HOLLINGER PROJECT

REQUEST FOR PERMIT TO TAKE WATER AND CERTIFICATE OF APPROVAL AMENDMENT LITTLE PEARL TAILINGS POND (LPTP)

Submitted to:

Ontario Ministry of the Environment
Environmental Approvals Branch and Northern
Region Water Unit Supervisor

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1.0 INTRODUCTION

1.1 Purpose of Submission

Porcupine Gold Mines (PGM), a joint venture between Goldcorp Canada Ltd. (51%) and Goldcorp Inc. (49%), (Goldcorp), is planning to redevelop the former Hollinger and McIntyre Mine area, in Timmins, as a new open pit and underground (UG) mining complex (Figure 1). The open pit complex would involve the sequential development of four staged phases that would be used to access shallow ore zones within 200 to 250 metres (m) of the ground surface. The UG portion of the mine complex would involve the development of two new UG ramps and associated future shafts that would be used to access deeper ore zones.

The four staged pit phases are generally referenced as the 92 Pit, the Millerton Pit, the Central Pit, and the Vipond Pit (Figures 1 and 2). The UG operations would consist of the Millerton and Central Porphyry Zone (CPZ) operations. Ramps developed at the Millerton and CPZ locations would be developed to approximately 400 m below grade. Mining beyond that point would likely involve shaft mining, potentially using the existing Hollinger No. 26 Shaft to develop the Millerton UG, and the McIntyre No. 11 Shaft to develop the CPZ UG. Ramp development and associated UG exploration would be used to confirm UG ore resources, and the viability of UG mining.

The former Hollinger and McIntyre Mines both support extensive historic and interconnected UG workings that extend to a maximum depth of more than 2,000 m below surface, and both mine sites are currently in a state of closure. To manage mine water levels in the area, Goldcorp currently pumps water from the McIntyre No. 11 Shaft to Little Pearl Tailings Pond (LPTP). Pumping generally occurs at a rate sufficient to maintain the water table in the McIntyre site UG workings at a position approximately 25 m below grade, and at more distant southern locations, near the Shania Twain Centre, at a level of about 10 m below grade. Pumping in this manner prevents groundwater from the UG workings, from breaking surface in an uncontrolled fashion, and allows the groundwater to be managed at one location – LPTP.

Water management at the sites is carried out in accordance with the terms and conditions specified in Amended Permit to Take Water (PTTW) 0248-6UJMBL, dated October 13, 2006; and in Amended Certificate of Approval (C. of A.) 8572-4L8GYF, dated July 6, 2000, as amended by Notice No. 1, dated October 13, 2000, and Notice No. 2, dated April 4, 2001.

PTTW 0248-6UJMBL allows pumping at a maximum rate of 13,402 cubic metres per day (m^3/d) from the McIntyre No. 11 Shaft, and 1,000 m^3/d from the Hollinger No. 26 Shaft. C. of A. 8572-4L8GYF provides for pumping groundwater from the McIntyre No. 11 Shaft to a silt-curtain enclosed area on the north side of LPTP.

To manage groundwater associated with future, planned mining operations, mine water from the McIntyre No. 11 Shaft would initially be pumped at a greater rate of up to 40,000 m^3/d for approximately the first 2 years of operations, and at a lesser rate of up to approximately 25,000 m^3/d thereafter, until mining operations are completed over a period of up to approximately 15 years, depending on whether or not UG operations proceed. Water pumped from the McIntyre No. 11 Shaft will contain suspended solids, residual ammonia from the use of ammonium-nitrate based blasting agents, reduced iron (Fe^{2+} state), and lesser quantities of other heavy metals.

To better manage the mine water discharge, the current point of discharge into LPTP would be shifted from the north side to the northwest end of the pond. The entire pond would then be used for mine water treatment. Water treatment in the LPTP would be assisted through the use of flocculants and silt curtains (or rock fill berms), as required to promote the settlement of total suspended solids (TSS). Residual ammonia would be managed through the use of emulsion, or emulsion blend explosives, as required to control soluble ammonia residuals at source.

The outflow from LPTP would be reconfigured from its current condition of a single 36-inch diameter culvert without controls, to the use of a thin-plate, concrete weir, connecting to a single larger concrete box culvert, sufficient to provide for the continuous measurement of flows from the treatment works to an accuracy of ±15% in accordance with Ontario Regulation (O. Reg.) 560/94.

The purpose of this submission is to support application for amendments to PTTW 0248-6UJMBL and C. of A. 8572-4L8GYF, to allow for increased mine water pumping rates, and the treatment of such water, as described above. Signed permit amendment applications are included as Appendix A. Copies of the current PTTW and C. of A. are included as Appendix B.

1.2 Background and Existing Conditions

Underground Workings and Groundwater Management

The main Hollinger Mine operated from 1910 to 1968, during which time 65,778,234 tons of gold ore were milled, yielding 19,327,691 ounces of gold. Further mining took place in the 1970's and 1980's, with numerous small open pit mines through the near surface crown pillars; along with additional UG mining during the mid 1980's. Approximately 182,000 additional ounces were mined in this fashion.

Historical UG workings at the Hollinger site were developed to a depth of approximately 2,000 m, and included almost 600 km of shafts and tunnels (Ferguson 1968 and Wright 1979). Most of the surface Hollinger facilities have been removed, but remaining facilities include the Main Shaft headframe, the Hollinger No. 26 Shaft headframe, the main office building, portions of the former mill building, and the tailings deposition area.

Because of their connection to the McIntyre Mine, the Hollinger UG workings were kept dry until 1988, when the McIntyre Mine was shut down. Upper mine levels continue to be dewatered to the present day, to an approximate level of 25 m below surface (measured at the McIntyre headframe), to help manage near surface groundwater levels in the area. Dewatering, as described above, occurs by way of UG pumping from the nearby McIntyre No. 11 Shaft headframe, with water discharge to the LPTP. The primary Hollinger Mine site remains fenced for public safety because of hazards associated with open stopes, mini-pits and potentially unstable crown pillars.

The McIntyre Mine operated from 1911 to 1988, and during that time 37,529,961 tons of ore were mined, yielding 10,745,361 ounces of gold. The main McIntyre structures have been removed as part of mine closure operations, but a number of facilities still remain. These include the McIntyre No. 11 Shaft headframe constructed in 1927, the executive lodge, and the tailings deposition area. Mine water from the Hollinger, McIntyre and Coniaurum Mines is managed through the McIntyre No. 11 Shaft, as described above.

Based on current gold prices, considerable gold resources are estimated to remain at the Hollinger and McIntyre sites; hence Goldcorp's current plan to re-commence mining at the two properties through both open pit and UG mining.

The interconnected nature of former Hollinger and McIntyre UG mine workings will allow the groundwater table at both sites to continue to be managed by pumping water from the McIntyre headframe to LPTP.

Little Pearl Tailings Pond and Receiving Waters

Prior to mining in the Timmins area, LPTP was a small lake connected directly to, and therefore comprising part of, Pearl Lake. Through subsequent mining activities in the 1920's and 1930's, LPTP was filled in with tailings, and in later years was restored as a park setting with a small central pond. The tailings deposited in LPTP were subsequently reclaimed in the late 1980's as part of the ERG tailings reprocessing operations to recover residual gold from the historic tailings in the pond. Currently LPTP has a maximum depth of about 10 m (Figure 3). A Closure Plan for this property was submitted in 2001 and accepted in 2002. Reclamation work has been completed around the perimeter of the LPTP property.

LPTP is positioned within the headwaters of the Porcupine River, and drains east and northeastward through Pearl Lake and Clearwater Lake, towards Porcupine Lake. Just upstream of Porcupine Lake, the Porcupine River joins with the South Porcupine River (Figure 4). The Porcupine River, upstream of its confluence with the South Porcupine River, receives drainage from several formerly active mine sites, including the Hollinger, McIntyre, Coniaurum, and ERG sites, as well as from the former Dome Mine tailings areas by way of Edwards Creek. The Porcupine River has therefore been affected by past mining activities.

Mill Processing

Ore mined from the Hollinger and McIntyre Mine sites, as part of this undertaking, would be shipped to the existing Dome Mill for processing, with the tailings effluent to be discharged to the existing Dome tailings facility, where treated effluent discharges to the South Porcupine River.

1.3 Regulatory Requirements

The proposed undertaking, which this document describes, requires a Category 3 PTTW amendment for groundwater withdrawal, and a C. of A. amendment to discharge and treat the groundwater to ensure adequate receiving water protection.

Existing Ministry of Environment (MOE) permits related to the current groundwater dewatering (management) program include:

- Amended PTTW 0248-6UJMBL, dated October 13, 2006, which provides for the taking of up to 13,402 m^3/d of water from the McIntyre No. 11 Shaft, and up to 1,000 m^3/d from the Hollinger Main Shaft;
- C. of A. 8572-4L8GYF, dated July 6, 2000, which provides for mine water discharge from the McIntyre No. 11 Shaft to Little Pearl Tailings Pond;
- Notice No. 1 to C. of A. 8572-4L8GYF, dated October 13, 2000; and,
- Notice No. 2 to C. of A. 8572-4L8GYF, dated April 4, 2001.

Activities at both the Hollinger and McIntyre mine sites are also governed by applicable Closure Plans, and amendments thereto, filed with the Ministry of Northern Development and Mines and Forestry (MNDMF).

1.4 Schedule

Accelerated dewatering in preparation for open pit and UG mining at the Hollinger and McIntyre Mine sites is expected to commence in January 2011, and to continue for a period of up to approximately 15 years.

2.0 ENVIRONMENTAL SETTING

2.1 Porcupine River System – Climate, Hydrology, Water and Sediment Quality

Climate

Climate data for the Hollinger site are available from the Timmins airport (1971 to 2000, 30-year climate normals). The data set includes monthly information on temperatures, precipitation, snow depth, wind speed and direction, degree days, humidity, wind chill, atmospheric pressure, visibility and cloud cover.

The mean annual temperature for Timmins airport is 1.3 degrees Celsius (^{o}C). January mean, mean minimum and mean monthly maximum temperatures are -17.5^{o}C, -23.9^{o}C, and -11^{o}C, respectively. Corresponding July temperatures are 17.4^{o}C, 10.5^{o}C, and 24.2^{o}C, respectively. The mean annual total precipitation for Timmins is 831.3 millimetres (mm), of which 558.1 mm (67.1%) falls as rain, and the remainder (32.9%) as snow. Annual lake evaporation and evapotranspiration estimates for the area are 537.5 mm and 361.8 mm, respectively.

Extreme event rainfall statistics for the Timmins area are available for durations of 5 minutes through 24 hours, and for return periods of from 2 to 100 years. Calculated extreme 24-hour rainfall statistics for 2, 5, 10, 15, 20, 25, 50 and 100 year return periods are 51.7, 69.4, 81.1, 87.7, 92.3, 95.9, 106.8 and 117.7 mm, respectively. Regional design storm data are derived from the Timmins Storm, which occurred in 1961.

Winds are typically out of the west – northwest in winter and out of the south in the summer and fall. Mean monthly wind speeds are consistently in the 11 to 12 kilometre per hour (km/h) range throughout the year.

Hydrology

The Porcupine and South Porcupine River watersheds, to the point of their confluence just west of Porcupine Lake, measure 32.0 square kilometres (km^{2}) and 42.7 km^{2}, respectively. These two systems drain to Porcupine Lake, and eventually to Night Hawk Lake and the Frederick House River system. The Water Survey of Canada (WSC) operates a flow monitoring station on the Porcupine River at Hoyle (Station 04MD004), well downstream of Porcupine Lake, near where the Porcupine River crosses Highway 101, upstream of its confluence with Night Hawk Lake. The station was operated from 1977 to 1994, and was then discontinued until 2008 when the station was re-established. The Porcupine River watershed at the 04MD004 gauging station measures 401 km^{2}.

Headwaters of the Porcupine and South Porcupine Rivers drain several small lakes and ponds including LPTP, and Pearl, Clearwater, Edwards, McDonald and Simpson Lakes. River mainstem gradients are low for both systems, averaging 0.44% for the Porcupine River, and 0.33% for the South Porcupine River. Both rivers and their tributaries are interrupted by numerous beaver dams. The elevations of LPTP (313.2 m above mean sea level [amsl]) and Pearl Lake (313.0 m amsl), which are important to overall water management considerations, were determined through a LiDAR digital elevation survey of the area completed during June 2006. Surveyed water levels on December 17, 2008 showed respective water level elevations for LPTP and Pearl Lake of 312.85 m and 312.73 m amsl.

Monthly flow data (cubic metres per second [m^3/s]) and watershed runoff equivalents (mm/d/unit area) for the Porcupine River WSC Hoyle station, for the continuous period of record from 1977 to 1994, are provided in Table 1, together with projected return period low and high flow monthly values shown in Table 2. The annual runoff rate averages 1.202 millimetres per day (mm/d) (439 millimetres per year [mm/a]), with monthly average rates varying from a low of 0.203 mm/d in February to a high of 3.796 mm/d in May. Extreme runoff statistics for: (1) the Porcupine River WSC station for the standard 7-day low flow conditions, for various return periods; (2) the Atmospheric Environment Service (AES) for 'Extreme Value Analysis of Rainfall Plus Snowmelt' for the Timmins area (Model 1 statistics); and (3) the AES Rainfall Frequency Atlas for Canada for extreme rainfall statistics, are shown in Tables 3, 4 and 5, respectively.

Water Quality

Water quality data for the Porcupine River system are available from Beak (1999), Minnow (2001, 2005), Goldcorp Canada Ltd. data files, and AMEC (2008) (Table 6). From upstream to downstream, water quality data are available for Pearl Lake (Goldcorp data files), the Porcupine River just downstream of Pearl Lake (Minnow 2001), Edwards Creek upstream (AMEC 2008), Edwards Creek downstream (AMEC 2008), Porcupine River at Highway 101 (Minnow 2005), and Porcupine River outlet to Porcupine Lake (Beak 1999 and Minnow 2005). Sample locations are shown in Figure 4.

The general watershed shows signs of water quality degradation for a number of parameters along its main stem from the Pearl Lake headwater area to Porcupine Lake and beyond. Edwards Creek, on the other hand, shows little if any signs of water quality degradation; and where apparent degradation of Edwards Creek is suggested, the reason for this is the use of laboratory detection limits which are in excess of guideline values (i.e., for total phosphorus, cadmium, and lead).

Headwater areas of the Porcupine River are influenced by (1) mine water pumped from the McIntyre No. 11 Shaft headframe to LPTP, which drains to Pearl Lake, and (2) seepage and runoff from the McIntyre and Coniaurum above grade tailings deposits (Figure 4). Mid channel reaches are affected by drainage from the ERG tailings facility and from the historic Dome tailings facilities; and the lower reach is affected by treated effluent discharge from the current Dome tailings facility. Of these various contaminant sources, only the McIntyre No. 11 Shaft discharge and the current Dome tailings discharge are actively managed. The other sources are passive inputs originating from historic mining infrastructure.

Parameters which exceed, or potentially, exceed provincial and/or federal protection of aquatic life guidelines in the Porcupine River mainstem include: nitrate, nitrite, total phosphorus, aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, and zinc. In a number of instances, potential exceedences are due mainly to the use of laboratory detection limits which are in excess of applicable provincial or federal guidelines; hence it can not be confirmed that existing water quality is consistent with these guidelines.

In the case of nutrients (nitrate, nitrite and total phosphorus) exceedences of nitrate/nitrite guidelines are minor and infrequent, and therefore not of concern. Phosphorus, however, occurs in modest to slight excess of the provincial interim guideline value of 0.03 milligram per litre (mg/L) throughout the system, with maximum recorded values in the range of 0.10 to 0.12 mg/L. The source of the added phosphorus is thought to be sewage from historic and active septic systems, and from past spills of untreated sewage (Minnow 2005).

Among the metals and metalloids, exceedences of aluminum concentrations are infrequent, marginal and not of concern; and arsenic was only observed to be in excess of provincial and federal guidelines (and the interim provincial guideline) in the Porcupine River downstream of its confluence with the South Porcupine River (Table 6).

Cadmium concentration detection limits have generally been sufficient to allow comparison with provincial water quality guidelines, set at 0.0002 mg/L, but not with the federal guideline set at a more stringent 0.000017 mg/L. There is only one instance where cadmium exceeded the provincial guideline, and that was for the upper range of samples collected from the Porcupine River just upstream of Porcupine Lake, where the guideline was marginally exceeded. Detection limits are not sufficiently rigorous to allow meaningful comparisons with the more stringent federal guideline value of 0.000017 mg/L, but at least some measured cadmium values were above the 0.0001 mg/L laboratory detection threshold frequently used, such that the federal guideline is likely to be exceeded in the present condition.

Chromium concentrations were generally either below the provincial/federal guideline, or below the applicable laboratory detection limit. The high upper range chromium concentration of 0.366 mg/L recorded for Pearl Lake is not consistent with other values from this site, and is considered anomalous (Table 6). This single elevated value also affected the average chromium concentration for Pearl Lake (Table 6). Where more stringent detection limits were used, chromium concentrations were well below protection of aquatic life guideline values, such that chromium does not appear to be of concern.

Cobalt concentrations were elevated with respect to provincial water quality guidelines in the Porcupine River downstream of its confluence with the South Porcupine River (Table 6). Cobalt concentrations at the Highway 101 crossing were inconclusive due to restricted laboratory detection limits. Upstream Porcupine River sites (effectively Pearl Lake) showed cobalt concentrations below the provincial guidelines.

Copper is elevated throughout the Porcupine River mainstem, downstream of the McIntyre and Coniaurum tailings areas. Copper is a frequent associate of gold mineralization, and the presence of elevated copper in the Porcupine River system is presumed to be directly attributable to past and current mining activities. Average copper concentrations are approximately twice the provincial and federal guideline values in the middle sections of the Porcupine River, and higher still in the lowest river reaches below the confluence with the South Porcupine River, where copper is the contaminant of primary concern. In Pearl Lake the average copper concentration was <0.004 mg/L, just below the provincial and federal water quality guideline values.

Iron concentrations are typically consistent with provincial and federal protection of aquatic life guidelines, except where TSS are elevated, in which case the iron is associated with particulate materials and is of lesser concern. The very high upper range iron value of 1.23 mg/L for samples from Pearl Lake was associated with an extremely elevated TSS value of 133 mg/L.

Lead concentrations in Porcupine River samples were generally low. Where potential exceedences of the more stringent federal protection of aquatic life guidelines are indicated, the problem is likely with the laboratory detection limits. Where more stringent detection limits were used, lead levels were generally quite low. The elevated 0.0666 mg/L upper range lead value shown for Pearl Lake was associated with a high TSS value of 35.9 mg/L, which is not indicative of the general data set.

Mercury concentrations were generally below the provincial water quality guideline value of 0.0002 mg/L, but potentially above the far more stringent federal guideline value of 0.000026 mg/L. The upper end ranges of samples from the Porcupine River at Highway 101 and at the outlet to Porcupine Lake showed mercury concentrations slightly above the provincial guideline (Table 6). Mercury was used historically for gold recovery (amalgamation) in the Porcupine camp, and therefore is still likely to be in the system (likely within sediments) at some level.

Nickel and zinc concentrations, with minor exceptions, were consistent with provincial and federal guidelines, and are not of concern.

