.0050	0.0078	0.0093	<0.010	3	<0.0050	0.0071	0.0054	0.011	3	<0.0050	0.0076	0.0069	0.012	3	0.033	0.041	0.034	0.063	0	0.0060	0.025	0.028	0.040
Total Sodium (Na)	mg/L	0	2.8	4.0	3.7	5.3	0	3.2	3.7	3.7	4.4	0	27	28	28	28	0	24	26	27	27	0	12	14	12	18
Total Strontium (Sr)	ug/L	0	330	390	380	510	0	380	460	470	510	0	4200	4500	4500	4800	0	2900	3100	3000	3500	0	320	380	350	500
Total Sulphur (S)	mg/L	0	15	19	19	27	0	18	25	26	29	0	150	160	170	170	0	160	180	180	200	0	5.6	7.1	7.0	8.6
Total Thallium (Tl)	ug/L	0	0.022	0.045	0.041	0.088	0	0.026	0.14	0.051	0.29	0	0.011	0.025	0.025	0.038	0	0.14	0.19	0.17	0.28	0	0.0020	0.013	0.015	0.021
Total Tin (Sn)	ug/L	5	<0.10	0.18	0.20	<0.20	5	<0.10	0.18	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	1	<0.20	0.27	0.20	0.47

Station		MW14-02A					MW14-02B					MW14-03A					MW14-03B					MW14-05A				
Lithology		**Gniess**					**Schist**					**Schist**					**Schist**					**Granite**				
Number of Samples		**5**					**5**					**4**					**4**					**4**				
Statistic		**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**
Total Titanium (Ti)	ug/L	3	<0.50	2.7	0.84	<10	3	<0.50	2.5	0.62	<10	3	<0.50	0.95	0.65	2.0	3	<0.50	0.67	0.61	0.95	0	1.1	2.4	2.4	3.9
Total Uranium (U)	ug/L	0	48	59	51	86	0	53	74	76	92	0	47	51	50	58	0	35	38	37	41	0	24	29	27	37
Total Vanadium (V)	ug/L	2	<0.20	0.44	0.29	<1.0	2	<0.20	0.40	0.24	<1.0	2	0.25	0.37	0.36	0.51	2	<0.20	0.23	0.22	0.29	1	<0.20	0.27	0.28	0.33
Total Zinc (Zn)	ug/L	1	0.33	1.8	2.1	<3.0	1	3.4	5.8	4.2	12	1	1.1	1.9	2.1	2.5	1	1.1	6.3	6.2	12	0	4.6	14	16	19
Total Zirconium (Zr)	ug/L	4	<0.10	0.10	0.10	<0.10	4	<0.10	0.10	0.10	<0.10	4	1.5	2.5	2.6	3.2	4	0.33	0.36	0.34	0.41	0	0.11	0.15	0.15	0.18
Dissolved Metals																										
Dissolved Aluminum (Al)	ug/L	0	4	10	8.7	17	0	1.0	4.6	2.2	15	0	3.4	20	13	53	0	2.8	11	11	19	0	4.0	11	8.4	24
Dissolved Antimony (Sb)	ug/L	0	0.7	0.76	0.72	0.92	0	3.3	5.7	6.0	6.6	0	0.31	0.65	0.64	1.0	0	0.087	0.10	0.097	0.13	0	0.41	0.56	0.57	0.69
Dissolved Arsenic (As)	ug/L	0	52	57	54	71	0	20	34	37	39	0	49	63	64	76	0	7.6	8.4	8.5	9.2	0	1500	1700	1700	1900
Dissolved Barium (Ba)	ug/L	0	9.9	13	13	14	0	41	50	52	58	0	98	120	120	140	0	62	81	81	99	0	93	100	100	120
Dissolved Beryllium (Be)	ug/L	5	<0.010	0.028	0.01	<0.10	5	<0.010	0.028	0.010	<0.10	5	<0.010	0.013	0.013	0.016	5	<0.010	0.010	0.010	<0.010	0	0.015	0.019	0.018	0.026
Dissolved Bismuth (Bi)	ug/L	5	<0.0050	0.1	0.005	<0.50	5	<0.0050	0.10	0.0050	<0.50	5	<0.0050	0.0050	0.0050	<0.0050	5	<0.0050	0.0070	0.0050	0.013	3	<0.0050	0.0060	0.0050	0.0089
Dissolved Boron (B)	ug/L	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	11	10	12	5	<10	11	10	12	4	<10	10	10	<10
Dissolved Cadmium (Cd)	ug/L	4	<0.0050	0.0062	0.005	<0.010	4	<0.0050	0.0066	0.0050	<0.010	4	<0.0050	0.019	0.0086	0.055	4	0.0080	0.028	0.020	0.063	3	<0.0050	0.0066	0.0050	0.012
Dissolved Calcium (Ca)	mg/L	0	40	44	46	46	0	52	55	52	62	0	120	130	140	140	0	130	130	130	140	0	43	45	45	47
Dissolved Chromium (Cr)	ug/L	0	0.45	0.5	0.49	0.6	0	<0.10	0.21	0.17	0.41	0	<0.10	0.18	0.16	0.30	0	<0.10	0.13	0.12	0.16	1	<0.10	0.15	0.15	0.20
Dissolved Cobalt (Co)	ug/L	0	0.014	0.044	0.036	0.11	0	0.62	1.5	1.5	2.5	0	1.3	1.9	1.9	2.5	0	6.1	7.0	7.1	7.6	0	0.74	0.92	0.89	1.2
Dissolved Copper (Cu)	ug/L	2	<0.050	0.17	0.2	0.31	2	<0.050	0.097	0.081	<0.20	2	0.068	0.58	0.30	1.7	2	0.49	1.0	1.0	1.6	0	0.053	0.39	0.17	1.2
Dissolved Iron (Fe)	ug/L	2	<1.0	11	10	27	2	1.5	6.7	7.3	<10	2	7300	8300	8200	9400	2	1000	1600	1600	2100	0	1900	2700	2700	3600
Dissolved Lead (Pb)	ug/L	3	<0.0050	0.022	0.021	<0.050	3	<0.0050	0.017	0.0098	<0.050	3	0.0060	0.096	0.11	0.16	3	0.022	0.049	0.048	0.080	0	0.0070	0.081	0.030	0.26
Dissolved Lithium (Li)	ug/L	0	6.5	7.5	7.7	8.1	0	6.8	7.3	7.5	7.6	0	27	29	29	32	0	21	24	24	27	0	28	30	29	34
Dissolved Magnesium (Mg)	mg/L	0	21	21	21	22	0	27	30	30	32	0	130	130	130	140	0	140	170	170	180	0	8.4	8.8	8.9	8.9
Dissolved Manganese (Mn)	ug/L	0	2.4	9	7.9	17	0	160	530	620	710	0	650	790	780	950	0	2900	3200	3300	3500	0	1100	1300	1300	1600
Dissolved Mercury (Hg)	ug/L	1	0.0025	0.0048	0.004	<0.010	1	<0.0020	0.0042	0.0027	<0.010	1	0.0021	0.0054	0.0049	0.0098	1	0.0028	0.0048	0.0048	0.0066	4	<0.0020	0.0020	0.0020	<0.0020
Dissolved Molybdenum (Mo)	ug/L	0	2.8	3.4	3.1	4.9	0	5.0	6.3	6.4	7.5	0	3.0	4.0	4.0	5.1	0	6.8	8.1	8.1	9.5	0	3.7	4.1	4.0	4.8
Dissolved Nickel (Ni)	ug/L	1	0.086	0.34	0.35	<0.50	1	2.5	9.2	9.3	15	1	0.34	1.2	1.1	2.4	1	17	19	19	22	0	0.54	1.1	1.3	1.4
Dissolved Phosphorus (P)	ug/L	1	7.4	27	13	53	1	5.2	37	7.5	120	1	43	90	88	140	1	29	47	44	70	0	84	100	100	120
Dissolved Potassium (K)	mg/L	0	2.9	3.1	2.9	3.6	0	3.3	3.5	3.6	3.7	0	8.3	8.6	8.3	9.4	0	7.7	8.4	8.4	9.2	0	5.3	6.0	5.7	7.1
Dissolved Selenium (Se)	ug/L	0	0.22	0.24	0.24	0.26	0	0.26	0.28	0.28	0.31	0	<0.040	0.055	0.042	0.097	0	0.12	0.17	0.16	0.25	0	0.068	0.086	0.086	0.10
Dissolved Silicon (Si)	ug/L	0	6100	6300	6200	6600	0	6100	6300	6300	6400	0	7100	7400	7200	8100	0	6000	6400	6200	7300	0	13000	14000	14000	15000
Dissolved Silver (Ag)	ug/L	3	<0.0050	0.0078	0.0053	0.014	3	<0.0050	0.0060	0.0050	<0.010	3	0.0079	0.0099	0.0091	0.014	3	0.0056	0.0096	0.0096	0.014	3	<0.0050	0.0051	0.0050	0.0054
Dissolved Sodium (Na)	mg/L	0	2.9	3.8	3.2	5.2	0	3.2	3.7	3.7	4.5	0	26	28	28	29	0	25	28	28	30	0	12	16	15	23
Dissolved Strontium (Sr)	ug/L	0	350	370	360	380	0	440	460	460	490	0	4400	4600	4500	5100	0	3000	3200	3200	3600	0	330	370	360	440
Dissolved Sulphur (S)	mg/L	0	17	18	18	19	0	25	27	27	29	0	150	160	160	180	0	160	190	200	200	0	5.1	7.0	6.7	9.4
Dissolved Thallium (Tl)	ug/L	0	0.022	0.038	0.041	0.056	0	0.025	0.13	0.078	0.27	0	0.0030	0.013	0.011	0.026	0	0.079	0.11	0.12	0.14	1	<0.0020	0.0067	0.0067	0.011
Dissolved Tin (Sn)	ug/L	5	<0.10	0.18	0.2	<0.20	5	<0.10	0.18	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	4	<0.20	0.20	0.20	<0.20
Dissolved Titanium (Ti)	ug/L	4	<0.50	2.4	0.5	<10	4	<0.50	2.4	0.50	<10	4	<0.50	0.57	0.55	0.69	4	<0.50	0.50	0.50	<0.50	3	<0.50	0.60	0.50	0.88
Dissolved Uranium (U)	ug/L	0	45	52	48	70	0	72	79	77	93	0	44	53	50	69	0	38	40	39	43	0	25	30	31	33
Dissolved Vanadium (V)	ug/L	3	<0.20	0.39	0.25	<1.0	3	<0.20	0.41	0.31	<1.0	3	<0.20	0.33	0.32	0.48	3	<0.20	0.22	0.21	0.26	3	<0.20	0.21	0.20	0.24
Dissolved Zinc (Zn)	ug/L	0	0.27	2.3	2.3	3.8	0	1.9	4.4	3.8	10	0	0.29	5.6	3.0	16	0	0.75	6.6	7.7	10	0	0.71	5.1	4.3	11
Dissolved Zirconium (Zr)	ug/L	4	<0.10	0.1	0.1	<0.10	4	<0.10	0.10	0.10	<0.10	4	2.4	3.0	3.0	3.4	4	0.33	0.39	0.39	0.44	1	<0.10	0.13	0.13	0.14

Notes:
Analytical results reported as <DL were set = DL for the calculation of mean and median values.
The sample collected at MW14-03A on Oct. 12, 2014 has been excluded from statistical calculations.
The sample collected at MW14-03B on Oct. 6, 2014 has been excluded from statistical calculations.
The sample collected at MW14-05A on Oct. 2, 2014 has been excluded from statistical calculations.
The sample collected at MW14-05B on Oct. 3, 2014 has been excluded from statistical calculations.
The sample collected at MW15-06WB on Jun. 21, 2015 has been excluded from statistical calculations.
DOC and TOC results for all samples collected at Westbay monitoring wells (MW15-01WB to MW15-06WB) have been excluded from statistical calculations.
DOC and TOC results for all samples collected at MW14-05B have been excluded from statistical calculations.

Station		**MW14-05B**					**MW15-01WB**					**MW15-02AZ**					**MW15-02WB**					**MW15-03AZ**				
Lithology		**Granite**					**Gniess**					**-**					**Schist**					**-**				
Number of Samples		**4**					**4**					**4**					**4**					**4**				
Statistic		**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**
Field Parameters																										
pH (field)	pH	0	7.2	7.5	7.6	7.7	0	6.8	7.1	7.0	7.9	0	7.3	7.4	7.5	7.5	0	7.3	7.4	7.4	7.5	0	6.6	6.9	7.0	7.1
Specific Conductance (field)	uS/cm	0	570	650	650	710	0	2200	2200	2200	2300	0	730	790	780	870	0	860	880	890	900	0	210	260	260	320
DO (field)	mg/L	0	0.44	1.6	0.71	4.5	0	6.8	7.9	8.0	9.0	0	6.4	7.2	7.1	8.2	0	5.3	7.3	7.5	9.2	0	0.34	0.88	0.87	1.4
ORP (field)	ORP mV	0	-91	-27	-58	100	0	23	31	33	38	0	21	64	45	140	0	-17	46	42	120	0	73	88	86	110
Temperature (field)	°C	0	1.4	3.0	2.9	4.6	0	3.4	6.0	5.8	9.2	0	1.1	1.5	1.5	2.0	0	3.2	4.4	3.9	6.7	0	1.7	2.3	2.4	2.8
Physical Properties																										
Conductivity (lab)	uS/cm	0	580	670	660	760	0	2100	2200	2200	2200	0	740	800	770	930	0	820	860	870	890	0	210	260	260	320
pH (lab)	pH	0	7.9	8.0	8.0	8.0	0	7.8	7.9	7.9	8.0	0	8.0	8.1	8.1	8.2	0	7.7	7.9	8.0	8.2	0	7.7	7.8	7.8	8.0
Total Hardness (CaCO3)	mg/L	0	140	150	150	150	0	1400	1400	1400	1500	0	390	430	410	490	0	460	470	460	490	0	99	120	120	150
Dissolved Hardness (CaCO3)	mg/L	0	130	140	140	150	0	1300	1400	1400	1500	0	380	430	410	510	0	460	470	460	510	0	97	120	120	150
Total Suspended Solids	mg/L	0	7.0	24	13	64	0	2.5	2.7	2.6	3.0	4	<1.0	1.0	1.0	<1.0	3	<1.0	1.0	1.0	1.1	4	<1.0	1.0	1.0	<1.0
Total Dissolved Solids	mg/L	0	400	470	450	580	0	1700	1800	1800	1900	0	480	530	510	640	0	600	620	620	640	0	140	170	170	220
Turbidity	NTU	0	7.9	17	12	38	0	3.5	4.7	4.7	5.9	1	<0.10	0.16	0.15	0.24	0	0.21	1.4	1.7	2.2	1	<0.10	0.29	0.27	0.51
Inorganics																										
Alkalinity (Total as CaCO3)	mg/L	0	180	190	190	200	0	550	560	560	570	0	230	240	240	260	0	210	230	230	250	0	80	95	95	110
Alkalinity (PP as CaCO3)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Bicarbonate (HCO3)	mg/L	0	220	230	240	240	0	670	680	680	690	0	280	300	290	320	0	250	280	290	300	0	98	120	120	130
Carbonate (CO3)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Hydroxide (OH)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Bromide (Br)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (F)	mg/L	0	0.28	0.36	0.37	0.41	0	0.044	0.055	0.058	0.060	0	0.088	0.099	0.099	0.11	0	0.12	0.18	0.19	0.21	0	0.048	0.057	0.058	0.063
Dissolved Chloride (Cl)	mg/L	3	3.1	5.0	5.4	5.9	3	0.69	0.99	0.78	1.7	3	0.50	0.83	0.86	1.1	3	<0.50	0.80	0.76	1.2	3	<0.50	0.69	0.74	0.78
Organic / Inorganic Carbon																										
Dissolved Organic Carbon (C)	mg/L	-	-	-	-	-	-	-	-	-	-	1	3.9	4.9	5.0	5.6	-	-	-	-	-	1	7.1	8.4	8.3	10
Total Organic Carbon (C)	mg/L	-	-	-	-	-	-	-	-	-	-	1	3.8	5.0	5.1	6.3	-	-	-	-	-	1	7.1	9.1	9.2	11
Anions and Nutrients																										
Total Phosphorus (P)	mg/L	0	0.21	0.22	0.22	0.25	0	0.014	0.048	0.033	0.11	0	<0.0050	0.0050	0.0050	<0.0050	0	<0.0050	0.026	0.0068	0.085	0	<0.0050	0.0050	0.0050	<0.0050
Dissolved Phosphorus (P)	mg/L	0	0.14	0.19	0.19	0.23	0	0.0041	0.012	0.013	0.018	0	<0.0050	0.0050	0.0050	<0.0050	0	0.0024	0.0041	0.0038	0.0062	0	<0.0050	0.0052	0.0050	0.0057
Total Ammonia (N)	mg/L	1	<0.0050	0.016	0.017	0.024	1	0.0052	0.013	0.015	0.016	1	<0.0050	0.014	0.013	0.025	1	0.011	0.015	0.015	0.018	1	0.0065	0.015	0.014	0.025
Total Total Kjeldahl Nitrogen (Calc)	mg/L	3	0.29	0.50	0.38	0.95	3	0.035	0.12	0.056	0.35	3	0.11	0.16	0.15	0.22	3	0.10	0.19	0.15	0.37	3	0.18	0.24	0.23	0.31
Nitrate plus Nitrite (N)	mg/L	0	<0.0020	0.0030	0.0027	0.0046	0	<0.0020	0.0027	0.0020	0.0048	0	0.23	0.42	0.47	0.53	0	<0.0020	0.037	0.0025	0.14	0	0.026	0.088	0.088	0.15
Nitrate (N)	mg/L	0	<0.0020	0.0020	0.0020	<0.0020	0	<0.0020	0.0027	0.0020	0.0048	0	0.23	0.44	0.48	0.54	0	<0.0020	0.036	0.0025	0.14	0	0.026	0.093	0.090	0.17
Nitrite (N)	mg/L	5	<0.0020	0.0028	0.0027	0.0037	5	<0.0020	0.0020	0.0020	<0.0020	5	<0.0020	0.0020	0.0020	<0.0020	5	<0.0020	0.0022	0.0020	0.0026	5	<0.0020	0.0020	0.0020	<0.0020
Total Nitrogen (N)	mg/L	0	0.29	0.50	0.38	0.95	0	0.040	0.13	0.056	0.35	0	0.38	0.59	0.65	0.69	0	0.13	0.23	0.20	0.37	0	0.21	0.32	0.32	0.46
Dissolved Nitrogen (N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0.24	0.24	0.24	0.24
Dissolved Sulphate (SO4)	mg/L	0	100	130	130	170	0	840	900	890	950	0	150	190	180	250	0	200	230	240	240	0	22	38	38	53
Sulphide	mg/L	1	<0.0050	0.065	0.067	0.12	1	<0.0050	0.0069	0.0066	0.0094	1	<0.0050	0.0058	0.0052	0.0077	1	0.0051	0.0065	0.0057	0.0095	1	<0.0050	0.0062	0.0063	0.0073
Total Metals																										
Total Aluminum (Al)	ug/L	0	69	360	220	950	0	4.2	18	8.5	49	0	7.0	8.6	8.7	10	0	1.8	9.9	7.5	23	0	19	31	29	47
Total Antimony (Sb)	ug/L	0	0.64	0.84	0.78	1.2	0	0.32	0.51	0.48	0.74	0	0.14	0.22	0.15	0.43	0	0.082	0.17	0.13	0.34	0	0.13	0.17	0.17	0.20
Total Arsenic (As)	ug/L	0	130	150	140	180	0	31	35	35	40	0	0.95	1.0	1.0	1.1	0	0.58	2.2	2.6	3.0	0	0.41	0.47	0.48	0.53
Total Barium (Ba)	ug/L	0	82	92	88	110	0	9.0	10	10	11	0	75	85	85	96	0	23	28	25	39	0	26	31	30	38
Total Beryllium (Be)	ug/L	4	<0.010	0.027	0.016	0.067	4	0.038	0.041	0.041	0.045	4	<0.010	0.010	0.010	<0.010	4	<0.010	0.012	0.012	0.015	4	<0.010	0.012	0.012	0.016
Total Bismuth (Bi)	ug/L	4	<0.0050	0.0092	0.0064	0.019	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050
Total Boron (B)	ug/L	5	11	17	15	26	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10
Total Cadmium (Cd)	ug/L	5	0.036	0.076	0.064	0.14	5	0.021	0.051	0.037	0.11	5	<0.0050	0.0085	0.0073	0.015	5	0.011	0.032	0.035	0.048	5	0.011	0.014	0.014	0.019
Total Calcium (Ca)	mg/L	0	43	46	46	49	0	220	250	250	280	0	100	110	110	130	0	130	130	130	130	0	26	34	34	41
Total Chromium (Cr)	ug/L	0	0.58	1.3	1.5	1.9	0	0.21	0.60	0.35	1.5	0	0.11	0.14	0.14	0.17	0	0.15	0.81	0.50	2.1	0	0.19	0.23	0.21	0.30
Total Cobalt (Co)	ug/L	0	1.4	1.7	1.6	2.2	0	0.70	0.78	0.77	0.88	0	0.026	0.090	0.075	0.19	0	0.074	0.12	0.12	0.15	0	0.058	0.062	0.060	0.071
Total Copper (Cu)	ug/L	2	2.1	6.0	4.2	13	2	0.30	0.56	0.53	0.86	2	0.99	1.1	1.1	1.2	2	0.25	0.95	0.87	1.8	2	1.4	1.7	1.7	2.0
Total Iron (Fe)	ug/L	1	970	1400	1300	1900	1	380	510	520	620	1	6.4	8.6	7.6	13	1	17	290	360	410	1	14	21	20	30
Total Lead (Pb)	ug/L	3	0.43	1.0	0.88	1.9	3	0.12	1.3	0.19	4.8	3	<0.0050	0.0095	0.0097	0.014	3	0.023	0.23	0.28	0.36	3	<0.0050	0.016	0.013	0.031
Total Lithium (Li)	ug/L	0	34	36	35	38	0	22	24	25	27	0	3.8	3.9	3.9	4.1	0	3.7	4.0	3.9	4.6	0	0.56	0.73	0.75	0.85
Total Magnesium (Mg)	mg/L	0	6.8	7.7	7.8	8.5	0	180	190	190	200	0	32	35	34	41	0	35	35	35	37	0	8.3	9.9	9.7	12
Total Manganese (Mn)	ug/L	0	610	880	830	1200	0	370	380	380	380	0	0.31	14	14	29	0	38	87	100	110	0	56	110	86	210
Total Mercury (Hg)	ug/L	1	0.0039	0.0053	0.0055	0.0062	1	<0.0020	0.0020	0.0020	<0.0020	1	<0.0020	0.0023	0.0022	0.0028	1	<0.0020	0.0020	0.0020	<0.0020	1	<0.0020	0.0035	0.0027	0.0067
Total Molybdenum (Mo)	ug/L	0	9.1	19	19	27	0	0.78	0.80	0.79	0.86	0	0.35	0.39	0.39	0.44	0	0.56	0.78	0.70	1.2	0	0.44	0.48	0.48	0.53
Total Nickel (Ni)	ug/L	1	4.2	6.9	6.6	10	1	1.7	2.0	2.0	2.4	1	0.48	0.73	0.68	1.1	1	1.0	1.6	1.4	2.5	1	1.1	1.1	1.1	1.3
Total Phosphorus (P)	ug/L	1	160	170	170	190	1	4.4	62	17	210	1	5.2	21	20	40	1	6.9	22	18	47	1	7.0	19	15	41
Total Potassium (K)	mg/L	0	10.0	12	12	14	0	5.0	5.1	5.1	5.3	0	5.4	6.4	6.5	7.1	0	8.4	9.3	8.8	11	0	1.5	1.7	1.7	1.8
Total Selenium (Se)	ug/L	0	0.17	0.33	0.38	0.41	0	0.070	0.49	0.12	1.7	0	0.16	0.45	0.19	1.3	0	0.11	0.18	0.13	0.34	0	<0.040	0.050	0.050	0.058
Total Silicon (Si)	ug/L	0	12000	13000	13000	14000	0	6800	8100	8400	9000	0	5000	5300	5300	5600	0	4900	5200	5100	5600	0	4700	4800	4800	5000
Total Silver (Ag)	ug/L	3	0.041	0.15	0.12	0.30	3	<0.0050	0.0063	0.0050	0.010	3	<0.0050	0.0050	0.0050	<0.0050	3	<0.0050	0.0050	0.0050	<0.0050	3	<0.0050	0.0052	0.0050	0.0056
Total Sodium (Na)	mg/L	0	62	85	82	110	0	26	27	27	29	0	4.6	5.1	4.9	5.9	0	6.2	8.4	8.7	10	0	3.3	3.6	3.6	4.0
Total Strontium (Sr)	ug/L	0	600	680	700	720	0	2700	2900	2900	3000	0	960	1100	1000	1300	0	920	930	930	950	0	210	250	250	310
Total Sulphur (S)	mg/L	0	31	46	46	60	0	290	300	300	320	0	56	63	57	83	0	80	82	82	84	0	7.6	12	11	17
Total Thallium (Tl)	ug/L	0	0.0080	0.049	0.034	0.12	0	0.017	0.032	0.032	0.045	0	0.0026	0.0047	0.0045	0.0072	0	0.0057	0.012	0.012	0.017	0	0.0023	0.0033	0.0029	0.0052
Total Tin (Sn)	ug/L	5	0.64	0.83	0.88	0.94	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20

Station		**MW14-05B**					**MW15-01WB**					**MW15-02AZ**					**MW15-02WB**					**MW15-03AZ**				
Lithology		**Granite**					**Gniess**					**-**					**Schist**					**-**				
Number of Samples		**4**					**4**					**4**					**4**					**4**				
Statistic		**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**
Total Titanium (Ti)	ug/L	3	3.9	18	8.5	50	3	<0.50	1.2	0.50	3.3	3	<0.50	0.50	0.50	<0.50	3	<0.50	0.68	0.53	1.2	3	0.70	0.96	0.73	1.7
Total Uranium (U)	ug/L	0	9.7	15	16	18	0	490	540	550	600	0	24	26	26	29	0	31	33	32	36	0	18	27	27	36
Total Vanadium (V)	ug/L	2	0.96	1.6	1.4	2.6	2	<0.20	0.20	0.20	<0.20	2	<0.20	0.28	0.25	0.43	2	<0.20	0.21	0.21	0.23	2	0.20	0.22	0.20	0.27
Total Zinc (Zn)	ug/L	1	6.5	21	21	35	1	58	98	97	140	1	0.20	1.0	1.1	1.7	1	10	23	23	36	1	0.37	3.7	3.3	8.0
Total Zirconium (Zr)	ug/L	4	0.30	0.41	0.38	0.59	4	0.38	0.53	0.51	0.72	4	0.15	0.16	0.16	0.17	4	0.13	0.64	0.76	0.91	4	0.27	0.35	0.35	0.41
Dissolved Metals																										
Dissolved Aluminum (Al)	ug/L	0	6.8	17	15	29	0	<0.50	6.1	4.8	14	0	3.6	7.7	6.2	15	0	1.9	4.5	4.5	6.9	0	19	27	25	38
Dissolved Antimony (Sb)	ug/L	0	0.57	0.82	0.77	1.2	0	0.35	0.54	0.51	0.81	0	0.14	0.22	0.15	0.44	0	0.076	0.18	0.13	0.38	0	0.14	0.17	0.17	0.20
Dissolved Arsenic (As)	ug/L	0	120	140	140	160	0	22	29	26	42	0	0.92	1.0	1.0	1.1	0	0.50	1.8	2.2	2.5	0	0.43	0.48	0.46	0.55
Dissolved Barium (Ba)	ug/L	0	77	81	81	84	0	9.2	10	11	11	0	72	84	86	92	0	23	28	25	40	0	25	30	30	38
Dissolved Beryllium (Be)	ug/L	5	<0.010	0.033	0.010	<0.10	5	<0.010	0.026	0.028	0.038	5	<0.010	0.010	0.010	<0.010	5	<0.010	0.012	0.010	0.019	5	<0.010	0.011	0.011	0.013
Dissolved Bismuth (Bi)	ug/L	5	<0.0050	0.25	0.0050	<1.0	5	<0.0050	0.0066	0.0050	0.011	5	<0.0050	0.0050	0.0050	<0.0050	5	<0.0050	0.0050	0.0050	<0.0050	5	<0.0050	0.0050	0.0050	<0.0050
Dissolved Boron (B)	ug/L	5	11	25	19	<50	5	<10	11	10	12	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10
Dissolved Cadmium (Cd)	ug/L	4	<0.0050	0.024	0.024	0.042	4	0.014	0.042	0.047	0.061	4	<0.0050	0.037	0.0080	0.13	4	0.011	0.029	0.031	0.042	4	0.010	0.015	0.011	0.026
Dissolved Calcium (Ca)	mg/L	0	43	45	46	47	0	230	250	250	270	0	100	120	120	140	0	130	130	130	140	0	26	33	34	41
Dissolved Chromium (Cr)	ug/L	0	0.17	0.49	0.39	<1.0	0	<0.10	0.31	0.10	0.94	0	<0.10	0.16	0.17	0.20	0	<0.10	0.58	0.14	1.9	0	0.16	0.21	0.19	0.28
Dissolved Cobalt (Co)	ug/L	0	0.96	1.1	1.2	1.3	0	0.66	0.76	0.75	0.89	0	0.039	0.10	0.079	0.21	0	0.068	0.12	0.12	0.18	0	0.050	0.064	0.061	0.086
Dissolved Copper (Cu)	ug/L	2	0.12	0.98	0.66	2.5	2	0.098	0.26	0.27	0.41	2	0.95	1.2	1.3	1.3	2	0.20	0.70	0.47	1.7	2	1.4	1.7	1.7	2.0
Dissolved Iron (Fe)	ug/L	2	69	870	910	1600	2	2.6	150	14	560	2	4.9	7.5	7.1	11	2	3.9	98	14	360	2	9.3	16	16	21
Dissolved Lead (Pb)	ug/L	3	0.010	0.079	0.054	<0.20	3	<0.0050	0.065	0.014	0.23	3	<0.0050	0.0095	0.0060	0.021	3	0.0052	0.087	0.014	0.31	3	0.0050	0.015	0.015	0.026
Dissolved Lithium (Li)	ug/L	0	33	34	34	36	0	23	25	26	26	0	3.7	4.1	4.2	4.4	0	3.6	4.2	4.3	4.5	0	<0.50	0.93	0.95	1.3
Dissolved Magnesium (Mg)	mg/L	0	6.3	7.2	7.2	8.4	0	190	190	190	200	0	32	38	38	43	0	33	35	35	38	0	7.7	9.9	9.8	12
Dissolved Manganese (Mn)	ug/L	0	410	820	810	1300	0	360	370	370	380	0	1.0	16	17	29	0	36	87	100	110	0	55	110	85	230
Dissolved Mercury (Hg)	ug/L	1	<0.0020	0.0042	0.0025	<0.010	1	<0.0020	0.0020	0.0020	<0.0020	1	<0.0020	0.0022	0.0020	0.0028	1	<0.0020	0.0020	0.0020	<0.0020	1	<0.0020	0.0024	0.0023	0.0028
Dissolved Molybdenum (Mo)	ug/L	0	8.3	18	18	29	0	0.84	0.96	0.97	1.0	0	0.35	0.38	0.37	0.44	0	0.53	0.84	0.77	1.3	0	0.45	0.47	0.47	0.50
Dissolved Nickel (Ni)	ug/L	1	2.9	5.3	5.5	7.2	1	1.8	2.2	2.3	2.4	1	0.65	0.83	0.70	1.3	1	0.89	1.5	1.4	2.2	1	1.0	1.1	1.1	1.4
Dissolved Phosphorus (P)	ug/L	1	110	140	160	160	1	<2.0	24	13	68	1	4.1	25	22	51	1	5.0	17	16	31	1	5.5	34	27	79
Dissolved Potassium (K)	mg/L	0	10	12	12	14	0	5.2	5.4	5.4	5.5	0	5.4	6.7	7.0	7.5	0	8.0	9.2	9.0	11	0	1.5	1.7	1.7	1.9
Dissolved Selenium (Se)	ug/L	0	0.16	0.33	0.37	0.42	0	0.075	0.10	0.10	0.13	0	0.16	0.41	0.18	1.1	0	0.10	0.19	0.15	0.37	0	0.041	0.048	0.048	0.055
Dissolved Silicon (Si)	ug/L	0	10000	12000	12000	14000	0	7800	8000	7900	8300	0	5000	5500	5500	5900	0	5100	5400	5300	5900	0	4800	5100	5200	5300
Dissolved Silver (Ag)	ug/L	3	<0.0050	0.0092	0.0059	<0.020	3	<0.0050	0.0053	0.0050	0.0060	3	<0.0050	0.0050	0.0050	<0.0050	3	<0.0050	0.0050	0.0050	<0.0050	3	<0.0050	0.0050	0.0050	<0.0050
Dissolved Sodium (Na)	mg/L	0	62	87	84	120	0	26	27	27	28	0	4.7	5.4	5.4	6.1	0	6.1	8.4	9.0	9.5	0	3.1	3.6	3.6	4.2
Dissolved Strontium (Sr)	ug/L	0	600	670	680	720	0	2700	2800	2700	3000	0	940	1100	1100	1200	0	930	950	950	960	0	200	250	260	300
Dissolved Sulphur (S)	mg/L	0	32	46	46	59	0	290	300	290	310	0	58	67	64	82	0	76	80	80	82	0	7.6	12	12	18
Dissolved Thallium (Tl)	ug/L	0	<0.0020	0.028	0.029	<0.050	0	0.020	0.030	0.032	0.038	0	0.0040	0.0053	0.0052	0.0070	0	0.0057	0.0100	0.0096	0.015	0	0.0020	0.0028	0.0023	0.0045
Dissolved Tin (Sn)	ug/L	5	0.30	1.5	0.37	<5.0	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.33	0.20	0.73	5	<0.20	0.20	0.20	<0.20
Dissolved Titanium (Ti)	ug/L	4	<0.50	1.7	0.69	<5.0	4	<0.50	0.52	0.50	0.58	4	<0.50	0.51	0.50	0.55	4	<0.50	0.60	0.50	0.91	4	<0.50	0.52	0.52	0.56
Dissolved Uranium (U)	ug/L	0	9.4	14	16	16	0	530	550	540	590	0	24	25	24	26	0	28	33	33	37	0	17	26	26	35
Dissolved Vanadium (V)	ug/L	3	0.85	2.1	1.2	<5.0	3	<0.20	0.22	0.20	0.28	3	<0.20	0.29	0.28	0.39	3	<0.20	0.23	0.20	0.31	3	<0.20	0.24	0.24	0.27
Dissolved Zinc (Zn)	ug/L	0	0.89	5.8	2.9	17	0	54	130	150	180	0	0.55	2.9	1.2	8.6	0	10	27	27	45	0	0.41	3.8	3.5	7.6
Dissolved Zirconium (Zr)	ug/L	4	0.25	0.35	0.33	<0.50	4	0.41	0.53	0.51	0.69	4	0.13	0.18	0.19	0.20	4	0.13	0.54	0.63	0.76	4	0.31	0.35	0.33	0.44

Notes:
Analytical results reported as <DL were set = DL for the calculation of mean and median values.
The sample collected at MW14-03A on Oct. 12, 2014 has been excluded from statistical calculations.
The sample collected at MW14-03B on Oct. 6, 2014 has been excluded from statistical calculations.
The sample collected at MW14-05A on Oct. 2, 2014 has been excluded from statistical calculations.
The sample collected at MW14-05B on Oct. 3, 2014 has been excluded from statistical calculations.
The sample collected at MW15-06WB on Jun. 21, 2015 has been excluded from statistical calculations.
DOC and TOC results for all samples collected at Westbay monitoring wells (MW15-01WB to MW15-06WB) have been excluded from statistical calculations.
DOC and TOC results for all samples collected at MW14-05B have been excluded from statistical calculations.

Station		MW15-03WB					MW15-04WB					MW15-05AZ					MW15-05WB					MW15-06WB				
Lithology		Gniess					Gniess					-					Granite					Gniess				
Number of Samples		4					5					1					4					3				
Statistic		<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max	<DL	Min	Mean	Median	Max
Field Parameters																										
pH (field)	pH	0	7.4	7.5	7.5	7.7	0	6.3	7.3	7.3	8.3	0	5.8	5.8	5.8	5.8	0	6.6	7.3	7.5	7.6	0	7.7	7.8	7.7	8.0
Specific Conductance (field)	uS/cm	0	1900	1900	1900	2000	0	650	670	670	690	0	28	28	28	28	0	290	300	300	310	0	600	630	610	670
DO (field)	mg/L	0	6.1	8.0	8.7	9.3	0	4.8	9.1	9.5	13	0	7.9	7.9	7.9	7.9	0	10.0	12	12	13	0	6.1	7.3	6.7	9.2
ORP (field)	ORP mV	0	-27	-1.4	7.1	16	0	73	130	130	190	0	98	98	98	98	0	0.20	77	57	190	0	-50	-28	-26	-8.7
Temperature (field)	°C	0	4.2	5.3	4.7	7.6	0	3.2	5.4	5.8	7.4	0	1.1	1.1	1.1	1.1	0	4.0	5.5	5.0	8.0	0	4.6	5.7	4.9	7.7
Physical Properties																										
Conductivity (lab)	uS/cm	0	1800	1900	1900	1900	0	640	660	660	670	0	28	28	28	28	0	290	290	290	300	0	610	640	640	660
pH (lab)	pH	0	8.0	8.0	8.0	8.0	0	8.1	8.1	8.1	8.3	0	6.8	6.8	6.8	6.8	0	8.0	8.0	8.0	8.2	0	8.0	8.0	8.0	8.2
Total Hardness (CaCO3)	mg/L	0	920	950	930	1000	0	330	330	330	350	0	10.0	10.0	10.0	10.0	0	130	140	130	140	0	290	320	330	340
Dissolved Hardness (CaCO3)	mg/L	0	910	950	940	1000	0	330	340	340	360	0	10	10	10	10	0	130	140	140	150	0	300	330	320	370
Total Suspended Solids	mg/L	0	1.7	2.5	2.4	3.6	5	<1.0	1.0	1.0	<1.0	0	1.5	1.5	1.5	1.5	4	<1.0	1.0	1.0	<1.0	0	2.3	3.5	3.7	4.6
Total Dissolved Solids	mg/L	0	1400	1500	1500	1700	0	400	430	440	450	0	22	22	22	22	0	160	180	180	190	0	330	380	380	420
Turbidity	NTU	0	3.8	4.4	4.5	4.9	1	<0.10	0.16	0.14	0.24	0	11	11	11	11	1	<0.10	0.39	0.22	1.0	0	3.2	4.4	3.2	7.0
Inorganics																										
Alkalinity (Total as CaCO3)	mg/L	0	150	150	150	150	0	230	230	230	230	0	9.1	9.1	9.1	9.1	0	140	140	140	150	0	220	240	240	260
Alkalinity (PP as CaCO3)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Bicarbonate (HCO3)	mg/L	0	180	180	180	190	0	280	280	280	290	0	11	11	11	11	0	170	170	170	180	0	270	290	290	320
Carbonate (CO3)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Hydroxide (OH)	mg/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50	4	<0.50	0.50	0.50	<0.50
Bromide (Br)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (F)	mg/L	0	0.13	0.14	0.14	0.15	0	0.096	0.11	0.11	0.11	0	0.036	0.036	0.036	0.036	0	0.26	0.29	0.29	0.30	0	0.073	0.088	0.082	0.11
Dissolved Chloride (Cl)	mg/L	3	8.7	9.0	9.0	9.1	3	<0.50	0.64	0.67	0.84	3	0.52	0.52	0.52	0.52	3	<0.50	0.60	0.57	0.75	3	1.5	1.8	1.7	2.1
Organic / Inorganic Carbon																										
Dissolved Organic Carbon (C)	mg/L	-	-	-	-	-	-	-	-	-	-	1	13	13	13	13	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon (C)	mg/L	-	-	-	-	-	-	-	-	-	-	1	13	13	13	13	-	-	-	-	-	-	-	-	-	-
Anions and Nutrients																										
Total Phosphorus (P)	mg/L	0	<0.0050	0.033	0.019	0.090	0	<0.0050	0.025	0.0050	0.11	0	0.025	0.025	0.025	0.025	0	0.012	0.057	0.070	0.076	0	0.025	0.036	0.032	0.052
Dissolved Phosphorus (P)	mg/L	0	0.0032	0.021	0.020	0.039	0	0.0043	0.024	0.0069	0.095	0	0.013	0.013	0.013	0.013	0	0.013	0.023	0.022	0.036	0	0.027	0.035	0.031	0.046
Total Ammonia (N)	mg/L	1	0.0093	0.25	0.026	0.92	1	0.015	0.019	0.019	0.022	1	0.61	0.61	0.61	0.61	1	<0.0050	0.042	0.011	0.14	1	0.047	0.13	0.098	0.23
Total Total Kjeldahl Nitrogen (Calc)	mg/L	3	0.036	0.16	0.073	0.45	3	0.044	0.11	0.088	<0.20	3	0.77	0.77	0.77	0.77	3	0.027	0.13	0.084	0.32	3	0.60	1.4	1.3	2.4
Nitrate plus Nitrite (N)	mg/L	0	<0.0020	0.0037	0.0025	0.0076	0	0.081	0.16	0.16	0.24	0	0.012	0.012	0.012	0.012	0	<0.0020	0.0021	0.0020	0.0022	0	<0.0020	0.0023	0.0020	0.0028
Nitrate (N)	mg/L	0	<0.0020	0.0037	0.0025	0.0076	0	0.070	0.15	0.14	0.23	0	0.010	0.010	0.010	0.010	0	<0.0020	0.0023	0.0020	0.0031	0	<0.0020	0.0020	0.0020	<0.0020
Nitrite (N)	mg/L	5	<0.0020	0.0020	0.0020	<0.0020	5	0.0065	0.011	0.011	0.017	5	0.0020	0.0020	0.0020	0.0020	5	<0.0020	0.0020	0.0020	<0.0020	5	<0.0020	0.0025	0.0024	0.0030
Total Nitrogen (N)	mg/L	0	0.044	0.16	0.074	0.45	0	0.18	0.23	0.23	0.30	0	0.78	0.78	0.78	0.78	0	0.082	0.18	0.16	0.32	0	0.60	1.4	1.3	2.4
Dissolved Nitrogen (N)	mg/L	0	0.23	0.23	0.23	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Sulphate (SO4)	mg/L	0	870	930	940	950	0	120	130	130	130	0	<0.50	0.50	0.50	<0.50	0	12	13	12	14	0	100	110	110	120
Sulphide	mg/L	1	<0.0050	0.0070	0.0051	0.013	1	<0.0050	0.0069	0.0072	0.0088	1	<0.0050	0.0050	0.0050	<0.0050	1	<0.0050	0.0067	0.0064	0.0091	1	0.0069	0.011	0.011	0.013
Total Metals																										
Total Aluminum (Al)	ug/L	0	6.9	25	20	55	0	5.8	11	7.8	24	0	200	200	200	200	0	1.4	10	4.8	30	0	59	160	150	280
Total Antimony (Sb)	ug/L	0	0.046	0.068	0.068	0.091	0	2.7	2.9	2.9	3.4	0	0.088	0.088	0.088	0.088	0	0.19	0.28	0.28	0.37	0	0.67	1.9	2.3	2.6
Total Arsenic (As)	ug/L	0	0.45	0.58	0.57	0.72	0	1.2	1.4	1.4	1.7	0	3.0	3.0	3.0	3.0	0	0.89	1.1	1.1	1.3	0	13	19	21	23
Total Barium (Ba)	ug/L	0	10	13	13	17	0	33	36	35	38	0	19	19	19	19	0	1.0	3.0	2.8	5.4	0	39	45	42	53
Total Beryllium (Be)	ug/L	4	0.010	0.012	0.011	0.017	4	<0.010	0.010	0.010	0.012	4	0.030	0.030	0.030	0.030	4	<0.010	0.010	0.010	<0.010	4	<0.010	0.010	0.010	<0.010
Total Bismuth (Bi)	ug/L	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050	4	<0.0050	0.0050	0.0050	<0.0050
Total Boron (B)	ug/L	5	18	26	28	31	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10	5	<10	10	10	<10
Total Cadmium (Cd)	ug/L	5	0.0096	0.019	0.020	0.026	5	0.035	0.065	0.061	0.13	5	0.022	0.022	0.022	0.022	5	<0.0050	0.032	0.027	0.068	5	0.026	0.043	0.041	0.064
Total Calcium (Ca)	mg/L	0	150	160	160	180	0	69	72	71	76	0	2.7	2.7	2.7	2.7	0	41	43	42	44	0	65	71	73	75
Total Chromium (Cr)	ug/L	0	0.30	0.72	0.61	1.4	0	0.12	0.41	0.30	1.0	0	0.80	0.80	0.80	0.80	0	0.13	0.90	0.40	2.7	0	0.59	1.2	1.1	1.9
Total Cobalt (Co)	ug/L	0	0.064	0.11	0.085	0.19	0	0.22	0.24	0.24	0.26	0	2.7	2.7	2.7	2.7	0	0.055	0.078	0.065	0.13	0	2.1	2.6	2.6	3.0
Total Copper (Cu)	ug/L	2	0.23	0.29	0.28	0.36	2	1.1	1.7	1.2	2.9	2	2.0	2.0	2.0	2.0	2	0.12	0.35	0.33	0.61	2	0.95	1.1	1.1	1.4
Total Iron (Fe)	ug/L	1	530	560	560	590	1	13	23	21	43	1	1400	1400	1400	1400	1	3.2	18	11	48	1	270	520	510	780
Total Lead (Pb)	ug/L	3	0.031	0.042	0.036	0.066	3	0.29	0.39	0.37	0.51	3	0.060	0.060	0.060	0.060	3	0.0090	0.071	0.062	0.15	3	0.063	0.15	0.12	0.26
Total Lithium (Li)	ug/L	0	10	12	12	12	0	6.0	6.9	7.0	7.3	0	<0.50	0.50	0.50	<0.50	0	12	12	12	13	0	11	11	11	12
Total Magnesium (Mg)	mg/L	0	130	130	130	140	0	36	37	37	39	0	0.77	0.77	0.77	0.77	0	7.0	7.0	7.0	7.1	0	31	34	35	36
Total Manganese (Mn)	ug/L	0	76	79	76	90	0	110	110	120	120	0	620	620	620	620	0	4.5	8.2	6.8	15	0	2300	3700	3400	5400
Total Mercury (Hg)	ug/L	1	<0.0020	0.0020	0.0020	<0.0020	1	<0.0020	0.0020	0.0020	<0.0020	1	0.0057	0.0057	0.0057	0.0057	1	<0.0020	0.0020	0.0020	<0.0020	1	0.091	0.16	0.094	0.28
Total Molybdenum (Mo)	ug/L	0	0.82	0.89	0.88	0.96	0	2.4	2.6	2.6	2.7	0	0.28	0.28	0.28	0.28	0	0.56	0.72	0.66	0.97	0	35	53	43	80
Total Nickel (Ni)	ug/L	1	1.2	1.9	1.6	3.0	1	0.69	1.0	0.93	1.6	1	1.3	1.3	1.3	1.3	1	0.24	0.80	0.35	2.3	1	2.7	3.4	3.3	4.2
Total Phosphorus (P)	ug/L	1	13	45	43	83	1	17	51	40	120	1	21	21	21	21	1	18	49	44	92	1	47	67	54	100
Total Potassium (K)	mg/L	0	8.1	8.5	8.4	9.0	0	4.0	4.4	4.3	4.9	0	0.12	0.12	0.12	0.12	0	0.69	1.1	1.1	1.7	0	6.4	6.7	6.5	7.2
Total Selenium (Se)	ug/L	0	<0.040	0.083	0.091	0.11	0	0.060	0.30	0.40	0.48	0	0.052	0.052	0.052	0.052	0	<0.040	0.24	0.24	0.44	0	0.15	0.35	0.41	0.48
Total Silicon (Si)	ug/L	0	7000	7800	7800	8600	0	5400	5600	5600	5900	0	6000	6000	6000	6000	0	8600	9200	9200	9700	0	5600	6400	6500	7000
Total Silver (Ag)	ug/L	3	<0.0050	0.0056	0.0050	0.0074	3	<0.0050	0.0055	0.0050	0.0076	3	0.0050	0.0050	0.0050	0.0050	3	<0.0050	0.0057	0.0050	0.0078	3	0.036	0.054	0.052	0.075
Total Sodium (Na)	mg/L	0	71	73	73	77	0	5.9	6.1	6.0	6.4	0	1.2	1.2	1.2	1.2	0	8.9	9.1	9.1	9.4	0	8.4	9.7	9.7	11
Total Strontium (Sr)	ug/L	0	8000	8900	9100	9300	0	760	790	790	850	0	16	16	16	16	0	140	140	140	150	0	410	430	440	440
Total Sulphur (S)	mg/L	0	310	330	330	340	0	38	41	41	43	0	<3.0	3.0	3.0	<3.0	0	3.8	4.0	4.0	4.2	0	31	32	33	34
Total Thallium (Tl)	ug/L	0	0.0060	0.0093	0.0071	0.017	0	0.0093	0.010	0.011	0.012	0	0.0080	0.0080	0.0080	0.0080	0	<0.0020	0.0035	0.0026	0.0070	0	0.024	0.037	0.033	0.053
Total Tin (Sn)	ug/L	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20	5	<0.20	0.20	0.20	<0.20

