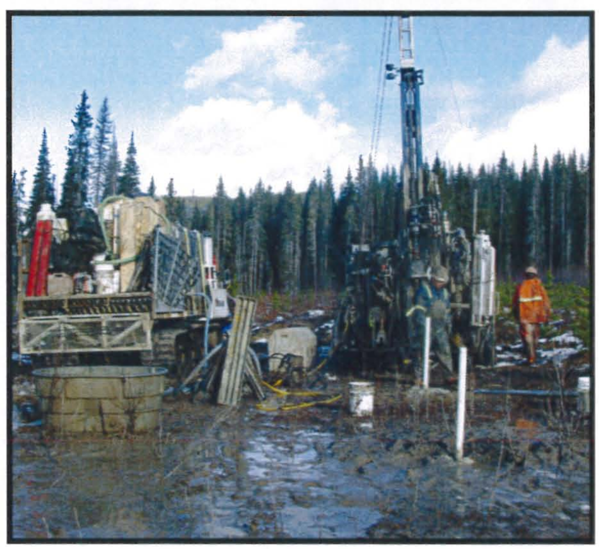
APPENDIX 24

Pacific Booker Minerals Inc.
Morrison Copper/Gold Project
British Columbia, Canada

Morrison Copper/Gold Project
Groundwater Baseline 2008



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Executive Summary

This report presents the hydrogeology study for Pacific Booker Minerals Inc (PBM).

PBM's proposed Morrison Copper/Gold Project (the Project) is 65 km northeast of Smithers and 35 km north of the village of Granisle in north-central British Columbia. The Project is on the east side of Morrison Lake on Crown land and falls within the traditional territory of the Lake Babine Nation. Access to the Project site is by road with barge access across Babine Lake, which is 50 km south of the site. The Project is approximately 35 km north of the former Bell and Granisle copper/gold mines.

The Morrison mine will be a 30,000 tpd open pit operation with ore processed in a conventional milling plant and the copper/gold concentrate transported to the Port of Stewart for shipment to offshore smelters. Molybdenum concentrate will be trucked from the mine to a refinery location to be confirmed. The mine will produce approximately 224 Mt of tailings and 170 Mt of waste rock.

The information contained in this baseline is intended to support a full environmental and socio-economic impact assessment of the Project.

This baseline study was initiated to characterize groundwater quantity and quality by installing shallow and deep groundwater monitoring wells across the Morrison property. This report aims to characterize the different aquifers encountered in the overburden and bedrock as well as groundwater flow directions and recharge/discharge sources.

The study primarily involved drilling 22 boreholes with either overburden drilling equipment or diamond drilling equipment; installation of 22 monitoring wells; hydraulic conductivity testing of the subsurface materials; monitoring seasonal variation of water levels; and monitoring seasonal variation in groundwater quality. This report presents data from the 2007 and 2008 field seasons, and also serves to characterize the baseline hydrogeological conditions on the Morrison property.

The results from the baseline program indicate that the hydraulic conductivity values measured range over several orders of magnitude. Overburden hydraulic conductivity measurements range from 4.70×10^{-11} to 1.40×10^{-5} m/s and bedrock measurements range from 8.10×10^{-11} to 1.23×10^{-5} m/s. In general, it appears that the hydrostratigraphy at the Morrison site consists of a low conductivity (confining) till overlying higher conductivity fractured bedrock. In general, with increasing depth (decreasing elevation) in the bedrock, fracturing becomes less dense hence hydraulic conductivity tends to decrease.

The water table tends to be a subdued replica of the topography. Groundwater flow will generally be from the higher elevations to the east of the site towards the lower elevations by Morrison Lake. At lower elevations artesian conditions and upward gradients are more common while at higher elevation downward gradients predominate.

The groundwater chemistry parameters monitored during this baseline study include general chemistry, total metals, dissolved metals, nutrients, and total organic carbon. Results from the monitoring program were compared against *British Columbia Water Quality Guidelines for Drinking Water*, *British Columbia Water Quality Guidelines for Freshwater Aquatic Life*, and *Canadian Council of Ministers of the Environment Guidelines for the Protection of Freshwater Aquatic Life*.

The following parameters naturally exceed the *British Columbia Water Quality Guidelines for Drinking Water*: hardness, colour, conductivity, pH, total dissolved solids, turbidity, fluoride, sulfate, total organic carbon, dissolved aluminum, total antimony, total arsenic, total barium, total cadmium, total chromium, total copper, total iron, total lead, total manganese, total mercury, total sodium, and total uranium.

The following parameters naturally exceed the *British Columbia Water Quality Guidelines for Freshwater Aquatic Life*: fluoride, sulfate, nitrite, dissolved aluminum, total antimony, total arsenic, total cadmium, total chromium, total copper, total iron, dissolved iron, total manganese, total mercury, total nickel, total selenium, total silver, total thallium, total titanium, and total zinc.

The following parameters naturally exceed the *Canadian Council of Ministers of the Environment Guidelines for the Protection of Freshwater Aquatic Life*: pH, ammonia as N, nitrite as N, total aluminum, total arsenic, total cadmium, total chromium, total copper, total iron, total lead, total mercury, total nickel, total selenium, total silver, total thallium, and total zinc.

Morrison Copper/Gold Project Groundwater Baseline 2008

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Acronyms and Abbreviations

BC	British Columbia
BCWQG	British Columbia Approved and Working Water Quality Guidelines
BFP	Biotite Feldspar Porphyry
CCME	Canadian Council of Ministers of the Environment
FBP	Feldspar Biotite Porphyry
masl	metres above sea level
mbgs	metres below ground surface
MFA	mine facilities area
NTU	nephelometric turbidity units
ODEX	overburden drilling equipment
PBM	Pacific Booker Minerals Inc.
the Project	Morrison Copper/Gold Project
PVC	Polyvinyl chloride
Rescan	Rescan Environmental Services Ltd.
RPD	relative percent difference
TCU	true colour unit
TDS	total dissolved solids
TOC	total organic carbon
TLSC	transmission line study corridor
TSF	tailings storage facility

TSS	total suspended solids
UTM	Universal Transverse Mercator

1. Introduction

1.1 Project Location and Background

Pacific Booker Minerals Inc.'s (PBM) proposed Morrison Copper/Gold Project (the Project) is 65 km northeast of Smithers and 35 km north of the village of Granisle in north-central British Columbia (BC). The Project is on the east side of Morrison Lake on Crown land and falls within the traditional territory of the Lake Babine Nation. (Figure 1.1-1). It is within the Babine Lake region, which forms a part of the rolling uplands of the Nechako Plateau within the Intermontane belt of central BC (Simpson 2007). The coordinates of the Morrison deposit are 55°11′24″ N and 126°19′7″ W. Elevations near the Project footprint range from 711 metres above sea level (masl) (Babine Lake) to 1,380 masl (Hearn Hill). The highest elevation within the Project footprint is approximately 1,050 masl, near the proposed tailings storage facility (TSF), and the lowest, 715 masl, is along the corridor (Rescan 2009b).

The current Project footprint (Figure 1.1-2) comprises two connected areas: the mine facilities area (MFA) (1,789.5 ha) and the transmission line study corridor (TLSC) (1,215.8 ha). The MFA principally includes the open pit, plant site, TSF, waste rock dumps, overburden stockpiles, soil stockpiles, low grade ore stockpiles, haul routes/pipelines connecting facilities, and the non-developed intervening area. The TLSC currently includes Option B, a 31 m buffered transmission line route extending northward from the Bell Mine Substation to the south end of the MFA (Rescan 2009b).

1.2 Climate

The Morrison Project area is on the Nechako Plateau of north-central BC. The property lies on the lee side of the Babine mountain ranges where precipitation is relatively low. Regional climate is moderate as it is on the interface between a mild coastal and extreme continental climate (Rescan 2009a).

In June, 2006, Rescan installed an automated meteorological station at the Morrison property. The station monitors air temperature, relative humidity, wind speed, wind direction, and rainfall. In addition the station is configured to measure precipitation in the form of snow water equivalent as well as snow depth throughout the winter.

The average annual air temperature at the Morrison station was 1.5ºC. The lowest hourly average air temperature measured at the station was -37ºC in January, 2008, and the highest hourly average air temperature was 33ºC in July, 2007. Average monthly air temperatures at the Morrison property are notably cooler than historical climate records from three regional meteorological stations operated by Environment Canada within 100 km of the property. This is expected to be caused by the higher elevation of the Morrison station.

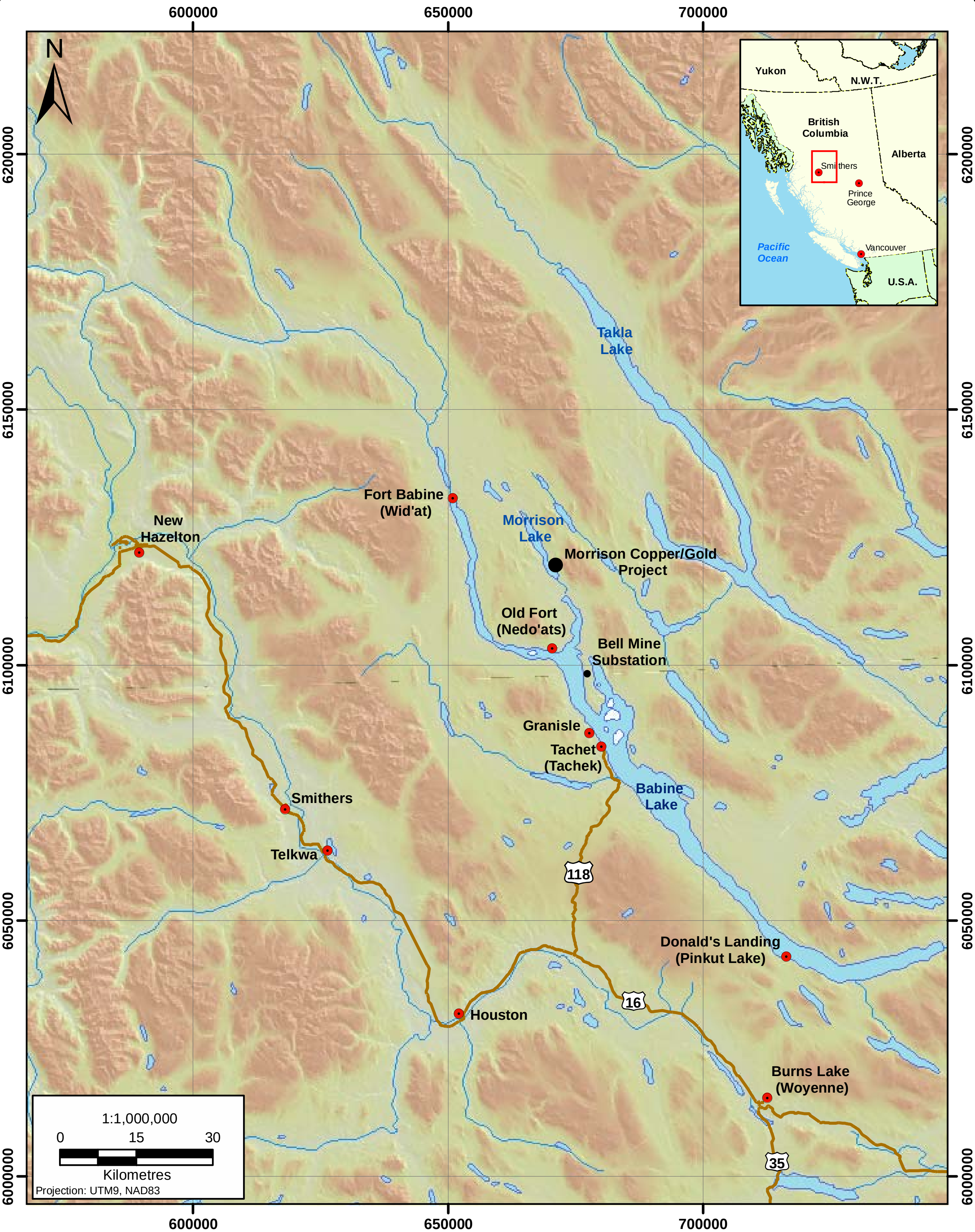

FIGURE 1.1-1

Morrison Copper/Gold Project Location Map

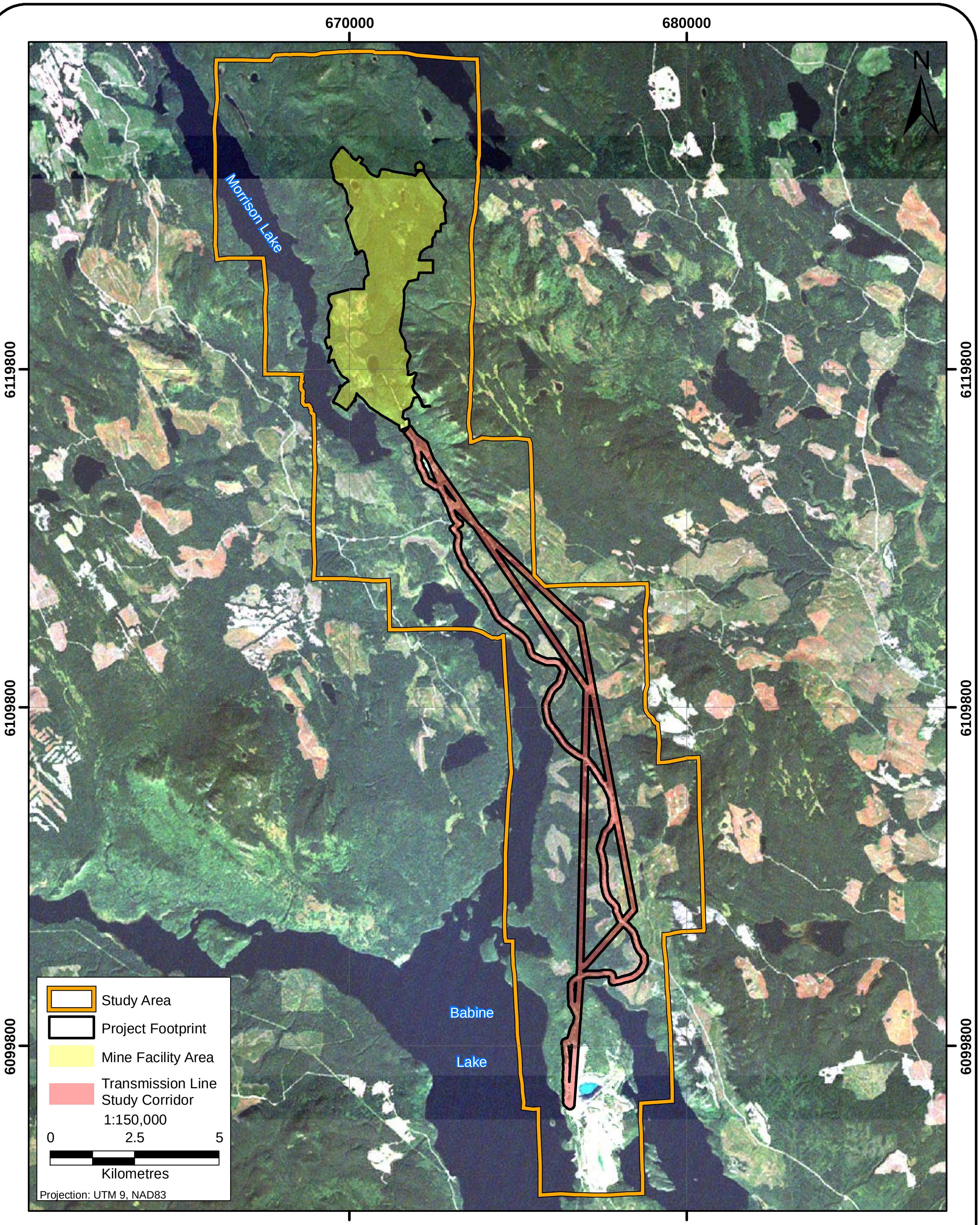

FIGURE 1.1-2

Morrison Copper/Gold Project Footprint

Precipitation through one full year totalled 628 mm. One full snow season has been measured at the Morrison station. Peak snow depth was measured at 105 cm in early March, 2008. Winds at the site were predominately from the east-southeast and of light intensity, generally less than 1 m/s (3.6 km/hr). Winds from the west, southeast, and east were also common.

1.3 Background

The Project consists of 20 units and 1 claim within the Omineca mining division. Exploration of the Morrison Lake area was initiated in the early 1960s during a period of porphyry copper exploration in the Babine lake region. The Norex Group of Noranda first discovered the Morrison deposit in 1963 by regional stream sediment sampling (Simpson 2007). From 1963 to 1973 Noranda completed 13,890 metres total drilling in 95 holes. In addition to drilling, Noranda performed geological mapping, trenching, and alteration studies along with soil geochemistry, electromagnetic, magnetic, and IP surveys (PBM 2007).

In 1998, Noranda investigated the gold content of the deposit by assaying 477 composite samples. In 1990 and 1998, Noranda also completed a preliminary pit design and operating studies to establish whether the deposit could supply the Bell mine. Noranda concluded that the mining operation at that time would not be economic (PBM 2007).

Activity was re-commenced in October, 1997, when Booker Gold Exploration, now PBM, obtained the Morrison property and initiated a three-phase drilling program. From 1998 to 2003 PBM completed surface backhoe trenching and 82 exploration holes, totalling 25,245 metres. As a part of a fourth phase of drilling in 2003, eight definition and geo-technical holes were drilled, totalling 2,420 metres.

In 2005, four pit definition holes were drilled totalling 957 metres, and four PQ holes, totalling 700 metres were drilled for metallurgical samples, twinning older holes. In 2006, 7 geotechnical holes (1,464 metres) along with 18 condemnation holes (643 metres) were also drilled. Condemnation holes were drilled in outlying areas that were regarded as potential plant, waste, and tailings sites. These holes were logged but not assayed as no visible mineralization was encountered. Several of the condemnation holes were then used for groundwater monitoring purposes (Simpson 2007).

Knight Piésold Consulting Ltd., commissioned by PBM, carried out a geotechnical feasibility study of the pit area, plant site, and tailings impoundment in 2005 and 2006. Between the period of November, 2005, to April, 2006, 17 holes in both the overburden and the bedrock were drilled in the area of the proposed tailings facility. Groundwater monitoring wells were installed in all but one of the holes. Along with the data collected from the drilled holes, 35 test pits were excavated to determine the thickness and composition of overburden. Also, between January and February 2006, Knight Piésold completed seven oriented drill holes within the proposed pit area (Knight Piésold 2006a, 2006b).

In 2007, Klohn Crippen Berger Ltd. completed a geotechnical site investigation for the feasibility level design of the TSF and the plant site foundation design. The fieldwork component of the investigation consisted of drilling 15 geotechnical holes in the TSF and plant site areas. Standard penetration tests were conducted in the overburden. Hydraulic conductivity testing included falling head tests in open boreholes and in piezometers in overburden and in the bedrock. Constant head (packer) tests were conducted in rock in open boreholes. Piezometers were installed in 13 boreholes. Additionally, eight test pits were excavated in the area of the TSF and along the 2007 access road between the plant site and the TSF (Klohn Crippen Berger 2008). Additional borehole drilling and test pitting was completed in 2008.

Rescan Environmental Services Ltd. (Rescan) was retained by PBM in 2006 to consolidate prior studies and to review outstanding requirements to complete the environmental baseline and environmental impact assessment studies.

1.4 Objectives

This Rescan baseline study was initiated to characterize groundwater quantity and quality by installing shallow and deep groundwater monitoring wells across the Morrison property. This report aims to characterize the different aquifers encountered in the overburden and bedrock as well as groundwater flow directions and recharge/discharge sources.

1.5 Methods

During September and October of 2007 and September of 2008, Rescan drilled 22 boreholes across the Morrison property. A 5-cm (2-inch) groundwater monitoring well was installed in each borehole. To determine the hydraulic conductivity (K) of the overburden and bedrock, a number of aquifer tests including packer, falling head, and rising head tests and discharge/recharge tests were conducted at each site. Also, for characterization of groundwater quality an ongoing water sampling program continues for each groundwater monitoring well.

The Rescan baseline groundwater study involved the following:

- Drilling 15 boreholes with overburden drilling equipment (ODEX) and seven boreholes using a combination of ODEX and diamond drilling equipment. Geotech Drilling Services Ltd. was commissioned for the drilling operations. The subsurface lithologies were defined based on rock chip analysis and cored samples collected from coring at seven locations. Borehole logs are presented in Appendix A. The software *gINT 2007 v.8.1.022*, released by *gINT Software Inc.*, was used to present the lithology for each drill hole.
- Completing 22 groundwater monitoring wells. A 5-cm (2 inch) polyvinyl chloride (PVC) pipe was installed in each hole. Schedule 40 PVC pipe was used in all boreholes except 2 deep boreholes (MW07-07A and MW08-02A), which were installed using schedule 80 PVC pipe. A sand filter pack was installed around the slotted portion of the PVC pipe. A bentonite seal was placed on top of the sand filter pack and bentonite grout was placed on top of the bentonite seal to surface. Well construction details and logs are presented in Table 3.1-1 and Appendix A, respectively. The software *gINT 2007 v.8.1.022*, released by gINT Software Inc., was used to construct each figure.
- Installing a single channel vibrating wire piezometer at the proposed location of the open pit. A vibrating wire piezometer was attached to the external surface of 5-cm (2-inch)

Schedule 80 PVC pipe (monitoring well MW07-07A) and placed at a depth of 71.32 metres below ground surface (mbgs). The vibrating wire piezometer was setup to record groundwater fluctuations on a daily basis. The data are collected from a data logger connected to the piezometer through a cable at the ground surface. The piezometer data are presented in Section 3.3.

- Conducting packer tests including 17 constant pressure, 5 falling head tests, and 1 recharge/discharge test in bedrock at 8 locations. Tested intervals were selected based on lithology and/or density of fractures in rock samples. The packer test data and results are presented in Table 3.1-2 and Appendix B.
- Conducting hydraulic tests at each well to determine the hydraulic conductivity (K) of different screened intervals. Eight falling head and 14 rising head tests were completed. Data from the hydraulic tests were analyzed using the software *Aquifer Test v.4*, released by Waterloo Hydrogeologic Inc. The Hvorslev method was used to calculate the K-value. Hydraulic test results are presented in Table 3.1-3 and Appendix C.
- Collecting groundwater samples to determine the general chemistry, total and dissolved metals, nutrients, and total organic carbon content in groundwater. Seventy-one groundwater samples and six duplicate samples were collected from Rescan groundwater monitoring wells and shipped to ALS Environmental in Vancouver for chemical analyses over the period from November, 2007, to October, 2008. Based on the obtained data, water samples were classified on a Piper diagram via *Aqua Chem v.5.1,* released by Waterloo Hydrogeologic Inc. (Figure 4.4-1).

2. General Setting

2.1 Geology and Structure

The property is at the northern edge of the Skeena Arch in a region mainly consisting of Lower Jurassic to Lower Cretaceous clastic and epiclastic rocks (Figure 2.1-1).

The Morrison deposit is a zoned annular porphyry copper-gold deposit. It is largely within a multi-phased Eocene "Babine Type" Biotite Feldspar Porphyry (BFP) body that intruded the Middle to Upper Jurassic Ashman Formation (Bowser Lake Group). The lower part of this formation is made of marine pebble conglomerate interbedded with greenish grey sandstone and siltstone grading in the upper parts to argillaceous siltstone and greywacke. The subvolcanic intrusion, with nearly vertical contacts, occupies a northwest-oriented elliptical area of 900 m by 150 m to 300 m (MacIntyre, Webster, and Desjardins 1997; Maclntyre 2001). Based on the regional geology map, the Niktiwa formation, which consists of shallow to deep fossiliferous marine feldspatic wackes as well as siltstone and conglomerate, is placed by the Ashman formation with a fault contact.

The central part of the intrusive contains the main portion of copper-gold mineralization, which corresponds with potassic alteration. Chalcopyrite and pyrite are the major sulphide minerals, which are occasionally associated with minor minerals such as: bornite, marcasite, pyrrhotite, galena, molybdenite, and sphalerite. The ratio of copper to iron sulphide minerals declines towards the peripheral portion of the plug such that a pyritic halo surrounds the central part. Sulfide mineralization generally occurs in the form of fracture filling and/or disseminated textures in the rock matrix (MacIntyre, Webster, and Desjardins 1997; Maclntyre 2001; Morin and Hutt 2007).

Hydrothermal alteration is characterized by potassic-chloritic zoning, which chlorite is mostly dominant in the peripheral zones corresponding with the pyritic halo. Argillic alteration, which is the least significant, occurs along the fractures (MacIntyre, Webster, and Desjardins 1997; Maclntyre 2001).

The Morrison deposit composes the central part of the major graben, which is believed to be formed as a result of the movement of two parallel dextral faults. The western bounding fault is believed to be along Morrison Lake, while the eastern fault is approximately 800 m east of the property. The most prominent structure is the northwest trending Morrison fault, which bisects the porphyry plug (MacIntyre, Webster, and Desjardins 1997; Maclntyre 2001).

In the north, lower to upper Jurassic formations including Telwak, Nikitkawa, Saddle Hill, and Smithers (Hazelton Group) form the foundation of the proposed tailings impoundment area. Lithologic units, which basically belong to continental shelf facies, consist of sandstone, siltstone, conglomerate, and limestone.

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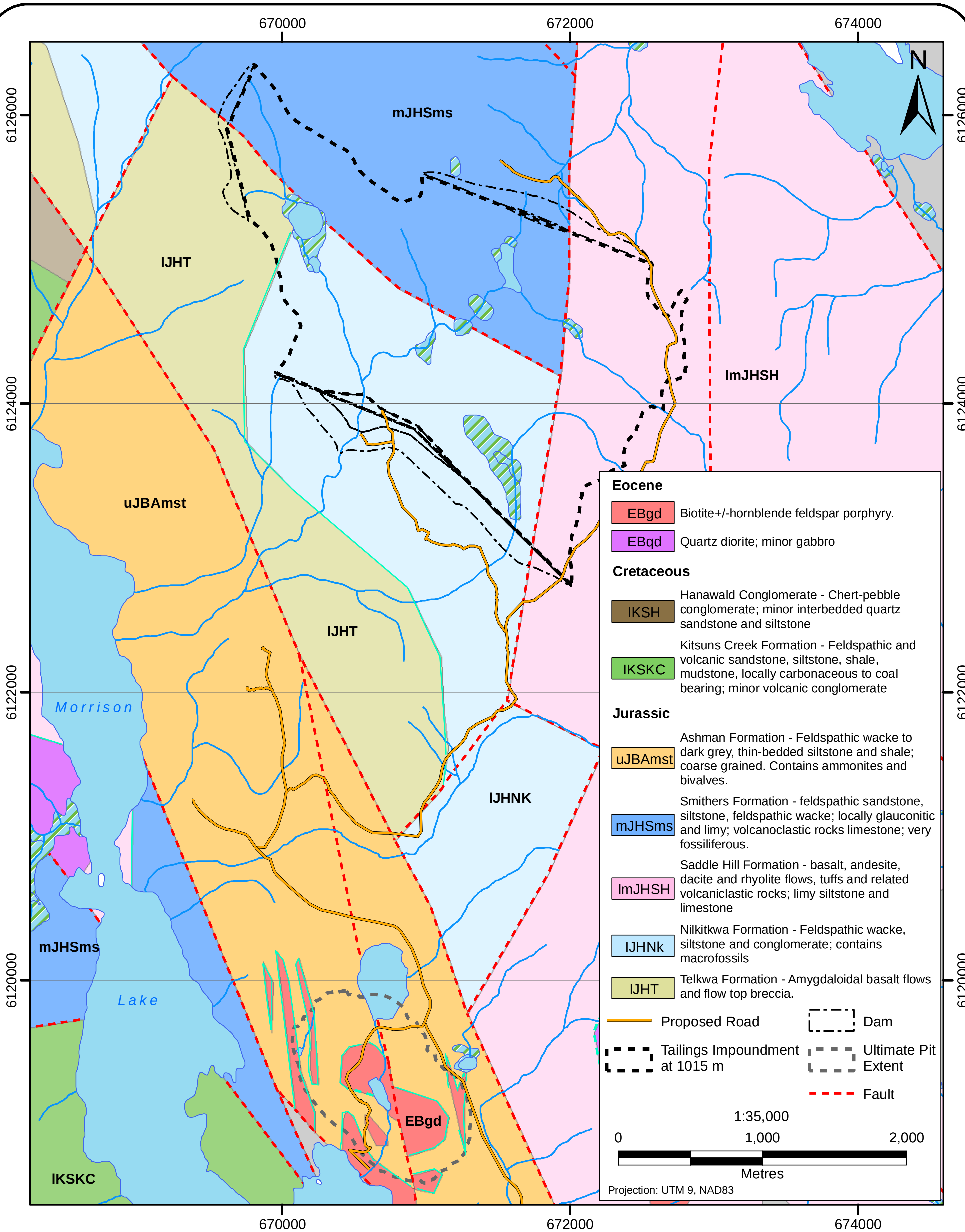


FIGURE 2.1-1

Morrison Copper/Gold Project: Local Geology and Mine Infrastructure

3. Physical Hydrogeology

3.1 Groundwater Monitoring Wells and Piezometers

Rescan installed 16 groundwater monitoring wells at 8 locations in October and November, 2007, to characterize baseline conditions in the Morrison Project footprint. Six additional groundwater monitoring wells at three locations were installed in September, 2008, to better characterize areas surrounding the open pit. Generally, one bedrock groundwater monitoring well (well A) and one overburden groundwater monitoring well (well B) were installed at each location. The location of each well is presented in Figure 3.1-1. The groundwater monitoring well construction details are presented in Table 3.1-1.

In addition to the Rescan groundwater monitoring wells, Klohn Crippen Berger and Knight Piésold have installed piezometers in the Project footprint. In 2007 and 2008, Klohn Crippen Berger installed 4 5-cm groundwater monitoring wells and 13 2.5-cm piezometers (including 3 nested piezometers) as a part of the 2007 geotechnical site investigations and continued 2008 investigations (Klohn Crippen Berger 2008). Well completion details for 2008 holes will be presented to PBM by Klohn Crippen Berger. In 2006, Knight Piésold installed 15 5-cm, 2 2.5-cm, and 3 1.9-cm diameter piezometers as a part of the 2006 geotechnical site investigations (Knight Piésold 2006b) and 2006 open pit geotechnical investigations (Knight Piésold 2006a). Knight Piésold also installed vibrating wire piezometers in three metallurgical holes (MET-1, MET-2, and MET-3) in the open pit area to collect groundwater elevation data. No valid data have been collected to date nor is it known if these installations are still functioning. Piezometer locations are presented in Figure 3.1-1, and construction details are presented in Table 3.1-2.

Notably, the Preliminary Report on Groundwater at Morrison, produced by Water Management Consultants in 2003, reveals that a pneumatic piezometer was installed in drillhole DDH 90 in the area of the open pit (Daly 2003). The Universal Transverse Mercator (UTM) location of this piezometer and current condition of the installation is unknown. In addition, the report proposed that 4 additional standpipe piezometers be installed in drillholes 9300-1, 9240-1, 9240-2, and 8900-1. It is also not known if these installations were completed.

Depths and elevations of Klohn Crippen Berger drill holes and test pits and Knight Piésold drill holes, without installations, are presented in Table 3.1-3.

3.2 Hydrostratigraphy

Based on borehole logs (Appendix A) and hydraulic conductivity test results, the hydrostratigraphy of the Morrison property can be summarized in two main units: overburden and bedrock. Rescan hydraulic conductivity values as well as those presented in both Knight Piésold (2006a; 2006b) and Klohn Crippen Berger (2008) reports were included in the analyses.

3.2.1 Overburden

Surficial overburden materials in the area include glacial till, glaciofluvial gravels, colluvium, and organics (Klohn Crippen Berger 2008). Silt/clay glacial till is the most common unit and overlies fractured, fine-grained sedimentary and volcanic rocks. Overburden at the proposed open pit area is typically between 3 m and 10 m deep, but the overburden thickness on ridges is often less than 1 m (Knight Piésold 2006a, 2006b). The deepest recorded depth in the proposed open pit area is approximately 25 m, but depths of overburden materials up to approximately 56 m were recorded in the area between the proposed open pit and waste rock dump areas. The depth to bedrock in the proposed TSF area varies between a minimum of 0 m on the crests of slopes to a maximum of approximately 22 m in the low-lying areas. Overburden is composed of particles generally ranging from clay to gravel-sized particles, but is dominated by silt and clay sized particles.

In 2007, Rescan conducted rising/falling head tests at six sites to estimate the hydraulic conductivity of the overburden. Testing involved adding or removing water to/from the groundwater monitoring well and recording the time it took for the groundwater to return to the static level. Data from the hydraulic tests were analyzed using the software *Aquifer Test v.4*, released by Waterloo Hydrogeologic Inc. The Hvorslev method was used to calculate the K-value. Rescan rising/falling head test results are presented in Appendix C.

Throughout the period from November, 2005, to April, 2006, Knight Piésold excavated 35 test pits throughout the Project footprint with an average depth of roughly 3.2 m (Knight Piésold 2006b). Knight Piésold conducted proctor compacted saturated hydraulic conductivity tests on samples collected from eight testpits; they also measured the hydraulic conductivity of shelby tube samples from five 2006 drillholes. In 2007, Klohn Crippen Berger conducted three falling head tests in overburden as a part of their 2007 geotechnical site investigations (Klohn Crippen Berger 2008). Results from hydraulic conductivity testing performed in 2008 are not included in this report as they were not available to Rescan at the time of writing. All available hydraulic conductivity values measured in the overburden are presented in Table 3.2-1.

Measured hydraulic conductivity in the Rescan groundwater monitoring wells ranged from 1.08×10^{-8} m/s to 1.02×10^{-6} m/s. Hydraulic conductivity results from all tests completed in the Project footprint (including Rescan, Knight Piésold, and Klohn Crippen Berger) ranged from 4.70×10^{-11} m/s to 1.40×10^{-5} m/s. Hydraulic conductivity values measured in the Morrison MFA generally correspond with the values that literature presents for glacial till, which range from 1×10^{-12} m/s to 1×10^{-6} m/s (Freeze and Cherry 1979). In general, overburden with a higher clay/silt content has been observed to have hydraulic conductivities on the low end of this range and overburden with a higher sand/gravel content has been observed to have hydraulic conductivities at the high end of this range.

3.2.2 Bedrock

The geology of the area is highly complex because of the diversity of the lithological units underlying the MFA and the influence of tectonic activities during and after mineralization. In the following discussion, the lithostratigraphy of the subsurface is described for each Rescan borehole location and compared with known local geology. Measured hydraulic conductivities of the bedrock in Rescan, Knight Piésold, and Klohn Crippen Berger drillholes are discussed below and are presented in Table 3.2-2. Rescan rising/falling head test results are presented in Appendix C. Packer testing results are presented in Appendix D.