Taking all of the above into consideration, the principal contaminants of potential concern are (1) cadmium and mercury relative to the more stringent federal guidelines, (2) cobalt in downstream portions of the system below the confluence with the South Porcupine River, and possibly at the Highway 101 crossing, and (3) copper throughout the system. Compared with historic conditions, overall metal concentrations in the Porcupine River system appear to be improving (Minnow 2005), which is a function of both reduced active mining activity, and the application of improved wastewater treatment technologies in the case of the Dome Mine. The Dome Mine currently uses a combination of natural degradation and chemical oxidation (INCO SO_2Air process) to destroy cyanide; and lime, ferric sulphate, and ethylenediaminetetraacetic acid (EDTA) addition to manage metal concentrations and toxicity (Minnow 2002). Results with this combined effluent treatment system have been effective at meeting provincial requirements.

Sediment Quality

Sediment quality data for the Porcupine River system are available from Beak (1999), Minnow (2001, 2005), and AMEC (2008) (Table 7). From upstream to downstream, sediment quality data are available for Pearl Lake (Minnow 2001), the Porcupine River just downstream of Pearl Lake (Minnow 2001), Edwards Creek (AMEC 2008), Porcupine River at Highway 101 (Minnow 2005), and Porcupine River outlet to Porcupine Lake (Beak 1999 and Minnow 2005). Sample locations are shown in Figure 5.

As with water quality data, the general watershed shows signs of sediment quality degradation for a number of parameters along the river mainstem from Pearl Lake to Porcupine Lake. Also, similar to the water quality data for this system, Edwards Creek for the most part shows limited degradation of sediment quality, with the exception of one sample (sample S2007-13659), which showed elevated concentrations of a number of parameters. The high copper, nickel and zinc values for this single sample suggest that the sample may contain tailings solids associated with the historic Dome tailings, which have long since been rehabilitated. This sample also contained notably elevated levels of organic materials, which can sequester heavy metals and therefore may account in part for the elevated metals concentrations.

Parameters which exceed provincial sediment quality guidelines in the Porcupine River mainstem include: total Kjeldahl nitrogen (TKN), total organic carbon (TOC % solids), arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc. Essentially all parameters, for which there are provincial sediment quality guidelines, are in exceedence of the guidelines at some level, with the exception of the guideline for total phosphorus, for which there are fewer measurements. In the majority of instances, the exceedences are for lowest effect level (LEL) thresholds. However, for TKN, TOC, arsenic, copper, nickel and zinc, there are a number of instances where contaminant concentrations exceed the severe effect level (SEL). LEL levels are defined such that the threshold “level of contamination which has no effect on the majority of the sediment-dwelling organisms. The sediment is clean to marginally polluted.” (Persaud et al. 1992). The SEL is defined as sediment which is “considered heavily polluted and likely to affect the health of sediment-dwelling organisms” (Persaud et al. 1992).

TKN is a measure of that portion of nitrogen associated with ammonia and organics (mainly amines), and is therefore related to the amount of organic matter present in the sediments. Hence, there is a strong relationship between the two measures. For example, a regression analysis of TKN and TOC values shown in Table 7 yields an “R^2” coefficient of 0.93. Where elevated TKN and TOC values are due to human influences, the sources of contamination are typically sewage and agricultural runoff. However, TKN and TOC are also high in wetland environments and in lake and pond sediments which contain naturally high organic sediment content. It is suspected that the majority of elevated TKN and TOC values shown for the Porcupine River system are due to natural causes, and not to anthropogenic influences (AMEC 2008).

Elevated concentrations of arsenic, copper, nickel and zinc, on the other hand, are most likely associated with local mining activities, past and present, although even here some local enrichment would be expected in the natural background condition due to regional mineralization. Pearl Lake, in the Porcupine River headwaters, shows marked elevations of all four parameters, and most notably arsenic, copper and zinc. Pearl Lake is a historic recipient of mine water discharges and may also have received some direct tailings input in the past. Further downstream, at the Highway 101 crossing and above Porcupine Lake, zinc and copper sediment concentrations appear to diminish (although copper concentrations are still well above the SEL concentration guideline); whereas arsenic concentrations remain elevated, and there is an increase in the concentration of nickel.

Descriptions above provide comparisons with provincial sediment guidelines, only. Federal guidelines are shown in Table 7 for comparison, but are not discussed. Generally, the federal guideline values (Canadian Environmental Quality Objectives – Probable Effect Level [CEQO PEL]) are all intermediate between the provincial LEL and SEL values, with the exception of copper, where the federal guideline is above the provincial SEL value.

2.2 Porcupine River System – Biological Condition

Aquatic Habitat

The Porcupine River comprises the receiving water system for the LPTP discharge, with Pearl Lake, on the north side of Highway 101, opposite Schumacher, comprising the northwestern most headwater area of this system (Figure 4). Pearl Lake receives direct drainage from LPTP.

LPTP has a surface area of approximately 8.7 hectares (ha) and mean and maximum depths of approximately 6.1 m and 11.9 m, respectively. LPTP originally comprised part of Pearl Lake, but was filled with mine tailings during the early 1900's. During 1989 the tailings solids stored in LPTP were dredged by ERG Resources to recover residual gold contained in the tailings solids, and through this action the original LPTP waterbody was partially restored, taking its current form. Over the past 20 years the shoreline of LPTP has become increasingly naturalized, and now supports an herbaceous and developing shrub community.

Pearl Lake measures approximately 30 ha in area, and has mean and maximum depths of 5.2 and 12.3 m, respectively (Figure 6). Land use surrounding Pearl Lake consists of mining operations to the north, mixed forest to the northeast and urbanized development to the south and west. A few residential properties border the eastern shoreline. The shoreline of Pearl Lake comprises three principal types, namely: rocky substrate with moderate gradients and overhanging vegetative shoreline (i.e., Type 1A – totalling approximately 637 m); dense cattail shoreline with soft bed substrate (Type 2A – totalling approximately 890 m); and an anthropogenically altered shoreline (constructed road) (Type 3 – totalling approximately 956 m). Details of shoreline habitat distributions and characteristics are provided in Figure 6 and in Tables 8 through 10.

The outflow channel from Pearl Lake extends northeastwards for approximately 1.1 km to its connection with Clearwater Lake, and consists predominantly of Reach Type 4 habitat (Figure 7, Table 11). The channel through this section is characterized mainly by variable floodplain widths (20 to 170 m), flat channel gradients, and slow moving and densely vegetated impounded waters; only a few areas exhibit a defined channel. Where the channel is better defined, water depths generally measure between 1.5 and 2 m, and wetted widths range from 5 to 10 m (Minnow 2001). Dense aquatic vegetation (cattails, sedges, duckweed, and pondweed) occupy open water areas (Minnow 2001). Local beaver activity frequently restricts water flow while contributing significant quantities of woody debris. A major beaver pond exists midway along the channel. Dense shrub and tree growth border the channel. Bed materials consist predominantly of silt and moderate to fine sands (Minnow 2001).

Clearwater Lake is a small waterbody with a surface area of 11.3 ha and mean and maximum depths of 2 m and 6 m, respectively (EAG 1989). Surrounding land use consists of historic tailing management areas to the north and east; mixed forest to the west and southwest; and low density residential development along the inlet channel to the south. The lake is characterized by one principal shoreline habitat type: cattail with associated submergent milfoil and stonewort species, with a soft bed substrate (Type 2A, Table 8). The northern margin of Clearwater Lake is influenced by the McIntyre tailings area dam, but has essentially become naturalized (Figure 8). The riparian backshore community consists of a mix of shrub dominated communities, with grasses, sedges, and herbaceous species, flanked by mixed forest communities. Bed materials consist of fine organic matter overlying a clay base (EAG 1989).

The outflow channel from Clearwater Lake passes through a small forested area positioned between the McIntyre and Coniaurum tailings areas, before breaking out into the broader forested landscape, downstream of the west Coniaurum tailings inflow. The initial part of this channel, to the road crossing linking the Mcintyre and Coniaurum tailings, consists of Reach Type 4. The remaining, larger portion of this channel section consists of Reach Type 9B (Figure 7).

Downstream of the west Coniaurum tailings inflow, the Porcupine River flows for approximately 8 km to its junction with Porcupine Lake. This 8 km long section of river includes five reach types (Types 3A, 3B, 4, 5, 6A and 9B) (Figure 7, Table 11). The dominant reach type through this section is Type 4, characterized by open water riverine wetland reaches, which is reflective of the flat topography, clay soils and extensive beaver activity. The river channel through this reach narrows to as much as 2 to 5 m, where the channel is well defined, but expands to widths of 50 m or more where there are large beaver ponds, within an overall floodplain that varies in width from as little as 25 m to as much as 400 m. Interspaced through the overall Reach Type 4 zone, are narrower, better defined channel and floodplain zones (i.e., Reach Type 3A areas). In one small section, the Porcupine River channel has become choked with cattails to the extent that a defined channel no longer exists through this section (Reach Type 5). This feature fragments the aquatic corridor function as do numerous beaver dams along the system. In the vicinity of the community of South Porcupine, urban infrastructure related development activities have resulted in the channelization of approximately 600 m of the river channel (Reach Type 6A).

Areas bordering the Porcupine River are forested with the exception of intrusions into the floodplain associated with the Coniaurum and McIntyre tailings, and with the downstream urbanized area.

Edwards Creek enters the Porcupine River, from the south side, at a point approximately 3 km downstream of Clearwater Lake (Figure 7). This creek exhibits many of the same characteristics as the mainstem of the Porcupine River.

Further details are provided in AMEC (2008).

Benthic Invertebrates

The earliest records describing the Porcupine River system benthic macroinvertebrate community are available from mine effluent monitoring studies conducted by EAG (1989). This investigation identified a chironomid dominated invertebrate community that was considered consistent with the soft textured organic and clay substrates common to both the Porcupine and South Porcupine Rivers. The Porcupine River immediately downstream of the ERG tailings discharge was characterized as exhibiting no crustaceans, very few molluscs, and many more tubificids and chironomids than the South Porcupine River.

According to sampling undertaken by Beak (1999), the lower reach of the Porcupine River immediately upstream of Porcupine Lake showed similar or greater (69 taxa) diversity than a reference reach in the South Porcupine River near McDonald Lake, as well as representation by suggested indicator species such as Ephemeroptera, Plecoptera and Trichoptera (EPT) species, amphipods and clams (*Pisidium*). Chironomids represented the most abundant organism with over 20% proportional representation.

Environmental effects monitoring undertaken by Minnow (2002) focused on the areas of the South Porcupine River, relative to the Dome tailings effluent discharge, the area below the confluence of the Porcupine and South Porcupine River, and the Porcupine River through the town of South Porcupine. Consistent with previous inventories, chironomids were the most abundant organism in the Porcupine River in the range of 20 to 30% of relative abundance. Tubificids ranged from 10 to 20% of relative abundance, also characterizing the fine soft sediments in this system. Other groups were noted to largely be expressed at less than 10% of the representative community, and were distributed in a patchy manner with localized abundance. EPT species were rare in all areas, including in those upstream of mine effluent related discharges, thereby suggesting general habitat limitations. In the reaches below the confluence of the two watercourses and above Porcupine Lake, the benthic community was notably different from the individual watercourse reaches upstream, suggesting higher habitat complexity, moderate enrichment and/or recovery from stress.

The upper watershed areas including Pearl Lake (Porcupine River system) were reported by Minnow (2001). A total of 21 taxa were identified within Pearl Lake and with the exception of seed shrimp, which dominated the macroinvertebrate community at one sampling station (67.0% of the total taxa), the predominate taxa was represented by chironomids consistent with other watershed areas of similar fine soft substrates. The low observed diversity was considered consistent with elevated metals levels in the sediments. Data collected in October 2001 (Minnow 2001) determined that the invertebrate community in the Pearl Lake Outlet had low density and diversity, but was similar to the lake with 20 taxa observed. Chironomids (44%) and Ostracods (27%) dominated the community. A high proportion of annelid worms within the samples were attributed to low dissolved oxygen levels and fine sediment substrates.

Although no historic sampling records were available for Clearwater and Edwards Lake, given the similarity of habitat conditions amongst the waterbodies, a similar macroinvertebrate community composition as observed in the most proximate sampling locations reported in the above noted reports is anticipated.

The benthic invertebrate community of LPTP has not been assessed, but the community would be expected to be comparatively simplistic as the major portion of LPTP substrates are comprised of historic tailings, which could not be economically removed by the ERG tailings dredging reclaim operation.

Fisheries Resources

The Porcupine River mainstem supports a variety of warm and coolwater coarse and forage fish including Brook Stickleback, Mottled Sculpin, Pearl Dace, Yellow Perch and White Sucker, with Yellow Perch being the most prevalent species (AMEC 2008, Minnow 2001). The lower reaches of the river above Porcupine Lake support a fish community of Northern Pike, White Sucker and Yellow Perch. Edwards Creek, upstream and downstream of Edwards Lake, supports a fish community consisting of Brook Stickleback, Creek Chub, Fathead Minnow, Finescale Dace, Northern Redbelly Dace and Pearl Dace. Yellow Perch and White Sucker may also have access to this area. Pearl Lake supports a fish community consisting of Yellow Perch, Rock Bass, Brook Stickleback, Fathead Minnow, Lake Chub, and White Sucker. Clearwater Lake supports Yellow Perch, White Sucker and Brook Stickleback. LPTP was investigated in September and October 2009, using a combination of fishing methods (boat electro-fisher, minnow traps, gillnets and beach seine nets) and was found to support a fish community consisting of Yellow Perch, Rock Bass, Brook Stickleback and Lake Chub.

2.3 Groundwater Systems

Data Review and 2007 / 2008 Field Programs

As part of the overall work program for the Hollinger mine redevelopment program, AMEC undertook a hydrogeological evaluation of the Hollinger site to characterize and evaluate the existing physical and chemical environment relating to the groundwater system, and to provide baseline data as input to pre-project conditions and to support the design and permitting for the Project. The hydrogeological evaluation consisted of a review of existing data sources directly relevant to the site, as well as a number of specific field surveys, which were conducted in 2007 and 2008. The existing data sources were used to obtain a general understanding of the site characteristics, including overburden stratigraphy, bedrock geology, existing mine workings, historic pumping rates and groundwater conditions.

The 2007 field investigations included the development of 13 monitoring wells in the general Project site area (Figure 9), for the installation of multi-level monitoring wells in order to:

- Determine the composition and extent of the overburden and bedrock deposits;
- Characterize aquifer conditions and properties; and,
- Provide information as to the existing or potential for interference with surrounding land use and/or surface water features.

The overburden and shallow bedrock aquifers were investigated through the use of a track-mounted, standard soils auger drilling rig, equipped with split-spoon sampling and NQ bedrock coring equipment and capabilities. Soil samples were collected via split-spoon sampling equipment throughout the overburden deposits on 0.76 m intervals, and bedrock coring and samples were completed continuously throughout shallow bedrock in 1.5 m runs.

Four deep bedrock instrumentations (two on the north perimeter of the property and two on the south perimeter) were completed to address both the fractured bedrock areas, as well as the solid rock mass in order to obtain site specific estimates of key model input parameters such as bedrock hydraulic conductivity values and specific yield. The four deep bedrock aquifer boreholes were completed using a truck mounted water well drilling rig, using 150 mm diameter dual rotary drilling technology, to depths between 134 and 183 m below grade in order to facilitate packer testing of respective fractured and unfractured rock masses. Locations of the shallow and deep monitoring well installations are presented in Figure 9.

The packer testing program involved the testing of bulk hydraulic conductivities of the entire open borehole for the shallow bedrock holes, as well as targeting discrete fractured intervals and other zones of hydraulic significance (i.e., weathered versus unweathered zones, etc). The deep bedrock holes were subjected to continuous packer testing on 20 m wide intervals over the entire depth of the hole. The data were used to assist in the development of a representative computer model for the hydrogeologic system.

In addition to the 2007 drilling program, a separate program was carried out in 2008 to define overburden conditions below Pearl Lake. The Pearl Lake drilling program was conducted off the ice in March 2008 and involved drilling three boreholes into the lake bed sediments to depths of up to 6.4 m below the organic lake bed sediments.

Existing Conditions

In terms of overburden conditions, the oldest overburden unit in the area is generally the Matheson boulder-sand-silt till, which is typically found overlying the bedrock surface in depressions in the bedrock surface. A significant esker deposit is located in the northern part of the study area running parallel to Highway 655. The esker complex formed before the ensuing lacustrine silts and clays were deposited, and consequently the silts and clays tend to overlie the esker sands and gravels. However, deposits of sand can be found over the clay as a result of erosion and reworking of the esker and ice-contact deltas. Finally, with time, peat and organic soils have formed in shallow wet areas. Overburden thickness in the general Project site area is shallow, with frequent bedrock outcroppings, except in the area of LPTP and Pearl Lake where a deep overburden trough exists with overburden thicknesses exceeding 70 m in some locations (Figures 10, 11, and 12).

Geologically, the Hollinger-McIntyre deposit is hosted by mafic volcanic rocks of the central and upper Tisdale assemblages that are intruded by porphyritic intrusions. Mafic volcanic rocks in the deposit have generally been divided into three units: the Northern, Central and Vipond Formations.

The Hollinger Mine historically was developed on gold bearing veins which are structurally controlled by lithologic contacts and deformation zones associated with altered Central and Vipond Formation volcanics. The lavas have been intruded by a group of porphyry stocks, the largest of which is the Pearl Lake Porphyry.

The core of the Hollinger-McIntyre deposits is an elliptical area of high strain developed along the south limb of the Central Tisdale anticline which surrounds the Pearl Lake porphyry and is approximately 450 to 600 m wide by more than 3 km in length. The elliptical fold of Central Tisdale anticline contains a series of subsidiary folds including the Northern anticline, Hollinger syncline and the Hollinger anticline. The elliptical nature of this structure in plan is due to the non-cylindrical, doubly plunging properties that close the structure to both the east and west.

From a hydrostratigraphic perspective, the site is comprised of six hydrostratigraphic units. Table 12 summarizes the general stratigraphy in the study area. However Units 1, 2 and 3 are not present or continuous across the entire site. For example, in the vicinity of Little Pearl Tailings Pond and Pearl Lake, Unit 2 is not present and the overburden is comprised solely of Units 1 and 3.

AMEC compiled the data and completed estimations of the hydraulic conductivity values for the tested stratigraphy and zones. These results show increasing hydraulic conductivity with depth, which does not follow the typical pattern of hydraulic conductivity within deep bedrock aquifers typically observed in Northern Ontario (i.e., tighter with depth). In this case, the apparent increasing hydraulic conductivity with depth is thought to reflect limitations of the packer testing equipment rather than the actual distribution of hydraulic conductivity. In particular, the packer testing results for some of the deeper intervals are questionable and it is possible that the tests at the deep intervals have exceeded the capability of the equipment to maintain a seal at depth during the field program. As a result, these values may over estimate the hydraulic conductivity of the deeper rock. This interpretation is supported by observations of a lack of drilling fluid losses, suggesting that there are no permeable zones within the area of deeper rock.

The March 2008 drilling results for Pearl Lake showed that the organic sediments were underlain by one to three metres of very soft clay and silt (>85 percent silt and clay material) that were in turn underlain by silty sand to sandy silt material, displaying a fining upwards sequence. The presence of the clay and silt material indicates that the lake bottom is underlain by an aquitard.