Station		MW15-03WB					MW15-04WB					MW15-05AZ					MW15-05WB					MW15-06WB				
Lithology		**Gniess**					**Gniess**					**-**					**Granite**					**Gniess**				
Number of Samples		**4**					**5**					**1**					**4**					**3**				
Statistic		**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**	**<DL**	**Min**	**Mean**	**Median**	**Max**
Total Titanium (Ti)	ug/L	3	<0.50	0.72	0.68	1.0	3	<0.50	0.56	0.50	0.82	3	2.9	2.9	2.9	2.9	3	<0.50	0.69	0.50	1.2	3	3.2	9.0	7.8	16
Total Uranium (U)	ug/L	0	7.4	8.1	8.3	8.6	0	160	170	170	190	0	0.81	0.81	0.81	0.81	0	70	73	72	77	0	95	98	97	100
Total Vanadium (V)	ug/L	2	<0.20	0.20	0.20	<0.20	2	0.21	0.27	0.29	0.33	2	3.0	3.0	3.0	3.0	2	<0.20	0.20	0.20	0.21	2	<0.20	0.40	0.49	0.50
Total Zinc (Zn)	ug/L	1	17	35	37	51	1	3.3	42	23	120	1	0.99	0.99	0.99	0.99	1	13	50	43	100	1	85	290	170	600
Total Zirconium (Zr)	ug/L	4	0.10	0.10	0.10	0.11	4	0.24	0.25	0.24	0.27	4	1.2	1.2	1.2	1.2	4	<0.10	0.10	0.10	<0.10	4	0.62	0.69	0.65	0.81
Dissolved Metals																										
Dissolved Aluminum (Al)	ug/L	0	3.5	13	5.7	36	0	3.2	17	11	44	0	190	190	190	190	0	1.7	3.3	3.6	4.5	0	7.2	28	8.4	68
Dissolved Antimony (Sb)	ug/L	0	0.042	0.074	0.077	0.099	0	2.6	2.9	3.0	3.1	0	0.084	0.084	0.084	0.084	0	0.22	0.34	0.33	<0.50	0	0.76	2.0	2.5	2.8
Dissolved Arsenic (As)	ug/L	0	0.27	0.41	0.44	0.49	0	1.3	1.4	1.3	1.5	0	2.3	2.3	2.3	2.3	0	0.88	1.1	1.1	1.3	0	10	19	20	26
Dissolved Barium (Ba)	ug/L	0	10	14	13	18	0	32	33	33	34	0	19	19	19	19	0	2.0	2.6	2.3	4.0	0	39	46	42	56
Dissolved Beryllium (Be)	ug/L	5	<0.010	0.010	0.010	<0.010	5	<0.010	0.046	0.010	<0.10	5	0.026	0.026	0.026	0.026	5	<0.010	0.033	0.010	<0.10	5	<0.010	0.010	0.010	<0.010
Dissolved Bismuth (Bi)	ug/L	5	<0.0050	0.0075	0.0050	0.015	5	<0.0050	0.40	0.0050	<1.0	5	0.0050	0.0050	0.0050	0.0050	5	<0.0050	0.25	0.0050	<1.0	5	<0.0050	0.0050	0.0050	<0.0050
Dissolved Boron (B)	ug/L	5	29	36	36	42	5	<10	26	10	<50	5	<10	10	10	<10	5	<10	20	10	<50	5	<10	10	10	<10
Dissolved Cadmium (Cd)	ug/L	4	<0.0050	0.019	0.012	0.048	4	0.037	0.062	0.049	0.100	4	0.022	0.022	0.022	0.022	4	0.016	0.022	0.021	0.029	4	0.013	0.024	0.022	0.037
Dissolved Calcium (Ca)	mg/L	0	160	160	160	170	0	70	74	73	79	0	2.9	2.9	2.9	2.9	0	42	45	45	47	0	66	73	72	83
Dissolved Chromium (Cr)	ug/L	0	<0.10	0.13	0.10	0.22	0	<0.10	0.51	0.37	<1.0	0	0.70	0.70	0.70	0.70	0	<0.10	0.40	0.26	<1.0	0	<0.10	0.29	0.10	0.66
Dissolved Cobalt (Co)	ug/L	0	0.055	0.083	0.076	0.12	0	0.20	0.33	0.23	<0.50	0	2.5	2.5	2.5	2.5	0	0.037	0.16	0.057	<0.50	0	2.1	2.6	2.5	3.2
Dissolved Copper (Cu)	ug/L	2	0.074	0.14	0.12	0.24	2	0.96	1.4	1.2	2.3	2	1.9	1.9	1.9	1.9	2	0.083	0.22	0.22	0.36	2	0.19	0.68	0.63	1.2
Dissolved Iron (Fe)	ug/L	2	5.6	150	8.5	570	2	5.4	8.8	6.7	13	2	930	930	930	930	2	2.3	5.3	3.9	11	2	57	330	74	850
Dissolved Lead (Pb)	ug/L	3	<0.0050	0.0088	0.0050	0.020	3	0.15	0.27	0.31	0.37	3	0.033	0.033	0.033	0.033	3	0.010	0.067	0.029	<0.20	3	0.017	0.046	0.023	0.098
Dissolved Lithium (Li)	ug/L	0	10	11	12	13	0	6.7	7.0	7.0	7.4	0	0.69	0.69	0.69	0.69	0	12	13	13	14	0	8.4	10	11	12
Dissolved Magnesium (Mg)	mg/L	0	130	130	130	140	0	37	37	37	38	0	0.75	0.75	0.75	0.75	0	7.0	7.5	7.5	8.0	0	33	35	33	40
Dissolved Manganese (Mn)	ug/L	0	74	79	79	84	0	110	110	120	120	0	620	620	620	620	0	4.6	7.6	6.2	13	0	2400	3900	3400	5800
Dissolved Mercury (Hg)	ug/L	1	<0.0020	0.0020	0.0020	<0.0020	1	<0.0020	0.0052	0.0020	<0.010	1	0.0054	0.0054	0.0054	0.0054	1	<0.0020	0.0040	0.0020	<0.010	1	0.022	0.057	0.054	0.095
Dissolved Molybdenum (Mo)	ug/L	0	0.85	0.96	0.98	1.0	0	2.3	2.5	2.6	2.6	0	0.25	0.25	0.25	0.25	0	0.64	1.0	0.85	1.9	0	38	57	46	87
Dissolved Nickel (Ni)	ug/L	1	1.1	1.6	1.6	2.0	1	0.80	1.00	0.99	1.2	1	1.2	1.2	1.2	1.2	1	0.22	0.54	0.48	<1.0	1	2.7	3.1	3.1	3.4
Dissolved Phosphorus (P)	ug/L	1	9.6	22	12	53	1	22	49	24	100	1	13	13	13	13	1	42	51	44	67	1	7.1	26	25	46
Dissolved Potassium (K)	mg/L	0	8.0	8.6	8.7	9.0	0	4.1	4.3	4.4	4.5	0	0.12	0.12	0.12	0.12	0	0.96	1.3	1.2	1.8	0	6.3	7.0	7.2	7.6
Dissolved Selenium (Se)	ug/L	0	<0.040	0.15	0.065	0.43	0	0.13	0.23	0.25	0.34	0	0.069	0.069	0.069	0.069	0	0.10	0.18	0.13	0.37	0	0.17	0.34	0.35	0.50
Dissolved Silicon (Si)	ug/L	0	7000	8400	8100	10000	0	5600	6000	5900	6400	0	6000	6000	6000	6000	0	8700	9400	9400	10000	0	6000	6200	6100	6500
Dissolved Silver (Ag)	ug/L	3	<0.0050	0.0060	0.0060	0.0069	3	<0.0050	0.011	0.0050	<0.020	3	<0.0050	0.0050	0.0050	<0.0050	3	<0.0050	0.0088	0.0050	<0.020	3	<0.0050	0.014	0.011	0.027
Dissolved Sodium (Na)	mg/L	0	68	72	72	76	0	5.9	6.1	6.1	6.6	0	1.1	1.1	1.1	1.1	0	9.1	9.6	9.6	10	0	9.1	10	9.6	12
Dissolved Strontium (Sr)	ug/L	0	8200	8900	9200	9300	0	780	780	780	800	0	15	15	15	15	0	140	140	140	150	0	420	450	430	490
Dissolved Sulphur (S)	mg/L	0	290	320	310	350	0	41	44	44	46	0	<3.0	3.0	3.0	<3.0	0	3.5	4.3	4.5	4.6	0	31	34	33	37
Dissolved Thallium (Tl)	ug/L	0	<0.0020	0.0053	0.0062	0.0070	0	0.0068	0.025	0.011	<0.050	0	0.0080	0.0080	0.0080	0.0080	0	<0.0020	0.016	0.0059	<0.050	0	0.026	0.036	0.034	0.049
Dissolved Tin (Sn)	ug/L	5	<0.20	0.20	0.20	<0.20	5	<0.20	2.1	0.20	<5.0	5	<0.20	0.20	0.20	<0.20	5	<0.20	1.4	0.20	<5.0	5	<0.20	0.21	0.20	0.24
Dissolved Titanium (Ti)	ug/L	4	<0.50	0.50	0.50	<0.50	4	<0.50	2.3	0.50	<5.0	4	2.0	2.0	2.0	2.0	4	<0.50	1.6	0.50	<5.0	4	<0.50	1.6	0.50	3.7
Dissolved Uranium (U)	ug/L	0	7.6	8.2	8.1	9.1	0	150	160	160	180	0	0.90	0.90	0.90	0.90	0	66	71	70	75	0	100	100	100	100
Dissolved Vanadium (V)	ug/L	3	<0.20	0.20	0.20	<0.20	3	<0.20	2.1	0.28	<5.0	3	1.5	1.5	1.5	1.5	3	<0.20	1.4	0.20	<5.0	3	<0.20	0.20	0.20	<0.20
Dissolved Zinc (Zn)	ug/L	0	4.9	50	44	110	0	9.6	34	36	58	0	1.1	1.1	1.1	1.1	0	38	60	53	97	0	21	140	160	250
Dissolved Zirconium (Zr)	ug/L	4	<0.10	0.10	0.10	<0.10	4	0.21	0.34	0.26	<0.50	4	1.2	1.2	1.2	1.2	4	<0.10	0.20	0.10	<0.50	4	0.46	0.57	0.62	0.63

Notes:

Analytical results reported as <DL were set = DL for the calculation of mean and median values.
The sample collected at MW14-03A on Oct. 12, 2014 has been excluded from statistical calculations.
The sample collected at MW14-03B on Oct. 6, 2014 has been excluded from statistical calculations.
The sample collected at MW14-05A on Oct. 2, 2014 has been excluded from statistical calculations.
The sample collected at MW14-05B on Oct. 3, 2014 has been excluded from statistical calculations.
The sample collected at MW15-06WB on Jun. 21, 2015 has been excluded from statistical calculations.
DOC and TOC results for all samples collected at Westbay monitoring wells (MW15-01WB to MW15-06WB) have been excluded from statistical calculations.
DOC and TOC results for all samples collected at MW14-05B have been excluded from statistical calculations.

Appendix 5-C: Laboratory Certificates of Analysis (Electronic Only)

GOLDCORP

Appendix 5-D: Groundwater Quality QAQC

GOLDCORP

Appendix 5-D: Groundwater Quality Assurance/Quality Control

An extensive quality assurance program was implemented for the groundwater quality monitoring program. Samples were collected, preserved, stored, transported, and tested in accordance with the requirements set forth in the British Columbia Environmental Laboratory Manual (BC MOE, 2009) and the British Columbia Field Sampling Manual (BC MWLAP, 2003). Laboratory quality control included the preparation and analysis of blanks, sample duplicates, and reference samples. These processes monitor the internal testing processes at the laboratory. The test results are only reported if internal quality control criteria are met. ALS Environmental in Burnaby, British Columbia (B.C.) completed the laboratory analysis for the samples collected at the site in 2014, while Maxxam Analytics (MAXXAM) in Burnaby, B.C. completed the laboratory analysis for samples collected in 2015. Laboratory quality control data indicate good precision, accuracy and contamination control in the laboratory test procedures.

Groundwater samples exceeded recommended holding times of 0.25 days for pH, 3 days for several physical, anion and nutrient parameters (turbidity, nitrate plus nitrite, nitrate, nitrite, and unpreserved dissolved phosphorus and dissolved organic carbon (DOC)). Several samples exceeded the recommended holding time of 7 days for total dissolved solids (TDS), total suspended solids (TSS) and total sulphide. Holding times were exceeded due to the remoteness of the site and time required to deliver samples to the laboratory. This was mitigated by keeping the samples cold during storage and transit prior to analysis.

Field quality control included monitoring indicator parameters during purging/sampling (see Appendix 3-F for groundwater sampling methods) and the preparation of field and trip blanks and field replicates. The purpose of field quality control is to evaluate the potential for contamination of the samples as a result of the sampling process, including sample collection, sample containers, preservatives, shipping, and sample processing at the lab. Field blank and trip blank analytical data are presented in Table 5D-1. Field replicate analytical data are presented in Table 5D-2.

The field blank and trip blank data (Table 5D -1) indicate good overall contamination control with the majority of values below the laboratory method detection limits (MDLs). Several physical, inorganic and nutrient parameters were measured at concentrations above the MDLs: conductivity, total alkalinity, bicarbonate, dissolved phosphorus and total ammonia in field blank FB-23/06/15 (Jun. 2015), conductivity, total ammonia and sulphide in FB-2 (Jul. 2015), conductivity and sulphide in FB-3 (Aug. 2015), conductivity, total ammonia and sulphide in FB-4 (Sept. 2015), and total ammonia, dissolved sulphate and sulphide in TRIP BLANK (Sept. 2015). These parameters (conductivity, total alkalinity, bicarbonate, dissolved phosphorus, dissolved sulphate, total ammonia and sulphide) are characterized by significant uncertainty as they were all detected within laboratory accuracy precision at concentrations ≤2x MDLs. The conductivity, total alkalinity, bicarbonate, and dissolved sulphate are not considered to impact the Project groundwater quality results which were characterized by concentrations greater than those detected in the field and trip blanks. However, dissolved phosphorus, total ammonia and sulphide levels detected in the field/trip blanks were within the low range of observed groundwater concentrations. Dissolved phosphorus in not considered to be of concern since it was detected in one field blank (FB-23/06/15) and four groundwater samples at concentrations <2x MDL of 0.002 mg/L, representing only 7% of groundwater samples with detectable levels. In contrast, total ammonia was detected in four field/trip blanks (FB-23/06/16, FB-2, FB-4, TRIP BLANK) and 11 groundwater samples at concentrations ≤2x MDL of 0.005 mg/L (*e.g.*, 0.010 mg/L), representing approximately 20% of groundwater samples with detectable levels. Sulphide was detected in four field/trip blanks (FB-2, FB-3, FB-4, TRIP BLANK) and 28 groundwater samples at concentrations <2x MDL of 0.005 mg/L (*e.g.*, 0.010 mg/L), representing approximately 60% of groundwater samples with detectable levels. Sulphide and total ammonia detected in several field/trip blanks have a notable impact on groundwater quality results and the interpretation of presence or absence for both of these parameters.

Several total and dissolved metals were detected at concentrations above the MDLs in field and trip blanks FB-23/06/15, FB-2, FB-4 and TRIP BLANK. Total and dissolved aluminum and nickel, in addition to dissolved arsenic, barium, lithium and zinc were detected at concentrations above the MDLs in FB-23/06/15. Total and dissolved aluminum, manganese, phosphorus and zinc, in addition to total arsenic and vanadium and dissolved molybdenum, titanium, and uranium were measured at concentrations above the MDLs in FB-4. Total copper was detected above the MDL in TRIP BLANK. The total and dissolved metal parameters detected in FB-23/06/15, FB-4 and TRIP BLANK were below Project groundwater concentrations, except total nickel in FB-23/06/15, and total vanadium and dissolved titanium in FB-4. However, dissolved nickel detected in FB-23/06/15 was below Project groundwater levels; further, vanadium and titanium levels in Project groundwater are low and neither is considered a primary or secondary parameter of concern nor known to complex with cyanide. Therefore, total and dissolved metal parameters detected in FB-23/06/15, FB-4 and TRIP BLANK are not considered to impact the interpretation of Project groundwater quality results. Field blank FB-2 was characterized by 10 total metal and 15 dissolved metal parameters with concentrations above MDLs. Parameters which had detectable levels in FB-2 include total and dissolved aluminum, arsenic, barium, iron, manganese, nickel, phosphorus, sodium, uranium and zinc, in addition to dissolved cobalt, copper, lead, strontium, and titanium. However, in contrast to the other field and trip blanks, FB-2 was characterized by a greater number of detected metal parameters with many at elevated concentrations ranging from 1.1 to 89.5 times their respective MDLs. Additionally, the majority of these parameters were characterized by dissolved metals greater than total metals. MAXXAM subsequently conducted an investigation to determine the origin of the metals contamination in FB-2 upon request by Lorax. Re-analysis of FB-2 for total and dissolved metals from the original sample bottles (falcon tubes) confirmed the original results. Another approach was used taking a portion of the sample from another bottle (unpreserved 250 mL plastic bottle) and analyzed for total and dissolved metals. The results all came back at <MDL. This suggests that the falcon tubes submitted for the total and dissolved metals were contaminated, however the lab cannot conclusively determine where the contamination occurred. The total and dissolved metal parameters detected in FB-2 are not considered to impact the Project groundwater quality results.

The precision of the field replicates is evaluated using relative percent difference (RPD). The following formula is used to calculate the RPD:

$$RPD = 100 * \frac{|Result\ 1 - Result\ 2|}{Average\ (Result\ 1,\ Result\ 2)}$$

RPD values were determined for all water quality parameters with detectable concentrations, including those close to the MDLs. Several field replicate pairs are characterized by one or more parameters with RPD values greater than 50% (Table 5D -2). However, RPD values calculated for replicate samples with one or both parameter concentrations within five times the MDLs are not considered to be representative of actual sample variability (or consistency) due to elevated analytical imprecision close to the MDLs. Consequently, water quality parameters characterized by RPD values exceeding 50% and at least one concentration within five times the MDLs are not included in the following discussion.

Nine replicate pairs were characterized by one to six water quality parameters with concentrations above five times the MDLs and RPD values greater than 50% (Table 5D -2); these include total phosphorus in MW15-04WB Jun. 2015, total zinc and dissolved zinc in MW15-03AZ Jun. 2015, dissolved cadmium, dissolved manganese, dissolved potassium and dissolved zinc in MW15-02AZ Jul. 2015, total organic carbon (TOC), DOC, total iron, total cadmium, total lead, and total zinc in MW15-04WB Jul.

2015, total aluminum, total copper, total lead, total phosphorus, total thallium and total zinc in MW14-03A Aug. 2015, total aluminum, total iron, total phosphorus and dissolved phosphorus in MW15-05WB Aug. 2015, and total nitrogen in MW14-02A Sept. 2015. All other parameters were characterized by RPD values less than 50% and/or concentrations below five times the MDLs. Overall, the field replicates indicate good precision and sample homogeneity.

A comparison of the analytical results for total and dissolved metals was completed as a QA/QC check and is presented in Table 5D-3. There is a 20% allowable limit for dissolved values greater than total values for sample results > 5x MDLs, based on the typical laboratory QA/QC criteria. Table 5D-3 highlights parameters where the detected concentrations are > 5x the MDL and the dissolved fraction was 20% greater than the total fraction. These parameters include aluminum (10 samples), antimony (2 samples), arsenic (2 samples), barium (2 samples), cadmium (7 samples), calcium (1 sample), chromium (2 samples), cobalt (6 samples), copper (7 samples), iron (6 samples), lead (8 samples), lithium (1 sample), magnesium (2 samples), manganese (4 samples), molybdenum (6 samples), nickel (7 samples), phosphorus (15 samples), potassium (4 samples), selenium (1 sample), silicon (3 samples), sodium (2 samples), strontium (2 samples), sulphur (2 samples), thallium (1 sample), uranium (4 samples), zinc (26 samples) and zirconium (1 sample). Typically, samples either have no parameters or only one parameter with a dissolved result elevated above the total; however, there are samples with 11 parameters (MW14-02B Jun. 2015, MW15-05WB Sept. 2015), 10 parameters (MW15-02AZ Aug. 2015), nine parameters (MW15-02AZ Jul. 2015, MW15-01WB Sept. 2015), seven parameters (MW15-03AZ Jul. 2015, MW14-03A Aug. 2015), six parameters (MW14-02A Aug. 2015), five parameters (MW14-03B Jun. 2015, duplicate at MW15-02AZ Jul. 2015, duplicate at MW14-03A Aug. 2015), four parameters (MW14-02A Jun. 2015, MW15-05WB Aug. 2015, MW15-06WB Sept. 2015), three parameters (MW14-03A Jun. 2015, MW15-03WB Jul. 2015, MW15-04WB Jul. 2015, duplicate at MW15-05WB Aug. 2015, MW15-04WB Sept. 2015), and two parameters (duplicate of MW15-03AZ Jun. 2015, MW14-02B Jul. 2015, MW15-01WB Jul. 2015, MW15-01WB Aug. 2015, MW15-02WB Aug. 2015,) in this category. MAXXAM subsequently investigated the laboratory data associated with the parameters and samples where the dissolved fraction was 20% greater than the total fraction to determine potential biases or causes. The lab investigation was inconclusive and did not determine contributing factors or causes.

Four or more groundwater samples were collected from all sampled monitoring wells, with the exception of MW15-05AZ where only one sample was collected (see Table 3-5 in the main report and Appendix 3-F). Five samples appear to have been impacted by artifacts of drilling and well installation, specifically MW14-03A Oct. 2014, MW14-03B Oct. 2014, MW14-05A Oct. 2014, MW14-05B Oct.2014, and MW15-06WB Jun. 2015. Details are provided below.

Groundwater collected at MW14-03A in October 2014 had a distinct hydrochemical composition compared to subsequent samples collected in 2015. Groundwater collected in 2014 was mixed magnesium-calcium-sodium-potassium-sulphate type water, while the samples collected in 2015 were magnesium-sulphate and magnesium-bicarbonate type water. Groundwater sampled in October 2014 was characterized by the presence of drilling additives, based on field observations (*i.e*., sample water was more viscous than typical and stringy/goopy in consistency). The October 2014 sample was characterized by low field specific conductance and total alkalinity, in addition to elevated field pH, TSS, total aluminum (T-Al), dissolved sodium (D-Na), DOC, TOC, total nitrogen (T-N), total phosphorus, and dissolved chloride (Cl) compared to subsequent samples. The field observations, depressed and elevated parameter concentrations, and distinct major ion chemistry relative to other MW14-03A samples suggest that the October 2014 sample was influenced by drilling and well installation. As a result, water quality data for the MW14-03A Oct. 2014 sample is not considered to be representative of formation water and is excluded from the groundwater quality baseline data set.

Groundwater collected at MW14-03B and MW14-05A in October 2014 was characterized by elevated TSS, T-Al, DOC, TOC, and T-N relative to subsequent groundwater samples. The elevated parameter concentrations relative to other MW14-03B and MW14-05A samples suggest that the October 2014 samples were influenced by drilling and well installation. For this reason, water quality data for the MW14-03B Oct. 2014 and MW14-05A Oct. 2014 samples is not considered to be representative of formation water and is excluded from the baseline groundwater quality characterization.

Groundwater collected at MW14-05B in October 2014 was characterized by elevated field pH, TSS, T-Al, and T-N relative to subsequent groundwater samples. Subsequent samples collected in 2015 suggest that groundwater chemistry had not stabilized, with decreasing field pH, TSS, T-Al and T-N, and increasing D-Na in 2015. A slight reversal in the TSS and D-Na trends was observed in September 2015. Additionally, all 2014 and 2015 groundwater samples were characterized by elevated TOC and DOC. Field observations during purging/sampling in June 2015 were indicative of drilling additive influence due to slightly turbid, greyish-brown water with effervescence and suspended sediments (which did not appear to be mineral in nature). Field observations in September 2015 indicated that the sampled groundwater remained effervescent. The field observations and elevated parameter concentrations relative to other MW14-05B samples suggest that the October 2014 sample was influenced by drilling and well installation. Water quality data for the MW14-05B Oct. 2014 sample is therefore not considered to be representative of formation water and is excluded from the baseline groundwater quality characterization. TOC and DOC data from samples collected at MW14-05B in 2015 are not considered to be representative of formation water and have been excluded from the baseline groundwater quality characterization. Subsequent groundwater sampling will inform whether observed trends at MW14-05B are a result of residual drilling influence or natural variability.

Groundwater collected at MW15-06WB in June 2015 had a distinct hydrochemical composition relative to subsequent samples collected in 2015. Groundwater collected in June 2015 was mixed calcium-magnesium-sodium-bicarbonate type water, while that sampled subsequently was mixed calcium-magnesium-bicarbonate to calcium-bicarbonate type water. Groundwater sampled in June 2015 was characterized by low field specific conductance and elevated TSS, T-Al, and Cl compared to subsequent samples. Subsequent sampling in 2015 suggests that groundwater chemistry had not stabilized, with increasing field specific conductance, total alkalinity, bicarbonate and sulfate, and decreasing TSS, Cl, T-Al and T-N. Groundwater sampled in June and initial purge water in July and August 2015 was slightly cloudy, slightly foamy, with a slight yellow colour due to suspected influence of drilling additives. Field observations during the July and August 2015 sampling events indicated a noticeable improvement after purging (minimal if any cloudiness and colour). The distinct major ion chemistry and depressed and elevated parameter concentrations relative to other MW15-06WB samples suggest that the June 2015 sample was influenced by drilling and well installation. As a result, water quality data for the MW15-06WB Jun. 2015 sample is not considered to be representative of formation water and is excluded from the baseline groundwater quality characterization. The observed trends in July, August and September samples suggest that groundwater chemistry at MW15-06WB has not stabilized. Subsequent groundwater sampling will inform whether observed trends at MW15-06WB are a result of residual drilling influence or natural variability.

Groundwater samples collected from the Westbay installations (MW15-01WB to MW15-06WB) were characterized by highly variable DOC and TOC, with concentrations ranging from 7 to 1080 mg/L. In contrast, DOC and TOC concentrations in groundwater collected from conventional wells were typically less than 10 mg/L. It is suspected that DOC and TOC in groundwater collected from Westbay installations may be influenced by propylene glycol contamination. A 3:1 mixture of water:propylene glycol was used inside the Westbay casing to prevent freezing and associated damage caused by freezing and to ensure proper functioning of the Westbay installations completed in permafrost. A small amount of glycol may be captured by the Westbay sampler probe (between the face seal and valve) during the sample collection process. As a result, TOC and DOC data associated with Westbay installations is not considered to be representative of formation water and has been excluded from the baseline groundwater quality characterization.

Table 1: Field Blank and Trip Blank Analytical Data

Sample ID	Units	RDL (ALS)	RDL (Maxxam)	F-BLANK-1	FB-23/06/15	FB-2	FB-3	FB-4	TRIP BLANK
Analytical Lab				ALS	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Lab Job ID				L1525019	B553846	B562572	B569424	B579224	B579224
Lab Sample ID				L1525019-3	MN4273	MS4334	MW5163	NC4791	NC4792
Sample Type				Water Field Blank	Water Field Blank	Water Field Blank	Water Field Blank	Water Field Blank	Trip Blank
Sample Date/Time				28-Sep-2014	23-Jun-2015	18-Jul-2015	12-Aug-2015	08-Sep-2015	11-Sep-2015
Filter and HNO3 Preservation					LAB	LAB	LAB	LAB	LAB
Physical Properties									
Conductivity	uS/cm	2	1	<2	1.2	1.2	1	1.1	<1
pH	pH	0.1	-	5.57	6.15	5.75	5.44	5.08	5.43
Total Hardness (CaCO3)	mg/L	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Hardness (CaCO3)	mg/L	-	0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Total Suspended Solids	mg/L	3	1	<3	<1	<1	<1	<1	<1
Total Dissolved Solids	mg/L	20	10	<20	<10	<10	<10	<10	<10
Turbidity	NTU	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Inorganics	mg/L	-	-						
Alkalinity (Total as CaCO3)	mg/L	1	0.5	<1	0.71	<0.5	<0.5	<0.5	<0.5
Alkalinity (PP as CaCO3)	mg/L	-	0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Bicarbonate (HCO3)	mg/L	-	0.5		0.87	<0.5	<0.5	<0.5	<0.5
Carbonate (CO3)	mg/L	-	0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Hydroxide (OH)	mg/L	-	0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Bromide (Br)	mg/L	1	-						
Fluoride (F)	mg/L	0.02	0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Chloride (Cl)	mg/L	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Organic / Inorganic Carbon		-	-						
Dissolved Organic Carbon (C)	mg/L	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (C)	mg/L	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anions and Nutrients	mg/L	-	-						
Total Phosphorus (P)	mg/L	0.002	0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002
Dissolved Phosphorus (P)	mg/L	0.002	0.002-0.005	<0.002	0.0036	<0.002	<0.005	<0.002	<0.002
Total Ammonia (N)	mg/L	0.025	0.005	<0.005	0.0092	0.01	<0.005	0.0085	0.0094
Total Total Kjeldahl Nitrogen (Calc)	mg/L	0.5	0.05	<0.05	<0.05	<0.05	<0.02	0.041	0.033
Nitrate plus Nitrite (N)	mg/L	-	0.002		<0.002	<0.002	<0.002	<0.002	<0.002
Nitrate (N)	mg/L	0.005	0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002
Nitrite (N)	mg/L	0.001	0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002
Total Nitrogen (N)	mg/L	2	0.05	<0.05	<0.05	<0.05	<0.02	0.041	0.033
Dissolved Nitrogen (N)	mg/L)	0.5	-	<0.05					
Dissolved Sulphate (SO4)	mg/L	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.78
Sulphide	mg/L	0.02	0.005	<0.002	<0.005	0.0069	0.0089	0.0061	0.006
Total Metals		-							
Total Aluminum (Al)	ug/L	3	0.5	<3	0.55	8.12	<0.5	1.29	<0.5
Total Antimony (Sb)	ug/L	0.1	0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02
Total Arsenic (As)	ug/L	0.1	0.02	<0.1	<0.02	0.024	<0.02	0.022	<0.02
Total Barium (Ba)	ug/L	0.05	0.02	<0.05	<0.02	0.033	<0.02	<0.02	<0.02
Total Beryllium (Be)	ug/L	0.1	0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
Total Bismuth (Bi)	ug/L	0.5	0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005
Total Boron (B)	ug/L	10	10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	ug/L	0.01	0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005
Total Calcium (Ca)	mg/L	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Chromium (Cr)	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Cobalt (Co)	ug/L	0.1	0.005	<0.1	<0.005	<0.005	<0.005	<0.005	<0.005
Total Copper (Cu)	ug/L	0.5	0.05	<0.5	<0.05	<0.05	<0.05	<0.05	0.069
Total Iron (Fe)	ug/L	10	1	<10	<1	4.6	<1	<1	<1
Total Lead (Pb)	ug/L	0.05	0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Total Lithium (Li)	ug/L	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	mg/L	0.1	0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Total Manganese (Mn)	ug/L	0.05	0.05	<0.05	<0.05	0.057	<0.05	0.152	<0.05
Total Mercury (Hg)	ug/L	0.5	0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002
Total Molybdenum (Mo)	ug/L	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Nickel (Ni)	ug/L	0.5	0.02	<0.5	0.131	0.11	<0.02	<0.02	<0.02
Total Phosphorus (P)	ug/L	50	2	<50	<2	90.6	<2	4.3	<2
Total Potassium (K)	mg/L	0.1	0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Total Selenium (Se)	ug/L	0.1	0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04
Total Silicon (Si)	ug/L	50	50	<50	<50	<50	<50	<50	<50
Total Silver (Ag)	ug/L	0.01	0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005
Total Sodium (Na)	mg/L	0.05	0.05	<0.05	<0.05	0.146	<0.05	<0.05	<0.05
Total Strontium (Sr)	ug/L	0.2	0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05
Total Sulphur (S)	mg/L	0.5	3	<0.5	<3	<3	<3	<3	<3
Total Thallium (Tl)	ug/L	0.01	0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002
Total Tin (Sn)	ug/L	0.1	0.2	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium (Ti)	ug/L	10	0.5	<10	<0.5	<0.5	<0.5	<0.5	<0.5
Total Uranium (U)	ug/L	0.01	0.002	<0.01	<0.002	0.0037	<0.002	<0.002	<0.002
Total Vanadium (V)	ug/L	1	0.2	<1	<0.2	<0.2	<0.2	0.23	<0.2
Total Zinc (Zn)	ug/L	3	0.1	<3	<0.1	0.65	<0.1	0.14	<0.1
Total Zirconium (Zr)	ug/L	-	0.1		<0.1	<0.1	<0.1	<0.1	<0.1

Table 1: Field Blank and Trip Blank Analytical Data

Sample ID	Units	RDL (ALS)	RDL (Maxxam)	F-BLANK-1	FB-23/06/15	FB-2	FB-3	FB-4	TRIP BLANK
Analytical Lab				ALS	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Lab Job ID				L1525019	B553846	B562572	B569424	B579224	B579224
Lab Sample ID				L1525019-3	MN4273	MS4334	MW5163	NC4791	NC4792
Sample Type				Water Field Blank	Water Field Blank	Water Field Blank	Water Field Blank	Water Field Blank	Trip Blank
Sample Date/Time				28-Sep-2014	23-Jun-2015	18-Jul-2015	12-Aug-2015	08-Sep-2015	11-Sep-2015
Filter and HNO3 Preservation					LAB	LAB	LAB	LAB	LAB
Dissolved Metals		-	-						
Dissolved Aluminum (Al)	ug/L	1	0.5	<1	0.56	23.4	<0.5	0.67	<0.5
Dissolved Antimony (Sb)	ug/L	0.1	0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02
Dissolved Arsenic (As)	ug/L	0.1	0.02	<0.1	0.047	0.024	<0.02	<0.02	<0.02
Dissolved Barium (Ba)	ug/L	0.05	0.02	<0.05	0.127	0.068	<0.02	<0.02	<0.02
Dissolved Beryllium (Be)	ug/L	0.1	0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth (Bi)	ug/L	0.5	0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron (B)	ug/L	10	10	<10	<10	<10	<10	<10	<10
Dissolved Cadmium (Cd)	ug/L	0.01	0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Calcium (Ca)	mg/L	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dissolved Chromium (Cr)	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Cobalt (Co)	ug/L	0.1	0.005	<0.1	<0.005	0.0062	<0.005	<0.005	<0.005
Dissolved Copper (Cu)	ug/L	0.2	0.05	<0.2	<0.05	1.85	<0.05	<0.05	<0.05
Dissolved Iron (Fe)	ug/L	10	1	<10	<1	19.9	<1	<1	<1
Dissolved Lead (Pb)	ug/L	0.05	0.005	<0.05	<0.005	0.0069	<0.005	<0.005	<0.005
Dissolved Lithium (Li)	ug/L	0.5	0.5	<0.5	0.62	<0.5	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	mg/L	0.1	0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Dissolved Manganese (Mn)	ug/L	0.05	0.05	<0.05	<0.05	0.301	<0.05	0.169	<0.05
Dissolved Mercury (Hg)	ug/L	0.01	0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002
Dissolved Molybdenum (Mo)	ug/L	0.05	0.05	<0.05	<0.05	<0.05	<0.05	0.052	<0.05
Dissolved Nickel (Ni)	ug/L	0.5	0.02	<0.5	0.068	1.17	<0.02	<0.02	<0.02
Dissolved Phosphorus (P)	ug/L	50	2	<50	<2	179	<2	3.2	<2
Dissolved Potassium (K)	mg/L	0.1	0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Dissolved Selenium (Se)	ug/L	0.1	0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04
Dissolved Silicon (Si)	ug/L	50	50	<50	<50	<50	<50	<50	<50
Dissolved Silver (Ag)	ug/L	0.01	0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Sodium (Na)	mg/L	0.05	0.05	<0.05	<0.05	0.382	<0.05	<0.05	<0.05
Dissolved Strontium (Sr)	ug/L	0.2	0.05	<0.2	<0.05	0.061	<0.05	<0.05	<0.05
Dissolved Sulphur (S)	mg/L	0.5	3	<0.5	<3	<3	<3	<3	<3
Dissolved Thallium (Tl)	ug/L	0.01	0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002
Dissolved Tin (Sn)	ug/L	0.1	0.2	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Titanium (Ti)	ug/L	10	0.5	<10	<0.5	0.64	<0.5	0.6	<0.5
Dissolved Uranium (U)	ug/L	0.01	0.002	<0.01	<0.002	0.0066	<0.002	0.019	<0.002
Dissolved Vanadium (V)	ug/L	1	0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Zinc (Zn)	ug/L	1	0.1	<1	0.16	1.26	<0.1	0.1	<0.1
Dissolved Zirconium (Zr)	ug/L	-	0.1		<0.1	<0.1	<0.1	<0.1	<0.1

Notes:
RDL = Reported Detection Limit
RPD = Relative Percent Difference
Red shading indicates detectable values

Table 2: Field Replicate Analytical Results

Sample ID	Units	MW14-02B	F-DUP-1	RDL	RPD (%)	MW15-04WB	MW15-20	RDL	RPD (%)	MW15-03AZ	MW15-21	RDL	RPD (%)	MW15-02AZ	MW15-40AZ	RDL	RPD (%)	MW15-04WB	MW15-30WB	RDL	RPD (%)
Analytical Lab		**ALS**	**ALS**			Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam		
Lab Job ID		L1525019	L1525019			B551383	B551383			B551383	B551383			B559978	B559978			B558916	B558916		
Lab Sample ID		L1525019-2	L1525019-4			MM1018	MM1019			MM1021	MM1022			MR0622	MR0623			MQ4530	MQ4532		
Sample Type						GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate		
Sample Date/Time		28-Sep-2014	28-Sep-2014			14-Jun-2015	14-Jun-2015			16-Jun-2015	16-Jun-2015			11-Jul-2015	11-Jul-2015			10-Jul-2015	10-Jul-2015		
Filter and HNO3 Preservation		FIELD	FIELD			LAB	LAB			FIELD	FIELD			FIELD	FIELD			LAB	LAB		
Physical Properties																					
Conductivity	uS/cm	508	514	2	1%	667	670	1	0%	323	319	1	1%	792	792	1	-	661	656	1	1%
pH	pH	8.02	7.92	0.1	1%	8.26	8.22	N/A	0%	7.97	7.96	N/A	0%	8.04	7.83	N/A	3%	8.1	8.15	N/A	1%
Total Hardness (CaCO3)	mg/L	283	282	0.5	0%	335	339	0.5	1%	151	148	0.5	2%	410	411	0.5	0%	329	327	0.5	1%
Dissolved Hardness (CaCO3)	mg/L	-	-	-	-	338	346	0.5	2%	151	158	0.5	5%	417	412	0.5	1%	326	330	0.5	1%
Total Suspended Solids	mg/L	<3	<3	3	-	<1	<1	1	-	<1	<1	1	-	<1	<1	1	-	<1	<1	1	-
Total Dissolved Solids	mg/L	348	347	20	0%	446	480	10	7%	216	202	10	7%	484	500	10	3%	396	402	10	2%
Turbidity	NTU	0.34	0.43	0.1	23%	0.2	0.14	0.1	35%	0.24	0.27	0.1	12%	0.11	0.15	0.1	31%	0.12	<0.1	0.1	18%
Inorganics	mg/L																				
Alkalinity (Total as CaCO3)	mg/L	209	209	1	0%	233	234	0.5	0%	108	107	0.5	1%	239	242	0.5	1%	234	234	0.5	-
Alkalinity (PP as CaCO3)	mg/L	-	-	-	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Bicarbonate (HCO3)	mg/L	-	-	-	-	284	285	0.5	0%	132	130	0.5	2%	291	295	0.5	1%	285	285	0.5	-
Carbonate (CO3)	mg/L	-	-	-	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Hydroxide (OH)	mg/L	-	-	-	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Bromide (Br)	mg/L																				
Fluoride (F)	mg/L	0.102	0.102	0.02	0%	0.096	0.094	0.01	2%	0.048	0.047	0.01	2%	0.088	0.087	0.01	1%	0.1	0.11	0.01	10%
Dissolved Chloride (Cl)	mg/L	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	0.78	0.52	0.5	40%	0.5	0.58	0.5	15%	0.68	0.67	0.5	1%
Organic / Inorganic Carbon																					
Dissolved Organic Carbon (C)	mg/L	1.63	1.37	0.5	17%	268	219	0.5	20%	7.87	7.81	0.5	1%	5.62	5.28	0.5	6%	93.6	10.3	0.5	160%
Total Organic Carbon (C)	mg/L	1.56	1.48	0.5	5%	1080	1310	0.5	19%	8.32	7.39	0.5	12%	6.29	6.24	0.5	1%	8.99	63.8	0.5	151%
Anions and Nutrients	mg/L																				
Total Phosphorus (P)	mg/L	<0.002	0.0025	0.002	-	0.105	0.401	0.005	117%	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-
Dissolved Phosphorus (P)	mg/L	0.0033	0.0028	0.002	16%	0.0951	0.022	0.005	125%*	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	0.0069	0.0043	0.005	46%
Total Ammonia (N)	mg/L	<0.005	<0.005	0.025	-	0.022	0.012	0.005	59%*	0.0087	0.025	0.005	97%*	0.016	0.01	0.005	46%	0.019	0.02	0.005	5%
Total Total Kjeldahl Nitrogen (Calc)	mg/L	0.142	0.145	0.5	2%	<0.2	<0.2	0.02	-	0.227	0.209	0.02	8%	0.22	0.19	0.02	15%	0.15	0.088	0.02	52%*
Nitrate plus Nitrite (N)	mg/L	-	-	-	-	0.156	0.158	0.002	1%	0.0255	0.0263	0.002	3%	0.436	0.437	0.002	0%	0.0809	0.0874	0.002	8%
Nitrate (N)	mg/L	0.0138	0.0164	0.005	17%	0.139	0.141	0.002	1%	0.0255	0.0263	0.002	3%	0.436	0.437	0.002	0%	0.0702	0.0777	0.002	10%
Nitrite (N)	mg/L	0.0015	0.002	0.001	29%	0.0167	0.017	0.002	2%	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-	0.0107	0.0097	0.002	10%
Total Nitrogen (N)	mg/L	0.155	0.156	2	1%	<0.2	<0.2	0.2	-	0.253	0.235	0.02	7%	0.654	0.626	0.02	4%	0.227	0.175	0.02	26%
Dissolved Nitrogen (N)	mg/L)	0.163	0.155	0.5	5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Sulphate (SO4)	mg/L	85.5	85.5	0.5	0%	125	130	5	4%	53	57.7	5	8%	190	185	5	3%	129	130	5	1%
Sulphide	mg/L	<0.002	<0.002	0.02	-	<0.005	0.0074	0.005	39%	<0.005	0.0065	0.005	26%	<0.005	0.006	0.005	18%	0.0072	0.0086	0.005	18%
Total Metals																					
Total Aluminum (Al)	ug/L	6.3	4.5	3	33%	8.95	11.8	0.5	27%	47.2	34.4	0.5	31%	10.3	8.17	0.5	23%	7.77	7.62	0.5	2%
Total Antimony (Sb)	ug/L	3.25	2.87	0.1	12%	2.86	2.91	0.02	2%	0.15	0.141	0.02	6%	0.14	0.143	0.02	2%	2.88	3.37	0.02	16%
Total Arsenic (As)	ug/L	19.4	20	0.1	3%	1.65	1.69	0.02	2%	0.45	0.445	0.02	1%	0.948	0.831	0.02	13%	1.39	1.25	0.02	11%
Total Barium (Ba)	ug/L	54	53	0.05	2%	35.4	34.8	0.02	2%	38	38.1	0.02	0%	87.6	94.4	0.02	7%	34.5	38.2	0.02	10%
Total Beryllium (Be)	ug/L	<0.1	<0.1	0.1	-	<0.01	<0.01	0.01	-	<0.01	0.011	0.01	10%	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-
Total Bismuth (Bi)	ug/L	<0.5	<0.5	0.5	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-
Total Boron (B)	ug/L	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-
Total Cadmium (Cd)	ug/L	<0.01	<0.01	0.01	-	0.0605	0.0572	0.005	6%	0.0118	0.0104	0.005	13%	0.0146	0.0209	0.005	35%	0.0611	0.0353	0.005	54%
Total Calcium (Ca)	mg/L	61.4	60.8	0.05	1%	73.2	75.4	0.05	3%	41	40	0.05	2%	109	114	0.05	4%	71.2	71.4	0.05	0%
Total Chromium (Cr)	ug/L	0.51	0.5	0.1	2%	0.3	0.28	0.1	7%	0.19	0.14	0.1	30%	0.17	0.13	0.1	27%	0.4	0.12	0.1	108%*
Total Cobalt (Co)	ug/L	0.62	0.63	0.1	2%	0.221	0.22	0.005	0%	0.0612	0.0589	0.005	4%	0.0261	0.0244	0.005	7%	0.255	0.243	0.005	5%
Total Copper (Cu)	ug/L	<0.5	<0.5	0.5	-	2.15	2.11	0.05	2%	1.39	1.28	0.05	8%	1.03	1.01	0.05	2%	1.18	1.08	0.05	9%
Total Iron (Fe)	ug/L	<10	<10	10	-	23.1	20.1	1	14%	30.1	23.5	1	25%	8.4	7.1	1	17%	21.1	12.6	1	50%
Total Lead (Pb)	ug/L	<0.05	<0.05	0.05	-	0.491	0.48	0.005	2%	0.0311	0.0216	0.005	36%	0.0135	0.0145	0.005	7%	0.293	0.513	0.005	55%
Total Lithium (Li)	ug/L	7.65	6.87	0.5	11%	6.88	6.47	0.5	6%	0.7	<0.5	0.5	33%	3.85	3.73	0.5	3%	6.04	7.19	0.5	17%
Total Magnesium (Mg)	mg/L	30.5	30.7	0.1	1%	36.9	36.6	0.05	1%	11.9	11.8	0.05	1%	33.2	30.5	0.05	8%	36.7	36.1	0.05	2%
Total Manganese (Mn)	ug/L	161	156	0.05	3%	118	119	0.05	1%	55.5	56.1	0.05	1%	0.31	0.244	0.05	24%	121	119	0.05	2%
Total Mercury (Hg)	ug/L	0.017	0.017	0.5	0%	<0.002	<0.002	0.002	-	0.0067	<0.002	0.002	108%*	0.0028	0.0029	0.002	4%	<0.002	<0.002	0.002	-
Total Molybdenum (Mo)	ug/L	5.43	4.89	0.05	10%	2.58	2.47	0.05	4%	0.442	0.444	0.05	0%	0.348	0.352	0.05	1%	2.41	2.66	0.05	10%
Total Nickel (Ni)	ug/L	2.49	2.47	0.5	1%	0.934	0.875	0.02	7%	1.05	1.06	0.02	1%	0.479	0.539	0.02	12%	1.17	0.798	0.02	38%
Total Phosphorus (P)	ug/L	<50	<50	50	-	49.6	59.9	2	19%	22	4.4	2	133%*	8.2	26.8	2	106%*	39.6	29.5	2	29%
Total Potassium (K)	mg/L	3.73	3.66	0.1	2%	4.65	4.57	0.05	2%	1.82	1.84	0.05	1%	5.43	5.16	0.05	5%	4.3	3.96	0.05	8%
Total Selenium (Se)	ug/L	0.34	0.33	0.1	3%	0.43	0.349	0.04	21%	0.045	0.052	0.04	14%	0.182	0.185	0.04	2%	0.153	0.06	0.04	87%*
Total Silicon (Si)	ug/L	6230	6240	50	0%	5680	5790	50	2%	5030	5010	50	0%	5040	5530	50	9%	5490	5560	50	1%
Total Silver (Ag)	ug/L	0.011	<0.01	0.01	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	0.0051	0.0076	0.005	39%
Total Sodium (Na)	mg/L	4.42	4.37	0.05	1%	5.95	5.98	0.05	1%	4	3.92	0.05	2%	4.64	4.38	0.05	6%	5.98	5.92	0.05	1%
Total Strontium (Sr)	ug/L	514	467	0.2	10%	783	789	0.05	1%	307	301	0.05	2%	1060	981	0.05	8%	792	764	0.05	4%
Total Sulphur (S)	mg/L	28.7	29	0.5	1%	40.6	40.9	3	1%	17.4	17.1	3	2%	55.9	50.7	3	10%	38.2	39.1	3	2%
Total Thallium (Tl)	ug/L	0.026	0.021	0.01	21%	0.0116	0.0099	0.002	16%	0.0028	0.0029	0.002	4%	0.0072	0.0057	0.002	23%	0.0093	0.0105	0.002	12%
Total Tin (Sn)	ug/L	<0.1	<0.1	0.1	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-