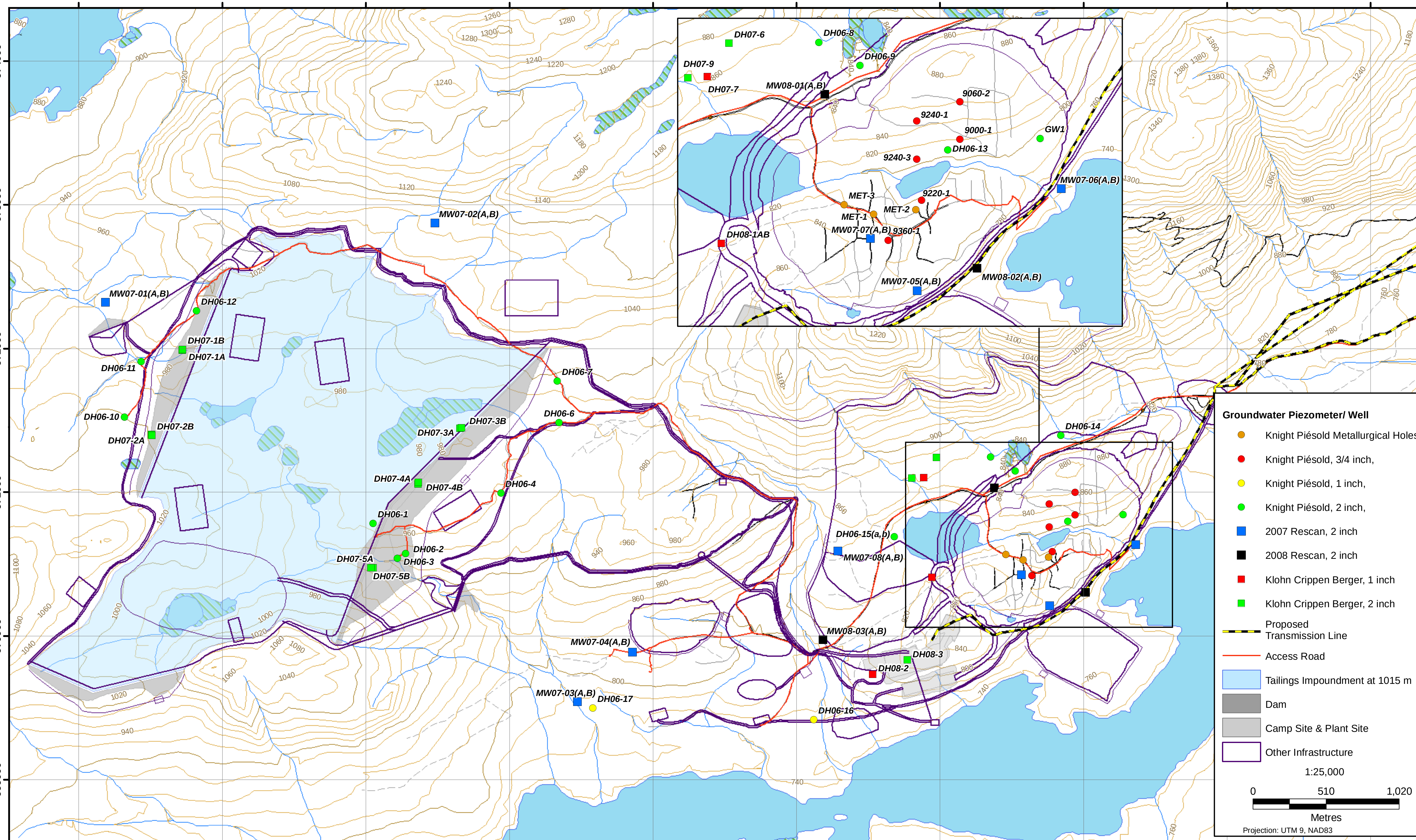


FIGURE 3.1-1

Morrison Copper/Gold Project: General Site with Monitoring Wells and Piezometers

Table 3.1-1
Morrison Copper/Gold Project: Rescan Monitoring Well Completion Table

Well I.D.	Installation Date mm/dd/yy	UTM Location Northing	UTM Location Easting	Elevation (masl)[1]	Drill Hole Depth (m)	Strike (degrees from North)	Inclination (degrees)	Stick up (mags)[2]	Drilling Method[3]	Drill Hole Diameter[4] (m)	Well Diameter (m)	Screened Interval (mbgs)[5] Top	Screened Interval (mbgs)[5] Bottom	Screened Horizon	Lithology
MW07-01A	11/10/2007	6125820	672325	970	28.04	0	90	0.93	ODEX and HQ3	0.114/**0.095**	0.053	21.94	28.04	Bedrock	Glauconitic Volcanoclastic unit
MW07-01B	11/10/2007	6125820	672325	970	12.19	0	90	0.94	ODEX	0.114	0.053	8.99	12.04	Overburden	Glacial Till
MW07-02A	11/7/2007	6123522	672874	1,091	40.23	0	90	0.87	ODEX and HQ3	0.114/**0.095**	0.053	35.81	38.7	Bedrock	Volcanic breccia
MW07-02B	11/8/2007	6123522	672874	1,091	9.14	0	90	0.85	ODEX	0.114	0.053	6.1	9.14	Bedrock	Fossiliferous Limestone
MW07-03A	10/24/2007	6122530	669544	782	33.53	0	90	0.83	ODEX	0.114	0.053	30.32	33.37	Overburden	Glacial Till
MW07-03B	10/26/2007	6122530	669544	782	5.94	0	90	0.93	ODEX	0.114	0.053	2.89	5.94	Overburden	Glacial Till
MW07-04A	10/22/2007	6122147	669890	822	40.84	0	90	0.87	ODEX	0.114	0.053	37.79	40.84	Overburden	Glacial Till
MW07-04B	10/24/2007	6122147	669890	822	6.1	0	90	0.87	ODEX	0.114	0.053	3.05	6.09	Overburden	Glacial Till
MW07-05A	10/17/2007	6119240	670211	807	40.23	0	90	0.95	ODEX	0.114	0.053	37.18	40.23	Bedrock	Altered Feldspar Biotite Porphyry
MW07-05B	10/18/2007	6119240	670211	807	21.34	0	90	0.91	ODEX	0.114	0.053	18.29	21.33	Overburden	Glacial Till
MW07-06A	10/19/2007	6118638	670637	746	16.31	0	90	0.93	ODEX and HQ3	0.114/**0.095**	0.053	11.58	14.63	Bedrock	Volcanic tuff
MW07-06B	10/20/2007	6118638	670637	746	5.18	0	90	0.91	ODEX	0.114	0.053	2.13	5.18	Overburden	Glacial Till
MW07-07A	10/6/2007	6119436	670428	837	149.66	0	90	0.98	ODEX and HQ3	0.114/**0.095**	0.049	131.97	147.22	Bedrock	Altered Feldspar Biotite Porphyry
MW07-07B	10/16/2007	6119436	670428	837	39.47	0	90	1.00	ODEX	0.114	0.053	36.42	39.47	Bedrock	Altered Feldspar Biotite Porphyry
MW07-08A	10/20/2007	6120715	670593	840	40.23	0	90	0.93	ODEX	0.114	0.053	37.18	40.23	Bedrock	Siltstone
MW07-08B	10/22/2007	6120715	670593	840	10.36	0	90	0.84	ODEX	0.114	0.053	7.31	10.36	Overburden	Glacial Till
MW08-01A	9/20/2008	6119626	671032	832	85.8	0	90	0.92	ODEX and HQ3	0.114/**0.095**	0.053	72.09	78.18	Bedrock	Siltstone and Tuff
MW08-01B	9/21/2008	6119626	671032	832	30.18	0	90	0.88	ODEX	0.114	0.053	23.78	29.87	Overburden	Gravelly Clay with Sand
MW08-02A	10/4/2008	6118990	670305	752	149.81	0	90	0.91	ODEX and HQ3	0.114/**0.095**	0.049	137.62	149.81	Bedrock	Siltstone and Feldspar Biotite
MW08-02B	10/4/2008	6118990	670305	752	75.59	0	90	1.00	ODEX	0.114	0.053	66.45	75.59	Overburden	Biotite Feldspar Porphyry
MW08-03A	9/23/2008	6120820	669975	800	35.51	0	90	0.92	ODEX and HQ3	0.114/**0.095**	0.053	30.48	35.05	Bedrock	Sandstone
MW08-03B	9/23/2008	6120820	669975	800	13.89	0	90	0.90	ODEX	0.114	0.053	8.99	13.72	Overburden	Gravelly Clay with Sand

Notes:

[1] masl = metres above sea level.

[2] mags = metres above ground surface.

[3] ODEX diameter = 11.43 cm and HQ3 diameter = 9.6 cm.

[4] Where the hole diameter varied over the drill hole length the completion zone diameter is indicated in bold .

[5] mbgs = metres below ground surface.

Coordinates are NAD 83, UTM Zone 9.

Table 3.1-2
Morrison Copper/Gold Project: Completion Details of Knight Piesold and Klohn Crippen Berger Monitoring Wells and Piezometers

Identification	Installation Year	Contractor	Description1	Well Contruction Details: UTM Location Northing	UTM Location Easting	Elevation (masl)*	Depth (m)	Strike (degrees from North)	Inclination (degrees)	Stick-up (mags)**	PVC Pipe Diam.2 (mm)	Screened Interval (mbgs)***	Screened Lithology
DH07-1A	2007	KCB	Piezometer	6125281	671989	973	49.4	0	90	0.9	26	43.1 - 49.2	Sandstone and siltstone
DH07-1B	2007	KCB	Piezometer	6125279	671996	973	17.4	0	90	0.83	26	14.2 - 17.2	Gravelly clay/silt (TILL)
DH07-2A	2007	KCB	Piezometer	6125496	671403	990	35.1	0	90	0.97	26	31.7 - 34.7	Siltstone
DH07-2B	2007	KCB	Piezometer	6125493	671396	990	11	0	90	0.93	26	7.6 - 10.7	Gravelly clay (TILL)
DH07-3A	2007	KCB	Piezometer	6123345	671446	974	41.6	0	90	0.92	26	38.4 - 41.5	Siltstone
DH07-3B	2007	KCB	Piezometer	6123335	671450	974	15.4	0	90	0.86	26	12 - 15.1	Gravelly clay (TILL)
DH07-4A (S1)	2007	KCB	Piezometer	6123637	671060	960	46.2	0	90	0.82	26	43 - 46	Siltstone
DH07-4A (S2)	2007	KCB	Piezometer	6123637	671060	960	46.2	0	90	0.84	26	33.4 - 36.4	Sandy siltstone
DH07-4B (S1)	2007	KCB	Piezometer	6123634	671070	960	11.4	0	90	0.9	26	9.8 - 11.3	Gravelly clay (TILL)
DH07-4B (S2)	2007	KCB	Piezometer	6123634	671070	960	11.4	0	90	0.92	26	3 - 4.6	Gravelly clay (TILL)
DH07-5A (S1)	2007	KCB	Piezometer	6123951	670477	935	21.5	0	90	0.85	26	19.2 - 21.3	Metasedimentary
DH07-5A (S2)	2007	KCB	Piezometer	6123951	670477	935	21.5	0	90	0.87	26	13.7 - 15.2	Gravel and clay (TILL)
DH07-5B	2007	KCB	Piezometer	6123965	670477	935	58.2	0	90	0.88	26	55 - 58.1	Sandstone
DH07-6	2007	KCB	Piezometer	6120025	671245	863	23.2	0	90	0.86	26	21 - 22.6	Silty clay (TILL)
DH07-7	2007	KCB	Monitoring Well	6120115	671105	851	22.9	0	90	0.91	50	21 - 22.6	Clay, some gravel (TILL)
DH07-9	2007	KCB	Piezometer	6120197	671101	841	25.3	0	90	0.91	26	18.3 - 19.8	Silty clay (TILL)
DH08-01A	2008	KCB	Monitoring Well	6120064	670403	819	20.1	0	90	0.95	50	16.15 - 19.2	Wacke
DH08-01B	2008	KCB	Monitoring Well	6120064	670403	819	12.8	0	90	0.92	50	8.53 - 12.8	Trace Cobbles and Boulders (TILL)
DH08-02	2008	KCB	Monitoring Well	6120472	669743	796	12.4	0	90	0.91	50	8.81 - 12.4	Shale
DH08-03	2008	KCB	Piezometer	6120229	669837	833	55.17	n/a	55	0.93	26	54.17 - 55.17	Biotite Feldspar Porphyry
DH06-2	2006	KP	Monitoring Well	6123723	670576	950	39.5	0	90	1	50	30.5 to 33.5	Volcanic unit
DH06-3	2006	KP	Monitoring Well	6123781	670541	950	37	0	90	1	50	4 to 5.5	Silt/Clay matrix with some gravel
DH06-4	2006	KP	Monitoring Well	6123060	670997	983	41.5	0	90	1	50	24.4 to 27.4	Limestone
DH06-6	2006	KP	Monitoring Well	6122655	671486	960	36.7	0	90	1	50	15.2 to 18.3	Volcanic unit
DH06-7	2006	KP	Monitoring Well	6122667	671775	993	43	0	90	1	50	30.5 to 33.5	Volcanic unit/ fine grained siltstone/sandstone
DH06-8	2006	KP	Monitoring Well	6119649	671249	838	39.9	0	90	1	50	36.6 to 39.6	Clay with some sand
DH06-9	2006	KP	Monitoring Well	6119478	671152	835	33.2	0	90	1	50	27.4 to 30.5	Silt/Clay matrix with traces of gravel and trace sand
DH06-10	2006	KP	Monitoring Well	6125683	671523	1,001	53.6	0	90	1	50	29 to 32	Sandstone/Fine grained siltstone
DH06-11	2006	KP	Monitoring Well	6125568	671912	965	37	0	90	1	50	1.5 to 3	Silt/Clay matrix with some gravel
DH06-12	2006	KP	Monitoring Well	6125182	672265	996	58	0	90	1	50	27.4 to 30.5	Sandstone/Siltstone
DH06-13	2006	KP	Monitoring Well	6119111	670800	808	20.3	0	90	1	50	17.1 to 20.1	Feldspar Biotite Porphyry
DH06-14	2006	KP	Monitoring Well	6119159	671396	840	29	0	90	1	50	17.1 to 20.1	Silt/Clay matrix with some gravel
DH06-15a	2006	KP	Monitoring Well	6120320	670693	817	33.1	0	90	1	50	29.9 to 32.9	Silt/Clay matrix with some gravel
DH06-15b	2006	KP	Monitoring Well	6120319	670690	817	5.6	0	90	1	50	2.4 to 5.5	Sandy silt to silty sand
DH06-16	2006	KP	Monitoring Well	6120880	669420	762	3.8	0	90	1	25	2.1 to 3.7	Silt/Clay matrix with some sand and gravel
DH06-17	2006	KP	Monitoring Well	6122420	669500	763	1.5	0	90	1	25	0.9 to 1.5	Silt/Clay matrix with some sand and gravel
GW1	2006	KP	Monitoring Well	6118724	670847	795	4.3	0	90	1	50	1.5 to 3.2	Silt/clay matrix with some gravel and highly decomposed bedrock
9000-1	2006	KP	Standpipe Piezometer	6119060	670844	818.1	177.1	232.6	55	unknown	19.05	26 to 32	Feldspar Biotite Porphyry
9240-1	2006	KP	Standpipe Piezometer	6119240	670920	848.9	277.7	296.5	45	unknown	19.05	59 to 65.4	Feldspar Biotite Porphyry
9240-3	2006	KP	Standpipe Piezometer	6119240	670760	805	232.6	11.4	55	unknown	19.05	33 to 39.3	Feldspar Biotite Porphyry
MET-1	2006	KP	Vibrating Wire	6119421	670530						**Information unavailable**		
MET-2	2006	KP	Vibrating Wire	6119244	670549						**Information unavailable**		
MET-3	2006	KP	Vibrating Wire	6119543	670569						**Information unavailable**		

Notes:

***masl = metres above sea level.**

****mags = metres above ground surface.**

*****mbgs = metres below ground surface.**

1. Contractors: KCB = Klohn Crippen Berger; KP = Knight Piésold Contracting Ltd.

2. PVC PIPE DIAMETERS: 26 mm = nominal 1"; 50 mm = nominal 2", 19.05 mm = nominal 3/4".

Table 3.1-3
Test Pit and Drillhole Details

Identification	Installation Year	Contractor	Description	UTM Location		Elevation	Depth
				Northing	Easting	(masl)*	(mbgs)**
TP07-1	2007	Klohn Crippen Berger	Test Pit	6120423	670641	821	5
TP07-2	2007	Klohn Crippen Berger	Test Pit	6121305	670015	795	6
TP07-3	2007	Klohn Crippen Berger	Test Pit	6121117	669994	795	6
TP07-4	2007	Klohn Crippen Berger	Test Pit	6120999	669939	789	6
TP07-5	2007	Klohn Crippen Berger	Test Pit	6120486	670347	828	6
TP07-6	2007	Klohn Crippen Berger	Test Pit	6120827	669928	776	6
TP07-7	2007	Klohn Crippen Berger	Test Pit	6123188	672197	1,040	2
TP07-8	2007	Klohn Crippen Berger	Test Pit	6123524	672499	1,025	3.4
DH07-8	2007	Klohn Crippen Berger	Drill hole	6120422	671193	877	4.3
DH07-10	2007	Klohn Crippen Berger	Drill hole	6120299	671036	845	47.5
DH06-1	2006	Knight Piésold	Drillhole	6123950	670785	950	126.3
9060-2	2006	Knight Piésold	Drillhole	6119060	671000	810	248.4
9220-1	2006	Knight Piésold	Drillhole	6119220	670589	849	127.4
9360-1	2006	Knight Piésold	Drillhole	6119360	670422	801.9	209.7
TP06-15	2006	Knight Piésold	Test Pit	6124074	670801	955	3.4
TP06-16	2006	Knight Piésold	Test Pit	6123975	671085	966	2.4
TP06-17	2006	Knight Piésold	Test Pit	6123668	671168	967	3.4
TP06-18	2006	Knight Piésold	Test Pit	6123527	671038	963	4.6
TP06-19	2006	Knight Piésold	Test Pit	6123650	671400	970	3.7
TP06-20	2006	Knight Piésold	Test Pit	6123321	671258	970	3
TP06-21	2006	Knight Piésold	Test Pit	6123485	671487	972	3.4
TP06-22	2006	Knight Piésold	Test Pit	6123214	671481	973	3.5

3.2.2.1 MW07-01A

Monitoring well MW07-01A was installed north of the TSF north dam. At this location, bedrock in this borehole was encountered at 14.93 mbgs and consisted of light green and very fine-grained glauconitic tuff with concretional structures distributed in a fine-grained matrix (14.93 mbgs to 28.04 mbgs) (Appendix A: Figure A1). The lithologic horizon at this location corresponds with the Saddle Hill Formation.

A single constant head packer test was performed in the interval from 16.76 mbgs to 28.04 mbgs at the bottom of this borehole. The measured hydraulic conductivity was determined to be 1.20×10^{-6} m/s (Appendix B: Figure B1).

Table 3.2-1
Morrison Copper/Gold Project: Summary of Overburden Hydraulic Conductivity Testing

Identification	Contractor	Location	Site Elevation (masl)*	Test Method	Tested Interval (mbgs)**	Tested Interval Midpoint (mbgs)**	Midpoint Elevation (masl)*	Lithology	Hydraulic Conductivity (m/s)
MW07-03B	Rescan	South of Main Dam	782	Slug Test - FHT	2.89 to 5.94	4.42	777.59	Glacial Till	7.00E-07
				Slug Test - RHT	2.89 to 5.94	4.42	777.59	Glacial Till	9.50E-07
MW07-04A	Rescan	South of Main Dam	822	Slug Test - RHT	37.79 to 40.84	39.32	782.69	Glacial Till	6.26E-08
				Slug Test - RHT	37.79 to 40.84	39.32	782.69	Glacial Till	4.83E-08
				Slug Test - RHT	37.79 to 40.84	39.32	782.69	Glacial Till	4.93E-08
MW07-04B	Rescan	South of Main Dam	822	Slug Test - FHT	3.05 to 6.09	4.57	817.43	Glacial Till	5.63E-07
				Slug Test - FHT	3.05 to 6.09	4.57	817.43	Glacial Till	3.49E-07
MW07-05B	Rescan	Open Pit	807	Slug Test - RHT	18.29 to 21.33	19.81	787.19	Glacial Till	5.20E-07
MW07-06B	Rescan	West of Open Pit	746	Slug Test - FHT	2.13 to 5.18	3.66	742.35	Glacial Till	1.10E-06
				Slug Test - FHT	2.13 to 5.18	3.66	742.35	Glacial Till	1.02E-06
MW07-08B	Rescan	Waste Rock Dump	840	Slug Test - FHT	7.31 to 10.36	8.84	831.17	Glacial Till	1.20E-08
DH07-2B	KCB	North Dam	990	Falling Head Test	7.6 to 10.7	9.15		Till	1.40E-10
DH07-3B	KCB	Main Dam	974	Falling Head Test	12.0 to 15.1	13.55	960.45	Till	3.10E-10
DH07-1A	KCB	North Dam	973	Falling Head Test	2.7 to 5.8	4.25	968.75	Till	4.70E-11
DH06-2	KP	Tailings Facilities	950	Shelby Tube	1.2 to 1.7	1.45	948.55	Till with silt/clay, trace sand and gravel	1.70E-09
DH06-7	KP	Tailings Facilities	993	Shelby Tube	1.2 to 1.5	1.35	991.65	Till with some gravel and trace sand	1.40E-05
DH06-9	KP	Old Plant Site	835	Shelby Tube	1.2 to 1.5	1.35	833.65	clay	2.40E-08
DH06-11	KP	Tailings Facilities	965	Shelby Tube	2.6 to 2.7	2.65	962.35	Till with silt/clay matrix	5.00E-07
DH06-12	KP	Tailings Facilities	996	Shelby Tube	1.4 to 1.5	1.45	994.55	Till with silt/clay matrix and some gravel	2.00E-10
TP06-15	KP	Tailings Facilities	955	Proctor Compacted	1.4	n/a	n/a	Till	1.50E-10
					2.4	n/a	n/a		
TP06-16	KPC	Tailings Facilities	966	Proctor Compacted	1.2	n/a	n/a	Till	1.50E-10
					2.4	n/a	n/a		
TP06-17	KPC	Tailings Facilities	967	Proctor Compacted	1.2	n/a	n/a	Till	1.50E-10
					3	n/a	n/a		
TP06-18	KP	Tailings Facilities	963	Proctor Compacted	0.6	n/a	n/a	Till	6.10E-09
					1.5	n/a	n/a		
					4.6	n/a	n/a		
TP06-19	KP	Tailings Facilities	970	Proctor Compacted	0.9	n/a	n/a	Till	6.10E-09
					3	n/a	n/a		
TP06-20	KP	Tailings Facilities	970	Proctor Compacted	0 to 1.5	0.75	969.25	Till	1.60E-07
					1.5	n/a	n/a		
TP06-21	KP	Tailings Facilities	972	Proctor Compacted	0 to 1.2	0.6	971.40	Till	1.60E-07
					2.7	n/a	n/a		
TP06-22	KP	Tailings Facilities	973	Proctor Compacted	1.2	n/a	n/a	Till	1.60E-07

Notes:
RHT = rising head test.
FHT = falling head test.
***masl = metres above sea level.**
****mags = metres above ground surface.**

Table 3.2-2
Morrison Copper/Gold Project: Summary of Bedrock Hydraulic Conductivity Testing

Well ID	Contractor	Location	Test Method	Site Elevation (masl)*	Tested Interval (mbgs)**	Tested Interval Midpoint (mbgs)**	Midpoint Elevation (masl)*	Lithology	Hydraulic Conductivity (m/s)
MW07-01A	Rescan	North Dam	Packer - CHT	970	16.76 to 28.04	22.40	947.60	Glauconitic Volcanoclastic unit	1.20E-06
MW07-02A	Rescan	East of TSF	Packer - CHT	1,091	4.57 to 21.94	13.26	1,077.75	Fossiliferous Limestone	6.78E-07
			Packer - CHT		21.94 to 40.23	31.09	1,059.92	Breccia	7.45E-09
MW07-02B	Rescan	East of TSF	Slug Test - RHT	1,091	6.1 to 9.14	7.62	1,083.38	Fossiliferous Limestone	1.43E-06
MW07-05A	Rescan	Open Pit	Slug Test - FHT	807	1.22 to 20.42	10.82	796.18	Altered Feldspar Biotite Porphyry	1.77E-07
			Slug Test - FHT		21.33 to 28.04	24.69	782.32	Altered Feldspar Biotite Porphyry	2.23E-07
			Packer - CHT		30.48 to 40.23	35.36	771.65	Altered Feldspar Biotite Porphyry	7.34E-07
			Slug Test - RHT		37.18 to 40.23	38.71	768.30	Altered Feldspar Biotite Porphyry	6.69E-07
			Slug Test - RHT		37.18 to 40.23	38.71	768.30	Altered Feldspar Biotite Porphyry	6.30E-07
MW07-06A	Rescan	Southwest of Open Pit	Slug Test - FHT	746	11.58 to 14.63	13.11	732.90	Volcanic Tuff	2.43E-08
			Slug Test - FHT		11.58 to 14.63	13.11	732.90	Volcanic Tuff	3.21E-08
			Slug Test - RHT		11.58 to 14.63	13.11	732.90	Volcanic Tuff	2.16E-07
MW07-07A	Rescan	Open Pit	Slug Test - FHT	837	9.14 to 15.85	12.50	824.51	Altered Feldspar Biotite Porphyry	3.11E-07
			Packer - CHT		32 to 38.71	35.36	801.65	Altered Feldspar Biotite Porphyry	1.20E-06
			Packer - CHT		54.86 to 57.91	56.39	780.62	Altered Feldspar Biotite Porphyry	6.20E-09
			Slug Test - FHT		74.67 to 77.22	75.95	761.06	Altered Feldspar Biotite Porphyry	8.50E-07
			Packer - CHT		119.02 to 149.65	134.34	702.67	Altered Feldspar Biotite Porphyry	3.51E-08
			Slug Test - FHT		146.45 to 149.65	148.05	688.95	Altered Feldspar Biotite Porphyry	5.70E-07
MW07-08A	Rescan	Waste Rock Dump	Slug Test - RHT	840	37.18 to 40.23	38.71	801.30	Siltstone	2.08E-09
			Slug Test - RHT		37.18 to 40.23	38.71	801.30	Siltstone	1.90E-09
			Packer - CHT		15.39 to 40.23	27.81	812.19	Siltstone	8.59E-09
MW08-01A	Rescan	In between Open Pit and Waste Rock Dump	Packer - CHT	832	58.37 to 65.99	62.18	769.82	Tuff	1.55E-07
			Packer - CHT		67.51 to 76.66	72.09	759.91	Tuff	1.56E-06
			Packer - CHT		75.13 to 85.00	80.07	751.94	Tuff and Siltstone	4.83E-09
			Slug Test - RHT		70.26 to 78.64	74.45	757.55	Tuff and Siltstone	2.28E-06
MW08-02A	Rescan	West of Open Pit	Packer - CHT	752	42.98 to 49.07	46.03	705.97	Biotite Feldspar Porphyry	5.51E-07
			Packer - CHT		64.31 to 73.46	68.89	683.11	Biotite Feldspar Porphyry	1.23E-05
			Packer - CHT		105.46 to 113.08	109.27	642.73	Biotite Feldspar Porphyry	1.36E-07
			Packer - CHT		135.94 to 151.20	143.57	608.43	Siltstone and Biotite Feldspar	1.57E-06
			Packer -DT		82.60 to 91.74	87.17	664.83	Biotite Feldspar Porphyry	5.95E-07
			Slug Test - RHT		137.62 to 149.81	143.72	608.29	Biotite Feldspar Porphyry	4.62E-06
MW08-03A	Rescan	Low Grade Ore Stockpile	Packer - CHT	800	18.59 to 23.32	20.96	779.04	Sandstone	1.25E-06
			Packer - CHT		30.78 to 35.51	33.15	766.85	Sandstone	3.29E-06
			Slug Test - RHT		28.96 to 35.51	32.24	767.77	Sandstone	1.02E-05
DH07-1A	KCB	North Dam	Packer Test	973	23.35 to 35.66	29.505	943.50	Sandstone/mudstone	6.00E-07
			Packer Test		35.51 to 49.38	42.445	930.56	Sandstone/mudstone	7.00E-08
DH07-2A	KCB	North Dam	Packer Test	990	26.2 to 35.1	30.65	959.35	Siltstone	2.40E-07
DH07-3A	KCB	Main Dam	Packer Test	974	24.23 to 35.51	29.87	944.13	Sandstone	1.60E-06
			Packer Test		35.51 to 41.61	38.56	935.44	Sandstone/siltstone	1.80E-06
			Falling Head Test		24.2 to 35.5	29.85	944.15	Sandstone	2.20E-06
DH07-4A	KCB	Main Dam	Packer Test	960	15.54 to 27.89	21.715	938.29	Sandstone/siltstone	3.20E-07
			Packer Test		36.12 to 46.18	41.15	918.85	Siltstone	2.30E-07
			Packer Test		27.89 to 36.12	32.005	928.00	Sandstone/siltstone	1.50E-07
DH07-05B	KCB	Main Dam	Falling Head Test	935	26.4 to 43	34.7	900.30	Volcaniclastic	6.20E-07
			Packer Test		45.26 to 58.22	51.74	883.26	Siltstone/Sandstone Cong.	6.60E-08
DH06-1	KP	Open Pit	Packer Permeability	950	27.4 to 60.8	44.1	911.81	Zs	1.40E-06
					59.4 to 89.9	74.65	885.35	Vol	2.40E-07
					89.9 to 126.5	108.2	841.80	Vol	negligible [1]
DH06-2	KP	Tailings Facilities	Packer Permeability	950	9.1 to 39.5	24.3	925.70	Vol	5.10E-07
DH06-3	KP	Tailings Facilities	Packer Permeability	950	6.7 to 36.9	23.3	926.70	Vol	3.30E-07
DH06-4	KP	Tailings Facilities	Packer Permeability	983	11 to 41.5	26.25	956.75	LM	7.40E-07
DH06-6	KP	Tailings Facilities	Packer Permeability	960	9.6 to 36.7	23.15	936.85	Vol	1.40E-06
DH06-7	KP	Tailings Facilities	Packer Permeability	993	12.8 to 43.3	28.05	964.95	Vol/ZS/SST	5.10E-06
DH06-10	KP	Tailings Facilities	Packer Permeability	1,001	21.9 to 53.6	37.75	963.25	SST/ZS	negligible [2]
DH06-11	KP	Tailings Facilities	Packer Permeability	965	8.8 to 36.9	22.85	942.15	ZS	7.20E-07
DH06-12	KP	Tailings Facilities	Packer Permeability	996	13.1 to 58.3	35.7	960.30	SST/Siltst/ZS	2.80E-07
DH06-13	KP	Open Pit	Packer Permeability	808	11.9 to 20.3	16.1	791.90	BFP	4.50E-07
DH06-14	KP	Waste Rock Dump	Packer Permeability	840	21.9 to 29.3	25.6	814.40	ZS	8.50E-07
9240-3	KP	Open Pit	Lugeon	833	62.8 to 64.9	63.85	780.70	Altered Feldspar Biotite Porphyry	3.90E-10
					71.9 to 74.1	73	773.20	Altered Feldspar Biotite Porphyry	1.60E-09
					93.3 to 95.4	94.35	755.71	Altered Feldspar Biotite Porphyry	1.00E-10
					105.5 to 107.6	106.55	745.72	Fine grained sandstone	2.00E-10
9060-2	KP	Open Pit	Packer	810	20.7 to 22	21.35	792.51	Altered Feldspar Biotite Porphyry	1.70E-08
					148.1 to 150.3	149.2	687.78	Altered Feldspar Biotite Porphyry	8.10E-11
9220-1	KP	Open Pit	Packer Test	849	34.4 to 75.3	54.85	804.07	Altered Feldspar Biotite Porphyry	1.30E-07
9360-1	KP	Open Pit	Packer Test	801.9	58.8 to 100	79.4	736.86	Altered Feldspar Biotite Porphyry	1.50E-10

Notes:
RHT = rising head test.
FHT = falling head test.
CHT = constant head test.
DT = discharge test.
***masl = metres above sea level.**
****mags = metres above ground surface.**
[1] = hydraulic conductivity too low to be measured.
[2] = hydraulic conductivity too high to be measured.

3.2.2.2 MW07-02A

Monitoring well MW07-02A was installed east of the proposed TSF. At this location, bedrock was encountered in this borehole at 1.83 mbgs. From bottom to top, bedrock lithologic units consist of a volcanic breccia unit overlain by a dark brown and fine-grained fossiliferous limestone (contact at 20.42 mbgs)(Appendix A: Figure A3). The lithological horizons at this location correspond with the Saddle Hill Formation

A total of two constant head packer tests were performed. One packer test was performed in the fossiliferous unit from 4.57 mbgs to 21.94 mbgs, with a calculated hydraulic conductivity of 6.78×10^{-7} m/s. The second packer test was performed in the volcanic breccia unit from 21.94 mbgs to 40.23 mbgs, with a calculated hydraulic conductivity of 7.45×10^{-9} m/s (Appendix B: Figures B2 and B3).

3.2.2.3 MW07-02B

Monitoring well MW07-02B was installed east of the proposed TSF. Bedrock was encountered in this borehole at 1.83 mbgs (Appendix A: Figure A4). The core from this borehole consists of fossiliferous limestone, which corresponds with the Saddle Hill Formation.

One rising head slug test was performed in this borehole over a test interval from 6.1 mbgs to 9.14 mbgs, with a calculated hydraulic conductivity of 1.43×10^{-6} m/s (Appendix C: Figure C1).

3.2.2.4 MW07-05A

Monitoring well MW07-05A was installed west of the proposed open pit area. At this location, bedrock was encountered in this borehole at 3.65 mbgs and consists of altered feldspar biotite porphyry that corresponds with Eocene Babine Feldspar Biotite Porphyry (FBP). The alteration types could not be described since lithological logging was based on rock chip samples (Appendix A: Figure A8).

One constant head packer test and two falling head packer tests were performed at varying intervals in this borehole along with two rising head slug tests within the screened interval. Calculated hydraulic conductivities varied between 1.77×10^{-7} m/s and 7.34×10^{-7} m/s. Packer testing data is presented in Appendix B, Figure B4 and rising/falling head test data is presented in Appendix C: Figures C9 to C12).

3.2.2.5 MW07-06A

Monitoring well MW07-06A was installed between the proposed open pit area and Morrison Lake. In this borehole, bedrock was encountered at 5.48 mbgs and consisted of light to dark grey andesitic tuff (Appendix A: Figure A10). The lithologic unit at this location corresponds with the Ashman Formation.

Two falling head tests and one rising head test were conducted at the screened interval in this well (11.58 m to 14.63 m). The calculated hydraulic conductivity values were 2.43×10^{-8} m/s, 3.21×10^{-8} m/s, and 2.16×10^{-7} m/s, respectively (Appendix C: Figures C14 to C16).

3.2.2.6 MW07-07A

Monitoring well MW07-07A was installed within the proposed open pit area. At this location, bedrock was encountered at 2.74 mbgs (Appendix A: Figure A12). Based on core samples obtained from this borehole, bedrock is composed of altered biotite feldspar porphyry. Alteration varied from moderate to intense chloritization, with moderate to minor silicification, calcification and partial argillization. Samples contained disseminated pyrite and minor amounts of chalcopyrite. Sulphide minerals also exist as fracture fillings within rock samples. Iron oxide staining along the open fractures was mostly observed at shallow intervals, especially above groundwater level. The lithological horizons at this location correspond with the Eocene Babine feldspar biotite porphyry.

Three constant head packer tests and three falling head packer tests were performed at varying intervals along the length of the borehole, starting at 9.14 mbgs and ending at 146.45 mbgs. The calculated hydraulic conductivities ranged from 6.20×10^{-9} m/s to 1.20×10^{-6} m/s. The falling head test results are presented in Appendix C, Figures C19 to C21, and packer testing results are presented in Appendix B, Figures B5 to B7.