Representative groundwater samples were collected from 16 of the 18 monitoring wells installed on-site (two of the monitoring wells were dry). In general the ground water quality in the vicinity of the proposed Hollinger Project is characterized by elevated concentrations of alkalinity, conductivity, hardness, sulphate, total dissolved solids (TDS) and various metals including iron and manganese. Hardness and manganese exceeded the ODWS for every monitoring well sampled during the fall 2007 monitoring event, and are considered representative of background conditions for the area.

Numerical Modelling

A numerical three-dimensional steady-state groundwater flow model was developed and used to estimate the seepage rate into the proposed Hollinger pit complex and to assess the likely effect of its dewatering on the groundwater levels in the aquifer. The developed model was used to simulate groundwater flow in both the overburden and bedrock aquifer zones.

The geologic setting used for the model domain was derived from the hydrostratigraphic units described above, the hydraulic conductivity estimates and the surrounding surface water features. Groundwater recharge and discharge zones, existing mine workings and boundary conditions were also included in the model.

The model domain extends over about 9 km to the south (Mountjoy River), 9 km to the east (Porcupine River and Lake), about 3 km to the west (Mattagami River) and 20 km to the north, to the outflow of Bigwater Lake into the North Porcupine River. In the vertical direction the model extends from the ground surface down to a depth of about 500 to 600 m. Groundwater flow below this depth and beyond the boundaries of the model domain is expected to provide negligible contribution to the simulated seepage into the proposed pit and existing UG mine workings.

Input parameters (hydraulic conductivities and recharge rates) were initially assigned to the various overburden and bedrock aquifer zones. These parameters were modified through the process of model calibration, achieved by adjusting the physical and hydraulic parameters that are associated with highest degree of uncertainty in order to obtain a reasonable match between computed and observed (measured) data. Despite some noticeable local discrepancies, the model properly replicated the overall water levels and expected groundwater flow system. Mean, mean absolute and root mean squared errors (discrepancies between computed and observed heads) were 0.5 m, 2.8 m, and 3.6 m, respectively. The ratio of the root mean squared error to the total head loss (or water table relief) in the area of interest is approximately 7.6%. Therefore, the errors represent only a small portion of the overall model response.

Groundwater Management

Modeling results indicated that the total seepage rate into the proposed pit and existing UG mine workings (down to an elevation of the proposed pit floor) at the end of year 7 of operations is expected to be approximately 8,900 m^3/d for the Base Case (expected case) and 12,400 m^3/d for the more Conservative Case, with Base Case and Conservative Case peak rates of 9,400 m^3/d and 13,900 m^3/d, respectively (Figure 13). The model predicted Base Case seepage rate is considered to be conservative as it applies to a fully excavated (maximum extent) open pit complex. This estimate relates strictly to groundwater seepage and does not include any process (drilling) water added to the system during mining activities, or direct precipitation; and also assumes that significant portions of the hosting sub-watersheds will be modified with perimeter ditches, etc to divert surface flow away from the open pit.

Of the 8,900 m^3/d of the Base Case seepage that is expected to report to the proposed pit, approximately 28% (i.e., 2,500 m^3/d) is predicted to be from the LPTP / Pearl Lake system. However, these waterbodies will retain their respective water levels because groundwater will be pumped directly into LPTP, which flows into Pearl Lake.

Based on the results of the current modelling efforts, under both the Base and Conservative cases, the radius of influence within the shallow bedrock is estimated to have the potential to depressurize bedrock underlying Pearl Lake, Little Pearl Tailings Pond, Gillies Lake and possibly Clearwater Lake (Figure 14). Gillies Lake is underlain by clay substrates and is therefore not susceptible to potential pit dewatering effects. The surface water bodies to the south of the subject site such as the McDonald Lake, Skynner Lake and Perch Lake systems are all beyond the estimated radius of influence and are not expected to see significant effects from the proposed dewatering. These findings are consistent with the effects reported on these systems as a result of historic dewatering efforts from the existing UG mine workings.

Further data on the groundwater program and predictive modeling results are provided in Appendix C.

2.4 Socio-economic Setting

The Hollinger and McIntyre Mine sites and LPTP are all located within the City of Timmins. Mining operations linked to this application would occur within the bounds of the former Hollinger and McIntyre Mine sites, with ore to be transported to the Dome Mill for processing. As such, the planned operations involve the three principal founding mine sites that gave rise to the Timmins gold camp.

The McIntyre No. 11 Shaft headframe, from which groundwater would be pumped to LPTP, and LPTP, itself, are both located north of the Town of Schumacher, and just east of downtown Timmins, on the north side of Highway 101. Lands where the mining and water management functions would occur are all located on lands held by Goldcorp, or to which Goldcorp has access.

Redevelopment of the Hollinger and McIntyre Mine sites is critical to the continued operations of Goldcorp in the Timmins area, which provide feed to the Dome Mill, which currently receives ore from the Dome and Hoyle Pond UG mines, as well as low grade ore from its Pamour Mine stockpile. Mining operations at the Pamour Mine (the principal ore feed source for the Dome Mill) were closed in June 2009, and associated feed sources to the Dome mill are now running on low grade stockpiled material. Once the stockpiled Pamour material runs out in approximately five years, and without new ore sources, the Dome Mill would be forced to operate at much lower capacity, with severe repercussions on the local economy.

Statistics Canada data from 2001 show the top three employment sectors in Timmins as retail trade (14.9%), mining (13.6%) and health care and social assistance (11.6%). The importance of mining activity in the Timmins area is further underscored by the approximate 3.75:1 spin-off factor associated with mining employment, which is not reflected in these statistics (Dungan and Murphy 2007).

With respect to private sector employment, 5 out of the 10 top ranking employers are from the mining sector, including Xstrata (1,413 employees), Goldcorp (700 employees), Redpath Group (310 employees), Dumas Contracting (300 employees), and Rio Tinto Minerals-Luzenac (65 employees).

Goldcorp's assets include the Dome UG mine and mill, the Hoyle Pond UG mine, Pamour and Dome mine stockpiles and a large land package in Timmins camp. The Hollinger and McIntyre Mines are located on these lands.

Redevelopment and operation of the Hollinger and McIntyre mining operations is expected to result in an estimated average of 250 direct jobs, and over 570 indirect jobs in the Timmins area, over a period of up to 15 years, with employment rising above and below these numbers depending on the stage of operations. Proposed developments at the Hollinger and McIntyre Mines therefore represent a vital opportunity for sustaining the mining industry as a crucial element of the Timmins economy.

3.0 PROPOSED OPERATIONS AND EXPECTED SYSTEM PERFORMANCE

3.1 Open Pit and Underground Mining Operations

The current mine plan provides for both open pit and UG mining operations. Planned open pit operations involve the development of a complex of four phased open pit stage, referred to as the 92 Pit, the Millerton Pit, the Central Pit and the Vipond Pit (Figures 1 and 2). The Millerton Pit is the westernmost of the three pits, being located on the north side of Shania Twain Drive, and positioned between the urban centre of Timmins in the west, the Shania Twain Centre in the east, and Hollinger Park and the Luzenac property in the north. The 92 Pit is located east of the Millerton Pit, and the Shania Twain Centre and the Fairway Village Trailer Park; and the Central Pit is located immediately north of 92 Pit, and just south of the Highway 101 corridor commercial centre (Rona Building Supplies, Shopper's Drug Mart, A&W Restaurant). The Vipond Pit is located between the Central and 92 Pits, and Vipond Road.

The four pit phases would be mined in overlapping sequence, such that more than one pit phase could be in operation at any one time. Current plans call for extending the 92, Millerton, Central and Vipond pits to approximate depths of 226, 254, 112 and 274 m amsl, respectively. The existing ground surface at the Hollinger site averages approximately 335 m amsl, and varies from approximately 315 to 355 m amsl.

Ore and waste production for the open pit operations are expected to average approximately 40,000 to 50,000 tonnes per day (tpd).

Two UG operations are also planned, with one operation to be positioned adjacent to the Millerton Pit, and the second operation to be positioned near to the existing McIntyre No. 11 Shaft headframe,. Further study is required to determine the exact locations of UG openings to both operations. Initial access to the two planned UG operations would be by ramp to the approximate 300 m below surface level, with deeper access to be provided by shafts, most likely using the existing McIntyre No 11 Shaft (i.e., the McIntyre Headframe) and the Hollinger No. 26 Shaft; however, all such details are tentative, and are dependent upon further evaluations.

UG operations are expected to generate a maximum ore and waste production rate of 2,000 to 5,000 tpd.

The important element to consider in terms of this document is that mine dewatering will be linked to both open pit and UG operations, with open pit operations to extend for approximately 5 to 7 years, and for UG operations to extend for approximately 10 to 15 years, with the potential to overlap both open pit and UG operations. The exact nature of UG operations, which is still under study, is not expected to affect mine dewatering requirements, as applied for herein.

3.2 Mine Dewatering Arrangements

The UG workings of the Hollinger and McIntyre Mines are all interconnected as described in Section 1.2. Therefore the entire system can be dewatered by pumping from a single location, together with possible supplementary in-pit sump dewatering to capture any seepage and runoff not removed by the main dewatering system. The planned mode of dewatering is to continue pumping from the McIntyre No. 11 Shaft (i.e., the McIntyre Headframe), with water discharge to continue to LPTP. In-pit sumps would discharge water to UG openings which would then be captured by the main dewatering system, such that there would be a single discharge from the entire system.

The current pumping arrangement at the McIntyre No. 11 Shaft maintains the water level within the UG workings at approximately 25 m below surface at the McIntyre site (i.e., to an elevation of approximately 290 m amsl), and about 10 m below surface in the vicinity of the proposed Millerton Pit (i.e., to an elevation of approximately 300 m amsl).

To determine mine dewatering rates, dewatering rates were calculated separately for open pit development and for UG ramp development.

Open pit dewatering rates are governed by UG void dewatering rates and by the resultant groundwater seepage that would enter the dewatered UG void space. In planning for mine development, PGM utilized a three dimensional database of the local geology, developed from exploration drill holes and detailed maps of the historic UG workings, as input into the development of a VULCAN geologic model for the property. Modeled UG workings are shown in Appendix C. The total volume of UG voids, associated with these workings is about 41,500,000 m^3, of which approximately 11,700,000 m^3 occur within the zone (vertical horizon) that would be exposed by open pit development over the approximately 7 year mine life, i.e., to a depth of approximately 240 m (Table 13). These mine workings are currently flooded and for the most part are not backfilled.

Expected dewatering rates for void dewatering are shown in Table 13, and range from a low of 994 m^3/d to a high of 9,226 m^3/d, determined on an average annual basis. The wide rage in variability is a function of overlapping pit sequencing.

Expected seepage rates into the UG workings associated with open pit development are shown in Figure 13, and are listed in Table 14, for both the Base Case and Conservative Case (Appendix C). UG seepage rates are expected to ramp up quickly over the first year, essentially stabilizing at the end of Year 2. End-of-year seepage rates vary from a low of 7,000 m^3/d to a high of 13,900 m^3/d.

Combined expected dewatering rates associated with open pit development range from a low of approximately 10,000 m^3/d to a high of approximately 22,100 m^3/d.

For the CPZ, UG ramp development, mine dewatering will also be governed by UG void dewatering rates and by the resultant groundwater seepage that would enter the dewatered UG void space. The maximum UG void dewatering rate that is expected to occur involves dewatering at a rate of 100 vertical metres over a period of about 8 months. The upper 100 vertical metres of UG void space totals approximately 5,000,000 m^3. Dewatering this volume over 8 months would result in an average dewatering rate of approximately 20,600 m^3/d. Added to this volume would be the Year 2.5 seepage rate from Figure 13, corresponding to the approximate minus 100 m elevation, which translates to a seepage rate of from 9,000 to 13,000 m^3/d, for a combined dewatering rate of from 29,600 m^3/d to 33,600 m^3/d.

As the shorter-term CPZ, UG ramp dewatering rate of from 29,600 m^3/d to 33,600 m^3/d exceeds the open pit sequencing dewatering rate of from 10,000 m^3/d to 22,100 m^3/d, the CPZ, UG dewatering rate would govern dewatering rates during those periods when the UG ramp is being advanced.

To allow for contingencies a request is made for a maximum dewatering rate of 40,000 m^3/d, with the recognition that dewatering rates would generally be much less than this over the longer-term, averaging closer to the open pit sequencing dewatering rate of from 10,000 to 22,100 m^3/d.

3.3 Little Pearl Tailings Pond

Currently, mine water is discharged from the McIntyre shaft to a small, silt curtain contained area on the north side of LPTP. This arrangement has been generally suitable for current mine dewatering conditions for closure conditions, but would not be suitable for operating mine conditions.

In the existing condition, the principal water quality consideration is iron, wherein reduced Fe^{2+} iron in groundwater exhibiting low oxygen conditions is brought to surface, at which point water contact with the air oxygenates the soluble Fe^{2+} iron to the insoluble Fe^{3+} form (principally as $Fe[OH]_3$), resulting in an elevated total suspended solids condition in the water column.

The existing silt curtain portion of the Little Pearl Tailings Pond is quite small (approximately 0.08 ha), and therefore not suitable for providing the surface area required for effective precipitate settlement. The current C. of A. (C. of A. 8572-4L8GYF, Notice No. 1, dated October 13, 2000) allows for TSS concentrations of 30 mg/L, as an objective. Difficulties have sometimes been experienced in meeting this objective, mainly because of the small surface area of the silt curtain containment area.

For an operating mine, and in accordance with O. Reg. 560/94, TSS limits of 15 mg/L as a monthly average, and 30 mg/L as a daily concentration limit, would apply. To meet these limits for an operating mine condition, Goldcorp is proposing the following modifications to the design and operation of the LPTP:

- That the current discharge point of mine water to LPTP be relocated from its present position on the north side of the pond, to a new location on the north west side of the pond (i.e., to a point furthest from the pond outflow to Pearl Lake) (Figure 15);

- That the entire area of LPTP be used for mine water treatment, and not just the small area currently contained within the silt curtain enclosure;

- That a larger silt curtain system (or rock berm system) be used to divide the LPTP into two or more large cells to better manage the settlement of TSS, as shown in Figure 15;

- That provision be made in the system to add flocculant(s) to the mine water inflow to the pond, as required to achieve effective settlement of TSS materials;

- That provision be made to add lime to the system to manage pH, as required for the management of heavy metals; and,

- That the outflow from LPTP to Pearl Lake be changed from its current condition of a simple culvert connection, to one using a thin-plate, concrete weir that will allow flows from the pond to be measured to the prescribed accuracy of ±15%, as required by O. Reg. 560/94.

Conceptual design details for the weir are shown in Figure 16. Further details are provided in Appendix D.

The principal constraints on weir design and operation are the following:

- Low gradient change in water level elevations between LPTP (312.85 m amsl) and Pearl Lake (312.73 m amsl);

- Limited tolerance for increased water levels on LPTP because of the adjacent road networks and the walking trail around the pond;

- Shallow water depths (<0.5 m) at the east end of the LPTP, near the pond outflow, which are prone to ice blockage, if mine water discharge should be curtailed in mid-winter for any significant period of time; and,

- The need to measure flows to an accuracy of ±15%.

The proposed weir design is such that during the period of maximum mine dewatering (i.e., approximately 30,000 m^3/d), a 25-year return period, 24-hour storm event would be expected to generate a 0.27 m peak water level increase above the normal pond operating water level (Appendix D). At the lower mine water pumping rate more typical longer-term open pit dewatering rates of approximately 15,000 m^3/d, the 25-year return period, storm induced peak water level change is calculated at 0.23 m. Both peak water level increases would be of short duration (<12 hrs).

The weir would be constructed as a broad-crested, double-chambered (2 x 1.5 m), thin-plate concrete facility. The wide openings are necessary to prevent unnecessary back-water effects on LPTP, while still allowing accurate flow measurement. Once the initial higher mine dewatering phase associated with UG ramp development is completed (likely within the first 2 to 3 years of development, it may be possible to close off one chamber of the weir. The weir would be housed within a small heated shed to protect against winter ice accretion. Also, because of the shallow water depth approach to the weir, the entryway to the weir from LPTP would be dredged to a depth of approximately 1.5 m, to prevent possible ice blockage of the water flow, during periods of severe winter weather.

Through implementation of the above water control measures, it is expected that Goldcorp will be able to effectively lower TSS concentrations, and associated heavy metals, to regulated levels. Silt curtains and flocculants have been used effectively at other operations such as with the Montcalm advanced exploration mine water settling pond, and at De Beers Victor mine site for both the advanced exploration phase pilot plant setup, and for the Central Quarry processed kimberlite containment facility.

The remaining consideration for mine water is ammonia-derived residuals from the use of blasting agents. Table 15 shows calculated ammonia residuals with the use of ammonium nitrate fuel oil (ANFO) and emulsion-based explosives. Emulsion based explosives are much less water soluble than ANFO explosives, and therefore offer superior effluent performance. Ammonia residuals are calculated for an average total rock (ore and waste) production rate of 50,000 tpd, and for mine water discharge rates varying from 10,000 to 30,000 m^3/d. Generally, total ammonia levels of greater than 10 mg/L can be problematic for effluent rainbow trout toxicity tests, such that target ammonia levels should generally be less than 5 mg/L to provide a reasonable factor of safety for toxicity testing, depending on pH and other factors. Use of emulsion-based explosives, as a general practice with minor potential use of ANFO in selected circumstances, is therefore recommended to ensure compliance with final effluent toxicity requirements.

4.0 ENVIRONMENTAL EFFECTS AND MITIGATION

4.1 Receiving Water Assessment

Water and sediment quality of the Porcupine River system have been affected by past mining activities, as described in Section 2.1, and as shown in Tables 6 and 7. The data for Pearl Lake and for the Porcupine River immediately downstream of Pearl Lake show that PWQO and CEQO PAL are generally met in the average condition for all parameters except for total phosphorus. However, a number of metals show occasionally elevated values including those for cobalt, copper, iron, lead and zinc. Laboratory detection limits were not sufficiently rigorous to determine whether or not cadmium and mercury concentrations actually exceeded the more stringent federal guideline values, but exceedance for cadmium is likely. The federal guideline for cadmium is an interim value.

Elevated phosphorus values are believed to derive from historic and active sewage systems within the catchment area, and not from mine water discharge.

Heavy Metals

Heavy metal values are believed to be mainly linked to past mining activities, as well as to natural mineralization in the area. Where occasionally elevated heavy metal values occur in Pearl Lake, these elevated values appear to be related to a combination of factors, with TSS and pH being among the more probable associated factors. For example, iron concentrations are strongly linked to TSS concentrations with an "r^2" value of 0.891 (Figure 17). Such a strong correlation between iron concentrations and TSS values is expected since Fe^{3+} in solid phase, as $Fe(OH)_3$, is the principal form of iron in oxygenated waters at neutral and near neutral pH values.

Zinc and copper show only a modest association with TSS values (Figure 17). Zinc also shows a modest relationship with pH (r^2 = 0.242), whereas as copper shows a rather poor relationship with pH (r^2 = 0.095), at least within the range of pH experienced within Pearl Lake. Part of the problem with copper is the comparatively high laboratory detection limit of 0.005 mg/L used in a portion of the analysis.