Table 2: Field Replicate Analytical Results

Sample ID	Units	MW14-03A	MW14-50	RDL	RPD (%)	MW15-05WB	MW15-60	RDL	RPD (%)	MW14-02A	MW14-100	RDL	RPD (%)	MW14-03B	MW14-200	RDL	RPD (%)
Analytical Lab		Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam		
Lab Job ID		B569424	B569424			B569424	B569424			B578440	B578440			B578440	B578440		
Lab Sample ID		MW5114	MW5119			MW5159	MW5160			NC0866	NC0868			NC0877	NC0878		
Sample Type		GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate		
Sample Date/Time		07-Aug-2015	07-Aug-2015			11-Aug-2015	11-Aug-2015			04-Sep-2015	04-Sep-2015			06-Sep-2015	06-Sep-2015		
Filter and HNO3 Preservation		FIELD	FIELD			LAB	LAB			FIELD	FIELD			FIELD	FIELD		
Physical Properties																	
Conductivity	uS/cm	1570	1550	1	1%	287	290	1	1%	385	389	1	1%	1700	1730	1	2%
pH	pH	8.03	8.04	N/A	0%	7.98	8	N/A	0%	8.14	8.21	N/A	1%	7.95	7.98	N/A	0%
Total Hardness (CaCO3)	mg/L	893	890	0.5	0%	136	141	0.5	4%	188	194	0.5	3%	987	990	0.5	0%
Dissolved Hardness (CaCO3)	mg/L	924	916	0.5	1%	139	140	0.5	1%	185	189	0.5	2%	998	1000	0.5	0%
Total Suspended Solids	mg/L	23.2	22.7	1	2%	<1	1.6	1	46%	<1	<1	1	-	3.5	2.8	1	22%
Total Dissolved Solids	mg/L	1180	1170	10	1%	189	184	10	3%	224	240	10	7%	1330	1330	10	-
Turbidity	NTU	35.9	44.7	0.1	22%	<0.1	0.13	0.1	26%	<0.1	0.49	0.1	132%*	3.06	3.32	0.1	8%
Inorganics	mg/L																
Alkalinity (Total as CaCO3)	mg/L	486	483	0.5	1%	140	144	0.5	3%	145	145	0.5	-	529	538	0.5	2%
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Bicarbonate (HCO3)	mg/L	592	590	0.5	0%	171	175	0.5	2%	177	177	0.5	-	646	657	0.5	2%
Carbonate (CO3)	mg/L	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Hydroxide (OH)	mg/L	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Bromide (Br)	mg/L																
Fluoride (F)	mg/L	0.2	0.2	0.01	-	0.3	0.3	0.01	-	0.09	0.091	0.01	1%	0.26	0.26	0.01	-
Dissolved Chloride (Cl)	mg/L	1.2	1	0.5	18%	<0.5	<0.5	0.5	-	0.56	<0.5	0.5	11%	1.6	2	0.5	22%
Organic / Inorganic Carbon																	
Dissolved Organic Carbon (C)	mg/L	3.7	4.1	0.5	10%	9.5	11	0.5	15%	0.63	0.59	0.5	7%	2.5	2	0.5	22%
Total Organic Carbon (C)	mg/L	4.3	3.6	0.5	18%	330	410	0.5	22%	0.64	0.51	0.5	23%	1.9	1.9	0.5	-
Anions and Nutrients	mg/L																
Total Phosphorus (P)	mg/L	0.0817	0.0808	0.005	1%	0.0654	0.121	0.005	60%	0.0192	0.0157	0.005	20%	0.031	0.0316	0.005	2%
Dissolved Phosphorus (P)	mg/L	0.0714	0.0714	0.005	-	0.0125	0.0112	0.005	11%	0.0159	0.0192	0.005	19%	0.0282	0.0277	0.005	2%
Total Ammonia (N)	mg/L	0.012	0.014	0.005	15%	<0.005	<0.005	0.005	-	0.015	0.021	0.005	33%	0.076	0.051	0.005	39%
Total Total Kjeldahl Nitrogen (Calc)	mg/L	0.282	0.254	0.02	10%	0.32	0.37	0.02	14%	<0.02	0.18	0.02	160%*	0.259	0.159	0.02	48%
Nitrate plus Nitrite (N)	mg/L	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-	0.16	0.113	0.002	34%	0.0048	0.0021	0.002	78%*
Nitrate (N)	mg/L	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-	0.16	0.161	0.002	1%	0.0048	0.0035	0.002	31%
Nitrite (N)	mg/L	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-
Total Nitrogen (N)	mg/L	0.282	0.254	0.02	10%	0.32	0.37	0.02	14%	0.159	0.293	0.02	59%	0.264	0.161	0.02	48%
Dissolved Nitrogen (N)	mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Sulphate (SO4)	mg/L	455	458	5	1%	12.2	13.1	5	7%	52.8	55.9	5	6%	490	535	5	9%
Sulphide	mg/L	0.12	0.12	0.005	-	<0.005	<0.005	0.005	-	0.0113	<0.005	0.005	77%*	0.0253	0.0249	0.005	2%
Total Metals																	
Total Aluminum (Al)	ug/L	9.08	27	0.5	99%	2.56	20.4	0.5	155%	3.72	3.79	0.5	2%	4.38	4.08	0.5	7%
Total Antimony (Sb)	ug/L	0.591	0.592	0.02	0%	0.202	0.212	0.02	5%	0.745	0.797	0.02	7%	0.1	0.101	0.02	1%
Total Arsenic (As)	ug/L	68	68.7	0.02	1%	0.927	0.957	0.02	3%	59	59.1	0.02	0%	8.13	7.94	0.02	2%
Total Barium (Ba)	ug/L	99.5	96.8	0.02	3%	1.65	1.91	0.02	15%	10.3	10.5	0.02	2%	68.2	69.4	0.02	2%
Total Beryllium (Be)	ug/L	0.012	0.015	0.01	22%	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-
Total Bismuth (Bi)	ug/L	0.0076	<0.005	0.005	41%	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-
Total Boron (B)	ug/L	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-
Total Cadmium (Cd)	ug/L	<0.005	0.0109	0.005	74%*	0.0135	0.0158	0.005	16%	<0.005	<0.005	0.005	-	0.051	0.049	0.005	4%
Total Calcium (Ca)	mg/L	130	131	0.05	1%	42.8	44.5	0.05	4%	39.4	40.7	0.05	3%	118	119	0.05	1%
Total Chromium (Cr)	ug/L	<0.1	0.13	0.1	26%	0.3	0.4	0.1	29%	0.51	0.52	0.1	2%	<0.1	<0.1	0.1	-
Total Cobalt (Co)	ug/L	1.73	1.66	0.005	4%	0.058	0.0656	0.005	12%	0.019	0.017	0.005	11%	6.94	6.93	0.005	0%
Total Copper (Cu)	ug/L	0.44	1.06	0.05	83%	0.116	0.411	0.05	112%*	0.075	0.091	0.05	19%	2.36	2.62	0.05	10%
Total Iron (Fe)	ug/L	8400	8610	1	2%	7.3	14.3	1	65%	1.1	1.2	1	9%	1070	1100	1	3%
Total Lead (Pb)	ug/L	0.0491	0.124	0.005	87%	0.019	0.0281	0.005	39%	<0.005	<0.005	0.005	-	0.164	0.178	0.005	8%
Total Lithium (Li)	ug/L	24.9	29.7	0.5	18%	12.5	12	0.5	4%	7.72	7.96	0.5	3%	27	26.4	0.5	2%
Total Magnesium (Mg)	mg/L	138	137	0.05	1%	7.01	7.3	0.05	4%	21.7	22.5	0.05	4%	168	168	0.05	-
Total Manganese (Mn)	ug/L	748	742	0.05	1%	4.45	4.9	0.05	10%	2.63	2.8	0.05	6%	3180	3140	0.05	1%
Total Mercury (Hg)	ug/L	0.0118	0.0116	0.002	2%	<0.002	<0.002	0.002	-	0.0041	0.0041	0.002	-	0.0201	0.0211	0.002	5%
Total Molybdenum (Mo)	ug/L	2.92	3.1	0.05	6%	0.564	0.631	0.05	11%	3.28	3.2	0.05	2%	7.65	7.86	0.05	3%
Total Nickel (Ni)	ug/L	0.616	0.804	0.02	26%	0.448	0.489	0.02	9%	0.075	0.067	0.02	11%	18.3	18.7	0.02	2%
Total Phosphorus (P)	ug/L	65.3	157	2	83%	21.2	59.8	2	95%	10.6	9.1	2	15%	34.6	35.1	2	1%
Total Potassium (K)	mg/L	8.4	8.47	0.05	1%	0.792	0.857	0.05	8%	2.75	2.8	0.05	2%	8.46	8.7	0.05	3%
Total Selenium (Se)	ug/L	<0.04	<0.04	0.04	-	0.104	0.111	0.04	7%	0.274	0.298	0.04	8%	0.15	0.153	0.04	2%
Total Silicon (Si)	ug/L	7300	7310	50	0%	8980	9780	50	9%	5610	5720	50	2%	5380	5470	50	2%
Total Silver (Ag)	ug/L	0.0058	0.0063	0.005	8%	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	0.034	0.033	0.005	3%
Total Sodium (Na)	mg/L	27.6	28.5	0.05	3%	9.36	9.65	0.05	3%	3.09	3.14	0.05	2%	26.8	27.3	0.05	2%
Total Strontium (Sr)	ug/L	4240	4240	0.05	-	138	137	0.05	1%	381	391	0.05	3%	3490	3490	0.05	-
Total Sulphur (S)	mg/L	166	167	3	1%	3.8	3.9	3	3%	19.6	19.7	3	1%	193	194	3	1%
Total Thallium (Tl)	ug/L	0.0377	0.0088	0.002	124%*	<0.002	<0.002	0.002	-	0.028	0.04	0.002	35%	0.193	0.206	0.002	7%
Total Tin (Sn)	ug/L	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-

Table 2: Field Replicate Analytical Results

Sample ID	Units	MW14-02B	F-DUP-1	RDL	RPD (%)	MW15-04WB	MW15-20	RDL	RPD (%)	MW15-03AZ	MW15-21	RDL	RPD (%)	MW15-02AZ	MW15-40AZ	RDL	RPD (%)	MW15-04WB	MW15-30WB	RDL	RPD (%)
Analytical Lab		**ALS**	**ALS**			Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam		
Lab Job ID		L1525019	L1525019			B551383	B551383			B551383	B551383			B559978	B559978			B558916	B558916		
Lab Sample ID		L1525019-2	L1525019-4			MM1018	MM1019			MM1021	MM1022			MR0622	MR0623			MQ4530	MQ4532		
Sample Type						GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate		
Sample Date/Time		28-Sep-2014	28-Sep-2014			14-Jun-2015	14-Jun-2015			16-Jun-2015	16-Jun-2015			11-Jul-2015	11-Jul-2015			10-Jul-2015	10-Jul-2015		
Filter and HNO3 Preservation		FIELD	FIELD			LAB	LAB			FIELD	FIELD			FIELD	FIELD			LAB	LAB		
Total Titanium (Ti)	ug/L	<10	<10	10	-	<0.5	0.57	0.5	13%	0.74	0.57	0.5	26%	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Total Uranium (U)	ug/L	91.9	81.6	0.01	12%	176	176	0.002	-	35.4	37	0.002	4%	23.5	25.2	0.002	7%	170	192	0.002	12%
Total Vanadium (V)	ug/L	<1	<1	1	-	0.25	0.26	0.2	4%	0.2	<0.2	0.2	-	0.29	0.21	0.2	32%	0.29	0.29	0.2	-
Total Zinc (Zn)	ug/L	11.9	11	3	8%	44.6	42.5	0.1	5%	7.96	0.71	0.1	167%	1.72	1.39	0.1	21%	17.9	3.3	0.1	138%
Total Zirconium (Zr)	ug/L	-	-	-	-	0.26	0.27	0.1	4%	0.3	0.28	0.1	7%	0.17	0.16	0.1	6%	0.27	0.24	0.1	12%
Dissolved Metals																					
Dissolved Aluminum (Al)	ug/L	1	<1	1	-	44.1	44.1	0.5	-	38.1	30.5	0.5	22%	14.8	12.2	0.5	19%	21	3.2	0.5	147%
Dissolved Antimony (Sb)	ug/L	3.27	2.89	0.1	12%	3.02	2.87	0.02	5%	0.153	0.158	0.02	3%	0.147	0.14	0.02	5%	2.97	3.05	0.02	3%
Dissolved Arsenic (As)	ug/L	20.4	20.5	0.1	0%	1.54	1.51	0.02	2%	0.431	0.411	0.02	5%	0.917	0.905	0.02	1%	1.37	1.32	0.02	4%
Dissolved Barium (Ba)	ug/L	54.7	54.2	0.05	1%	33.3	32.4	0.02	3%	37.9	39.7	0.02	5%	89.9	85.5	0.02	5%	31.9	32.3	0.02	1%
Dissolved Beryllium (Be)	ug/L	<0.1	<0.1	0.1	-	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-	<0.1	<0.1	0.01	-
Dissolved Bismuth (Bi)	ug/L	<0.5	<0.5	0.5	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<1	<1	0.005	-
Dissolved Boron (B)	ug/L	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-	<50	<50	10	-
Dissolved Cadmium (Cd)	ug/L	<0.01	<0.01	0.01	-	0.0487	0.0539	0.005	10%	0.012	0.0122	0.005	2%	0.125	0.0283	0.005	126%	0.081	0.037	0.005	75%
Dissolved Calcium (Ca)	mg/L	61.8	61.4	0.05	1%	73.1	76.4	0.05	4%	40.6	41.4	0.05	2%	111	110	0.05	1%	70	71.7	0.05	2%
Dissolved Chromium (Cr)	ug/L	0.41	0.42	0.1	2%	<0.1	<0.1	0.1	-	0.16	0.1	0.1	46%	0.2	0.15	0.1	29%	<1	<1	0.1	-
Dissolved Cobalt (Co)	ug/L	0.62	0.62	0.1	0%	0.221	0.227	0.005	3%	0.0611	0.0597	0.005	2%	0.0388	0.0294	0.005	28%	<0.5	<0.5	0.005	-
Dissolved Copper (Cu)	ug/L	<0.2	<0.2	0.2	-	2.26	2.12	0.05	6%	1.37	1.54	0.05	12%	1.34	1.09	0.05	21%	1.31	0.96	0.05	31%
Dissolved Iron (Fe)	ug/L	<10	<10	10	-	6.4	8.9	1	33%	12.3	11.1	1	10%	10.7	11.2	1	5%	12.4	5.4	1	79%
Dissolved Lead (Pb)	ug/L	<0.05	<0.05	0.05	-	0.337	0.32	0.005	5%	0.0196	<0.005	0.005	119%*	0.021	0.0085	0.005	85%*	<0.2	0.31	0.005	43%
Dissolved Lithium (Li)	ug/L	7.59	7.19	0.5	5%	7.37	6.91	0.5	6%	1.33	2.45	0.5	59%*	3.71	3.91	0.5	5%	6.7	7	0.5	4%
Dissolved Magnesium (Mg)	mg/L	31.2	31.1	0.1	0%	37.7	37.7	0.05	-	12.1	13.2	0.05	9%	33.8	33.3	0.05	1%	36.7	36.6	0.05	0%
Dissolved Manganese (Mn)	ug/L	162	159	0.05	2%	115	116	0.05	1%	55.2	57.6	0.05	4%	1	0.269	0.05	115%	123	119	0.05	3%
Dissolved Mercury (Hg)	ug/L	<0.01	<0.01	0.01	-	<0.002	<0.002	0.002	-	<0.002	<0.002	0.002	-	0.0028	0.0029	0.002	4%	<0.01	<0.01	0.002	-
Dissolved Molybdenum (Mo)	ug/L	4.96	4.55	0.05	9%	2.55	2.4	0.05	6%	0.451	0.42	0.05	7%	0.354	0.343	0.05	3%	2.6	2.3	0.05	12%
Dissolved Nickel (Ni)	ug/L	2.5	2.4	0.5	4%	0.804	0.795	0.02	1%	1.08	1.12	0.02	4%	0.682	0.552	0.02	21%	1.2	<1	0.02	18%
Dissolved Phosphorus (P)	ug/L	<50	<50	50	-	23.8	30.4	2	24%	26.8	7.2	2	115%*	5.36	5.39	2	1%	4.47	4.05	2	10%
Dissolved Potassium (K)	mg/L	3.74	3.69	0.1	1%	4.16	4.55	0.05	9%	1.78	1.89	0.05	6%	36.3	11.2	0.05	106%			0.05	
Dissolved Selenium (Se)	ug/L	0.31	0.33	0.1	6%	0.246	0.265	0.04	7%	0.052	0.064	0.04	21%	0.169	0.177	0.04	5%	0.2	0.13	0.04	42%
Dissolved Silicon (Si)	ug/L	6270	6270	50	0%	6370	6270	50	2%	5300	5810	50	9%	5180	5130	50	1%	5550	5680	50	2%
Dissolved Silver (Ag)	ug/L	<0.01	<0.01	0.01	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.02	<0.02	0.005	-
Dissolved Sodium (Na)	mg/L	4.53	4.56	0.05	1%	6.05	5.96	0.05	1%	4.16	4.37	0.05	5%	4.75	4.66	0.05	2%	6.61	5.92	0.05	11%
Dissolved Strontium (Sr)	ug/L	494	459	0.2	7%	782	794	0.05	2%	303	319	0.05	5%	1070	1070	0.05	-	777	776	0.05	0%
Dissolved Sulphur (S)	mg/L	29	29	0.5	0%	45.9	42.3	3	8%	18	18.2	3	1%	59.8	59	3	1%	44.9	41.6	3	8%
Dissolved Thallium (Tl)	ug/L	0.025	0.022	0.01	13%	0.0068	0.0078	0.002	14%	0.0024	<0.002	0.002	18%	0.0059	0.0049	0.002	19%	<0.05	<0.05	0.002	-
Dissolved Tin (Sn)	ug/L	<0.1	<0.1	0.1	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<5	<5	0.2	-
Dissolved Titanium (Ti)	ug/L	<10	<10	10	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<5	<5	0.5	-
Dissolved Uranium (U)	ug/L	92.5	83.3	0.01	10%	176	176	0.002	-	35.4	37.4	0.002	5%	23.9	23.6	0.002	1%	161	169	0.002	5%
Dissolved Vanadium (V)	ug/L	<1	<1	1	-	0.25	0.25	0.2	-	<0.2	<0.2	0.2	-	0.29	0.27	0.2	7%	<5	<5	0.2	-
Dissolved Zinc (Zn)	ug/L	10.3	10.3	1	0%	24	29.4	0.1	20%	7.61	3.15	0.1	83%	8.64	1.75	0.1	133%	35.9	9.6	0.1	116%
Dissolved Zirconium (Zr)	ug/L	-	-	-	-	0.26	0.26	0.1	-	0.32	0.26	0.1	21%	0.19	0.17	0.1	11%	<0.5	<0.5	0.1	-

Notes:
1. RDL = Reported Detection Limit
2. RPD = Relative Percent Difference
3. "-" indicates that analyses were not performed, or RPD was not calculated for parameters where one or both of the concentrations were below the RDL.
4. "*" indicates that one or both of the measured concentrations is < 5x the RDL. The RPD is not considered to be representative of the actual sample variability due to elevated analytical imprecision close to the RDL.

Red shading indicates duplicate sample values which have an RPD greater than 50%.

Table 2: Field Replicate Analytical Results

Sample ID	Units	MW14-03A	MW14-50	RDL	RPD (%)	MW15-05WB	MW15-60	RDL	RPD (%)	MW14-02A	MW14-100	RDL	RPD (%)	MW14-03B	MW14-200	RDL	RPD (%)
Analytical Lab		Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam			Maxxam	Maxxam		
Lab Job ID		B569424	B569424			B569424	B569424			B578440	B578440			B578440	B578440		
Lab Sample ID		MW5114	MW5119			MW5159	MW5160			NC0866	NC0868			NC0877	NC0878		
Sample Type		GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate			GW Sample	GW Duplicate		
Sample Date/Time		07-Aug-2015	07-Aug-2015			11-Aug-2015	11-Aug-2015			04-Sep-2015	04-Sep-2015			06-Sep-2015	06-Sep-2015		
Filter and HNO3 Preservation		FIELD	FIELD			LAB	LAB			FIELD	FIELD			FIELD	FIELD		
Total Titanium (Ti)	ug/L	0.62	<0.5	0.5	21%	<0.5	0.69	0.5	32%	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Total Uranium (U)	ug/L	49.4	48.9	0.002	1%	72.9	73.3	0.002	1%	49.6	50.3	0.002	1%	41.3	41.7	0.002	1%
Total Vanadium (V)	ug/L	0.29	0.33	0.2	13%	<0.2	<0.2	0.2	-	0.23	<0.2	0.2	14%	<0.2	<0.2	0.2	-
Total Zinc (Zn)	ug/L	2.46	8.34	0.1	109%	20.3	26.3	0.1	26%	0.33	0.31	0.1	6%	1.07	1.01	0.1	6%
Total Zirconium (Zr)	ug/L	2.58	2.88	0.1	11%	<0.1	<0.1	0.1	-	<0.1	<0.1	0.1	-	0.33	0.27	0.1	20%
Dissolved Metals																	
Dissolved Aluminum (Al)	ug/L	52.8	43.5	0.5	19%	1.7	23.1	0.5	173%*	3.96	4.44	0.5	11%	2.81	2.88	0.5	2%
Dissolved Antimony (Sb)	ug/L	0.586	0.595	0.02	2%	0.217	0.222	0.02	2%	0.697	0.708	0.02	2%	0.087	0.085	0.02	2%
Dissolved Arsenic (As)	ug/L	68.9	71.9	0.02	4%	0.971	0.958	0.02	1%	53.8	54.7	0.02	2%	7.63	7.76	0.02	2%
Dissolved Barium (Ba)	ug/L	98	103	0.02	5%	1.97	1.91	0.02	3%	9.88	10.1	0.02	2%	61.8	64.1	0.02	4%
Dissolved Beryllium (Be)	ug/L	0.016	0.017	0.01	6%	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-	<0.01	<0.01	0.01	-
Dissolved Bismuth (Bi)	ug/L	<0.005	0.0111	0.005	76%*	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-
Dissolved Boron (B)	ug/L	<10	18	10	57%*	<10	<10	10	-	<10	<10	10	-	<10	<10	10	-
Dissolved Cadmium (Cd)	ug/L	0.0545	0.014	0.005	118%*	0.0159	0.0159	0.005	-	<0.005	<0.005	0.005	-	0.008	<0.005	0.005	46%
Dissolved Calcium (Ca)	mg/L	135	137	0.05	1%	44.5	44.7	0.05	0%	40.3	40.5	0.05	0%	129	131	0.05	2%
Dissolved Chromium (Cr)	ug/L	0.21	0.22	0.1	5%	<0.1	<0.1	0.1	-	0.47	0.49	0.1	4%	<0.1	<0.1	0.1	-
Dissolved Cobalt (Co)	ug/L	1.75	1.88	0.005	7%	0.0571	0.0451	0.005	23%	0.014	0.013	0.005	7%	6.14	6.11	0.005	0%
Dissolved Copper (Cu)	ug/L	1.65	1.53	0.05	8%	0.083	0.102	0.05	21%	0.065	0.056	0.05	15%	0.489	0.434	0.05	12%
Dissolved Iron (Fe)	ug/L	8760	8880	1	1%	2.7	3.3	1	20%	<1	<1	1	-	1010	1020	1	1%
Dissolved Lead (Pb)	ug/L	0.14	0.205	0.005	38%	0.0104	0.0122	0.005	16%	<0.005	<0.005	0.005	-	0.022	0.015	0.005	38%
Dissolved Lithium (Li)	ug/L	32.3	31.4	0.5	3%	13	13	0.5	-	7.42	7.66	0.5	3%	23	24.9	0.5	8%
Dissolved Magnesium (Mg)	mg/L	142	139	0.05	2%	7	6.97	0.05	0%	20.5	21.4	0.05	4%	164	163	0.05	1%
Dissolved Manganese (Mn)	ug/L	754	797	0.05	6%	5.36	4.02	0.05	29%	2.42	2.46	0.05	2%	2920	2890	0.05	1%
Dissolved Mercury (Hg)	ug/L	0.0021	0.0039	0.002	60%*	<0.002	<0.002	0.002	-	0.004	0.0038	0.002	5%	0.0047	0.0033	0.002	35%
Dissolved Molybdenum (Mo)	ug/L	2.95	3.41	0.05	14%	0.635	0.721	0.05	13%	2.78	2.84	0.05	2%	6.77	6.86	0.05	1%
Dissolved Nickel (Ni)	ug/L	0.846	0.935	0.02	10%	0.345	0.365	0.02	6%	0.086	0.082	0.02	5%	16.6	16.6	0.02	-
Dissolved Phosphorus (P)	ug/L	144	195	2	30%	42.4	105	2	85%	7.4	6.9	2	7%	29.4	27.4	2	7%
Dissolved Potassium (K)	mg/L	8.25	8.91	0.05	8%	1.07	1.03	0.05	4%	2.86	2.83	0.05	1%	8.42	8.51	0.05	1%
Dissolved Selenium (Se)	ug/L	<0.04	<0.04	0.04	-	0.138	0.128	0.04	8%	0.229	0.237	0.04	3%	0.123	0.131	0.04	6%
Dissolved Silicon (Si)	ug/L	7320	7270	50	1%	8860	8910	50	1%	6160	6350	50	3%	6070	6300	50	4%
Dissolved Silver (Ag)	ug/L	0.0135	0.0077	0.005	55%*	<0.005	<0.005	0.005	-	<0.005	<0.005	0.005	-	0.007	0.006	0.005	15%
Dissolved Sodium (Na)	mg/L	29	28	0.05	4%	9.22	9.16	0.05	1%	2.87	2.89	0.05	1%	26.8	25.6	0.05	5%
Dissolved Strontium (Sr)	ug/L	4380	4550	0.05	4%	140	140	0.05	-	362	352	0.05	3%	3380	3400	0.05	1%
Dissolved Sulphur (S)	mg/L	166	162	3	2%	3.5	3.6	3	3%	18.2	18.6	3	2%	193	191	3	1%
Dissolved Thallium (Tl)	ug/L	0.0263	0.01	0.002	90%	0.0027	<0.002	0.002	30%	0.024	0.035	0.002	37%	0.135	0.14	0.002	4%
Dissolved Tin (Sn)	ug/L	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-
Dissolved Titanium (Ti)	ug/L	0.69	0.86	0.5	22%	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-	<0.5	<0.5	0.5	-
Dissolved Uranium (U)	ug/L	50.1	53.7	0.002	7%	70	71.6	0.002	2%	44.6	45.4	0.002	2%	37.5	38.2	0.002	2%
Dissolved Vanadium (V)	ug/L	0.41	0.34	0.2	19%	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-	<0.2	<0.2	0.2	-
Dissolved Zinc (Zn)	ug/L	16.2	16.2	0.1	-	45.8	40.1	0.1	13%	0.27	0.54	0.1	67%*	0.75	0.85	0.1	13%
Dissolved Zirconium (Zr)	ug/L	2.96	3.1	0.1	5%	<0.1	<0.1	0.1	-	<0.1	<0.1	0.1	-	0.34	0.3	0.1	13%

Notes:
1. RDL = Reported Detection Limit
2. RPD = Relative Percent Difference
3. "-" indicates that analyses were not performed, or RPD was not calculated for parameters where one or both of the concentrations were below the RDL.
4. "*" indicates that one or both of the measured concentrations is < 5x the RDL. The RPD is not considered to be representative of the actual sample variability due to elevated analytical imprecision close to the RDL.

Red shading indicates duplicate sample values which have an RPD greater than 50%.

Table 3: Comparison of Total and Dissolved Metals Analytical Results

Sample ID	Station	Sample Date	Analytical Laboratory	Lab Job ID	Total Aluminum (Al)	Total Antimony (Sb)	Total Arsenic (As)	Total Barium (Ba)	Total Beryllium (Be)	Total Bismuth (Bi)	Total Boron (B)	Total Cadmium (Cd)	Total Calcium (Ca)	Total Chromium (Cr)	Total Cobalt (Co)	Total Copper (Cu)	Total Iron (Fe)	Total Lead (Pb)	Total Lithium (Li)	Total Magnesium (Mg)
					ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
Maxxam RDL:					0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	0.1	0.005	0.05	1	0.005	0.5	0.05
ALS RDL:					3	0.1	0.1	0.05	0.1	0.5	10	0.01	0.05	0.1	0.1	0.5	10	0.05	0.5	0.1
MW14-02A	MW14-02A	28/09/14	ALS	L1525019	7.5	0.85	68.4	13.4	<0.1	<0.5	<10	<0.01	44.6	0.65	0.13	<0.5	<10	<0.05	7.01	21.4
MW14-02A	MW14-02A	12/06/15	Maxxam	B550137	59.9	7.07	38	51.3	0.02	0.0106	<10	<0.0050	49.5	0.22	2.81	0.368	42.4	0.159	7.53	31.9
MW14-02A	MW14-02A	16/07/15	Maxxam	B562572	12.9	0.748	47.4	13.1	<0.010	<0.0050	<10	<0.0050	39.6	0.4	0.0233	<0.050	14.1	<0.0050	7.73	19.7
MW14-02A	MW14-02A	06/08/15	Maxxam	B569424	16.1	0.734	55.2	13.9	<0.010	<0.0050	<10	<0.0050	46.1	0.58	0.0332	0.183	20.7	0.0148	8.79	23.4
MW14-02A	MW14-02A	04/09/15	Maxxam	B578440	3.72	0.745	59	10.3	<0.010	<0.0050	<10	<0.0050	39.4	0.51	0.019	0.075	1.1	<0.0050	7.72	21.7
MW14-100	MW14-02A	04/09/15	Maxxam	B578440	3.79	0.797	59.1	10.5	<0.010	<0.0050	<10	<0.0050	40.7	0.52	0.017	0.091	1.2	<0.0050	7.96	22.5
F-DUP-1	MW14-02B	28/09/14	ALS	L1525019	4.5	2.87	20	53	<0.1	<0.5	<10	<0.01	60.8	0.5	0.63	<0.5	<10	<0.05	6.87	30.7
MW14-02B	MW14-02B	28/09/14	ALS	L1525019	6.3	3.25	19.4	54	<0.1	<0.5	<10	<0.01	61.4	0.51	0.62	<0.5	<10	<0.05	7.65	30.5
MW14-02B	MW14-02B	12/06/15	Maxxam	B550137	13	0.86	54.4	14.6	<0.010	<0.0050	<10	<0.0050	41.9	0.58	0.0385	0.538	38	0.0472	7.06	21
MW14-02B	MW14-02B	16/07/15	Maxxam	B562572	12.5	6.39	37.2	57.9	<0.010	<0.0050	<10	<0.0050	52.3	<0.10	1.57	0.143	20	0.0142	7.72	29.9
MW14-02B	MW14-02B	06/08/15	Maxxam	B569424	15.3	5.96	39.2	55.3	<0.010	<0.0050	<10	<0.0050	59.7	0.17	1.45	0.264	24.2	0.0434	8.55	31.7
MW14-02B	MW14-02B	04/09/15	Maxxam	B578440	21.8	6.37	42	44.6	0.013	<0.0050	<10	0.013	52.3	0.37	1.75	0.981	101	0.113	8.23	30.7
MW14-03A	MW14-03A	22/06/15	Maxxam	B553846	6.05	0.979	46	141	0.013	0.008	<10	0.007	133	<0.10	2.42	0.63	7680	0.076	27.4	137
MW14-03A	MW14-03A	12/07/15	Maxxam	B559978	24.5	0.754	65	132	0.013	<0.0050	<10	0.0065	140	0.27	2.05	0.887	9580	0.128	26.9	125
MW14-03A	MW14-03A	07/08/15	Maxxam	B569424	9.08	0.591	68	99.5	0.012	0.0076	<10	<0.0050	130	<0.10	1.73	0.44	8400	0.0491	24.9	138
MW14-03A	MW14-03A	06/09/15	Maxxam	B578440	5.29	0.356	75.3	118	0.018	<0.0050	10	<0.0050	126	<0.10	1.51	0.726	8370	0.564	29.9	136
MW14-50	MW14-03A	07/08/15	Maxxam	B569424	27	0.592	68.7	96.8	0.015	<0.0050	<10	0.0109	131	0.13	1.66	1.06	8610	0.124	29.7	137
MW14-03B	MW14-03B	22/06/15	Maxxam	B553846	18.4	0.136	7.68	91.7	<0.010	0.006	<10	0.067	120	0.3	6.9	5.38	1670	0.201	22.9	158
MW14-03B	MW14-03B	12/07/15	Maxxam	B559978	26.4	0.129	9.72	87.6	<0.010	<0.0050	<10	0.106	133	0.55	6.78	4.39	2280	0.297	20.8	138
MW14-03B	MW14-03B	07/08/15	Maxxam	B569424	15.9	0.111	8.23	70	<0.010	0.0139	<10	0.056	130	0.14	6.94	3.47	1320	0.172	22.8	171
MW14-03B	MW14-03B	06/09/15	Maxxam	B578440	4.38	0.1	8.13	68.2	<0.010	<0.0050	<10	0.051	118	<0.10	6.94	2.36	1070	0.164	27	168
MW14-200	MW14-03B	06/09/15	Maxxam	B578440	4.08	0.101	7.94	69.4	<0.010	<0.0050	<10	0.049	119	<0.10	6.93	2.62	1100	0.178	26.4	168
MW14-05A	MW14-05A	23/06/15	Maxxam	B553846	89.5	0.789	1910	99.7	0.03	0.008	<10	0.015	42.6	0.22	1.13	1.77	2080	0.317	25.9	8.72
MW14-05A	MW14-05A	13/07/15	Maxxam	B559978	116	0.748	1670	95.8	0.027	0.0095	<10	0.0499	46.7	0.43	0.89	3.19	2660	0.742	27.4	7.12
MW14-05A	MW14-05A	08/08/15	Maxxam	B569424	69.7	0.746	1710	108	0.024	0.0105	<10	0.0705	47.8	0.35	0.948	1.86	3080	0.372	35.3	10.3
MW14-05A	MW14-05A	07/09/15	Maxxam	B578440	22.8	0.561	1810	123	0.023	<0.0050	<10	0.024	46.6	0.2	1.04	0.467	3790	0.154	28.1	8.95
MW14-05B	MW14-05B	24/06/15	Maxxam	B554336	945	1.16	148	111	0.067	0.019	11	0.14	43.1	1.85	2.15	13.4	1370	1.94	35.7	7.79
MW14-05B	MW14-05B	14/07/15	Maxxam	B560161	334	0.912	129	93.4	0.016	0.0057	18	0.0815	47.4	1.2	1.59	5.86	969	1.23	34.1	6.83
MW14-05B	MW14-05B	09/08/15	Maxxam	B569424	108	0.642	141	83	0.015	<0.0050	26	0.0356	49	0.58	1.4	2.07	1290	0.525	37.9	7.72
MW14-05B	MW14-05B	08/09/15	Maxxam	B579224	68.9	0.635	176	81.5	<0.010	0.007	12	0.046	45.5	1.73	1.51	2.56	1900	0.427	34.9	8.47
MW15-01WB	MW15-01WB	08/07/15	Maxxam	B558595	11.9	0.585	31	10.7	0.038	<0.0050	<10	0.0476	246	0.23	0.765	0.862	510	4.83	23.4	192
MW15-01WB	MW15-01WB	10/08/15	Maxxam	B569424	49	0.376	34.7	11.4	0.04	<0.0050	<10	0.108	251	1.48	0.77	0.605	620	0.211	26.5	200
MW15-01WB	MW15-01WB	03/09/15	Maxxam	B578440	5.1	0.321	39.8	8.96	0.045	<0.0050	<10	0.026	222	0.46	0.701	0.301	520	0.167	25.7	197
MW15-01WB/BH8-WB	MW15-01WB	07/06/15	Maxxam	B549739	4.17	0.742	34.5	10.1	0.041	<0.0050	<10	0.0211	283	0.21	0.88	0.459	384	0.123	22	184
MW15-02 AZ/BH10-AZ	MW15-02AZ	31/05/15	Maxxam	B546672	8.38	0.434	1.1	95.8	<0.010	<0.0050	<10	0.0089	130	0.11	0.186	1.19	6.4	0.0094	4.09	41
MW15-02AZ	MW15-02AZ	11/07/15	Maxxam	B559978	10.3	0.14	0.948	87.6	<0.010	<0.0050	<10	0.0146	109	0.17	0.0261	1.03	8.4	0.0135	3.85	33.2
MW15-02AZ	MW15-02AZ	12/08/15	Maxxam	B569424	8.95	0.153	1.03	82.8	<0.010	<0.0050	<10	0.0056	106	0.15	0.049	1.12	6.8	0.01	4.03	34.8
MW15-02AZ	MW15-02AZ	07/09/15	Maxxam	B578440	6.95	0.152	1.04	74.9	<0.010	<0.0050	<10	<0.0050	104	0.12	0.1	0.994	12.6	<0.0050	3.77	32.4
MW15-40AZ	MW15-02AZ	11/07/15	Maxxam	B559978	8.17	0.143	0.831	94.4	<0.010	<0.0050	<10	0.0209	114	0.13	0.0244	1.01	7.1	0.0145	3.73	30.5
MW15-02 WB/BH10-WB	MW15-02WB	01/06/15	Maxxam	B546672	6.19	0.343	2.44	26.3	<0.010	<0.0050	<10	0.0478	129	2.1	0.154	1.44	324	0.311	3.73	34.6
MW15-02WB	MW15-02WB	11/07/15	Maxxam	B559978	22.9	0.128	2.68	23	0.013	<0.0050	<10	0.0348	128	0.37	0.106	0.293	397	0.24	3.91	34.5
MW15-02WB	MW15-02WB	12/08/15	Maxxam	B569424	8.86	0.128	2.99	24	0.015	<0.0050	<10	0.0342	134	0.62	0.13	0.248	412	0.362	4.57	36.9
MW15-02WB	MW15-02WB	07/09/15	Maxxam	B578440	1.84	0.082	0.581	38.9	<0.010	<0.0050	<10	0.011	128	0.15	0.074	1.81	16.7	0.023	3.85	35.2
MW15-03AZ	MW15-03AZ	16/06/15	Maxxam	B551383	47.2	0.15	0.45	38	<0.010	<0.0050	<10	0.0118	41	0.19	0.0612	1.39	30.1	0.0311	0.7	11.9
MW15-03AZ	MW15-03AZ	09/07/15	Maxxam	B558921	25.5	0.128	0.409	29.5	<0.010	<0.0050	<10	0.0185	37.7	0.2	0.0709	1.44	17.4	0.0129	0.56	11
MW15-03AZ	MW15-03AZ	10/08/15	Maxxam	B569424	32.8	0.203	0.525	30	0.013	<0.0050	<10	0.016	29.3	0.3	0.0583	1.94	23.3	0.0136	0.85	8.44
MW15-03AZ	MW15-03AZ	04/09/15	Maxxam	B578440	19.4	0.188	0.515	25.8	0.016	<0.0050	<10	0.011	26	0.22	0.058	1.99	14	<0.0050	0.8	8.27
MW15-21	MW15-03AZ	16/06/15	Maxxam	B551383	34.4	0.141	0.445	38.1	0.011	<0.0050	<10	0.0104	40	0.14	0.0589	1.28	23.5	0.0216	<0.50	11.8
MW15-03WB	MW15-03WB	16/06/15	Maxxam	B551383	54.5	0.076	0.525	17	0.017	<0.0050	18	0.0096	182	1.37	0.187	0.232	533	0.0361	12.1	140
MW15-03WB	MW15-03WB	09/07/15	Maxxam	B558921	30	0.091	0.611	13.9	0.01	<0.0050	31	0.0258	155	0.74	0.102	0.362	586	0.0656	10	132
MW15-03WB	MW15-03WB	10/08/15	Maxxam	B569424	9.55	0.046	0.719	11.4	<0.010	<0.0050	25	0.0186	156	0.48	0.068	0.325	553	0.0308	12.1	133
MW15-03WB	MW15-03WB	04/09/15	Maxxam	B578440	6.88	0.059	0.447	10.4	0.011	<0.0050	31	0.022	151	0.3	0.064	0.238	557	0.036	12	132
MW15-04WB	MW15-04WB	14/06/15	Maxxam	B551383	8.95	2.86	1.65	35.4	<0.010	<0.0050	<10	0.0605	73.2	0.3	0.221	2.15	23.1	0.491	6.88	36.9
MW15-04WB	MW15-04WB	10/07/15	Maxxam	B558916	7.77	2.88	1.39	34.5	<0.010	<0.0050	<10	0.0611	71.2	0.4	0.255	1.18	21.1	0.293	6.04	36.7
MW15-04WB	MW15-04WB	11/08/15	Maxxam	B569424	23.8	2.69	1.65	37.6	<0.010	<0.0050	<10	0.125	75.7	1.02	0.241	2.85	43.1	0.293	7.01	39.4
MW15-04WB	MW15-04WB	05/09/15	Maxxam	B578440	5.75	2.69	1.2	33.3	0.012	<0.0050	<10	0.042	69.3	0.21	0.218	1.07	17	0.367	7.33	38.2
MW15-20	MW15-04WB	14/06/15	Maxxam	B551383	11.8	2.91	1.69	34.8	<0.010	<0.0050	<10	0.0572	75.4	0.28	0.22	2.11	20.1	0.48	6.47	36.6
MW15-30WB	MW15-04WB	10/07/15	Maxxam	B558916	7.62	3.37	1.25	38.2	<0.010	<0.0050	<10	0.0353	71.4	0.12	0.243	1.08	12.6	0.513	7.19	36.1
MW15-05AZ	MW15-05AZ	06/09/15	Maxxam	B578440	201	0.088	3.03	18.5	0.03	<0.0050	<10	0.022	2.73	0.8	2.7	2.03	1360	0.06	<0.50	0.766
MW15-05WB	MW15-05WB	18/06/15	Maxxam	B553846	7.11	0.371	1.25	3.97	<0.010	<0.0050	<10	0.041	44.3	0.5	0.072	0.607	13.7	0.15	12.9	7.06
MW15-05WB	MW15-05WB	10/07/15	Maxxam	B558916	29.7	0.348	1.25	5.44	<0.010	<0.0050	<10	0.0683	41.1	2.67	0.125	0.551	47.5	0.104	11.7	7.08
MW15-05WB	MW15-05WB	11/08/15	Maxxam	B569424	2.56	0.202	0.927	1.65	<0.010	<0.0050	<10	0.0135	42.8	0.3	0.058	0.116	7.3	0.019	12.5	7.01
MW15-05WB	MW15-05WB	06/09/15	Maxxam	B578440	1.43	0.186	0.891	1.01	<0.010	<0.0050	<10	<0.0050	42	0.13	0.055	0.118	3.2	0.009	12.2	6.97
MW15-60	MW15-05WB	11/08/15	Maxxam	B569424	20.4	0.212	0.957	1.91	<0.010	<0.0050	<10	0.0158	44.5	0.4	0.0656	0.411	14.3	0.0281	12	7.3
MW15-06WB	MW15-06WB	21/07/15	Maxxam	B562572	275	2.3	12.5	39.2	<0.010	<0.0050	<10	0.0635	65.1	1.86	2.13	1.38	507	0.263	11.1	30.5
MW15-06WB	MW15-06WB	09/08/15	Maxxam	B569424	151	2.63	21.2	41.8	<0.010	<0.0050		0.0407	74.5	1.13	2.58	0.952	269	0.124	11.4	36.3
MW15-06WB	MW15-06WB	08/09/15	Maxxam	B579224	58.7	0.673	22.8	52.5	<0.010	<0.0050	<10	0.026	73.4	0.59	2.95	1.09	780	0.063	11.9	35.4

and Dissolved Metals Analytical Results

Station	Sample Date	Total Manganese (Mn)	Total Mercury (Hg)	Total Molybdenum (Mo)	Total Nickel (Ni)	Total Phosphorus (P)	Total Potassium (K)	Total Selenium (Se)	Total Silicon (Si)	Total Silver (Ag)	Total Sodium (Na)	Total Strontium (Sr)	Total Sulphur (S)	Total Thallium (Tl)	Total Tin (Sn)	Total Titanium (Ti)	Total Uranium (U)	Total Vanadium (V)	Total Zinc (Zn)	Total Zirconium (Zr)
		ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
		0.05	0.002	0.05	0.02	2	0.05	0.04	50	0.005	0.05	0.05	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
		0.05	0.5	0.05	0.5	50	0.1	0.1	50	0.01	0.05	0.2	0.5	0.01	0.1	10	0.01	1	3	-
MW14-02A	28/09/14	17.5	<0.01	4.56	<0.5	<50	3.61	0.28	6350	<0.01	5.28	341	18.7	0.041	<0.1	<10	62.7	<1	<3	
MW14-02A	12/06/15	687	0.0038	7.53	16.7	8.1	3.77	0.267	6050	0.0093	3.68	509	26.6	0.0883	<0.20	1.76	85.8	0.49	2.05	<0.10
MW14-02A	16/07/15	7.69	0.0043	3.09	0.278	28	2.67	0.235	6400	<0.0050	2.77	325	14.5	0.0223	<0.20	<0.50	47.7	<0.20	2.62	<0.10
MW14-02A	06/08/15	7.59	0.0032	3.57	0.354	7.3	3.34	0.251	6760	0.0096	5.01	402	17.9	0.0454	<0.20	0.84	50.6	0.29	1.23	<0.10
MW14-02A	04/09/15	2.63	0.0041	3.28	0.075	10.6	2.75	0.274	5610	<0.0050	3.09	381	19.6	0.028	<0.20	<0.50	49.6	0.23	0.33	<0.10
MW14-02A	04/09/15	2.8	0.0041	3.2	0.067	9.1	2.8	0.298	5720	<0.0050	3.14	391	19.7	0.04	<0.20	<0.50	50.3	<0.20	0.31	<0.10
MW14-02B	28/09/14	156	0.017	4.89	2.47	<50	3.66	0.33	6240	<0.01	4.37	467	29	0.021	<0.1	<10	81.6	<1	11	
MW14-02B	28/09/14	161	0.017	5.43	2.49	<50	3.73	0.34	6230	0.011	4.42	514	28.7	0.026	<0.1	<10	91.9	<1	11.9	
MW14-02B	12/06/15	10.6	0.0054	3.5	0.24	9.6	3	0.232	5920	0.0092	3.23	380	17.8	0.0445	<0.20	<0.50	52.7	0.24	4.15	<0.10
MW14-02B	16/07/15	714	0.008	6.9	8.77	69	3.63	0.248	6440	<0.0050	3.72	463	26	0.0507	<0.20	<0.50	73.3	<0.20	5.49	<0.10
MW14-02B	06/08/15	667	0.0035	6.61	9.22	6.5	3.71	0.271	6270	0.0054	3.68	474	25.5	0.27	<0.20	1	75.9	0.32	3.4	<0.10
MW14-02B	04/09/15	560	0.0036	6.06	12	7.1	3.35	0.296	5790	<0.0050	3.55	483	28.7	0.288	<0.20	0.62	78.2	0.23	4.06	<0.10
MW14-03A	22/06/15	794	0.0254	4.56	2.56	53.9	8.99	0.065	6090	<0.0050	28.2	4490	169	0.033	<0.20	0.68	58.2	0.25	1.69	1.49
MW14-03A	12/07/15	963	0.0284	5.22	1.5	123	8.58	0.118	6840	0.0115	27.1	4490	145	0.0163	<0.20	1.98	50.9	0.51	2.51	2.7
MW14-03A	07/08/15	748	0.0118	2.92	0.616	65.3	8.4	<0.040	7300	0.0058	27.6	4240	166	0.0377	<0.20	0.62	49.4	0.29	2.46	2.58
MW14-03A	06/09/15	795	0.0112	4.11	0.772	74.8	8.82	<0.040	6660	0.008	28.3	4760	164	0.011	<0.20	<0.50	47	0.42	1.11	3.15
MW14-03A	07/08/15	742	0.0116	3.1	0.804	157	8.47	<0.040	7310	0.0063	28.5	4240	167	0.0088	<0.20	<0.50	48.9	0.33	8.34	2.88
MW14-03B	22/06/15	3090	0.0309	8.75	20.6	42.9	8.25	0.28	5350	0.063	27.2	2990	170	0.276	<0.20	0.72	35	0.29	2.21	0.35
MW14-03B	12/07/15	3240	0.017	8.71	18.3	70.8	7.5	0.2	6460	0.0348	23.9	2850	155	0.148	<0.20	0.95	35.2	0.23	10.2	0.41
MW14-03B	07/08/15	3030	0.0304	6.95	19.5	53.5	8.07	0.146	6350	0.0325	27.1	2960	198	0.143	<0.20	<0.50	39	<0.20	11.8	0.33
MW14-03B	06/09/15	3180	0.0201	7.65	18.3	34.6	8.46	0.15	5380	0.034	26.8	3490	193	0.193	<0.20	<0.50	41.3	<0.20	1.07	0.33
MW14-03B	06/09/15	3140	0.0211	7.86	18.7	35.1	8.7	0.153	5470	0.033	27.3	3490	194	0.206	<0.20	<0.50	41.7	<0.20	1.01	0.27
MW14-05A	23/06/15	1320	0.003	3.65	1.31	84.5	5.14	0.149	13700	0.04	12.4	336	8.6	0.01	<0.20	2.76	26.4	0.31	14.8	0.11
MW14-05A	13/07/15	1080	0.0024	4.05	1.6	128	5.22	0.147	13700	0.0397	11.7	323	5.6	0.0211	0.2	3.88	26.8	0.33	16.7	0.17
MW14-05A	08/08/15	1160	<0.0020	4.89	1.92	247	8.03	0.108	13900	0.016	18.4	498	7.5	0.0197	0.47	2.03	24.3	0.25	19.1	0.18
MW14-05A	07/09/15	1620	<0.0020	4.27	0.659	92.1	5.62	0.102	13400	0.006	12.4	356	6.5	0.002	0.2	1.09	36.5	<0.20	4.56	0.12
MW14-05B	24/06/15	612	0.0054	27.3	10.1	176	14.3	0.403	12300	0.302	72.8	701	40.5	0.119	0.92	50.1	16.6	2.56	34.3	0.59
MW14-05B	14/07/15	734	0.0062	22	7.87	187	12.3	0.408	11800	0.111	91.5	722	50.9	0.0486	0.83	13	18.4	1.55	34.5	0.42
MW14-05B	09/08/15	935	0.0056	16.1	5.33	161	10.8	0.356	12800	0.0406	112	693	59.9	0.0201	0.64	3.88	14.8	1.23	6.49	0.3
MW14-05B	08/09/15	1240	0.0039	9.09	4.23	173	9.95	0.17	14200	0.128	62.3	600	30.7	0.008	0.94	3.96	9.67	0.96	7.84	0.34
MW15-01WB	08/07/15	373	<0.0020	0.864	2.03	14.9	5.09	1.65	8170	<0.0050	26.8	2700	296	0.0172	<0.20	<0.50	542	<0.20	84.2	0.38
MW15-01WB	10/08/15	382	<0.0020	0.776	2.39	209	5.13	0.07	8530	<0.0050	28.8	2700	304	0.0297	<0.20	3.26	548	<0.20	138	0.59
MW15-01WB	03/09/15	368	<0.0020	0.788	1.73	18.1	5.26	0.135	6760	<0.0050	27.2	3020	316	0.045	<0.20	<0.50	598	<0.20	110	0.42
MW15-01WB	07/06/15	377	<0.0020	0.788	1.91	4.4	4.96	0.106	8960	0.01	26.2	3000	294	0.0347	<0.20	<0.50	490	<0.20	58	0.72
MW15-02AZ	31/05/15	19.8	<0.0020	0.436	1.09	39.7	7.14	1.26	5200	<0.0050	5.87	1260	83.1	0.0059	<0.20	<0.50	29.3	<0.20	1.01	0.16
MW15-02AZ	11/07/15	0.31	0.0028	0.348	0.479	8.2	5.43	0.182	5040	<0.0050	4.64	1060	55.9	0.0072	<0.20	<0.50	23.5	0.29	1.72	0.17
MW15-02AZ	12/08/15	8.32	0.0023	0.367	0.674	32.1	6.11	0.193	5380	<0.0050	5.05	959	56.1	0.0026	<0.20	<0.50	24.7	0.43	1.24	0.16
MW15-02AZ	07/09/15	28.7	<0.0020	0.418	0.69	5.2	6.87	0.162	5560	<0.0050	4.77	996	58	0.003	<0.20	<0.50	27.7	<0.20	0.2	0.15
MW15-02AZ	11/07/15	0.244	0.0029	0.352	0.539	26.8	5.16	0.185	5530	<0.0050	4.38	981	50.7	0.0057	<0.20	<0.50	25.2	0.21	1.39	0.16
MW15-02WB	01/06/15	94.1	<0.0020	1.17	2.54	8.1	8.43	0.344	5090	<0.0050	8.32	954	81.5	0.0071	<0.20	<0.50	36.4	<0.20	35.6	0.91
MW15-02WB	11/07/15	105	<0.0020	0.69	1.04	46.7	8.5	0.113	4910	<0.0050	9.12	949	82.6	0.0164	<0.20	1.16	31.8	0.22	18.2	0.84
MW15-02WB	12/08/15	110	<0.0020	0.708	1.24	27.9	9.07	0.139	5560	<0.0050	10.1	917	83.7	0.0057	<0.20	0.56	31	0.23	28.1	0.67
MW15-02WB	07/09/15	37.9	<0.0020	0.56	1.56	6.9	11	0.12	5200	<0.0050	6.22	916	80.2	0.017	<0.20	<0.50	31.4	<0.20	10.2	0.13
MW15-03AZ	16/06/15	55.5	0.0067	0.442	1.05	22	1.82	0.045	5030	<0.0050	4	307	17.4	0.0028	<0.20	0.74	35.4	0.2	7.96	0.3
MW15-03AZ	09/07/15	214	<0.0020	0.465	1.25	7.9	1.82	<0.040	4670	<0.0050	3.72	280	14.7	0.0023	<0.20	1.69	36.3	0.2	0.57	0.27
MW15-03AZ	10/08/15	66.4	0.0028	0.497	1.1	40.9	1.59	0.055	4970	0.0056	3.38	210	8	0.0052	<0.20	0.72	17.9	0.27	6.03	0.41
MW15-03AZ	04/09/15	105	0.0026	0.528	1.15	7	1.5	0.058	4690	<0.0050	3.29	212	7.6	0.003	<0.20	0.7	18.6	<0.20	0.37	0.4
MW15-03AZ	16/06/15	56.1	<0.0020	0.444	1.06	4.4	1.84	0.052	5010	<0.0050	3.92	301	17.1	0.0029	<0.20	0.57	37	<0.20	0.71	0.28
MW15-03WB	16/06/15	89.6	<0.0020	0.848	2.96	83	9.03	<0.040	8600	<0.0050	76.5	9260	341	0.0172	<0.20	1.03	8.56	<0.20	16.5	0.11
MW15-03WB	09/07/15	76.1	<0.0020	0.916	1.64	47.8	8.14	0.108	7530	0.0074	71	8840	310	0.006	<0.20	0.85	7.39	<0.20	27	0.1
MW15-03WB	10/08/15	76.5	<0.0020	0.817	1.6	37.3	8.14	0.073	8010	<0.0050	71.9	8040	329	0.0061	<0.20	<0.50	8.51	<0.20	51.2	<0.10
MW15-03WB	04/09/15	75.5	<0.0020	0.962	1.24	12.9	8.59	0.109	7010	<0.0050	73.9	9280	328	0.008	<0.20	<0.50	8.02	<0.20	46.3	<0.10
MW15-04WB	14/06/15	118	<0.0020	2.58	0.934	49.6	4.65	0.43	5680	<0.0050	5.95	783	40.6	0.0116	<0.20	<0.50	176	0.25	44.6	0.26
MW15-04WB	10/07/15	121	<0.0020	2.41	1.17	39.6	4.3	0.153	5490	0.0051	5.98	792	38.2	0.0093	<0.20	<0.50	170	0.29	17.9	0.27
MW15-04WB	11/08/15	110	<0.0020	2.57	1.58	119	4.9	0.477	5930	<0.0050	6.4	788	41.7	0.0109	<0.20	0.82	157	0.33	122	0.24
MW15-04WB	05/09/15	106	<0.0020	2.59	0.688	16.9	3.98	0.403	5440	<0.0050	6.05	846	43.2	0.01	<0.20	<0.50	167	0.21	23	0.24
MW15-04WB	14/06/15	119	<0.0020	2.47	0.875	59.9	4.57	0.349	5790	<0.0050	5.98	789	40.9	0.0099	<0.20	0.57	176	0.26	42.5	0.27
MW15-04WB	10/07/15	119	<0.0020	2.66	0.798	29.5	3.96	0.06	5560	0.0076	5.92	764	39.1	0.0105	<0.20	<0.50	192	0.29	3.3	0.24
MW15-05AZ	06/09/15	620	0.0057	0.276	1.33	21.1	0.123	0.052	6010	0.005	1.16	16.2	<3.0	0.008	<0.20	2.94	0.811	2.97	0.99	1.2
MW15-05WB	18/06/15	14.5	<0.0020	0.646	0.235	66.2	1.66	0.374	9670	<0.0050	8.88	138	4	0.007	<0.20	<0.50	71.7	<0.20	64.7	<0.10
MW15-05WB	10/07/15	7.43	<0.0020	0.969	2.26	91.6	1.45	0.444	8580	0.0078	9.11	140	3.9	0.0031	<0.20	1.24	69.5	0.21	102	<0.10
MW15-05WB	11/08/15	4.45	<0.0020	0.564	0.448	21.2	0.792	0.104	8980	<0.0050	9.36	138	3.8	<0.0020	<0.20	<0.50	72.9	<0.20	20.3	<0.10
MW15-05WB	06/09/15	6.25	<0.0020	0.682	0.247	18.2	0.693	<0.040	9410	<0.0050	9.16	145	4.2	<0.0020	<0.20	<0.50	76.9	<0.20	12.5	<0.10
MW15-05WB	11/08/15	4.9	<0.0020	0.631	0.489	59.8	0.857	0.111	9780	<0.0050	9.65	137	3.9	<0.0020	<0.20	0.69	73.3	<0.20	26.3	<0.10
MW15-06WB	21/07/15	2300	0.091	34.5	4.18	99.8	7.22	0.475	7040	0.0748	10.9	413	30.7	0.024	<0.20	16.1	96.5	0.5	604	0.65
MW15-06WB	09/08/15	3410	0.281	42.6	3.34	54.1	6.51	0.414	6520	0.0524	9.74	442	32.5	0.053	<0.20	7.78	103	0.49	172	0.81
MW15-06WB	08/09/15	5430	0.0942	80.4	2.7	46.8	6.42	0.147	5550	0.036	8.43	444	33.6	0.033	<0.20	3.17	95	<0.20	85.1	0.62