3.2.2.7 MW07-08A

Monitoring well MW07-08A was installed on the northern edge of the proposed waste rock dump. At this location bedrock was encountered in the borehole at 12.49 mbgs (Appendix A: Figure A14). Based on rock chip samples obtained from this borehole, bedrock consists of light green fine-grained siltstone or sandstone that corresponds with the Ashman Formation.

A constant head packer test within the siltstone/sandstone interval from 15.39 mbgs to 40.23 mbgs yielded a calculated hydraulic conductivity of 8.59×10^{-9} m/s, while two rising head tests within the screened interval from 37.18 mbgs to 40.23 mbgs yielded calculated hydraulic conductivities of 1.90×10^{-9} m/s and 2.08×10^{-9} m/s, respectively. Appendix B, Figure B8, presents the packer test results and Appendix C, Figures C22 and C23, presents the rising head test results.

3.2.2.8 MW08-01A

Monitoring well MW08-01A was installed in between the proposed waste rock dump and the open pit. At this location bedrock was encountered in the borehole at 55.79 mbgs (Appendix A: Figure A13). Based on core samples obtained from this borehole, bedrock is composed of alternating layers of siltstone and tuff. The lithological horizons at this location correspond with the Jurassic Ashman Formation and Saddle Hill Formation.

Three constant head packer tests were performed at varying intervals along the length of the borehole, starting at 58.37 mbgs and ending at 85.00 mbgs (Appendix B: Figures B9 to B11). One rising head test was performed along the length of the screened interval of the well (70.26 m to 78.64 m) (Appendix C, Figure C25). The calculated hydraulic conductivity values ranged from 4.83×10^{-9} m/s to 1.56×10^{-6}m/s.

3.2.2.9 MW08-02A

Monitoring well MW08-02A was installed between the western edge of the proposed open pit and Morrison Lake. At this location bedrock was encountered at 4.48 mbgs (Appendix A:

Figure A15). Based on core samples obtained from this borehole, bedrock is composed of biotite feldspar porphyry alternating with siltstone and minor sandstone layers near the bottom of the borehole. One mafic dike was encountered near the top of the hole (7.45 m to 12.05 m). The lithological horizons at this location correspond mainly with the Eocene Babine Biotite Feldspar Porphyry (Figure 2.1-1).

Four constant head packer tests, one discharge packer test and one rising head test were conducted at varying intervals along the length of the borehole, starting at 42.98 mbgs and ending at 151.21 mbgs. The calculated hydraulic conductivities ranged from 5.95×10^{-7} m/s to 1.23×10^{-5} m/s. Packer testing data including a recharge/discharge test, are presented in Appendix B, Figures B12 to B15, and falling head test result results are presented in Appendix C, Figure C26.

3.2.2.10 MW08-03A

Monitoring well MW08-03A was installed north of the proposed open pit, in the area of the proposed low grade ore stock pile. At this location, bedrock was encountered at 16.56 mbgs (Appendix A: Figure A20). Based on core samples obtained from this borehole, bedrock is composed of sandstone and wacke, corresponding with the Ashman Formation.

Two constant head packer tests and one rising head test were conducted at varying intervals along the length of the borehole, starting at 18.59 mbgs and ending at 35.51 mbgs. The calculated hydraulic conductivities ranged from 1.25×10^{-6} m/s to 1.02×10^{-5} m/s (Table 3.2-2). The packer test results are provided in Appendix B: Figures B15 and B16. The rising head test results are provided in Appendix C: Figure C27.

3.2.2.11 Other Studies

The hydraulic conductivity of the bedrock in five boreholes was also determined by Klohn Crippen Berger in 2007 through nine packer tests and two rising head tests (Klohn Crippen Berger 2008). In 2006, Knight Piésold completed 21 packer tests in 15 boreholes (Knight Piésold 2006a, 2006b). The measured hydraulic conductivity values from tests in these two studies range from 8.10×10^{-11} m/s to 5.10×10^{-6} m/s. Notably, this range does not include two hydraulic conductivity values defined as "negligible" by Knight Piésold in drill holes DH06-01 (where there was no water acceptance because of low permeability) and DH06-10 (where the rock would not hold the water because of high permeability).

3.2.2.12 Summary

The calculated hydraulic conductivity values from the Rescan boreholes/monitoring wells ranged from 1.90×10^{-9} m/s to 1.23×10^{-5} m/s. Hydraulic conductivity values measured in the Morrison MFA generally correspond to the values in the literature for fractured bedrock, which range from 1×10^{-8} m/s to 1×10^{-3} m/s (Freeze and Cherry 1979).

3.2.2.13 Pit Inflow Memorandum

In a memorandum produced by Rescan for PBM on November 25, 2008, titled *Morrison Pit 2D Inflow Estimate*, hydraulic conductivity values of the bedrock in the area of the pit were analyzed to estimate a pit inflow rate. Hydraulic conductivity values were graphed against elevation and depth below ground surface. These hydraulic conductivity results showed a general trend of decreasing hydraulic conductivity with decreasing elevation and were also shown to deviate in isolated zones of higher conductivity throughout the rock mass. From the information available, there appears to be an "upper bedrock" layer, which is more fractured and thus associated with higher conductivity values. Underlying the upper bedrock layer is a "mid-bedrock" layer that has a range of hydraulic conductivities varying over several orders of magnitude, but typically the hydraulic conductivity values tends to decrease with depth below ground surface as the rock mass becomes much less fractured with depth (Rescan 2008). The hydraulic conductivity data are limited to a maximum depth of 151.2 mbgs.

3.3 Groundwater Flow

To determine the general groundwater flow and temporal fluctuation of the water table, groundwater level measurements were made in Rescan groundwater monitoring wells in November, 2007, and January, April, July, and October, 2008 (Table 3.3-1). Manual water level measurements recorded in Klohn Crippen Berger and Knight Piésold monitoring wells and piezometers are presented in Tables 3.3-2 and 3.3-3.

Groundwater levels varied from flowing artesian in MW07-01A, MW07-03A, and MW08-02B during all seasons, to a maximum of 42.7 mbgs in MW07-07A in April, 2008. In general, water levels are highest in the spring and are lowest in fall and winter. The initial water level measurements taken in MW07-04B and MW07-08B were significantly lower than subsequent water level measurements. This was likely caused by the incomplete recharge of the well after development at the time of water level measurement. For increased clarity, Figure 3.3-1 separates water levels measured in monitoring wells screened in the overburden from those screened in the bedrock. Artesian wells were plotted as having a water level of 0 mbgs since artesian pressure was not measured.

A single channel vibrating wire piezometer was installed in monitoring well MW07-07A in the open pit area in October, 2007. The data logger was installed at a depth of 71.32 mbgs and records water level in metres above the logger. Water level measurements have been recorded every 12 hours for one full year (October 2007 to October 2008) and are presented in Figure 3.3-2. Water levels dropped from October, 2007, to April, 2008. Water levels rose by 3.5 m from early April to mid-May. Water levels dropped again from mid-April to October, 2008.

Available water level data from monitoring wells and piezometers on-site were combined to create a potentiometric surface map (Figures 3.3-3a and 3.3-3b). The water levels in wells 9240-1 and 9000-1 were not included in the data set on which the potentiometric surface map was based. This was because only one measurement was available at these two locations that did not agree with multiple measurements in wells in close proximity.

In the northern area of the property, groundwater flows in a northeast direction away from the north dam. The TSF is surrounded by highlands to the east and to the northwest. Water flows from these highlands into the proposed tailings pond area, where wetlands are common. Water ultimately drains from this area in a southwest direction into Morrison Lake. In the southern

Table 3.3-1
Morrison Copper/Gold Project: Rescan Water Level Measurements

Well I.D.	Elevation (masl)*	First Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Second Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Third Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Fourth Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Fifth Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Average Elevation (masl)*
MW07-01A	970	16-Nov-07	artesian	970	23-Jan-08	artesian	970	7-Apr-08	artesian	970	18-Jul-08	artesian	970	8-Oct-08	artesian	970	970.0
MW07-01B	970	16-Nov-07	dry	unknown	23-Jan-08	frozen	unknown	7-Apr-08	frozen	unknown	18-Jul-08	-0.94	970.94	8-Oct-08	5.18	964.82	967.9
MW07-02A	1,091	16-Nov-07	2.19	1,088.81	23-Jan-08	3.38	1,087.62	7-Apr-08	3.34	1,087.66	18-Jul-08	1.85	1,089.15	8-Oct-08	3.55	1,087.45	1,088.1
MW07-02B	1,091	16-Nov-07	1.51	1,089.49	23-Jan-08	2.52	1,088.48	7-Apr-08	2.845	1,088.16	18-Jul-08	2.37	1,088.63	8-Oct-08	1.93	1,089.07	1,088.8
MW07-03A	782	14-Nov-07	artesian	782	24-Jan-08	artesian	782	8-Apr-08	artesian	782	16-Jul-08	-0.83	782.83	5-Oct-08	0.71	781.29	782.0
MW07-03B	782	14-Nov-07	1.51	780.49	24-Jan-08	1.63	780.37	8-Apr-08	1.76	780.24	16-Jul-08	1.585	780.415	5-Oct-08	1.73	780.27	780.4
MW07-04A	822	14-Nov-07	23.38	798.62	24-Jan-08	25.37	796.63	8-Apr-08	25.34	796.66	16-Jul-08	25.45	796.55	5-Oct-08	25.38	796.62	797.0
MW07-04B	822	14-Nov-07	5.42	816.58	24-Jan-08	0.87	821.13	8-Apr-08	0.74	821.26	16-Jul-08	1.74	820.26	5-Oct-08	0.67	821.33	820.1
MW07-05A	807	12-Nov-07	16.59	790.41	25-Jan-08	17.65	789.35	10-Apr-08	17.56	789.44	19-Jul-08	17.19	789.81	4-Oct-08	20.64	786.36	789.1
MW07-05B	807	12-Nov-07	17.34	789.66	25-Jan-08	16.91	790.09	10-Apr-08	17.56	789.44	17-Jul-08	16.135	790.865	4-Oct-08	17.78	789.22	789.9
MW07-06A	746	13-Nov-07	1.7	744.3	25-Jan-08	3.65	742.35	10-Apr-08	4.485	741.515	19-Jul-08	5.28	740.72	5-Oct-08	4.36	741.64	742.1
MW07-06B	746	13-Nov-07	2.25	743.75	25-Jan-08	2.22	743.78	10-Apr-08	3.05	742.95	19-Jul-08	3.27	742.73	5-Oct-08	2.69	743.31	743.3
MW07-07A	837	12-Nov-07	38.99	798.01	26-Jan-08	39.66	797.34	11-Apr-08	40.12	796.88	17-Jul-08	39.47	797.53	9-Oct-08	42.7	794.3	796.8
MW07-07B	837	11-Nov-07	30.63	806.37	25-Jan-08	30.79	806.21	10-Apr-08	30.82	806.18	17-Jul-08	30.17	806.83	9-Oct-08	29.65	807.35	806.6
MW07-08A	840	12-Nov-07	0.02	839.98	24-Jan-08	0.72	839.28	9-Apr-08	1.645	838.355	15-Jul-08	1.61	838.39	4-Oct-08	0.49	839.51	839.1
MW07-08B	840	12-Nov-07	10.31	829.69	24-Jan-08	3.36	836.64	9-Apr-08	7.09	832.91	15-Jul-08	4.87	835.13	4-Oct-08	3.04	836.96	834.3
MW08-01A	832	10-Oct-08	24.93	807.07	-	-	-	-	-	-	-	-	-	-	-	-	-
MW08-01B	832	10-Oct-08	28.64	803.36	-	-	-	-	-	-	-	-	-	-	-	-	-
MW08-02A	752	9-Oct-08	3.83	748.17	-	-	-	-	-	-	-	-	-	-	-	-	-
MW08-02B	752	9-Oct-08	0	752	-	-	-	-	-	-	-	-	-	-	-	-	-
MW08-03A	800	10-Oct-08	12.66	787.34	-	-	-	-	-	-	-	-	-	-	-	-	-
MW08-03B	800	10-Oct-08	13.54	786.46	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

*** - Metres above sea level**

**** - Metres below groud surface**

Table 3.3-2
Klohn Crippen Berger Water Level Measurements

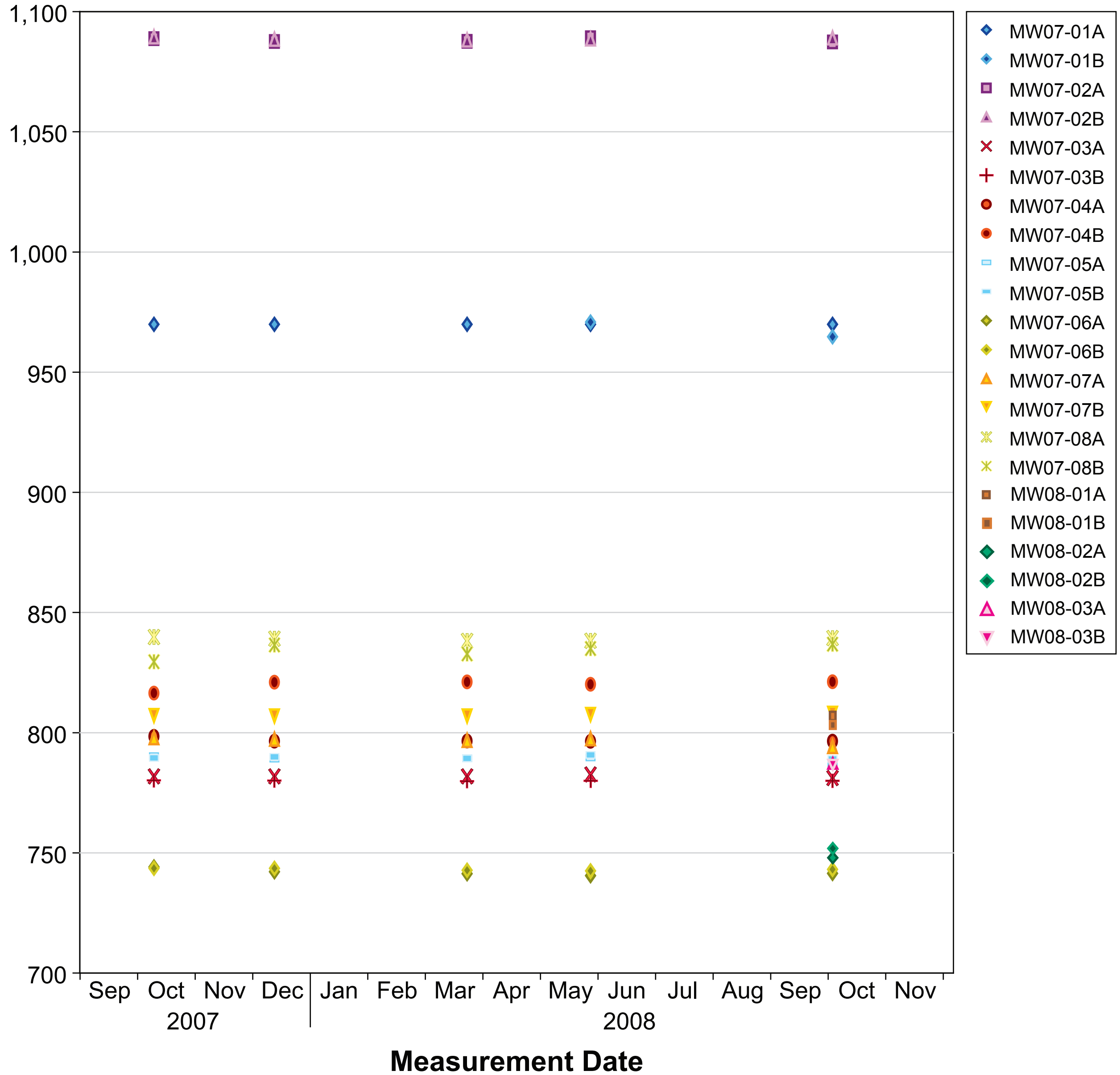
Identification	Installation Year		Sample Event 1	Sample Event 2	Sample Event 3	Sample Event 4
DH07-1A	2007	Date	Nov-07	6-Apr-08	18-Jul-08	8-Oct-08
		Water Level (mbgs)	-4.5 (artesian)	artesian	artesian	artesian
DH07-1B	2007	Date	6-Apr-08	18-Jul-08	8-Oct-08	
		Water Level (mbgs)	frozen	-0.83	-0.83	
DH07-2A	2007	Date	Nov-07	6-Apr-08	18-Jul-08	8-Oct-08
		Water Level (mbgs)	27.7	27.74	27.87	27.98
DH07-2B	2007	Date	6-Apr-08	18-Jul-08	8-Oct-08	
		Water Level (mbgs)	6.32	6.42	6.32	
DH07-3A	2007	Date	Nov-07	6-Apr-08	9-Oct-08	
		Water Level (mbgs)	10.7	8.59	8.78	
DH07-3B	2007	Date	6-Apr-08	9-Oct-08		
		Water Level (mbgs)	10.72	10.8		
DH07-4A (S1)	2007	Date	Nov-07	6-Apr-08	9-Oct-08	
		Water Level (mbgs)	9.7	10.28	9.94	
DH07-4A (S2)	2007	Date	Nov-07	6-Apr-08	9-Oct-08	
		Water Level (mbgs)	10.5	10.94	10.78	
DH07-4B (S1)	2007	Date	6-Apr-08	9-Oct-08		
		Water Level (mbgs)	10.77	10.57		
DH07-4B (S2)	2007	Date	6-Apr-08	9-Oct-08		
		Water Level (mbgs)	4.05	1.44		
DH07-5A (S1)	2007	Date	Nov-07	6-Apr-08		
		Water Level (mbgs)	9.3	11.47		
DH07-5A (S2)	2007	Date	Nov-07	6-Apr-08		
		Water Level (mbgs)	10	10.62		
DH07-5B	2007	Date	6-Apr-08			
		Water Level (mbgs)	11.5			
DH07-6	2007	Date	15-Jul-08	21-Sep-08		
		Water Level (mbgs)	artesian	-0.93		
DH07-7	2007	Date	15-Jul-08	21-Sep-08		
		Water Level (mbgs)	8.38	8.14		
DH07-9	2007	Date	15-Jul-08	21-Sep-08		
		Water Level (mbgs)	1.45	1.47		
DH08-01A	2008	Date	10-Oct-08			
		Water Level (mbgs)	6.68			
DH08-01B	2008	Date	10-Oct-08			
		Water Level (mbgs)	1.52			
DH08-02	2008	Date	10-Oct-08			
		Water Level (mbgs)	4.71			
DH08-03	2008	Date	10-Oct-08			
		Water Level (mbgs)	8.6			

mbgs = metres below ground surface

Table 3.3-3
Knight Piésold Water Level Measurements

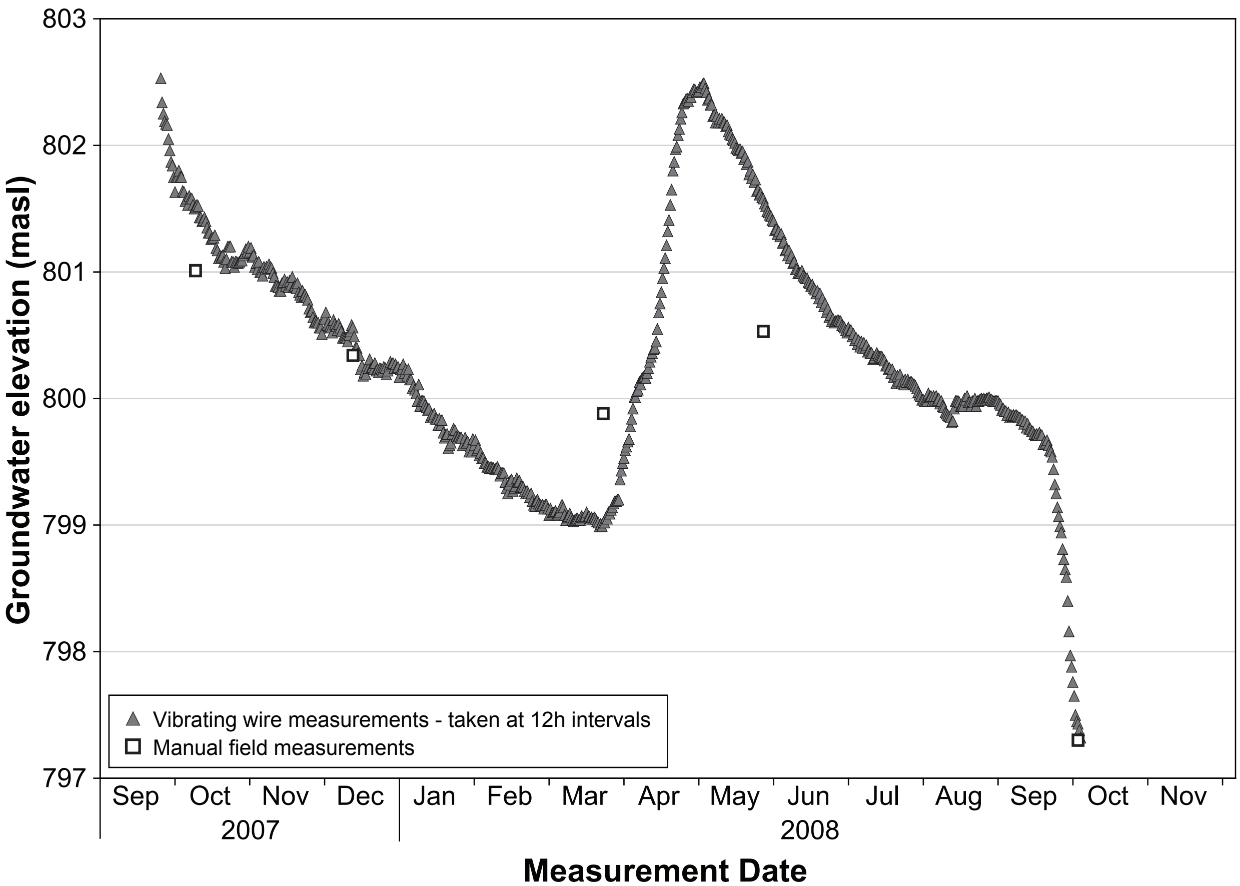
Identification		Sample Event 1	Sample Event 2	Sample Event 3
DH06-2	Date	6-Mar-06	9-Oct-08	
	Water Level (mbgs)	artesian	artesian	
DH06-3	Date	4-Mar-06	9-Oct-08	
	Water Level (mbgs)	4.5	2.75	
DH06-4	Date	9-Mar-06	9-Oct-08	
	Water Level (mbgs)	12.2	10.13	
DH06-6	Date	11-Mar-06	9-Oct-08	
	Water Level (mbgs)	artesian	artesian	
DH06-7	Date	1-Mar-06	9-Oct-08	
	Water Level (mbgs)	artesian	artesian	
DH06-8	Date	20-Mar-06	15-Jul-08	6-Oct-08
	Water Level (mbgs)	artesian	artesian	artesian
DH06-9	Date	20-Mar-06	15-Jul-08	6-Oct-08
	Water Level (mbgs)	21	7.3	7.42
DH06-10	Date	20-Feb-06	18-Jul-08	8-Oct-08
	Water Level (mbgs)	29.6	30.28	30.32
DH06-11	Date	22-Feb-06	18-Jul-08	8-Oct-08
	Water Level (mbgs)	1.2	2	1.79
DH06-12	Date	26-Feb-06	18-Jul-08	39729
	Water Level (mbgs)	3.8	3.95	4.34
DH06-13	Date	23-Mar-06		
	Water Level (mbgs)	8.8		
DH06-14	Date	Nov 05 - Apr 06	15-Jul-08	6-Oct-08
	Water Level (mbgs)	10.4	6.76	3.54
DH06-15a	Date	16-Mar-06	9-Oct-08	
	Water Level (mbgs)	artesian	artesian	
DH06-15b	Date	17-Mar-06		
	Water Level (mbgs)	3		
DH06-16	Date	2-Apr-06		
	Water Level (mbgs)	3		
DH06-17	Date	Nov 05 - Apr 06		
	Water Level (mbgs)	Dry		
GW1	Date	4-Apr-06		
	Water Level (mbgs)	2.6		
9000-1	Date	4-Feb-06		
	Water Level (mbgs)	22.48		
9240-1	Date	24-Jan-06		
	Water Level (mbgs)	51.84		
9240-3	Date	11-Feb-06		
	Water Level (mbgs)	6.37		

mbgs = metres below ground surface



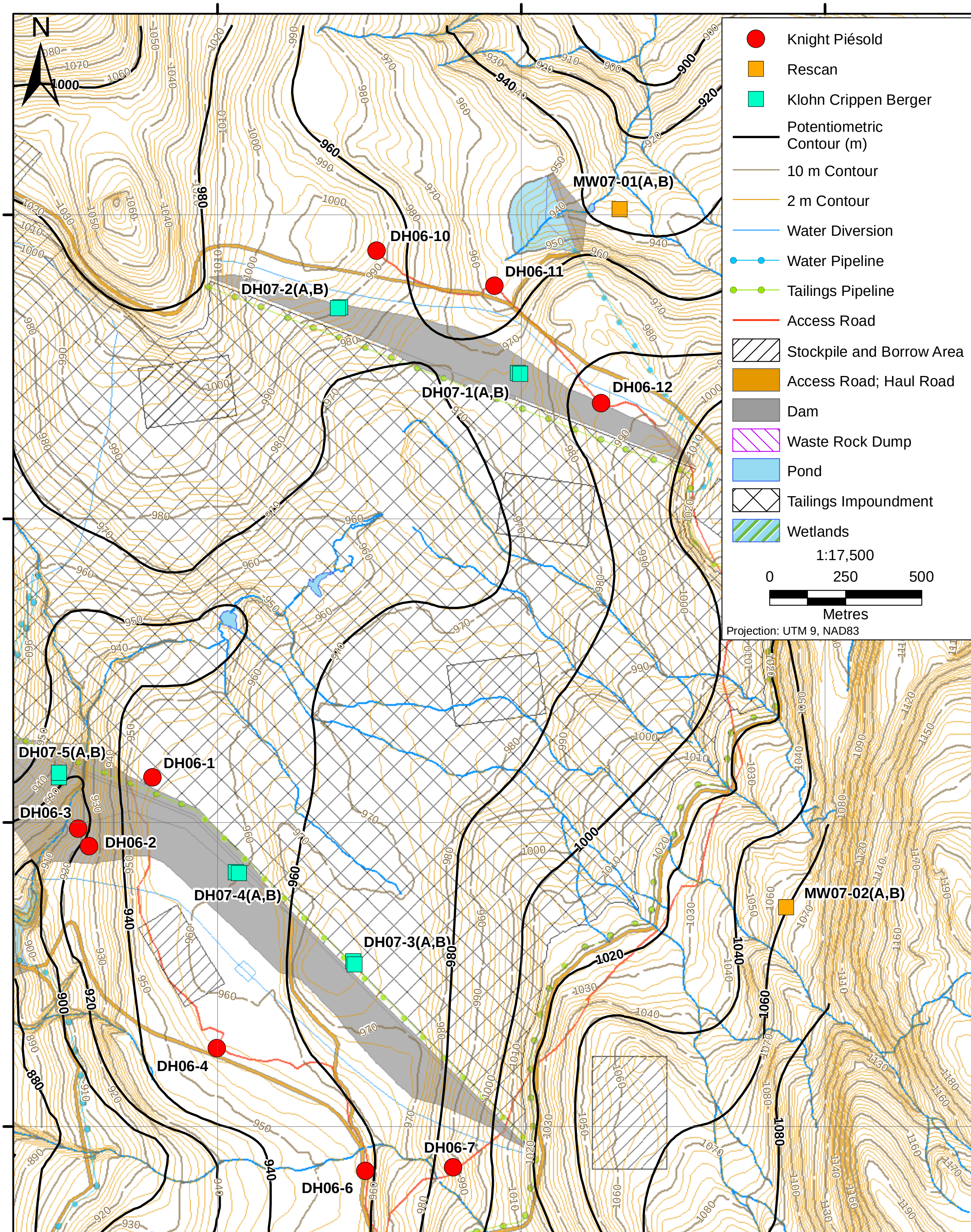
Morrison Copper/Gold Project:
Manual Groundwater Level Measurements from November 2007 to October 2008

FIGURE 3.3-1



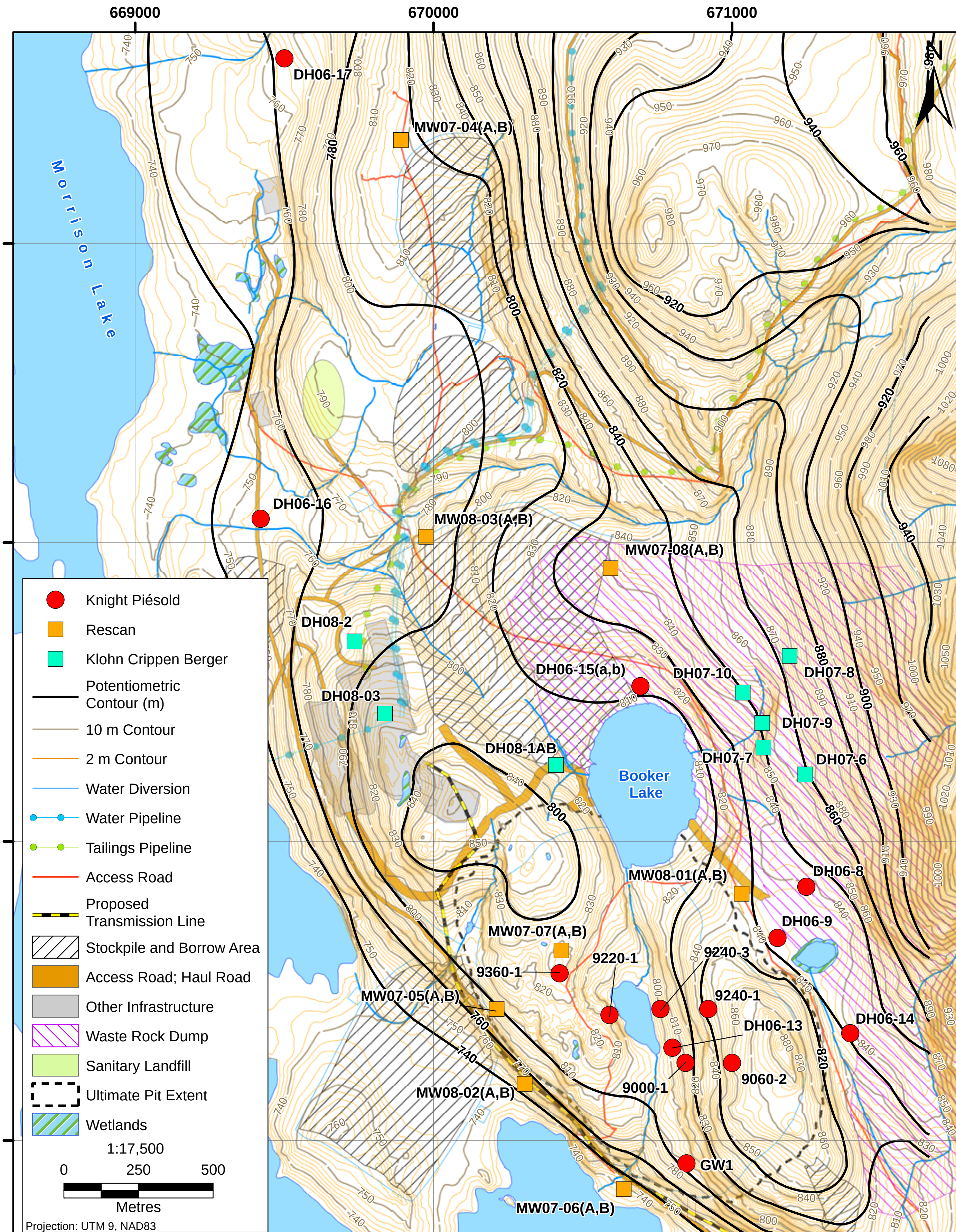
Morrison Copper/Gold Project: Groundwater Levels in MW07-07A from October 2007 to October 2008

FIGURE 3.3-2



Morrison Copper/Gold Project : Potentiometric Surface

FIGURE 3.3-3a



Morrison Copper/Gold Project : Potentiometric Surface

FIGURE 3.3-3b

portion of the property, in the proposed open pit location and surrounding area, groundwater generally flows in a southwest direction from the highlands to the east towards Morrison Lake. Two major fault structures are known to exist in the area of the proposed open pit. These will be significant contributors to the groundwater flow regime in the open pit area.

3.3.1 Vertical Gradients

Since the Rescan monitoring wells were installed in pairs near one another, and because they were screened at different elevations, it is possible to use the measured water levels in the well pairs to determine vertical groundwater gradients at various locations through the site.

Table 3.3-4 shows the measured groundwater levels within the Rescan wells (both the 2007 and 2008 wells). In general the groundwater gradient is downwards in wells at higher elevations (MW07-02 and MW07-04) and upwards at lower elevations (MW07-01, MW07-03, MW08-01, and MW08-03). Some exceptions to this general trend exist in the area of the open pit where MW07-05, MW07-06, MW07-07, and MW08-02 are located. It is anticipated that this is because of the effects from the proximity to the lake (MW07-05, MW07-06, and MW08-02) and geological fault structures (MW07-07).

3.4 Groundwater Recharge/Discharge

3.4.1 Recharge to Groundwater

3.4.1.1 Overburden Groundwater

The primary recharge sources to groundwater in the overburden are rainfall and snow melt waters. Environment Canada meteorological stations within 100 km of the Project property recorded an average annual precipitation of around 500 mm. Precipitation measured through one full year by an automated meteorological station installed by Rescan on the Morrison property totalled 628 mm (Rescan 2009a). Secondary sources of groundwater recharge in the overburden will include upward gradients in the subsurface flows originating from elevated areas and flowing towards lower elevations.

3.4.1.2 Bedrock Groundwater

Recharge to the bedrock groundwater regime is mainly from two sources: direct infiltration from exposed bedrock on the surface and leakage from the overlying overburden. Fractured bedrock exposed to the ground surface generally occurs at higher elevations.