The data for Little Pearl Tailings Pond show similar trends in heavy metal associations with TSS and pH values, as shown for Pearl Lake (Figure 18). However, for copper and zinc the relationships with TSS are stronger, and the relationships with pH are weaker due to a small number of outliers (Figure 18). Copper and zinc concentrations versus time for both Pearl Lake and LPTP are shown in Figure 19.

Taking all of the above into consideration, the data show that by managing TSS and pH values, heavy metals can reasonably be expected to be kept to comparatively low levels, such that metal concentrations in the receiving water system would not be expected to increase over current background values. Adverse effects on downstream water quality and aquatic biota, beyond those presently occurring, is therefore not expected with modifications to the current mine dewatering and mine water treatment systems, as proposed herein. Partitioning LPTP by means of a silt curtain (or mine rock berm) should further improve overall water quality.

Ammonia

The remaining consideration is ammonia. With use of emulsion, or emulsion blend explosives, total ammonia concentrations in the mine water are expected to range from approximately 1.77 to 5.32 mg/L, at mine water production rates of 30,000 m^3/d and 10,000 m^3/d, respectively. The watershed of Pearl Lake measures approximately 2.5 km^2.

The Porcupine River watershed exhibits an average annual runoff of 0.439 mm (WSC flow monitoring station Porcupine River at Hoyle, watershed area 401 km^2, period of record 1977 to 1994). The average natural flow for the Pearl Lake watershed is therefore calculated at 4,510 m^3/d averaged over 8 months of the year.

Table 16 summarizes expected receiving water (Pearl Lake) un-ionized ammonia concentrations for winter and summer conditions, respectively. Calculations for both conditions assume a receiving water pH condition of 7.85, and respective winter and summer temperatures of 0°C and 20°C, respectively. The summer condition assumes a 10-fold reduction in total ammonia concentration due to biological uptake and volatilization. This factor of reduction is based on data from Barrick Gold's Holt McDermott Mine, near Kirkland Lake, where an approximate 100-fold reduction in ammonia has been noted in the tailings holding pond (Figure 20).

Results of the analysis indicate that un-ionized ammonia levels (as N) in Pearl Lake would be expected to range between 0.01 and 0.03 mg/L in winter, and between 0.004 and 0.01 in summer. The higher 0.03 mg/L winter value is calculated for the reduced mine water flow volume condition (i.e., same amount of explosives used but less mine water production, yielding higher mine water ammonia concentrations). Under this condition, there would be a substantial dilution (mixing) with the residual lake volume, which would tend to bring down the calculated 0.03 mg/L higher value, to a value closer to 0.02 mg/L. As such, the un-ionized ammonia levels in Pearl Lake (as N) are expected to be consistent with the PWQO of 0.02 mg/L (as N) for the protection of aquatic life.

4.2 Area Wide Surface Water Condition

Dewater Rates and Historical Data

Historical UG workings at the Hollinger site were developed to a depth of approximately 2,000 m, and included almost 600 km of shafts and tunnels (Ferguson 1968 and Wright 1979). Hydrogeological studies conducted by AMEC predict a Base Case longer-term steady state dewatering rate of approximately 8,900 m^3/d with development of the Hollinger open pits and associated UG operations, and a Conservative Case longer-term dewatering rate of approximately 12,400 m^3/d (Appendix C). Higher dewatering rates would be required during early years of operation remove greater volumes of stored water contained within the upper levels of the UG workings; but the removal of stored water in the UG working would not be expected to affect surface water conditions. The above predicted steady state dewatering rate compares with an historic dewatering rate for UG mining at the Hollinger and McIntyre sites of approximately 7,600 m^3/d (Appendix C), and a current dewatering rate in the Closure condition, averaging approximately 1,200 to 1,900 m^3/d.

As an indication of the potential for this dewatering rate to affect surface water bodies, the reader is referred to Figure 21, which shows the extent of surface water features in 1969, when the Hollinger and McIntyre Mines were still in a dewatered state, compared with 2006 LiDAR images of the principal lake area shoreline boundaries. The image shows that virtually all of the principal lakes and ponds within the study area had very similar perimeter outlines and hence similar depths (within seasonal norms), for the two timeframes (1969 and 2006), with the exception of Little Pearl Tailings Pond to the immediate north of the proposed Hollinger open pit, and Peroli Lake located approximately 3.5 km southwest of the proposed Hollinger open pit centroid. Little Pearl Tailings Pond was dredged by ERG Resources Inc. in 1989, and therefore has an expectedly larger current water surface area than that shown in the 1969 air photo. Peroli Lake is very shallow and is currently impounded by a small road at its north end, which is sufficient to account for the observed water level differences between 1969 and 2006.

The fact that lake area outlines were essentially the same in 1969, when the area was under drained, as they were in 2006 when there was only limited dewatering to manage near surface water levels within the UG workings in the immediate Hollinger mine area, strongly suggests that surface water bodies in the Hollinger area are unlikely to be measurably affected by dewatering rates proposed herein.

Also, in discussing conditions associated with Pearl Lake with area residents, including Kees Pols of the Mattagami Region Conservation Authority, no one was aware of any marked changes in Pearl Lake water levels during the period of approximately 1988 to 2000; nor have AMEC staff observed any such changes outside of seasonal norms during frequent visits to this portion of the Timmins area during that period. The period from 1988 to 2000 coincided with the time when UG pumping from the McIntyre (and Hollinger) mines ceased, and groundwater levels were recovering. Starting in year 2000 more limited groundwater pumping was resumed from the McIntyre No. 11 Shaft, as groundwater levels reached to near surface. When groundwater levels were recovering during 1988 to 2000, and when groundwater was consequently not being pumped to the Pearl Lake system (as per historic mine dewatering when mine water was pumped to the Pearl Lake system), Pearl Lake would have been effectively under drained.

Groundwater modeling for the Hollinger Project indicates that Pearl Lake would potentially be the most affected surface water body, in terms of groundwater / surface water effects interactions, as this lake would be completely under drained. Since historical observations during the 1988 to 2000 period indicate that there was little if any effect on Pearl Lake water levels, when the lake was previously under drained, the potential for adverse effects to more distant water bodies is even less likely, supporting evidence obtained from groundwater modeling and the 1969 aerial photograph of the area that adverse effects to area water bodies, as a result of mine dewatering and associated under draining are not expected.

Groundwater Model Predictions

Groundwater modeling predicts that the cone of influence from mine dewatering will extend outwards to encompass LPTP, Pearl Lake and Gillies Lake, and would approach Clearwater Lake (Appendix C). Mine water will be discharged into LPTP, which will then flow downstream into Pearl and Clearwater Lakes, thereby retaining water levels in these lakes irrespective of mine dewatering effects through bedrock depressurization. Gillies Lake is underlain by clay substrates (Figure 22), and is therefore isolated from the underlying bedrock aquifer.

4.3 Area Wide Groundwater Condition

There are three considerations here:

- Potential effect on area wells;
- Potential effect on ground settlement; and,
- Stability of existing UG workings.

The City of Timmins provides municipal water to residents and businesses within the urban area, and it is expected that there are no private wells that would effected by mine dewatering close to the mine. Municipal water is not available in the rural areas, further to the southwest of the proposed mine, and a search of the water well records and local maps indicates that there are a few residents in this area that rely on water wells for their water supply. However, the closest of these is more than one kilometre from the mine near the edge of the Zone of Influence. At this distance, it is not anticipated that the operation of these wells will be affected by mine dewatering. However, any active wells in this area should be monitored to confirm expected conditions. Further details are presented in Appendix C.

With regard to the potential to induce ground settlement, there are two potential issues. One is depressurization and settlement of the overburden layer. The second is the potential for ground shifting within the former UG workings because of shifting in existing backfill zones caused by a change in water levels.

With respect to the potential for depressurization and settlement of the overburden layers, such settlement is not expected to occur because:

- The area was previously dewatered starting in 1911, continuing until 1988 when operations at the McIntyre Mine ceased. It then took approximately 10 to 12 years for the water table to recover in the area, so any significant consolidation of the overburden due to pore water removal would have occurred during the previous mining period. Reflooding the area would not have had an appreciable change on the consolidated materials, such that materials are already in a "settled" condition;

- Once the water table had recovered around year 2000, it was noted that mine water was breaking surface at a few locations. Goldcorp (and its predecessors) re-instituted groundwater pumping at a lesser rate to maintain the water table in the UG workings at a level of about 30 m below surface at the McIntyre Mine, and about 10 m below surface in the area immediately south of the Hollinger site. Hence there was no real opportunity to re-infuse overburden pore water space within the upper overburden zone in any event; and,

- Overburden in much of the area, especially closer to the Hollinger site tends to be thin, with frequent rock outcrops, with the major exception of a deeper trough within which LPTP and Pearl Lake occur. This area would remain saturated.

With respect to the potential for ground subsidence related to backfill shifting, this aspect will be addressed in the mine closure plan amendment. MNDMF has already flagged this as a concern, and there has been an extensive program around this issue. Goldcorp has identified all areas where stopes are near surface and where potential problems could occur. The vast majority of such areas (with a few minor exceptions) are already fenced as part of the existing closure plan. Development of the proposed open pit complex and associated mine rock stockpiling will remove most of these potential hazards; and any areas that are not so removed will remain fenced.

4.4 Other Considerations

The roadway to the immediate west side of the McIntyre Arena, running between Little Pearl Tailings Pond and Pearl Lake, and linking to the McIntyre property, will continue to be used as a transportation corridor. The proposed LPTP weir and associated discharge box culvert arrangement will be constructed so as to preserve this transportation corridor function.

A public trail system has also been constructed partway around LPTP on its east, north and west sides. There would be no appreciable changes to the water level of the tailings pond, and hence no adverse impact to the use of this trail system.

5.0 GOVERNMENT AGENCY AND PUBLIC CONSULTATION

5.1 Government Agency Consultation

A teleconference was held with Ms. Carroll Leith of the MOE Timmins District office on November 20, 2008 to discuss the general concepts of mine water management as described herein. During that discussion it was confirmed that Goldcorp should apply for amendments to existing permits (PTTW and C. of A.) rather than for new permits. It was also determined that a future meeting should be held with the MOE District staff, as well as with MOE Technical Support staff from the Thunder Bay Regional office, to discuss details of permitting requirements and information needs.

On February 24, 2009 a provincial/federal interagency meeting was held in Timmins (South Porcupine Government Complex) with MOE, MNDMF, Ministry of Natural Resources (MNR), Department of Fisheries and Oceans (DFO), and Environment Canada (EC), as well as with representatives from the City of Timmins, to discuss the Hollinger/McIntyre Project, including proposed dewatering operations. Following from that meeting, and relevant to this permit application, it was concluded that:

- Further discussions should be held with MOE Technical Support in Thunder Bay regarding planned changes to mine dewatering and use of LPTP (a teleconference with MOE Technical Support was held on March 19, 2009 – see below);

- Application would likely be required to MNR for approval of the LPTP weir and box culvert, pursuant to *Lakes and Rivers Improvement Act* requirements;

- MNR may establish timing restrictions on the LPTP weir, box culvert and dredging activities to protect fish and fish habitat in adjacent Pearl Lake (warm water fish spawning restrictions, if applicable, normally take effect from April 1 to July 1);

- DFO would likely provide a letter of advice regarding the proposed in-water construction works, to protect fish and fish habitat in adjacent Pearl Lake;

- PGM should develop an outline of their overall Consultation Plan for the Hollinger Project for review by the affected government agencies (an updated Consultation Plan was submitted to the government agencies in April 2009 – see Appendix E);

- PGM committed to uploading all submitted permit documents to their Project website (such website already exists), and to maintaining a public information centre for the Project (such information centre already exists); and,

- Coordination will be required on Aboriginal consultation to ensure that the Hollinger Project is considered in its entirety, and not just on a permit-by-permit basis.

A copy of minutes from the February 24 meeting in Timmins is attached (Appendix E).

On March 19, 2009 a meeting/teleconference was held between PGM, AMEC, MOE Timmins District Office, and MOE Technical Support in Thunder Bay. The purpose of the teleconference was to inform and discuss Project plans regarding mine dewatering and mine water treatment with MOE Technical Support staff. An information package was sent out in advance of the discussions, as per Appendix E. Minutes of the teleconference are attached (Appendix E).

Also, in follow-up to the March 19 meeting/teleconference, a memo outlining AMEC's groundwater modeling approach was forwarded to MOE Technical Support on April 9, 2009 (Memo dated April 8, 2009). The memo and related e-mail exchanges are attached as part of Appendix E.

Additional meetings with provincial government and City of Timmins representatives were held on:

- April 17, 2009;
- May 26, 2009;
- November 5, 2009;
- November 23, 2009;
- May 5, 2010; and,
- August 17, 2010.

The majority of these meetings focused on broader issues relating to the Hollinger Project, including preparation of an overall Environmental Review Report (ERR), permitting requirements and schedules, and the need for a City of Timmins Site Plan Control Agreement (SPCA).

5.2 General Public

Goldcorp held separate open house meetings in Timmins on March 29, 2007 and October 2, 2008 to discuss redevelopment of the Hollinger and McIntyre Mine sites. General response at these sessions was positive, with the principal environmental concerns being those associated with protection of property values, and noise and dust control. No concerns were expressed regarding water management or the continued use of LPTP for this purpose.

Goldcorp also maintains an active website on its activities, including those related to the Hollinger Project, at www.porcupinegoldmines.ca. A public information centre (i.e., the Hollinger Project Information Centre) has also been set up at 979 Algonquin Blvd East, on the north side of the Hollinger property, to provide information to local residents on an ongoing basis. This information centre is generally open for about 30 hours per week, except in the winter when the centre has been closed.

A third public information session was held at the McIntyre Area on May 19 and 20, 2010 to provide the general public, and other interested parties, with information on the entire Hollinger Project, as part of the Environmental Review process that PGM has agreed to carry out for the Hollinger Project, so as to provide government agency representatives, the general public and the local Aboriginal peoples an opportunity to view the proposed Hollinger (and McIntyre) Mine redevelopment within its broader context, rather than to limit review and consultation opportunities to specific permit notification and consultation requirements. The reason for agreeing to enter into this Environmental Review process is that the mine redevelopment program, as currently planned, has no triggers either federally or provincially that would require completion of an environmental assessment. Goldcorp desires public support for the planned mine redevelopment, and therefore, along with government agency concurrence, views an Environmental Review process as the best means of providing the broader Project perspective to interested stakeholders.

A draft ERR was released to government agencies and to the general public in association with the May 19 and 20 public information sessions. A second public information session is planned for the fall of 2010, which will coincide with release of the final ERR. As in the case with earlier public open house sessions, the majority of public comments were in support of the Project, and where concerns were expressed these concerns revolved around issues related to noise, dust, vibration, visual aesthetics, and property values. No concerns have been expressed to date regarding water quality of the mine water discharge / LPTP / Pearl Lake system, other than comments from MNDMF that additional parameters should be included in monitoring than just those listed in Table 8.1 of the ERR. Parameter listings in Table 8.1 of the ERR were in error. A much broader suite of metals is included in the current receiving water analysis, and this broader analysis will be carried forward.

It is expected that there will be one more public information session on the Hollinger (and McIntyre) Mine redevelopment project in fall 2010, coincident with release of the final ERR. It is also expected that this application for amendments to the existing PTTW and C. of A. will be posted on the Environmental Bill of Rights (EBR) registry for broader public comment.

5.3 Aboriginal Communities

PGM initiated consultation with Aboriginal communities through notification letters sent to those communities that were identified by MNDMF. A preliminary meeting was held with the leadership of the Mattagami First Nation (MFN) on January 15, 2008 to discuss potential redevelopment of the Hollinger (and McIntyre) Mine site. The Economic Development & Technical Services Advisor of the Wabun Tribal Council was also present at the January meeting. The leadership of the MFN and the Grand Tribal Council both expressed that they expected to see direct benefits from redevelopment of the properties, and that other Wabun Tribal Council First Nations should also be consulted.

In 2009, Goldcorp initiated a comprehensive process of relationship building as a first step in effective consultation with those Aboriginal communities who claim traditional territory in the PGM camp.

Consultation with the Matachewan, Mattagami, and Wahgoshig First Nations and the Métis community has included discussions on economic, social and environmental impacts to the communities, including those deriving from closure plans.

Further discussions have been held with both Wabun Tribal Council and Métis Nation of Ontario in 2009. It is Goldcorp's plan to enter into some form of agreement with the various aboriginal partners in the area which will facilitate further dialogue and consultation with respect to this project. Follow-up discussions with potentially affected Wabun Tribal Council First Nation communities and the Wahgoshig First Nation (formerly a member of the Wabun Tribal Council) are planned, together with discussions with the Métis Nation of Ontario.

The potential for involvement of the Aboriginal communities in this particular undertaking remains unclear at this time, since the Project effectively involves redevelopment of historic mine sites within the City of Timmins. Archaeological background and field studies conducted as part of the baseline study program for the Hollinger Project have identified an historic portage route running through the City of Timmins along what is now the Highway 101 corridor, on the north side of present-day Highway 101, that previously linked the Mattagami River area to the Night Hawk Lake/Frederick House River system, via the system of small lakes in the area, including Pearl Lake and Porcupine Lake. The area of this trail through the McIntyre and Hollinger properties has been completely overprinted by historic mining and associated urban developments in the local area.

6.0 MONITORING

6.1 Discharge Flows

Mine water discharges from the McIntyre No. 11 Shaft to LPTP will be monitored as part of general mine operations, separate from any specific monitoring obligations linked to the PTTW. The data from this monitoring will be used for mine water management information purposes.

Discharge flows at the outflow weir from LPTP will be measured to an accuracy of ±15%, in accordance with O. Reg. 560/94 requirements.

6.2 Effluent Quality

Samples of the final effluent quality from LPTP will be collected and analyzed in accordance with O. Reg. 560/94 requirements. This sampling will include: thrice weekly sampling for pH and TSS; weekly sampling for arsenic, copper, lead, nickel and zinc; and monthly acute toxicity sampling using rainbow trout and *Daphnis magna* (as modified by sampling results in accordance with the regulation).

Goldcorp, at its discretion, will collect additional samples internal to the mine water management system (such as from the mine water discharge to LPTP, and from various locations within the mine water pond) to assist with day-to-day operation of the mine water management system. Data from any such additional monitoring will not be reported directly to MOE, but would be made available to MOE on an as requested basis, and would be used as appropriate in any annual monitoring reports to document general functioning and overall performance of the system.

6.3 Receiving Water Flows and Quality

The WSC previously maintained a flow monitoring station on the Porcupine River at Hoyle, downstream from Porcupine Lake. The station was active from 1977 to 1994, and this station was reactivated in 2008.

In addition, as part of a broader watershed monitoring initiative, AMEC on behalf of Goldcorp, has set up continuous (mounted transducer) flow monitoring stations on the Porcupine River at the Highway 101 crossing, and on the South Porcupine River at the Pamour Haul Road crossing (Figure 23). These stations were set up in November 2008, and as such it will take some time to develop rating curves that will yield meaningful flow data.

The water quality of Pearl Lake (as the most proximal element of the Porcupine River receiving water system) will continue to be monitored on a monthly basis, as per current practice, for a broad suite of parameters as per the parameter list shown in Table 6 for the Pearl Lake site.