Table 3: Comparison of Total and Dissolved Metals Analytical Results

Sample ID	Station	Sample Date	Analytical Laboratory	Lab Job ID	Dissolved Aluminum (Al)	Dissolved Antimony (Sb)	Dissolved Arsenic (As)	Dissolved Barium (Ba)	Dissolved Beryllium (Be)	Dissolved Bismuth (Bi)	Dissolved Boron (B)	Dissolved Cadmium (Cd)	Dissolved Calcium (Ca)	Dissolved Chromium (Cr)	Dissolved Cobalt (Co)	Dissolved Copper (Cu)	Dissolved Iron (Fe)	Dissolved Lead (Pb)	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)
					ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
Maxxam RDL:					0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	0.1	0.005	0.05	1	0.005	0.5	0.05
ALS RDL:					1	0.1	0.1	0.05	0.1	0.5	10	0.01	0.05	0.1	0.1	0.2	10	0.05	0.5	0.1
MW14-02A	MW14-02A	28/09/14	ALS	L1525019	5.7	0.92	71.1	14.2	<0.1	<0.5	<10	<0.01	45.7	0.49	0.11	<0.2	<10	<0.05	7.79	21.6
MW14-02A	MW14-02A	12/06/15	Maxxam	B550137	14.5	0.784	53.8	13.4	<0.010	<0.0050	<10	<0.0050	45.8	0.51	0.0356	0.232	14	0.0206	6.45	20.8
MW14-02A	MW14-02A	16/07/15	Maxxam	B562572	8.65	0.719	52.4	12.9	<0.010	<0.0050	<10	<0.0050	40.7	0.45	0.0194	<0.050	2.9	<0.0050	7.74	20.9
MW14-02A	MW14-02A	06/08/15	Maxxam	B569424	17.4	0.7	51.9	13.8	<0.010	<0.0050	<10	0.006	46.1	0.6	0.0419	0.305	26.6	0.0291	8.06	21.8
MW14-02A	MW14-02A	04/09/15	Maxxam	B578440	3.96	0.697	53.8	9.88	<0.010	<0.0050	<10	<0.0050	40.3	0.47	0.014	0.065	<1.0	<0.0050	7.42	20.5
MW14-100	MW14-02A	04/09/15	Maxxam	B578440	4.44	0.708	54.7	10.1	<0.010	<0.0050	<10	<0.0050	40.5	0.49	0.013	0.056	<1.0	<0.0050	7.66	21.4
F-DUP-1	MW14-02B	28/09/14	ALS	L1525019	<1	2.89	20.5	54.2	<0.1	<0.5	<10	<0.01	61.4	0.42	0.62	<0.2	<10	<0.05	7.19	31.1
MW14-02B	MW14-02B	28/09/14	ALS	L1525019	1	3.27	20.4	54.7	<0.1	<0.5	<10	<0.01	61.8	0.41	0.62	<0.2	<10	<0.05	7.59	31.2
MW14-02B	MW14-02B	12/06/15	Maxxam	B550137	3.19	6.56	34	45	<0.010	<0.0050	<10	<0.0050	52.4	0.12	2.47	0.081	7.3	0.0114	6.75	27.1
MW14-02B	MW14-02B	16/07/15	Maxxam	B562572	15.1	6.6	37.4	57.7	<0.010	<0.0050	<10	<0.0050	52.3	<0.10	1.57	<0.050	9.8	<0.0050	7.08	30.3
MW14-02B	MW14-02B	06/08/15	Maxxam	B569424	2.16	5.89	39.3	52.2	<0.010	<0.0050	<10	<0.0050	57.5	0.17	1.46	0.082	4.8	0.0098	7.63	31.9
MW14-02B	MW14-02B	04/09/15	Maxxam	B578440	1.57	5.97	38.8	40.5	<0.010	<0.0050	<10	0.008	52.2	0.24	1.53	0.074	1.5	0.009	7.52	28.8
MW14-03A	MW14-03A	22/06/15	Maxxam	B553846	5.35	1.02	49.4	143	0.012	<0.0050	12	<0.0050	135	<0.10	2.46	0.175	7330	0.162	31.3	143
MW14-03A	MW14-03A	12/07/15	Maxxam	B559978	20.2	0.698	58.6	128	<0.010	<0.0050	<10	0.0121	138	0.3	2.03	0.417	9370	0.0778	27.2	125
MW14-03A	MW14-03A	07/08/15	Maxxam	B569424	52.8	0.586	68.9	98	0.016	<0.0050	<10	0.0545	135	0.21	1.75	1.65	8760	0.14	32.3	142
MW14-03A	MW14-03A	06/09/15	Maxxam	B578440	3.44	0.313	75.7	103	0.013	<0.0050	<10	<0.0050	124	<0.10	1.32	0.068	7560	0.006	26.6	125
MW14-50	MW14-03A	07/08/15	Maxxam	B569424	43.5	0.595	71.9	103	0.017	0.0111	18	0.014	137	0.22	1.88	1.53	8880	0.205	31.4	139
MW14-03B	MW14-03B	22/06/15	Maxxam	B553846	18.9	0.134	8.7	99	<0.010	<0.0050	12	0.0223	138	0.14	7.55	1.58	1770	0.0798	24.6	176
MW14-03B	MW14-03B	12/07/15	Maxxam	B559978	14.1	0.103	9.2	87.8	<0.010	<0.0050	<10	0.0628	127	0.16	7	0.941	2140	0.0615	21.1	143
MW14-03B	MW14-03B	07/08/15	Maxxam	B569424	7.11	0.091	8.21	74.7	<0.010	0.0129	<10	0.0184	133	<0.10	7.2	1.11	1340	0.0338	26.6	184
MW14-03B	MW14-03B	06/09/15	Maxxam	B578440	2.81	0.087	7.63	61.8	<0.010	<0.0050	<10	0.008	129	<0.10	6.14	0.489	1010	0.022	23	164
MW14-200	MW14-03B	06/09/15	Maxxam	B578440	2.88	0.085	7.76	64.1	<0.010	<0.0050	<10	<0.0050	131	<0.10	6.11	0.434	1020	0.015	24.9	163
MW14-05A	MW14-05A	23/06/15	Maxxam	B553846	7.95	0.688	1860	98.4	0.026	<0.0050	<10	<0.0050	47.1	<0.10	1.17	0.152	1920	0.0483	30	8.9
MW14-05A	MW14-05A	13/07/15	Maxxam	B559978	24.2	0.664	1680	93.4	0.016	<0.0050	<10	0.0115	43.8	0.2	0.933	1.16	2380	0.257	27.9	8.42
MW14-05A	MW14-05A	08/08/15	Maxxam	B569424	8.88	0.476	1480	109	0.015	0.0089	<10	<0.0050	47.2	0.17	0.742	0.18	2940	0.0112	34.3	8.87
MW14-05A	MW14-05A	07/09/15	Maxxam	B578440	4	0.407	1700	118	0.02	<0.0050	<10	<0.0050	43.2	0.12	0.85	0.053	3590	0.007	28.4	8.86
MW14-05B	MW14-05B	24/06/15	Maxxam	B554336	18.5	1.17	135	83.6	<0.010	<0.0050	13	0.0423	45.8	0.17	0.955	2.48	69.2	0.0788	36	6.28
MW14-05B	MW14-05B	14/07/15	Maxxam	B560161	28.5	0.86	117	78	<0.10	<1.0	<50	0.031	42.7	<1.0	1.14	1.02	638	<0.20	32.8	6.6
MW14-05B	MW14-05B	09/08/15	Maxxam	B569424	12.4	0.672	145	84.1	<0.010	<0.0050	25	0.017	46.6	0.31	1.25	0.293	1180	0.0283	34.3	7.71
MW14-05B	MW14-05B	08/09/15	Maxxam	B579224	6.82	0.572	161	77.2	<0.010	<0.0050	11	<0.0050	46	0.47	1.25	0.122	1610	0.01	34.2	8.4
MW15-01WB	MW15-01WB	08/07/15	Maxxam	B558595	3.92	0.626	22.2	11.2	<0.010	<0.0050	<10	0.0485	244	<0.10	0.794	0.348	2.6	0.0235	25.8	194
MW15-01WB	MW15-01WB	10/08/15	Maxxam	B569424	5.67	0.395	29	9.93	0.022	0.0114	12	0.0607	228	<0.10	0.704	0.191	24.9	<0.0050	25.7	185
MW15-01WB	MW15-01WB	03/09/15	Maxxam	B578440	14.3	0.347	42.2	9.23	0.038	<0.0050	<10	0.046	250	0.94	0.664	0.413	558	0.225	22.8	186
MW15-01WB/BH8-WB	MW15-01WB	07/06/15	Maxxam	B549739	<0.50	0.808	23.9	11.1	0.033	<0.0050	<10	0.0141	266	<0.10	0.888	0.098	2.8	<0.0050	25.9	195
MW15-02 AZ/BH10-AZ	MW15-02AZ	31/05/15	Maxxam	B546672	3.65	0.435	1.1	91.7	<0.010	<0.0050	<10	0.009	135	0.14	0.207	1.28	4.9	<0.0050	4.35	42.5
MW15-02AZ	MW15-02AZ	11/07/15	Maxxam	B559978	14.8	0.147	0.917	89.9	<0.010	<0.0050	<10	0.125	111	0.2	0.0388	1.34	10.7	0.021	3.71	33.8
MW15-02AZ	MW15-02AZ	12/08/15	Maxxam	B569424	8.74	0.14	1.12	81.3	<0.010	<0.0050	<10	0.007	125	0.2	0.0699	1.33	9	0.0069	4.27	43.1
MW15-02AZ	MW15-02AZ	07/09/15	Maxxam	B578440	3.62	0.145	0.978	71.5	<0.010	<0.0050	<10	<0.0050	101	<0.10	0.088	0.947	5.2	<0.0050	4.22	31.8
MW15-40AZ	MW15-02AZ	11/07/15	Maxxam	B559978	12.2	0.14	0.905	85.5	<0.010	<0.0050	<10	0.0283	110	0.15	0.0294	1.09	11.2	0.0085	3.91	33.3
MW15-02 WB/BH10-WB	MW15-02WB	01/06/15	Maxxam	B546672	6.92	0.375	2.5	26.6	0.019	<0.0050	<10	0.042	144	1.92	0.184	0.692	362	0.312	4.42	37.5
MW15-02WB	MW15-02WB	11/07/15	Maxxam	B559978	4.2	0.123	1.92	22.7	<0.010	<0.0050	<10	0.0345	130	<0.10	0.0957	0.199	13.7	0.0078	3.64	32.7
MW15-02WB	MW15-02WB	12/08/15	Maxxam	B569424	4.8	0.143	2.48	23.5	<0.010	<0.0050	<10	0.0267	129	<0.10	0.135	0.249	3.9	0.0052	4.12	35.2
MW15-02WB	MW15-02WB	07/09/15	Maxxam	B578440	1.92	0.076	0.498	39.5	<0.010	<0.0050	<10	0.011	125	0.18	0.068	1.66	13.8	0.021	4.45	35.2
MW15-03AZ	MW15-03AZ	16/06/15	Maxxam	B551383	38.1	0.153	0.431	37.9	<0.010	<0.0050	<10	0.012	40.6	0.16	0.0611	1.37	12.3	0.0196	1.33	12.1
MW15-03AZ	MW15-03AZ	09/07/15	Maxxam	B558921	24.6	0.137	0.446	30.1	<0.010	<0.0050	<10	0.0258	38.7	0.21	0.0861	1.74	21.3	0.0257	<0.50	10.9
MW15-03AZ	MW15-03AZ	10/08/15	Maxxam	B569424	26.3	0.197	0.552	29.4	0.013	<0.0050	<10	0.0108	28.4	0.28	0.0601	1.98	19.5	0.0113	0.77	8.75
MW15-03AZ	MW15-03AZ	04/09/15	Maxxam	B578440	18.6	0.178	0.477	24.5	0.011	<0.0050	<10	0.01	25.9	0.17	0.05	1.73	9.3	0.005	1.13	7.73
MW15-21	MW15-03AZ	16/06/15	Maxxam	B551383	30.5	0.158	0.411	39.7	<0.010	<0.0050	<10	0.0122	41.4	0.1	0.0597	1.54	11.1	<0.0050	2.45	13.2
MW15-03WB	MW15-03WB	16/06/15	Maxxam	B551383	35.6	0.096	0.268	17.6	<0.010	<0.0050	42	<0.0050	172	<0.10	0.123	0.074	11.4	<0.0050	12.2	141
MW15-03WB	MW15-03WB	09/07/15	Maxxam	B558921	7.69	0.099	0.474	14.4	<0.010	<0.0050	33	0.0481	160	<0.10	0.0867	0.238	5.6	<0.0050	10	130
MW15-03WB	MW15-03WB	10/08/15	Maxxam	B569424	3.72	0.058	0.485	11.8	<0.010	0.0148	38	0.014	156	<0.10	0.0656	0.145	5.6	<0.0050	12.5	126
MW15-03WB	MW15-03WB	04/09/15	Maxxam	B578440	3.53	0.042	0.413	10.4	<0.010	<0.0050	29	0.01	160	0.22	0.055	0.087	569	0.02	11.2	131
MW15-04WB	MW15-04WB	14/06/15	Maxxam	B551383	44.1	3.02	1.54	33.3	<0.010	<0.0050	<10	0.0487	73.1	<0.10	0.221	2.26	6.4	0.337	7.37	37.7
MW15-04WB	MW15-04WB	10/07/15	Maxxam	B558916	21	2.97	1.37	31.9	<0.10	<1.0	<50	0.081	70	<1.0	<0.50	1.31	12.4	<0.20	6.7	36.7
MW15-04WB	MW15-04WB	11/08/15	Maxxam	B569424	11.3	2.79	1.32	33.8	<0.010	<0.0050	<10	0.0999	78.8	<0.10	0.225	1.22	6.7	0.149	6.73	38.4
MW15-04WB	MW15-04WB	05/09/15	Maxxam	B578440	3.47	2.56	1.32	32.7	<0.010	<0.0050	<10	0.042	74.1	0.37	0.202	1.09	13	0.366	6.98	37.4
MW15-20	MW15-04WB	14/06/15	Maxxam	B551383	44.1	2.87	1.51	32.4	<0.010	<0.0050	<10	0.0539	76.4	<0.10	0.227	2.12	8.9	0.32	6.91	37.7
MW15-30WB	MW15-04WB	10/07/15	Maxxam	B558916	3.2	3.05	1.32	32.3	<0.10	<1.0	<50	0.037	71.7	<1.0	<0.50	0.96	5.4	0.31	7	36.6
MW15-05AZ	MW15-05AZ	06/09/15	Maxxam	B578440	189	0.084	2.28	18.8	0.026	0.005	<10	0.022	2.93	0.7	2.49	1.86	931	0.033	0.69	0.747
MW15-05WB	MW15-05WB	18/06/15	Maxxam	B553846	4.1	0.403	1.27	4	<0.010	<0.0050	<10	0.029	47.4	<0.10	0.037	0.363	2.3	0.013	14.2	8.02
MW15-05WB	MW15-05WB	10/07/15	Maxxam	B558916	3.1	<0.50	0.88	2.1	<0.10	<1.0	<50	0.019	42	<1.0	<0.50	<0.20	<5.0	<0.20	11.9	6.99
MW15-05WB	MW15-05WB	11/08/15	Maxxam	B569424	1.7	0.217	0.971	1.97	<0.010	<0.0050	<10	0.0159	44.5	<0.10	0.0571	0.083	2.7	0.0104	13	7
MW15-05WB	MW15-05WB	06/09/15	Maxxam	B578440	4.49	0.252	1.19	2.47	<0.010	<0.0050	<10	0.023	45.5	0.41	0.057	0.243	11.1	0.044	12.1	7.9
MW15-60	MW15-05WB	11/08/15	Maxxam	B569424	23.1	0.222	0.958	1.91	<0.010	<0.0050	<10	0.0159	44.7	<0.10	0.0451	0.102	3.3	0.0122	13	6.97
MW15-06WB	MW15-06WB	21/07/15	Maxxam	B562572	8.4	2.45	10.3	39.1	<0.010	<0.0050	<10	0.0131	65.6	<0.10	2.14	0.193	56.9	0.023	8.36	32.9
MW15-06WB	MW15-06WB	09/08/15	Maxxam	B569424	7.18	2.84	20.2	41.5	<0.010	<0.0050	<10	0.0217	71.8	<0.10	2.49	0.629	73.5	0.0172	10.7	33.4
MW15-06WB	MW15-06WB	08/09/15	Maxxam	B579224	67.5	0.764	25.8	56.1	<0.010	<0.0050	<10	0.037	82.5	0.66	3.22	1.23	849	0.098	12.4	39.9

Black Text [Dissolved Metals] 20% > [Total Metals] and >5x RDL (values with "<" not used for calculation)
• Samples MW14-03A Oct. 2014, MW14-03B Oct. 2014, MW14-05A Oct. 2014, MW14-05B Oct. 2014, MW15-06WB Jun. 2015 not considered to be representative of formation water are excluded from the comparison of total and dissolved metals. See Appendix 5-D for the discussion regarding these samples.

and Dissolved Metals Analytical Results

Station	Sample Date	Dissolved Manganese (Mn)	Dissolved Mercury (Hg)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Phosphorus (P)	Dissolved Potassium (K)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)	Dissolved Sulphur (S)	Dissolved Thallium (Tl)	Dissolved Tin (Sn)	Dissolved Titanium (Ti)	Dissolved Uranium (U)	Dissolved Vanadium (V)	Dissolved Zinc (Zn)	Dissolved Zirconium (Zr)
		ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
		0.05	0.002	0.05	0.02	2	0.05	0.04	50	0.005	0.05	0.05	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
		0.05	0.01	0.05	0.5	50	0.1	0.1	50	0.01	0.05	0.2	0.5	0.01	0.1	10	0.01	1	1	-
MW14-02A	28/09/14	17	<0.01	4.88	<0.5	<50	3.63	0.25	6410	<0.01	5.18	378	18.7	0.041	<0.1	<10	70.4	<1	1.6	
MW14-02A	12/06/15	10.7	0.0035	3.19	0.348	53	2.94	0.255	6070	0.0053	3.17	361	17.7	0.0555	<0.20	<0.50	46.4	0.25	3.37	<0.10
MW14-02A	16/07/15	7.88	0.0042	3.04	0.327	12.8	2.98	0.241	6580	<0.0050	3.03	372	17.4	0.0217	<0.20	<0.50	48	<0.20	2.26	<0.10
MW14-02A	06/08/15	6.82	0.0025	3.14	0.419	11.1	2.94	0.218	6050	0.0135	4.69	353	17.6	0.0486	<0.20	0.65	48.1	0.3	3.83	<0.10
MW14-02A	04/09/15	2.42	0.004	2.78	0.086	7.4	2.86	0.229	6160	<0.0050	2.87	362	18.2	0.024	<0.20	<0.50	44.6	<0.20	0.27	<0.10
MW14-02A	04/09/15	2.46	0.0038	2.84	0.082	6.9	2.83	0.237	6350	<0.0050	2.89	352	18.6	0.035	<0.20	<0.50	45.4	<0.20	0.54	<0.10
MW14-02B	28/09/14	159	<0.01	4.55	2.4	<50	3.69	0.33	6270	<0.01	4.56	459	29	0.022	<0.1	<10	83.3	<1	10.3	
MW14-02B	28/09/14	162	<0.01	4.96	2.5	<50	3.74	0.31	6270	<0.01	4.53	494	29	0.025	<0.1	<10	92.5	<1	10.3	
MW14-02B	12/06/15	621	0.0021	7.45	14.7	6.6	3.25	0.277	6090	<0.0050	3.21	441	24.6	0.0784	<0.20	<0.50	72.2	0.36	1.92	<0.10
MW14-02B	16/07/15	710	0.0042	6.84	8.85	117	3.67	0.264	6420	<0.0050	3.73	469	26.1	0.0536	<0.20	<0.50	76.8	<0.20	3.78	<0.10
MW14-02B	06/08/15	645	<0.0020	6.42	9.29	7.5	3.61	0.274	6130	<0.0050	3.73	462	26.8	0.267	<0.20	<0.50	79.9	0.31	3.86	<0.10
MW14-02B	04/09/15	511	0.0027	5.72	10.6	5.2	3.47	0.278	6430	<0.0050	3.28	454	26.7	0.249	<0.20	<0.50	72.2	<0.20	2.19	<0.10
MW14-03A	22/06/15	815	0.0068	4.82	2.36	42.7	9.39	0.097	8050	0.0079	28.3	5130	182	0.0176	<0.20	<0.50	69.3	0.23	1.68	2.39
MW14-03A	12/07/15	954	0.0098	5.14	1.35	118	8.31	0.043	7100	0.0082	26.8	4570	156	0.0037	<0.20	0.6	49.3	0.48	4.35	3.07
MW14-03A	07/08/15	754	0.0021	2.95	0.846	144	8.25	<0.040	7320	0.0135	29	4380	166	0.0263	<0.20	0.69	50.1	0.41	16.2	2.96
MW14-03A	06/09/15	653	0.003	3.19	0.343	57.2	8.38	<0.040	7080	0.01	26.1	4440	153	0.003	<0.20	<0.50	43.6	<0.20	0.29	3.39
MW14-03A	07/08/15	797	0.0039	3.41	0.935	195	8.91	<0.040	7270	0.0077	28	4550	162	0.01	<0.20	0.86	53.7	0.34	16.2	3.1
MW14-03B	22/06/15	3490	0.0049	9.53	22	69.9	9.18	0.249	7250	0.0121	30	3620	198	0.132	<0.20	<0.50	43.3	0.26	10.1	0.44
MW14-03B	12/07/15	3300	0.0066	8.76	18.5	50.2	7.7	0.169	5980	0.0056	24.5	2950	164	0.0793	<0.20	<0.50	37.9	0.21	9.45	0.44
MW14-03B	07/08/15	3210	0.0028	7.38	20.4	38.2	8.46	0.143	6290	0.0138	29.8	3010	200	0.11	<0.20	<0.50	40.5	<0.20	6.03	0.33
MW14-03B	06/09/15	2920	0.0047	6.77	16.6	29.4	8.42	0.123	6070	0.007	26.8	3380	193	0.135	<0.20	<0.50	37.5	<0.20	0.75	0.34
MW14-03B	06/09/15	2890	0.0033	6.86	16.6	27.4	8.51	0.131	6300	0.006	25.6	3400	191	0.14	<0.20	<0.50	38.2	<0.20	0.85	0.3
MW14-05A	23/06/15	1390	<0.0020	3.8	1.25	89.7	5.34	0.103	14800	0.0054	13.5	375	9.4	0.0048	<0.20	<0.50	32.5	<0.20	11.2	<0.10
MW14-05A	13/07/15	1170	<0.0020	4.14	1.39	124	5.92	0.1	13400	<0.0050	23.2	353	6.8	0.0085	<0.20	0.88	28.6	0.24	7.63	0.14
MW14-05A	08/08/15	1100	<0.0020	4.83	1.38	112	7.12	0.071	13700	<0.0050	15.9	437	5.1	0.0114	<0.20	<0.50	25.4	<0.20	0.92	0.14
MW14-05A	07/09/15	1600	<0.0020	3.71	0.544	84.2	5.45	0.068	14100	<0.0050	12.2	334	6.6	<0.0020	<0.20	<0.50	32.4	<0.20	0.71	0.12
MW14-05B	24/06/15	414	<0.0020	28.9	7.23	112	14	0.421	10600	0.0067	76.4	719	39.8	0.0456	0.4	0.87	16.2	1.25	4.31	0.25
MW14-05B	14/07/15	685	<0.010	20	6.3		12.2	0.42	10200	<0.020	92.5	665	51.7	<0.050	<5.0	<5.0	16.2	<5.0	16.5	<0.50
MW14-05B	09/08/15	933	0.0029	16.1	4.79	161	11.3	0.318	12700	<0.0050	116	701	59.1	0.0124	0.34	<0.50	15.1	1.12	1.53	0.32
MW14-05B	08/09/15	1260	<0.0020	8.31	2.93	160	10	0.157	14400	<0.0050	62.1	596	31.7	<0.0020	0.3	<0.50	9.43	0.85	0.89	0.33
MW15-01WB	08/07/15	375	<0.0020	1.04	2.31	6.4	5.53	0.126	7870	<0.0050	27.6	2690	294	0.0201	<0.20	<0.50	530	<0.20	128	0.49
MW15-01WB	10/08/15	372	<0.0020	0.936	2.24	68.3	5.19	0.075	7950	<0.0050	25.9	2660	295	0.0273	<0.20	<0.50	542	<0.20	167	0.53
MW15-01WB	03/09/15	357	<0.0020	1.01	2.38	20	5.43	0.11	8250	0.006	26.1	2770	310	0.036	<0.20	0.58	535	0.28	181	0.41
MW15-01WB	07/06/15	382	<0.0020	0.843	1.78	<2.0	5.27	0.091	7820	<0.0050	27.6	2990	287	0.038	<0.20	<0.50	589	<0.20	53.9	0.69
MW15-02AZ	31/05/15	21	<0.0020	0.436	1.26	7.1	7.41	1.1	5740	<0.0050	6.04	1150	81.7	0.007	<0.20	<0.50	26.4	0.26	0.55	0.19
MW15-02AZ	11/07/15	1	0.0028	0.354	0.682	36.3	5.36	0.169	5180	<0.0050	4.75	1070	59.8	0.0059	<0.20	<0.50	23.9	0.29	8.64	0.19
MW15-02AZ	12/08/15	12.9	<0.0020	0.362	0.722	50.7	7.51	0.199	5020	<0.0050	6.09	1170	67.6	0.0044	<0.20	0.55	24.4	0.39	1.55	0.2
MW15-02AZ	07/09/15	28.5	<0.0020	0.38	0.649	4.1	6.65	0.161	5890	<0.0050	4.67	943	58.4	0.004	<0.20	<0.50	23.9	<0.20	0.8	0.13
MW15-02AZ	11/07/15	0.269	0.0029	0.343	0.552	11.2	5.39	0.177	5130	<0.0050	4.66	1070	59	0.0049	<0.20	<0.50	23.6	0.27	1.75	0.17
MW15-02WB	01/06/15	98.2	<0.0020	1.31	2.16	15.6	9.28	0.373	5880	<0.0050	9.45	932	76	0.008	<0.20	0.91	37.4	0.31	36.8	0.76
MW15-02WB	11/07/15	101	<0.0020	0.68	0.885	17.3	7.96	0.102	5430	<0.0050	8.69	943	82.3	0.0112	0.73	<0.50	31.9	<0.20	16.9	0.67
MW15-02WB	12/08/15	111	<0.0020	0.851	1.37	30.5	8.8	0.169	5140	<0.0050	9.4	952	78.8	0.0057	<0.20	<0.50	33.2	<0.20	44.5	0.58
MW15-02WB	07/09/15	36.4	<0.0020	0.525	1.46	5	10.8	0.126	5250	<0.0050	6.09	963	80.9	0.015	<0.20	<0.50	28.2	<0.20	10.1	0.13
MW15-03AZ	16/06/15	55.2	<0.0020	0.451	1.08	26.8	1.78	0.052	5300	<0.0050	4.16	303	18	0.0024	<0.20	<0.50	35.4	<0.20	7.61	0.32
MW15-03AZ	09/07/15	225	<0.0020	0.47	1.4	78.8	1.86	0.041	4810	<0.0050	3.89	290	15	0.0021	<0.20	0.56	34.3	0.23	3.75	0.31
MW15-03AZ	10/08/15	67.7	0.0028	0.502	1.07	26.3	1.65	0.055	5050	<0.0050	3.39	220	8.4	0.0045	<0.20	0.53	18.2	0.24	3.28	0.44
MW15-03AZ	04/09/15	102	0.0026	0.467	1.02	5.5	1.53	0.044	5250	<0.0050	3.07	198	7.6	0.002	<0.20	<0.50	17.2	0.27	0.41	0.34
MW15-03AZ	16/06/15	57.6	<0.0020	0.42	1.12	7.2	1.89	0.064	5810	<0.0050	4.37	319	18.2	<0.0020	<0.20	<0.50	37.4	<0.20	3.15	0.26
MW15-03WB	16/06/15	84.2	<0.0020	0.981	2.01	10.1	8.87	<0.040	10300	<0.0050	75.7	9250	348	<0.0020	<0.20	<0.50	8.4	<0.20	4.92	<0.10
MW15-03WB	09/07/15	78.9	<0.0020	1.04	1.56	52.8	8.97	0.432	6990	0.0069	71.1	9090	294	0.0062	<0.20	<0.50	7.86	<0.20	47.5	<0.10
MW15-03WB	10/08/15	78.1	<0.0020	0.976	1.58	13.7	8.04	0.09	8060	0.006	68.4	8190	320	0.0061	<0.20	<0.50	9.09	<0.20	107	<0.10
MW15-03WB	04/09/15	73.5	<0.0020	0.851	1.1	9.6	8.62	<0.040	8230	0.006	71.9	9210	309	0.007	<0.20	<0.50	7.57	<0.20	39.9	<0.10
MW15-04WB	14/06/15	115	<0.0020	2.55	0.804	23.8	4.16	0.246	6370	<0.0050	6.05	782	45.9	0.0068	<0.20	<0.50	176	0.25	24	0.26
MW15-04WB	10/07/15	123	<0.010	2.6	1.2		4.47	0.2	5550	<0.020	6.61	777	44.9	<0.050	<5.0	<5.0	161	<5.0	35.9	<0.50
MW15-04WB	11/08/15	109	<0.0020	2.56	0.99	102	4.38	0.251	5890	<0.0050	6.15	783	41.3	0.0114	<0.20	<0.50	161	0.28	57.6	0.23
MW15-04WB	05/09/15	105	<0.0020	2.6	0.986	21.8	4.43	0.335	6320	<0.0050	5.94	804	44.4	0.008	<0.20	<0.50	154	<0.20	42.7	0.21
MW15-04WB	14/06/15	116	<0.0020	2.4	0.795	30.4	4.55	0.265	6270	<0.0050	5.96	794	42.3	0.0078	<0.20	<0.50	176	0.25	29.4	0.26
MW15-04WB	10/07/15	119	<0.010	2.3	<1.0		4.05	0.13	5680	<0.020	5.92	776	41.6	<0.050	<5.0	<5.0	169	<5.0	9.6	<0.50
MW15-05AZ	06/09/15	617	0.0054	0.248	1.23	13.3	0.12	0.069	6040	<0.0050	1.14	15.4	<3.0	0.008	<0.20	1.96	0.899	1.51	1.1	1.18
MW15-05WB	18/06/15	13.4	<0.0020	0.698	0.217	66.7	1.8	0.372	10200	<0.0050	10.4	147	4.6	0.009	<0.20	<0.50	70.9	<0.20	60.7	<0.10
MW15-05WB	10/07/15	4.6	<0.010	<1.0	<1.0		0.964	0.12	8720	<0.020	9.06	138	4.5	<0.050	<5.0	<5.0	66.3	<5.0	37.8	<0.50
MW15-05WB	11/08/15	5.36	<0.0020	0.635	0.345	42.4	1.07	0.138	8860	<0.0050	9.22	140	3.5	0.0027	<0.20	<0.50	70	<0.20	45.8	<0.10
MW15-05WB	06/09/15	7.09	<0.0020	1.85	0.607	44.4	1.33	0.102	9880	<0.0050	9.88	150	4.4	<0.0020	<0.20	<0.50	74.8	<0.20	97	<0.10
MW15-05WB	11/08/15	4.02	<0.0020	0.721	0.365	105	1.03	0.128	8910	<0.0050	9.16	140	3.6	<0.0020	<0.20	<0.50	71.6	<0.20	40.1	<0.10
MW15-06WB	21/07/15	2390	0.022	37.6	3.1	24.6	7.57	0.502	6540	<0.0050	11.9	417	33.2	0.0261	<0.20	<0.50	100	<0.20	253	0.46
MW15-06WB	09/08/15	3400	0.0544	45.6	2.72	7.1	6.27	0.349	6090	0.0113	9.08	434	31.1	0.0487	<0.20	<0.50	103	<0.20	20.9	0.62
MW15-06WB	08/09/15	5810	0.0952	87.4	3.44	46.4	7.18	0.172	6030	0.027	9.55	487	36.9	0.034	0.24	3.7	100	<0.20	159	0.63

Black Text [Dissolved Metals] 20% > [Total Metals] and >5x RDL (values with "<" not used for calculation)

• Samples MW14-03A Oct. 2014, MW14-03B Oct. 2014, MW14-05A Oct. 2014, MW14-05B Oct. 2014, MW15-06WB Jun. 2015 not considered to be representative of formation water are excluded from the comparison of total and dissolved metals. See Appendix 5-D for the discussion regarding these samples.

Appendices

GOLDCORP

Appendix P-1: 2016 Coffee Gold Mine Hydrogeology Drilling Program Summary

GOLDCORP

TECHNICAL MEMORANDUM

To:	**Jennie Gjertsen, Goldcorp**	**Date: March 13th, 2017**
	James Scott, Goldcorp	
Cc:	**Jasmin Dobson, Goldcorp**	
From:	**Andrew Solod and Laura-Lee Findlater, Lorax**	**Project #: A362-5**
Subject:	**2016 Coffee Gold Mine Hydrogeology Drilling Program Summary**	

1. Introduction

This memorandum provides a summary of field activities undertaken by Lorax Environmental Service Ltd (Lorax) at the Coffee Gold Project between August 17th to August 27th, 2016, and September 28th to October 4th 2016. Field activities conducted in August, September, and October are part of the larger baseline groundwater monitoring program at the Coffee Gold Project. As part of the 2016 Coffee Gold Hydrogeology Field Program, Lorax personnel were on site to supervise the drilling and installation of one (1) combination Vibrating Wire Piezometers (VWP)/ thermistor string borehole, and one (1) Westbay multilevel groundwater monitoring well downgradient of the Heap Leach Facility (HLF) proposed for construction at the Coffee Gold Mine (Figure 1). This memorandum briefly summarizes methods and findings of the program. The information is organized into the following sections:

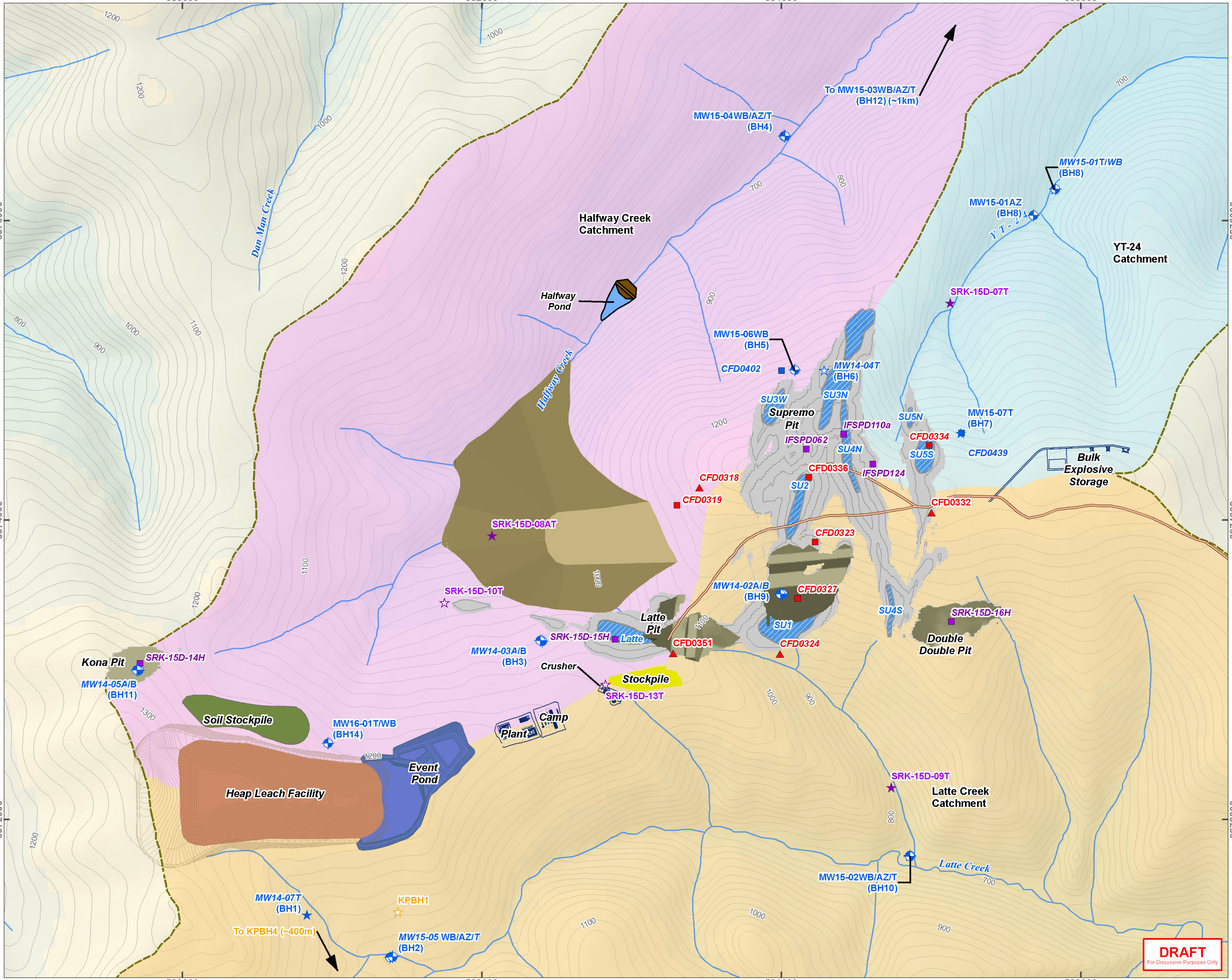
2. Staffing and Timeline
3. Methods
4. Results
5. Closure

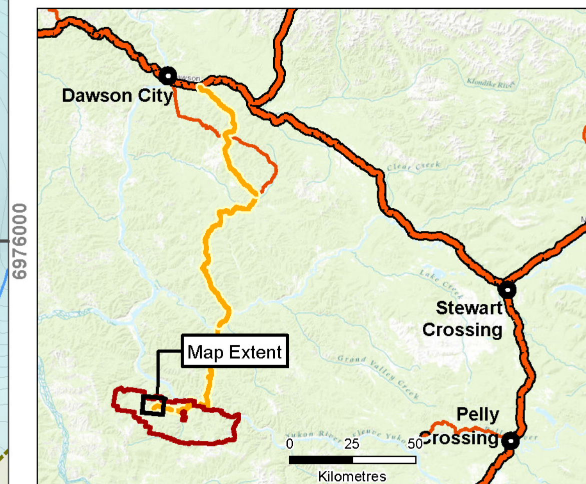
2. Staffing and Timeline

The Lorax team consisted of Andrew Solod for the installation of the VWP/thermistor in August and Andrew Solod and Chris Bourque for the installation of the Westbay well in September/October, with additional oversight provided by Mark Lessard of Westbay Instruments (Westbay). Drilling was conducted on a single shift basis during the daytime by Northspan Explorations Ltd (Northspan). Logistical support for material and equipment transport to the drill pad was handled by the drilling contractor, and Goldcorp staff. A timeline of program activities is outlined in Table 1.

COFFEE GOLD MINE

2016 Drilling Program Site Map - End of Mine Layout and Monitoring Locations





Legend

Symbol	Description
Monitoring Well	AZ = active zone, WB = Westbay, A = deep conventional (200+m), B = shallow coventional (150+m), T = thermistor/VWP, BH = original drillpad name
	Thermistor (Lorax 2014)
	Thermistor (KP 2014)
	Thermistor (SRK 2015)
	Thermistor/VWP (Lorax 2015)
	Thermistor/VWP (SRK 2015)
	Vibrating Well Piezometer (VWP) (EBA 2013)
	Packer Tests (EBA 2013)
	Packer/Slug Tests (Lorax 2014)
	Packer Tests (SRK 2015)
	City/Community
	Catchment Boundary
	Elevation Contours (20m)

Proposed Infrastructure

- Backfill
- WRSF
- Open Pit
- ROM Stockpile
- Support Infrastructure
- Organics Stockpile
- Heap Leach Pad Base
- Event pond
- Mine Site Access Road
- Northern Access Route

Pre-Mine Catchment Area

- Halfway Creek
- Latte Creek
- YT-24 Creek

N

1:25,000

0 200 400 600 800

Meters

NAD 1983 UTM Zone 7N

Page Size: 11" x 17"

Figure 1	Date: Mar 6, 2017	Drawn by: GM	Reviewed: JH

GOLDCORP

**Table 1:
Timeline of 2016 Coffee Gold Mine Hydrogeology Field Program.**

Date	# Shifts	Pad/Hole/Well ID	Activities
August 17th	1	n/a	• AS, travel to site • Wire up VWP/Thermistor and test instrumentation operation • Rig mobilized to BH14/MW16-01T drill pad
August 18th	1	BH14 / CFR1137 / MW16-01T	• Bedrock encountered at ~3.5 meters below ground surface (m bgs) • Casing advanced to ~5m bgs • 4.5" open hole advanced to ~5-12.5m bgs
August 19th-23nd	5	BH14 / CFR1137 / MW16-01T	• 4.5" open hole advanced to 12.5-183m bgs • Conduct short term airlift tests during hole advancement • 3.5" open hole advanced to 183-188m bgs • Terminate hole at ~188m bgs • Conduct 30 & 60 min airlift tests at 106 & 188 m bgs, yield of 15 US gallons per minute, (US GPM)
August 24th	1	BH14 / CFR1137 / MW16-01T	• Conduct pumping and recover test (16.5 min pumping / 30 min recovery) • Conduct 2 Packer Tests (1) 116-188 m bgs (2) 146.5-188 m bgs
August 25th-27th	3	BH14 / CFR1137 / MW16-01T	• Install 13-point Thermistor string from .5-180 m bgs • Install (2) VWP's at 98 and 132m bgs • Instrumentation installed and grouted in (~1.5 days) • 19.5 batches grout batches emplaced via (2) 1" Tremmie lines • Instrumentation hookup to datalogger & initial readings recorded • Lorax crew demobilized
September 28th	1	BH14/ CFR1206 / MW16-01WB	• Fly materials and equipment to drill pad • Drill 6.125" hole and advance 5.07" ID surface casing to ~4.8m bgs • Bedrock encountered ~2.4m bgs • Advance open hole RC from 4.8-24m bgs
September 29th-30th	2	BH14/ CFR1206 / MW16-01WB	• Open hole drilling 24-120.9 m bgs • Sustained measured flow during drilling at 21
October 1st - 4th	4	BH14/ CFR1206 / MW16-01WB	• Install HQ drill rod (casing) to 68.4 m bgs • MP38 Westbay casing emplaced to depth of ~118 m bgs; • Dilute glycol solution injected into WB casing to counteract buoyancy • Inflated Packers within the HQ drill rods • Pump glycol into the HQ casing • Seal annulus between HQ and surface & Weld on surface monument. • Conducted Pressure profile of sampling ports • Develop sampling zone (3) 71.6-73.1 m bgs

3. Field Methods

3.1 Drilling

The drilling program focused on providing information on groundwater characteristics below the bottom of permafrost downgradient of the proposed Heap Leach Facility. The purpose for drilling the combination VWP/thermistor hole first was to gain insight on depth of permafrost, depth of overburden, ground conditions and groundwater pressures ahead of the drilling and installation of the Westbay well approximately one month later. Previous site experience had demonstrated that a duration of at least four weeks between installations would provide enough opportunity for the thermistor string to equilibrate with ground conditions and provide permafrost thickness and vertical hydraulic gradients. Drilling depths, airlift yield values (visual estimate) and instrument installation depths are summarized in Table 2 and Appendix A.