3.4.1.3 Discharge to Surface Water

In general, downward gradients at higher elevations indicate flow is from the surficial material to the deeper groundwater system. At lower elevations upward gradients indicate flow towards the ground surface. Therefore, discharge from the groundwater to the surface water will be much more likely, but not exclusively, at lower elevations within the property. The presence of wetlands in low-lying areas along the central portions of the proposed tailings impoundment as well as waterbodies in the proposed open pit area (i.e., Booker Lake) and surrounding vicinities

Table 3.3-4
Morrison Copper/Gold Project: Vertical Groundwater Gradients

Well I.D.	Elevation (masl)*	Depth	First Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Second Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Third Measurement Date	Water Level (mbgs)**	Elevation (masl)*	Gradient
MW07-01A	970	28.0416	Nov-07	0	970	Jan-08	0	970	Apr-08	0	970	
MW07-01B	970	12.192	16-Nov-07	dry	unknown	23-Jan-08	frozen	unknown	07-Apr-08	frozen	unknown	up
MW07-02A	1,091	40.2336	Nov-07	2.19	1,088.81	Jan-08	3.38	1,087.62	Apr-08	3.34	1,087.66	
MW07-02B	1,091	9.144	Nov-07	1.51	1,089.49	Jan-08	2.52	1,088.48	Apr-08	2.85	1,088.16	down
MW07-03A	782	33.528	Nov-07	0	782.00	Jan-08	0.00	782.00	Apr-08	0.00	782.00	
MW07-03B	782	5.9436	Nov-07	1.51	780.49	Jan-08	1.63	780.37	Apr-08	1.76	780.24	up
MW07-04A	822	40.8432	Nov-07	23.38	798.62	Jan-08	25.37	796.63	Apr-08	25.34	796.66	
MW07-04B	822	6.096	Nov-07	5.42	816.58	Jan-08	0.87	821.13	Apr-08	0.74	821.26	down
MW07-05A	807	40.23368	Nov-07	16.59	790.41	Jan-08	17.65	789.35	Apr-08	17.56	789.44	
MW07-05B	807	21.336	Nov-07	17.34	789.66	Jan-08	16.91	790.09	Apr-08	17.56	789.44	none
MW07-06A	746	16.306833	Nov-07	1.7	744.30	Jan-08	3.65	742.35	Apr-08	4.49	741.52	
MW07-06B	746	5.1816	Nov-07	2.25	743.75	Jan-08	2.22	743.78	Apr-08	3.05	742.95	down
MW07-07A	837	149.6571	Nov-07	38.99	798.01	Jan-08	39.66	797.34	Apr-08	40.12	796.88	
MW07-07B	837	39.4716	Nov-07	30.63	806.37	Jan-08	30.79	806.21	Apr-08	30.82	806.18	down
MW07-08A	840	40.2336	Nov-07	0.02	839.98	Jan-08	0.72	839.28	Apr-08	1.65	838.36	
MW07-08B	840	10.3632	Nov-07	10.31	829.69	Jan-08	3.36	836.64	Apr-08	7.09	832.91	up
MW08-01A	832	85.8	10-Oct-08	24.93	60.87	-	-	-	-	-	-	
MW08-01B	832	30.18	10-Oct-08	28.64	1.54	-	-	-	-	-	-	up
MW08-02A	752	149.81	9-Oct-08	3.83	145.98	-	-	-	-	-	-	
MW08-02B	752	75.59	9-Oct-08	0	75.59	-	-	-	-	-	-	down
MW08-03A	800	35.51	10-Oct-08	12.66	22.85	-	-	-	-	-	-	
MW08-03B	800	13.89	10-Oct-08	13.54	0.35	-	-	-	-	-	-	up

Notes:

*** masl = metres above sea level.**

**** mbgs = metres below ground surface.**

appear to indicate that groundwater flow is towards the surface locations. Artesian conditions in MW07-01 and MW07-03A, installed adjacent to creeks, are evidence that upward gradient flows are contributing to discharge into these surface waterbodies.

3.5 Summary of Site-wide Physical Hydrogeology

The sedimentary unit overlying the bedrock is a heterogeneous glacial till composed of clay to gravel-size fragments, but dominated by clay/silt particles. Field observations reveal that the sedimentary overburden is most likely derived from erosion of nearby igneous and sedimentary rock units consisting of Babine FBP, volcanoclastic rocks, siltstone, sandstone, and limestone as well as silica and sulphide mineral debris.

The hydraulic conductivity values estimated by Rescan, Klohn Crippen Berger (2008), and Knight Piésold (2006a; 2006b) are used to characterize the overburden and the bedrock. Hydraulic conductivity in the bedrock is higher in the upper, highly fractured, bedrock unit and generally decreases with depth.

Groundwater flow is generally a subdued replica of topography at the Morrison Project area. This indicates continuity of the groundwater regime. General groundwater flow in the north dam area is directed towards the northeast while near the TSF groundwater flows towards Morrison Lake in a southwest direction. Groundwater flow in the southern portion of the property, in the proposed open pit and surrounding areas, flows in a southwest direction.

Recharge sources to groundwater include rainfall, snowmelt, and upward gradient subsurface flows originating from hills mainly on the eastern side of the property. Exposure of fractured bedrock on the ground surface, especially at higher altitudes, may contribute greatly to direct recharge of bedrock groundwater. Discharge to surface water occurs along creeks, such as those adjacent to MW07-03A and MW07-01A, and waterbodies such as Booker Lake.

Comparison of ground surface topography with the groundwater potentiometric surface map indicates that groundwater is recharged from the eastern edge of the property and discharges into surface waterbodies including creeks, wetlands, and lakes within the proposed sites. Significant amounts of surface and subsurface water in both the tailings and pit watershed areas discharges into the Morrison Lake on the west and is partly directed towards the northern end of the Morrison property.

4. Groundwater Quality

The data set described in this section is derived from groundwater sampling trips undertaken in November, 2007, and January, April, July, and October, 2008. Groundwater samples were obtained from the Rescan monitoring wells MW07-01 to MW07-08 and MW08-01 to MW08-03. The wells drilled during the summer of 2008 (MW08-01, MW08-02, and MW08-03) were sampled once. The sampling program for these wells will continue to obtain a full year data set. All samples were sent to ALS laboratories in Vancouver, BC, for analysis. Groundwater samples were also collected on one occasion from three monitoring wells installed by Knight Piésold (DH06-07, DH06-11 and DH06-12) in July, 2006; this data is included herein. The raw chemical data results are presented in Appendix D. A summary of the number of samples collected and sampling dates for each monitoring well is presented in Table 4-1. The respective detection limits for chemical variables are summarized in Table 4-2. The results are compared with the BC Water Quality Guidelines for Drinking Water, Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Freshwater Aquatic Life, and the BC Water Quality Guidelines for Freshwater Aquatic Life.

Table 4-1
Summary of Morrison Copper/Gold Project Groundwater Sampling

Well ID	Screened Unit	Total Number of Samples	Dates Sampled					
			Jul-06	Nov-07	Jan-08	Apr-08	Jul-08	Oct-08
DH06-7	Volcanic unit/ fine grained siltstone/sandstone	1	July 2006	-	-	-	-	-
DH06-11	Silt/Clay matrix with some gravel	1	July 2006	-	-	-	-	-
DH06-12	Sandstone/Siltstone	1	July 2006	-	-	-	-	-
MW07-01A	Glauconitic Volcanoclastic unit	5	-	16-Nov-07*	23-Jan-08	7-Apr-08	18-Jul-08	8-Oct-08
MW07-01B	Glacial Till	2	-	A	B	B	18-Jul-08	8-Oct-08
MW07-02A	Volcanic Breccia	5	-	16-Nov-07	23-Jan-08	7-Apr-08	18-Jul-08	8-Oct-08
MW07-02B	Fossiliferous Limestone	5	-	16-Nov-07	23-Jan-08	7-Apr-08	18-Jul-08	8-Oct-08
MW07-03A	Glacial Till	3	-	14-nov-07*	D	D	16-Jul-08	5-Oct-08
MW07-03B	Glacial Till	5	-	14-Nov-07	24-Jan-08	8-Apr-08	16-Jul-08	5-Oct-08
MW07-04A	Glacial Till	5	-	14-Nov-07	24-Jan-08	8-Apr-08	16-Jul-08	5-Oct-08
MW07-04B	Glacial Till	1		A	C	C	E	5-Oct-08
MW07-05A	Feldspar Biotite Porphyry	5	-	12-Nov-07	25-Jan-08*	10-Apr-08*	19-Jul-08*	8-Oct-08*
MW07-05B	Glacial Till	2	-	C	C	C	19-Jul-08	7-Oct-08
MW07-06A	Volcanic Tuff	5	-	7-Nov-07	25-Jan-08	11-Apr-08	19-Jul-08	7-Oct-08
MW07-06B	Glacial Till	4	-	-	25-Jan-08	10-Apr-08	19-Jul-08	5-Oct-08
MW07-07A	Feldspar Biotite Porphyry	4	-	-	26-Jan-08	12-Apr-08	17-Jul-08	9-Oct-08
MW07-07B	Feldspar Biotite Porphyry	5	-	7-Nov-07	25-Jan-08	11-Apr-08	17-Jul-08	9-Oct-08

(continued)

Table 4-1
Summary of Morrison Copper/Gold Project Groundwater Sampling (completed)

Well ID	Screened Unit	Total Number of Samples	Dates Sampled					
			Jul-06	Nov-07	Jan-08	Apr-08	Jul-08	Oct-08
MW07-08A	Siltstone	4	-	7-Nov-07	24-Jan-08	9-Apr-08	18-Jul-08	-
MW07-08B	Glacial Till	4	-	C	24-Jan-08	11-Apr-08	18-Jul-08	7-Oct-08
MW08-01A	Tuff and siltstone	1	-	-	-	-	-	10-Oct-08
MW08-01B	Gravelly Clay with Sand	0	-	-	-	-	-	-
MW08-02A	Siltstone and Feldspar Biotite Porphyry	1	-	-	-	-	-	9-Oct-08
MW08-02B	Feldspar Biotite Porphyry	1	-	-	-	-	-	9-Oct-08
MW08-03A	Sandstone	1	-	-	-	-	-	10-Oct-08
MW08-03B	Gravelly Clay with Sand	0	-	-	-	-	-	-

A = Dry well - could not be sampled
B = frozen water - could not be sampled
C = Shallow water level - insufficient water to sample
D = frozen artesian
E = only sampled for general chemistry
*** = duplicate sample was taken**

Table 4-2
Groundwater Quality Parameters, Analytical Methods and Detection Limits

Parameters	Basis	Units	Minimum Detection Limit
Physical Parameters			
Anion Sum	-	me/L	1
Cation Sum	-	me/L	1
Cation - Anion Balance	-	%	1
Hardness CaCO3	Dissolved	mg/L	0.5 to 5
Colour, True	Dissolved	CU	1
Electrical Conductivity	Total	uS/cm	0.5 to 2
pH	Total	pH	0.01
Total Dissolved Solids	Dissolved	mg/L	1 to 45
Total Suspended Solids	Total	mg/L	3 to 45
Turbidity	Total	NTU	0.1
Anions and Nutrients			
Ammonia as N	Total	mg/L	0.005 to 0.05
Acidity (as $CaCO_3$)	Total	mg/L	1 to 2
Alkalinity, Bicarbonate	Total	mg/L	1 to 2
Alkalinity, Carbonate	Total	mg/L	1 to 2

(continued)

Table 4-2
Groundwater Quality Parameters, Analytical Methods and Detection Limits (continued)

Parameters	Basis	Units	Minimum Detection Limit
Alkalinity, Hydroxide	Total	mg/L	1 to 2
Alkalinity, Total	Total	mg/L	1 to 2
Bromide (Br)	Dissolved	mg/L	0.05 to 5
Chloride (Cl)	Dissolved	mg/L	0.5 to 50
Fluoride (F)	Dissolved	mg/L	0.02 to 2
Sulfate (SO_4)	Dissolved	mg/L	0.5 to 50
Nitrate (as N)	Dissolved	mg/L	0.005 to 0.5
Nitrite (as N)	Dissolved	mg/L	0.001 to 0.1
Total Kjeldahl Nitrogen	Total	mg/L	0.05 to 0.5
Total Nitrogen	Total	mg/L	0.05 to 0.5
Total Phosphate as P	Total	mg/L	0.002 to 2
Metals			
Aluminum	Dissolved and Total	mg/L	0.001 to 0.01
Antimony	Dissolved and Total	mg/L	0.0001 to 0.001
Arsenic	Dissolved and Total	mg/L	0.0001 to 0.001
Barium	Dissolved and Total	mg/L	0.00005 to 0.0005
Beryllium	Dissolved and Total	mg/L	0.0005 to 0.005
Bismuth	Dissolved and Total	mg/L	0.0005 to 0.005
Boron	Dissolved and Total	mg/L	0.01 to 0.1
Cadmium	Dissolved and Total	mg/L	0.000017 to 0.0002
Calcium	Dissolved and Total	mg/L	0.02 to 0.2
Chromium	Dissolved and Total	mg/L	0.0005 to 0.02
Cobalt	Dissolved and Total	mg/L	0.0001 to 0.001
Copper	Dissolved and Total	mg/L	0.0001 to 0.003
Iron	Dissolved and Total	mg/L	0.03 to 0.06
Lead	Dissolved and Total	mg/L	0.00005 to 0.0005
Lithium	Dissolved and Total	mg/L	
Magnesium	Dissolved and Total	mg/L	0.005 to 0.05
Manganese	Dissolved and Total	mg/L	0.00005 to 0.0005
Mercury	Dissolved and Total	mg/L	0.00001 to 0.001
Molybdenum	Dissolved and Total	mg/L	0.00005 to 0.0005
Nickel	Dissolved and Total	mg/L	0.0005 to 0.005
Phosphorus	Dissolved and Total	mg/L	0.3 to 0.6
Potassium	Dissolved and Total	mg/L	0.05 to 0.5
Selenium	Dissolved and Total	mg/L	0.0001 to 0.001
Silicon	Dissolved and Total	mg/L	0.05 to 0.1

(continued)

Table 4-2
Groundwater Quality Parameters, Analytical Methods and Detection Limits (completed)

Parameters	Basis	Units	Minimum Detection Limit
Silver	Dissolved and Total	mg/L	0.00001 to 0.0001
Sodium	Dissolved and Total	mg/L	2 to 4
Strontium	Dissolved and Total	mg/L	0.0001 to 0.001
Thallium	Dissolved and Total	mg/L	0.0001 to 0.001
Tin	Dissolved and Total	mg/L	0.0001 to 0.001
Titanium	Dissolved and Total	mg/L	0.01 to 0.02
Uranium	Dissolved and Total	mg/L	0.00001 to 0.0001
Vanadium	Dissolved and Total	mg/L	0.001 to 0.01
Zinc	Dissolved and Total	mg/L	0.001 to 0.01
Organic Parameters			
Total Organic Carbon C	Total	mg/L	0.5 to 5

4.1 Groundwater Sampling Methodology

A groundwater sampling program commenced following the installation and development of the groundwater monitoring wells. Before sampling, a total of three well volumes of water were purged to ensure the groundwater contained in the wells was representative of the groundwater within the screened geologic formation. During purging, several parameters (pH, pH-mV, temperature, electrical conductivity, and total dissolved solids) were monitored to ensure these parameters reached a consistent level. On completion of the purging the groundwater samples were obtained by pumping the required volume of water directly into the appropriate containers. The samples were retained and preserved in the following manner:

- General Chemistry: 1l plastic bottle with no preservative added.
- Total Metals: 250-ml plastic bottle with a capsule of 1:4 solution of nitric acid preservative added.
- Dissolved Metals: 250-ml plastic bottle with a capsule of 1:4 solution of nitric acid preservative added following field filtering.
- Total Organic Carbon (TOC): 125-ml glass bottle with a capsule of 1:1 solution of hydrochloric acid preservative added.
- Nutrients: 250-ml glass bottle with a capsule of 1:1 solution of sulphuric acid preservative added.
- Dissolved metals sample filtering was performed in the field. For quality assurance/quality control purposes, 10% of all samples were collected in duplicate. A travel blank and a field blank were also taken at each field trip.

4.1.1 Quality Assurance/Quality Control

The precision of the groundwater sampling methodology and the laboratory analysis was assured by the inclusion of duplicate samples, as well as both field and travel blanks. All chemical analysis performed (including blanks and duplicates) are contained in Appendix E. The assessment of sampling and analysis precision involved calculating the relative percent difference (RPD) between duplicates and their associated samples; duplicates should have a RPD of less than 25%. Calculated RPD values are also contained within Appendix E.

For each of the sampling trips the following RPD values were noted for the parameters:

- November 2007 (Duplicate 1): No parameters had a RPD greater than 25%.
- November 2007 (Duplicate 2): turbidity, acidity (as $CaCO_3$), chloride, total phosphate (as P), total aluminum, total arsenic, total cadmium, total copper, total zinc, dissolved aluminum, dissolved arsenic, dissolved cadmium, and dissolved zinc.
- January 2008: turbidity, ammonia (as N), and dissolved aluminum.
- April 2008: turbidity, ammonia (as N), total Kjeldahl nitrogen, total nitrogen, total phosphate (as P), total aluminum, total lead, and total silver.
- July 2008: total kjeldahl nitrogen, total aluminum, dissolved aluminum, and dissolved cadmium.
- October 2008: total aluminum and dissolved arsenic.

Where the turbidity parameter is in excess of the RPD it is expected to have additional parameters exceed the RPD because of the variation in the concentration of suspended solids between the samples.

An incomplete data set exists for the July, 2008, duplicate as the analysis did not include general chemistry parameters. Since the data set is incomplete the RPD may or may not have been exceeded for additional parameters to those listed above.

Possible contamination from handling samples in the field, in the laboratory, or in transit is monitored with field and travel blanks. Test results from the field and travel blanks are included in Appendix D. In all travel and field blanks all parameters were not detected with the exception of two: acidity (November, 2007) and total manganese (January, 2008). These parameters were detected at very low concentrations and do not affect the overall interpretation of groundwater quality.

4.2 Site-wide Groundwater Chemistry

4.2.1 Physical Parameters, Anions and Nutrients, and Total Organic Carbon

Table 4.2-1 summarizes the site-wide range of physical parameters, major anion concentrations, nutrients, and TOC compared to the British Columbia Approved and Working Water Quality

Table 4.2-1
Physical Parameters, Concentrations of Major Anions and Cations and Total Organic Carbon in Groundwater at Morrison Property

Parameter	Units	Minimum	Average[1]	Maximum	BCWQG (DW)[2]	BCWQG (FAL)[3]	CCME (FAL)[4]
Physical Parameters							
Anion Sum	me/L	3.6	6.5	9.7	ng	ng	ng
Cation Sum	me/L	3.3	6.32	9.7	ng	ng	ng
Cation - Anion Balance	%	-8	-1.08	3.1	ng	ng	ng
Hardness (as CaCO3)	mg/L	12.8	**212.4**	**1,040**	200	ng	ng
Colour, True	CU	<5	8.86	**58.4**	15 TCU	A	narrative
Conductivity	uS/cm	307	**974.65**	**4,330**	700	ng	ng
pH	pH	7.38	8.21	***12.1***	6.5 - 8.5	ng	6.5 - 9.0
Total Dissolved Solids	mg/L	150	**571.28**	**3,360**	500	ng	ng
Total Suspended Solids	mg/L	<3.0	627.84	11,100	ng	B	B
Turbidity	NTU	0.69	**294.11**	**>4,000**	5 NTU	B	B
Anions and Nutrients							
Ammonia as N	mg/L	<0.005	*0.09*	*0.619*	ng	C	D
Acidity (as CaCO3)	mg/L	<1.0	7.53	78.7	ng	ng	ng
Alkalinity, Bicarbonate (as CaCO3)	mg/L	<1.0	309.17	1,660	ng	ng	ng
Alkalinity, Carbonate (as CaCO3)	mg/L	<1.0	16.79	278	ng	ng	ng
Alkalinity, Hydroxide (as CaCO3)	mg/L	<1.0	44.08	850	ng	ng	ng
Alkalinity, Total (as CaCO3)	mg/L	136	361.32	1,660	ng	ng	ng
Bromide (Br)	mg/L	<0.05	<0.3	<5.0	ng	ng	ng
Chloride (Cl)	mg/L	<0.5	4.75	30	250	600	ng
Fluoride (F)	mg/L	0.08	0.49	**1.87**	1.5	E	ng
Sulfate (SO4)	mg/L	2.56	127.17	**1,060**	500	100F	ng
Nitrate (as N)	mg/L	<0.005	<0.04	<0.5	10	200	2.9
Nitrite (as N)	mg/L	<0.001	0.004	*0.13*	1	G	0.06
Total Kjeldahl Nitrogen	mg/L	<0.05	0.64	3.77	ng	ng	ng
Total Nitrogen	mg/L	<0.05	0.65	3.8	ng	ng	ng
Total Phosphate as P	mg/L	<0.002	0.70	15.1	ng	ng	ng
Total Organic Carbon	mg/L	<0.5	**23.08**	**130**	4	H	ng

Note:
Bold = exceeds the MAC listed in the BCDWS guidelines.
Underline = exceeds the MAC listed in the BC aquatic life guidelines.
***Italic* = exceeds the MAC listed in the CCME guidelines.**
1. Average is calculated using half of the detection limit when the result was below it.
2. BCWQG (DW) = British Columbia Water Quality Guidelines, Drinking Water. Source: BC MOE 2006.
3. BCWQG (FAL) = British Columbia Water Quality Guidelines, Freshwater Aquatic Life. Source: BC MOE 2008.
4. CCME (FAL) = Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Source: CCME 2007.
ng = no guideline.
A = 30-day average transmission of white light >80% of background.
B = depends on background values.
C = depends on field temperature and pH.
D = All ammonia was assumed un-ionized and the guideline value was 0.019 mg/L .
E = Fluoride BC Max 0.2 mg/L when at <50mg/L [CaCO3], 0.3mg/L at >50mg/L [CaCO3] .
F = Sulphate BC Max alert to monitor aquatic moss at 50mg/L.
G = Dependent on chloride concentration, ranges from 0.06 to 0.60 mg/L.
H = 30 day median + 20% of median background concentration.

Guidelines (BCWQG) for Drinking Water, the BCWQG for Freshwater Aquatic Life, and the CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life. The monitoring wells mentioned in the following sections have one or more samples that exceed the standards applied for each parameter. The concentration profiles are also illustrated in Figures 4.2-1 to 4.2-7; only those parameters that exceed one or more of the standards have been graphed.

The hardness of groundwater samples collected at the Morrison property varied from 12.8 mg/L (MW07-03A) to 1,040 mg/L (MW07-08B). Hardness exceeded BCWQG for drinking water for samples from monitoring wells MW07-02B, MW07-04A and B, MW07-05A, MW07-07B, MW07-08A and B, MW08-01A, MW08-02A and B, and DH06-11. There are no BCWQG or CCME water quality guidelines for hardness for freshwater aquatic life; however, most metal guidelines are hardness dependent.

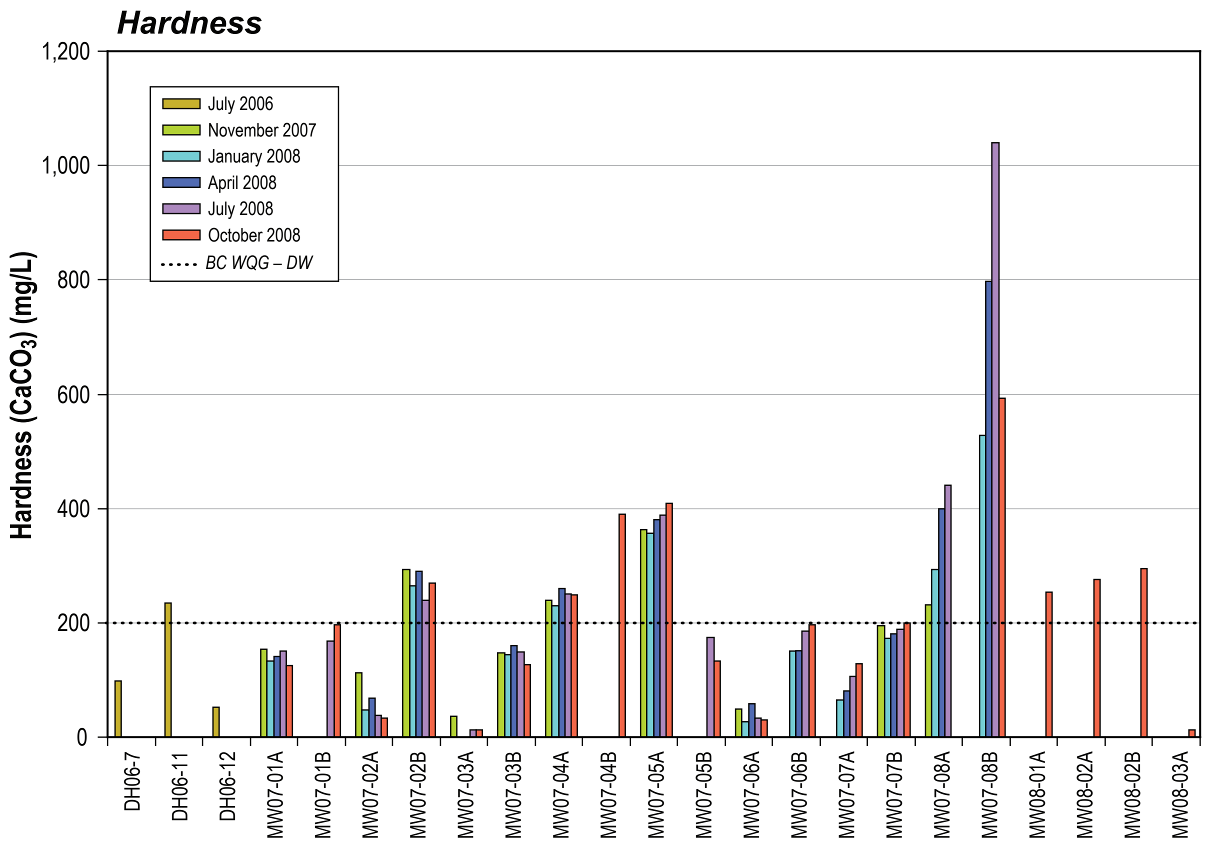
The colour of groundwater samples varied from <5 (in several monitoring wells) to 58.4 true colour unit (TCU) (MW07-07A). The colour of samples taken from wells MW07-06A, MW07-07A, and MW07-08B exceeded the guideline for BCWQG for drinking water of 15 TCU. The chemical analysis results for hardness and colour can be found in Figure 4.2-1. There is no BCWQG for colour for freshwater aquatic life, but most metal guidelines are hardness dependent. The CCME water quality guidelines narrative for colour indicates that the true colour should not be significantly higher than the seasonally adjusted colour value for the water system, measured at 456 nanometres. Similarly, the adjusted colour, measured as the mean percent transmission of white light per metre, should not be significantly higher than the seasonally adjusted colour value for the water system.

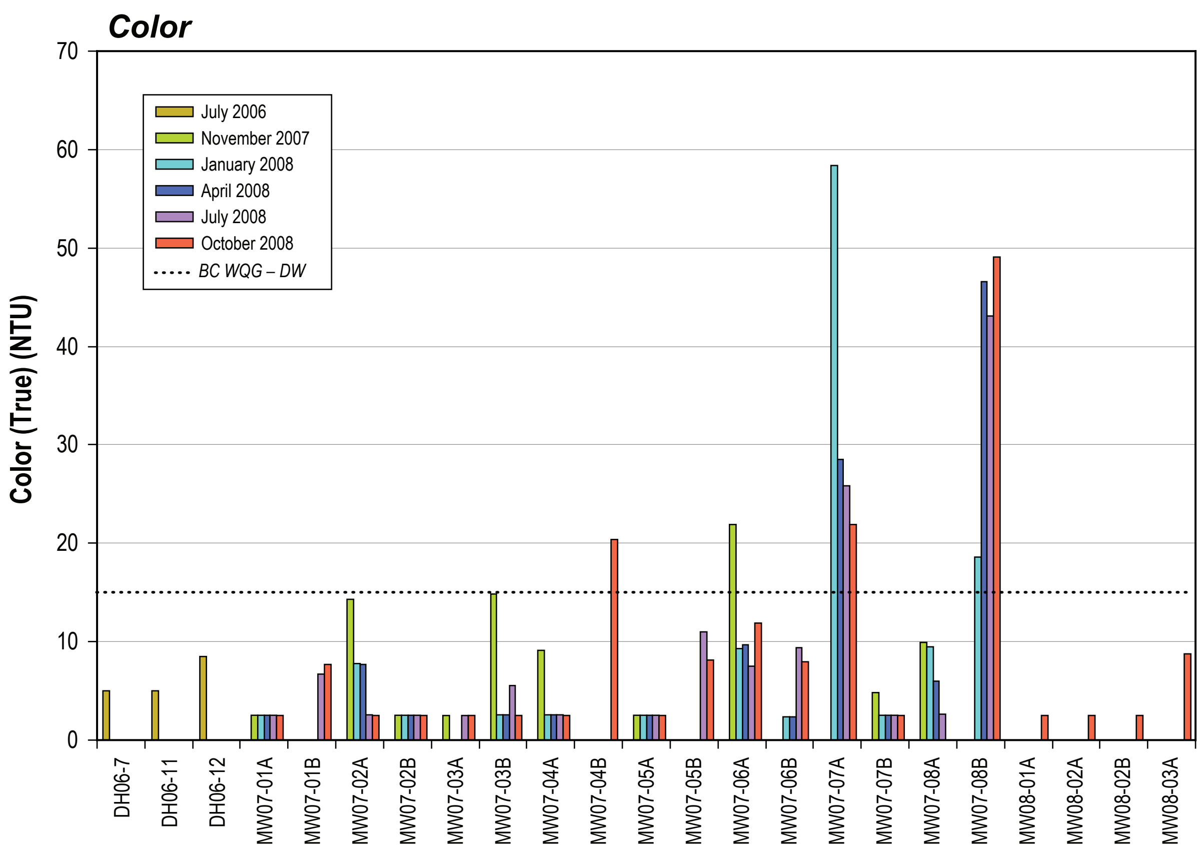
The measured conductivity of the groundwater at the Morrison property varied between 307 µS/cm (MW07-03B) and 4,330 µS/cm (MW07-08B). The BCWQG for conductivity of drinking water is 500 µS/cm and was exceeded in monitoring wells MW07-01A and B, MW07-02B, MW07-04A and B, MW07-05A and B, MW07-06A, MW07-07A, MW07-08A and B, and MW08-03A. There are no BCWQG or CCME water quality guidelines for conductivity for freshwater aquatic life.

The pH measurements of groundwater at the Morrison property varied from 7.38 (MW07-07B) to 12.1 (MW07-07A). Those monitoring wells where the pH results exceeded BCWQG for drinking water are MW07-01A, MW07-02A, MW07-03A, MW07-07A, and MW08-03A. The BCWQG (6.0 to 8.5) and CCME water quality guidelines (6.0 to 9.0) for pH were only exceeded in MW07-07A. The chemical analysis results for electrical conductivity and pH are shown in Figure 4.2-2.

The total dissolved solids (TDS) values in groundwater ranged from 150 mg/L (MW07-03B) to 3,360 mg/L (MW07-08B). The BCWQG for TDS in drinking water of 500 mg/L was exceeded in samples taken from monitoring wells MW07-01A, MW07-04A and B, MW07-05A and B, MW07-06A, MW07-07A, MW07-08A and B, and MW08-03A. There are no BCWQG or CCME water quality guidelines for TDS for freshwater aquatic life.

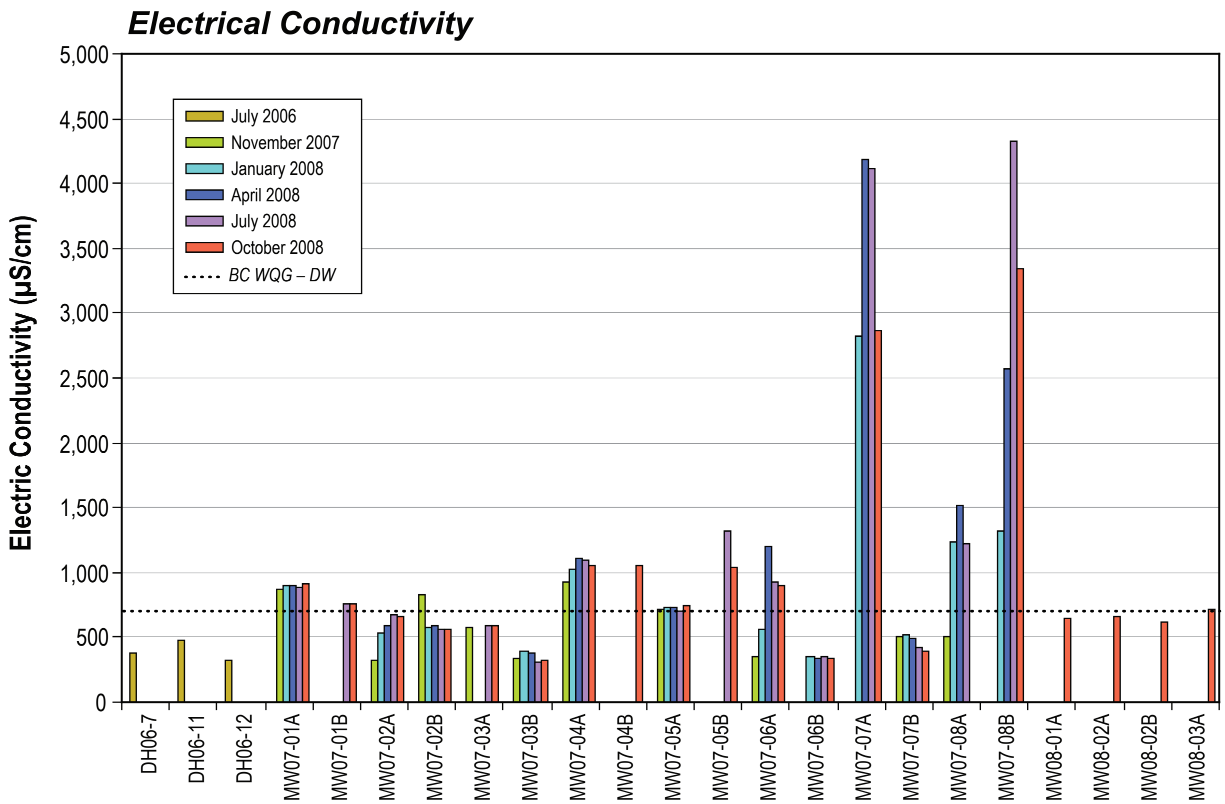
The total suspended solids (TSS) values in groundwater ranged from <3 mg/L (in several

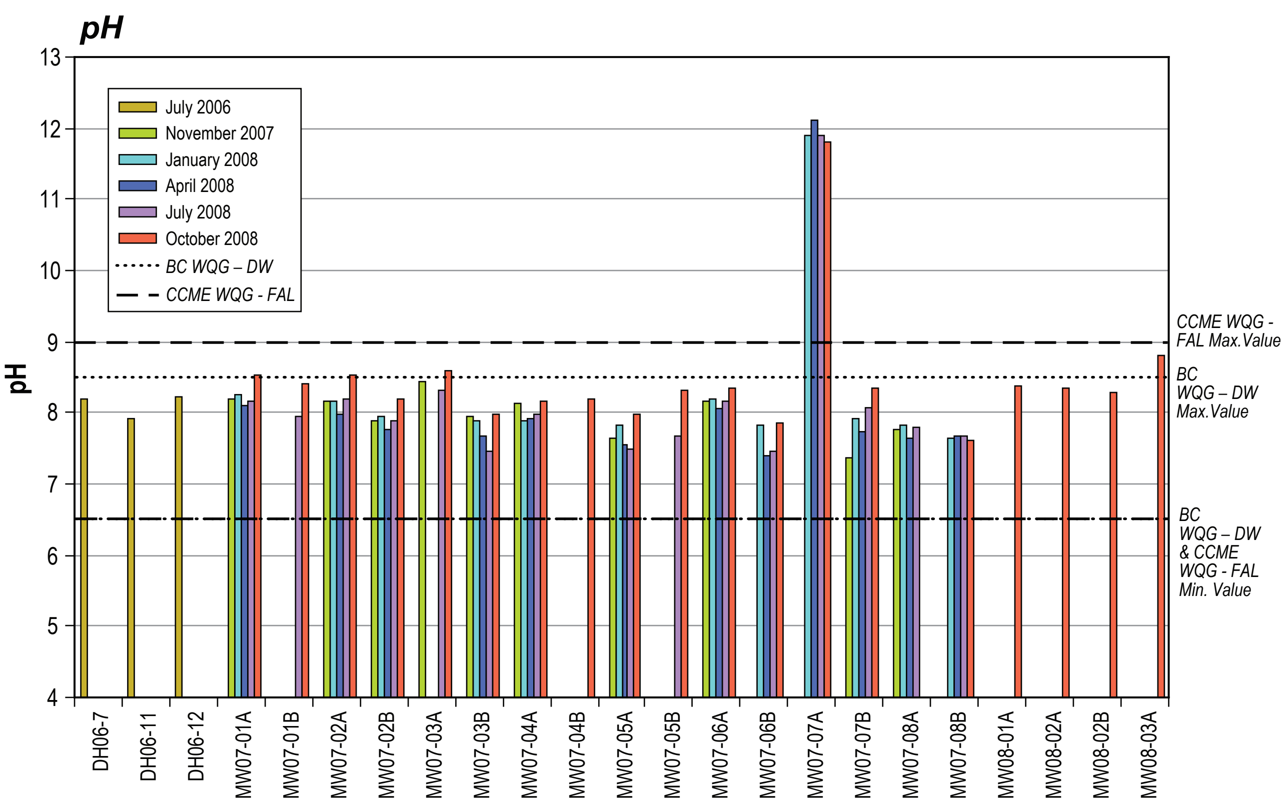




Morrison Copper/Gold Project: Hardness and Colour

FIGURE 4.2-1





Morrison Copper/Gold Project: Electrical Conductivity and pH

FIGURE 4.2-2

monitoring wells) to 11,100 mg/L (MW07-06B). The BCWQG for drinking water and the CCME water quality guidelines for TSS for freshwater aquatic life are dependent on background levels. These measure values are background values, and therefore no comparison was made. There is no BCWQG for TSS for the aquatic life. Figure 4.2-3 shows the concentrations of TDS and TSS for the groundwater samples.