6.4 General Area Watershed Monitoring

To monitor potential dewatering effects on surface water systems, a network of flow monitoring and water level monitoring stations has been set up (Figure 23). A number of the stations were installed during November 2008, with the remaining stations having been set up in the spring of 2009. All stations have been equipped with continuous water level recorders (mounted transducers). Data from these transducers are downloaded on a minimum quarterly basis.

Adverse effects to local surface water systems are not expected as per discussions presented above in Section 4.2, and the monitoring system is viewed purely as a precautionary measure to detect any potential changes in surface water system hydrological regimes, should these occur.

Local well systems will also be monitored to ensure that there are no adverse dewatering effects on local well users.

7.0 REFERENCES

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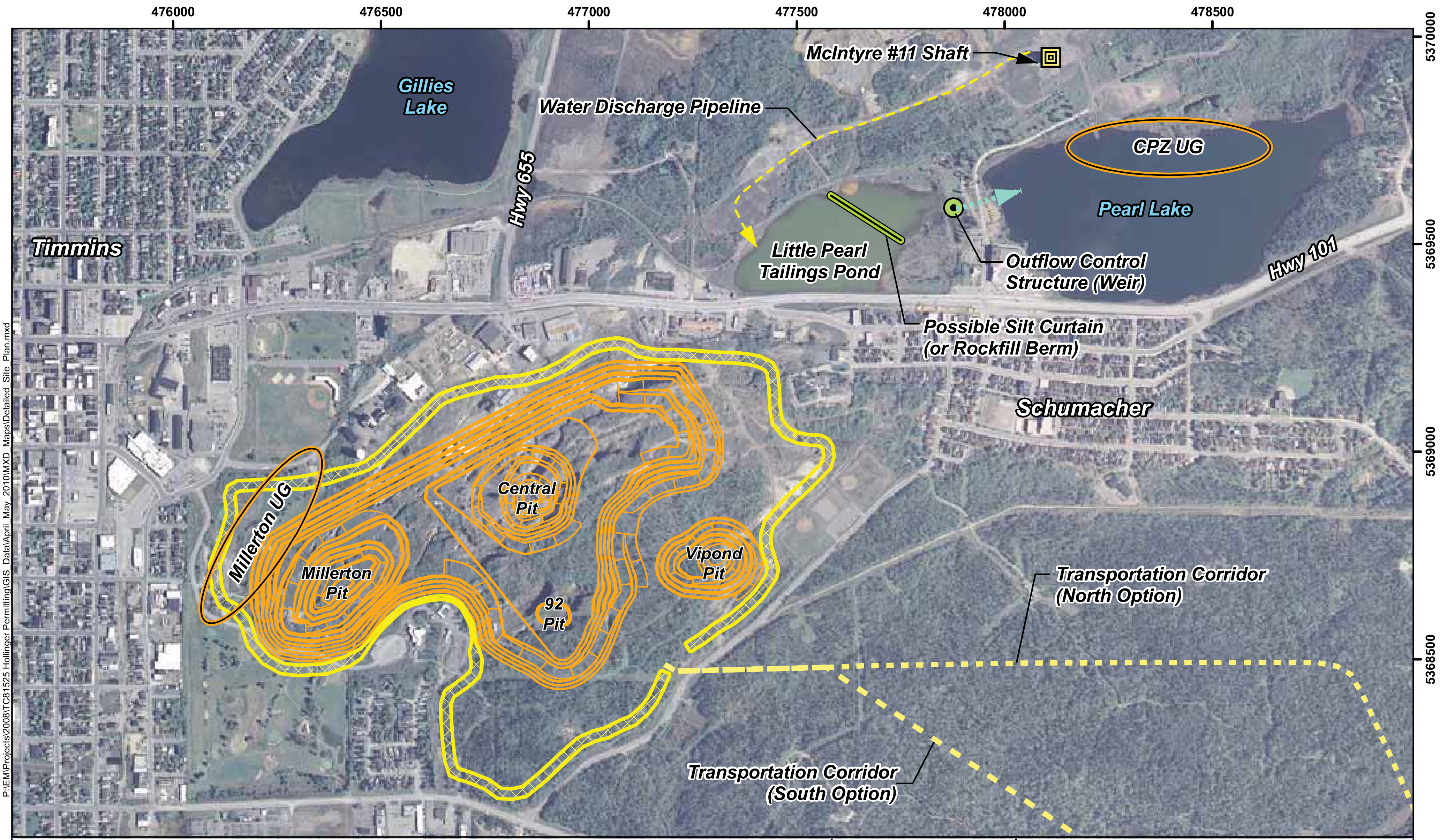


LEGEND

- ▨ Environmental Control Berm Footprint
- Transportation Corridor (To Dome Site)
- Proposed Open Pit
- ● Outflow Control Sturcture (Weir)
- ▣ McIntyre #11 Shaft
- Possible Silt Curtain (or Rockfill Berm)
- Water Discharge Pipeline
- ○ Underground Works (Approximate)

0 0.125 0.25 0.5 0.75 1
Kilometres

NOTES:
-

Datum: NAD83
Projection: UTM Zone 17N

GOLDCORP
PORCUPINE GOLD MINES

amec

HOLLINGER PROJECT

Detailed Site Plan

PROJECT N^o: TC81525	FIGURE: 1
SCALE: 1:12,700	DATE: September 2010

HOLLINGER BASELINE STUDIES

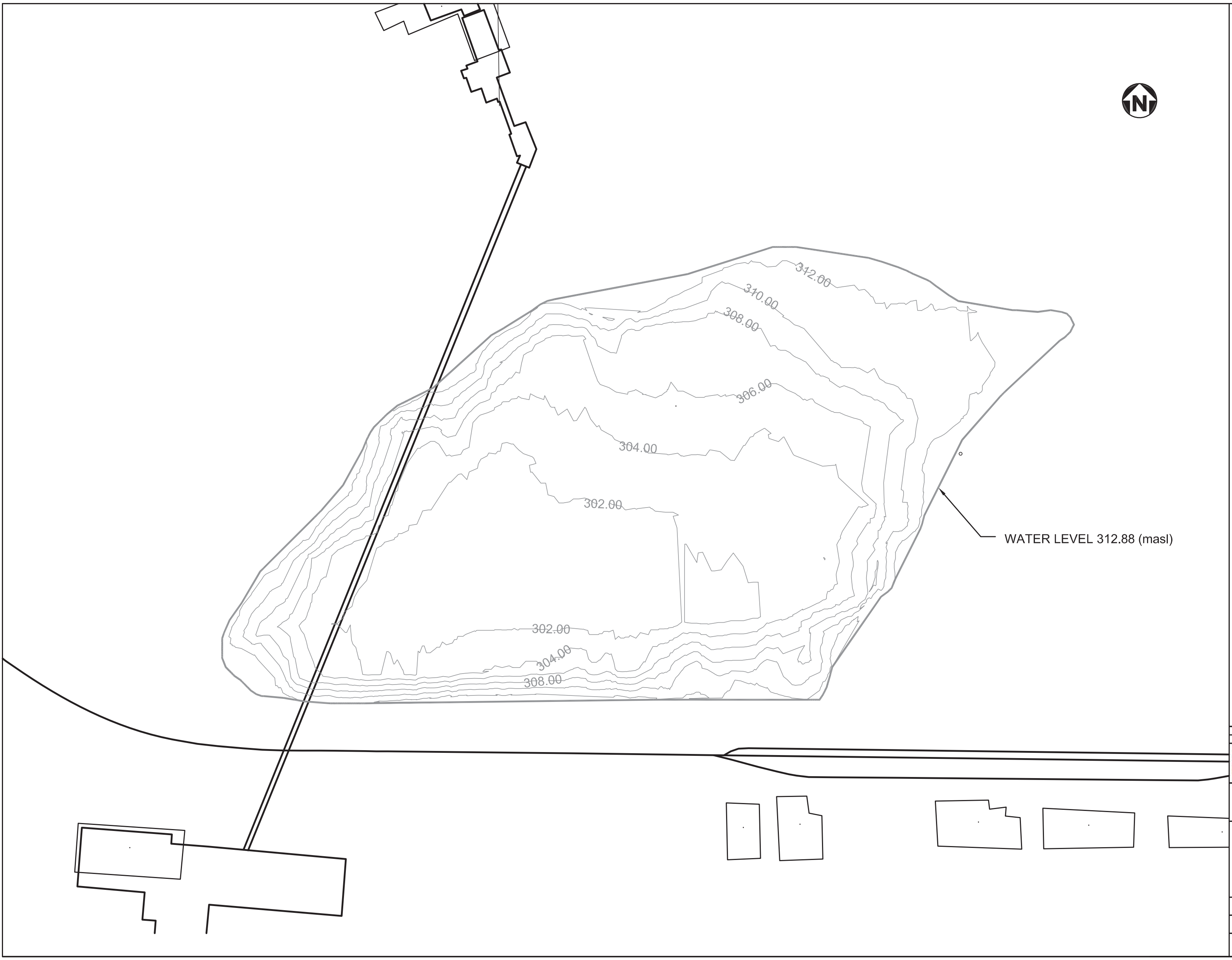
TIMMINS ONTARIO

Proposed Hollinger Open Pit Oblique Rendering

SCALE: NOT TO SCALE | DATE: APRIL 2009

PROJECT No: TC81525 | FIGURE: 2 | REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 2 - Rendering.mxd



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NOTES:

1. BUILDING OUTLINES BASED ON (HCG, 1917)

LEGEND:

LIMIT OF LITTLE PEARL BATHYMETRY SURVEY 2007

~~310.0~~ 2007 CONTOURS

0 50 100
SCALE (m)

REV.	DATE	DESCRIPTION

REVISIONS

terrapoint amec

HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

LITTLE PEARL TAILINGS POND
2007 BATHYMETRY SURVEY

DATE APRIL 2009	SCALE 1:1000	CHECKED BY:
DRAWN BY: PL/MSM	DESIGNED BY:	APPROVED BY:
PROJECT NO. TC71507	FIGURE 3	REV. A

P:\EM\Projects\2008\TC81525 Hollinger Permitting\Drawings\PTTW\Figure 3.dwg – Fig 3.4 – Apr. 20, 2009 2:55pm – peter.liu

Legend:

- ✱ Proposed Hollinger Pit Centroid
- Study Area (Watershed Boundary)
- Waste Rock Stockpile (Maximum Footprint Under Consideration)
- Study Area (Riverine and Road Boundary)
- Watersheds
- River or Creek
- Intermitent River or Creek

Water Quality Sampling Location

- ● AMEC (2007)
- △ Aquifer Beach (2000)
- ● Beak (1999)
- ▲ Goldcorp
- ● Minnow (2001)
- ▲ Minnow (2002)
- ● Senes (2007)
- AMEC (2007)
- Beak (1999)
- Minnow (2001)
- Minnow (2005)

0 1 2 3
Kilometers
1:53,000

amec

HOLLINGER BASELINE STUDIES
TIMMINS ONTARIO

Historical and AMEC 2007
Water Quality Sampling Locations

SCALE: 1:53,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 4 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 4 - Water Quality_Historic.mxd

amec

HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Historical and AMEC 2007 Sediment and Benthic Sampling Locations

SCALE: 1:53,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 5 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 5 - Sediment_Historic.mxd

Legend

Bathymetry Contours - 1.0 metre intervals

Shoreline Habitat Types

Type 1A

Type 2A

Type 3

N

0 50 100 150

Meters

amec

HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Pearl Lake
Bathymetry and Shoreline Habitat Types

SCALE: 1:5,000

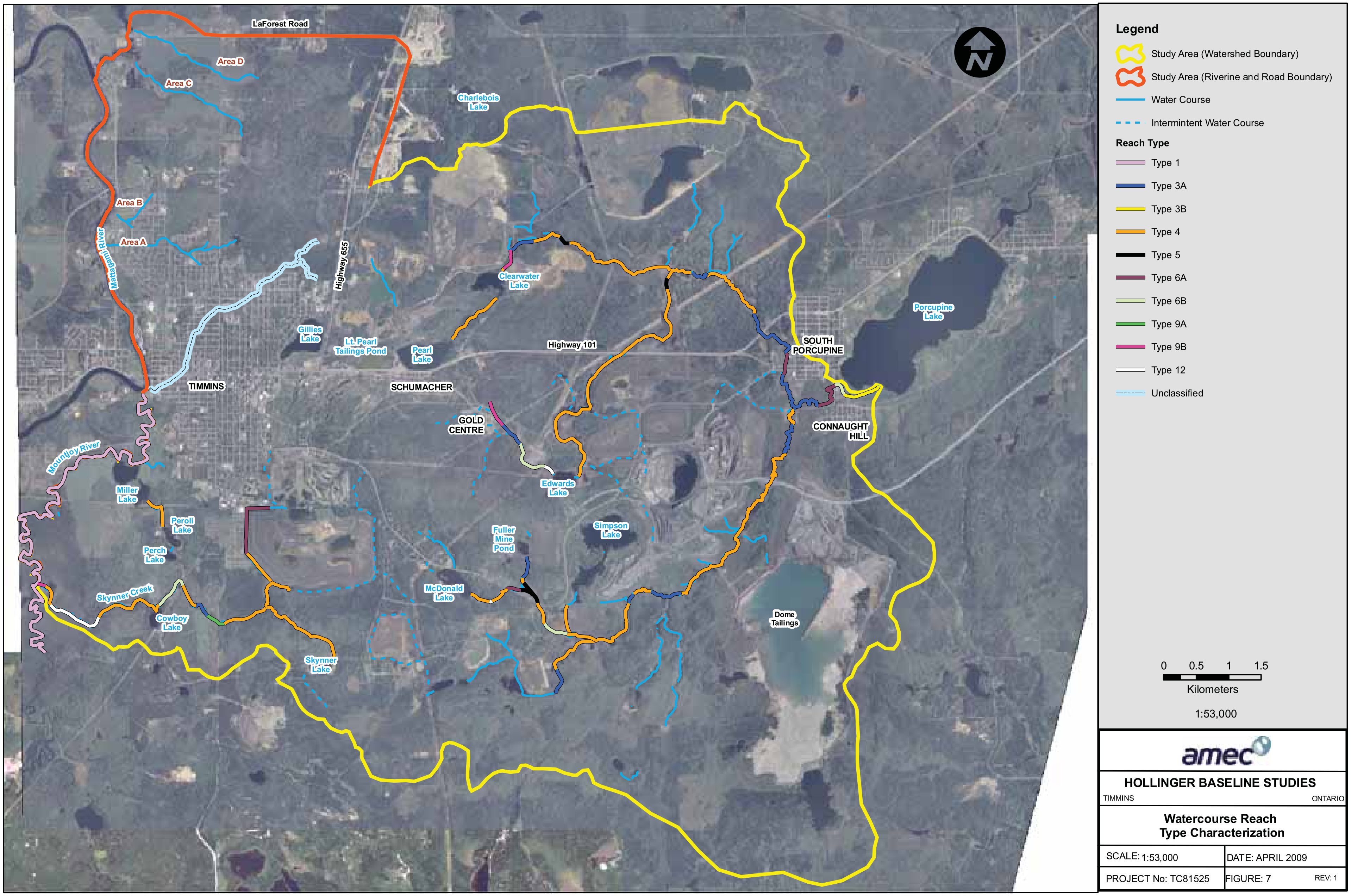
DATE: APRIL 2009

PROJECT No: TC81525

FIGURE: 6

REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 6 - Littoral_Pearl.mxd



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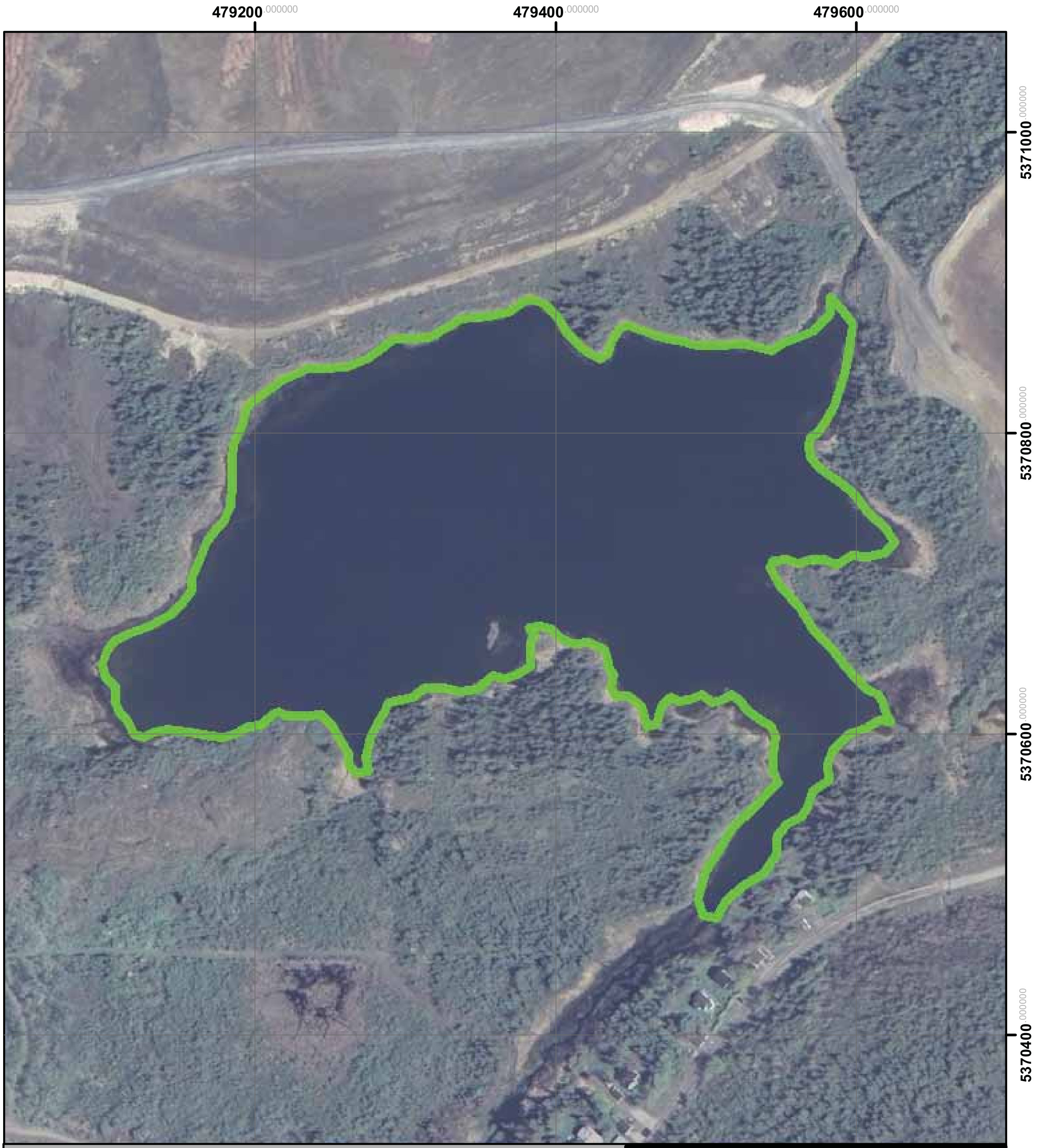
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Watercourse Reach Type Characterization

SCALE: 1:53,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 7 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 7 - Reaches.mxd