The two vertical boreholes were advanced using a Hornet RC drill operated by Northspan. Five-inch inner diameter casing was advanced into competent bedrock using a double-sided casing advancer system with joints welded every five feet. Once the casing was keyed into bedrock (6.5 m bgs for MW16-01T and 4.6 m bgs for MW16-01WB), the casing advance system was exchanged for a COP44 hammer with 4.5-inch bit. Open hole drilling ensued using reverse circulation. In both MW16-01T and MW16-01WB the volume of formation water encountered during drilling overwhelmed the capacity of air circulation system (compressor units & booster) to properly lift and circulate cuttings and water out of the hole, impeding the drill bit from advancing deeper. In MW16-01T this occurred at 183 m bgs and MW16-01WB at 120 m bgs. In both cases, it was elected to trip out the 4.5-inch hammer and advance the hole with a 3.5-inch hammer. MW16-01T was advanced from 183-189 m bgs, and terminated at 189.3 m bgs having attained sufficient depth to accommodate the full length of the 13-point thermistor string. At MW16-01WB the volume of water prevented even the smaller 3.5-inch diameter hammer from properly firing. The hole was terminated at 120 m bgs which was deemed sufficient for targeting the critical water bearing intervals.

3.2 Hydraulic Testing

Lorax field personnel collected data about groundwater occurrence during the drilling to support VWP and Westbay installation design. Both drill holes encountered significant formation water and hydraulic testing was focused on delineating the water bearing zones.

Table 2:
Summary of MW16-01T & MW-16WB installations

Monitoring Well ID	Units	CFR1137 / BH14 / MW16-01T	Monitoring Well ID	Units	CFR1206 / BH14 / MW16-01WB
Mine Area		Heap Leach D/S	Mine Area		Heap Leach D/S
Drilling Start Date		8/18/2016	Drilling Start Date		9/28/2016
Drilling Completion Date		8/23/2016	Drilling Completion Date		9/30/2016
Easting (UTM NAD83 Zone 7)	M	580,987.7	Easting (UTM NAD83 Zone 7)	m	580,971.3
Northing (UTM NAD83 Zone 7)	M	6,972,502.9	Northing (UTM NAD83 Zone 7)	m	6,972,510.5
Ground Elevation (UTM NAD83 Zone 7)	M	1203.67	Ground Elevation (UTM NAD83 Zone 7)	m	1203.91
Survey type		RTK GPS	Survey type		RTK GPS
Azimuth (estimated)	Degrees	0	Azimuth (estimated)	degrees	0
Dip (not measured)	Degrees	-90	Dip (not measured)	degrees	-90
Estimated depth to bedrock	m bgs	5	Estimated depth to bedrock	m bgs	3.5
Surface Casing Depth	m bgs	7.0	Surface Casing Depth	m bgs	4.8
Surface Casing Method		Casing Advance/ Welded Joints	Surface Casing Method		Casing Advance/ Welded Joints
Surface Casing ID/OD	Inch	5.07/ 5.5	Surface Casing ID/OD	inch	5.07/ 5.5
Borehole ID	Inch	4.5 / 3.5	Borehole ID	inch	4.5
Borehole Method		RC open hole	Borehole Method		RC open hole
Borehole Drilled Depth	m bgs	189.3	Borehole Drilled Depth	m bgs	120.1
Borehole Measured Depth	m bgs	188	Borehole Measured Depth	m bgs	120.1
Stickup (Steel Surface Casing)	m ags	1.2	Stickup (Steel Surface Casing)	m ags	1.44
Installations			**Installations**		
Start Date		24-Aug-16	Start Date		1-Oct-16
Completion Date		27-Aug-16	Completion Date		3-Oct-16
Sch 80 PVC Install Nom. Dia.	Inch	1" Sch. 80	Sch 80 PVC Install Nom. Dia.	inch	MP38 Westbay
Other Instrumentation		T/VWP	stickup (PVC)	m	1.4
bottom of bentonite chips	m bgs	0	stickup (Elevation)		1205.31
top of bentonite chips	m bgs	1	Protective Casing Depth	m bgs	68.4
bottom of grout	m bgs	188	Protective Casing ID/OD	inch	3.06/3.5 (HQ)
top of grout	m bgs	1	***Westbay Primary Sampling Zones***		
VWP/Thermistor Instrumentation			Bottom of Westbay zone 1	m bgs	113.8
RST Datalogger	Serial #	02139	Top of Westbay zone 1	m bgs	110.1
Datalogger Model		DT2041	Bottom of Westbay zone 2	m bgs	89.4
Logging Frequency	Hours	12	Top of Westbay zone 2	m bgs	85.7
Thermistor String 1	Serial #	TS4132	Bottom of Westbay zone 3	m bgs	73.5
Thermistor 1-1	vertical m bgs	0.3	Top of Westbay zone 3	m bgs	71.4
Thermistor 1-2	vertical m bgs	0.9	Bottom of Westbay zone 4	m bgs	70.5
Thermistor 1-3	vertical m bgs	1.8	Top of Westbay zone 4	m bgs	66.8
Thermistor 1-4	vertical m bgs	3.8	Bottom of Westbay zone 1	m asl	1090.1
Thermistor 1-5	vertical m bgs	7.8	Top of Westbay zone 1	m asl	1093.8
Thermistor 1-6	vertical m bgs	12.8	Bottom of Westbay zone 2	m asl	1114.5
Thermistor 1-7	vertical m bgs	20.0	Top of Westbay zone 2	m asl	1118.2
Thermistor 1-8	vertical m bgs	29.7	Bottom of Westbay zone 3	m asl	1130.4
Thermistor 1-9	vertical m bgs	56.6	Top of Westbay zone 3	m asl	1132.5
Thermistor 1-10	vertical m bgs	89.5	Bottom of Westbay zone 4	m asl	1133.4
Thermistor 1-11	vertical m bgs	119.5	Top of Westbay zone 4	m asl	1137.1
Thermistor 1-12	vertical m bgs	149.5	Westbay port 1	m bgs	114.9
Thermistor 1-13	vertical m bgs	179.5	Westbay port 2	m bgs	110.3
Thermistor String 2	Serial #	NA	Westbay port 3	m bgs	90.5
Thermistor 2-1	vertical m bgs	-1.20	Westbay port 4	m bgs	85.9
VWP 1	Serial #/ Rating	VW37992/3 MPa	Westbay port 5	m bgs	74.6
Thermistor 1-9	vertical m bgs	97.5	Westbay port 6	m bgs	71.6
VWP 2	Serial #/ Rating	VW37991/3 MPa	Westbay port 7	m bgs	67
Thermistor 1-11	vertical m bgs	131.5	Westbay port 8	m bgs	64

Notes:
m bgs = meters below ground surface; m ags = meters above ground surface; MPa = Mega pascal

3.2.1 Borehole Yield Testing

Hydraulic testing was conducted on both holes as they were advanced to determine instrumentation placement. The primary method, airlift yield tests, comprised of retaining formation water discharged from the cyclone in a 30-US gallon drum for a timed duration. Repeated several times at a given depth interval, the rates were averaged. By placing the drill string below a fracture zone and circulating the air, water from the zone could be expelled out of the hole and the yield measured. Increases in yield over the borehole length indicate the location and productivity of transmissive zones. Testing was often conducted at the end of the shift while removing the drill string to maximise time. The depth and duration of airlift tests are outlined in Table 3 and Appendix A. MW16-01T was more thoroughly airlift tested with the results used to inform the design of MW16-01WB.

Table 3:
Airlift tests conducted at MW16-01T & MW16-01WB

Borehole	Date	Test Depth (m)	Elapsed Time (min)	Yield (US GPM)	Rational
CFR1137 / BH14 / MW16-01T	8/19/2016	94	Initial	10	Water production from borehole sufficient to conduct initial airlift test
			5	14	
			10	8	
			15	10	
		100	Initial	6	Second zone of interest, determine if yield is increasing with depth
			5	7.5	
			10	7.5	
	8/20/2016	97	Initial	14	Total depth, conduct test to determine if yield increased from previous day
			5	10	
			10	10	
		103	Initial	10	Testing during active drilling
			5	8	
		113	Initial	6.5	Testing during active drilling
			5	6.5	
		134	Initial	6	Total drilled depth on 8/20
			5	6	
			10	6	
	8/21/2016	105	Initial	8.5	Below the major fracture zone producing water, isolate via airlifting.
			15	7	
			30	7	
			45	7	
			60	7	
			75	7	
		134	Initial	8.5	Approximately the maximum drilled depth on the 20th. Determine if any of the fractures from 105-134 m bgs were contributing water
			15	6.5	
			30	6.5	
			45	6.5	
		150	Initial	7.5	Targeting sequence of hard competent granite, very hard and unfractured.
			15	6.5	
			30	6.5	
		165	Initial	8.5	Bottom of hole for 21st. Thick sequence of competent unfractured granite.
			15	7.5	
			30	7.5	
	8/22/2016	107	Initial	8.5	Upper fracture zone, thought to be producing all the water from the borehole, determine if yield is consistent from previous testing
			15	7.75	
			30	7.75	
		116	Initial	13	Entire upper fracture zone, determine if yield is different between the upper portion and its entirety.
			15	8	
			30	8	

Borehole	Date	Test Depth (m)	Elapsed Time (min)	Yield (US GPM)	Rational
			45	7.75	
			60	7.75	
			75	7.75	
		184	Initial	10	Bottom of Drill hole on 8/22
			15	7.75	
			30	7.75	
	8/23/2016	106	Initial	15	Below the major fracture zone producing water, isolating via airlifting and producing water only from it.
			15	15	
			30	15	
		188	Initial	15	Total Drill Depth
			15	15	
			30	15	
			10	30	
			20	30	
			30	31	
			40	31	
CFR1206 / BH14 / MW16-01WB	9/29/2016	77	Initial	20	Hydraulic profiling of borehole to delineate water bearing intervals upon removal of drill string
			5	18	
			10	18	
		86	Initial	17	As Above
			5	15	
			10	15	
		97	Initial	18	As above
			5	14.5	
			10	14.5	
		105	Initial	14.5	As Above
			5	14.5	
			10	14.5	
	9/30/2016	68	Initial	24	Hydraulic profile conducted during emplacement of the drill string in the borehole to determine if yield had increased from previous day
			5	24	
			10	24	
		78	Initial	16	As above
			5	16	
			10	16	
		115	Initial	21	As above
			5	23	
			10	23	
		120	Initial	31	Airlift testing conducted in conjunction with the VWP's of MW16-01T. Ahead of airlifting the data logger at MW16-01T was set to record at 30 second intervals. Logging continued overnight to measure recovery
			10	30	
			20	30	
			30	31	
			40	31	

3.2.2 Packer Testing

Two (2) constant rate injection packer tests characterizing 71.7 metres of bedrock were conducted in MW16-01T. In a constant rate injection test, the injection water pressure is maintained at a constant value for the entire test. The test was initiated by introducing flow to the test interval with the injection pressure controlled by the supervising hydrogeologist. The tests employed a single packer system and were conducted once the borehole had reached maximum depth. The key objective of the packer testing was to determine if the lower portion of the borehole comprised of fresh granite intercepted water bearing fractures. Packer test intervals are summarized in Table 4.

The first packer test was evaluated based on the constant head method. The test was conducted in accordance with Lugeon test methodology. A single packer assembly was placed at a depth of

147.8 m bgs in the borehole, isolating a test zone between the packer gland and the bottom of the drill hole at 189 m bgs. The packer was inflated to a pressure of 4150 kPa, sufficient to overcome the downhole pressures. The test was terminated after 20 minutes, during the first pressure step of the test, due to exhaustion of the water supply at the drill rig. The second packer test, attempted at a depth of 117.3 m bgs, was aborted due to suspected bypass of water around the packer.

Table 4:
Summary of packer tests conducted on MW16-01T

Tests	Test Interval (m bgs)	Test Method
Test # 2	117.3-189	Aborted (possible packer bypass) test
Test # 1	147.8-189	Constant head

Notes:
m bgs = meters below ground surface

3.2.3 Pumping and Recovery Tests

Artesian conditions during the drilling of MW16-01T presented the opportunity to conduct a pumping and recovery test using the drill rig water pump and the flow skid totalizing meter from the packer testing equipment. The intake line of the pump was lowered to its maximum depth in the drill hole and connected at the surface to the flow skid. Discharged water passed through the flow skid and the total pumped volume tabulated. The discharged water was captured in the onsite water storage reducing the need for water to be flown in. The test was run until the drawdown in the borehole exceeded the intake depth of the pump.

A second pumping test, on September 30, 2016, consisted of airlifting MW16-01WB for 40 minutes and recording the recovery by changing the sampling frequency of the two VWP sensors in the adjacent MW16-01T borehole. The data are interpreted in Section 4.3.3.

3.3 VWP/Thermistor

Vibrating wire piezometers (VWPs) were prepared according to manufacturer directions and both VWPs and thermistor string were taped to the outside of a 1-inch schedule 80 PVC riser pipe at predetermined intervals as the PVC was lowered down the open hole. The VWPs were installed at 97.5 m bgs and 131.5 m bgs respectively as detailed in the borehole provided in Appendix A. The shallow VWP targets the main fracture zone encountered in the borehole and below the permafrost interface. The deeper one targets the lowest encountered fractured zone above the fresh granite sequence that dominates the lower portion of the borehole.

Two thermistor strings were installed at MW16-01T. One string, 185 meters long, consisted of 13 individual sensors spaced at increasing intervals along the string and permanently installed (*i.e.*

grouted-in). The second thermistor, an individual sensor, was deployed into the top of the surface casing of MW16-01T above the grout to measure ambient temperature. The installation details are summarized in Table 2.

Grout was prepared according to the methods outlined by Mikkelson (2002) with adjustment to the prescribed bentonite proportion to arrive at the desired consistency and density. Nineteen and half batches of grout were prepared in a grout plant using a mix of 50 kg general use cement (2.5 bags) in 33 gallons of water to which 34-40 kg bentonite (1.5-1.75 bags) was added. Eleven batches of grout were emplaced in one shift through the 1" PVC riser pipe to which instruments were attached, which was suspended approximately 8 meters off the bottom of the hole. The remaining 8.5 batches were pumped the following day via a second 1" PVC tremie line which was lowered to the top of the grout column (Figure 2). Once grouting was completed, a steel enclosure was mounted on top of the surface casing and the instrument wires were connected to a datalogger housed inside the enclosure (Figure 3). The enclosure was tack-welded to the steel surface casing. The datalogger was programed to record every twelve (12) hours.

Figure 2: Grouting of MW16-01T Through 1" PVC Tremie. Both Tremie lines visible, with active pumping into the second line

Figure 3: Datalogger and Steel Enclosure at MW16-01T.

3.4 Westbay Installation

MW16-01WB was completed approximately one month after MW16-01T following a formula adapted in 2015 for Westbay/thermistor installations. Unlike previous Westbay/thermistor installations, MW16-01WB was positioned on topographic contour with MW16-01T and on a separate and purposely built drill pad 10 meters away, and not up gradient on the same pad. MW16-01WB was constructed over the course of three shifts. The drilling and installation schedule for MW16-01WB is summarized in Table 1.

The weather for the installation was favourable and limited the extra steps necessary to protect sensitive sampling equipment and construction material from the cold. A draft construction plan was developed based on the results of the installation of MW16-01T, with the final position of the sampling zones determined by the field hydrogeologist based on airlift testing and downhole geology. To protect the Westbay PVC casing from ice damage, a string of HQ drill rods was hung from the surface casing to a depth 68.4 m bgs, spanning the permafrost. The installation of the Westbay casing was directed by Westbay personnel, including the pressure testing of each section of PVC casing during emplacement, and inflation of the various packer systems. Figure 4 shows the Westbay casing and a packer element being lowered into the borehole. Diluted propylene glycol (1 part glycol to 3 parts water) was used to inflate the sampling zone and stabilizing packers, and to fill inside of the Westbay PVC casing and the annulus between the Westbay casing and HQ rods. Diluted propylene glycol was used to prevent ice formation inside and outside of the Westbay casing. A surface monument was welded on top of the surface casing and 50 kg of sand added to the annular space. Finally, the annulus between the HQ drill rods and the surface casing was filled with 3 meters of bentonite chips sealing the annular space from the surface. Westbay has provided a completion report detailing the installation procedure and as-built schematic (Appendix B).

The primary objective for the installation of MW16-01WB is the collection of sub-permafrost groundwater samples. For the final construction, four (4) sampling zones were selected, targeting both intervals producing water below the permafrost and deeper intervals in tighter rock. Water was first encountered during drilling at a depth of 70 m bgs, roughly corresponding to the bottom of the permafrost based on thermistor data. Airlift testing revealed prolific water production with yields of 18 US GPM. An interval from 66.8-70.5 m bgs was selected as the fourth sampling zone (zones number from bottom upwards) along the margin of the permafrost. The third sampling zone was placed between 71.4-73.5 m bgs and is the primary sampling zone targeting groundwater close to the margin of the permafrost. The second sampling zone targets a lower weak fractured section between 85.7-89.4 m bgs. The first sampling zone, 110.1-113.8m bgs targets the fresh granite encountered near the well bottom and provides a location should deeper sampling be required. Sampling zones are labeled in the borehole log (Appendix A).

Figure 4: Emplacement of Westbay Casing (MW16-01WB) with packer element

4. Results

4.1 Geology

The geology differs slightly between MW16-01T and MW16-01WB despite their proximity (~18 meters separation). Borehole logs detailing geology and well completion schematics are found in Appendix A. MW16-01T was advanced through approximately six meters of overburden before encountering a series of weak zones defined by fractures, with visible oxidation, weathering, and clay alteration in a regional granite complex as described by Goldcorp field geologists. The bottom portion of the hole (from 135 m bgs to the 189 m bgs) is characterized by fresh granite, with small fractures. MW16-01WB was advanced through a similar thickness of overburden. Weak zones with oxidation and clay alteration are less prevalent and the hole generally exhibits a geology of fresh granite. It is inferred that this borehole is outside of the fault complex that dominates the geology of MW16-01T.

Goldcorp geologists have indicated that there is a prominent NNW-SSE trending linear magnetic break apparent in the tilt-derivative magnetic survey of the HLF area and that these types of breaks are occasionally indicative of faults or mineralized structures in the Coffee area (E. Buitenhuis, pers. communication). As shown in Figure 5, the magnetic break skirts the location of the MW16-01T/WB drill holes. The findings of 2016 drilling program suggest that this feature could likely represent a fault.

4.2 Groundwater Pressures

During drilling, both MW16-01T and MW16-01WB exhibited artesian flow with yields measured at approximately 0.95 L/s and 2 L/s respectively. Both the shallow and deep sensors (VWP 2 and VWP 1, respectively) exhibit artesian conditions and a downward hydraulic gradient of ~5% (Table 5). Both VWP sensors displayed increasing water level trends from installation until the drilling of MW16-01WB (Figure 6). This trend may reflect a seasonal trend in water levels; future monitoring will be used to confirm the trend. The data in Figure 6 are truncated to September 29th, when drilling at MW16-01WB initiated. The sensors both responded to drilling/airlifting of the nearby hole, as discussed in Section 4.3.3.

Pressure profiling of the Westbay sampling ports was conducted on October 3rd, 2016 prior to collecting groundwater samples. Water level readings are provided in Table 5 and presented in Figure 7. All water levels have been barometrically compensated. The artesian head at each of the Westbay ports is comparable to the artesian head displayed by the shallow VWP installed at MW16-01T. A very slight downward hydraulic gradient (0.4%) is measured between Ports 1 and 5.

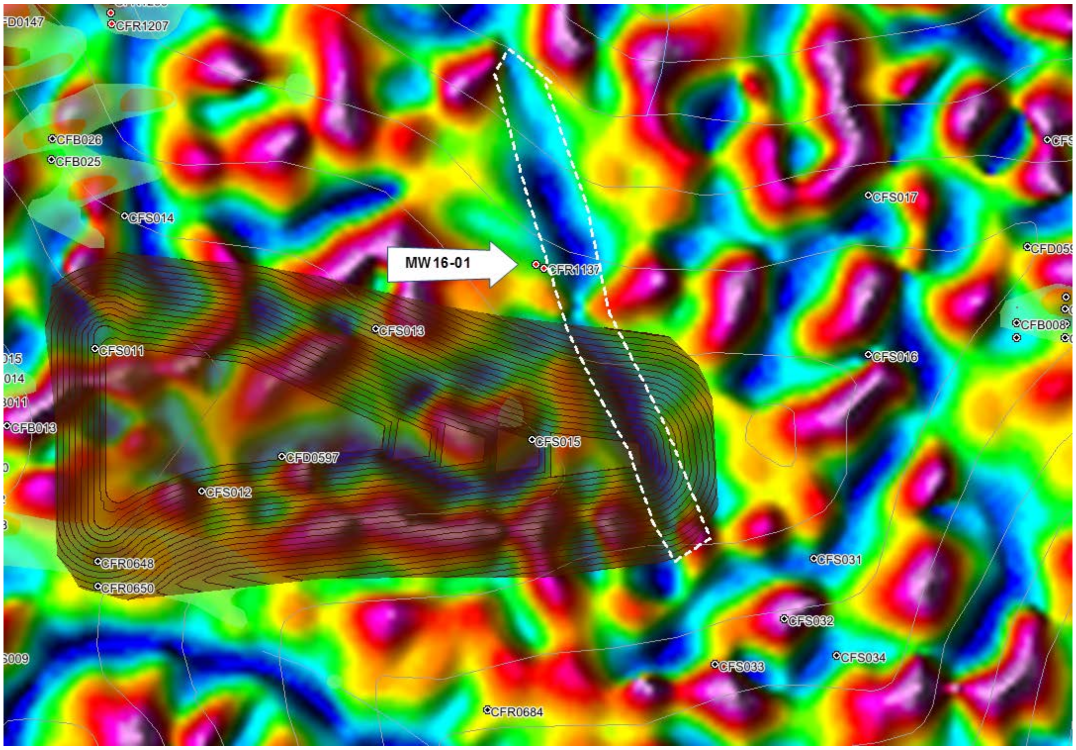


Figure 5: Tilt-derivative magnetic survey of proposed HLF area. White outline highlights a prominent magnetic break in the area.

Table 5:
Pressure head readings from VWP sensors installed at MW16-01T.

Installation	Sensor	Surface Elevation (m asl)	Installed Depth (m bgs)	Date	Water Level (m asl)	Depth to Water[1] (m bgs)	Hydraulic Gradient[2,3]
MW16-01T	VWP 1	1203.67	131.5	29-Sep-2016	1204.47	-0.80	0.045
	VWP 2		97.5		1205.94	-2.28	
MW16-01WB	Port 1	1203.91	114.9	03-Oct-2016	1205.44	-1.53	0.004
	Port 2		110.3		1205.49	-1.58	
	Port 3		90.5		1205.50	-1.59	
	Port 4		85.9		1205.53	-1.62	
	Port 5		74.6		1205.59	-1.68	
	Port 6		71.6		1205.54	-1.63	
	Port 7		67.0		1205.55	-1.64	

Note:
m asl – metres above sea level, m bgs – metres below ground surface
1. Negative depth to water indicates water level above surface
2. Positive hydraulic gradient is downward
3. MW16-01WB hydraulic gradient measured between port 1 and port 5.

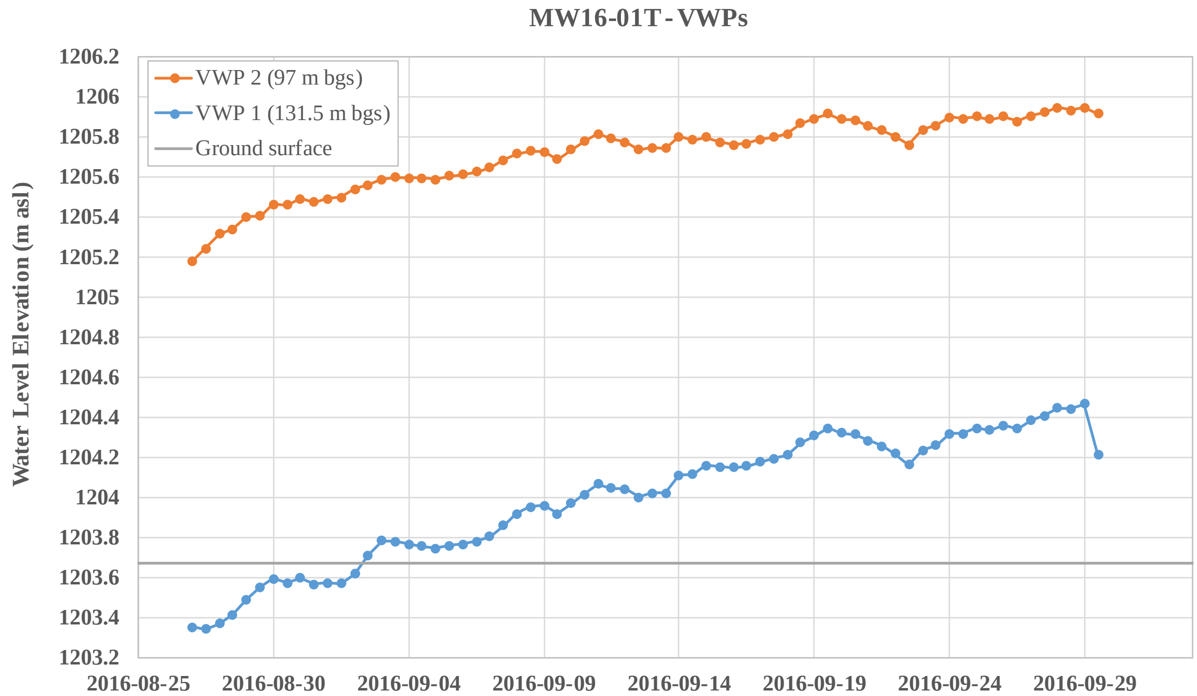


Figure 6: Groundwater elevation trends at MW16-01T.

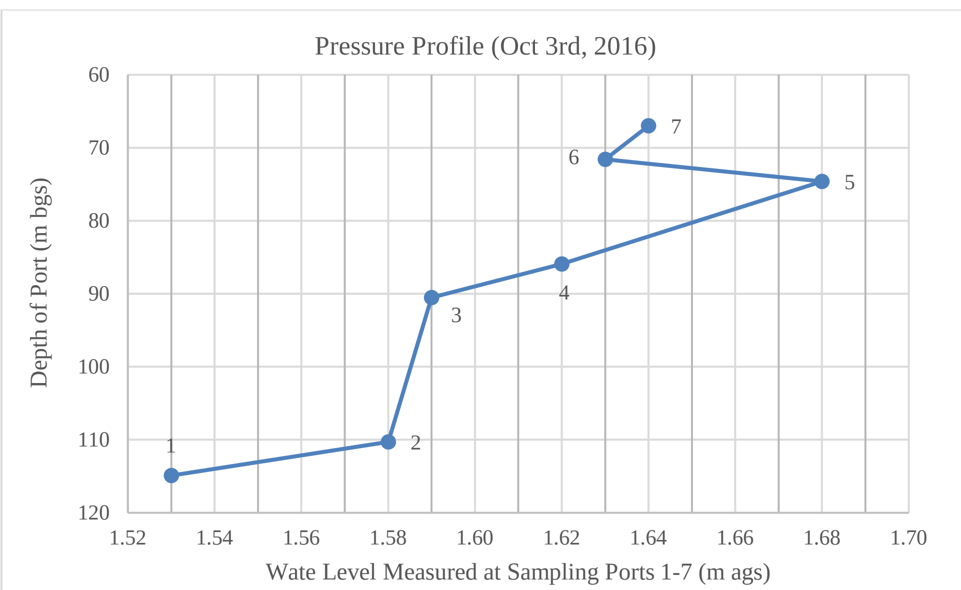


Figure 7: Groundwater pressure profile at MW16-01WB.

4.3 Hydraulic Testing

4.3.1 Borehole Yield Testing

Groundwater was first observed in MW16-01T at a depth of approximately 89 m bgs and in MW16-01WB at a depth of approximately 76 m bgs. At both locations, yields increased over the course of drilling and airlifting. In both instances, the increased yield was unrelated to the intersection of additional fractures as drilling progressed, and instead related to the fractures becoming more productive through the process of being developed by air and water. In MW16-01T, the yield increased from 6 to 15 US GPM and in MW16-01WB the yield increased from 14.5 to 31 US GPM.

4.3.2 Packer Test Interpretation

The successful packer test at MW16-01T involved injecting water a constant pressure of 200 kPa at flow rates of 0.6 to 0.3 L/s. The data was analyzed using the Hvorslev method (Hvorslev, 1951) with supporting calculations provided in Appendix C. A hydraulic conductivity (K) of 6E-07 m/s has been calculated for the interval of 147.8-189 m, which is in good agreement with the transmissivity (T) value calculated from the mini-pumping test performed in the same hole (Table 6).

4.3.3 Pumping Airlift Test Interpretation

MW16-01T was pumped for 16.5 minutes at ~0.32 L/s (~5.1 US GPM). Water level recovery in MW16-01T was manually measured for 30 minutes after cessation of pumping, with a water level recovery to 91% of the pre-pumping level. The recovery was evaluated by the Cooper-Jacob graphical method (Cooper and Jacob, 1946), yielding a formation transmissivity of 1E-05 m^2/s. Supporting calculations are provided in Appendix C.

Airlift testing of MW16-01WB was supported by high-resolution monitoring of groundwater pressures at MW16-01T. MW16-01WB was airlifted at 115 L/s (30.5 US GPM) for 40 minutes with the hammer positioned at the bottom of the open hole (~120 m bgs). The datalogger at MW16-01T, was set to record at 30 second intervals. Water level changes were documented in both the shallow and deep VWP sensors (Figure 8). The shallow VWP recorded a slight increase in water level, followed by a relatively quick return to pre-airlifting levels. The deep VWP displayed a drop-in water level of 7.15 meters from pre-drilling levels, and a drop of 6.45 meters during the airlifting testing. The recovery test was evaluated by the Cooper-Jacob graphical method as illustrated in Figure 9 (Cooper and Jacob, 1946). The test provided transmissivity of 1E-04 m^2/s and a confined storativity value of 9E-05. Both values are reasonable for a bedrock aquifer. The transmissivity value is consistent with that measured at MW16-01T (Table 6).

Table 6:
Summary of hydraulic testing results at MW16-01T/WB

Hole ID	Test Type	Analytical Method	Interval (m)	Transmissivity (m^2/s)	Hydraulic Conductivity (m/s)
MW16-01T	Packer Constant Head Test	Hvorslev (1951)	147.8-189		6E-07
MW16-01T	Pumping Test Recovery	Cooper and Jacob (1946)	0-189	1E-05	6E-07[2]
MW16-01WB	Airlift Test Recovery	Cooper and Jacob (1946)	0-120[1]	1E-04	

Notes
[1]Airlifting conducted in MW16-01WB, measurements recorded at 97 and 131.5 m bgs in MW16-01T
[2] Bulk measurement based on 20m fracture zone

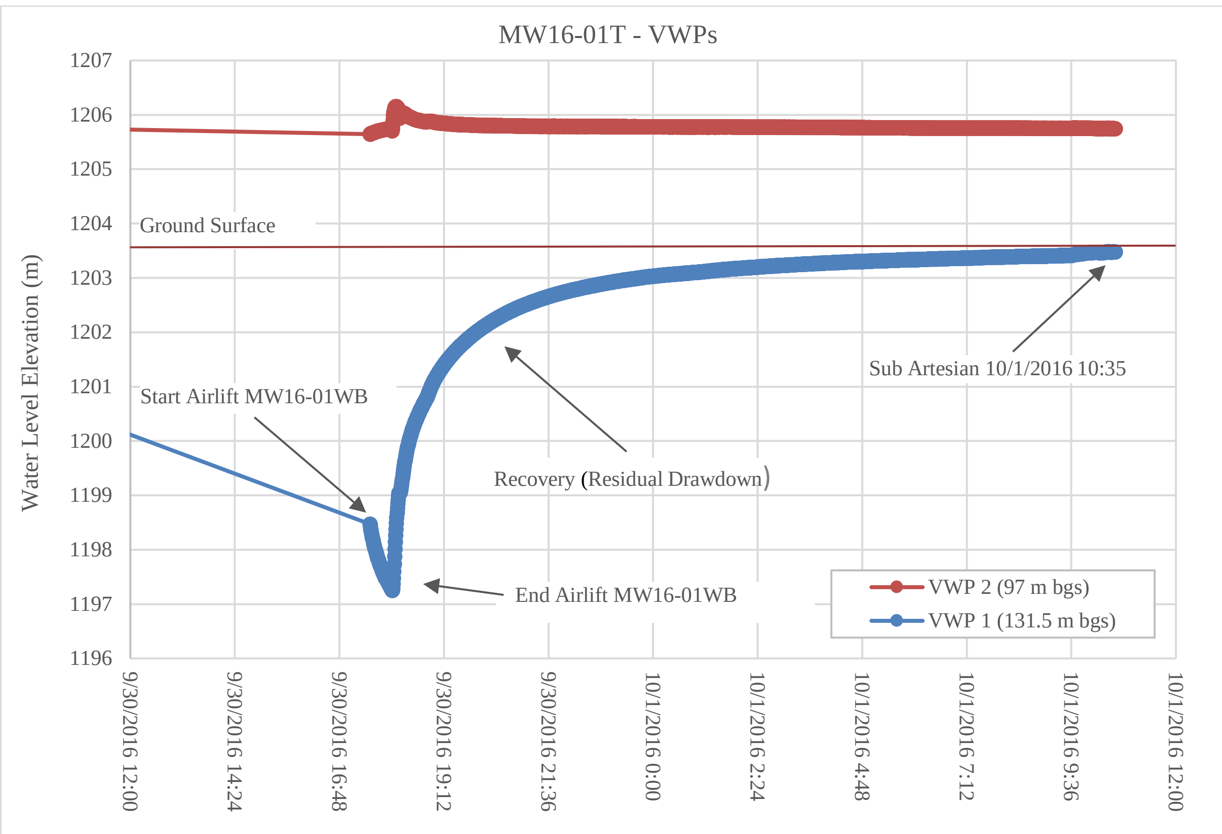


Figure 8: Water level changes at MW16-01T in respone to airlift testing in MW16-01WB

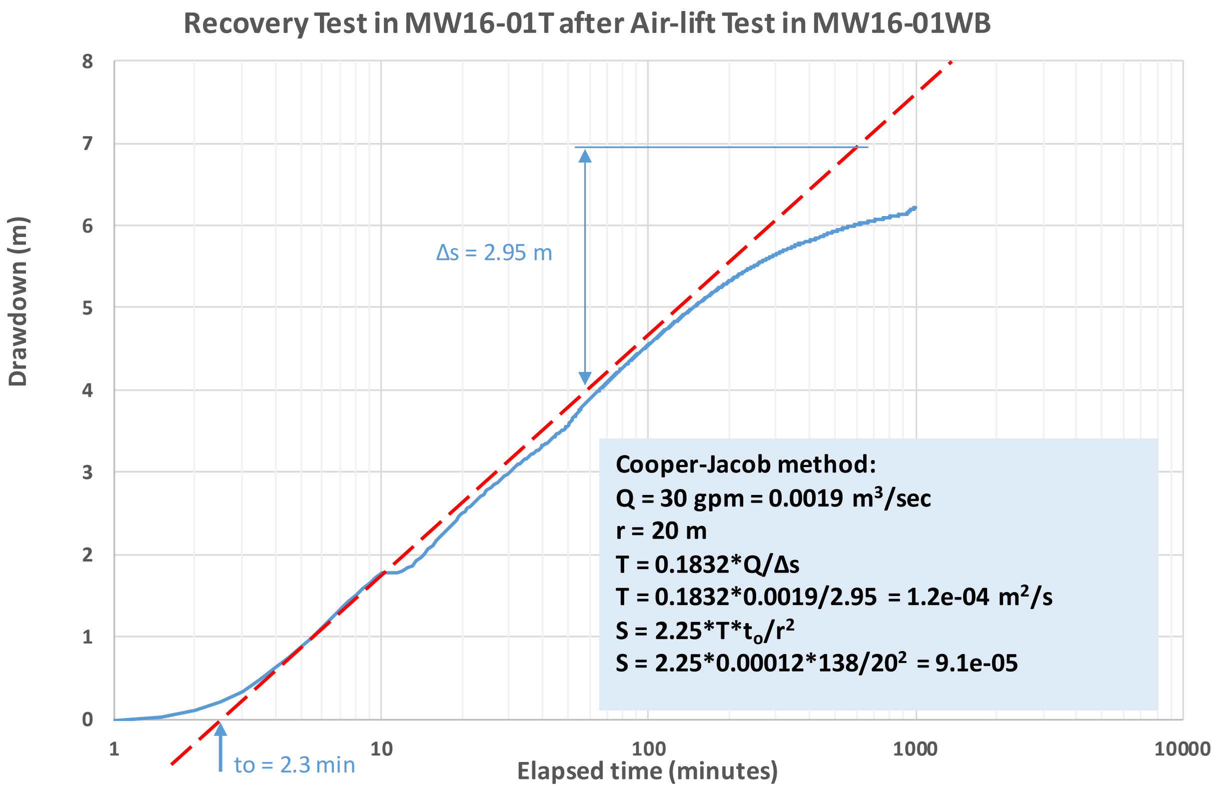


Figure 9: Recovery test in MW16-01T in response to airlift testing in MW16-01WB

4.4 Ground Temperature

The thermistor string was downloaded approximately five (5) weeks after installation which provided sufficient time for the cement to set and cool, and the sensors to equilibrate to ground conditions. The thermistor data displayed temperature stabilization useful for determining permafrost thickness for the final planning of the MW16-01WB installation. Permafrost thickness is on the order of 67 metres, with temperatures below 0°C between 0.5 and 67 metres below ground surface. Figure 10 demonstrates sensor temperature stabilization over the course of several weeks after installation.

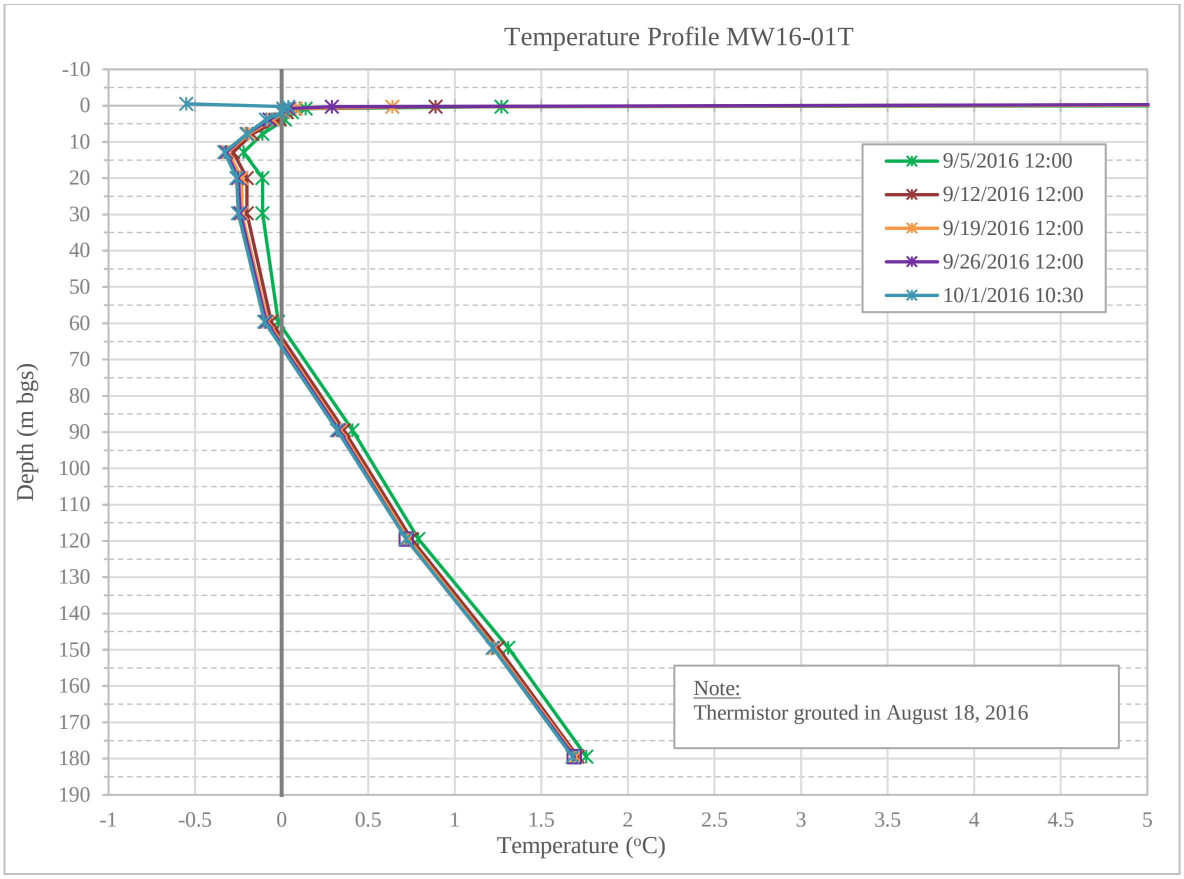


Figure 10: Temperature profile at MW16-01T.

4.5 Groundwater Quality

Between October 3rd and 4th MW16-01WB sampling zone 3 was manually developed using the Westbay sampling probe. Approximately 30 L was removed from the zone prior to sampling. The formation water was clear, odorless, and did not exhibit a change in clarity over the course of development. Upon completion of development, groundwater samples were collected.

5. Closure

The data presented within this report is considered preliminary in nature. Additional monitoring of the instruments will be required to understand longer term water level and ground temperature trends. Lorax appreciates the support from Goldcorp and Northspan crews in the planning and successful execution for this latest phase of the Baseline Hydrogeology Program. Please contact the undersigned with any questions or comments regarding the contents of this memo.

Sincerely,

LORAX ENVIRONMENTAL SERVICES LTD.

Prepared by:	Reviewed by:
Signature REDACTED	Signature REDACTED
Andrew Solod, B.Sc.	**Laura-Lee Findlater, P.Geo.**
Project Hydrogeologist	Project Hydrogeologist

References

Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

Hvorslev M.J. (1951) Time Lag and Soil Permeability in Ground-Water Observations. Bull. No.36, Waterways Experiment Station, Corps. Of Engineers, U.S. Army, pp. 50.

Mikkelson, E. 2002. Cement-bentonite grout backfill for borehole instruments. Geotechnical News: December 2002, pp. 38-4

Appendix A
Borehole Logs MW16-01T & MW16-01WB

MW16-01T / BH-14 / CFR-1137

GOLDCORP

Coffee Creek Gold
Project #: A362-4

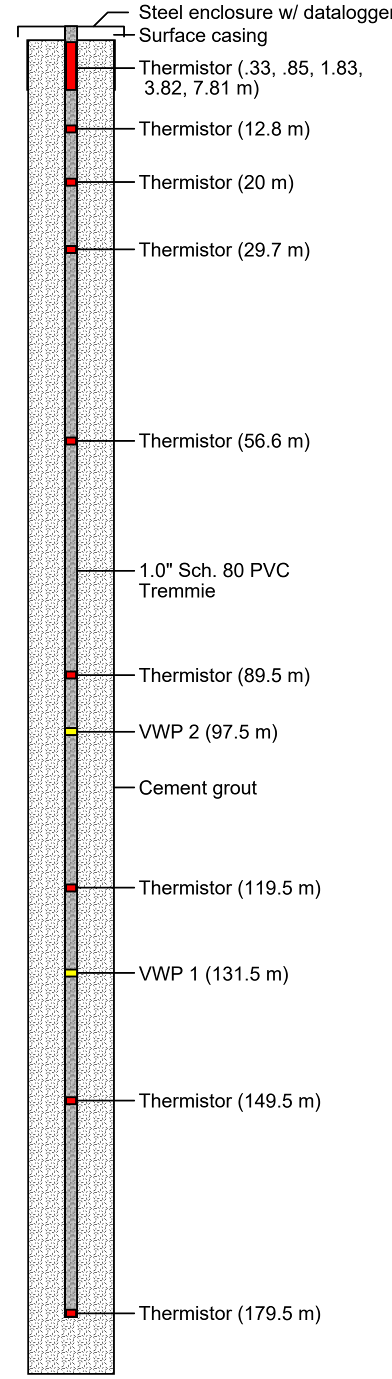
Drilling Started	: August 18, 2016	Drilling Method	: Casing Advance / RC
Install Completed	: August 27,2016	Drilling Company	: Northspan
Drilling Diameter(s)	: 6" / 4.5" / 3.5"	Supervised By	: A. Solod
Drilled depth	: 189.28 mbgs	Logged By	: Goldcorp
		Checked By	: A. Solod

Depth to Bedrock: 5 mbgs
Casing Depth: 7 mbgs

Easting: 580,978.69 m
Northing: 6,972,502.92 m
Elevation: 1203.67 m asl
Survey Type: RTK GPS

Depth (m)	Elev. (masl)	LITHOLOGY	Fracture = Fr Fault = Flt	Airlift Yield 8/22/2016 (USGPM)	Airlift Yield 8/23/2016 (USGPM)
0	1203	OVERBURDEN			
		6.1-25.9 Oxidized granite grading to weakly bleached down-hole. Patchy fracture controlled weak clay alteration. Blebs of silver-brassy pyrite up to 0.25%. Weak patchy sericite (generally along fracture surfaces).	6-25		
20	1183				
		25.9 -32 Weak zone. Weak to moderate fracture controlled clay alteration with weak patchy sericite. Disseminated hematite up to 1%, with fracture controlled limonite up to 0.5%.	25-32		
		32-39.6 Weak zone. Moderate pervasive clay alteration with weak pervasive sericite. Disseminated sooty sulphides up to 2.5%, patchy disseminated hematite up to 1.5%. (distinct sulphur smell)	32-39		
40	1163				
		39.6-54.9 Weak zone. Moderate pervasive clay with weak patchy sericite. Strongly oxidized throughout. Disseminated hematite up to 1.5%, with disseminated limonite up to 1%. (No significant As-by-XRF results)	39-54		
60	1143				
		54.9-73.2 Fresh granite, weak patchy fracture controlled oxidation.			
		73.2-83.8 Moderate pervasive clay alteration with weak pervasive sericite alteration. Disseminated hematite up to 1.5%, with patchy limonite up to 0.75%.	73-86		
80	1123				
		83.8-86.9 Moderate pervasive clay alteration, weak pervasive sericite.			
		86.9-114.3 Weak zone. Moderate pervasive clay alteration, with weak patchy sericite alteration. Disseminated hematite up to 1%, fracture controlled limonite up to 0.75%.	86-114	7.75	15
100	1103				
		114.3-125.0 Fresh granite with weak clay alteration/trace bleaching.		7.75	
120	1083				
		125.0-135.6 Weak zone. Weak to moderate pervasive clay alteration, fracture controlled hematite up to 0.75%, with patchy limonite up to 0.25%.	124-135		
140	1063	135.6-189.0 Fresh Granite			
160	1043				
180				7.75	15

Installation depths along hole (m)



MW16-01WB / BH14-WB / CFR-1206

GOLDCORP

Coffee Creek Gold
Project #: A362-4

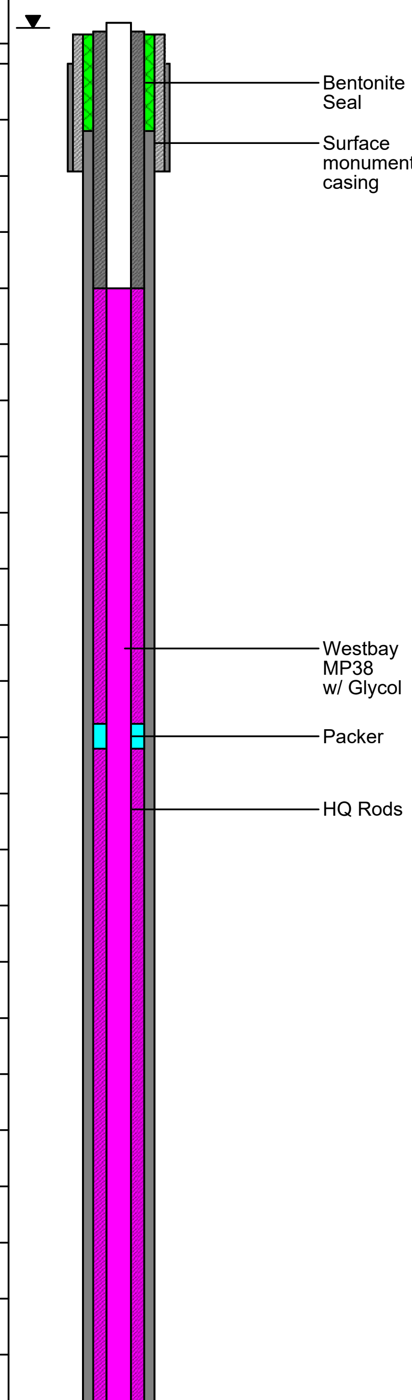
Drilling Started	: September 28,2016	Drilling Method	: Casing Advance & RC
Install Completed	: October 03,2016	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: AS (Lorax)
Drilled Depth	: 120.09m	Logged By	: AS
		Checked By	: LF

Casing Depth: 4.8 mbgs
HQ Depth: 68.4 mbgs
Westbay Depth: 117.97 mbgs

Easting: 580,971.33 m
Northing: 6,972,510.54 m
Elevation: 1203.91 m asl
Survey Type: RTK GPS

Surface Casing Stickup: 1.30 m ags
HQ Rods Stickup: 1.44 m abs
Westbay Stickup: 1.82 m ags
Water Level: 1.6 m above ground (3-Oct-16; Port 6)

Depth (m)	Elev. (masl)	LITHOLOGY	pH	Airlift 9/29/2016 (USGPM)	Airlift 9/30/2016 (USGPM)	Depth (m)
0	1203	OVERBURDEN Oxidized granite in overburden with mixed biological material.				0
		Oxidized granite grading to weakly bleached down-hole. Patchy fracture controlled weak clay alteration.				
10	1193					10
20	1183					20
30	1173					30
		Moderate pervasive clay alteration, weak pervasive sericite.				
40	1163	Fresh granite with weak clay alteration/trace bleaching.				40
50	1153					50
60						60



MW16-01WB / BH14-WB / CFR-1206

GOLDCORP

Coffee Creek Gold
Project #: A362-4

Drilling Started	: September 28,2016	Drilling Method	: Casing Advance & RC
Install Completed	: October 03,2016	Drilling Company	: Northspan
Drilling Diameter(s)	: 6.0" & 4.5"	Supervised By	: AS (Lorax)
Drilled Depth	: 120.09m	Logged By	: AS
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Casing Depth: 4.8 mbgs
HQ Depth: 68.4 mbgs
Westbay Depth: 117.97 mbgs

Easting: 580,971.33 m
Northing: 6,972,510.54 m
Elevation: 1203.91 m asl
Survey Type: RTK GPS

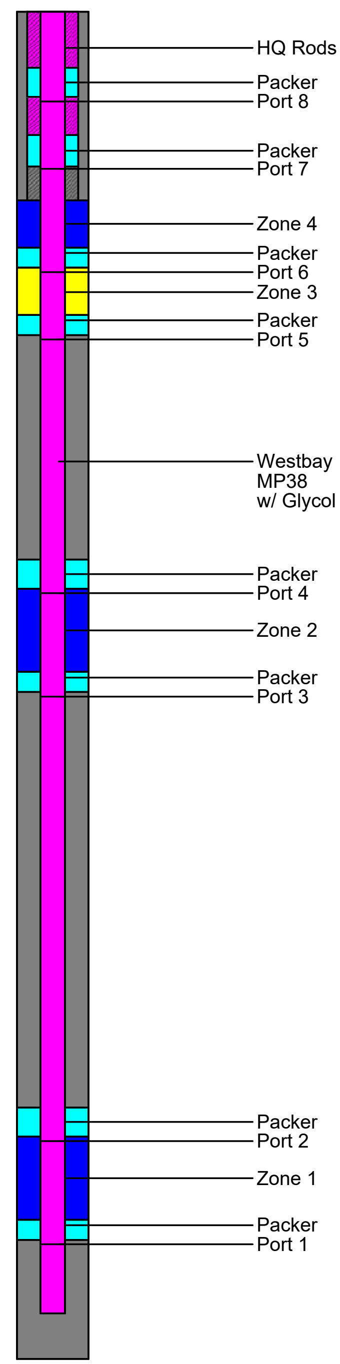
Surface Casing Stickup: 1.30 m ags
HQ Rods Stickup: 1.44 m abs
Westbay Stickup: 1.82 m ags
Water Level: 1.6 m above ground (3-Oct-16; Port 6)

Depth (m)	Elev. (masl)
60	1143
70	1133
80	1123
90	1113
100	1103
110	1093
120	

LITHOLOGY

Fresh granite

pH	Airlift 9/29/2016 (USGPM)	Airlift 9/30/2016 (USGPM)
	18	24
	15.5	16
	14.5	
		23
		31

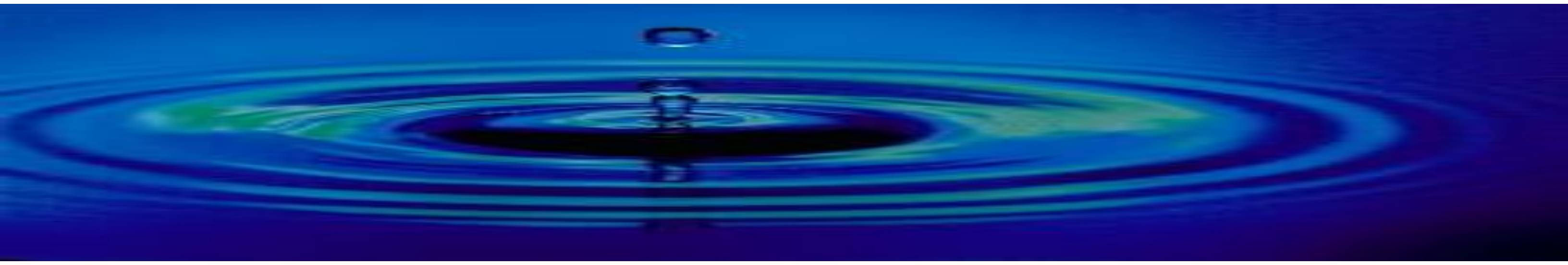


Appendix B
Westbay Completion Report

November 2, 2016

Completion Report WB950

Kaminak Gold Coffee Creek Project
MW-16-01WB



Westbay Instruments

November 2, 2016

Completion Report WB950

Kaminak Gold Coffee Creek Project
MW-16-01WB

Project Number: WB950

Prepared for:

Lorax Environmental Services Ltd.