The measured turbidity of groundwater at the Morrison property varied from 0.69 nephelometric turbidity units (NTU) (MW07-01A) to >4,000 NTU (MW07-03A, MW07-04A, MW07-06A, MW07-06B and DH06-11). The turbidity exceeds the BCWQG of 5 NTU for drinking water in groundwater samples collected from monitoring wells MW07-01B, MW07-02A and B, MW07-03A and B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07A and B, MW07-08A and B, DH06-11, and DH06-12. The BCWQG and CCME water quality guidelines for turbidity for freshwater aquatic life are dependent on background levels. These measured values are background values, and therefore no comparison was made.

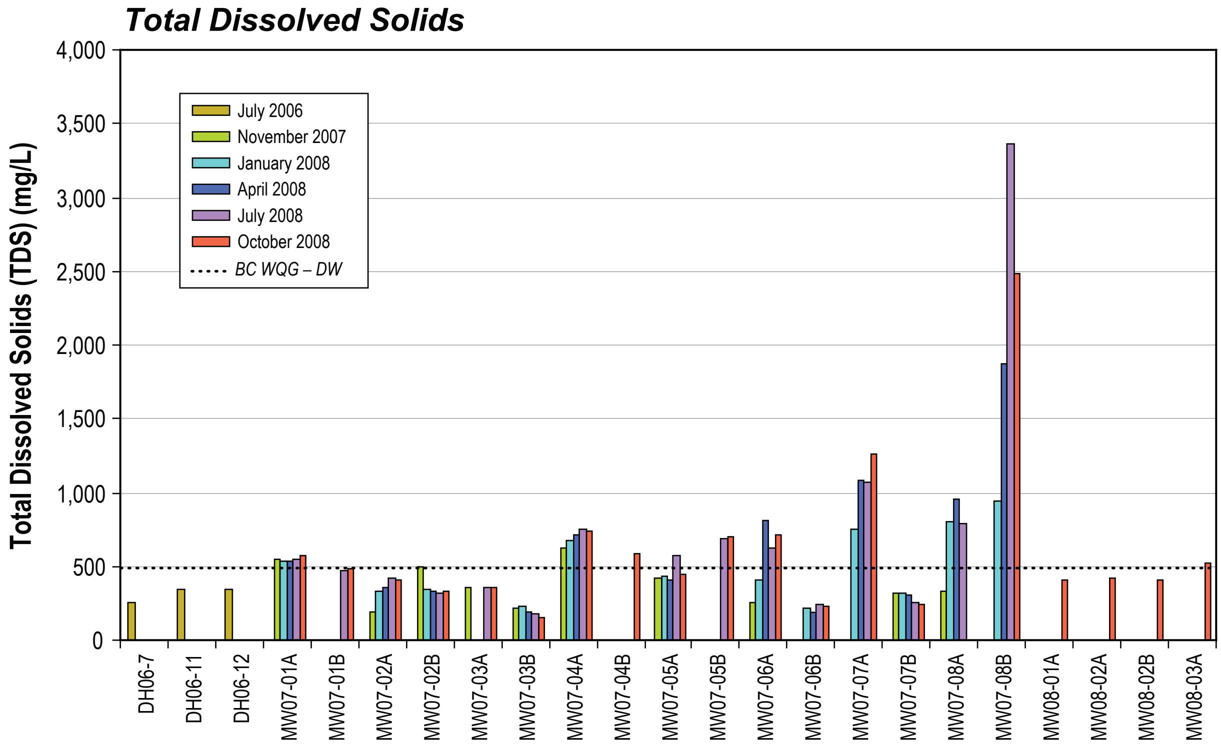
The ammonia concentrations in groundwater varied between <0.005 mg/L (in several monitoring wells) and 0.619 mg/L (MW07-06A). Ammonia exceeded CCME water quality guidelines of un-ionized ammonia of 0.019 mg/L in monitoring wells MW07-01A, MW07-02A, MW07-03A, MW07-04A, MW07-05A, MW07-06A and B, MW07-07A, MW07-07B, MW08-01A, MW08-02A and B, and MW08-03A. No groundwater samples exceeded the most restrictive BCWQG for the protection of freshwater aquatic life of 0.681 mg/L (pH 9 at 7ºC). Measured turbidity and ammonia concentrations are graphed in Figure 4.2-4.

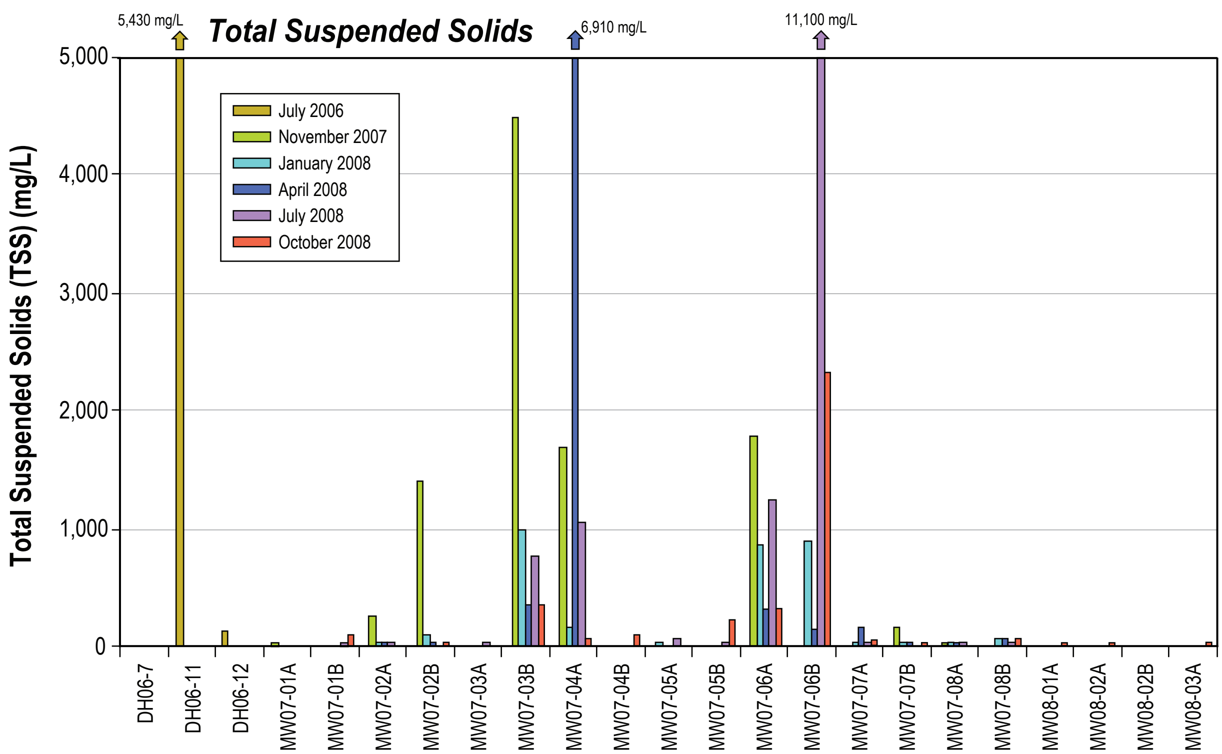
The acidity (as $CaCO_3$) in groundwater varied between <1 (in several monitoring wells) and 78.7 mg/L (MW07-08B). Total alkalinity (as $CaCO_3$) in groundwater varied between 136 mg/L (MW07-02A) and 1,660 mg/L (MW07-08B). No BCWQG or CCME water quality guidelines for freshwater aquatic life exist for acidity or total alkalinity. The groundwater acidity and total alkalinity are graphed in Figure 4.2-5.

The chloride concentrations in groundwater samples varied from <0.5 mg/L (in several monitoring wells) to 30 mg/L (MW07-08B). No results exceeded either the BCWQG for drinking water of 250 mg/L or the BCWQG for freshwater aquatic life of 600 mg/L. There were two samples in MW07-08B where the detection limit was 50 mg/l. There are no CCME water quality guidelines for chloride for the protection of freshwater aquatic life.

The fluoride concentrations in groundwater samples varied from 0.08 mg/L (MW07-06B) to 1.87 mg/L (DH06-7). Fluoride exceeded the BCWQG of 1.5 mg/L for drinking water in MW07-08B, MW08-03A, and DH06-7. The fluoride concentrations in groundwater samples exceeded the BCWQG for freshwater aquatic life in monitoring wells MW07-01A and B, MW07-02A, MW07-03A, MW07-05B, MW07-06A, MW07-07A and B, MW07-08A and B, DH06-7, and DH06-12.

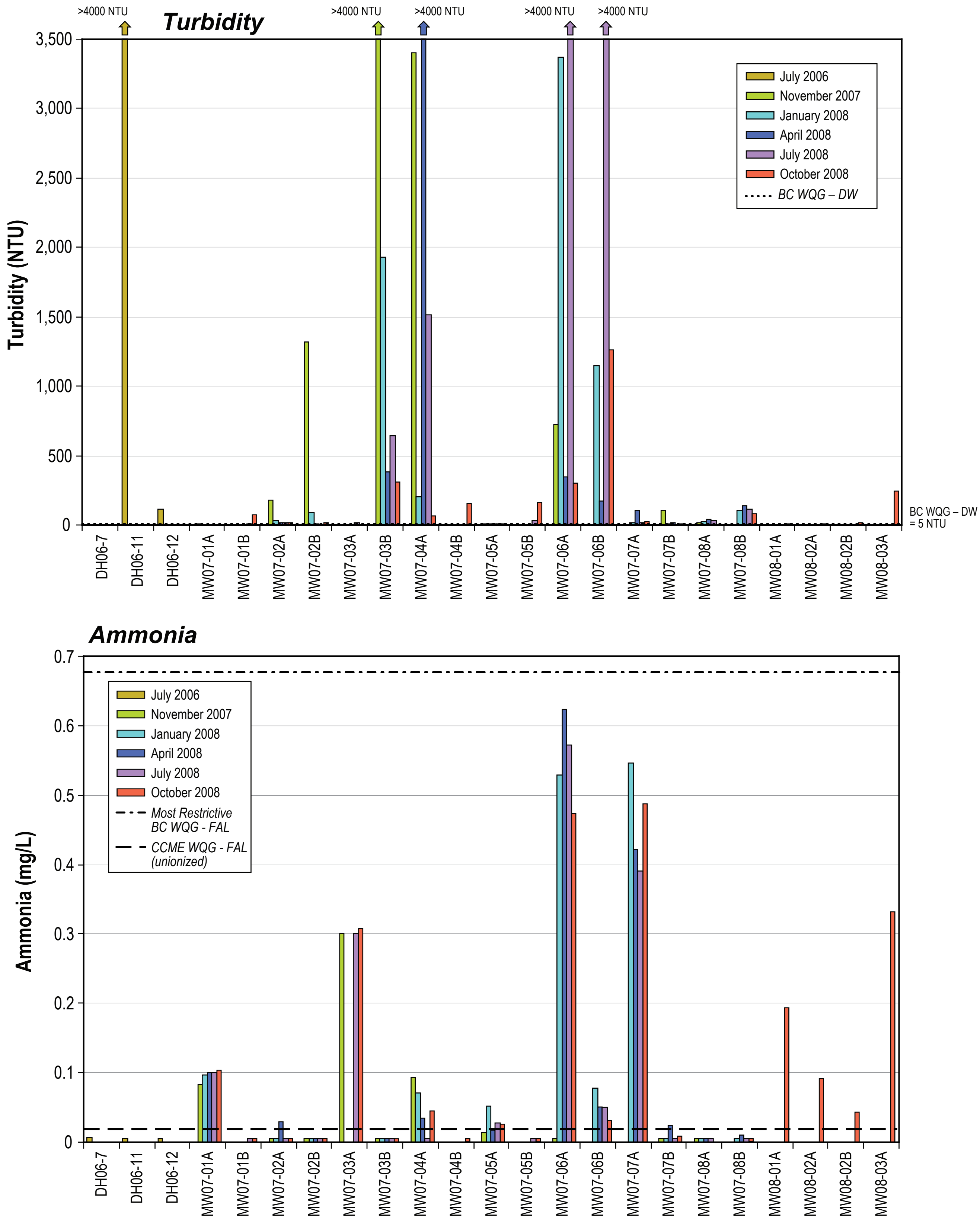
The sulfate concentrations in groundwater samples varied from 2.56 mg/L (MW07-03B) to 1,060 mg/L (MW07-08B). The sulfate concentration exceeded BCWQG of 500 mg/L for drinking water in one sample from MW07-08B. The sulfate concentrations exceeded the





Morrison Copper/Gold Project:
Total Dissolved Solids and Total Suspended Solids

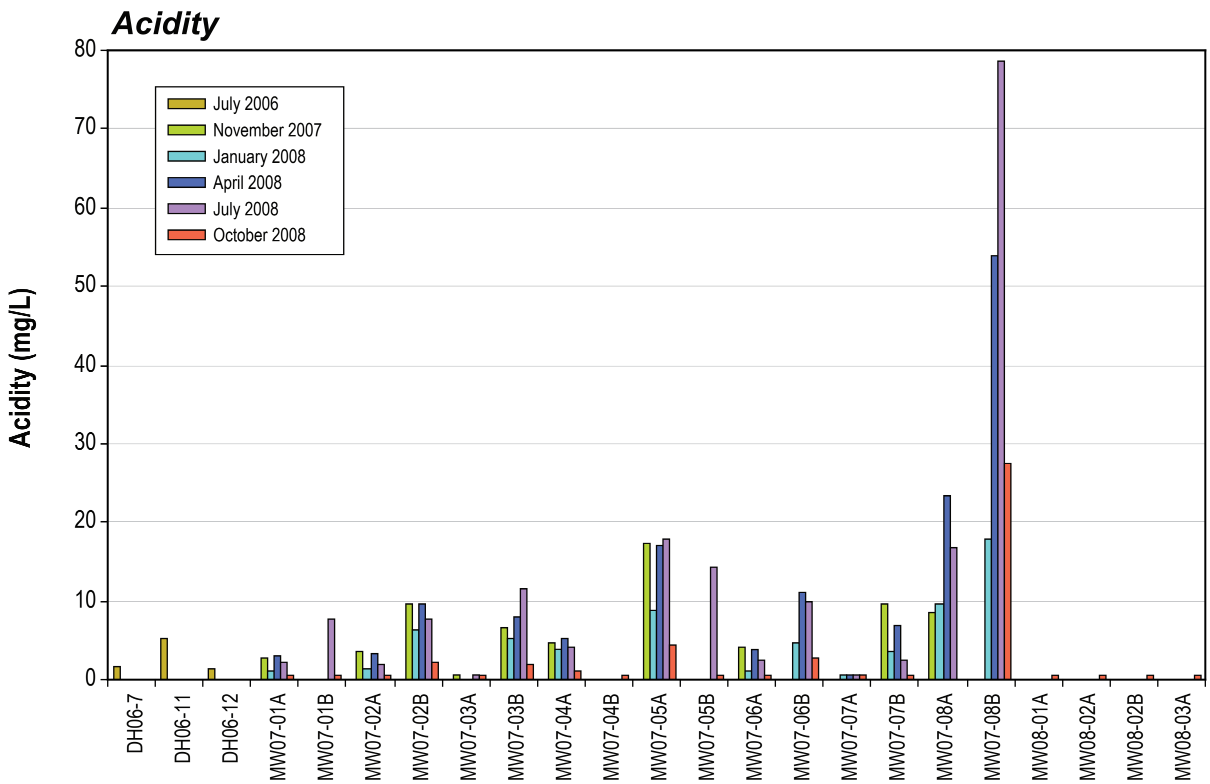
FIGURE 4.2-3

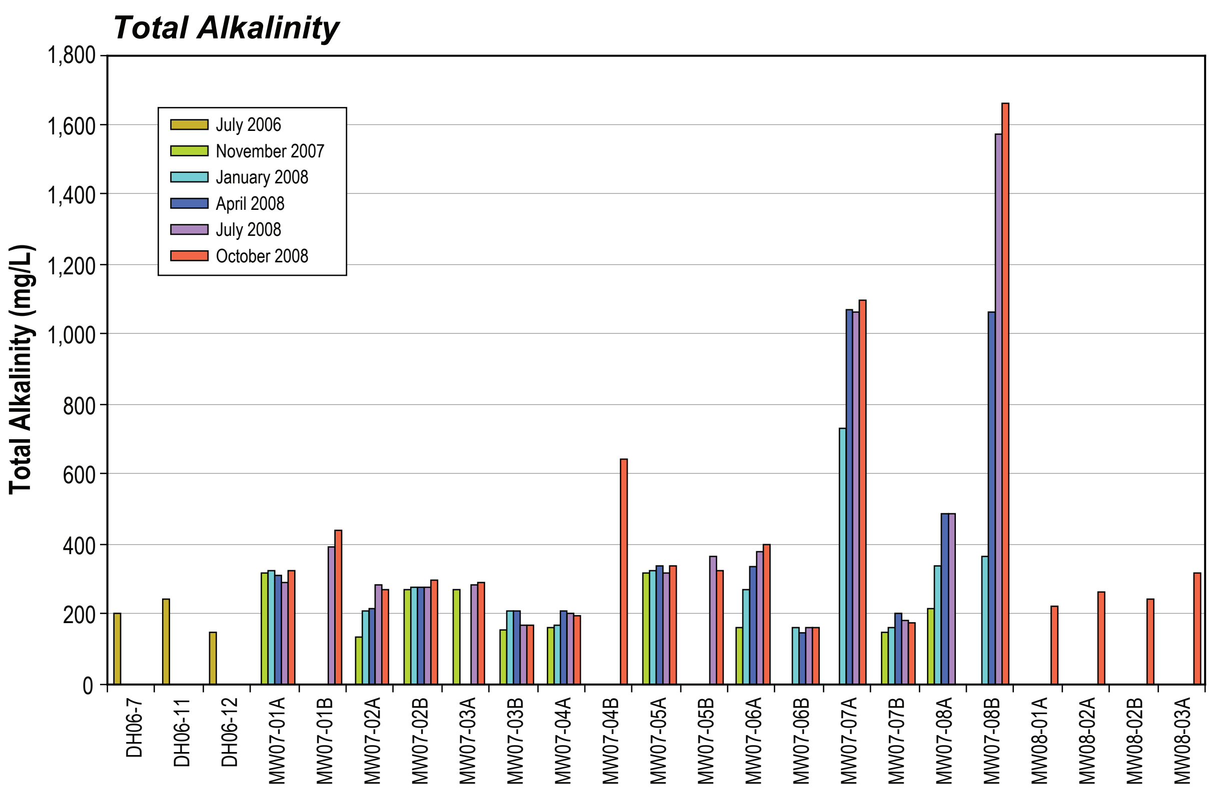


Note: All ammonia was assumed un-ionized (guideline 0.019 mg/L)

Morrison Copper/Gold Project: Turbidity and Ammonia

FIGURE 4.2-4





Morrison Copper/Gold Project:
Total Acidity and Total Alkalinity

FIGURE 4.2-5

BCWQG of 100 mg/L for freshwater aquatic life in monitoring wells MW07-01A, MW07-02B, MW07-04A, MW07-05B, MW07-06A, MW07-07B, MW07-08A and B, MW08-01A, MW08-02A, and MW08-02B. There are no CCME water quality guidelines for sulfate for the protection of freshwater aquatic life. The fluoride and sulphate concentrations in the groundwater samples are shown in Figure 4.2-6.

The nitrate concentrations in the groundwater samples varied from <0.005 mg/L (in several monitoring wells) to 0.125 mg/L (MW07-03B). All measured values for nitrate were less than the BCWQG for drinking water and the BCWQG and CCME water quality guidelines for the protection of freshwater aquatic life.

The nitrite concentrations in the groundwater varied from <0.001 mg/L (in several monitoring wells) to 0.13 mg/L (MW07-08B). One groundwater sample in monitoring well MW07-08B exceeded the CCME water quality guidelines and BCWQG of 0.06 mg/L for the protection of freshwater aquatic life. Note that one sample in MW07-08B had a detection limit of <0.1 mg/l; thus, it may also have been an exceedance.

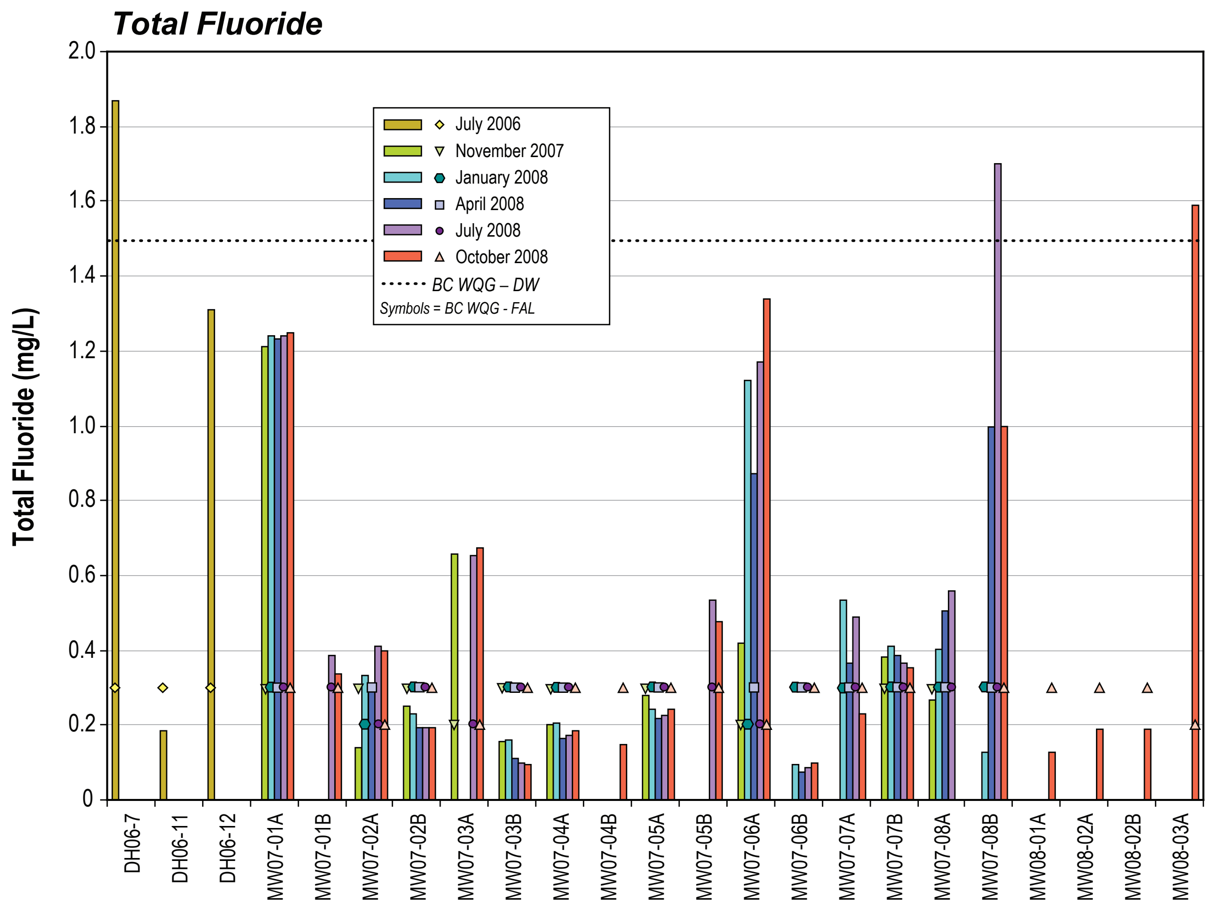
The TOC concentrations varied from <0.5 mg/L (in MW07-01A) to 130 mg/L (in DH06-12). The TOC exceeded the BCWQG of 4 mg/L for drinking water in monitoring wells DH06-7, DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07A and B, and MW07-08A and B. The nitrite and TOC concentrations in the groundwater samples are shown in Figure 4.2-7.

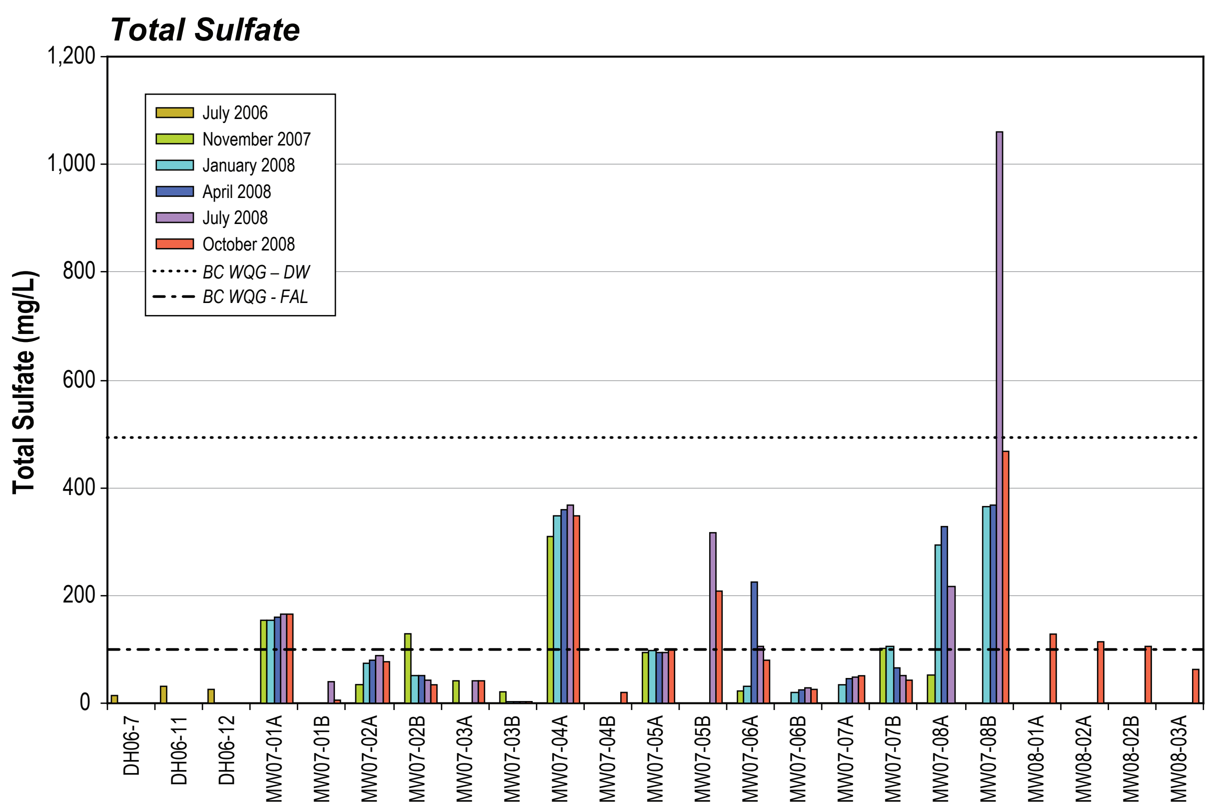
4.3 Total and Dissolved Metals

In this section, total and dissolved metals concentrations in groundwater are discussed. The ranges of concentrations of all metals are shown in Table 4.3-1 and their temporal variations relative to the BCWQG for drinking water and the BCWQG and CCME water quality guidelines for the protection of freshwater aquatic life are graphically presented in Figures 4.3-1 to 4.3-13. Only those parameters that exceed one or more of the guidelines have been graphed and presented in this report.

The total aluminum concentrations at the Morrison property varied from less than 0.001 mg/L (MW07-01A) to 98 mg/L (MW07-06B). Total aluminum exceeded the CCME water quality guidelines for the protection of freshwater aquatic life for groundwater samples from wells DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03A and B, MW07-04 A and B, MW07-05B, MW07-06A and B, MW07-07A and B, MW07-08A and B, MW08-01A, and MW08-03A. Dissolved aluminum concentrations ranged from below the detection limits (in multiple wells) to 2.98 mg/L (MW07-07A). Dissolved aluminum concentrations exceeded BCWQG for drinking water in monitoring wells MW07-03B, MW07-06A and B, MW07-07A, and MW08-03A. Dissolved aluminum concentrations exceeded the BCWQG of 0.1 mg/L for freshwater aquatic life in groundwater samples from monitoring wells MW07-02A, MW07-03B, MW07-04A, MW07-06A and B, MW07-07A, and MW08-03A. Figure 4.3-1 shows the total and dissolved aluminum concentrations in groundwater at the Morrison property.