Legend

Shoreline Habitat Types

〰 Type 2A

NOTE: No bathymetry data collected during
AMEC 2007 field program

N

0 30 60 90
Meters

amec

HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Clearwater Lake
Shoreline Habitat Type

SCALE: 1:3,500	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 8 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 8 - Littoral_Clearwater.mxd

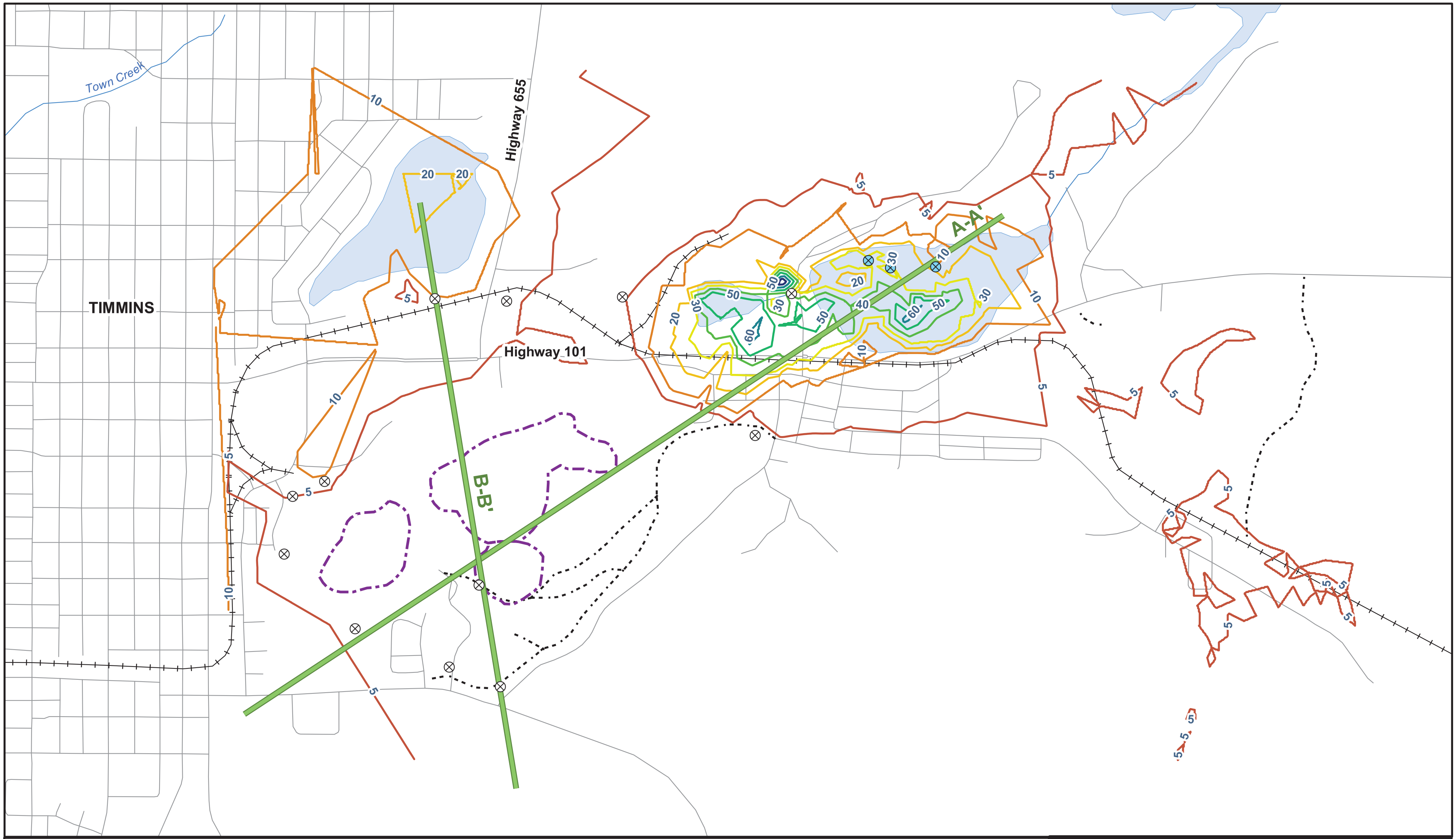
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Monitoring Well and Borehole Location Plan

SCALE: 1:15,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 9 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\PTTW and C of A\Final Figures\Raw Data\New_Figure9_MonitoringWells.mxd



Legend

- ⊗ AMEC Monitoring well
- ⊗ AMEC Borehole (drilled through lake ice)
- ⬠ Municipal Pumping well
- 🟩 Cross Section Locations
- ▭ Pit Outlines

N

0 140 280 420
Meters

amec

HOLLINGER BASELINE STUDIES

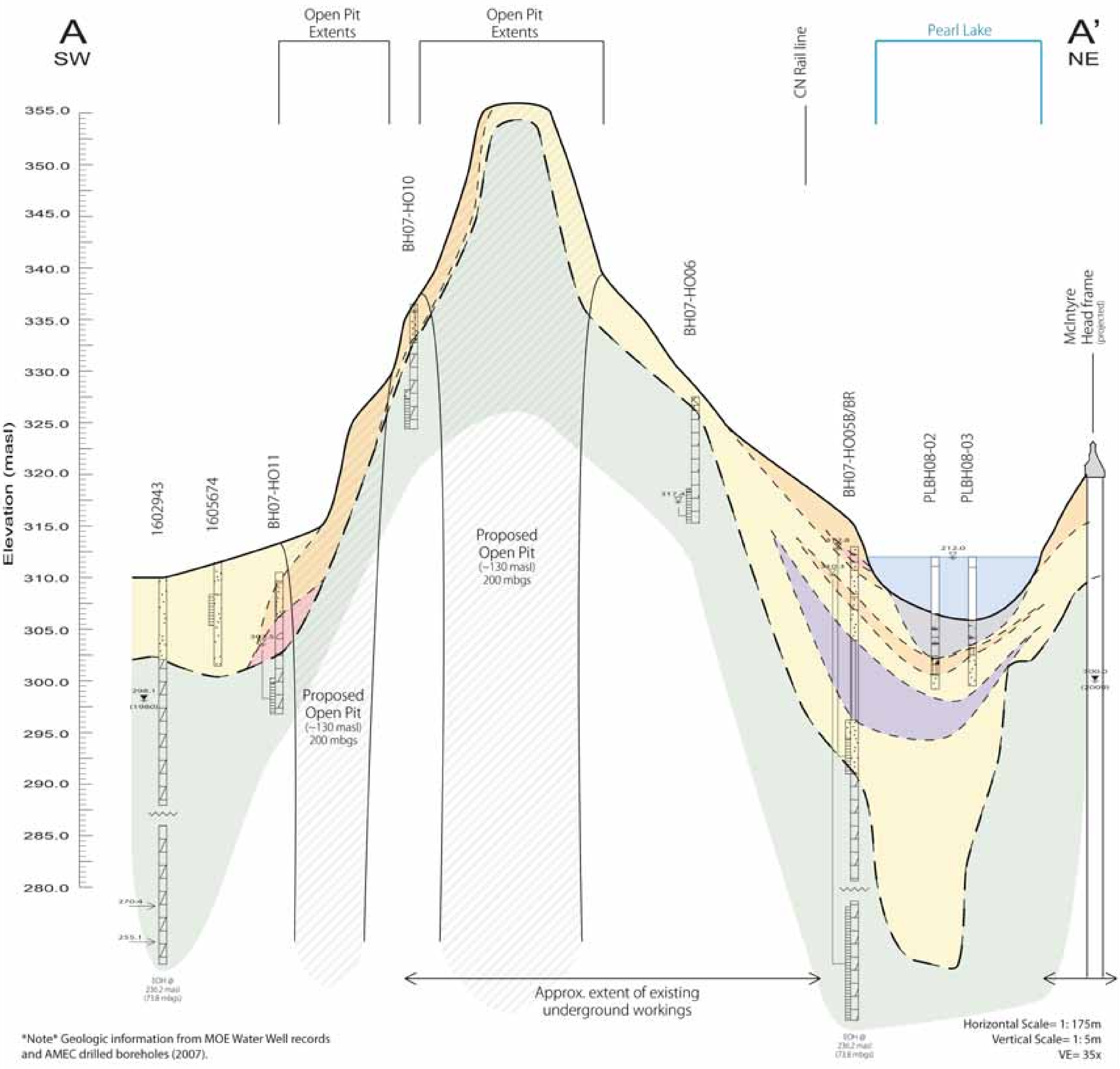
TIMMINS ONTARIO

Overburden Thickness and Cross Section Locations

SCALE: 1:20,000 DATE: JULY 2009

PROJECT No: TC81525 FIGURE: 10 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_Investigation_Dec2008\Site_Plan.mxd



Note Geologic information from MOE Water Well records and AMEC drilled boreholes (2007).

HYDROGEOLOGICAL ASSESSMENT HOLLINGER MINE

Figure 11

Regional Hydrostratigraphic
Cross Section A-A'

Legend

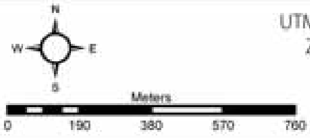
▨	Organics
▨	Clay
▨	Silt
▨	Sand
▨	Silty Sand to Sandy Silt
▨	Gravel
▨	Bedrock
▯ 271.7	Monitoring well screened interval and sand pack
▼ 150.2	Static Water level from other sources (year)
← 271	Water Found interval

Source: National Topographic Database (Canvec) base map shapefiles, 1:10 000 nominal scale.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project # TC81525*1300
Date: July 2009
Client:

Drawn by: RM
Checked by: SG
Revision No.: 2



UTM NAD 83
Zone 17N

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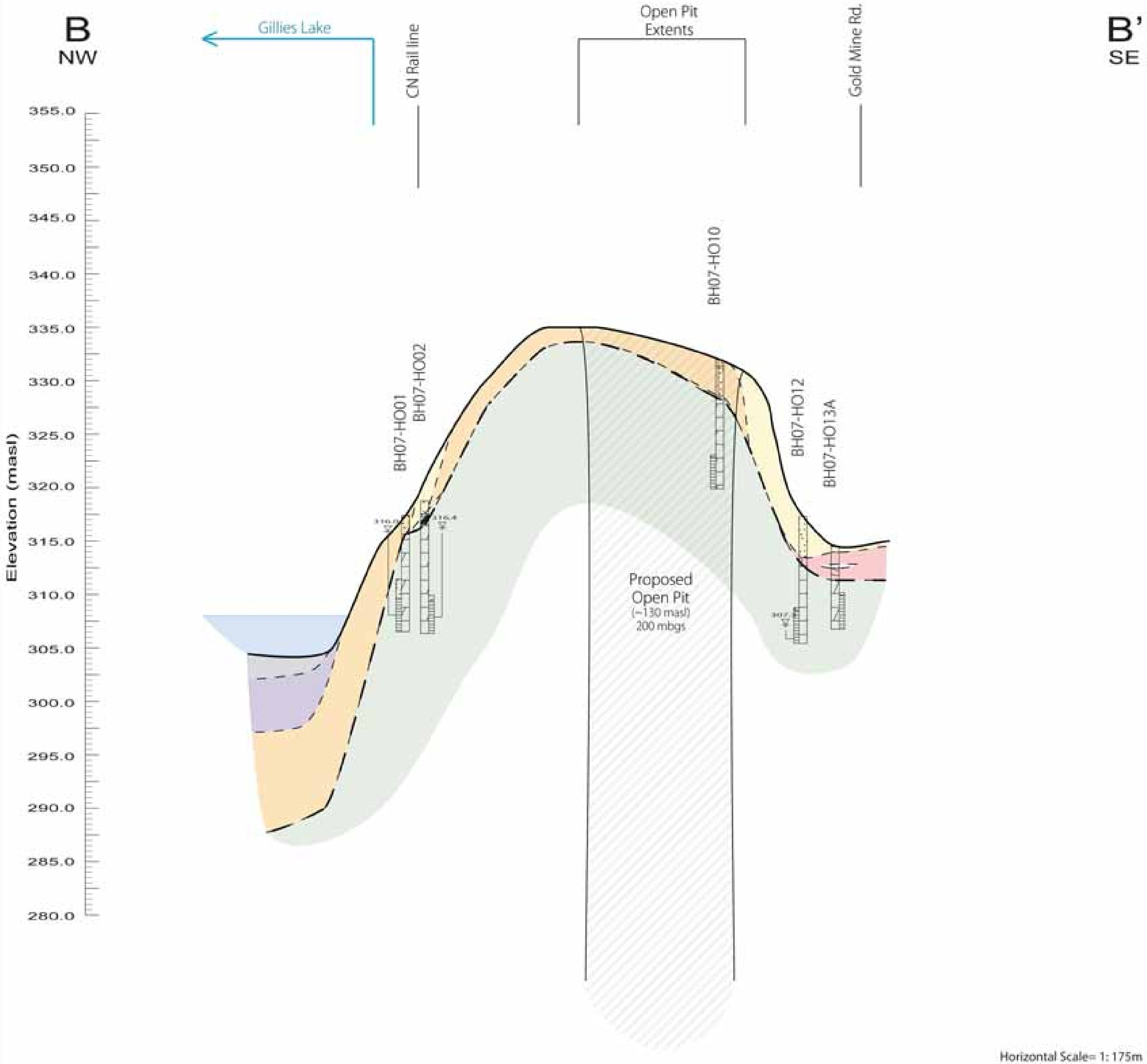

Note Geologic information from MOE Water Well records and AMEC drilled boreholes (2007).

Horizontal Scale= 1: 175m
Vertical Scale= 1: 5m
VE= 35x

HYDROGEOLOGICAL ASSESSMENT
HOLLINGER MINE

Figure 12

Regional Hydrostratigraphic
Cross Section B-B'

Legend

- Organics
- Clay
- Silt
- Sand
- Silty Sand to Sandy Silt
- Gravel
- Bedrock (Greenstone)
- Monitoring well screened interval and sand pack
- Static Water level from other sources
- Water Found interval

Source: National Topographic Database (Canvec) base map shapefiles, 1:10 000 nominal scale.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project # TC81525*1300	Drawn by: RM
Date: July 2009	Checked by: SG
Client:	Revision No.: 2

UTM NAD 83
Zone 17N

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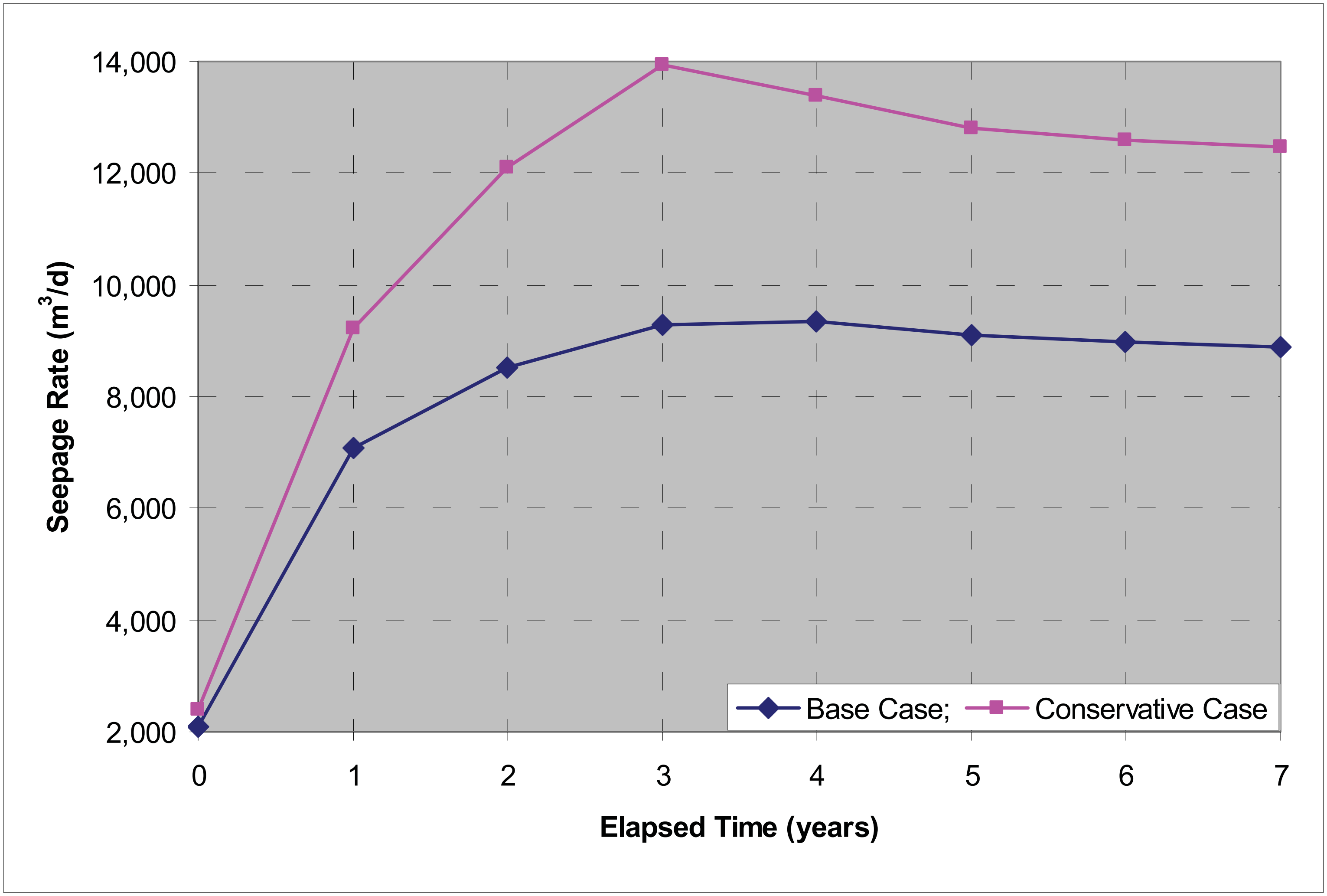


HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Predicted Seepage Rates into Proposed Pits, main Access Ramp and Existing Mine Workings