Prepared by:

Westbay Instruments

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Suite134
Burnaby, BC
V5J 0B6

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

This report and the attached Appendix document the technical services carried out by Westbay Instruments (Westbay) under Lorax Environmental Services Ltd. P.O. No. A362-4. A Westbay System completion was installed in borehole MW-16-01WB at the Kaminak Gold site near Coffee Creek, Yukon Territory.

This report documents the installation tasks and related QA checks.

2 PRE-INSTALLATION ACTIVITIES

Borehole MW-16-01WB was drilled using an air rotatory method at a nominal 4.5-inch diameter to a depth of 120.1m. Permanent surface casing was installed to bedrock in the borehole. A string of HQ-size drill rods (nominal 76mm ID) was permanently installed to 68 meters depth before installation of the Westbay System.

3 INSTALLATION

Westbay technical services representative Mr. Mark Lessard was on site for the installation from September 30 to October 5, 2016. Lorax representatives Mr. Andrew Solod and Mr. Chris Bourque were on-site to assist and supervise the work.

Table 1, Summary of Westbay System Completion

Monitoring Well No.	Installation Dates 2016	Borehole Depth (m)	Depth of HQ rods (m)	MP38 Tubing Length (m)	No. Monitoring Zones
MW-16-01WB	Oct 1 - 3	120.1	68	118.0	4

(Note: all depths are with respect to ground surface. Monitoring well reference elevations were not available at the time of writing).

The Westbay System was installed according to the procedure described below.

3.1 Preparation of Westbay System Design

Packer locations and the projected depth of permafrost (about 60m) for the borehole were provided to Westbay by Mr. Andrew Solod of Lorax. A well design was created based on these depths. The well design was used to prepare a Westbay Completion Log, which specifies the location of components in the well. The log was reviewed and approved in the field by Mr. Solod prior to installation of the well. The Westbay Completion Log as approved was used as an installation guide in the field. A field copy of the log is in the Appendix.

A measurement port coupling was included in each primary zone to provide the capability to measure fluid pressures and to collect fluid samples. Measurement port couplings were also included in QA zones to provide QA testing capabilities. A pumping port was placed above the top packer located directly above the expected base of permafrost in the completion. This pumping port was placed as part of a plan to introduce a 3:1 propylene glycol/water mixture into the steel casing adjacent to the permafrost zone.

Mr. Andrew Solod of Lorax requested that optional synthetic (PET) filters were not to be installed over the measurement port couplings.

3.2 Layout of Westbay System Components

Prior to Westbay System installation, the Westbay System components were set out on a rack near the borehole according to the sequence indicated on the Westbay Completion Log. Each component was numbered beginning with the lowermost as an aid to confirming the proper sequence of components. The appropriate Westbay System couplings were attached to the tubing sections. Magnetic location collars were attached 0.6 meters below the top of the measurement port in each primary zone.

Each component was visually inspected. Serial numbers for each packer, pumping port and measurement port coupling were recorded on the Westbay Completion Log. The well component layout was confirmed with the log before the components were lowered into the borehole.

3.3 Lowering of Westbay System Components

The Westbay System components were lowered into the borehole by hand, through permanent HQ drill rods (nominal 76mm ID) to 68 meters and open borehole to total depth. Each tubing joint was tested with a minimum internal hydraulic pressure of 150 psi for one minute to confirm hydraulic seals. A record of each successful joint test and the placement of each component are noted on the Westbay Completion Log by check marks.

A 3:1 water/propylene glycol mixture supplied by Lorax was added to the Westbay completion when necessary to counter buoyancy effects while components were lowered into the borehole and for testing of joint seals during lowering.

3.4 Hydraulic Integrity Testing

After the Westbay System components were lowered into the borehole, the water inside the tubing was monitored at a depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the tubing. The data from the hydraulic integrity test is shown in Table 2 below.

Table 2, Borehole and Westbay Tubing Water Level

Well number	Borehole water level (ground surface)	Westbay tubing water level (below top of Westbay)
MW-16-01WB	ground level (artesian)	37.310 m

3.5 Positioning of Westbay System Completion

The final position of the guide tube is illustrated on the Summary Completion Log in the Appendix. The Westbay System tubing was positioned as indicated on the cover page of the Summary Completion

Log. Ground surface was used as zero reference for the installation. The Westbay System components were supported in this position while packer inflations were carried out.

The positioning of the Westbay System is based on the "nominal" lengths of Westbay System components. The positioning calculations do not include allowances for borehole temperature or deviation effects.

The attached figure titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX Transducer sensors to the reference position at the top of the Measurement Port. The attached figure titled "Dimensions of Packer Seals and Monitoring Zones" outlines the calculations used to determine the packer centerline depths and zone length.

The Summary Completion Log and Table 4, shows the final "as-built" locations of key components in the well, and Table 5 shows the final "as-built" locations of all components in the well, are included in the Appendix.

3.6 Pre-inflation Profile

Prior to inflating the packers, a pre-inflation pressure profile was carried out in the Westbay System to confirm the proper operation and position of measurement ports and magnetic collars. The data confirmed proper operation and position of all measurment ports (Figure 3). The data for the pre-inflation profile for the well is located in the Appendix.

3.7 Inflation of Westbay System Packers and Placement of Antifreeze Solution

The Westbay packers were inflated using a 3:1 proplyene glycol/water mixture provided by Lorax. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All the packers appear to have inflated normally. The data for inflation of each packer are provided on the Westbay Packer Inflation Records included in the Appendix.

The packers were inflated in a specific sequence as part of a plan to introduce and control an antifreeze solution in the well annulus through the permafrost zone.

The sequence of tasks for introducing 3:1 proplyene glycol/water mixture is illustrated below:

- A set of two packers positioned inside the HQ rods immediately below the expected base of permafrost are inflated.
- The pumping port above the upper inflated packer was opened.
- A 3:1 mixture of water and propylene glycol supplied by Lorax was pumped inside the Westbay tubing, out the pumping port and into the well annulus (HQ rods). Pumping continued until a return flow of the mixture was observed from the well annulus at ground level, thus indicating that the well annulus (HQ rods) was full of the antifreeze mixture.
- The pumping port above the upper inflated packer was closed.
- The remaining Westbay packers were inflated sequentially beginning at the bottom.
- The squeeze relief venting function of the packer inflation tool was disabled to prevent accidental release of tubing fluid to the formations.

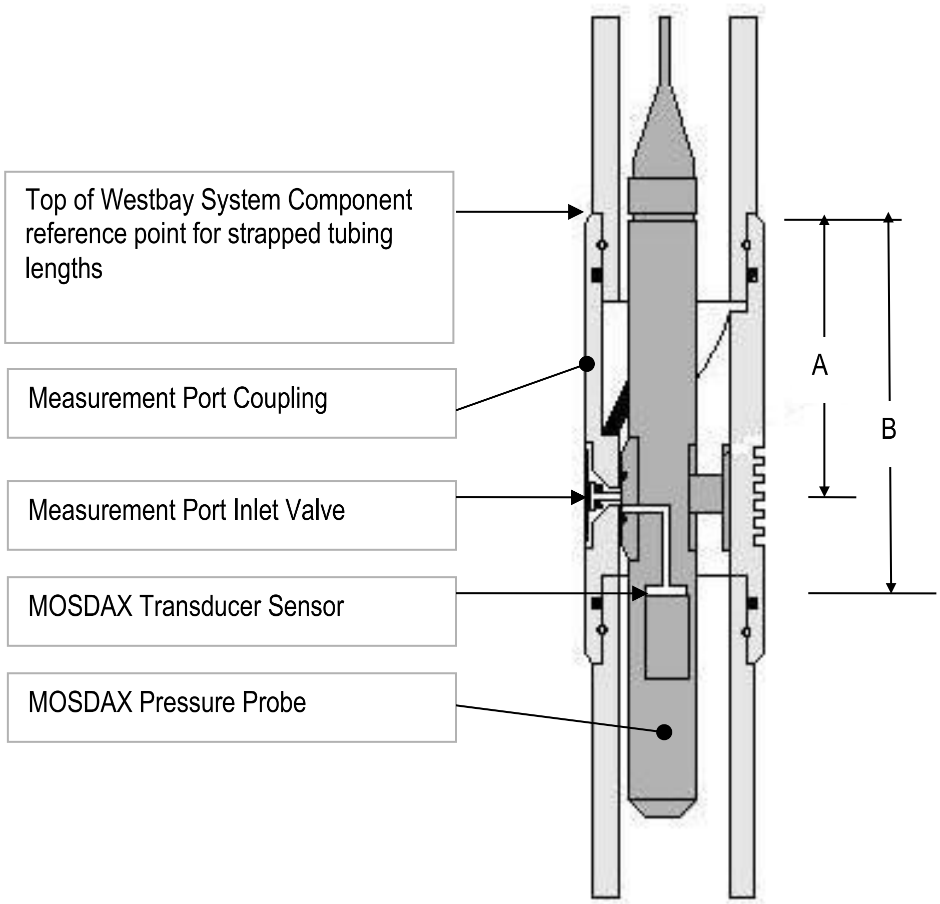
4 FLUID PRESSURE MEASUREMENTS

After packer inflation was completed, fluid pressures were measured at each measurement port. At that time, the in-situ formation pressures may not have recovered from the pre-installation activities and potential groundwater pressure increases in monitoring zones that may result from packer inflation. This latter effect may be more likely to occur in monitoring zones located in low-permeability geological formations. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the piezometric levels in all zones in the well is shown on Figure 4 in the Appendix. The data were examined to confirm proper operation of the measurement ports and as a check on the presence of annulus seals between monitoring zones. The calculation sheet for the pressure profile is also enclosed in the Appendix.

MOSDAX Transducer Position

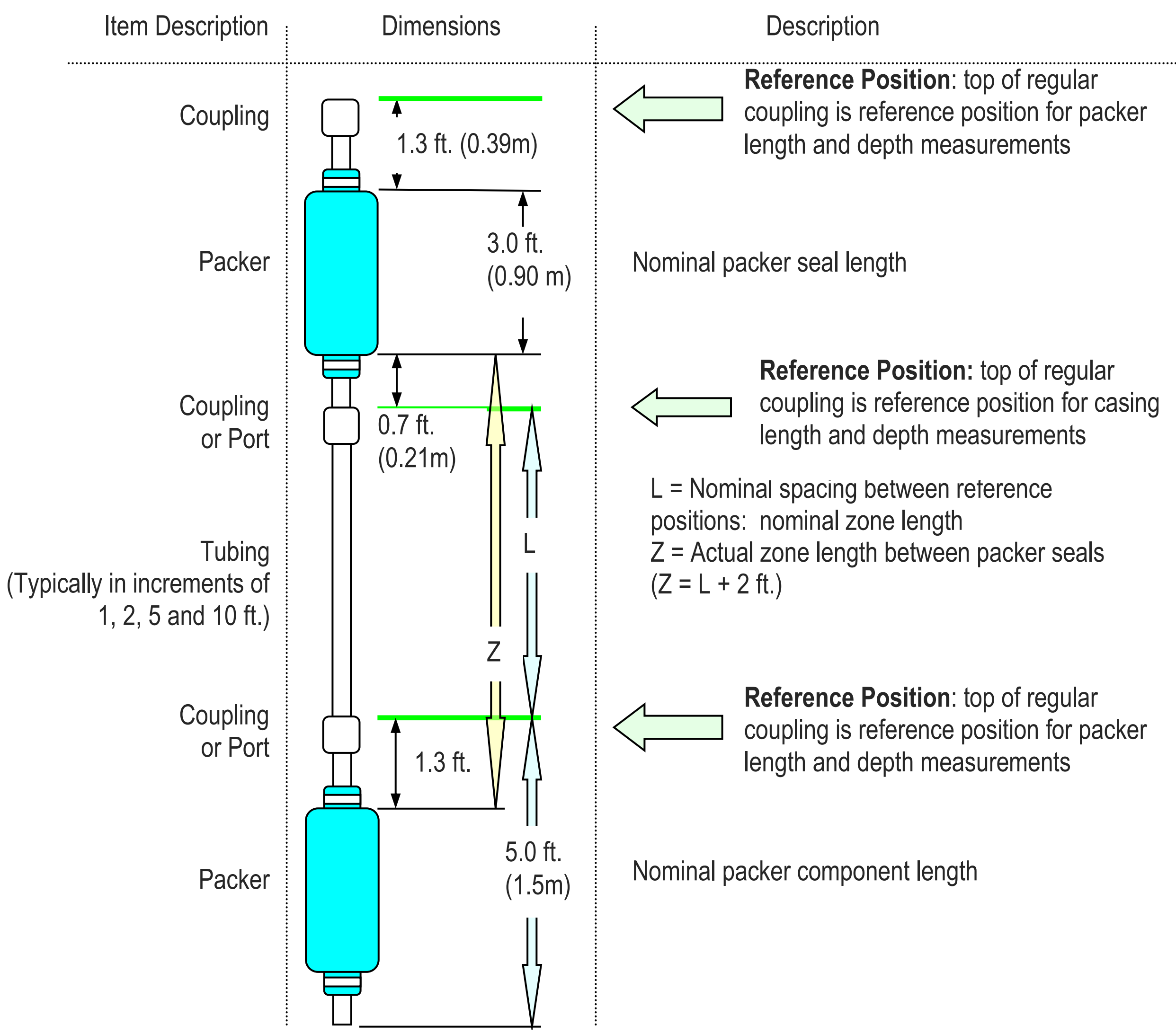
In an Westbay System Measurement Port Coupling



System	Measurement Port	A	B
Plastic MP38	0205	4.5" (114.3 mm)	6.5" (165.1 mm)

Figure 1: MOSDAX Transducer Position

Dimensions of Packer Seals and Monitoring Zones. 0238 Packers



Discussion Points:

- The top of a coupling (Regular Coupling, Measurement Port or Pumping Port) is the reference point for describing nominal depths and nominal lengths. Actual positions of packer seals and zone lengths are determined with respect to the appropriate reference positions.
- Packer Position Example: A packer with a nominal depth of 50 ft. (15.2m), will have a nominal packer seal position of 51.3 to 54.3 ft. (15.59 to 16.49m)
- Zone Length Example: A zone whose upper packer is at 50 ft. (15.2m) and bottom packer is at 70 ft. (21.3m) will have a nominal zone length of 15 ft. (4.6m) and an actual zone length (between packer seals) of 15.0+1.3+0.7 = 17.0ft. (4.6 + 0.39 + 0.2 = 5.19m)
- Information on the position of Measurement Port Valve and MOSDAX Transducer sensor, used for detailed calculation of piezometric level measurements, are described separately.

APPENDIX: MONITORING WELL: MW-16-01WB

As-Built Key Components Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 2 pages
Summary Completion Log	- 3 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (Oct 1)	- 1 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Oct 3)	- 1 page
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 5 pages
Westbay System Packer Inflation Records	- 9 pages

TABLE 4
MW-16-01WB As-Built Packer and Port Summary

Port No.	Zone No.	Measurement Port Depth (m)	Pumping Port Depth (m)	Magnetic Collar Depth (m)	Depth to top of Packer (m)	Top of Zone (m)	Bottom of Zone (m)
1	QA1	114.9			113.4	114.7	120.1
2	Zone 1	110.3		110.9	108.8	110.1	113.8
3	QA2	90.5			89.0	90.3	109.2
4	Zone 2	85.9		86.5	84.4	85.7	89.4
5	QA3	74.6			73.1	74.4	84.8
6	Zone 3	71.6		72.2	70.1	71.4	73.5
7	Zone 4	67.0		67.6	65.5	66.8	70.5
8	QA4	64.0			62.5	63.8	65.9
	Riser		62.5	61.3	30.5	31.8	62.9

Note 1: All depth measurements in meters below ground surface.
Note 2: All depth measurements use 'Nominal' casing lengths.
Note 3: Not corrected for borehole angle, deviation or borehole temperature effects.
Note 4: All Westbay Port depth measurements to upper edge of coupling item.
Note 5: Depths for top and bottom of zone based on packer seal position.

Item No.	Component Part Number	Component Description	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
49	W0203								-1.91
48	W020105			W0202					-1.86
47	W020101			W0202					-0.33
46	W020105			W0202					-0.03
45	W020110			W0202			W0216	2.1	1.50
44	W020105			W0202					4.54
43	W020110			W0202					6.07
42	W020110			W0202					9.11
41	W020110			W0202					12.16
40	W020110			W0202					15.21
39	W020110			W0202					18.26
38	W020110			W0202					21.31
37	W020110			W0202					24.35
36	W020110			W0202					27.40
35	W0238	Packer	19330	W0202					30.45
34	W020110			W0202					31.97
33	W020110			W0202					35.02
32	W020110			W0202					38.07
31	W020110			W0202					41.12
30	W020110			W0202					44.17
29	W020110			W0202					47.21
28	W020110			W0202					50.26
27	W020110			W0202					53.31
26	W020110			W0202					56.36
25	W020110			W0202			W0216	60.0	59.40
24	W0238	Packer	19325	W0224	Pumping Port	8821			62.45
23	W020105			W0205	Measurement Port	8908			63.98
22	W0238	Packer	19388	W0202					65.50
21	W020110			W0205	Measurement Port	8906	W0216	67.6	67.02
20	W0238	Packer	19387	W0202					70.07
19	W020105			W0205	Measurement Port	8907	W0216	72.2	71.60
18	W0238	Packer	19404	W0202					73.12
17	W020110			W0205	Measurement Port	8914			74.64
16	W020110			W0202					77.69
15	W020102			W0202					80.74
14	W020110			W0202					81.35
13	W0238	Packer	19403	W0202					84.40
12	W020110			W0205	Measurement Port	8912	W0216	86.5	85.92
11	W0238	Packer	19402	W0202					88.97
10	W020110			W0205	Measurement Port	8915			90.49
9	W020110			W0202					93.54
8	W020110			W0202					96.59
7	W020110			W0202					99.64
6	W020110			W0202					102.68

Item No.	Component Part Number	Component Description	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
5	W020110			W0202					105.73
4	W0238	Packer	19401	W0202					108.78
3	W020110			W0205	Measurement Port	8916	W0216	110.9	110.30
2	W0238	Packer	19334	W0202	Packer				113.35
1	W020110			W0205	Measurement Port	8911			114.88
0	W0203								117.92

Depths are with respect to ground surface.

* Component positions are referenced to the top of the subject Westbay System coupling.

* Packer positions are referenced to the top Westbay System coupling on the packer.

Monitoring zone dimensions are determined as described on the attached "Dimensions of Packer Seals and Monitoring Zones".

The position of a MOSDAX Transducer in a Measurement Port is illustrated in the attached "MOSDAX Transducer Position".

This information may be used in calculating piezometric levels.

Summary Completion Log

Company: LORAX
Well: MW-16-01WB
Site: Coffee Creek
Project: Kaminak

Job No: WB950
Author: ML

Well Information

Reference Datum: Ground Surface
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 117.97 m.

Borehole Depth: 120.09 m.
Borehole Inclination: Vertical
Borehole Diameter: 114.00 mm

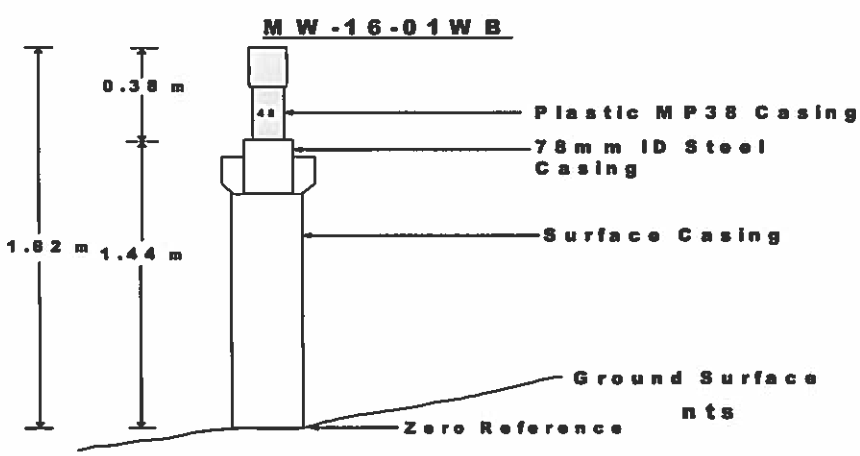
Well Description:
Permafrost
Other References:

File Information

File Name: MW-16-~1.WWD
Report Date: Tue Oct 11 10:38:09 2016

File Date: Oct 01 17:57:08 2016

Sketch of Wellhead Completion



Legend

(Qty) MP Components

(Library - WD Library 01/23/14)

(2) W0203 - MP38 End Cap

(5) W020105 - MP38 Tubing 2 (5F/1.5M)

(1) W020101 - MP38 Tubing 4 (1F/0.3M)

(32) W020110 - MP38 Tubing 1 (10F/3M)

(9) W0238 - MP38 Packer - 74mm (5F/1.5M)

(1) W020102 - MP38Tubing 3 (2F/0.6M)

(39) W0202 - MP38 Regular Coupling

(1) W0224 - MP38 Pumping Port

(8) W0205 - MP38 Measurement Port

(6) W0216 - Magnetic Location Collar

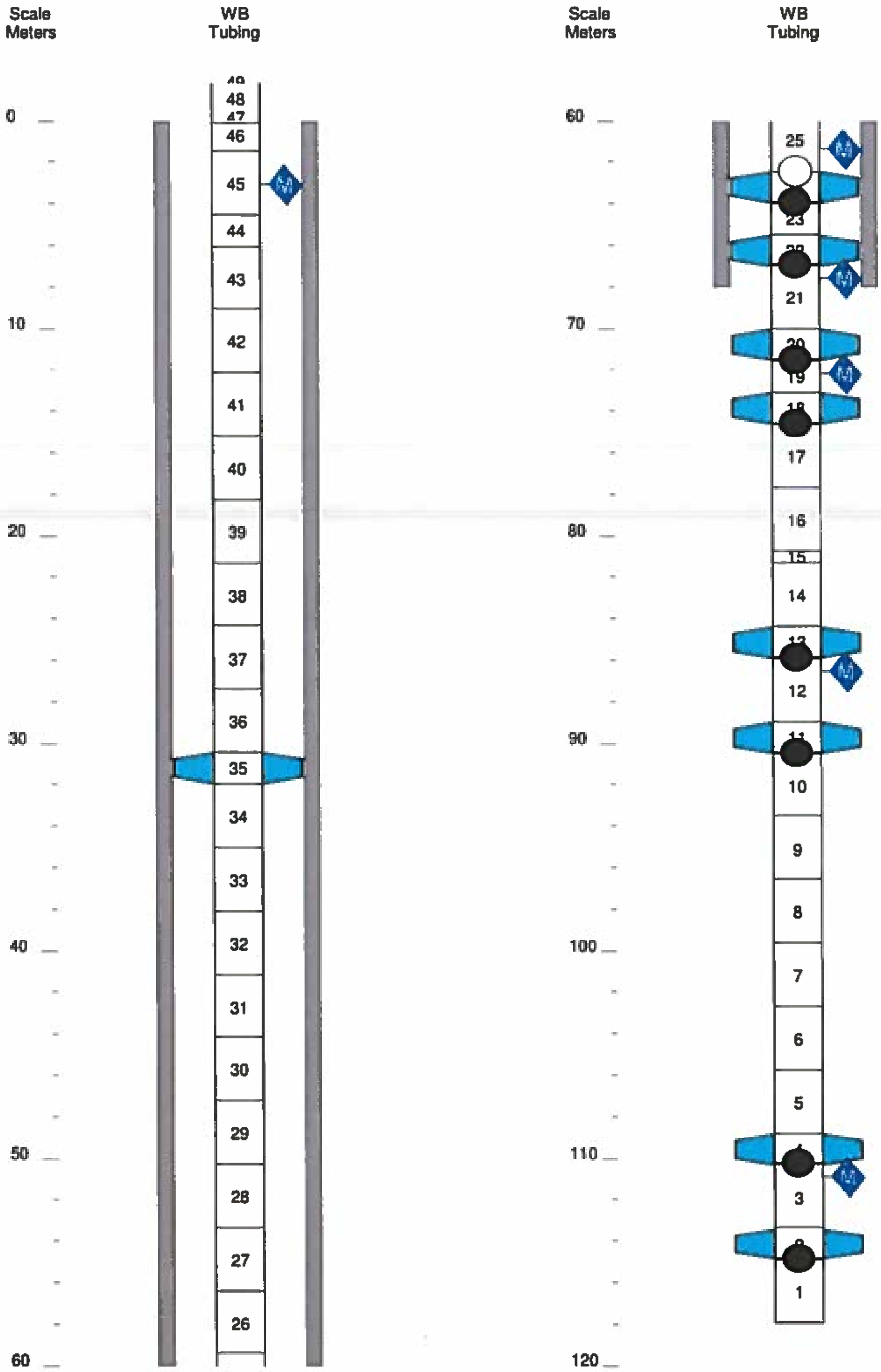
Geology

Backfill/Casing

Mild Steel

Summary Completion Log
LORAX

Job No: WB950
Well: MW-16-01WB



PRE-INFLATION

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Westbay Instruments

Well No.: MW16-01WB
Datum: GS
Elev. G.S.: Ø
Height of Westbay above G.S.: 1.85 m
Elev. top of Westbay Casing: Ø
Reference Elevation: Ø
Borehole angle: 90°

Probe Type: Sounder
Serial No.: EMS 2221
Probe Range: 250 psi
Westbay Casing Type: MP38
Sampler Valve Position: CLOSED

Date: 10/1/16
Client: [illegible]
Job No.: WB 950
Location: [illegible]
Weather: Sunny ~ 2°C
Operator: _

Signature RED

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 12.64 psi

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 12.64
Temp -
Time 17:56

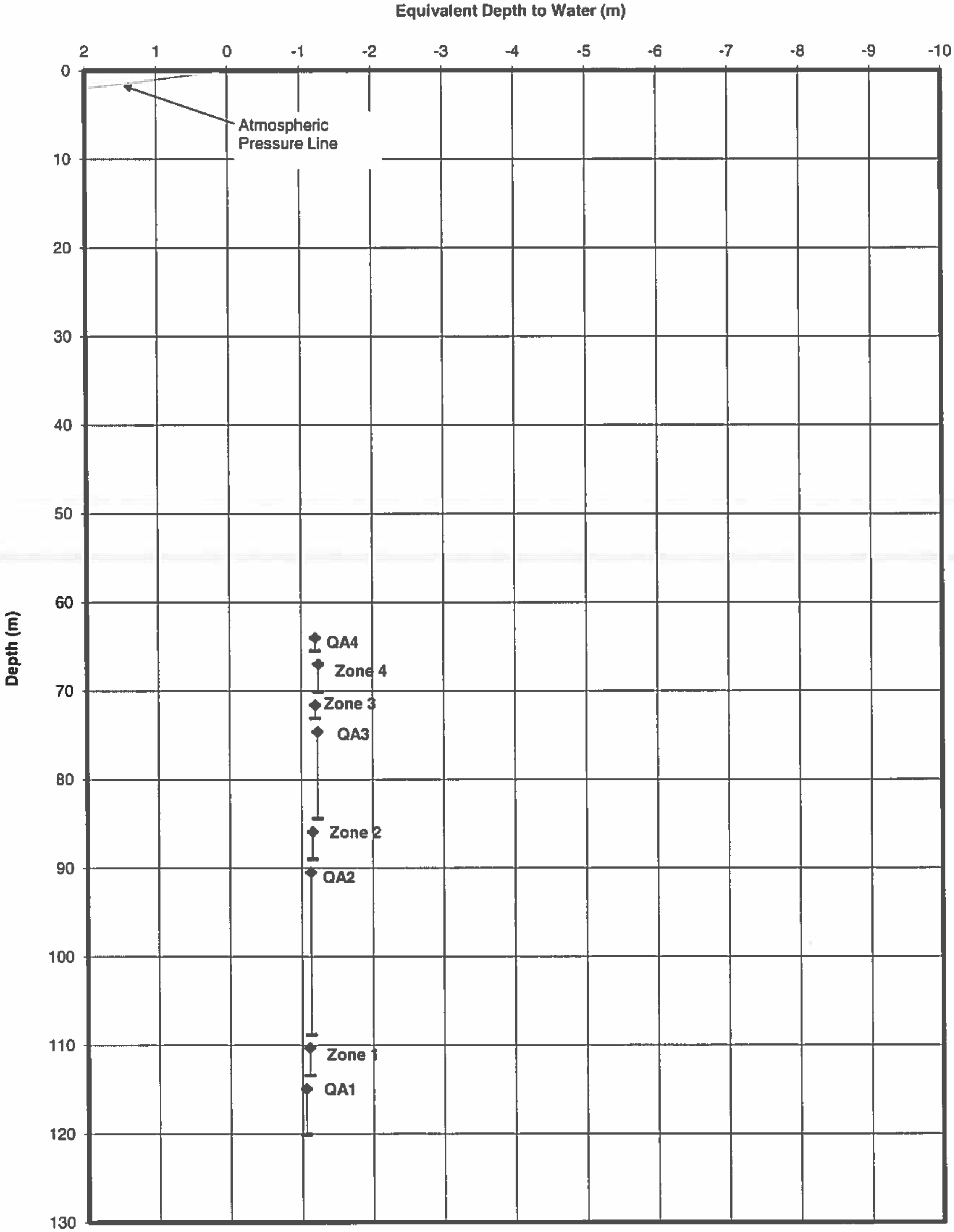
Finish: (struck through)

Port No.	Port Position From Log m	Port Position From Cable (ft)	True Port Depth "Dp" (ft)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (ft) H = (P2-Patm)/w	Piez. Level Outside Port (ft) Dz = Dp - H	ZONE	Comments
1	114.9	114.3	—	129.65	177.53	18:09:12	4.14	129.65	116.0	-1.1	QA1	
2	110.3	109.6	—	122.97	171.06	18:19:08	1.01	122.96	111.4	-1.1	ZONE 1	
3	90.5	90.0	—	93.99	142.94	18:22:00	0.61	94.01	91.63	-1.1	QA2	
4	85.9	85.4	—	87.32	136.45	18:24:19	0.43	87.32	87.0	-1.1	ZONE 2	
5	74.6	74.2	—	70.83	120.47	18:27:28	0.29	70.84	75.83	-1.2	QA3	
6	71.6	71.2	—	66.37	116.16	18:30:51	0.14	66.37	72.80	-1.2	ZONE 3	
7	67.0	66.6	—	59.69	109.68	18:33:18	0.07	59.69	68.24	-1.2	ZONE 4	
8	64.0	63.6	—	55.23	105.35	18:35:48	0.01	55.23	65.2	-1.2	QA4	

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: MW-16-01-WB

Profile Date: Oct 1, 2016
Comments: Pre-Inflation Profile



Client: LORAX
Site: Coffee Creek
Datum: GS

Figure 3

Plot By: MT Date: Oct 11/16
Checked By: DL Date: Nov 2/16
Westbay Project: WB950

POST INFLATION

Westbay Instruments

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: MW16-01WB
Datum: GS
Elev. G.S.: Ø
Height of Westbay above G.S.: 1.82 m
Elev. top of Westbay Casing: Ø
Reference Elevation: Ground level
Borehole angle: 90°

Probe Type: WB Sampling
Serial No.: 2221
Probe Range: 250 PSI
Westbay Casing Type: MP38
Sampler Valve Position: CLOSED

Date: 10/03/16
Client: Coldwarp
Job No.: WB950
Location: Cobbeq, Week
Weather: Overcast
Operator: _

Signature RE

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

P_{atm} 12.66 psi

Ambient Reading (P_{atm}) (pressure, temperature, time)

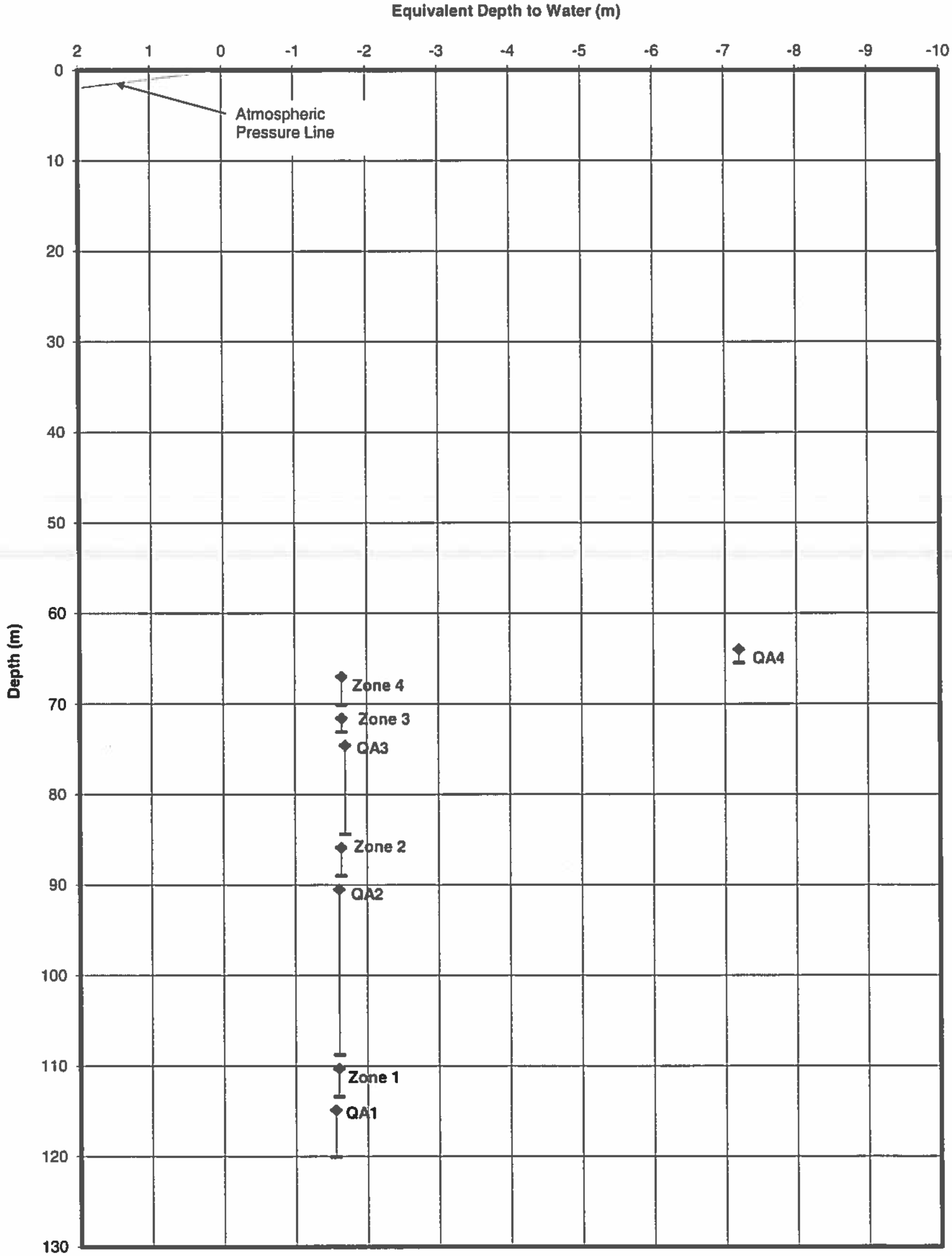
	Start	Finish
Pressure	12.66	12.67
Temp	5.51	-0.14
Time	16:10	16:51

Port No.	Port Position From Log (ft)	Port Position From Cable (ft)	True Port Depth "Dp" (ft)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (ft) H = (P2-Patm)/w	Piez. Level Outside Port (ft) Dz = Dp - H	ZONE / Comments
1	114.9	114.2	–	169.14	178.26	16:26	7.25	169.14	116.46	-1.56	QA1
2	110.3	109.7	–	162.45	171.78	16:30	1.31	162.45	111.90	-1.60	ZONE 1
3	90.5	90.0	–	133.40	143.64	16:34	0.79	133.40	92.11	-1.61	QA2
4	85.9	85.4	–	126.70	137.14	16:36	0.52	126.70	87.54	-1.64	ZONE 2
5	74.6	74.2	–	110.16	121.15	16:38	0.36	110.18	76.29	-1.69	QA3
6	71.6	71.2	–	105.71	116.82	16:41	0.16	105.71	73.25	-1.65	ZONE 3
7	67.0	66.6	–	99.01	110.28	16:43	0.05	99.01	68.65	-1.65	ZONE 4
8	64.0	63.6	–	94.56	113.90	16:46	-0.03	94.55	71.20	-7.20	QA4

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: MW-16-01WB

Profile Date: Oct 3, 2016
Comments: Post-Inflation Profile



Client: LORAX
Site: Coffee Creek
Datum: GS

Plot By: ML Date: Oct 11/16
Checked By: DC Date: Nov 2/16
Westbay Project: WB950

Figure 4

Westbay Completion Log

Company: LORAX
Well: MW-16-01WB
Site: Coffee Creek
Project: Coffee Creek

Job No: WB950
Author: ML

Well Information

Reference Datum: Ground Surface
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 117.97 m.

Borehole Depth: 120.~~30~~ 09 (AL) m.
Borehole Inclination: Vertical
Borehole Diameter: 114.00 mm

Well Description:
Permafrost
Other References:

File Information

File Name: MW-16V2.WWD
Report Date: Sat Oct 01 09:07:42 2016

File Date: Oct 01 09:04:01 2016

Comments

Zero reference is ground surface (AL)
Filter socks not to be used - (AL)

Log Information

Borehole condition confirmed.	(method) Tagline	Date: Oct 1/16
MP well design & preparation.	By Signature REDACTED	Date: Oct 1/16
MP well design checked.	By	Date: 10/1/16
MP well and borehole approved to install.	By	Date: 10/1/16

Legend

(Qty) MP Components

(Library - WD Library 01/23/14)

(2) W0203 - MP38 End Cap

(5) W020105 - MP38 Tubing 2 (5F/1.5M)

(1) W020101 - MP38 Tubing 4 (1F/0.3M)

(32) W020110 - MP38 Tubing 1 (10F/3M)

(9) W0238 - MP38 Packer - 74mm (5F/1.5M)

(1) W020102 - MP38Tubing 3 (2F/0.6M)

(39) W0202 - MP38 Regular Coupling

(1) W0224 - MP38 Pumping Port

(8) W0205 - MP38 Measurement Port

(6) W0216 - Magnetic Location Collar

Geology

Backfill/Casing

Mild Steel

Westbay Completion Log
LORAX

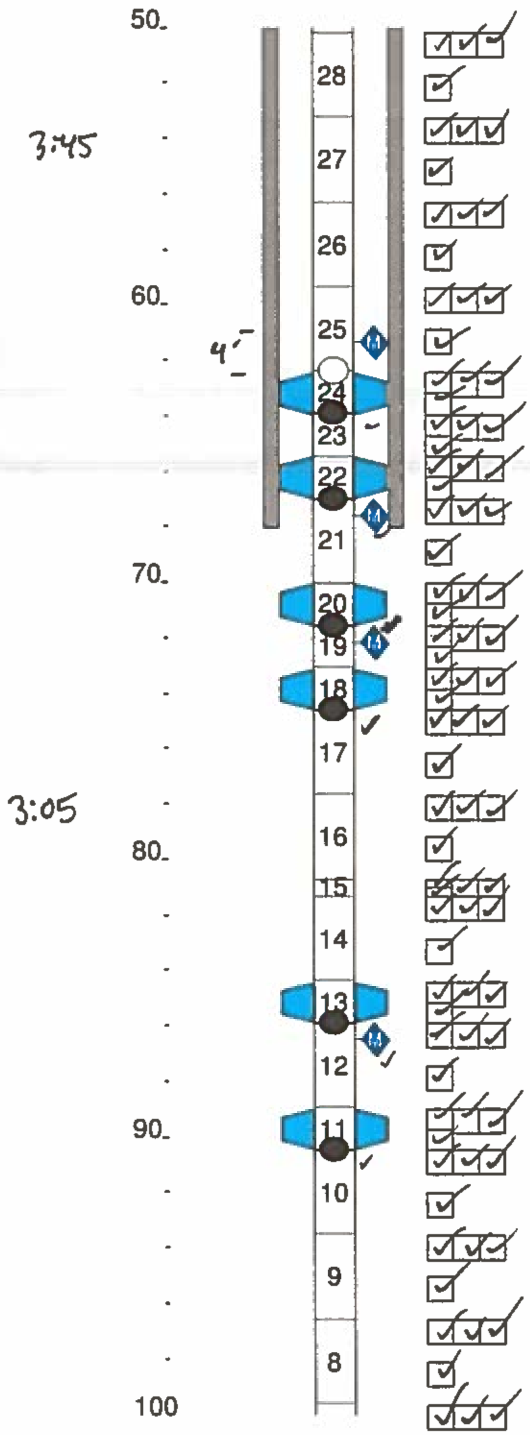
Job No: WB950
Well: MW-16-01WB

Finish lowering + westbay set
4:55 pm on Oct 1, 2016

Scale Meters	WB Tubing	WB Tubing Description	Serial Numbers
0	48		
	47		
	46	W020105 - MP38 Tubing 2 (5F/1.5M)	
	45	W020110 - MP38 Tubing 1 (10F/3M)	
	44	W020105 - MP38 Tubing 2 (5F/1.5M)	
	43	W020110 - MP38 Tubing 1 (10F/3M)	
10	42	W020110 - MP38 Tubing 1 (10F/3M)	
	41	W020110 - MP38 Tubing 1 (10F/3M)	
	40	W020110 - MP38 Tubing 1 (10F/3M)	
20	39	W020110 - MP38 Tubing 1 (10F/3M)	
	38	W020110 - MP38 Tubing 1 (10F/3M)	
	37	W020110 - MP38 Tubing 1 (10F/3M)	
4:10	36	W020110 - MP38 Tubing 1 (10F/3M)	
30	35	W0238 - MP38 Packer - 74mm (5F/1.5M) W0205 - MP38 Measurement Port	19730 - 155 ~~8970~~ Replaced with regular coupling
	34	W020110 - MP38 Tubing 1 (10F/3M)	
	33	W020110 - MP38 Tubing 1 (10F/3M)	
40	32	W020110 - MP38 Tubing 1 (10F/3M)	
	31	W020110 - MP38 Tubing 1 (10F/3M)	
	30	W020110 - MP38 Tubing 1 (10F/3M)	
50	29	W020110 - MP38 Tubing 1 (10F/3M)	

Westbay Completion Log
LORAX

Job No: WB950
Well: MW-16-01WB

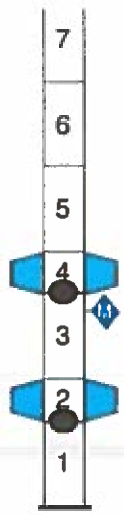


WB Tubing Description	Serial Numbers
W020110 - MP38 Tubing 1 (10F/3M)	
W020110 - MP38 Tubing 1 (10F/3M)	
W020110 - MP38 Tubing 1 (10F/3M)	
W020110 - MP38 Tubing 1 (10F/3M)	
W0224 - MP38 Pumping Port	8821
W0238 - MP38 Packer - 74mm (5F/1.5M)	19325-150
W0205 - MP38 Measurement Port	8908
W020105 - MP38 Tubing 2 (5F/1.5M)	
W0238 - MP38 Packer - 74mm (5F/1.5M)	19388-150
W0205 - MP38 Measurement Port	8906
W020110 - MP38 Tubing 1 (10F/3M)	
W0238 - MP38 Packer - 74mm (5F/1.5M)	19387-155
W0205 - MP38 Measurement Port	8907
W020105 - MP38 Tubing 2 (5F/1.5M)	
W0238 - MP38 Packer - 74mm (5F/1.5M)	19404-150
W0205 - MP38 Measurement Port	8915 8914
W020110 - MP38 Tubing 1 (10F/3M)	
W020110 - MP38 Tubing 1 (10F/3M)	
W020102 - MP38Tubing 3 (2F/0.6M)	
W020110 - MP38 Tubing 1 (10F/3M)	
W0238 - MP38 Packer - 74mm (5F/1.5M)	19403-150
W0205 - MP38 Measurement Port	8912
W020110 - MP38 Tubing 1 (10F/3M)	
W0238 - MP38 Packer - 74mm (5F/1.5M)	19402-160
W0205 - MP38 Measurement Port	
W020110 - MP38 Tubing 1 (10F/3M)	~~8909~~ 8915
W020110 - MP38 Tubing 1 (10F/3M)	
W020110 - MP38 Tubing 1 (10F/3M)	

Westbay Completion Log
LORAX

Job No: WB950
Well: MW-16-01WB

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
100	7	☑	W020110 - MP38 Tubing 1 (10F/3M)	
		☑☑☑		
	6	☑	W020110 - MP38 Tubing 1 (10F/3M)	
2:31		☑☑☑		
	5	☑	W020110 - MP38 Tubing 1 (10F/3M)	
110	4	☑☑☑	W0238 - MP38 Packer - 74mm (5F/1.5M)	19401-160
		☑☑☑	W0205 - MP38 Measurement Port	8916
	3	☑	W020110 - MP38 Tubing 1 (10F/3M)	
	2	☑☑☐	W0238 - MP38 Packer - 74mm (5F/1.5M)	19334-145
		☑☑☑	W0205 - MP38 Measurement Port	8911
	1	☑	W020110 - MP38 Tubing 1 (10F/3M)	
		☑☑☑	W0203 - MP38 End Cap	
120				
130				
140				
150				



Start lowering at 2:21 pm on Oct 1, 2016.