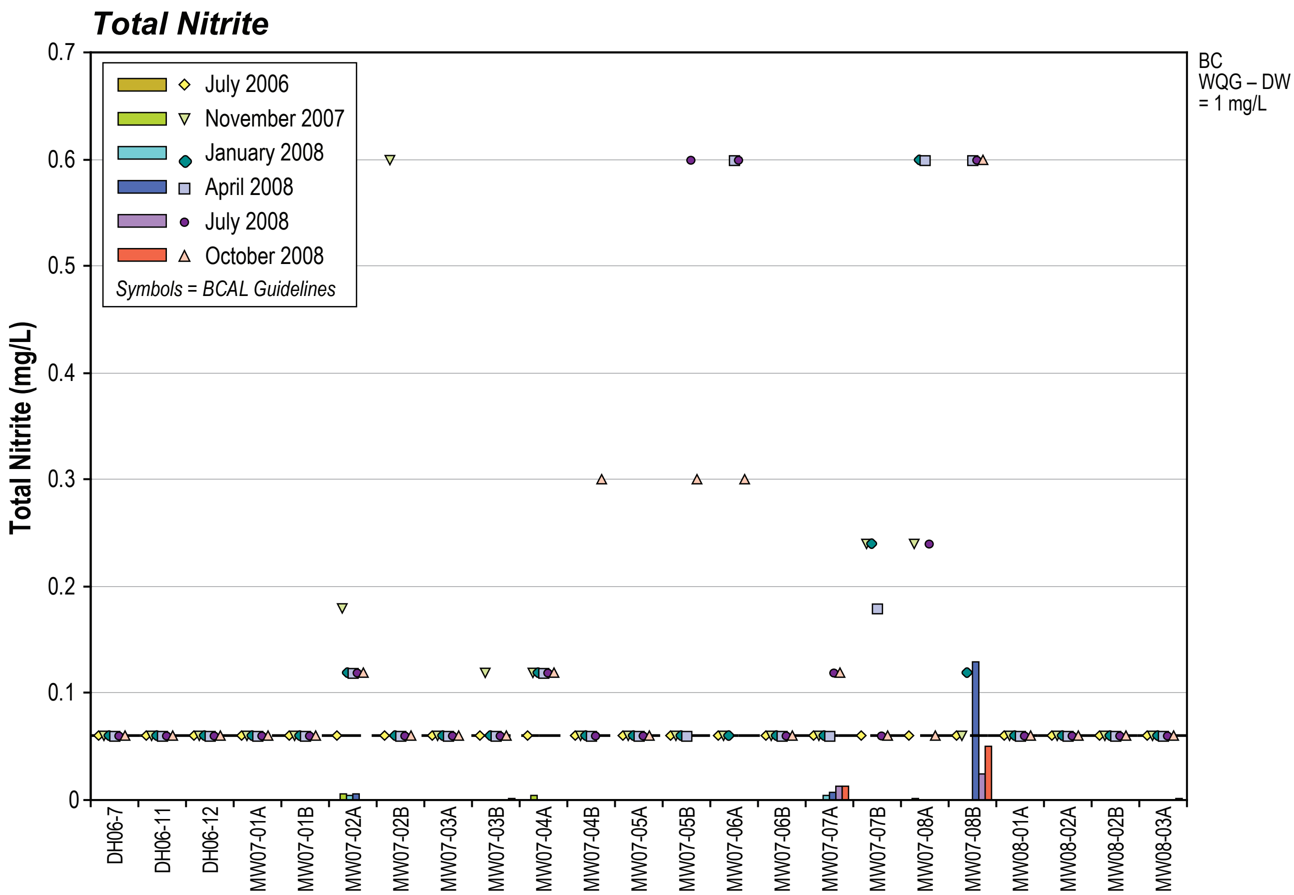
The total antimony concentrations varied between less than 0.0001 mg/L (in multiple wells) and

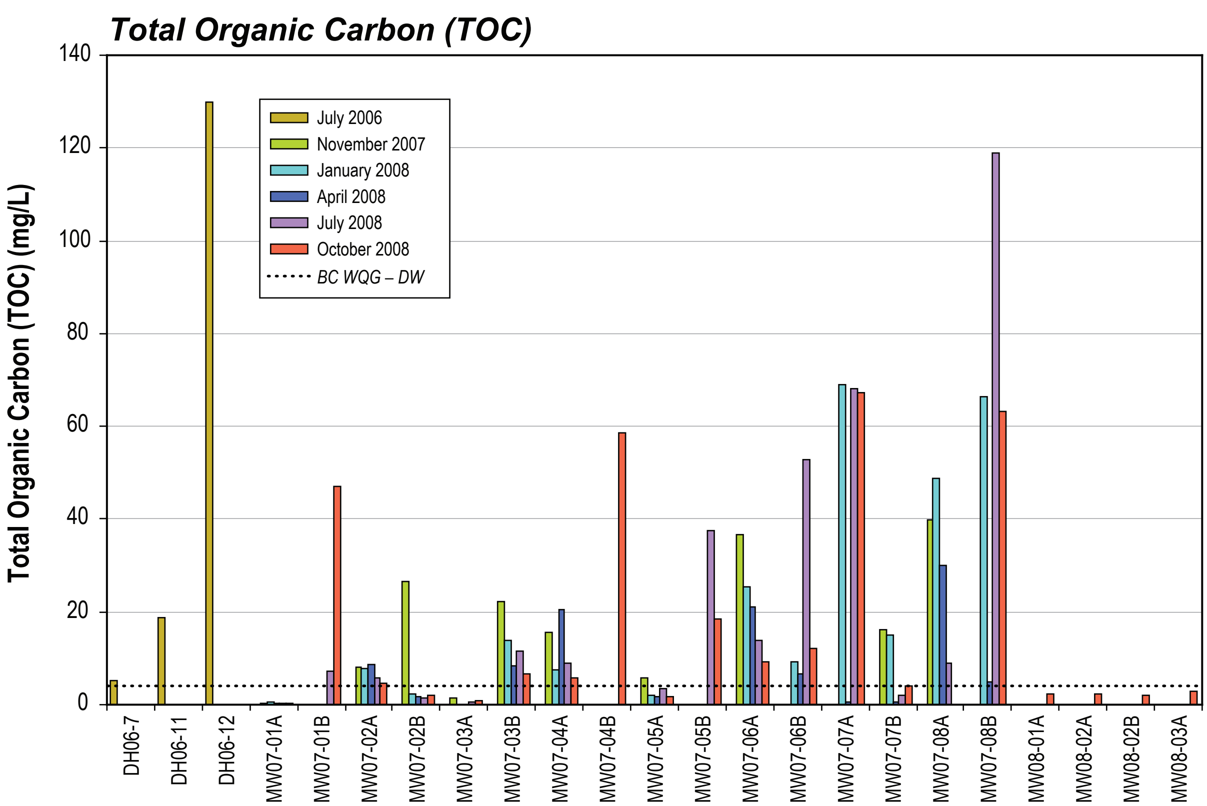




Morrison Copper/Gold Project: Total Fluoride and Total Sulfate

FIGURE 4.2-6





Morrison Copper/Gold Project: Total Nitrite and Total Organic Carbon (TOC)

FIGURE 4.2-7

Table 4.3-1
Morrison Copper/Gold Project: Total and Dissolved Metals Concentrations in Groundwater at Morrison Property

	Units	Total Metals			BCWQG[2] (DW) (Total)	BCWQG (FAL)[3] (Total)	CCME (FAL)[4] (Total)	Dissolved Metals			BCWQG[2] (DW) (Dissolved)	BCWQG (FAL)[3] (Dissolved)	CCME (FAL)[4] (Dissolved)
		Minimum	Average[1]	Maximum	(maximum)	(Maximum)	(Maximum)	Minimum	Average[1]	Maximum	(maximum)	(Maximum)	(Maximum)
Aluminum	mg/L	<0.001	*10.87*	*98*	ng	ng	0.005-0.100 H	<0.001	**<u>0.232</u>**	**<u>2.98</u>**	0.2	0.1U	ng
Antimony	mg/L	<0.0001	0.0017	**<u>0.0205</u>**	0.006	0.02	ng	<0.0001	0.001	0.0234	ng	ng	ng
Arsenic	mg/L	<0.0002	***<u>0.028127</u>***	***<u>0.318</u>***	0.025	0.005	0.005	<0.0002	0.011	0.119	ng	ng	ng
Barium	mg/L	0.0122	0.272	**2.58**	1	5	ng	0.0123	0.10	0.498	ng	ng	ng
Beryllium	mg/L	<0.0005	0.0007	0.0038	ng	0.0053	ng	<0.0005	BDL	<0.005	ng	ng	ng
Bismuth	mg/L	<0.0005	BDL	<0.005	ng	ng	ng	<0.0005	BDL	<0.005	ng	ng	ng
Boron	mg/L	<0.01	0.096	0.423	5	1.2	ng	<0.01	0.091	0.406	ng	ng	ng
Cadmium	mg/L	<0.000017	*<u>0.000823</u>*	***<u>0.0158</u>***	0.005	N	N	<0.000017	0.00010	0.00076	ng	ng	ng
Calcium	mg/L	3.09	64.75	318	ng	V	ng	2.38	54.33	268	ng	ng	ng
Chromium	mg/L	<0.0005	*<u>0.020</u>*	***<u>0.213</u>***	0.05	0.001	I	<0.0005	0.001	0.0128	ng	ng	ng
Cobalt	mg/L	<0.0001	0.0145	<u>0.15</u>	ng	0.11	ng	<0.0001	0.002	0.0296	ng	ng	ng
Copper	mg/L	<0.0001	*<u>0.1060</u>*	***<u>3.06</u>***	0.5	O	J	<0.0001	0.002	0.021	ng	ng	ng
Iron	mg/L	0.044	***<u>19.6892</u>***	***<u>201</u>***	0.3	1	0.3	<0.03	<u>0.623</u>	<u>11.1</u>	ng	0.35	ng
Lead	mg/L	<0.00005	***0.010524***	***0.194***	0.01	P	K	<0.00005	0.00015	0.00119	ng	ng	ng
Lithium	mg/L	<0.005	0.037475	0.233	ng	5	ng	<0.005	0.032	0.242	ng	ng	ng
Magnesium	mg/L	1.06	22.76	85.5	ng	ng	ng	<0.025	18.63	90.5	500	ng	ng
Manganese	mg/L	0.00456	**1.73**	**<u>12.6</u>**	0.05	Q	ng	0.0019	1.22	12	ng	ng	ng
Mercury	mg/L	<0.00001	*<u>0.000159</u>*	***<u>0.0054</u>***	0.001	0.0001	L	<0.00001	0.00001	0.0001	ng	ng	ng
Molybdenum	mg/L	0.000783	0.0116	0.0475	0.25	2	0.073	0.000502	0.011	0.0468	ng	ng	ng
Nickel	mg/L	<0.0005	0.028	*<u>0.372</u>*	ng	M	M	<0.0005	0.004	0.0302	ng	ng	ng
Phosphorus	mg/L	<0.3	0.576	7.43	n/a [6]	n/a[6]	W	<0.3	0.16	0.61	ng	ng	ng
Potassium	mg/L	0.175	4.03	14.1	ng	ng	ng	0.17	2.79	13.3	ng	ng	ng
Selenium	mg/L	<0.0001	0.00083	*<u>0.0069</u>*	0.01	0.002 R	0.001	<0.0001	0.00047	0.00377	ng	ng	ng
Silicon	mg/L	3.67	18.77	170	ng	ng	ng	2.4	5.23	10.4	ng	ng	ng
Silver	mg/L	<0.00001	0.0011	*<u>0.0545</u>*	ng	S	0.0001	<0.00001	0.00002	0.00016	ng	ng	ng
Sodium	mg/L	3.8	123.08	**849**	200	ng	ng	3.6	123.70	870	ng	ng	ng
Strontium	mg/L	0.0586	0.6215	3.45	ng	ng	ng	0.0398	0.56	3.16	ng	ng	ng
Thallium	mg/L	<0.0001	<u>0.00036</u>	*<u>0.0064</u>*	ng	0.0003	0.0008	<0.0001	BDL	<0.0001	ng	ng	ng
Tin	mg/L	<0.0001	0.00113	0.0108	ng	ng	ng	<0.0001	0.00040	0.0046	ng	ng	ng
Titanium	mg/L	<0.01	<u>0.16</u>	<u>2.67</u>	ng	0.1	ng	<0.01	0.007	0.028	ng	ng	ng
Uranium	mg/L	0.000024	0.0034	**0.0454**	0.02	0.3	ng	0.000023	0.002	0.0293	ng	ng	ng
Vanadium	mg/L	<0.001	0.041	0.451	ng	ng	ng	<0.001	0.003	0.0316	ng	ng	ng
Zinc	mg/L	<0.001	*0.110*	*<u>1.67</u>*	5	T	0.03	<0.001	0.007	0.074	ng	ng	ng

Note:

All measurements are in unit mg/L.

Bold = exceeds the MAC listed in the BCDWS guidelines.

<u>Underline</u> = exceeds the MAC listed in the BC aquatic life guidelines.

***italic* = exceeds the MAC listed in the CCME guidelines.**

1. Average is calculated using half of the detection limit when the result was below it.
2. BCWQG (DS)= BC Water Quality Guidelines for Drinking Water. Source: BC MOE 2006.
3. BCWQG (FAL) = British Columbia Water Quality Guidelines, Freshwater Aquatic Life. Source: BC MOE 2008.
4. CCME (WQG) (FAL) = Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Source: CCME 2007.
5. BDL = Below Detection Limit.
6. There is no guideline for phosphorous in groundwater, only in lakes (0.01 mg/L) for BC - DW and in salmon predominant lakes (0.005 to 0.015 mg/L) for BC - FAL.
ng = no guideline.

H = CCME aluminum guideline=0.005 mg/L at pH<6.5; [Ca2+] <4 mg/L; DOC<2 mg/L, 0.1 mg/L at pH ≥ 6.5; [Ca2+] ≥ 4 mg/L; DOC ≥ 2 mg/L.

I = CCME chromium guideline = 0.001 mg/L (Cr VI), or 0.0089 (Cr III) which is interim.

J = CCME guideline for copper = 0.002 mg/L at 0-120 mg/L [$CaCO_3$], 0.003mg/L at 120 - 180 mg/L [$CaCO_3$], 0.004 mg/L at > 180 mg/L [$CaCO_3$].

K = CCME guideline for lead = 0.001 mg/L for [$CaCO_3$]=0-60 mg/L, 0.002 mg/L for [$CaCO_3$]=60-120 mg/L, 0.004 mg/L for [$CaCO_3$]=120-180 mg/L, 0.007 mg/L for [$CaCO_3$] . >180 mg/L.

L = CCME guideline for mercury 0.000026 mg/L inorganic Hg, 0.000004 mg/L MeHg.

M = CCME and BC aquatic life guideline for nickel = 0.025 mg/L at 0-60 mg/L [$CaCO_3$], 0.065mg/L at 60 - 120 mg/L [$CaCO_3$], 0.110 mg/L at 120 - 180 mg/L [$CaCO_3$], 0.150 mg/L at > 180 mg/L [$CaCO_3$].

N = Cadmium BC max and CCME guideline = 0.001 * $10^{\{0.86[\log(\text{hardness})] - 3.2\}}$ mg/L.

O = Copper BC Max guideline of (0.094(hardness)+2) µg/L. The 30-d mean Cu guideline is ≤ 2 µg/L for hardness ≤ 50 mg/L, and guideline is ≤ 0.04*(mean hardness) µg/L for hardness > 50 mg/L.

P = Lead BC Max guideline of $e^{(1.273 \ln(\text{hardness}) - 1.460)}$ ug/L if hardness > 8mg/L; 0.003 mg/L if hardness ≤ 8mg/L. 30-day mean Pb guideline of ≤3.31 + e(1.273 ln (mean hardness) - 4.704) ug/L for hardness > 8mg/L only; otherwise no 30-d mean guideline.

Q = Manganese BC Max guideline 0.01102(hardness)+0.54 mg/L; 30-day mean Mn guideline 0.0044(mean hardness)+0.605 mg/L.

R = selenium BC 30-day mean.

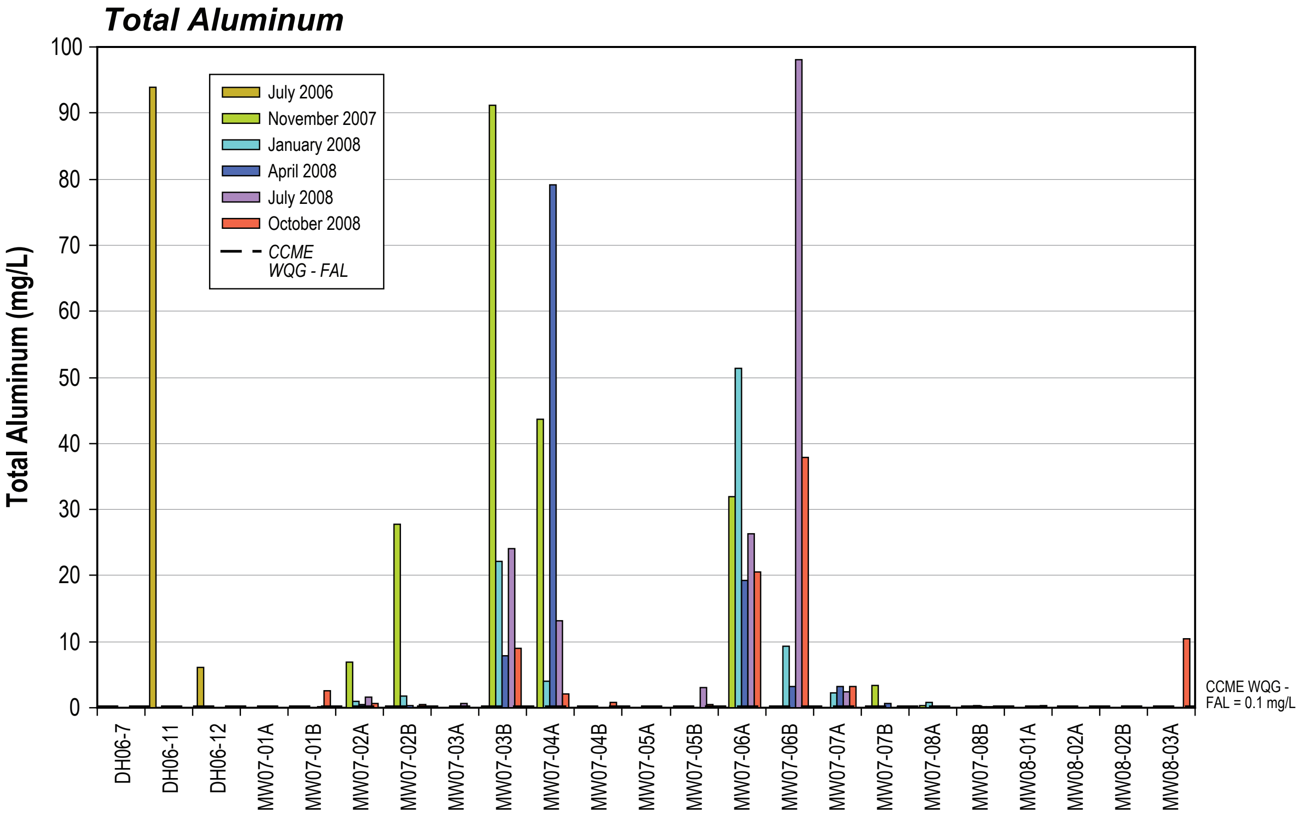
S = Max Ag guideline of 0.003 mg/L if hardness > 100mg/L, max of 0.0001mg/L if hardness ≤ 100mg/L 30-d mean Ag guideline of 0.0015 mg/L if hardness > 100mg/L, 30-d mean of 0.00005 mg/L if hardness ≤ 100mg/L.

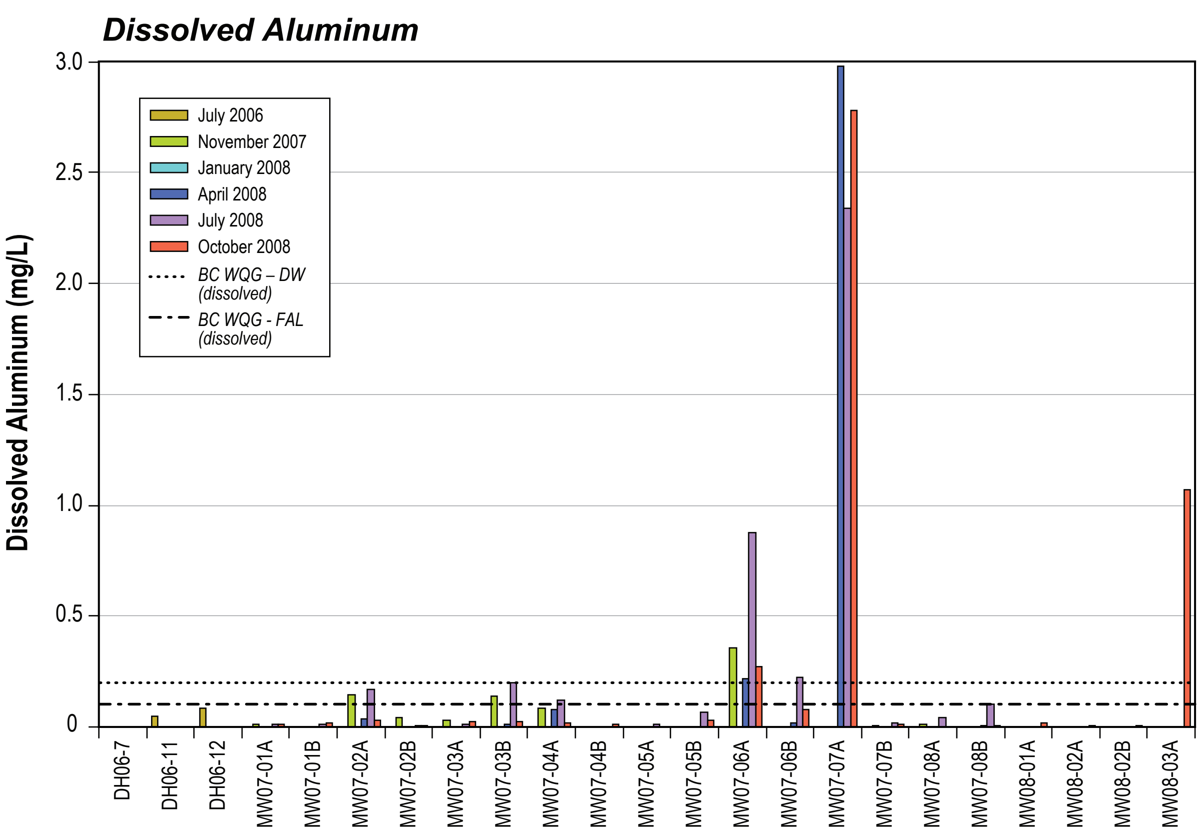
T = Max Zn guideline = [33 + 0.75*(hardness - 90)] µg/L, minimum of 33 µg/L. 30-day mean Zn guideline = [7.5 + 0.75*(hardness - 90)] µg/L, min of 7.5 µg/L.

U = for pH ≥ 6.5, for pH < 2 dissolved Al = $e^{(1.209 - 2.426 (pH) + 0.286 K)}$ where K = (pH)2.

V = Ranges from <4 to >8 mg/L, dependent on sensitivity of acid influx.

W = depends on background values.





Morrison Copper/Gold Project:
Total and Dissolved Aluminum

FIGURE 4.3-1

0.0205 mg/L (MW07-07B). The total antimony concentrations exceeded the BCWQG for drinking water of 0.006 mg/L for samples taken from monitoring wells MW07-07B and MW08-01A. The total antimony concentrations exceeded the BCWQG for freshwater aquatic life of 0.02 mg/L in only one groundwater sample from MW07-07B.

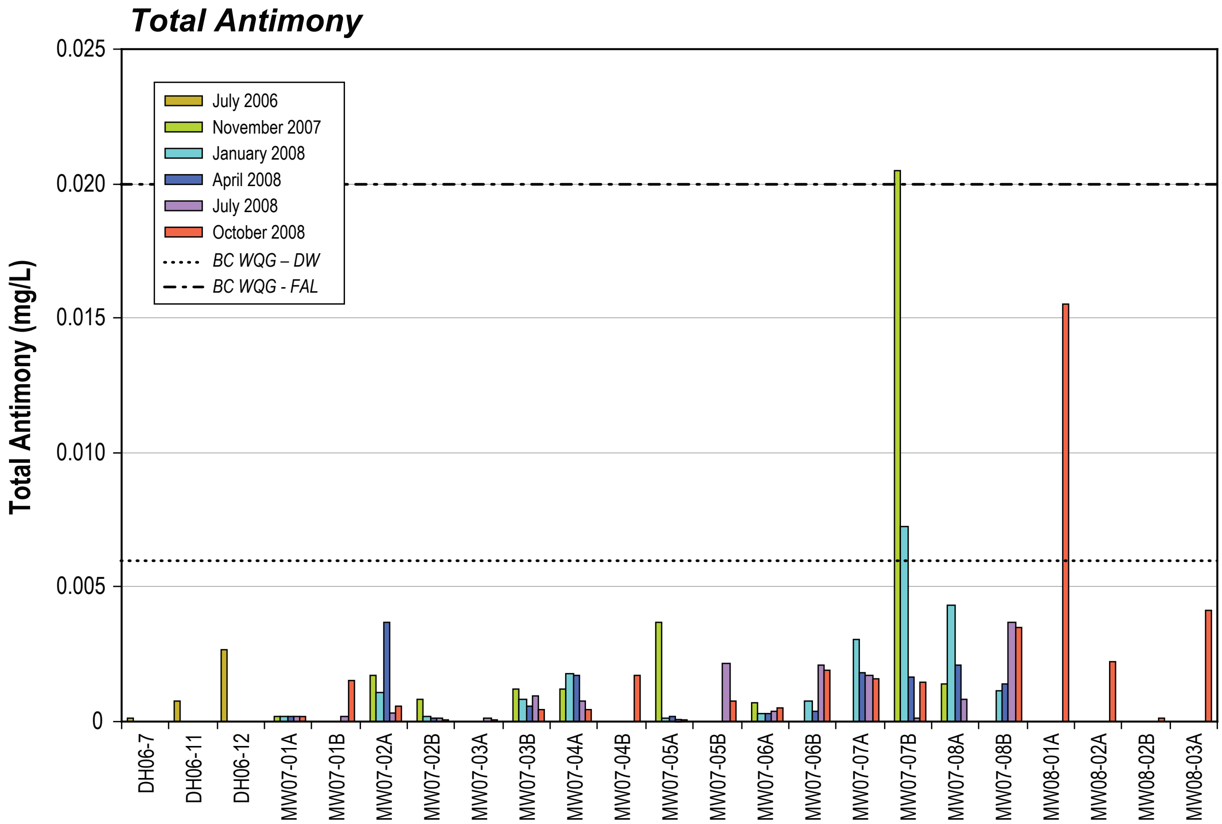
Total arsenic concentrations in groundwater samples collected varied from less than 0.0002 mg/L (in multiple wells) to 0.318 mg/L (MW07-06B). Total arsenic concentrations exceeded the BCWQG of 0.025 mg/L for drinking water in monitoring wells DH06-11, MW07-02B, MW07-03B, MW07-04A, MW07-05A, MW07-06B, MW07-07A, and MW07-08B. The BCWQG (0.005 mg/L) and the CCME water quality guidelines (0.005 mg/L) for the protection of freshwater aquatic life for total arsenic were exceeded in monitoring wells DH06-11, MW07-01B, MW07-02A and B, MW07-03A and B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07A and B, MW07-08A and B, MW08-02A, MW08-02B, and MW08-03A. Figure 4.3-2 shows the concentrations of total antimony and arsenic in groundwater from monitoring wells at the Morrison property.

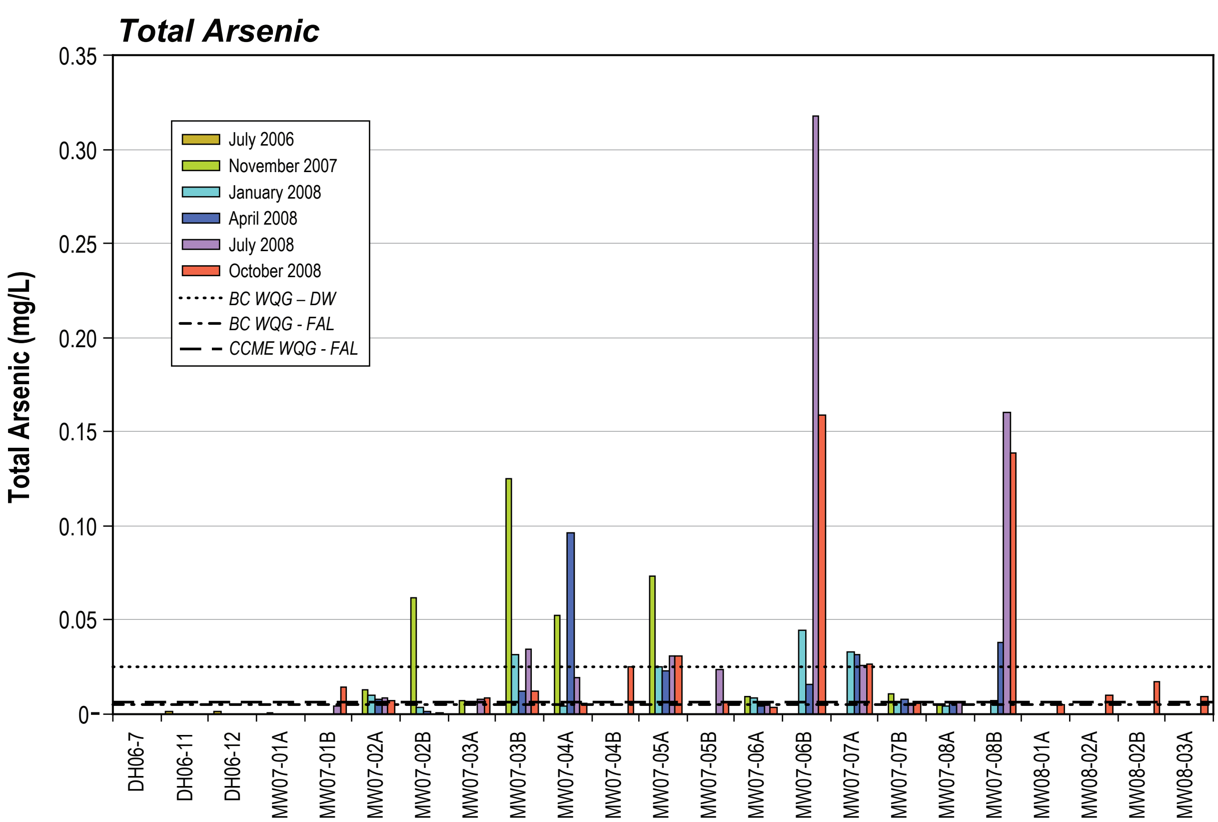
The total barium concentration measured in groundwater from monitoring wells during the baseline program varied from 0.0122 mg/L (MW07-01A) and 2.58 mg/L (DH06-11). The BCWQG of 1 mg/L for drinking water was exceeded for total barium in groundwater samples obtained from monitoring wells DH06-11, MW07-03B, and MW07-06B. No groundwater samples exceeded the BCWQG for the protection of freshwater aquatic life. There are no CCME water quality guidelines for the protection of freshwater aquatic life for total barium.

The total cadmium concentrations in groundwater at the Morrison property varied from less than 0.000017 mg/L (in multiple wells) to 0.0158 mg/L (MW07-06B). Two samples exceeded the BCWQG of 0.005 mg/L for drinking water for total cadmium. These were both taken from MW07-06B. The BCWQG and CCME Guidelines for the Protection of Freshwater Aquatic Life are hardness dependent and were exceeded for groundwater samples taken from monitoring wells DH06-11, DH06-12, MW07-01A and B, MW07-02A and B, MW07-03A and B, MW07-04A and B, MW07-05A, MW07-06A and B, MW07-07A and B, MW07-08A and B, MW08-01A, and MW08-03A. The total barium and total cadmium concentrations are shown in Figure 4.3-3.

The total chromium concentrations measured in groundwater samples from the Project varied from less than 0.0005 mg/L (in multiple wells) to 0.213 mg/L (MW07-06B). At least one sample from monitoring wells DH06-11, MW07-03B, MW07-04A, MW07-06A, and MW07-06B exceeded the BCWQG of 0.05 mg/L for drinking water for total chromium. The total chromium concentrations exceeded the BCWQG (0.001 mg/L) and CCME water quality guidelines (0.001 mg/L) for the protection of freshwater aquatic life for groundwater in monitoring wells DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07A and B, MW07-08A and B, MW08-02A, and MW08-03A.

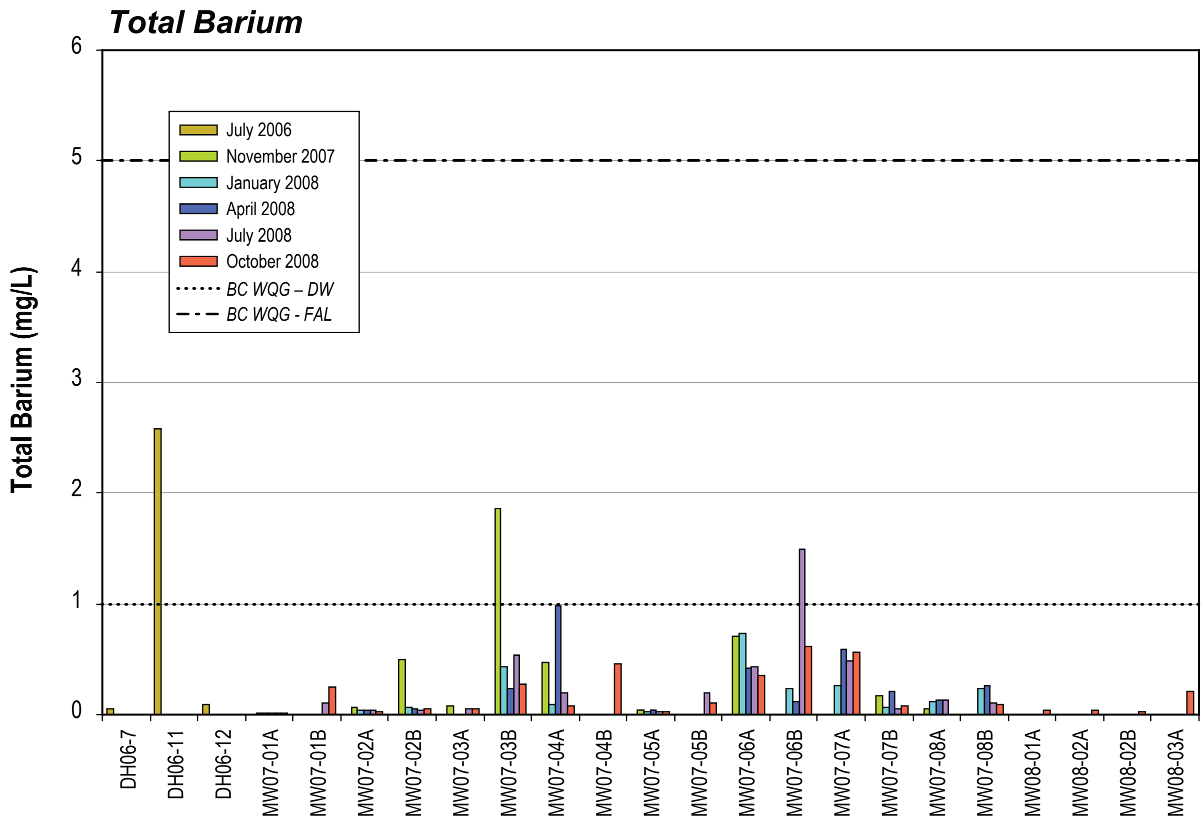
The total cobalt concentrations in monitoring well groundwater varied from less than 0.0001 mg/L (in multiple wells) to 0.15 mg/L (MW07-06B). The BC WQG of 0.11 mg/L for freshwater aquatic life for total cobalt was exceeded in only two samples taken during the

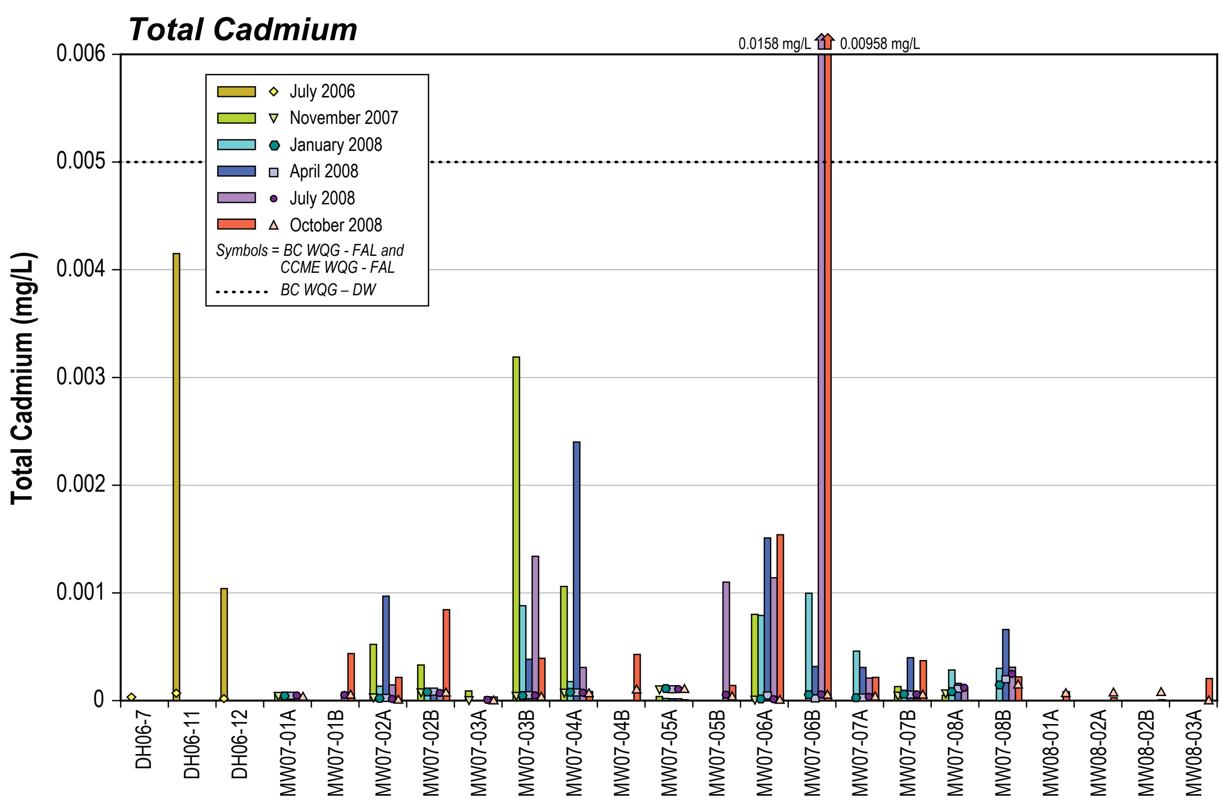




Morrison Copper/Gold Project: Total Antimony and Total Arsenic

FIGURE 4.3-2





Morrison Copper/Gold Project: Total Barium and Total Cadmium

FIGURE 4.3-3

baseline program. These were groundwater samples from monitoring wells DH06-11 and MW07-06B. Figure 4.3-4 shows the total chromium and total cobalt concentrations measured during the baseline program at the Morrison property.