SCALE: As Shown

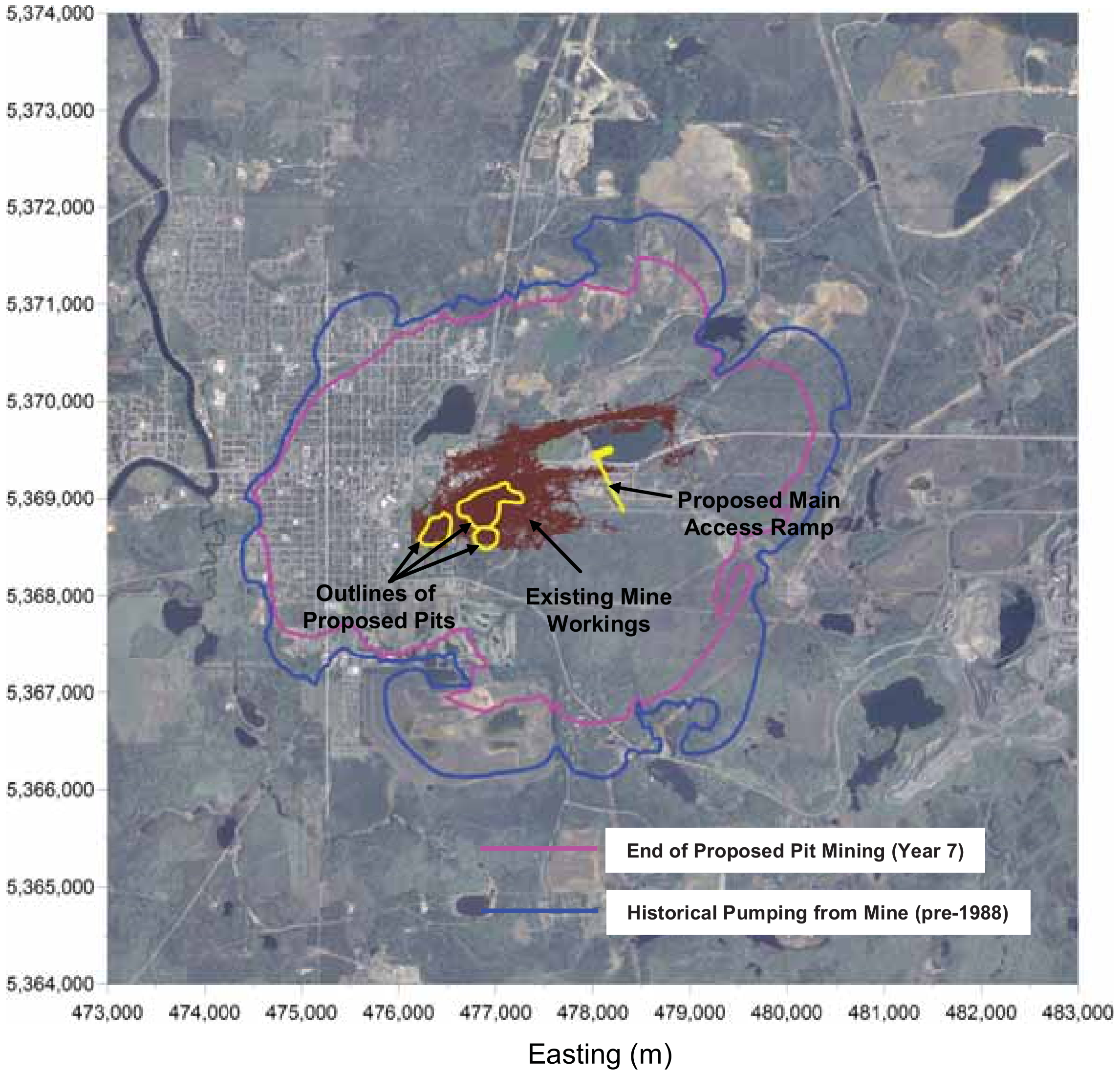
DATE: JULY 2009

PROJECT No: TC81525

FIGURE: 13

REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-15 - Seepage Rates.mxd



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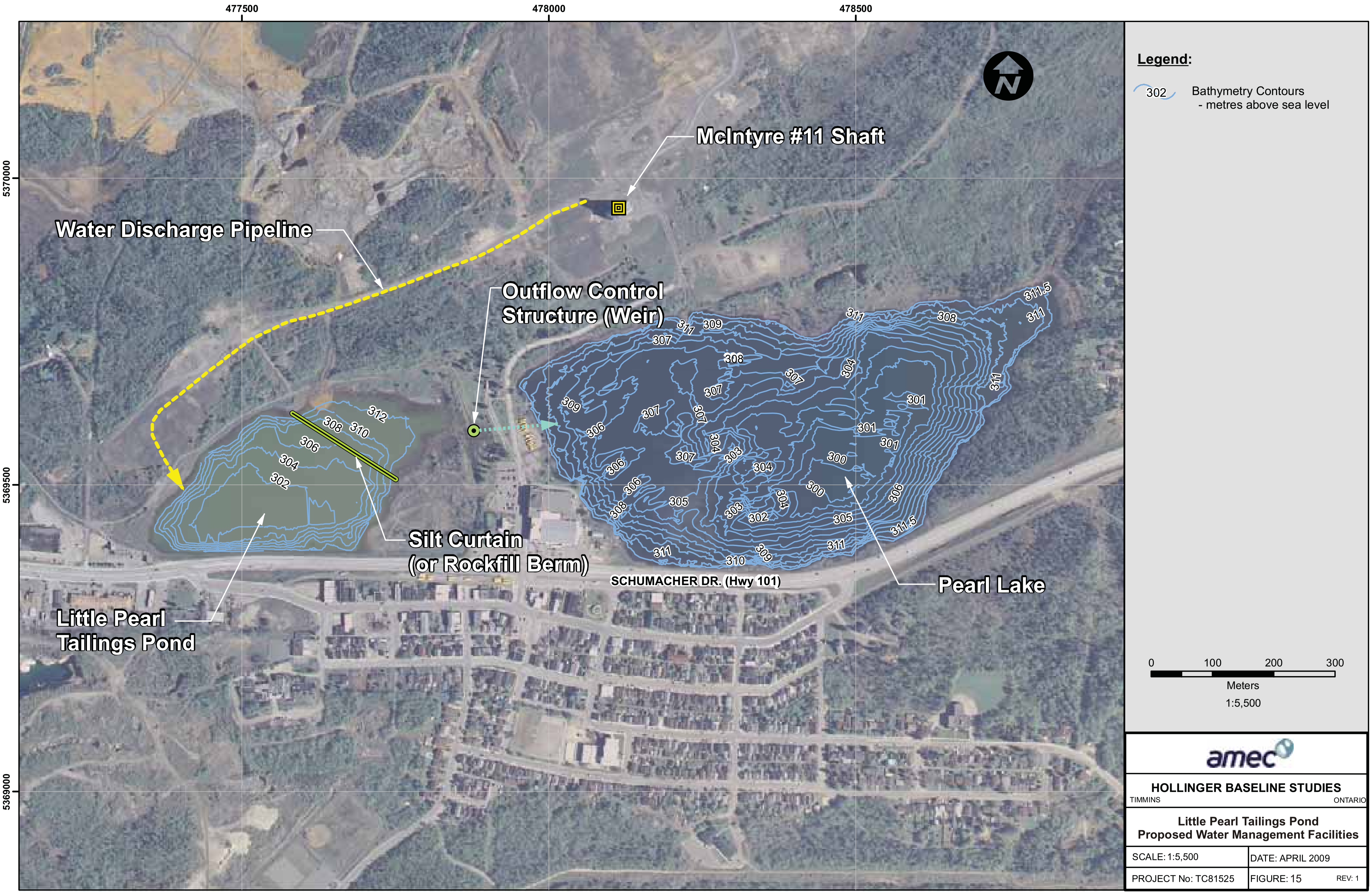
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Model Predicted 1 m Drawdown in Shallow Rock (Base Case)

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 14 REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-16 - Shallow Rock Drawdown.mxd



amec

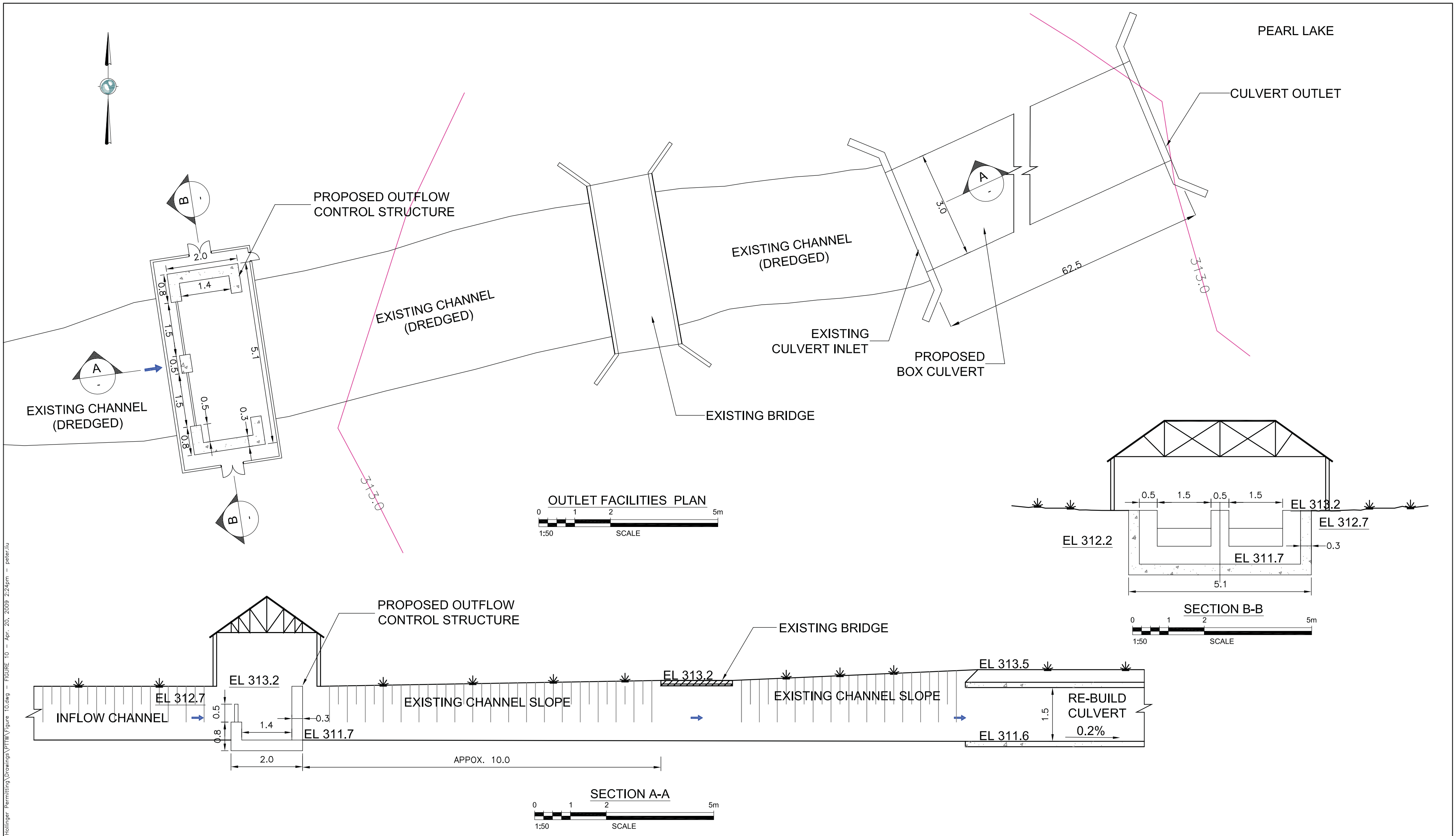
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Little Pearl Tailings Pond
Proposed Water Management Facilities

SCALE: 1:5,500	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 15 REV: 1

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\Additional_forDS_Feb2009\MXD_Maps\Water_Management_with_AdditionalInfo.mxd



NOTES:

1. ALL ELEVATIONS, GRIDS AND DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
2. TOPOGRAPHIC SURVEY WAS PROVIDED BY TALBOT SURVEY LTD. ON DECEMBER 17, 2008.
3. THIS DRAWING IS A CONCEPTUAL LEVEL DESIGN. DETAILED DESIGN FOR THE LPTP OUTLET FACILITIES WOULD BE REQUIRED DURING THE NEXT STAGE OF STUDY.

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	ENG.	APPR.
△						
△						
△						
△						
△						
△						
A	15	04	2009	ISSUED FOR PERMITTING	J.Y.	D.S.

Client Logo:

Client:
GOLDCORP CANADA LTD.
PORCUPINE GOLD MINES

AMEC Earth & Environmental
160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

DRAWN BY: P.L.
DESIGNED BY: J.Y.
CHECKED BY: D.S.
REVIEWED BY: D.S.
APPROVED BY: D.S.

PROJECT: HOLLINGER PERMITTING

TITLE:
LITTLE PEARL TAILINGS POND
OUTLET FACILITIES CONCEPTUAL DESIGN
PLAN AND SECTIONS

PROJECT NO.: TC81525
REVISION NO. A
DATE: APRIL 2009
SCALE: AS SHOWN
DRAWING NO.: FIGURE 16

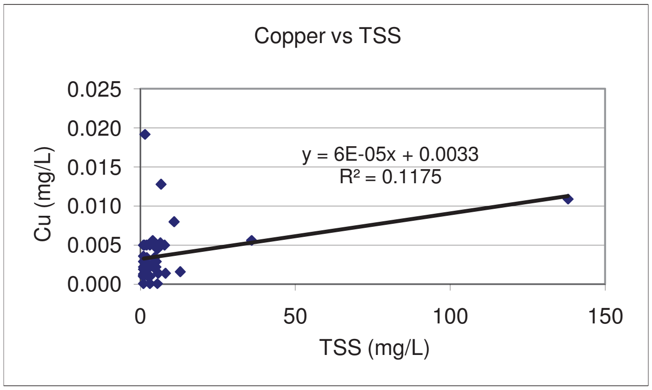
P:\EM\Projects\2008\TC81525 Hollinger Permitting\Drawings\PTTW\Figure 10.dwg – FIGURE 10 – Apr. 20, 2009 2:24pm – peter.liu

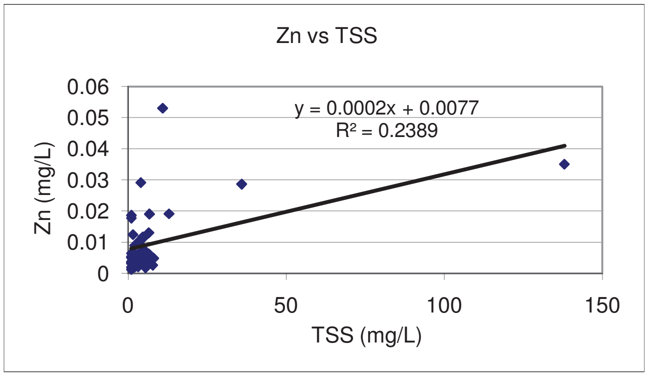
FIGURE 17

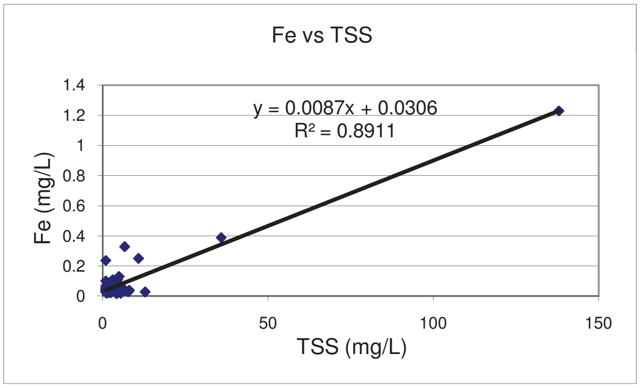
PEARL LAKE WATER QUALITY - SELECTIVE METALS AS A FUNCTION OF TSS AND pH

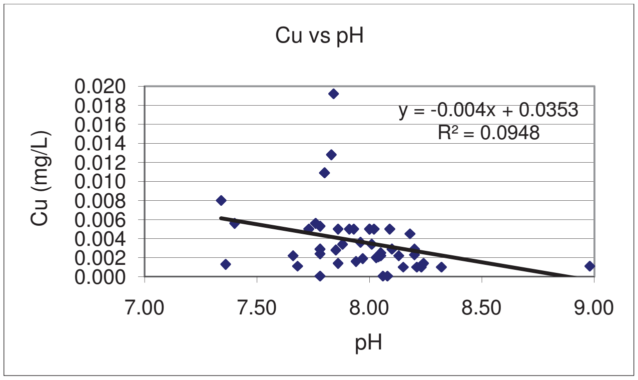
(all metal and TSS concentrations expressed in mg/L)

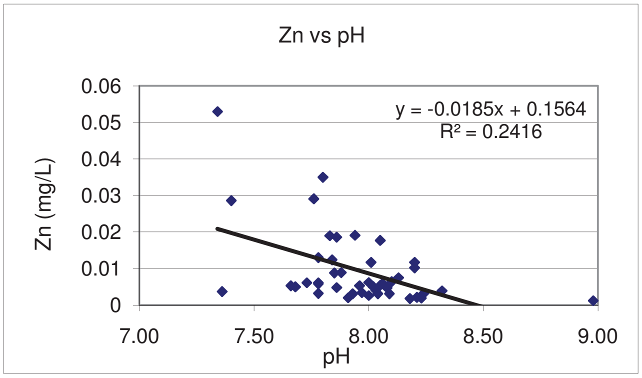
Date	TSS	Cu	Zn	Fe	pH
9-Jan-06	35.9	0.0056	0.0286	0.388	7.40
15-Mar-06	10.9	0.0080	0.053	0.25	7.34
13-Apr-06	3.1	0.0050	0.0061	0.108	7.73
9-May-06	7.8	0.0050	0.0026	0.0287	8.00
13-Jun-06	6.5	0.0050	0.0062	0.0446	8.00
10-Jul-06	5.1	0.0050	0.005	0.0337	8.02
8-Aug-06	2	0.0050	0.002	0.0276	7.91
8-Sep-06	1	0.0050	0.0186	0.236	7.86
3-Oct-06	6.7	0.0050	0.0031	0.0357	7.93
6-Nov-06	1.3	0.0050	0.0031	0.0183	8.09
4-Dec-06	138	0.0109	0.035	1.23	7.80
2-Jan-07	6.5	0.0053	0.013	0.0421	7.78
7-Feb-07	12.9	0.0016	0.0191	0.0273	7.94
5-Mar-07	4	0.0056	0.0291	0.0214	7.76
2-Apr-07	6.7	0.0128	0.019	0.328	7.83
7-May-07	5.5	0.0001	0.0059	0.0192	8.06
4-Jun-07	1	0.0029	0.0064	0.0674	8.10
4-Jul-07	8.1	0.0014	0.0048	0.0391	7.86
15-Aug-07	4.6	0.0034	0.0117	0.108	8.01
6-Sep-07	1	0.0011	0.005	0.0288	7.68
2-Oct-07	2.1	0.0034	0.0089	0.0506	7.88
8-Nov-07	3.1	0.0001	0.0047	0.0359	8.08
22-Apr-08	1.4	0.0029	0.0058	0.0557	7.78
12-May-08	2.3	0.0020	0.0041	0.0233	8.03
10-Jul-08	3.1	0.0010	0.0021	0.03	8.21
11-Aug-08	1	0.0001	0.0032	0.0477	7.78
9-Sep-08	1	0.0019	0.0034	0.0315	7.97
7-Oct-08	5.8	0.0014	0.0032	0.042	8.24
12-Nov-08	5.5	0.0045	0.0018	0.0189	8.18
17-Feb-09	4.3	0.0028	0.0088	0.0152	7.85
30-Apr-09	1.8	0.0022	0.0053	0.0533	7.66
5-May-09	2.2	0.0025	0.0054	0.0343	8.05
8-Jun-09	1	0.0010		0.100	8.15
6-Jul-09	1	0.0013	0.0037	0.0276	7.36
4-Aug-09	2.5	0.0010	0.0039	0.0215	8.32
2-Sep-09	4.5	0.0021	0.0031	0.0712	8.04
5-Oct-09	2	0.0024	0.0061	0.0584	7.78
4-Nov-09	1	0.0036	0.0053	0.0539	7.96
3-Dec-09	3.3	0.0023	0.0102	0.0596	8.20
9-Feb-10	1.5	0.0192	0.0124	0.0457	7.84
7-Apr-10	5.1	0.0029	0.0117	0.0704	8.20
5-May-10	5	0.0022	0.0075	0.13	8.13
8-Jun-10	1	0.0022	0.0177	0.0349	8.05
7-Jul-10	1	0.0010	0.0019	0.0384	8.23
10-Aug-10	1	0.0011	0.0012	0.0344	8.98