Joint test tool - 300 psi.
Borehole water depth - artesian.
Inflation tool - 400-410 psi.

Pre-Inflation Profile

- measurements recorded, calculations completed.
- confirm m-port position and function.

[signature]

Hydraulic Integrity Test

37.310 m at 1850 on Oct 1/16
37.310 m at 1905 on Oct 1/16
37.310 m at 1915 on Oct 1/16
37.310 m at 1930 on Oct 1/16
37.310 m at 1415 on Oct 2/16

Westbay tubing is water tight.

[signature]

Westbay Packer Inflation Record

Westbay Instruments

Project: LoRAX
Project No.: WB 950 Signature REDACTED
Well No.: MW-16-01 WB

Location: Coffee Creek
Completed b
Date Inflated: Oct 3/16

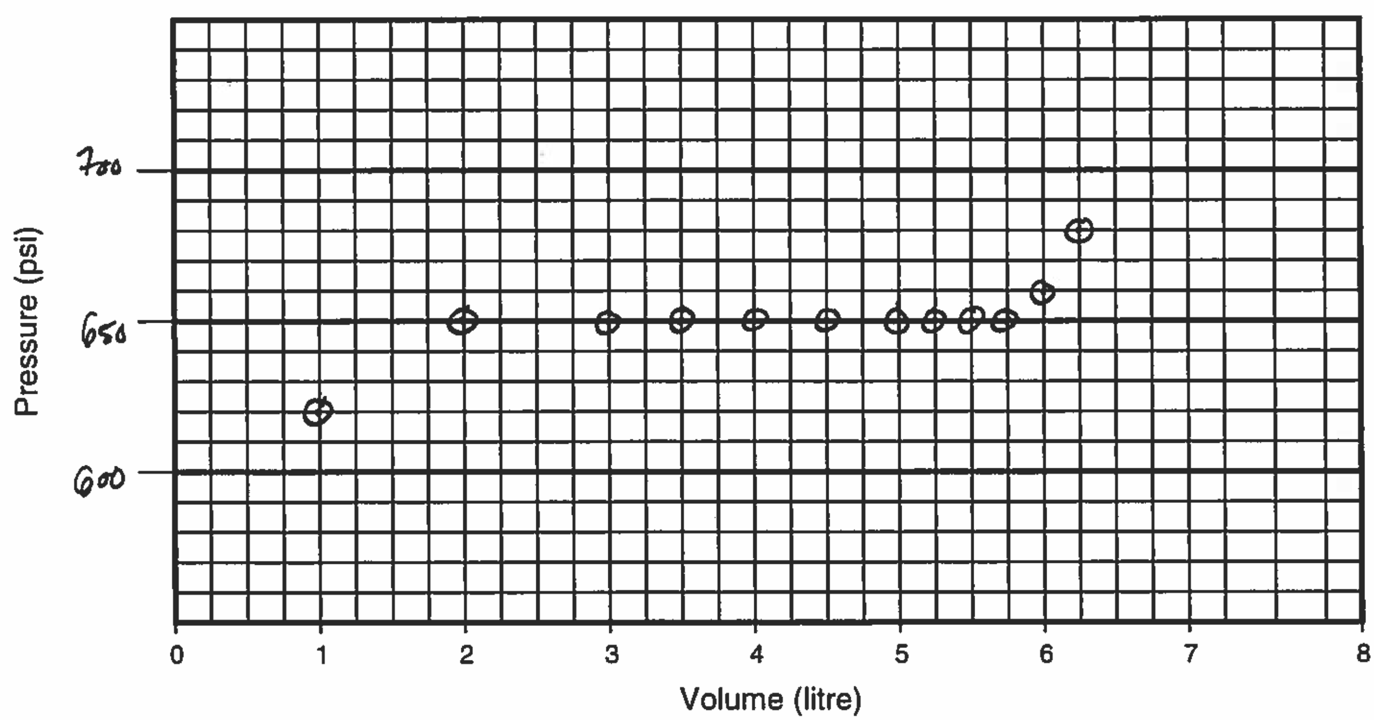
Packer No. 1, Comp 2 SN# 19334
Depth (ft/m): 113.4
Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi
Final Line Pressure, P_L: 680 psi
Tool Pressure, P_T: 410 psi

Borehole Water Level: 0 (ft/m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 125 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.5	5.0	5.25	5.5	5.75
Pressure, psi	620	650	650	650	650	650	650	650	650	650
Volume, litres	6.0	6.25	/	6.0						
Pressure, psi	660	680	/	∅						



Comments: Packer #1
Time - 10:40 am
700 PL = 145 PE

Sheet 2 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX | Project No.: WB950 | Well No.: MW-16-01 WB

Location: Coffee Creek | Completed by: Signature REDACTED' | Date Inflated: Oct 3/16

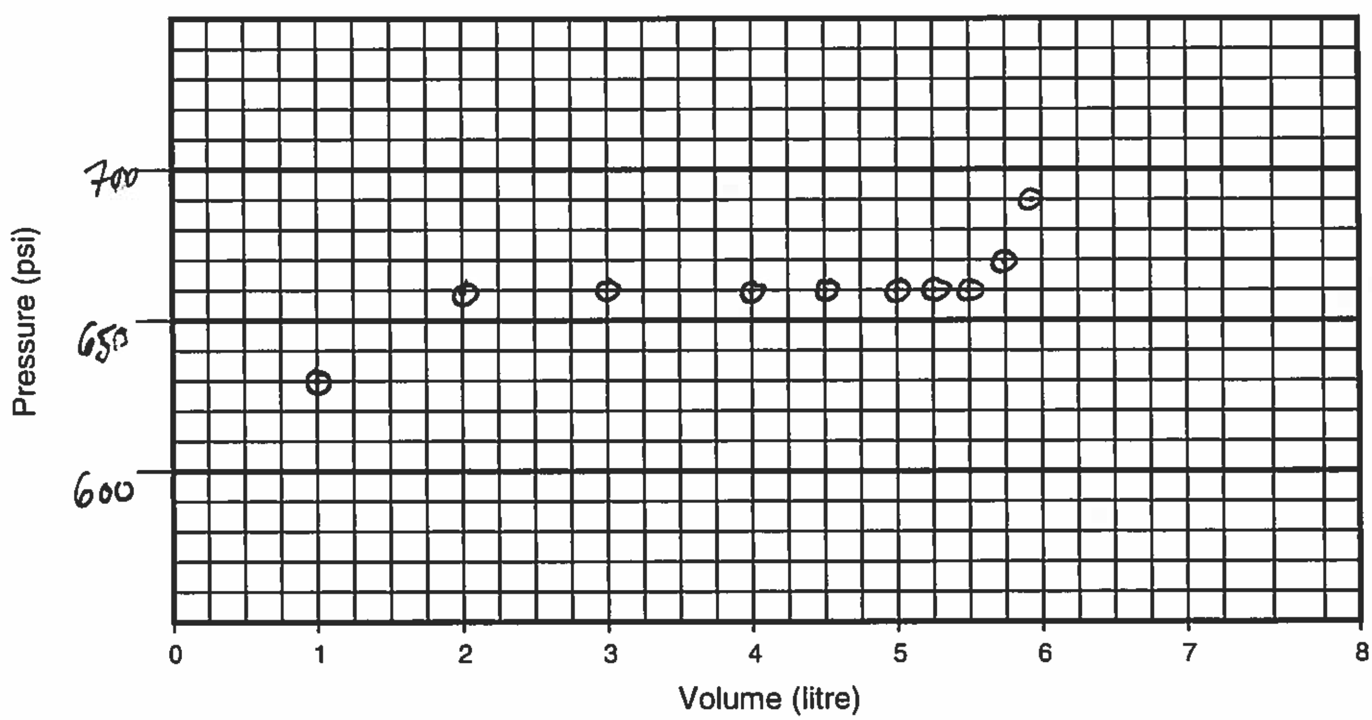
Packer No. 2, comp 4 SN# 19401 | Depth (ft / m): 108.8 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 160 psi | Final Line Pressure, P_L: 690 psi | Tool Pressure, P_T: 410 psi

Borehole Water Level: 0 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 120 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	5.0	5.25	5.5	5.75	5.9
Pressure, psi	630	660	660	660	660	660	660	660	670	690
Volume, litres	/	5.6								
Pressure, psi	/	Ø								



Comments: Packer # 2 Time - 11:00 am

Sheet 3 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LoRAX Project No.: WB950 Well No.: MW-16-01 WB

Location: Coffee Creek Completed by: Signature REDACTED Date Inflated: Oct 3/16

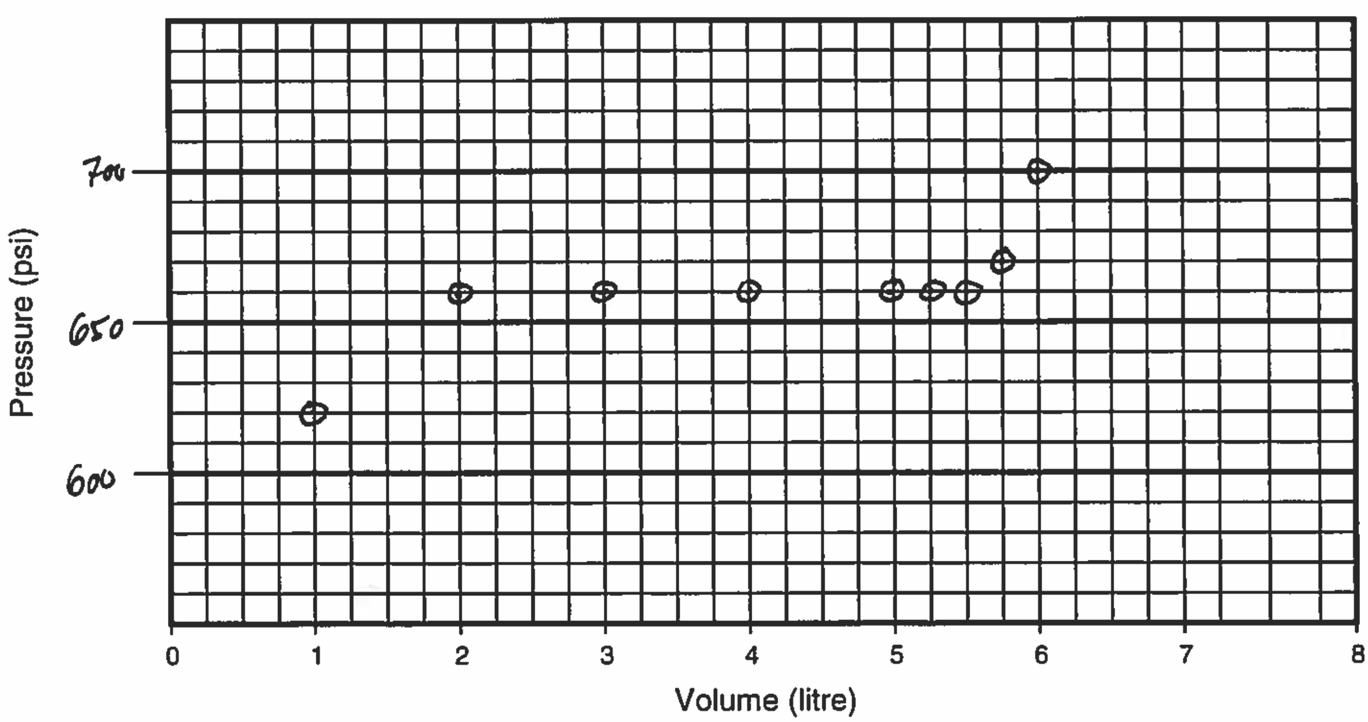
Packer No. 3, comp 11 SN# 19402 Depth (ft/m): 89.0 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 160 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 410 psi

Borehole Water Level: 0 (ft/m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 130 psi

Volume, litres	1.0	2.0	3.0	4.0	5.0	5.25	5.5	5.75	6.0	/
Pressure, psi	620	660	660	660	660	660	660	670	700	/
Volume, litres	5.75									
Pressure, psi	Ø									



Comments: Packer #3 Time - 11:26 am

Sheet 4 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LoRAX Project No.: WB950 Well No.: MW-16-01WB

Location: Coffee Creek Completed by: Signature REDACTED Date Inflated: Oct 3/16

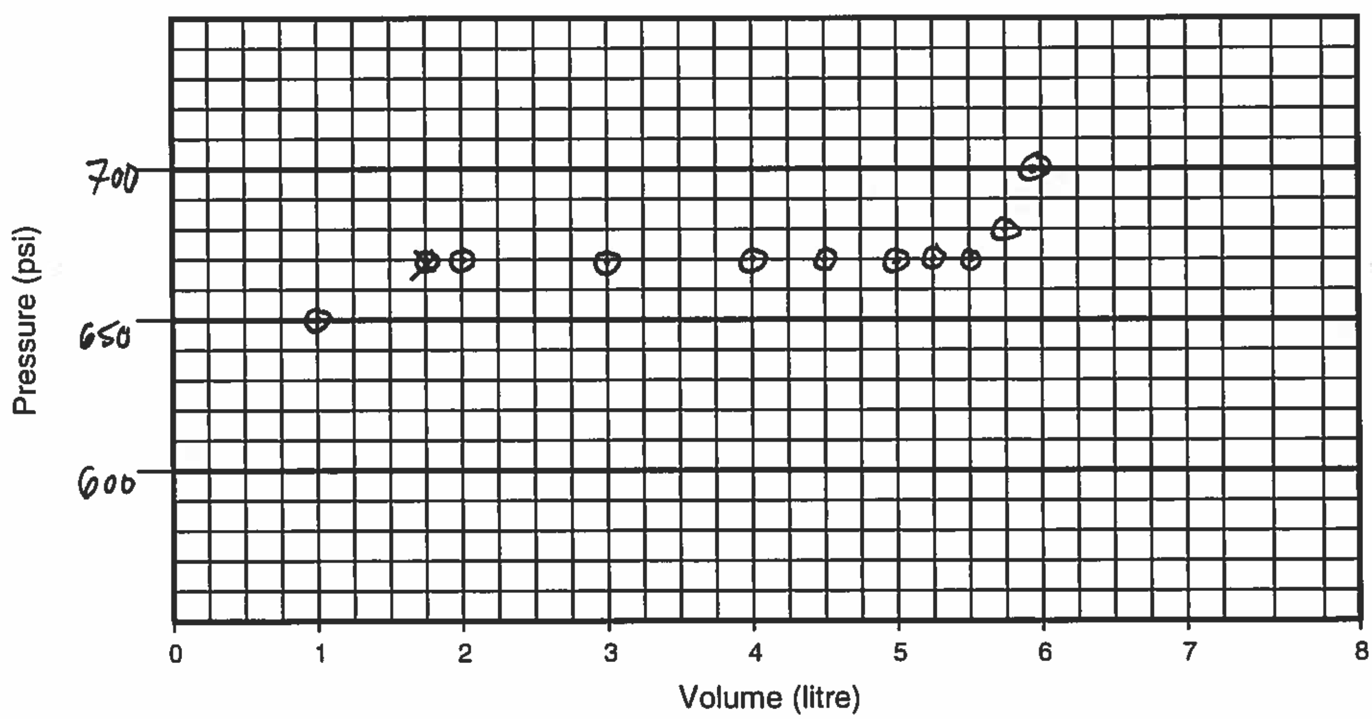
Packer No. 4, Comp 13 SN# 19403 Depth (ft/ m): 84.4 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 410 psi

Borehole Water Level: 0 (ft/ m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 140 psi

Volume, litres	1.0	2.0	3.0	4.0	4.5	5.0	5.25	5.5	5.75	5.9
Pressure, psi	650	670	670	670	670	670	670	670	680	700
Volume, litres	/	5.7								
Pressure, psi	/	Ø								



Comments: Packer #4 Time - 11:56 am

Filter getting dirty

Sheet 5 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LoRAx Project No.: WB950 Well No.: MW-16-01 WB

Location: Coffee Creek Completed by: Signature REDACTED Date Inflated: Oct 3/16

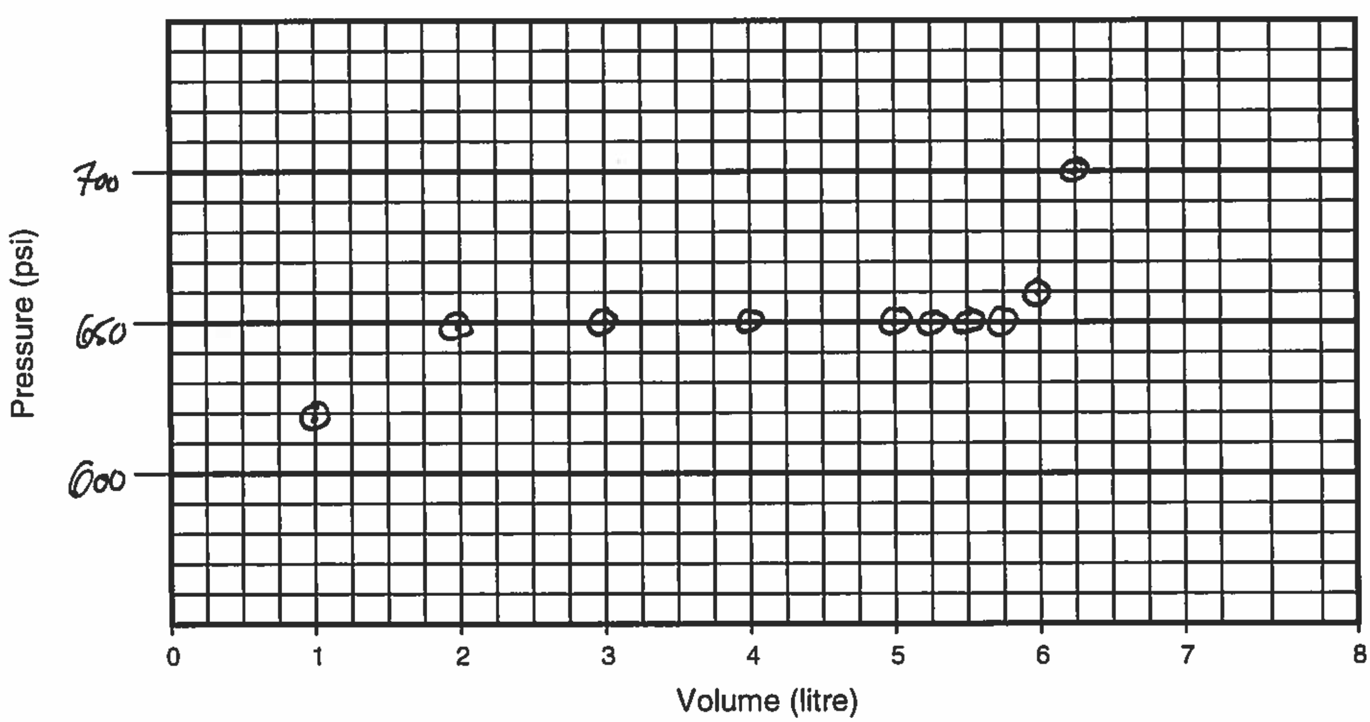
Packer No. 5, comp 18 SN# 19404 Depth (ft / m): 73.1 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 0 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ ~~140~~ 150 psi

Volume, litres	1.0	2.0	3.0	4.0	5.0	5.25	5.5	5.75	6.0	6.25
Pressure, psi	620	650	650	650	650	650	650	650	660	700
Volume, litres	/	6.0								
Pressure, psi	/	Ø								



Comments: Packer # 5 Time - 12:30pm

Sheet 6 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX

Project No.: WB 950 Signature REDACTED

Well No.: MW-16-01 WB

Location: Coffee Creek

Completed by:

Date Inflated: Oct 3/16

Packer No. 6, comp 20 SN# 19387

Depth (ft / m): 70.1

Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 155 psi

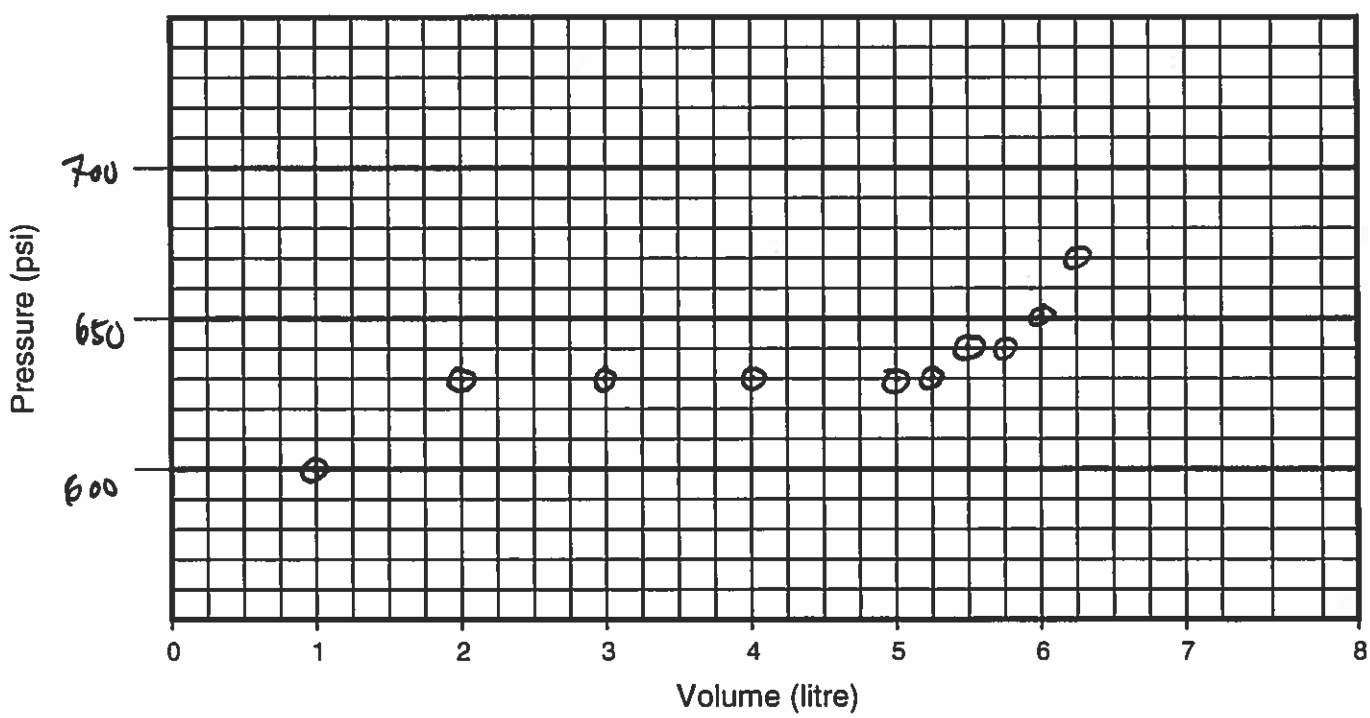
Final Line Pressure, P_L: 670 psi

Tool Pressure, P_T: 400 psi

Borehole Water Level: 0 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 115 psi

Volume, litres	1.0	2.0	3.0	4.0	5.0	5.25	5.5	5.75	6.0	6.25
Pressure, psi	600	630	630	630	630	630	640	640	650	670
Volume, litres	/	6.0								
Pressure, psi	/	0								



Comments: Packer # 6

Time - 12:51 pm

Sheet 7 of 9

Westbay Packer Inflation Record

Project: LORAX   Project No.: WB950   Well No.: MW-16-01 WB

Location: Coffee Creek   Completed by Signature REDACTED   Date Inflated: Oct 21/16

Packer No. 7, comp 22   Depth (ft / m): 65.5   Inflation Tool No.: 3197

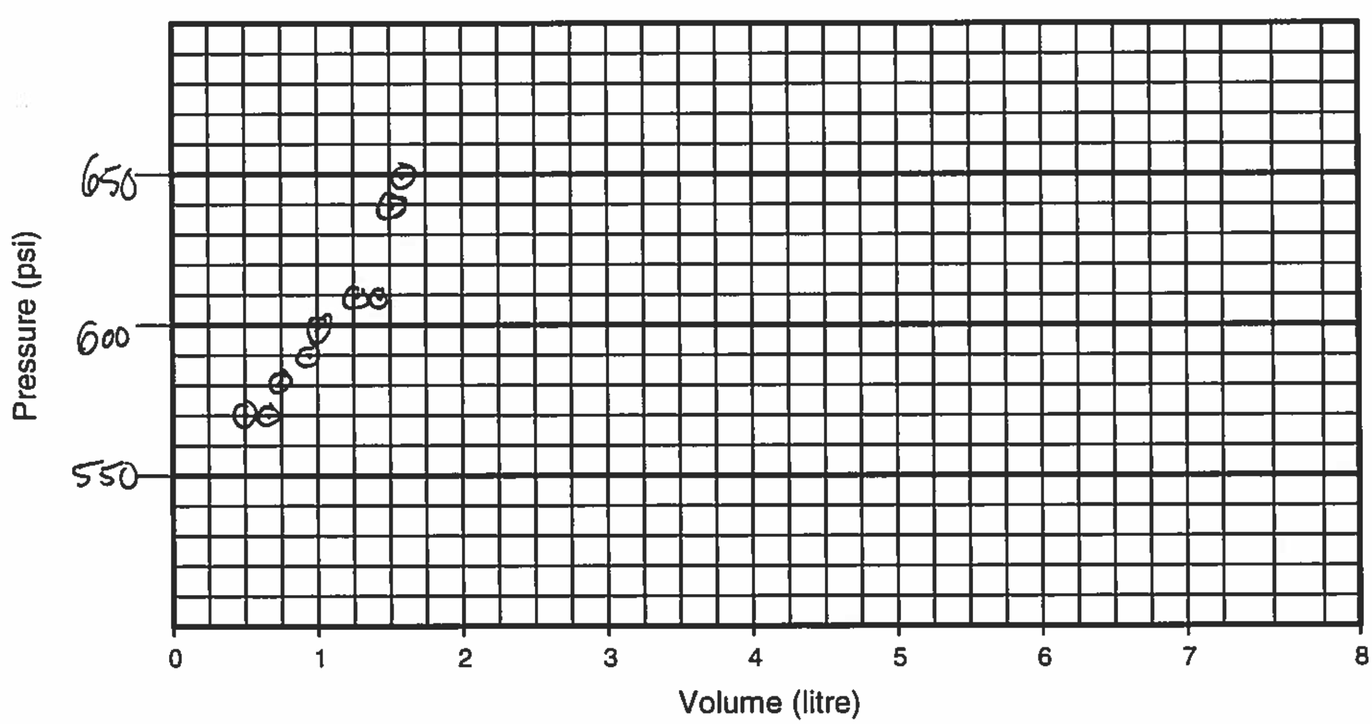
Packer Valve Pressure, P_V: 150 psi   Final Line Pressure, P_L: 650 psi   Tool Pressure, P_T: 410 psi

Borehole Water Level: 0 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 90 psi

Volume, litres	0.25	0.5	0.7	0.75	0.9	1.0	1.25	1.3	1.4	1.5
Pressure, psi	280	570	570	580	590	600	610	620	620	640

Volume, litres	1.6	/	1.3							
Pressure, psi	650	/	∅							



Comments: Packer # 7   Time - 4:34pm

Target 700 psi

Sheet 8 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LORAX Project No.: WB950 Signature REDACTED Well No.: MW-16-01WB

Location: Coffee Creek Completed by: Date Inflated: Oct 2/16

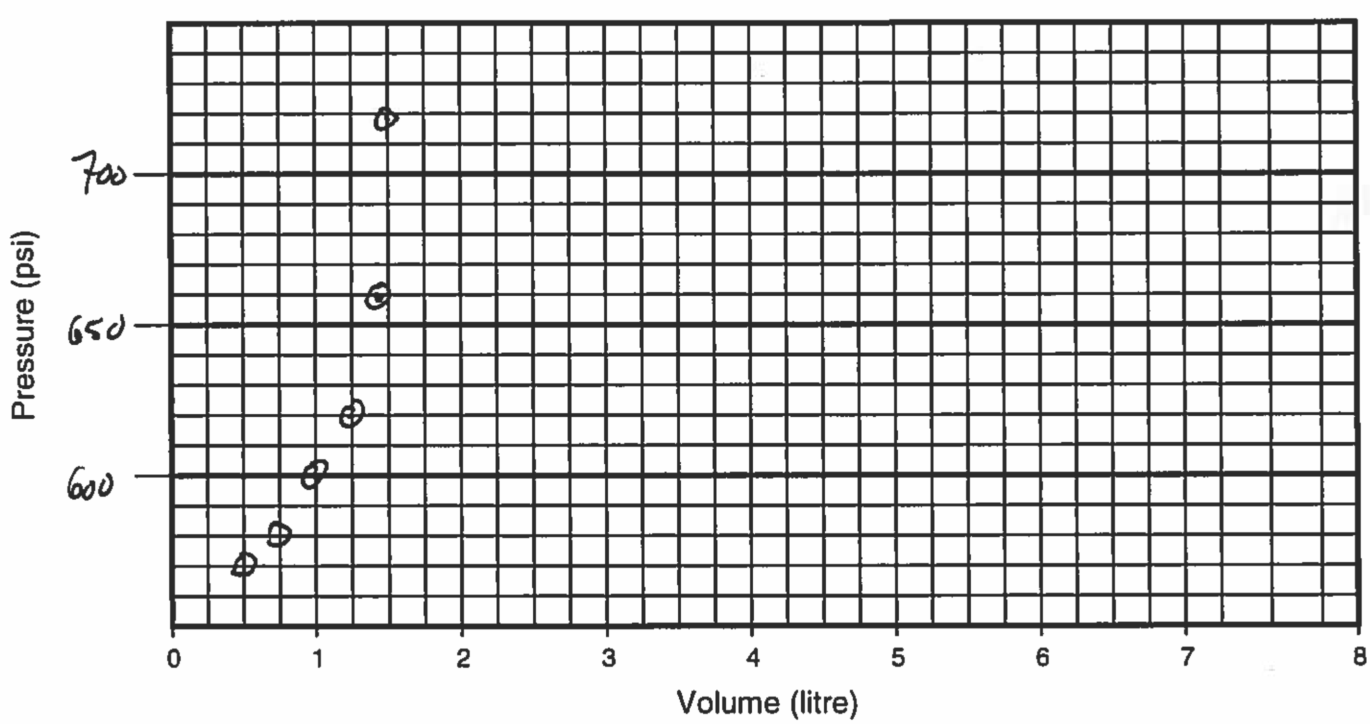
Packer No. 8, comp 24 SN# 19325 Depth (ft / m): 62.5 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 720 psi Tool Pressure, P_T: 410 psi

Borehole Water Level: 0 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 160 psi

Volume, litres	0.25	5.0	7.5	1.0	1.25	1.4	1.5	/	1.25	
Pressure, psi	340	570	580	600	620	660	720	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer #8 Time - 4:52 pm

Sheet 9 of 9

Westbay Packer Inflation Record

Westbay Instruments

Project: LoRAx Project No.: WR950 Well No.: MW-16-01WB

Location: Coffee Creek Completed by: -Signature REDACTED- Date Inflated: Oct 3/16

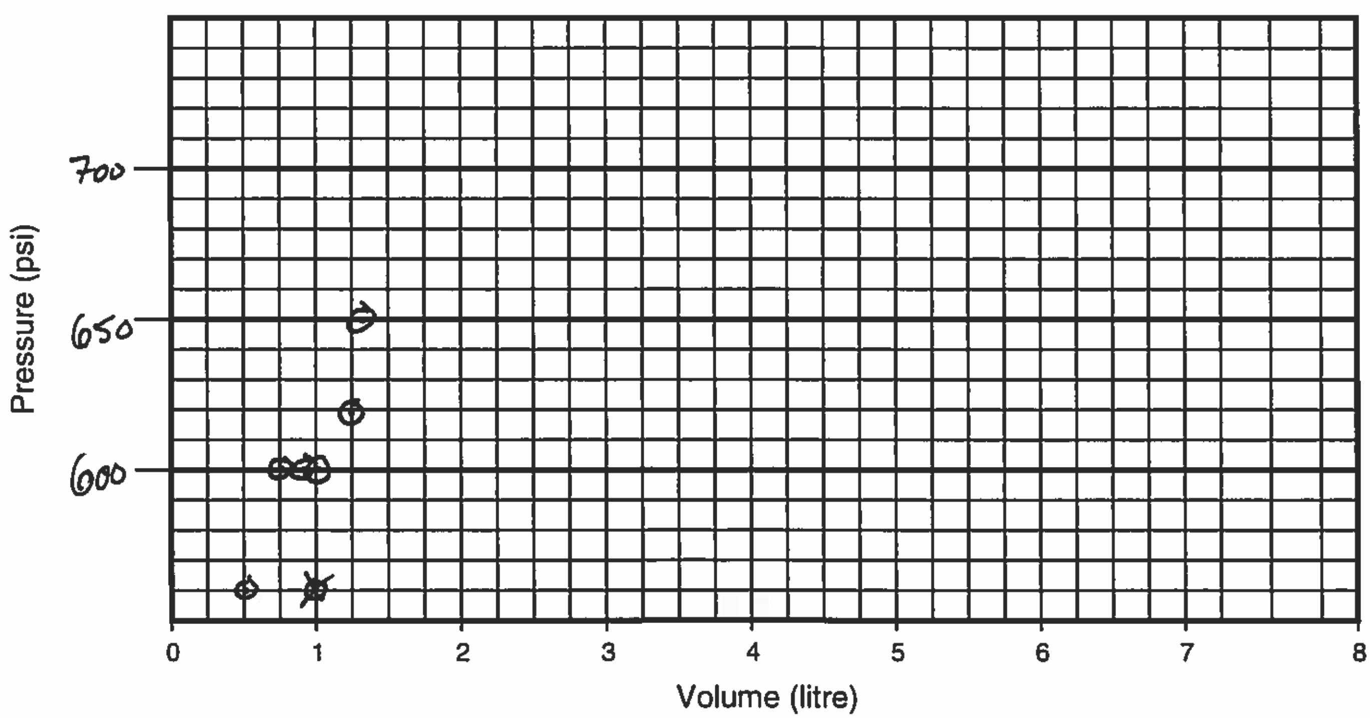
Packer No. 9, Comp 35 SN#19330 Depth (ft / m): 30.5 Inflation Tool No.: 2197

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 0 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T =$ 95 psi

Volume, litres	0.5	0.75	0.9	1.0	1.25	1.35	/	1.1		
Pressure, psi	560	600	600	600	620	650	/	Ø		
Volume, litres										
Pressure, psi										



Comments: Packer #9 In HQ casing. Time - 1:03 pm

Appendix C
Hydraulic Testing Results MW16-01T

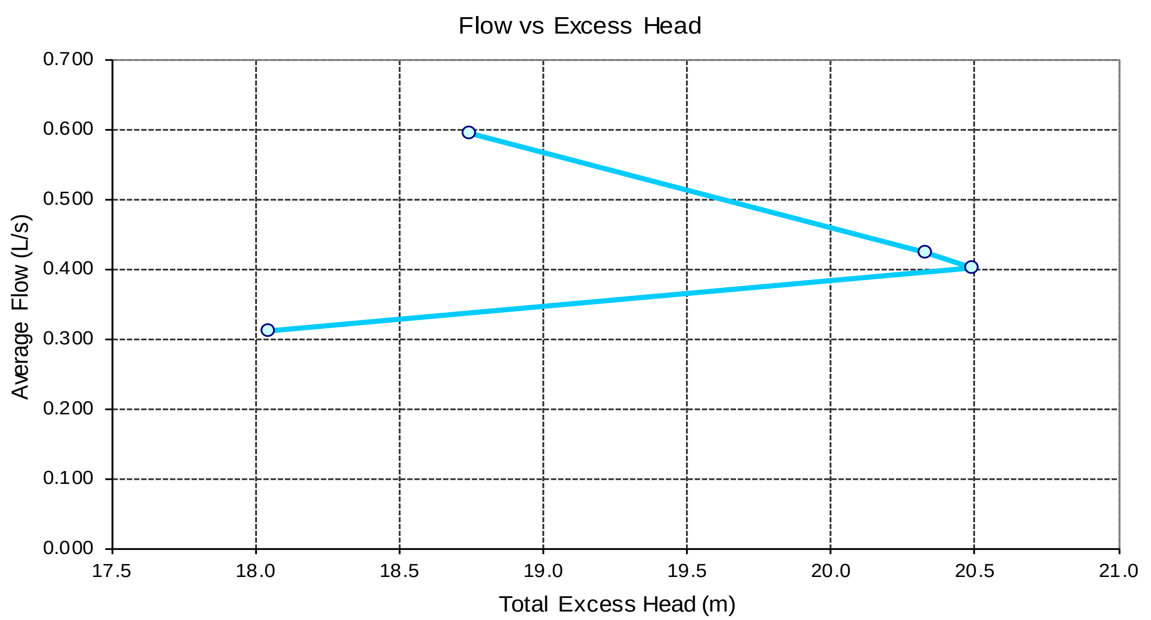
Packer Test Analysis MW16-01T

PACKER TESTING - CONSTANT HEAD TEST (Hvorslev, 1951)

Date of Test:	21-Aug-16	Apparent Current Depth of Drill Hole (m):			189.00
Drill Hole No:	**MW16-01T**	Test Section from (m):	147.83	to:	189.00
Test No:	#1	Length of Test Section (m):			41.17
Packer Type:	Single	Static Groundwater Level (vertical m below datum):			0.47
Inflation Pressure (kPa):	4143.8	Height of Gauge (m above datum):			1.40
Casing Details:	8 m	Drill Hole Dip (deg from horizontal):			90
Diameter of Drill Hole (mm):	114.3	Vertical Depth of Drill Hole (m):			189.00
ID of Drilling Rods (mm):	n/a	Vertical Depth of Test Section (m):			168.41

If groundwater level is unknown during the test use depth of test center section

Stage	Injection Duration	Injection Pressure	Cummulative Consumption	Friction Head Loss Drop pipe	Friction Head Loss Hose	Total Excess Head	Injection Rate	Note
no.	min	kPa	m3	m	m	m	L/s	
zero		0	7.920	0	0	0	0.00	
#1	5	200	8.098	3.55	0.00	18.74	0.593	
#2	5	200	8.225	1.97	0.00	20.33	0.423	
#3	7	200	8.394	1.80	0.00	20.49	0.402	
#2	3	170	8.450	1.15	0.00	18.05	0.311	
#1								



Bulk K (m/s)	Stage no. #1	#2	#3	#2 back	#1 back	Average K	Lugeon
	8.1E-07	5.3E-07	5.0E-07	4.4E-07		**5.7E-07**	3.32

LORAX ENVIRONMENTAL
2289 Burrard St., Vancouver, B.C.

PROJ. NO.:	A362-4		
PROJECT:	Coffee Creek Gold		
DETAILS:	MW16-01 Packer Testing 148-189m		
ENG.	VS	Checked:	
DATE	30-Aug-16	Figure:	1

Pumping Test MW16-01T

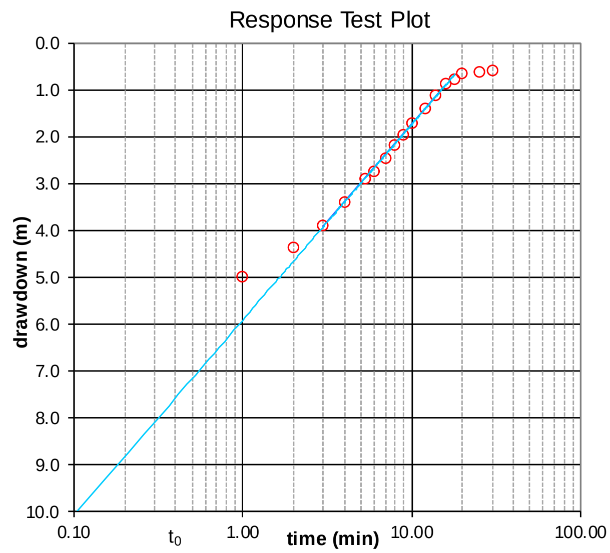
RECOVERY TEST EVALUATION

Well:	**MW16-01T**	Date:	**August 24, 2016**
Location:	**Coffee Ck, HLF**	Discharge Q:	**0.323** (l/s)
Type of Test:	Recovery after 16.5min of drawdown from pumpin		
Radial Distance r (m):	**0.063**	Static level:	**0** (m)
Well Diameter (mm):	**125**	Max. level:	**6.79** (m)

clock time	elapsed time t (min)	point	water level h (m)	d_down s (m)	normalized drawdown
8:05	0	0	0	0	0.00
8:06	1.00	1	5.00	5.00	0.74
8:07	2.00	2	4.39	4.39	0.65
8:08	3.00	3	3.92	3.92	0.58
8:09	4.00	4	3.42	3.42	0.50
8:10	5.30	5	2.92	2.92	0.43
8:11	6.00	6	2.74	2.74	0.40
8:12	7.00	7	2.48	2.48	0.37
8:13	8.00	8	2.19	2.19	0.32
8:14	9.00	9	1.99	1.99	0.29
8:15	10.00	10	1.73	1.73	0.25
8:17	12.00	11	1.41	1.41	0.21
8:19	14.00	12	1.13	1.13	0.17
8:21	16.00	13	0.89	0.89	0.13
8:23	18.00	14	0.78	0.78	0.11
8:25	20.00	15	0.67	0.67	0.10
8:27	25.00	16	0.62	0.62	0.09
8:32	30.00	17	0.59	0.59	0.09

Cooper - Jacob Graphical Method

		T = 0.1832.Q/s	
Interpretation section :		$S = 2.246.T.t_o/r^2$	
point 1:	3	**s (m) =**	4.20
point 2:	13	**t_o (min) =**	26.28
T (m^2/s) =	**1.41E-05**	**S' =**	**1.26E+01**



LORAX ENVIRONMENTAL
2289 Burrard St., Vancouver, B.C.

Project no:	A362-4		
Project:	Coffee Ck Gold		
Details:	Recovery test in MW16-01T		
Eng.: VS		Checked:	**AS**
Date:		Fig. no.:	**1**

Appendices

GOLDCORP

Appendix 3-C: RST VWP Calibration Sheets

GOLDCORP

Appendix 3-C1: RST VWP Calibration Sheets

KAMINAK
GOLD CORPORATION

rst INSTRUMENTS | innovation in geotechnical instrumentation

Calibration Record

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Vibrating Wire Piezometer

CFD0318-P1

Customer:		EBA Eng. Consultants-Yukon
Model:		VW2100-5.0-HD
Serial Number:		**VW25899**
Mfg Number:		1313002
Range:		5.0 MPa
Temperature:		24.8 °C
Barometric Pressure:		988.9 millibars
Work Order Number:		201464
Cable Length:		230 meters
Cable Markings:		181880 m - 182108 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8765	8765	8765	0.010	0.20	-0.02
1.0	7990	7990	7990	1.000	-0.01	0.04
2.0	7213	7214	7214	1.991	-0.17	0.00
3.0	6431	6432	6432	2.990	-0.19	-0.02
4.0	5644	5643	5644	3.997	-0.06	-0.02
5.0	4848	4850	4849	5.012	0.23	0.01
				Max. Error (%):	0.23	0.04

Linear Calibration Factor:	**C.F.=**	**0.0012773 MPa/B unit**
Regression Zero:	**At Calibration =**	**8772.7 B unit**
Temperature Correction Factor:	**Tk =**	**0.0009906 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** -5.3394E-09 **B:** -0.0012046 **C:** 10.967

Pressure is calculated with the following equations:

Linear: $P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]$

Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	17-Jul-13	8772	22.4	1020.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician Signature REDACTED Date: 17-Jul-13

Applied Science Technologists and Technicians of British Columbia • 22724 • A.C • AL CULLEY • AScT

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

Document Number: ELL0143H

innovation in geotechnical instrumentation

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

CFD0324-P2

Vibrating Wire Piezometer

Customer:		EBA Eng. Consultants-Yukon
Model:		VW2100-5.0-HD
Serial Number:		**VW25900**
Mfg Number:		1313003
Range:		5.0 MPa
Temperature:		24.8 °C
Barometric Pressure:		988.9 millibars
Work Order Number:		201464
Cable Length:		230 meters
Cable Markings:		182109 m - 182338 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8696	8697	8697	0.010	0.21	-0.02
1.0	7936	7935	7936	1.000	0.01	0.06
2.0	7175	7176	7176	1.989	-0.21	-0.03
3.0	6407	6406	6407	2.990	-0.20	-0.02
4.0	5632	5631	5632	3.998	-0.04	0.01
5.0	4852	4853	4853	5.012	0.23	0.00
				Max. Error (%):	0.23	0.06

Linear Calibration Factor:	**C.F.=**	**0.0013010 MPa/B unit**
Regression Zero:	**At Calibration =**	**8704.5 B unit**
Temperature Correction Factor:	**Tk =**	**0.0009280 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** -5.8977E-09 **B:** -0.0012211 **C:** 11.064

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	17-Jul-13	8694	22.5	1020.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Signature REDACTED

Technician: B

Date: 17-Jul-13

Applied Science Technologists and Technicians of British Columbia
22724
AL CULLEY
ASCT

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

Document Number: ELL0143H

Recycled
MIG0106B

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Calibration Record

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

CFD0332-P3

Vibrating Wire Piezometer

Customer:		EBA Eng. Consultants-Yukon
Model:		VW2100-5.0-HD
Serial Number:		**VW25901**
Mfg Number:		1316118
Range:		5.0 MPa
Temperature:		23.3 °C
Barometric Pressure:		996.2 millibars
Work Order Number:		201464
Cable Length:		230 meters
Cable Markings:		181650 m - 181878 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8981	8982	8982	0.014	0.27	-0.02
1.0	8204	8203	8204	0.999	-0.02	0.03
2.0	7422	7422	7422	1.988	-0.23	0.00
3.0	6634	6633	6634	2.987	-0.26	-0.02
4.0	5837	5836	5837	3.996	-0.07	-0.01
5.0	5032	5032	5032	5.015	0.30	0.01
				Max. Error (%):	0.30	0.03

Linear Calibration Factor:	**C.F.=**	**0.0012664 MPa/B unit**
Regression Zero:	**At Calibration =**	**8992.2 B unit**
Temperature Correction Factor:	**Tk =**	**0.0009979 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** -7.0535E-09 **B:** -0.0011675 **C:** 11.054

Pressure is calculated with the following equations:

Linear: $P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]$

Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	17-Jul-13	8991	22.3	1020.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

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Technician: Date: 17-Jul-13

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Calibration Record

CFD0351-P4

Vibrating Wire Piezometer

Customer:		EBA Eng. Consultants-Yukon
Model:		VW2100-5.0-HD
Serial Number:		**VW25902**
Mfg Number:		1316119
Range:		5.0 MPa
Temperature:		23.3 °C
Barometric Pressure:		996.2 millibars
Work Order Number:		201464
Cable Length:		230 meters
Cable Markings:		181420 m - 181649 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8899	8900	8900	0.011	0.23	-0.03
1.0	8113	8113	8113	1.000	0.00	0.05
2.0	7325	7325	7325	1.991	-0.19	0.02
3.0	6532	6531	6532	2.988	-0.24	-0.03
4.0	5731	5729	5730	3.995	-0.09	-0.03
5.0	4919	4920	4920	5.014	0.29	0.03
				Max. Error (%):	0.29	0.05

Linear Calibration Factor:	**C.F.=**	**0.0012570 MPa/B unit**
Regression Zero:	**At Calibration =**	**8908.5 B unit**
Temperature Correction Factor:	**Tk =**	**0.001014 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-6.1713E-09** **B:** **-0.0011717** **C:** **10.915**

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	17-Jul-13	8922	22.3	1020.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

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Technician Date: 17-Jul-13

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MW14-07T (124m)

Vibrating Wire Piezometer

Customer:		Lorax Environmental
Model:		VW2100-2.0
Serial Number:		VW30262
Mfg Number:		1425034
Range:		2.0 MPa
Temperature:		22.6 °C
Barometric Pressure:		985.7 millibars
Work Order Number:		205069
Cable Length:		130 meters
Cable Markings:		584320 m - 584449 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	9004	9004	9004	0.004	0.21	-0.01
0.4	8294	8294	8294	0.399	-0.03	0.01
0.8	7580	7581	7581	0.796	-0.18	0.00
1.2	6862	6862	6862	1.196	-0.18	0.00
1.6	6138	6139	6139	1.599	-0.05	0.00
2.0	5410	5410	5410	2.004	0.22	0.00
				Max. Error (%):	0.22	0.01

Linear Calibration Factor:	C.F.=	**0.00055654 MPa/B unit**
Regression Zero:	At Calibration =	**9011.6 B unit**
Temperature Correction Factor:	Tk =	**0.0005086 MPa/°C rise**

Polynomial Gage Factors (MPa) A: -2.5492E-09 B: -0.00051979 C: 4.8867

Pressure is calculated with the following equations:

Linear: $P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]$

Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	19-Sep-14	9004	21.6	1017.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: Signature REDACTED Date: 19-Sep-14

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MW15-01T (76m)

Vibrating Wire Piezometer

Customer:		Lorax Environmental
Model:		VW2100-2.0
Serial Number:		VW30262
Mfg Number:		1425034
Range:		2.0 MPa
Temperature:		22.6 °C
Barometric Pressure:		985.7 millibars
Work Order Number:		205069
Cable Length:		130 meters
Cable Markings:		584320 m - 584449 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	9004	9004	9004	0.004	0.21	-0.01
0.4	8294	8294	8294	0.399	-0.03	0.01
0.8	7580	7581	7581	0.796	-0.18	0.00
1.2	6862	6862	6862	1.196	-0.18	0.00
1.6	6138	6139	6139	1.599	-0.05	0.00
2.0	5410	5410	5410	2.004	0.22	0.00
				Max. Error (%):	0.22	0.01