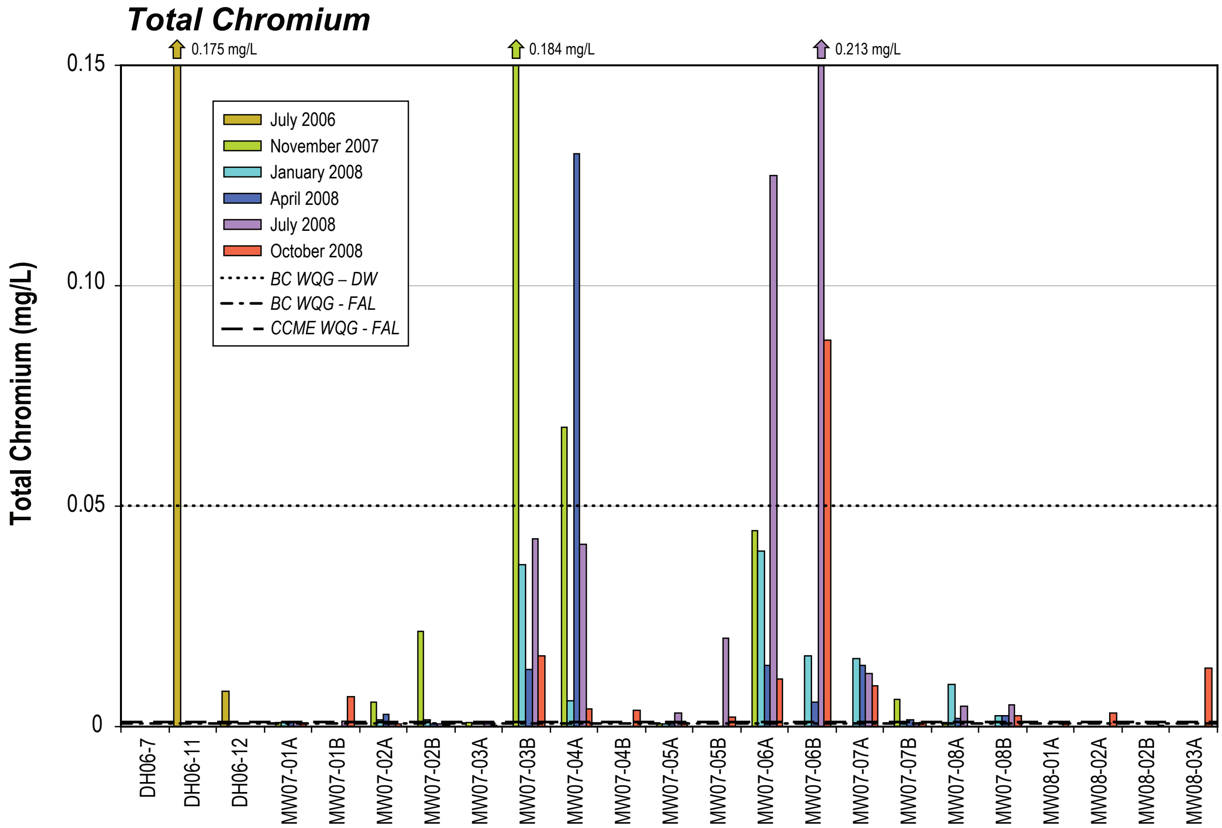
The total copper concentrations in groundwater at the Morrison property varied from less than 0.0001 mg/L (MW07-01A) to 3.06 mg/L (MW07-06B). The BCWQG of 0.5 mg/L for drinking water was exceeded for two groundwater samples taken from monitoring wells MW07-06B. The BCWQG for freshwater aquatic life, which is hardness dependent, was exceeded for samples collected from monitoring wells DH06-11, DH06-12, MW07-02A, MW07-03B, MW07-04A, MW07-05B, MW07-06A and B, MW07-07A and B, MW07-08A, and MW08-03A. The CCME Guidelines for the Protection of Freshwater Aquatic Life, which is hardness dependent, was exceeded for samples obtained from monitoring wells DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07A and B, MW07-08A and B, and MW08-03A. The total copper concentrations are shown in Figure 4.3-5.

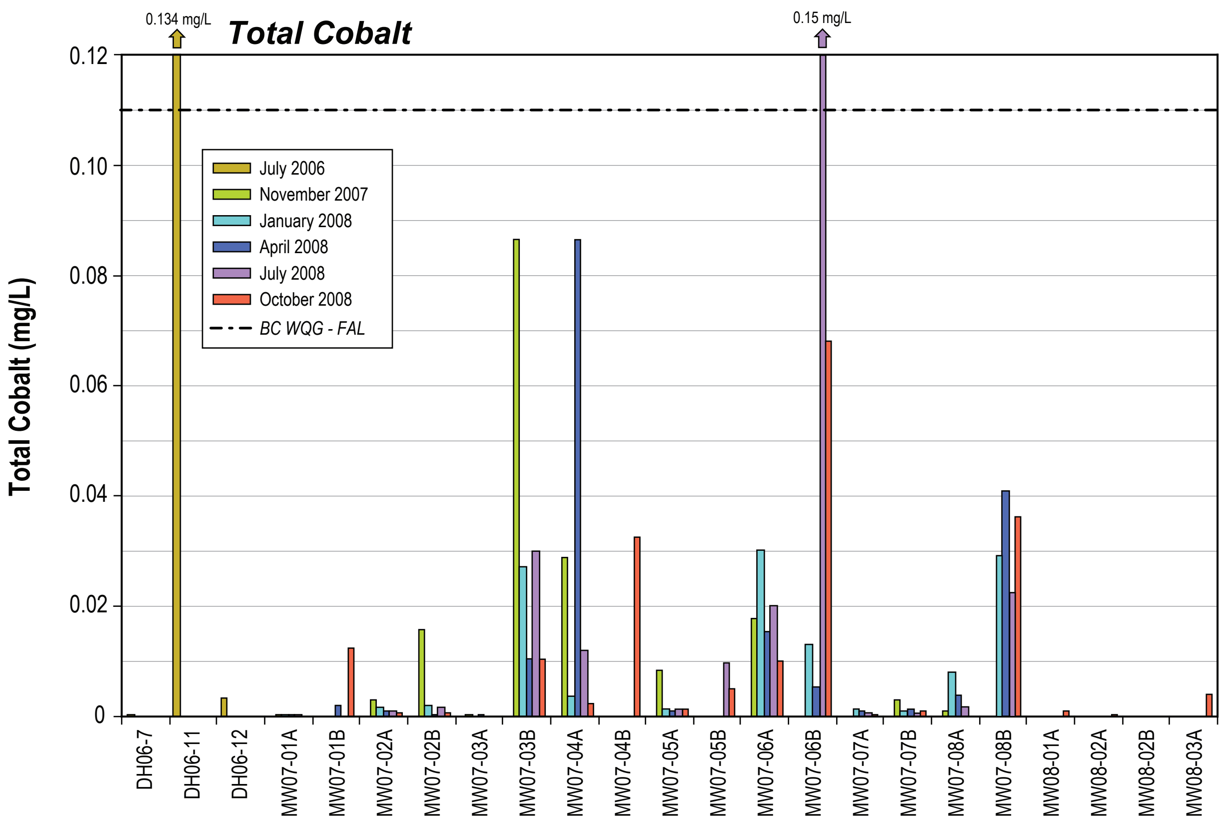
The total iron concentrations in groundwater samples collected during the baseline study varied from 0.044 mg/L (MW07-03A) to 201 mg/L (MW07-06B). The BCWQG of 0.3 mg/L for drinking water and the CCME water quality guidelines of 0.3 mg/L for the protection of freshwater aquatic life for total iron were exceeded in monitoring wells DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03A and B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07A and B, MW07-08A and B, MW08-01A, MW08-02A, MW08-02B, and MW08-03A. The BCWQG of 1 mg/L for freshwater aquatic life was exceeded for total iron in monitoring wells DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03B, MW07-04A and B, MW07-05B, MW07-06A and B, MW07-07B, MW07-08A and B, MW08-02B, and MW08-03A.

Dissolved iron concentrations in groundwater samples collected at the Project varied from less than 0.03 mg/L (in multiple wells) to 11.1 mg/L (MW07-04B). Monitoring wells MW07-01B, MW07-03B, MW07-04A and B, MW07-05A and B, MW07-06A and B, MW07-07B, MW07-08A and B, MW08-02B, and MW08-03A had dissolved iron concentrations that exceeded the BCWQG of 0.35 mg/L for freshwater aquatic life. Figure 4.3-6 shows the groundwater sampling results for total and dissolved iron.

The total lead concentrations in groundwater sampled from the monitoring wells at Project varied from less than 0.00005 mg/L (in multiple wells) to 0.194 mg/L (MW07-06B). The BCWQG of 0.1 mg/L for drinking water was exceeded in at least one sample from monitoring wells DH06-11, MW07-02B, MW07-03B, MW07-04A, MW07-06A and B and MW07-08A. The BCWQG for freshwater aquatic life, which is hardness dependent, was exceeded in monitoring wells MW07-06A and B. The CCME Guidelines for the Protection of Freshwater Aquatic Life, which is hardness dependent, was exceeded in monitoring wells DH06-11, DH06-12, MW07-02A and B, MW07-03B, MW07-04A, MW07-05B, MW07-06A and B, MW07-07A, MW07-08A and MW08-03A. The total lead concentrations are presented in Figure 4.3-7.

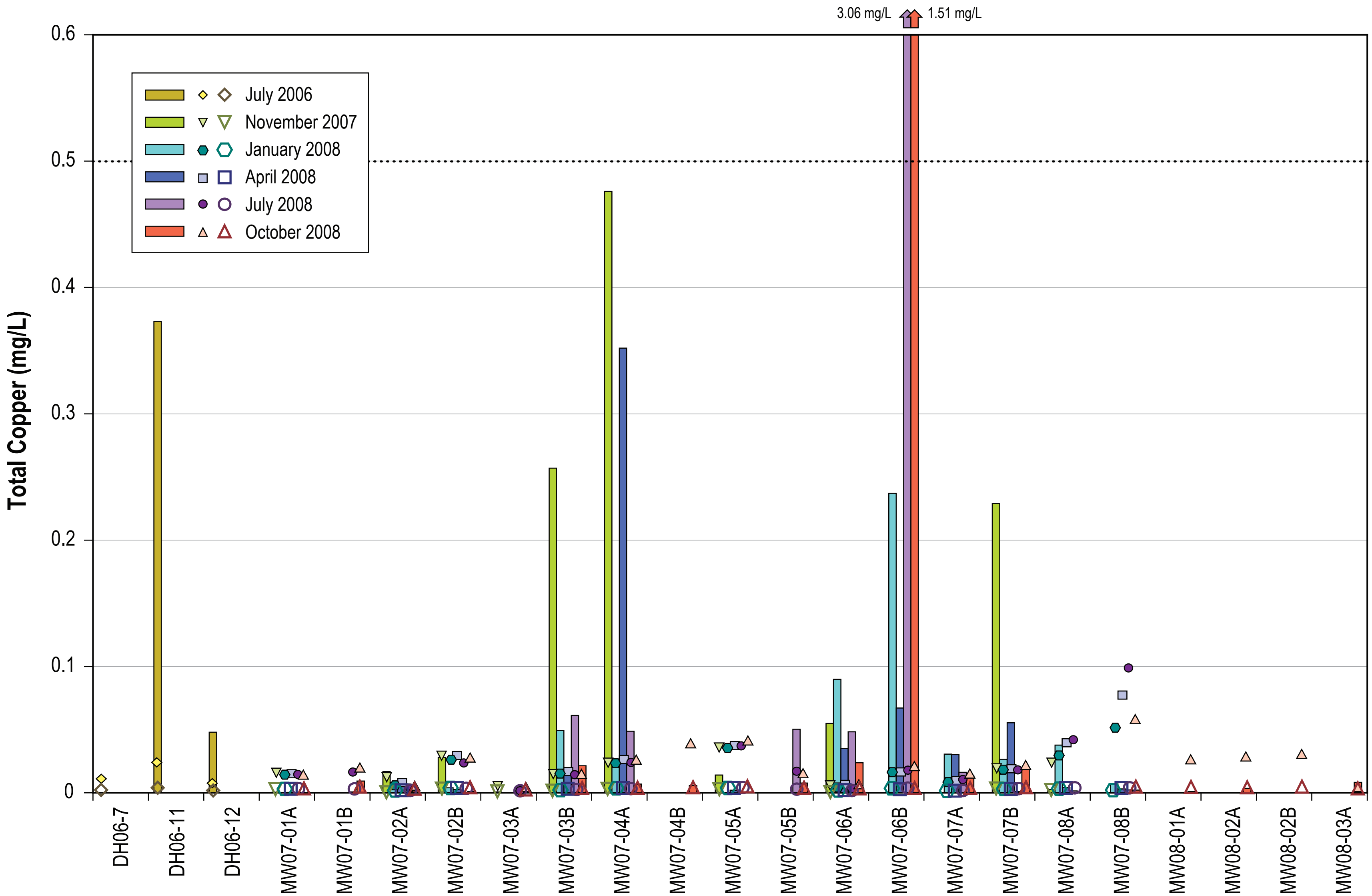
The total manganese concentrations in groundwater samples collected from the monitoring wells at the Project varied from 0.00456 mg/L (MW07-01A) to 12.6 mg/L (MW07-08B). The total





Morrison Copper/Gold Project:
Total Chromium and Total Cobalt

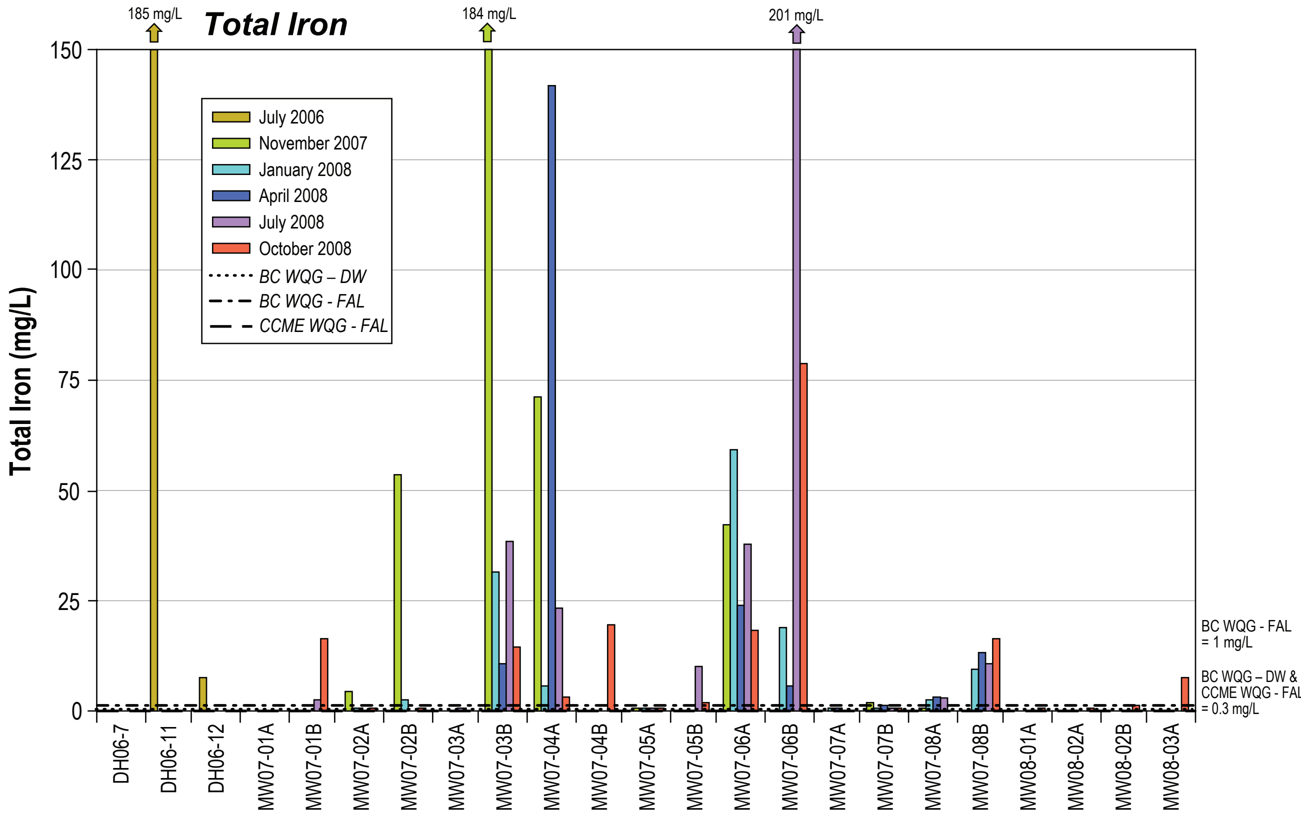
FIGURE 4.3-4



Notes: Dotted line represents the BC WQG – DW.
Solid symbols represent BC WQG - FAL.
Blank symbols represnt CCME WQG - FAL.

FIGURE 4.3-5

Morrison Copper/Gold Project: Total Copper



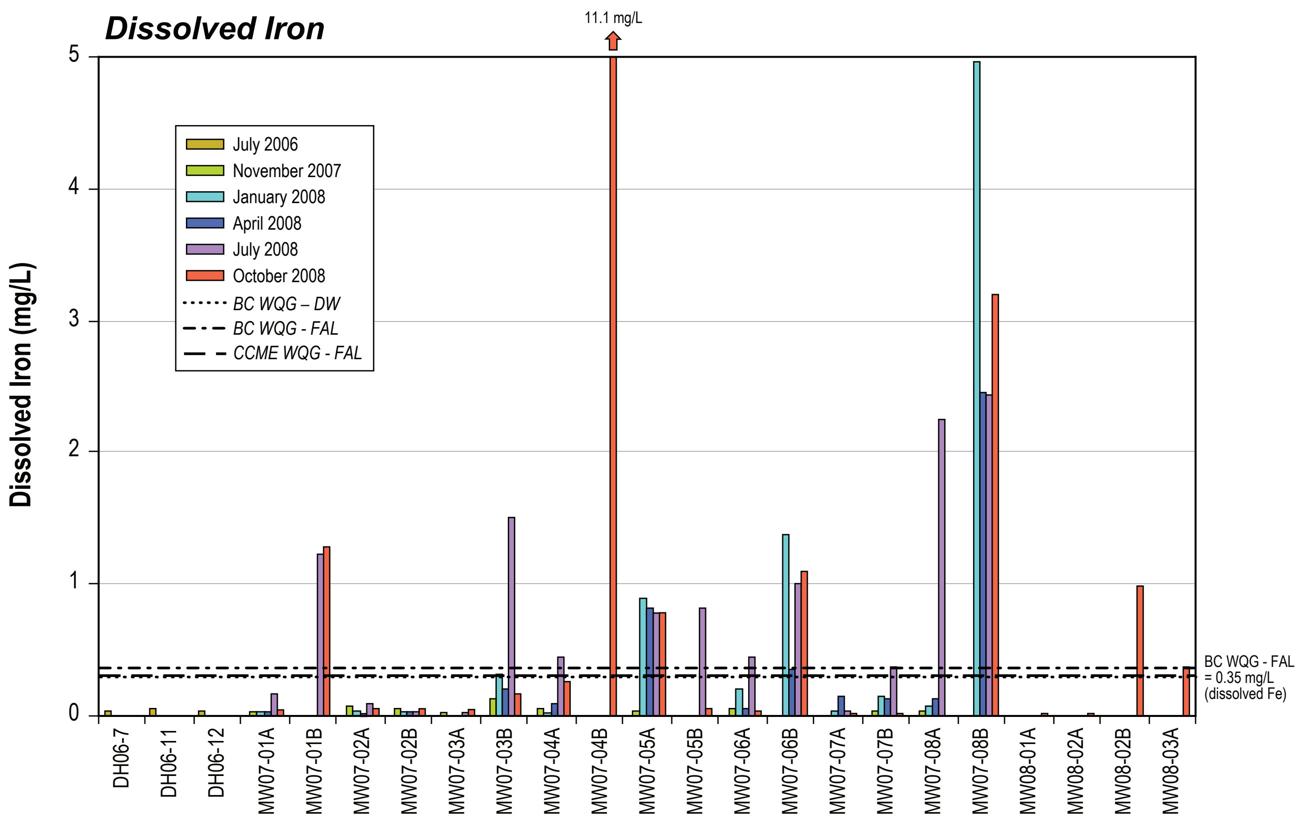
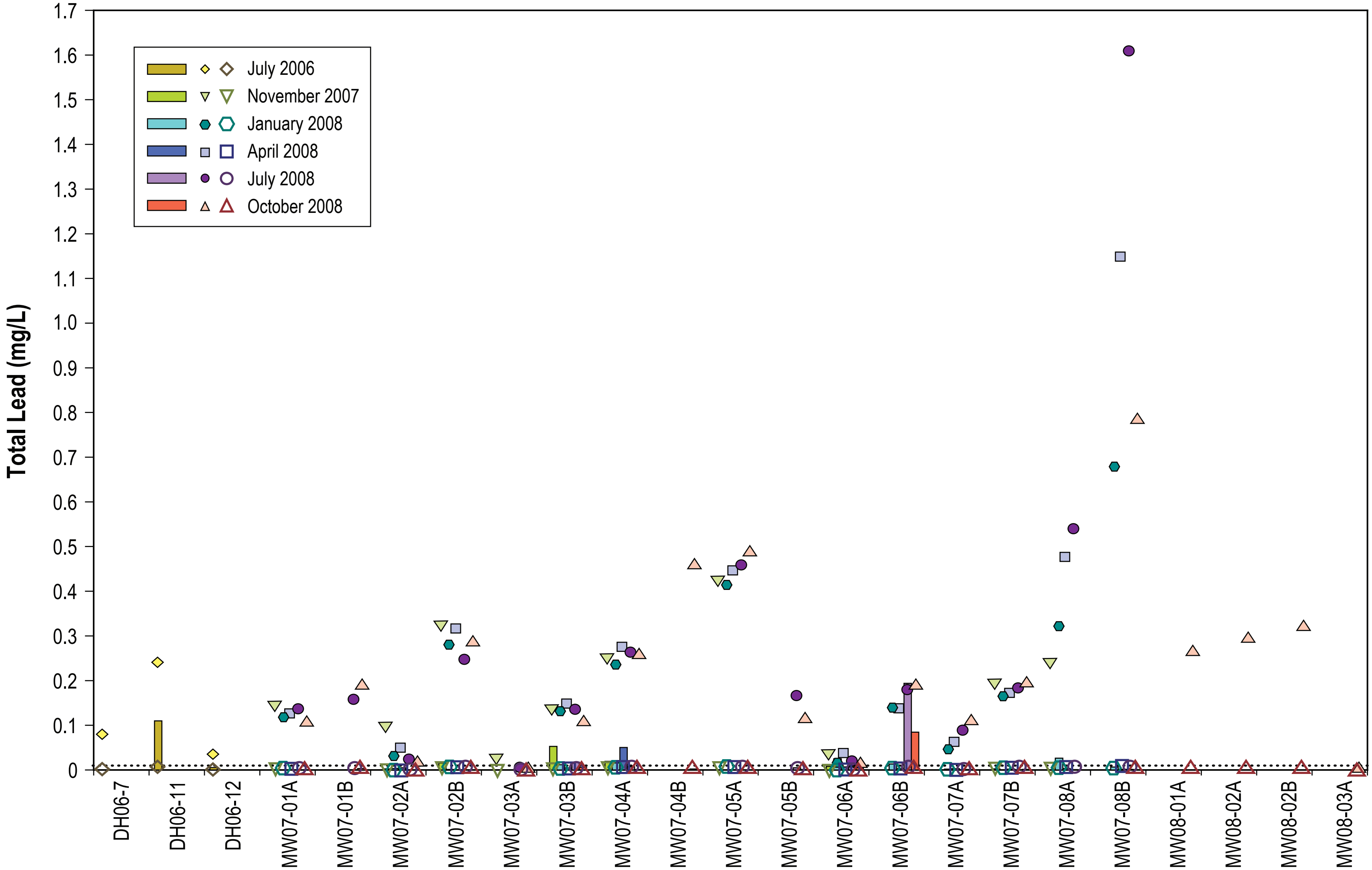


FIGURE 4.3-6

Morrison Copper/Gold Project:
Total and Dissolved Iron



Notes: Dotted line represents the BC WQG – DW.
Solid symbols represent BC WQG - FAL.
Blank symbols represnt CCME WQG - FAL.

FIGURE 4.3-7

Morrison Copper/Gold Project: Total Lead

manganese concentrations in groundwater samples exceeded the BCWQG of 0.05 mg/L for drinking water in all monitoring wells, with the exception of MW07-01A and MW07-03A. At least one sample from monitoring wells DH06-11, MW07-01B, MW07-03B, MW07-04A, MW07-05B, MW07-06B, and MW07-08B also exceeded the BCWQG for freshwater aquatic life, which is hardness dependent. Figure 4.3-8 shows the total manganese concentrations in the groundwater samples. There are no CCME Guidelines for the Protection of Freshwater Aquatic Life for total manganese

Total mercury concentrations varied from less than 0.00001 mg/L (in multiple wells) to 0.0054 mg/L (MW07-04A). The BCWQG of 0.001 mg/L for drinking water was exceeded in monitoring wells MW07-03B, MW07-04A, and MW07-06B. The BCWQG of 0.0001 mg/L for freshwater aquatic life was exceeded in monitoring wells MW07-03B, MW07-04A, MW07-06A, and MW07-06B. The CCME Guidelines for the Protection of Freshwater Aquatic Life was exceeded in at least one sample from monitoring wells MW07-02B, MW07-03B, MW07-04A, MW07-06A and MW07-06B, and MW07-07A. One-half the detection limit was above the CCME water quality guidelines of 0.000026 mg/L for the protection of freshwater aquatic life for three of the samples analyzed: MW07-02B (November, 2007) and MW07-06A (November, 2007 and January, 2008) and may also have been exceedances.

The total nickel concentrations varied from less than 0.0005 mg/L (in multiple wells) to 0.372 mg/L (MW07-06B). The BCWQG and the CCME Guidelines for the Protection of Freshwater Aquatic Life, which are hardness dependent, were exceeded for total nickel in monitoring wells DH06-11, MW07-03B, MW07-04A, and MW07-06B. Figure 4.3-9 shows the total mercury and nickel concentrations in groundwater samples collected from monitoring wells at the Morrison property during the baseline study.

The total selenium concentrations varied from less than 0.0001 mg/L (in multiple wells) to 0.0069 mg/L (MW07-06B). No samples were collected that exceeded the BCWQG of 0.01 mg/L for drinking water. The selenium concentrations in groundwater samples collected from monitoring wells MW07-03B, MW07-04A, MW07-06B, and MW07-07A exceeded the BCWQG of 0.002 mg/L for freshwater aquatic life. Groundwater samples collected from monitoring wells DH06-11, MW07-02A and B, MW07-03B, MW07-04A, MW07-06A and B, MW07-07A and B, and MW08-03A contained selenium concentration that exceeded the CCME water quality guidelines of 0.001 mg/L for the protection of freshwater aquatic life.

The total silver concentrations measured in groundwater samples collected from monitoring wells during the baseline groundwater sampling program varied from less than 0.00001 mg/L (in multiple wells) to 0.0545 mg/L (DH06-11). The monitoring wells that had samples exceeding the BCWQG for freshwater aquatic life, which is hardness dependent, were DH06-11, DH06-12, MW07-02A, MW07-06A and B, MW07-07A, and MW08-03A. The CCME water quality guidelines of 0.0001 mg/L for the protection of freshwater aquatic life was exceeded in groundwater samples collected from monitoring wells DH06-11, DH06-12, MW07-02A and B, MW07-03B, MW07-04A, MW07-05B, MW07-06A and B, MW07-07A, and MW08-03A. Figure 4.3-10 shows the total selenium and silver concentrations measured in groundwater samples collected during the groundwater baseline study.

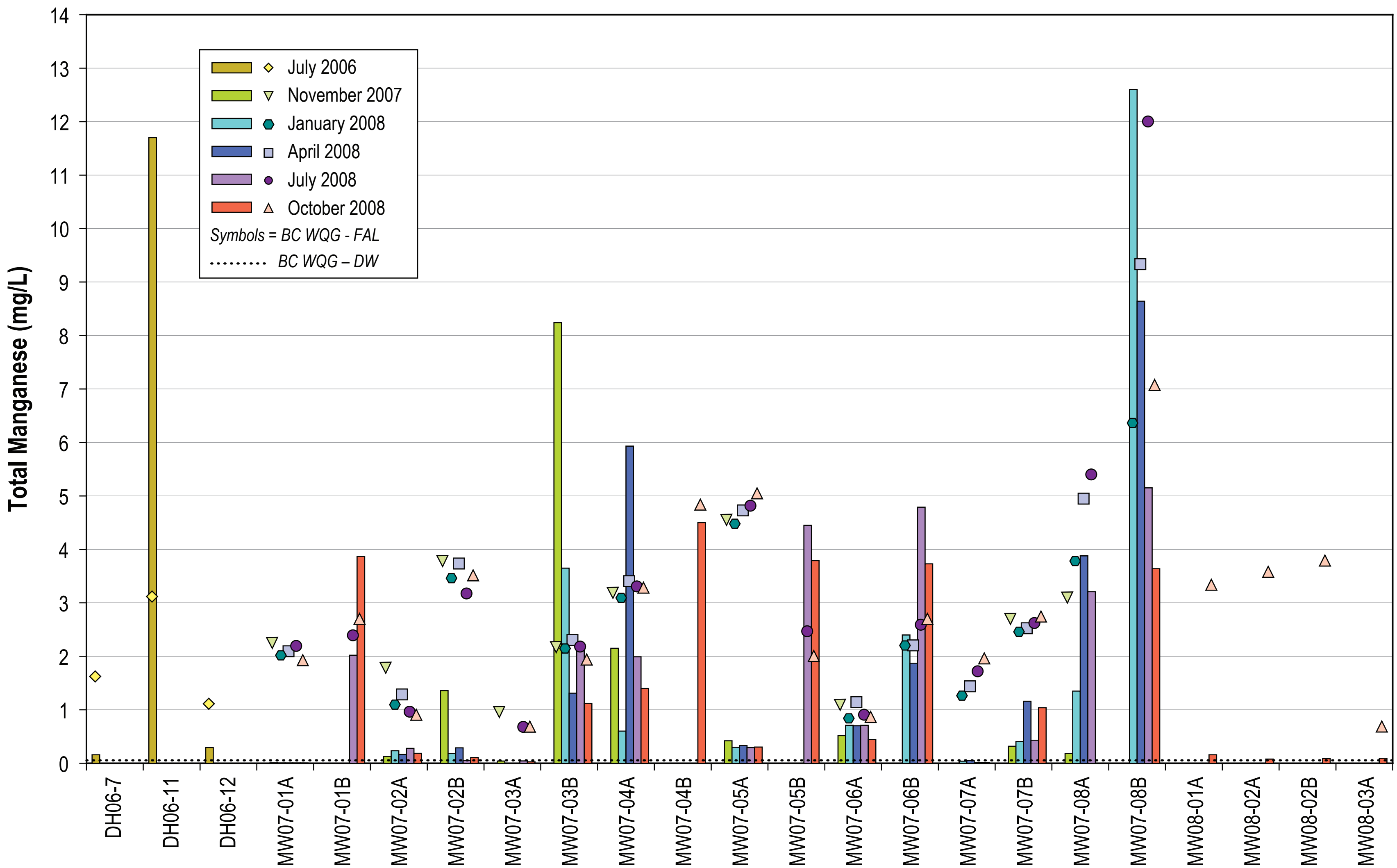
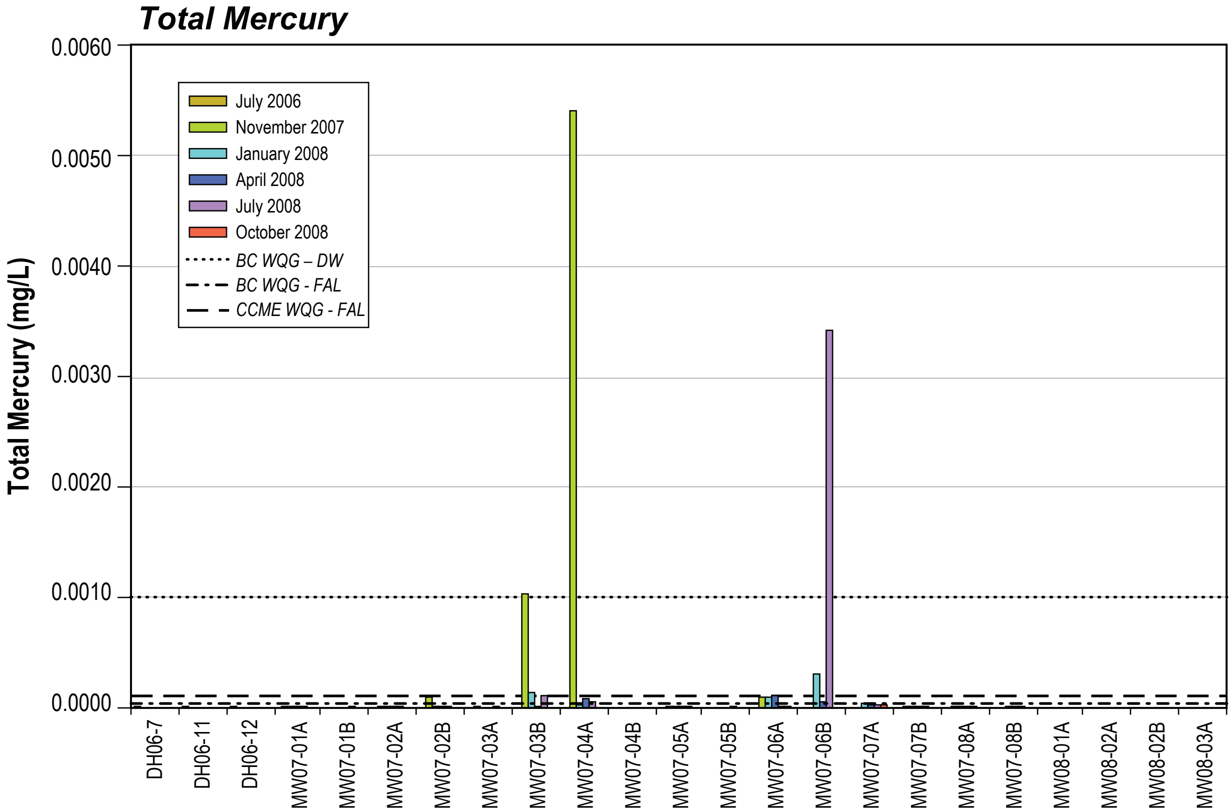