Linear Calibration Factor: C.F.= **0.00055654 MPa/B unit**
Regression Zero: At Calibration = **9011.6 B unit**
Temperature Correction Factor: Tk = **0.0005086 MPa/°C rise**

Polynomial Gage Factors (MPa) A: -2.5492E-09 B: -0.00051979 C: 4.8867

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	19-Sep-14	9004	21.6	1017.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: Signature REDACTED Date: 19-Sep-14

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Vibrating Wire Piezometer

MW15-01T (89.1m)

Customer: Kaminak Gold Corporation
Model: VW2100-2.0
Serial Number: **VW30463**
Mfg Number: 1425036
Range: 2.0 MPa
Temperature: 22.6 °C
Barometric Pressure: 985.7 millibars
Work Order Number: 205089
Cable Length: 155 meters
Cable Markings: 592942 m - 593099 m
Cable Colour Code: Red / Black (Coil) Green / White (Thermistor)
Cable Type: EL380004
Thermistor Type: 3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8908	8909	8909	0.004	0.18	-0.01
0.4	8196	8196	8196	0.400	-0.01	0.03
0.8	7482	7482	7482	0.797	-0.17	-0.01
1.2	6762	6763	6763	1.197	-0.17	-0.01
1.6	6038	6039	6039	1.599	-0.04	0.00
2.0	5310	5311	5311	2.004	0.20	0.00
				Max. Error (%):	0.20	0.03

Linear Calibration Factor: **C.F.= 0.00055594 MPa/B unit**
Regression Zero: **At Calibration = 8915.0 B unit**
Temperature Correction Factor: **Tk = 0.0004177 MPa/°C rise**

Polynomial Gage Factors (MPa) **A: -2.2532E-09** **B: -0.00052390** **C: 4.8458**

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	26-Sep-14	8910	21.0	1015.5

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

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Technician: Date: 26-Sep-14

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MW15-02T (33.9m)

Vibrating Wire Piezometer

Customer:		Kaminak Gold Corporation
Model:		VW2100-1.0
Serial Number:		**VW30460**
Mfg Number:		1427122
Range:		1.0 MPa
Temperature:		22.6 °C
Barometric Pressure:		993.2 millibars
Work Order Number:		205089
Cable Length:		80 meters
Cable Markings:		586052 m - 586131 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8982	8982	8982	0.002	0.17	0.00
0.2	8228	8228	8228	0.200	-0.04	0.00
0.4	7470	7470	7470	0.399	-0.13	0.00
0.6	6708	6708	6708	0.599	-0.13	0.01
0.8	5943	5943	5943	0.800	-0.04	-0.01
1.0	5173	5173	5173	1.002	0.17	0.00
				Max. Error (%):	0.17	0.01

Linear Calibration Factor:	**C.F.=**	**0.00026254 MPa/B unit**
Regression Zero:	**At Calibration =**	**8988.4 B unit**
Temperature Correction Factor:	**Tk =**	**0.00002498 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-8.7254E-10** **B:** **-0.00025019** **C:** **2.3176**

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	26-Sep-14	8978	20.9	1015.5

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

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Technician: Date: 26-Sep-14

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MW15-03T (48.8m)

Vibrating Wire Piezometer

Customer:		Kaminak Gold Corporation
Model:		VW2100-1.0
Serial Number:		**VW30461**
Mfg Number:		1427123
Range:		1.0 MPa
Temperature:		22.6 °C
Barometric Pressure:		993.2 millibars
Work Order Number:		205089
Cable Length:		105 meters
Cable Markings:		585741 m - 585845 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8788	8788	8788	0.001	0.14	0.01
0.2	8081	8081	8081	0.199	-0.05	-0.02
0.4	7368	7368	7368	0.399	-0.07	0.03
0.6	6656	6656	6656	0.599	-0.12	-0.01
0.8	5939	5939	5939	0.800	-0.03	-0.01
1.0	5219	5219	5219	1.001	0.14	0.00
				Max. Error (%):	0.14	0.03

Linear Calibration Factor:	**C.F.=**	**0.00028019 MPa/B unit**
Regression Zero:	**At Calibration =**	**8793.0 B unit**
Temperature Correction Factor:	**Tk =**	**0.0001214 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** -7.9534E-10 **B:** -0.00026905 **C:** 2.4259

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	26-Sep-14	8786	21.1	1015.5

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

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Technician: [redacted] Date: 26-Sep-14

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MW15-03T (94.7m)

Vibrating Wire Piezometer

Customer: Kaminak Gold Corporation
Model: VW2100-1.0
Serial Number: **VW32594**
Mfg Number: 1504836
Range: 1.0 MPa
Temperature: 22.4 °C
Barometric Pressure: 1000.4 millibars
Work Order Number: 206796
Cable Length: 105 meters
Cable Markings: 814838 m - 814942 m
Cable Colour Code: Coil: Red 1, Blk 2 Thermistor: Grn 3, Wht 4
Cable Type: EL380004
Thermistor Type: 3 kΩ

Male M12 Connector
Wiring Diagram

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8901	8901	8901	0.002	0.19	0.00
0.2	8176	8176	8176	0.200	-0.04	0.00
0.4	7447	7447	7447	0.398	-0.16	-0.01
0.6	6713	6713	6713	0.599	-0.14	0.01
0.8	5976	5976	5976	0.800	-0.05	0.00
1.0	5234	5234	5234	1.002	0.19	0.00
				Max. Error (%):	0.19	0.01

Linear Calibration Factor: **C.F.= 0.00027270 MPa/B unit**
Regression Zero: **At Calibration = 8908.0 B unit**
Temperature Correction Factor: **Tk = 0.0001547 MPa/°C rise**

Polynomial Gage Factors (MPa) **A: -1.0592E-09** **B: -0.00025772** **C: 2.3779**

Pressure is calculated with the following equations:
Linear: $P(MPa) = C.F.(Li\text{-}Lc) - [Tk(Ti\text{-}Tc)] + [0.00010(Bi\text{-}Bc)]$
Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc\text{-}Ti) - [0.00010(Bc\text{-}Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Apr-15	8902	21.4	1025.9

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: S. Kim SK Date: 30-Apr-15

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MW15-04T (38.8m)

Vibrating Wire Piezometer

Customer:		Kaminak Gold Corporation
Model:		VW2100-1.0
Serial Number:		**VW32593**
Mfg Number:		1504835
Range:		1.0 MPa
Temperature:		22.4 °C
Barometric Pressure:		1000.4 millibars
Work Order Number:		206796
Cable Length:		105 meters
Cable Markings:		814733 m - 814837 m
Cable Colour Code:	Coil: Red 1, Blk 2	Thermistor: Grn 3, Wht 4
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Male M12 Connector
Wiring Diagram

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8883	8883	8883	0.002	0.18	0.01
0.2	8175	8176	8176	0.199	-0.05	-0.02
0.4	7463	7463	7463	0.399	-0.15	-0.01
0.6	6746	6747	6747	0.599	-0.13	0.01
0.8	6026	6027	6027	0.800	-0.01	0.02
1.0	5305	5304	5305	1.002	0.16	-0.01
				Max. Error (%):	0.18	0.02

Linear Calibration Factor:	**C.F.=**	**0.00027937 MPa/B unit**
Regression Zero:	**At Calibration =**	**8889.5 B unit**
Temperature Correction Factor:	**Tk =**	**0.0001763 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-9.9777E-10** **B:** **-0.00026521** **C:** **2.4348**

Pressure is calculated with the following equations:

Linear: $P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]$

Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Apr-15	8881	21.5	1025.9

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = $Hz^2 / 1000$ ie: 1700Hz = 2890 B units

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Technici: Date: 30-Apr-15

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Calibration Record

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

MW15-04T (51.6m)

Vibrating Wire Piezometer

Customer: Kaminak Gold Corporation
Model: VW2100-2.0
Serial Number: **VW32596**
Mfg Number: 1504858
Range: 2.0 MPa
Temperature: 22.5 °C
Barometric Pressure: 1003.1 millibars
Work Order Number: 206796
Cable Length: 105 meters
Cable Markings: 814522 m - 814626 m
Cable Colour Code: Coil: Red 1, Blk 2 Thermistor: Grn 3, Wht 4
Cable Type: EL380004
Thermistor Type: 3 kΩ

Male M12 Connector
Wiring Diagram

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	9047	9048	9048	0.005	0.23	-0.01
0.4	8311	8311	8311	0.399	-0.04	0.01
0.8	7570	7570	7570	0.796	-0.18	0.00
1.2	6824	6824	6824	1.196	-0.19	0.00
1.6	6072	6073	6073	1.599	-0.06	-0.01
2.0	5315	5315	5315	2.005	0.24	0.01
				Max. Error (%):	0.24	0.01

Linear Calibration Factor: **C.F.= 0.00053589 MPa/B unit**
Regression Zero: **At Calibration = 9056.0 B unit**
Temperature Correction Factor: **Tk = 0.0004083 MPa/°C rise**

Polynomial Gage Factors (MPa) **A: -2.5250E-09** **B: -0.00049963** **C: 4.7269**

Pressure is calculated with the following equations:
Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]
Polynomial: P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Apr-15	9048	21.4	1025.9

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: S. Kim *SK* Date: 30-Apr-15

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MW15-05T (55.4m)

Vibrating Wire Piezometer

Customer:		Kaminak Gold Corporation
Model:		VW2100-2.0
Serial Number:		**VW30464**
Mfg Number:		1425037
Range:		2.0 MPa
Temperature:		22.6 °C
Barometric Pressure:		985.7 millibars
Work Order Number:		205089
Cable Length:		205 meters
Cable Markings:		585846 m - 586051 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8911	8911	8911	0.004	0.22	-0.01
0.4	8173	8173	8173	0.399	-0.03	0.01
0.8	7431	7432	7432	0.796	-0.18	0.00
1.2	6685	6685	6685	1.196	-0.20	-0.01
1.6	5932	5932	5932	1.599	-0.04	0.01
2.0	5175	5175	5175	2.004	0.22	0.00
				Max. Error (%):	0.22	0.01

Linear Calibration Factor: **C.F.=** **0.00053537 MPa/B unit**
Regression Zero: **At Calibration =** **8919.1 B unit**
Temperature Correction Factor: **Tk =** **0.0003744 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-2.4148E-09** **B:** **-0.00050135** **C:** **4.6592**

Pressure is calculated with the following equations:
Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]
Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	26-Sep-14	8911	20.7	1015.5

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

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Technici Date: 26-Sep-14

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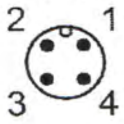
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

MW15-05T (81.4m)

Vibrating Wire Piezometer

Customer: Kaminak Gold Corporation
Model: VW2100-2.0
Serial Number: VW32595
Mfg Number: 1504857
Range: 2.0 MPa
Temperature: 22.5 °C
Barometric Pressure: 1003.1 millibars
Work Order Number: 206796
Cable Length: 105 meters
Cable Markings: 814627 m - 814732 m
Cable Colour Code: Coil: Red 1, Blk 2 Thermistor: Grn 3, Wht 4
Cable Type: EL380004
Thermistor Type: 3 kΩ

Male M12 Connector
Wiring Diagram



Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	9003	9003	9003	0.005	0.23	0.00
0.4	8295	8295	8295	0.399	-0.04	0.01
0.8	7583	7583	7583	0.796	-0.20	-0.01
1.2	6865	6865	6865	1.196	-0.19	0.00
1.6	6142	6142	6142	1.599	-0.05	0.00
2.0	5414	5414	5414	2.005	0.24	0.00
				Max. Error (%):	0.24	0.01

Linear Calibration Factor: C.F.= 0.00055727 MPa/B unit
Regression Zero: At Calibration = 9011.4 B unit
Temperature Correction Factor: Tk = 0.0004612 MPa/°C rise

Polynomial Gage Factors (MPa) A: -2.7813E-09 B: -0.00051717 C: 4.8814

Pressure is calculated with the following equations:
Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]
Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Apr-15	9009	21.2	1025.9

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: S. Kim SK Date: 30-Apr-15

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

MW15-07T (239m)

Vibrating Wire Piezometer

Customer: Kaminak Gold Corporation
Model: VW2100-3.0
Serial Number: **VW33363**
Mfg Number: 1515537
Range: 3.0 MPa
Temperature: 23.3 °C
Barometric Pressure: 990.0 millibars
Work Order Number: 207453
Cable Length: 280 meters
Cable Markings: 886588 m - 886868 m
Cable Colour Code: Red / Black (Coil) Green / White (Thermistor)
Cable Type: EL380004
Thermistor Type: 3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8767	8768	8768	0.006	0.21	0.00
0.6	8066	8067	8067	0.599	-0.04	0.00
1.2	7361	7361	7361	1.195	-0.16	0.00
1.8	6651	6652	6652	1.795	-0.17	0.00
2.4	5937	5937	5937	2.399	-0.04	0.00
3.0	5218	5219	5219	3.006	0.20	0.00
				Max. Error (%):	0.21	0.00

Linear Calibration Factor: **C.F.= 0.00084529 MPa/B unit**
Regression Zero: **At Calibration = 8774.8 B unit**
Temperature Correction Factor: **Tk = 0.0006609 MPa/°C rise**

Polynomial Gage Factors (MPa) **A: -3.7001E-09** **B: -0.00079354** **C: 7.2418**

Pressure is calculated with the following equations:
Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]
Polynomial: P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Jun-15	8775	22.9	1019.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: I. Barua B Date: 30-Jun-15

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Vibrating Wire Piezometer

MW15-07T (267.8m)

Customer:		Kaminak Gold Corporation
Model:		VW2100-3.0
Serial Number:		**VW33364**
Mfg Number:		1515556
Range:		3.0 MPa
Temperature:		23.3 °C
Barometric Pressure:		990.0 millibars
Work Order Number:		207453
Cable Length:		300 meters
Cable Markings:		886871 m - 887172 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8761	8761	8761	0.007	0.22	0.00
0.6	8081	8081	8081	0.599	-0.03	0.01
1.2	7398	7398	7398	1.194	-0.19	-0.01
1.8	6709	6709	6709	1.795	-0.18	0.00
2.4	6016	6016	6016	2.399	-0.05	0.00
3.0	5318	5318	5318	3.007	0.22	0.00
				Max. Error (%):	0.22	0.01

Linear Calibration Factor:	**C.F.=**	**0.00087138 MPa/B unit**
Regression Zero:	**At Calibration =**	**8768.5 B unit**
Temperature Correction Factor:	**Tk =**	**0.001181 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-4.2667E-09** **B:** **-0.00081131** **C:** **7.4352**

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Jun-15	8766	22.7	1019.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: I. Barua Date: 30-Jun-15

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Calibration Record

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SRK-15D-07 (103.6m)

Vibrating Wire Piezometer

Customer:		Kaminak Gold Corporation
Model:		VW2100-1.0
Serial Number:		**VW32653**
Mfg Number:		1504837
Range:		1.0 MPa
Temperature:		22.4 °C
Barometric Pressure:		1000.4 millibars
Work Order Number:		206893
Cable Length:		110 meters
Cable Markings:		828121 m - 828230 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8893	8893	8893	0.002	0.21	0.00
0.2	8189	8189	8189	0.200	-0.05	-0.01
0.4	7480	7480	7480	0.398	-0.16	0.00
0.6	6767	6767	6767	0.598	-0.16	0.00
0.8	6049	6050	6050	0.800	-0.04	0.01
1.0	5328	5328	5328	1.002	0.20	0.00
				Max. Error (%):	0.21	0.01

Linear Calibration Factor:	**C.F.=**	**0.00028048 MPa/B unit**
Regression Zero:	**At Calibration =**	**8900.4 B unit**
Temperature Correction Factor:	**Tk =**	**0.0001733 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-1.1969E-09** **B:** **-0.00026346** **C:** **2.4377**

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-May-15	8897	22.1	1018.6

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: J. Somphanthabansouk Date: 6-May-15

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Calibration Record

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Vibrating Wire Piezometer

SRK-15D-07 (149.2m)

Customer: Kaminak Gold Corporation
Model: VW2100-2.0
Serial Number: **VW32655**
Mfg Number: 1505025
Range: 2.0 MPa
Temperature: 21.6 °C
Barometric Pressure: 1004.0 millibars
Work Order Number: 206893
Cable Length: 160 meters
Cable Markings: 828393 m - 828552 m
Cable Colour Code: Red / Black (Coil) Green / White (Thermistor)
Cable Type: EL380004
Thermistor Type: 3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8987	8988	8988	0.004	0.20	-0.01
0.4	8284	8284	8284	0.400	-0.02	0.02
0.8	7578	7578	7578	0.797	-0.17	0.00
1.2	6867	6867	6867	1.196	-0.18	-0.01
1.6	6151	6151	6151	1.599	-0.05	-0.01
2.0	5430	5430	5430	2.004	0.22	0.01
				Max. Error (%):	0.22	0.02

Linear Calibration Factor: C.F.= **0.00056229 MPa/B unit**
Regression Zero: At Calibration = **8994.6 B unit**
Temperature Correction Factor: Tk = **0.0005237 MPa/°C rise**

Polynomial Gage Factors (MPa) A: -2.5298E-09 B: -0.00052582 C: 4.9299

Pressure is calculated with the following equations:
Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]
Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-May-15	8996	21.7	1018.6

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: J. Somphanthabansouk Date: 6-May-15

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Vibrating Wire Piezometer

SRK-15D-08 (103.6m)

Customer:		Kaminak Gold Corporation
Model:		VW2100-1.0
Serial Number:		**VW33361**
Mfg Number:		1514089
Range:		1.0 MPa
Temperature:		23.0 °C
Barometric Pressure:		1002.5 millibars
Work Order Number:		207453
Cable Length:		105 meters
Cable Markings:		887173 m - 887278 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8957	8958	8958	0.002	0.22	0.01
0.2	8227	8228	8228	0.199	-0.05	-0.01
0.4	7491	7492	7492	0.398	-0.17	0.01
0.6	6751	6752	6752	0.598	-0.17	0.01
0.8	6007	6007	6007	0.799	-0.05	0.00
1.0	5257	5257	5257	1.002	0.22	0.00
				Max. Error (%):	0.22	0.01

Linear Calibration Factor:	**C.F.=**	**0.00027022 MPa/B unit**
Regression Zero:	**At Calibration =**	**8965.6 B unit**
Temperature Correction Factor:	**Tk =**	**0.0001134 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** **-1.1804E-09** **B:** **-0.00025344** **C:** **2.3650**

Pressure is calculated with the following equations:

Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]

Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Jun-15	8958	22.9	1019.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000   ie: 1700Hz = 2890 B units

Technician: I. Barua   Date: 30-Jun-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

Applied Science Technologists and Technicians of British Columbia 22724 AL CULLEY AScT

Document Number: ELL0143H

MIG0106B

innovation in geotechnical instrumentation

Calibration Record

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Vibrating Wire Piezometer

SRK-15-08D (149.2m)

Customer:	Kaminak Gold Corporation	
Model:	VW2100-2.0	
Serial Number:	**VW32654**	
Mfg Number:	1505023	
Range:	2.0 MPa	
Temperature:	21.6 °C	
Barometric Pressure:	1004.0 millibars	
Work Order Number:	206893	
Cable Length:	160 meters	
Cable Markings:	828232 m - 828391 m	
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:	EL380004	
Thermistor Type:	3 kΩ	

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	9038	9039	9039	0.004	0.22	0.00
0.4	8309	8310	8310	0.399	-0.04	0.00
0.8	7576	7576	7576	0.796	-0.18	0.00
1.2	6838	6838	6838	1.196	-0.19	-0.01
1.6	6094	6094	6094	1.599	-0.04	0.00
2.0	5345	5346	5346	2.004	0.22	0.00
				Max. Error (%):	0.22	0.01

Linear Calibration Factor:	**C.F.=**	**0.00054158 MPa/B unit**
Regression Zero:	**At Calibration =**	**9046.6 B unit**
Temperature Correction Factor:	**Tk =**	**0.0003615 MPa/°C rise**

Polynomial Gage Factors (MPa) **A:** -2.4733E-09 **B:** -0.00050601 **C:** 4.7755

Pressure is calculated with the following equations:

Linear: $P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]$

Polynomial: $P(MPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-May-15	9046	21.7	1018.6

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: J. Somphanthabansouk Date: 6-May-15

Applied Science Technologists and Technicians of British Columbia 22724 AL CULLEY AScT

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

Document Number: ELL0143H

MIG0108B

rst INSTRUMENTS | innovation in geotechnical instrumentation

Calibration Record

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

SRK-15D-09 (99.7m)

Vibrating Wire Piezometer

Customer:		Kaminak Gold Corporation
Model:		VW2100-1.0
Serial Number:		**VW33362**
Mfg Number:		1514140
Range:		1.0 MPa
Temperature:		22.2 °C
Barometric Pressure:		998.5 millibars
Work Order Number:		207453
Cable Length:		105 meters
Cable Markings:		887279 m - 887384 m
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:		EL380004
Thermistor Type:		3 kΩ

Applied Pressure (MPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (MPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8709	8710	8710	0.002	0.21	-0.01
0.2	7975	7976	7976	0.200	-0.03	0.02
0.4	7238	7238	7238	0.398	-0.17	0.01
0.6	6496	6496	6496	0.598	-0.19	-0.01
0.8	5748	5749	5749	0.799	-0.06	-0.01
1.0	4995	4995	4995	1.002	0.23	0.01
				Max. Error (%):	0.23	0.02

Linear Calibration Factor: C.F.= **0.00026927 MPa/B unit**
Regression Zero: At Calibration = **8717.2 B unit**
Temperature Correction Factor: Tk = **0.0001677 MPa/°C rise**

Polynomial Gage Factors (MPa) A: **-1.1985E-09** B: **-0.00025285** C: **2.2930**

Pressure is calculated with the following equations:
Linear: P(MPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.00010(Bi-Bc)]
Polynomial: P(MPa) = $A(Lc)^2$ + BLc + C + Tk(Tc-Ti) - [0.00010(Bc-Bi)]

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	30-Jun-15	8707	23.0	1019.1

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: I. Barua Date: 30-Jun-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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AScT

Document Number: ELL0143H

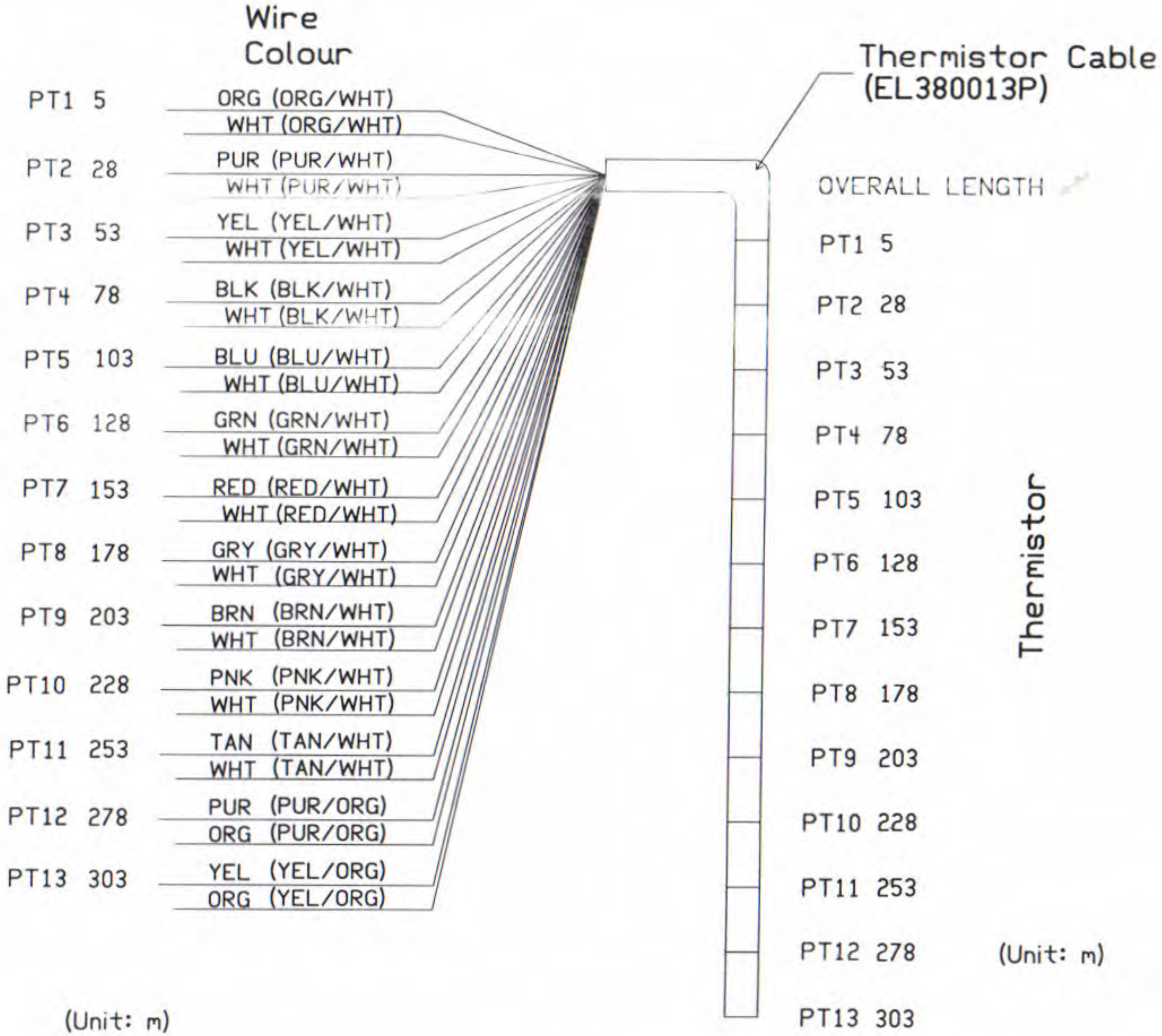
MIG0106B

Appendix 3-C2:
RST Thermistor Wiring Diagrams

KAMINAK
GOLD CORPORATION

BH6-T
MW14-04T

MW14-04T



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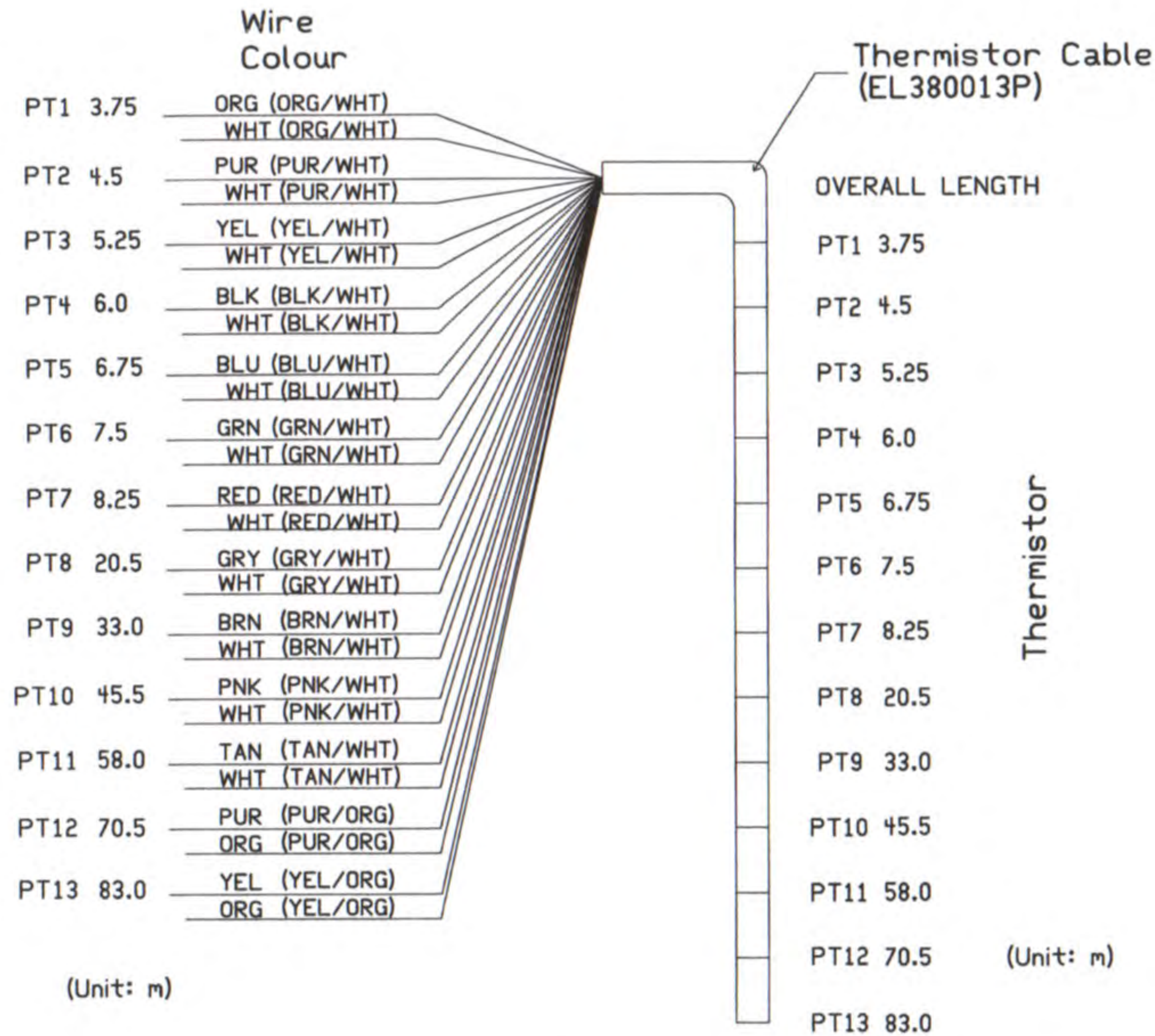
Title:	THERMISTOR CABLE		
J/N:	THW0190/W0204548	Revision:	A
Author:	CB	Size:	A
Date:	2014/07/29	Sheet	1 of 1

MW14-07T (3.7-83m)



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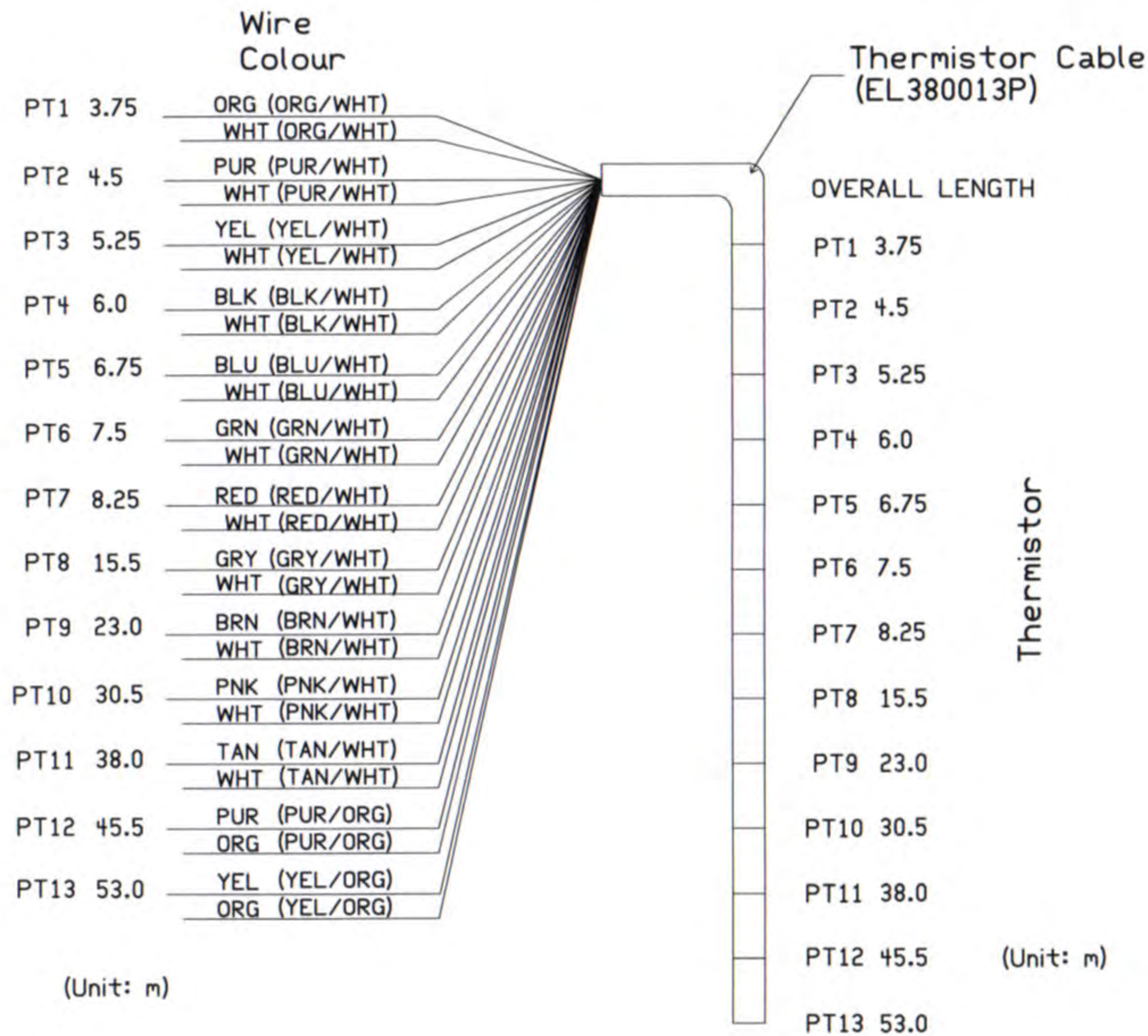
J/N:	THW0191/W0204549	Revision:	A
Author:	CB	Size:	A
Date:	2014/07/29	Sheet	1 of 1

MW15-01T



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S/N: TS3797

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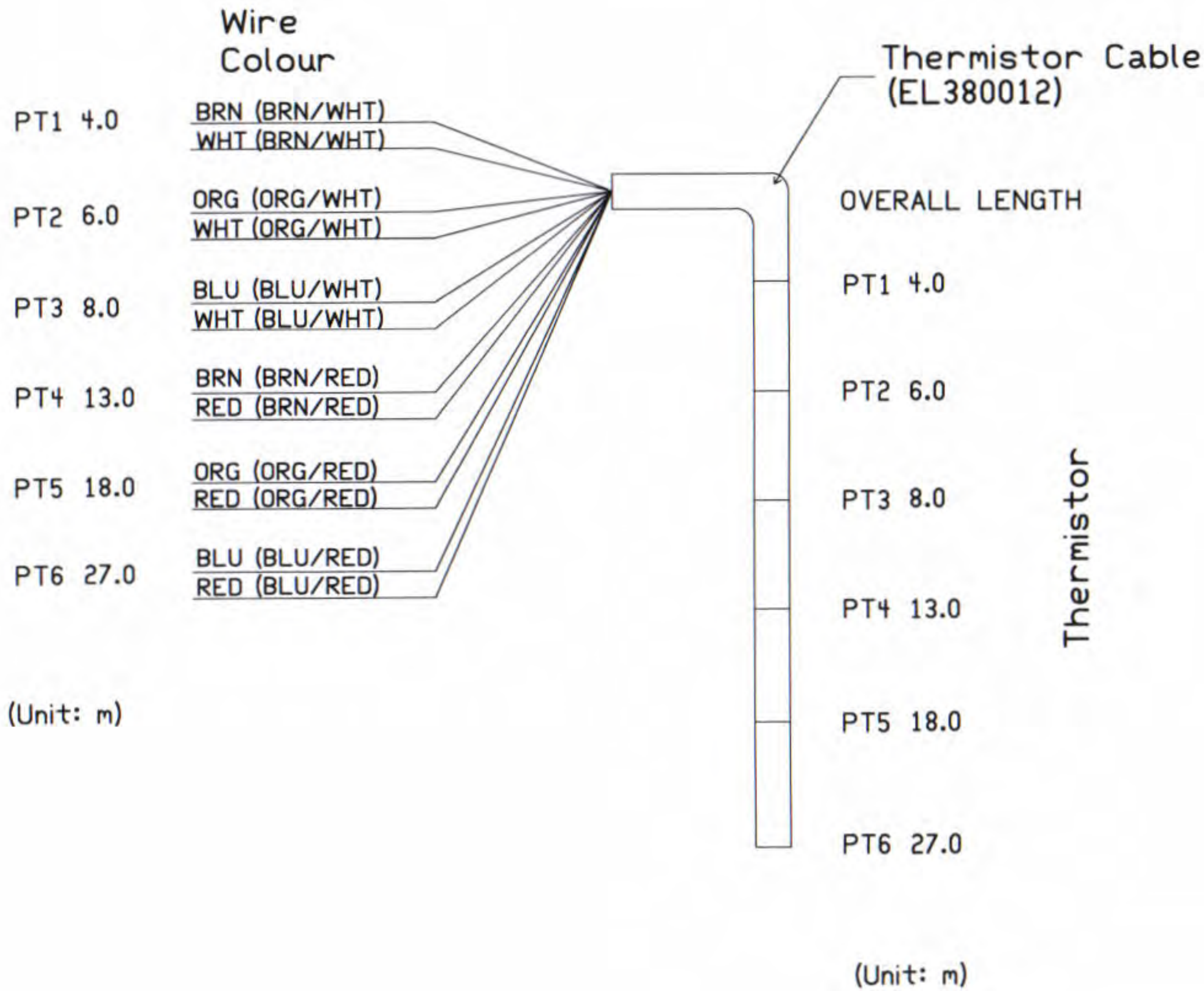
Title:	THERMISTOR CABLE
J/N:	THW0191/W0204549 Revision: A
Author:	CB Size: A
Date:	2014/07/29 Sheet 1 of 1

MW15-02T

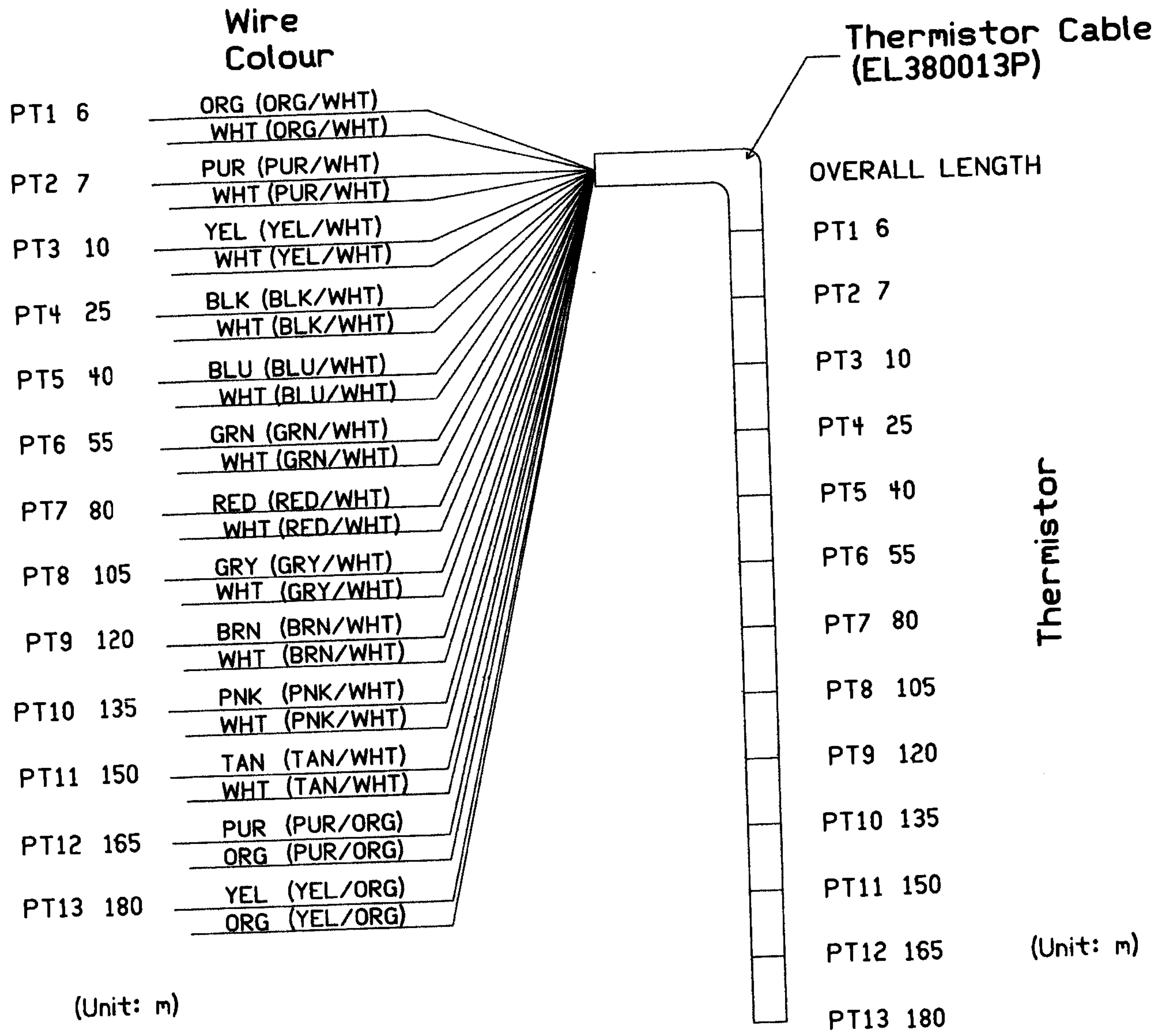


Co:	RST INSTRUMENTS LTD		
Title:	THERMISTOR CABLE		
J/N:	THW0191/W0204549	Revision:	A
Author:	CB	Size:	A
Date:	2014/07/29	Sheet 1 of 1	

TAG: BH-10T

S/N: TS3798

MW15-07T



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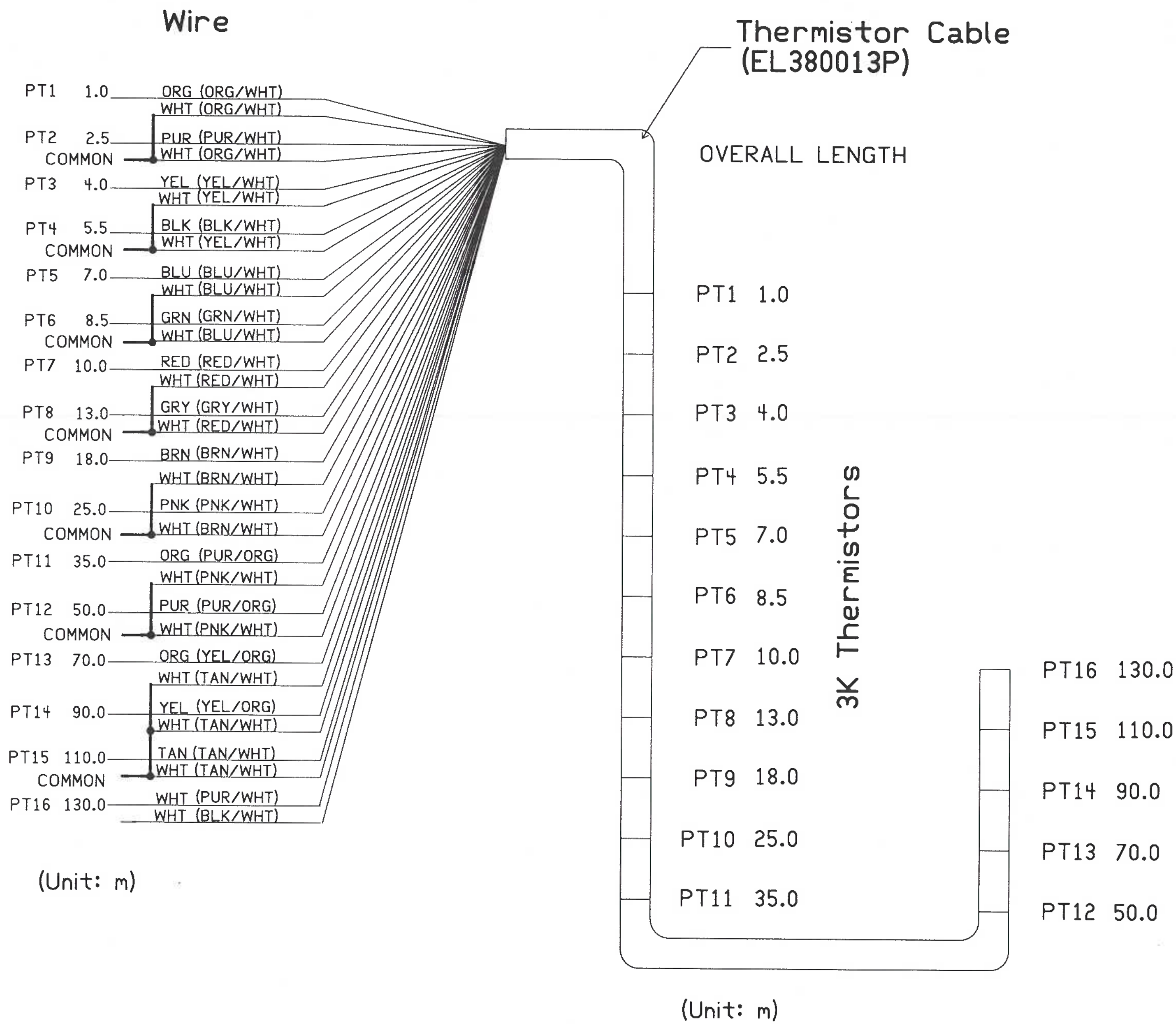
Title:	THERMISTOR CABLE
J/N:	THW0197/W0205090 — Revision: A
Author:	WY — Size: A
Date:	2014/09/22 — Sheet 1 of 1

S/N: TS3837



SRK-15D-07
SRK-15D-08

S/N: TS3977-TS3978

Co:	RST INSTRUMENTS LTD
Title:	THERMISTOR CABLE
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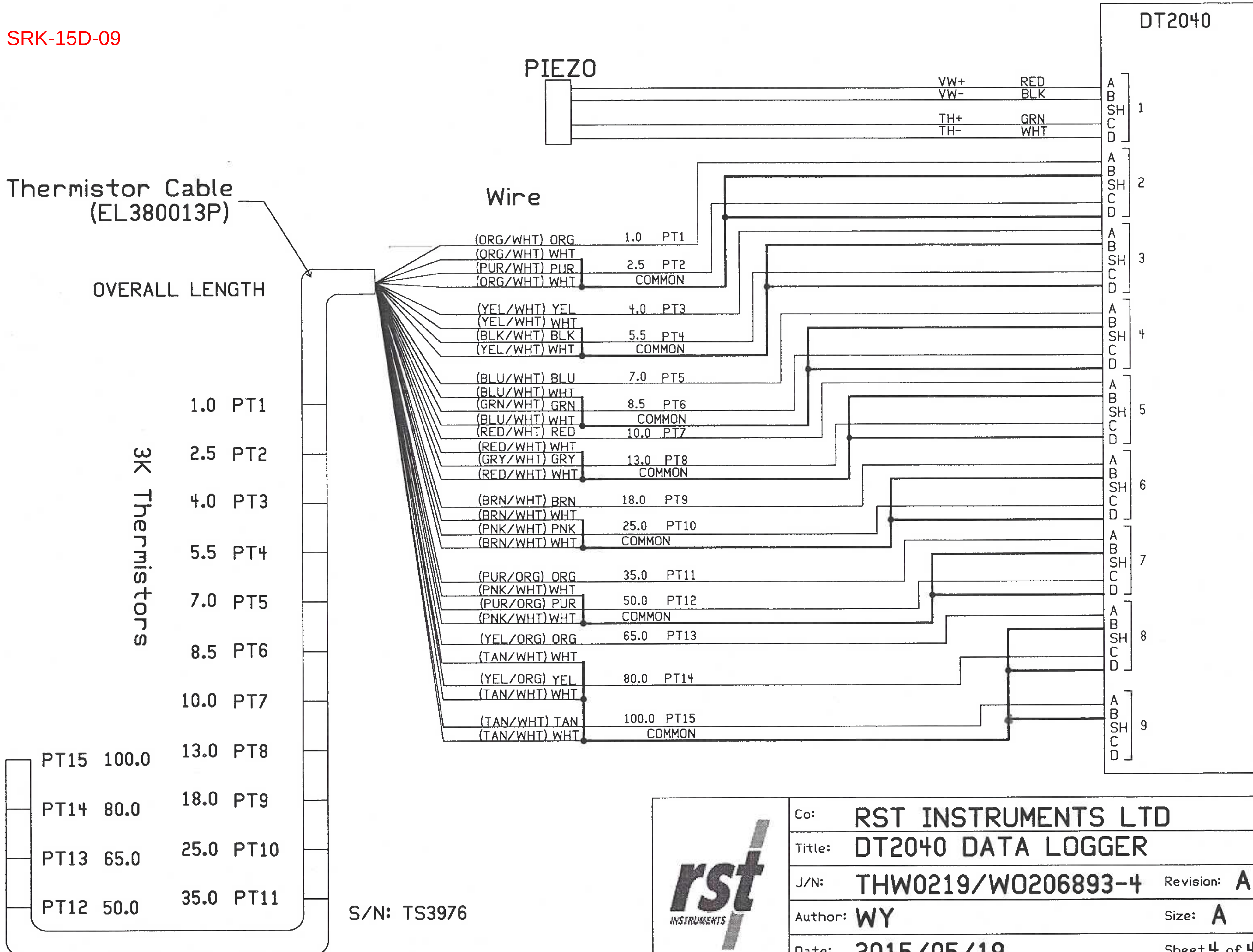
Author:	CB Size: A
Date:	2015/05/01 Sheet 1 of 2

SRK-15D-09



S/N: TS3976

Co:	RST INSTRUMENTS LTD		
Title:	DT2040 DATA LOGGER		
J/N:	THW0219/W0206893-4	Revision:	A
Author:	WY	Size:	A
Date:	2015/05/19	Sheet 4 of 4	