FIGURE 4.3-8

Morrison Copper/Gold Project: Total Manganese



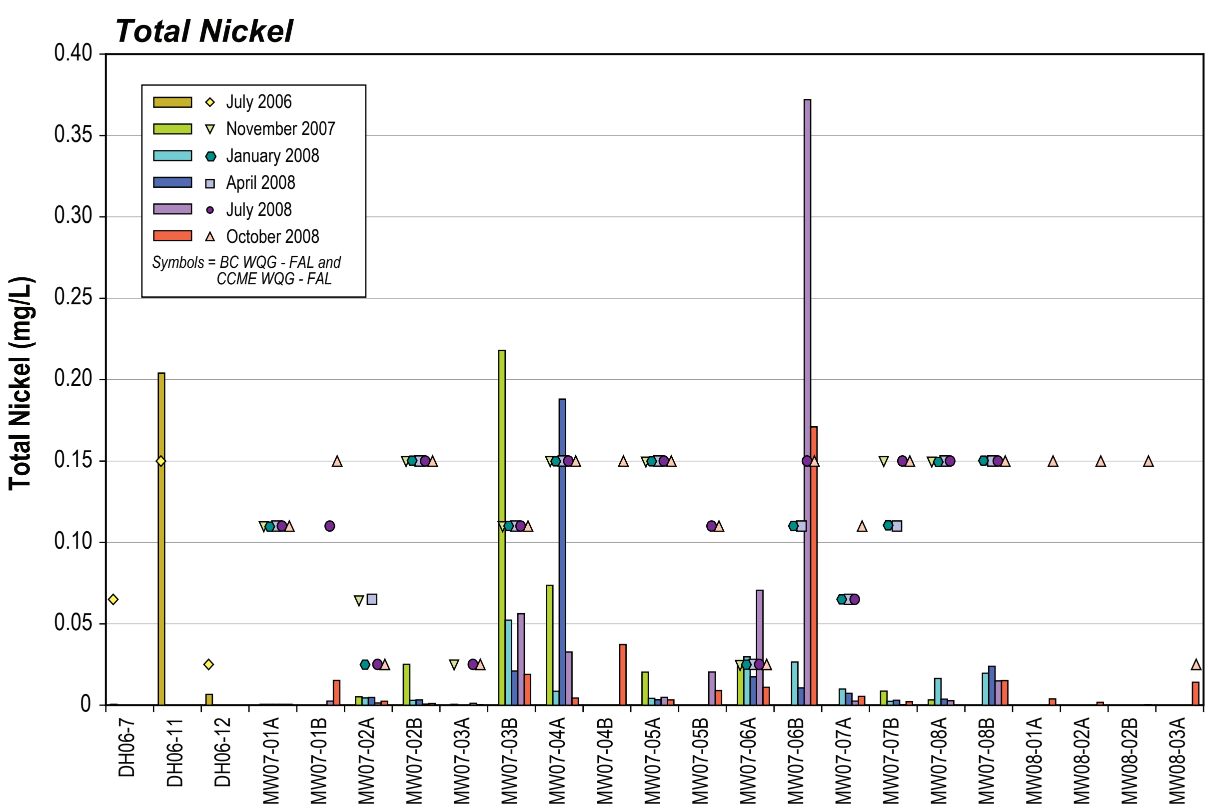
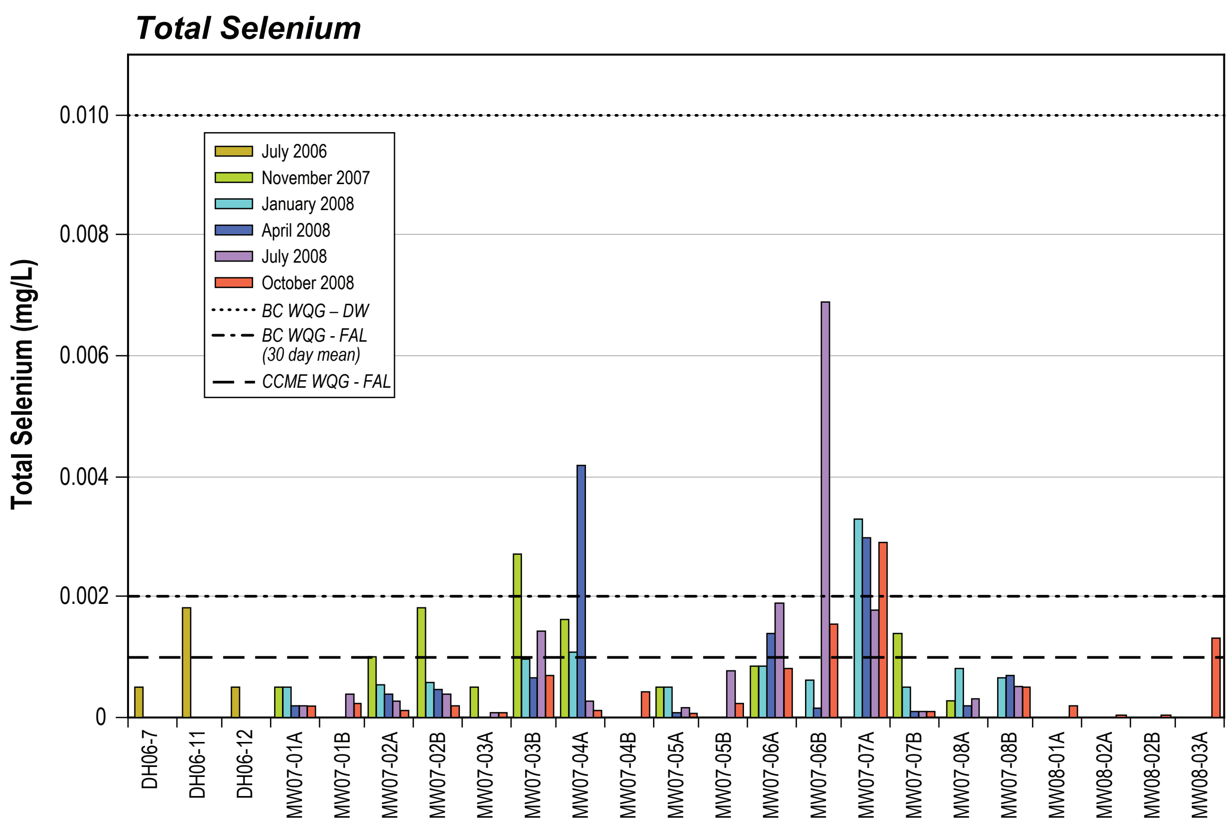
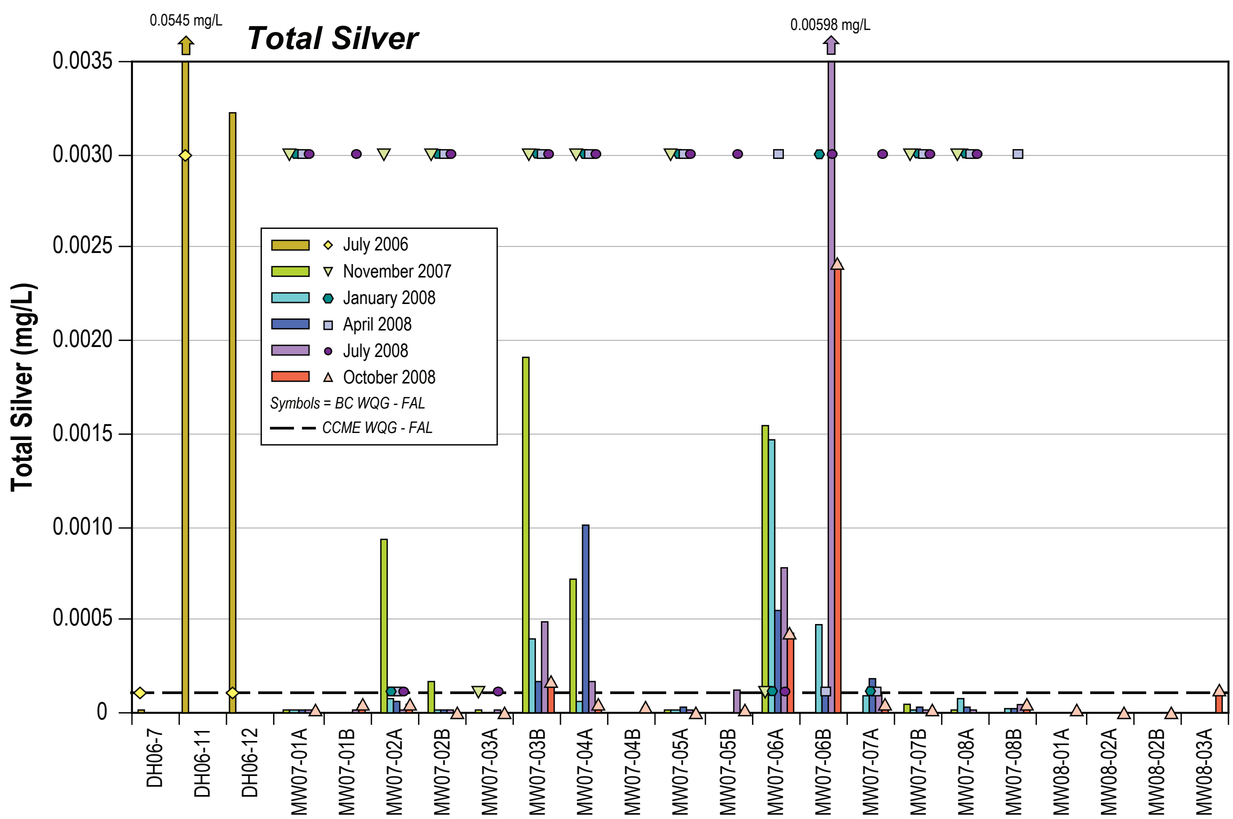


FIGURE 4.3-9

Morrison Copper/Gold Project: Total Mercury and Total Nickel





Morrison Copper/Gold Project:
Total Selenium and Total Silver

FIGURE 4.3-10

The total sodium concentrations varied from 3.8 mg/L (MW07-06B) to 849 mg/L (MW07-08B). At least one sample from monitoring wells MW07-05B, MW07-06A, MW07-07A, and MW-07-08B exceed the BCWQG of 200 mg/L for drinking water for total sodium.

Total thallium concentrations varied from less than 0.0001 mg/L (in multiple wells) to 0.0064 mg/L (MW07-06B). Groundwater samples with total thallium concentrations that were in excess of the BCWQG of 0.003 mg/L for freshwater aquatic life were taken in monitoring wells DH06-11, MW07-02B, MW07-03B, MW07-04A, MW07-05B, MW07-06B, MW07-07A, and MW07-08B. Samples with total thallium concentrations that were in excess of the CCME water quality guidelines of 0.0008 mg/L for the protection of freshwater aquatic life were collected from monitoring wells DH06-11, MW07-03B, MW07-04A, and MW07-06B. Figure 4.3-11 illustrates the variations in total sodium and total thallium concentrations in the baseline groundwater samples collected.

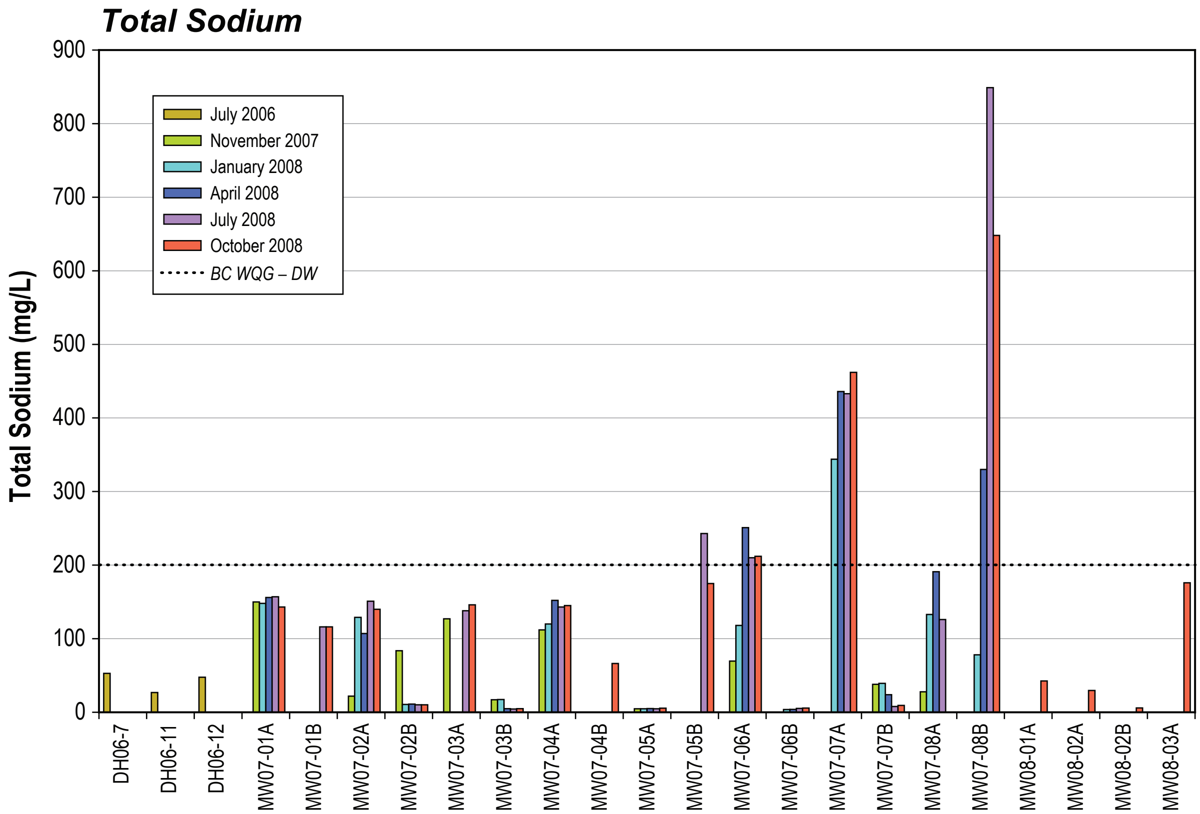
The total titanium concentrations in the groundwater samples collected varied from less than 0.01 mg/L(in multiple wells) to 2.67 mg/L (MW07-04A). Groundwater samples collected from monitoring wells DH06-11, MW07-02B, MW07-03B, MW07-04A, MW07-05B, MW07-06A and B, and MW08-03A contained at least one sample that exceeded the BCWQG of 0.1 mg/L for freshwater aquatic life guidelines.

The total uranium concentration in the groundwater samples collected varied from 0.000024 mg/L (MW07-01A) to 0.0454 mg/L (MW07-08B). Only two groundwater samples collected exceed the BCWQG of 0.02 mg/L for drinking water for uranium. Both of these are in MW07-08B. No sample exceeded the BCWQG of 0.3 mg/L for freshwater aquatic life. Figure 4.3-12 shows graphically the total titanium and total uranium concentrations in the groundwater samples collected.

Total zinc concentrations varied from less than 0.001 mg/L (in multiple wells) to 1.67 mg/L (MW07-06B). Monitoring wells DH06-11, DH06-12, MW07-02A, MW07-03B, MW07-04A, MW07-06A and B, and MW07-07A had groundwater samples that exceeded the BCWQG for freshwater aquatic life, which is hardness dependent. Monitoring wells DH06-11, DH06-12, MW07-01B, MW07-02A and B, MW07-03B, MW07-04A, MW07-06A and B, 0 MW07-7A and B, and MW07-08A and B had groundwater samples that exceeded the CCME water quality guidelines of 0.03 mg/L for the protection of freshwater aquatic life. No samples exceeded the BCWQG for drinking water. Figure 4.3-13 shows the total zinc concentrations of the groundwater samples collected.

4.4 Piper Diagram

Groundwater chemistry is usually representative of the host rock in which it circulates. Common rock-forming minerals that are abundant in unaltered BFP are hornblende, biotite, plagioclase, quartz, and K-feldspar. According to the Piper diagram Figure 4.4-1, the groundwater on the Morrison property shows a trend of calcium to sodium-potassium cations with low concentrations of magnesium. The anions are mainly carbonates with some samples showing higher concentrations of sulfate.



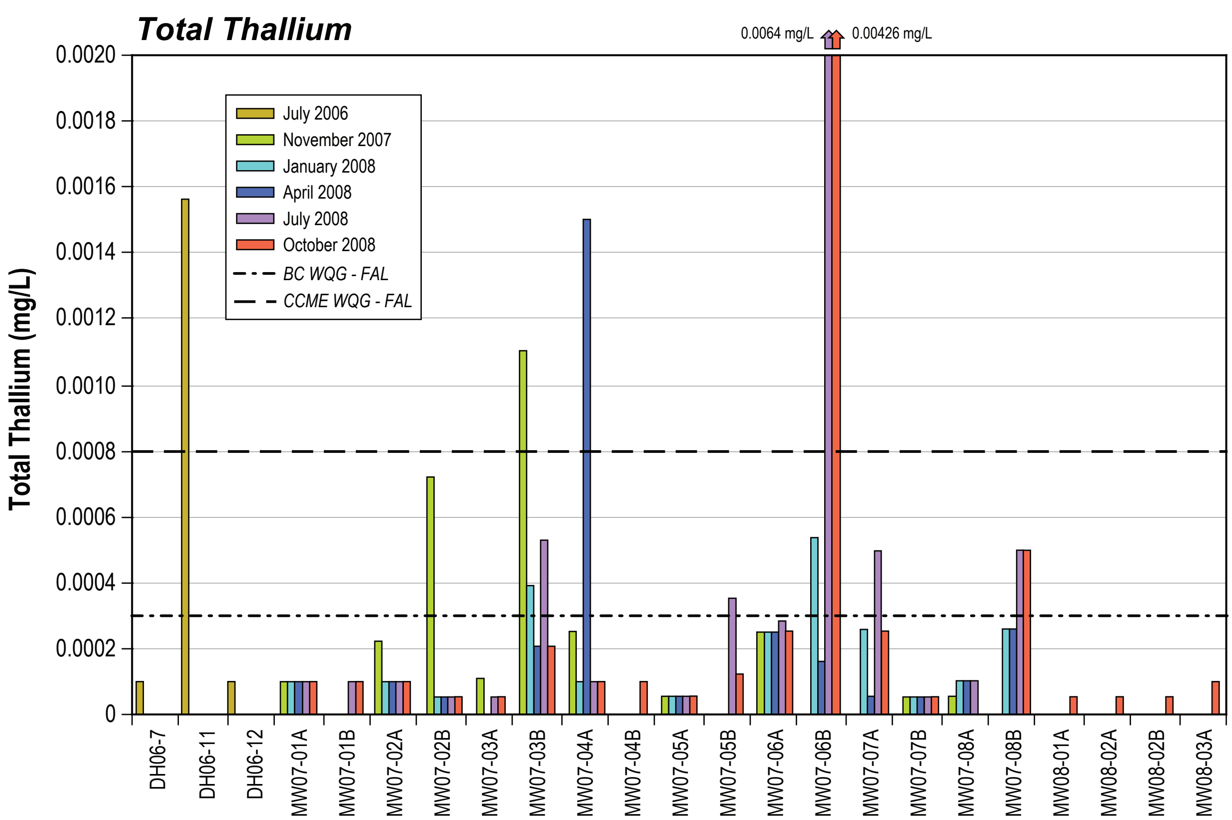
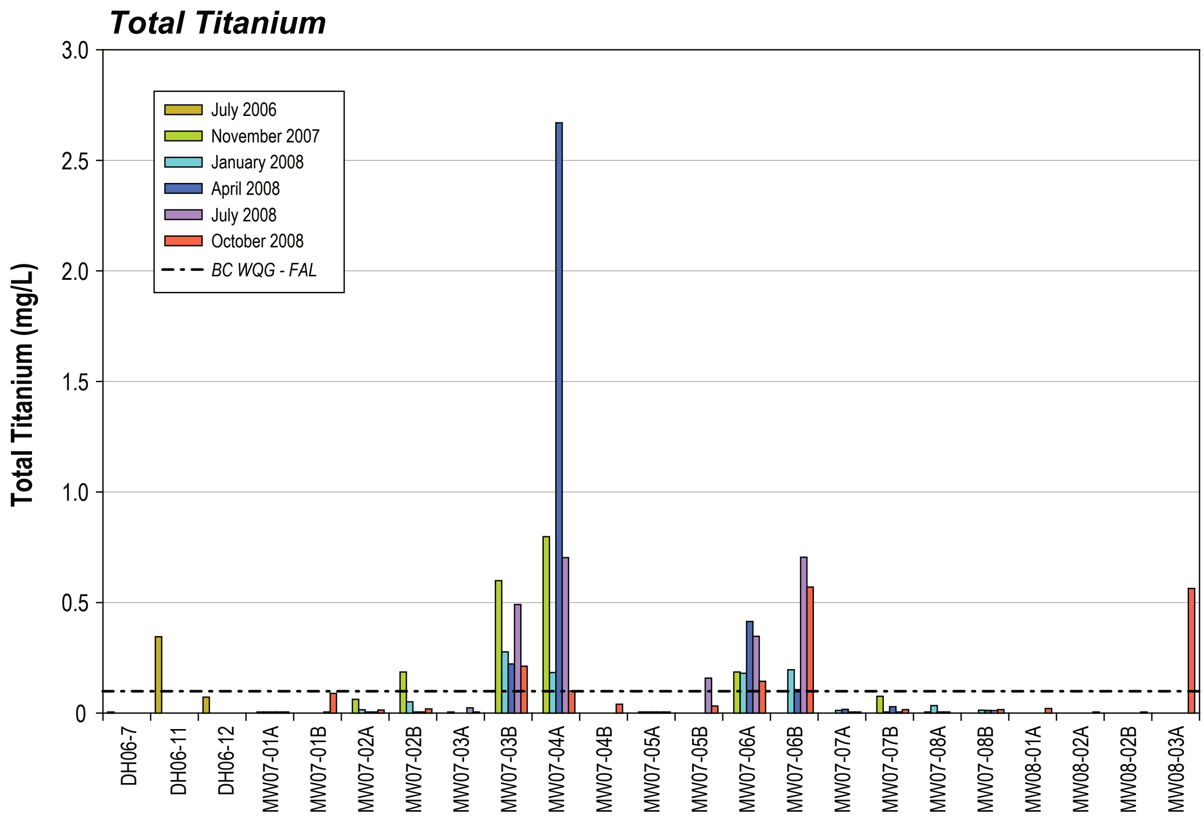
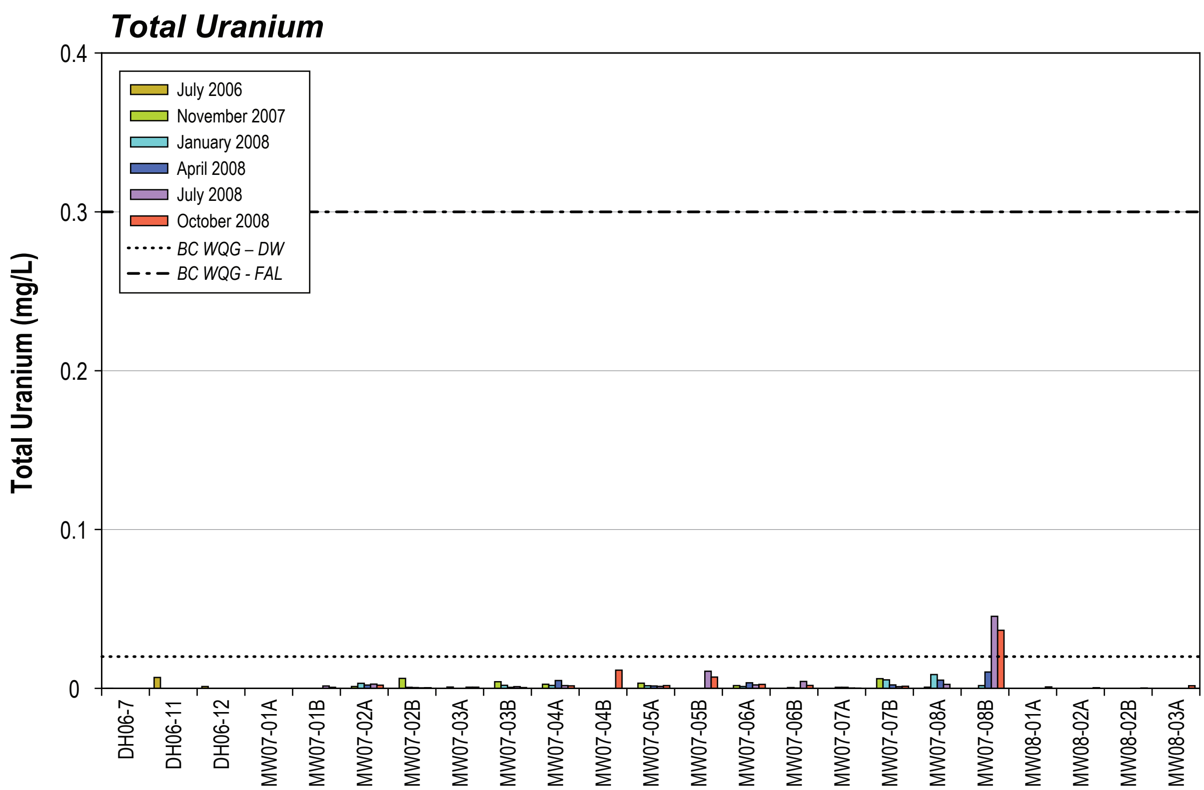


FIGURE 4.3-11

Morrison Copper/Gold Project:
Total Sodium and Total Thallium





Note: Measurements were below detection limits for total titanium.

Morrison Copper/Gold Project: Total Titanium and Total Uranium

FIGURE 4.3-12

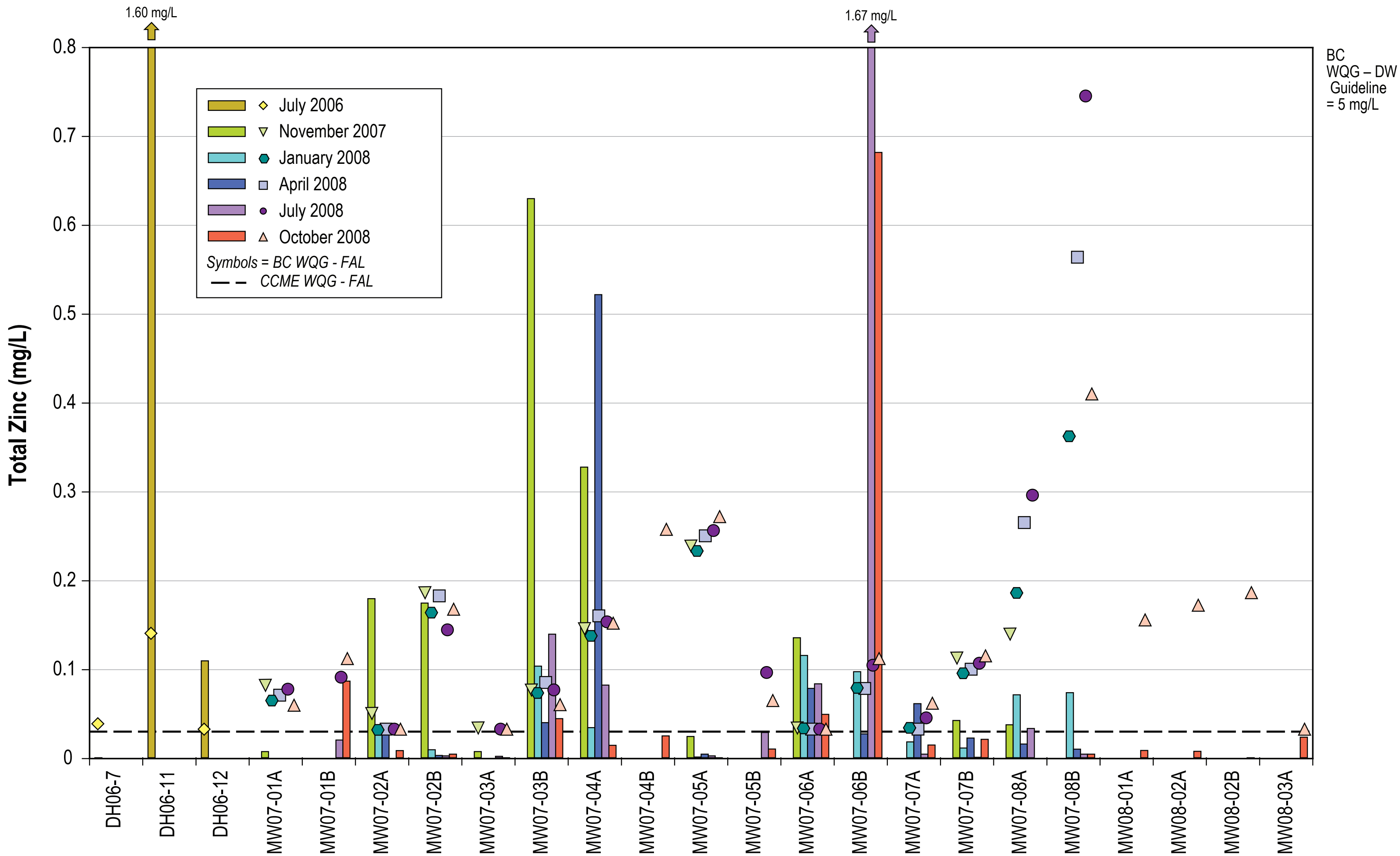
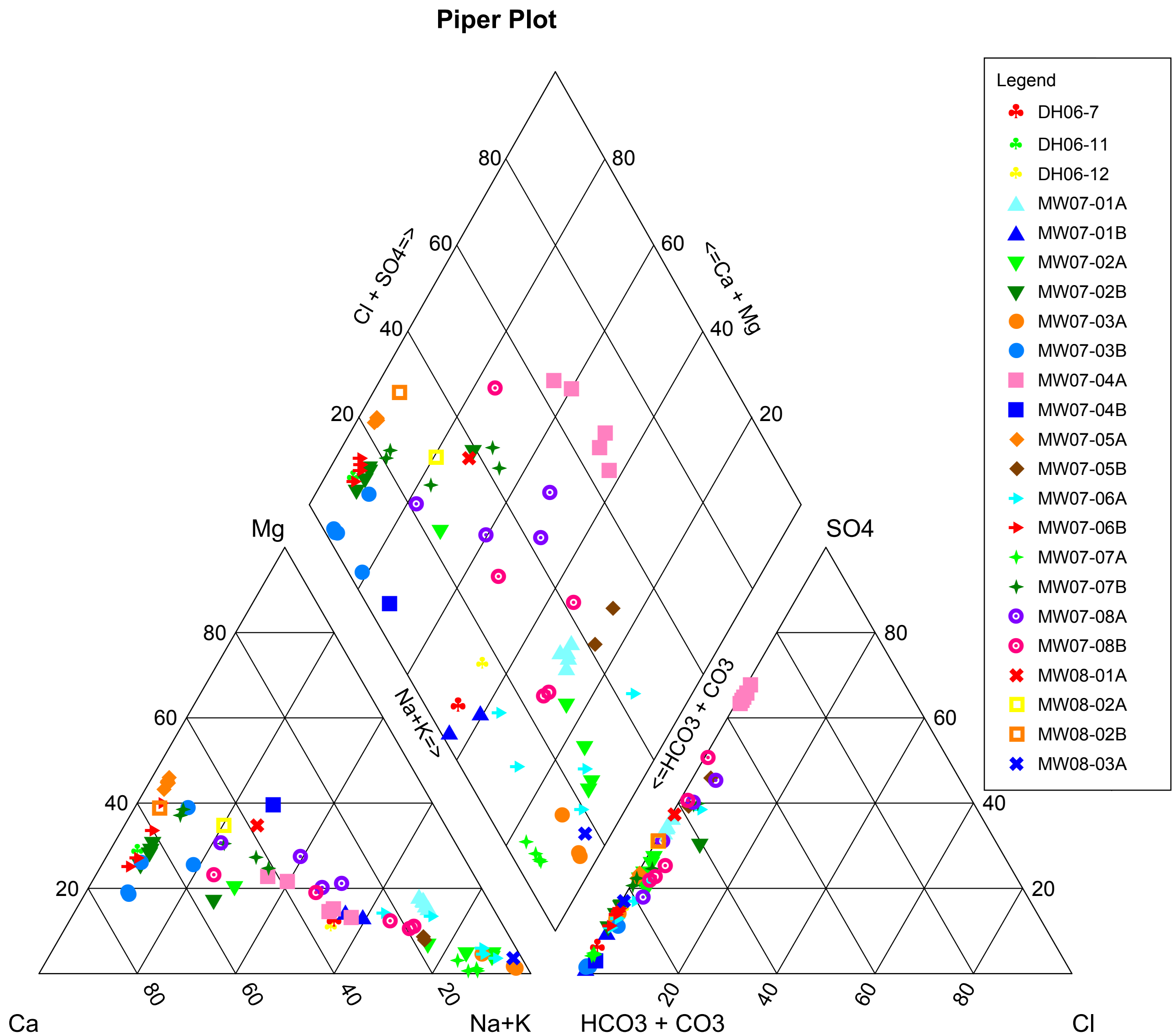


FIGURE 4.3-13

Morrison Copper/Gold Project: Total Zinc



Morrison Copper/Gold Project: Morrison Groundwater Chemical Analysis - Piper Plot

FIGURE 4.4-1

The majority of the groundwater samples collected from monitoring wells on the Morrison property display a calcium-bicarbonate (Ca-HCO_3) water type. This type of water generally characterizes shallow unconfined groundwater aquifers that are influenced by recharge from surface water, precipitation, and snow melt. On average, the deep monitoring wells are screened at a depth of 30 mbgs to 40 mbgs. Groundwater samples collected from the two deepest monitoring wells (MW07-07A and MW08-02A), screened at approximately 150 mbgs, do not show a significant variation from the observed trend. The chemistry of all four groundwater samples taken from MW07-07A was sodium-bicarbonate (Na-HCO_3). This well is in the proposed open pit area. The one groundwater sample collected from monitoring well MW08-02A west of the proposed open pit area and down gradient from the ore deposit was of calcium-magnesium bicarbonate water type (Ca-Mg HCO_3).

Groundwater originating from fresh recharge waters that have undergone more intensive water-rock interactions or that have been in longer contact with soils and aquifer sediments will show greater effect of magnesium and sulfate in its composition. For sulphate at the Morrison property, this may reflect the oxidation of sulphide minerals and the release of sulphate, acidity, and metals into groundwater. For example, this is the case for groundwater samples taken from MW07-04A that show a higher concentration in sulfate. This monitoring well is northwest of the proposed open pit and south of the second dam (Ashman formation). The metals concentrations in groundwater samples collected from this monitoring well were relatively high for the following metals: aluminum, chromium, cobalt, copper, iron, mercury, nickel, selenium, thallium, titanium, and zinc.

4.5 Summary of Site-wide Groundwater Chemistry

Groundwater samples derived from 16 monitoring wells at 8 different locations at the Project provide a preliminary indication of groundwater quality in the Project footprint. The presence of high concentrations of total and dissolved metals may be explained by the fact that metals are originating from water-rock interactions and natural weathering of mineralized bedrock. High metal concentrations in the groundwater may also be encountered in surficial overburden, possibly caused by mineralized rock fragments derived from local bedrock sources.

High pH values observed consistently in MW07-07A may indicate that there is interference from the grout seal of the monitoring well. The high pH values are only detected at this one location. The high pH values in this one well may affect the validity of other parameters obtained from this well. High TSS and turbidity values in some wells may indicate that further monitoring well development is required. Additionally, these values may have affected some other parameters (i.e., elevated metals levels may be the result of elevated TSS).

Various elevated metals and anions concentrations in the groundwater at the Project exceed maximum allowable concentrations listed in the BCWQG for drinking water, the BCWQG for freshwater aquatic life, and the CCME Guidelines for the Protection of Freshwater Aquatic Life. These exceedances of groundwater quality should be taken into consideration when managing and displacing groundwater during mine development, operation, and closure, especially near Morrison Lake.

5. Conclusion

The baseline hydrogeological conditions at the Project have been described within this document. Testing and sampling methodologies involved drilling boreholes and installing groundwater monitoring wells that have been used to measure groundwater levels, to perform hydraulic testing, and to obtain representative groundwater samples.

The groundwater quantity has been preliminarily characterized. This includes determination of groundwater levels and general groundwater flow directions. Since the groundwater flow is generally a reflection of the topography, it appears that there is continuity in the groundwater system. Generally vertical gradients show upward gradients in lower areas and downward gradients at higher elevations. Hydraulic conductivity measurements from slug and packer testing are in agreement with literature values for the lithologies tested.

Groundwater quality is typical of a mineralized zone. The concentrations/values of a number of general chemistry and total metals parameters are naturally elevated and exceed applicable BC and federal water quality guidelines. The piper diagram summarizes the groundwater chemistry as generally being of the sodium-bicarbonate type.

Rescan will continue measuring groundwater levels and taking groundwater quality samples to continue to develop a better understanding of the hydrogeologic conditions at the Project.

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