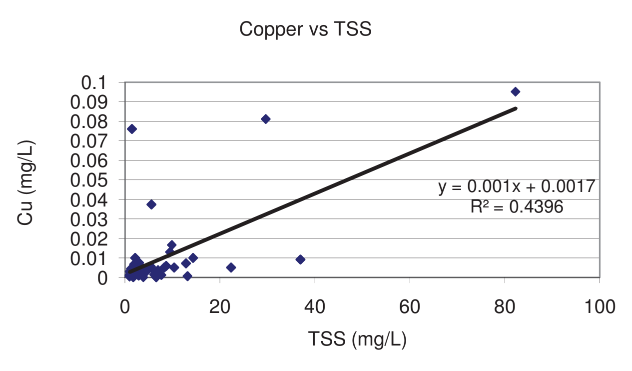


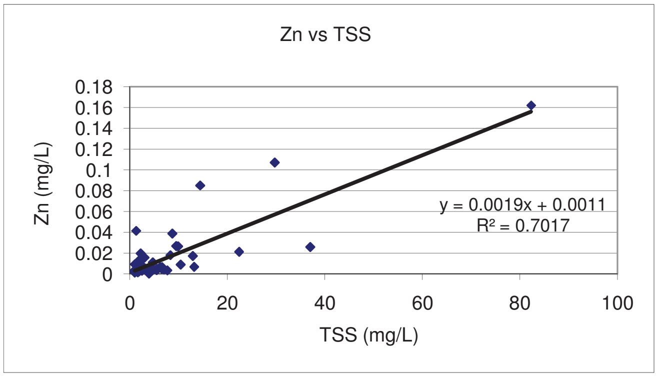


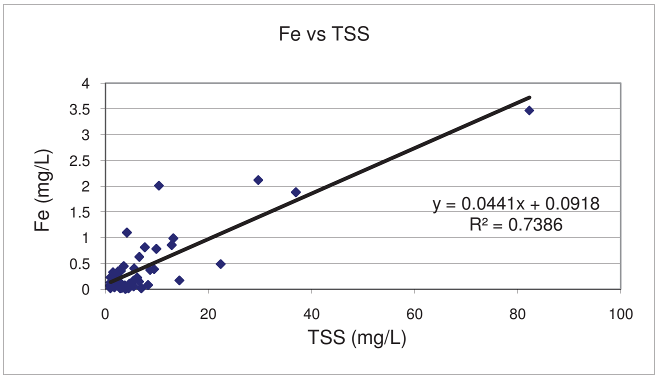
Note: Highlighted values in the data series table are "less than" values, set at the laboratory detection limit, for those sample periods

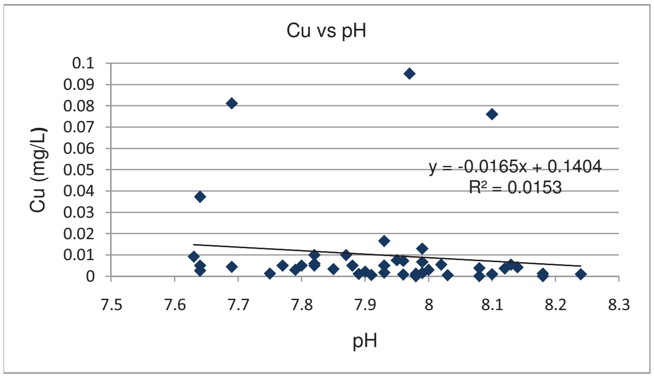
FIGURE 18
ANALYSIS OF LITTLE PEARL TAILINGS POND WATER QUALITY - SELECTIVE METALS AS A FUNCTION OF TSS AND pH
(all metal and TSS concentrations expressed in mg/L)

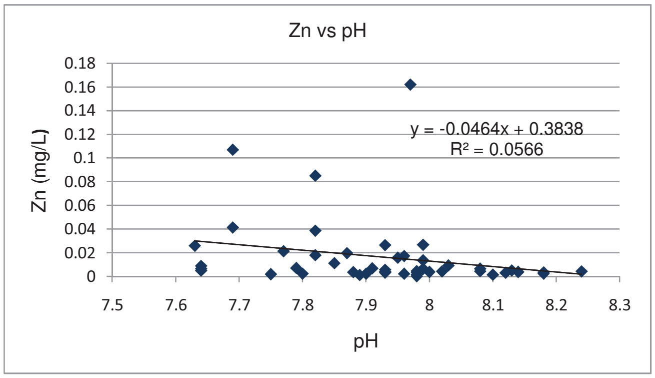
Date	TSS	pH	Cu	Zn	Fe
9-Jan-06	22.4	7.77	0.005	0.0212	0.487
23-Feb-06	8.3	7.82	0.005	0.0179	0.0819
15-Mar-06	14.4	7.82	0.01	0.085	0.17
13-Apr-06	10.4	7.64	0.005	0.0088	2.01
9-May-06	3.6	7.8	0.005	0.0023	0.445
13-Jun-06	5.5	7.88	0.005	0.0035	0.168
10-Jul-06	3.2	8.13	0.0055	0.005	0.0228
8-Aug-06	1.8	7.93	0.005	0.004	0.295
8-Sep-06	8.7	7.82	0.0059	0.0386	0.372
3-Oct-06	9.9	7.93	0.0166	0.0264	0.782
6-Nov-06	2.5	7.93	0.005	0.0055	0.347
4-Dec-06	9.5	7.99	0.013	0.0267	0.388
2-Jan-07	4.7	7.85	0.0034	0.0111	0.105
7-Feb-07	13.2	7.91	0.0006	0.0067	0.989
5-Mar-07	1.3	7.69	0.0044	0.0413	0.103
2-Apr-07	2.2	7.87	0.01	0.0196	0.135
7-May-07	6.6	7.98	0.00006	0.0045	0.146
4-Jun-07	2	7.99	0.0067	0.0135	0.162
26-Jun-07	1	8.03	0.0005	0.0092	0.131
4-Jul-07	7	8.08	0.0038	0.0043	0.0201
15-Aug-07	4.5	8.12	0.0037	0.003	0.0156
6-Sep-07	1	8.18	0.0013	0.0033	0.0199
2-Oct-07	4.1	8.14	0.0042	0.0037	0.017
8-Nov-07	6.6	8.08	0.00006	0.0064	0.626
22-Apr-08	2.7	7.79	0.003	0.007	0.145
12-May-08	2.5	7.93	0.0017	0.0031	0.247
10-Jul-08	2.9	8.24	0.001	0.0042	0.0165
11-Aug-08	1.8	8.18	0.00006	0.0023	0.0346
9-Sep-08	1.9	7.9	0.0022	0.0022	0.1
7-Oct-08	3.9	7.98	0.00006	0.00006	0.0024
12-Nov-08	5.5	8.02	0.0055	0.0042	0.052
17-Feb-09	4.2	7.64	0.0026	0.0065	1.1
30-Apr-09	37	7.63	0.0092	0.0258	1.88
5-May-09	6.2	7.99	0.0015	0.0063	0.225
8-Jun-09	1.5	8.1	0.076		0.33
6-Jul-09	1	7.89	0.0011	0.001	0.062
4-Aug-09	1	7.96	0.0008	0.0021	0.0835
2-Sep-09	3.8	7.75	0.0013	0.0018	0.077
7-Oct-09	29.7	7.69	0.0811	0.107	2.12
4-Nov-09	3	7.95	0.0075	0.0157	0.356
3-Dec-09	7.7	7.98	0.0012	0.0034	0.815
9-Feb-10	5.6	7.64	0.0373	0.0049	0.403
7-Apr-10	12.9	7.96	0.0072	0.0172	0.859
5-May-10	82.3	7.97	0.0951	0.162	3.47
8-Jun-10	1.6	8.1	0.001	0.0013	0.15
7-Jul-10	1	7.98	0.0006	0.0014	0.229
10-Aug-10	1	8.00	0.003	0.0037	0.0625





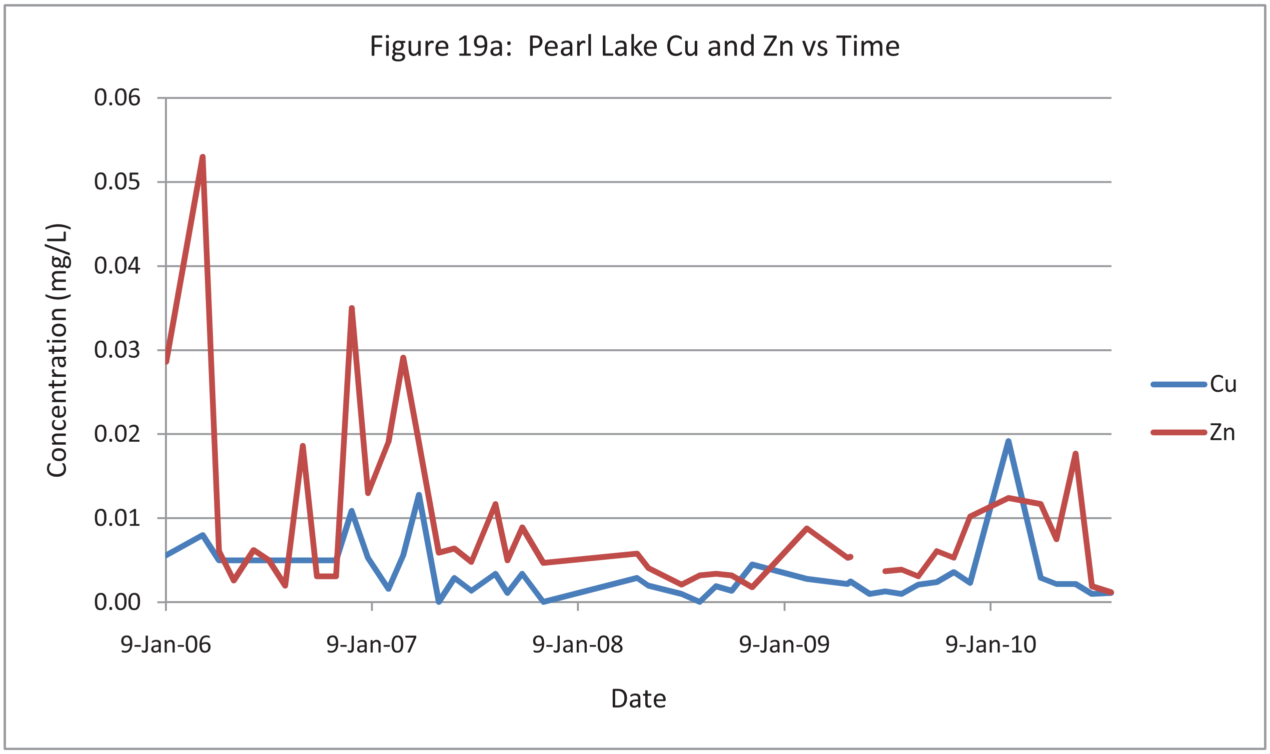






Note:	Highlighted values for copper in the data series table are "less than" values, set at the laboratory detection limit, for those sample

FIGURE 19
Pearl Lake and Little Pearl Tailings Pond Copper and Zinc Concentrations



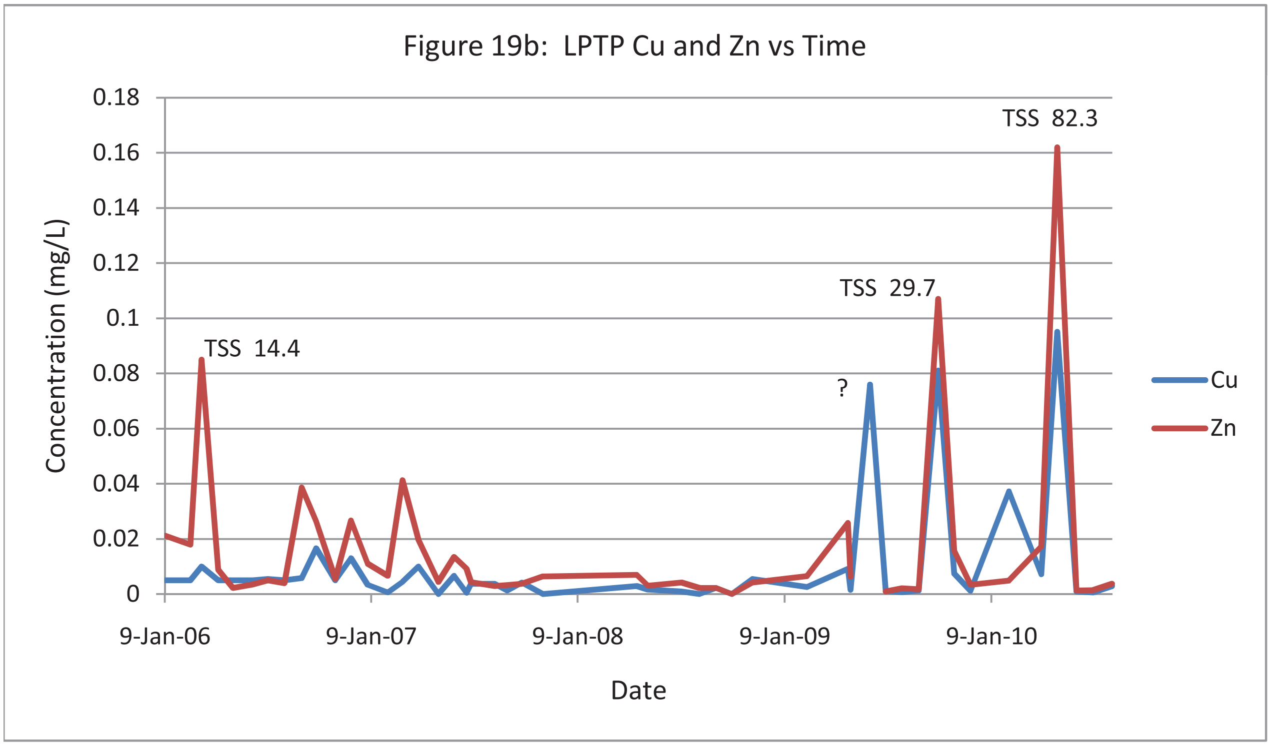
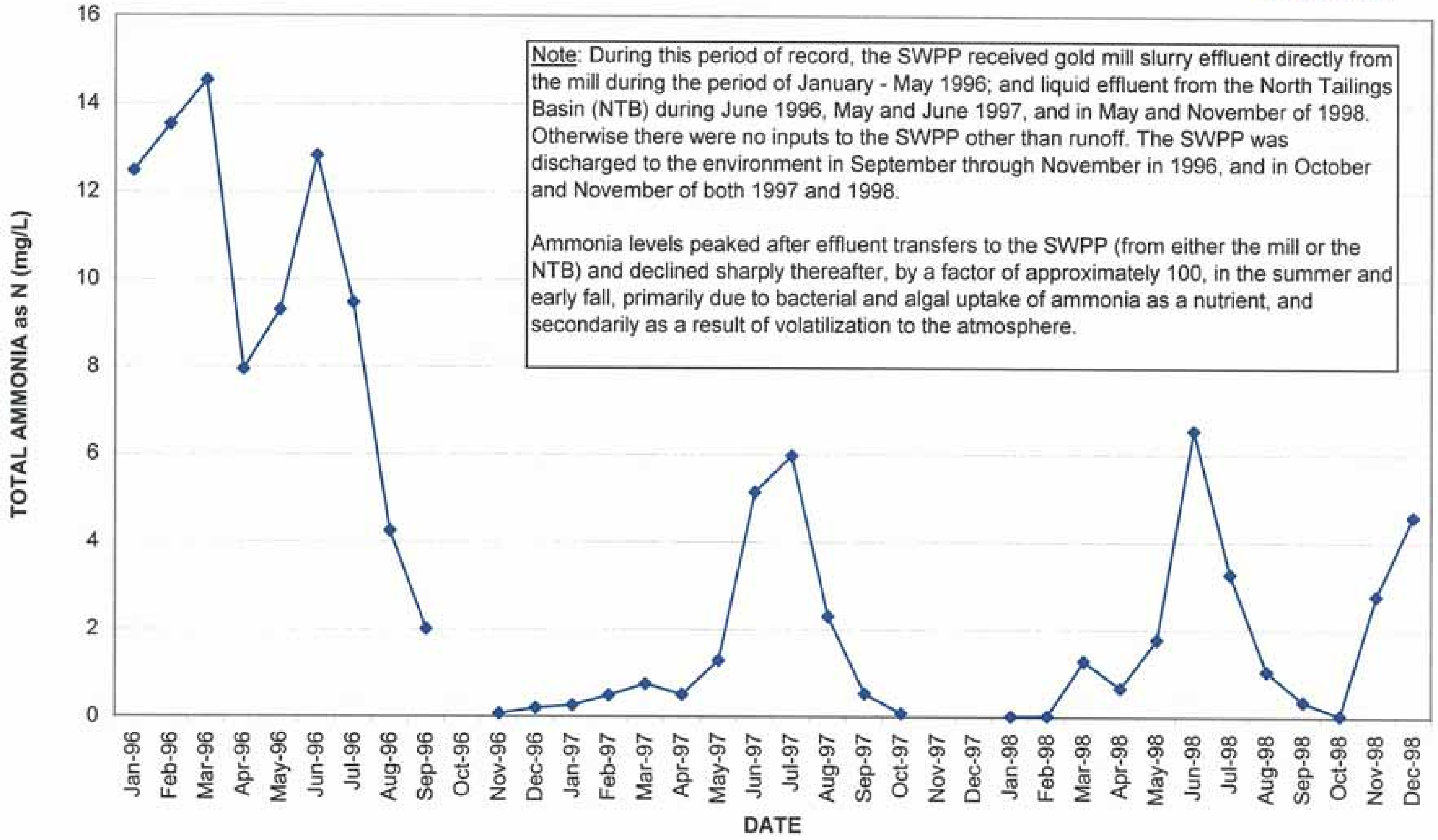


FIGURE 20: Example of Total Ammonia Degradation as a Function of Time *



Note: During this period of record, the SWPP received gold mill slurry effluent directly from the mill during the period of January - May 1996; and liquid effluent from the North Tailings Basin (NTB) during June 1996, May and June 1997, and in May and November of 1998. Otherwise there were no inputs to the SWPP other than runoff. The SWPP was discharged to the environment in September through November in 1996, and in October and November of both 1997 and 1998.

Ammonia levels peaked after effluent transfers to the SWPP (from either the mill or the NTB) and declined sharply thereafter, by a factor of approximately 100, in the summer and early fall, primarily due to bacterial and algal uptake of ammonia as a nutrient, and secondarily as a result of volatilization to the atmosphere.

* Holt McDermott Mine Southwest Polishing Pond (SWPP)

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HOLLINGER PROJECT

Historic Expression of Area Lakes and Ponds (Photo 1969)

SCALE: 1:40,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 21

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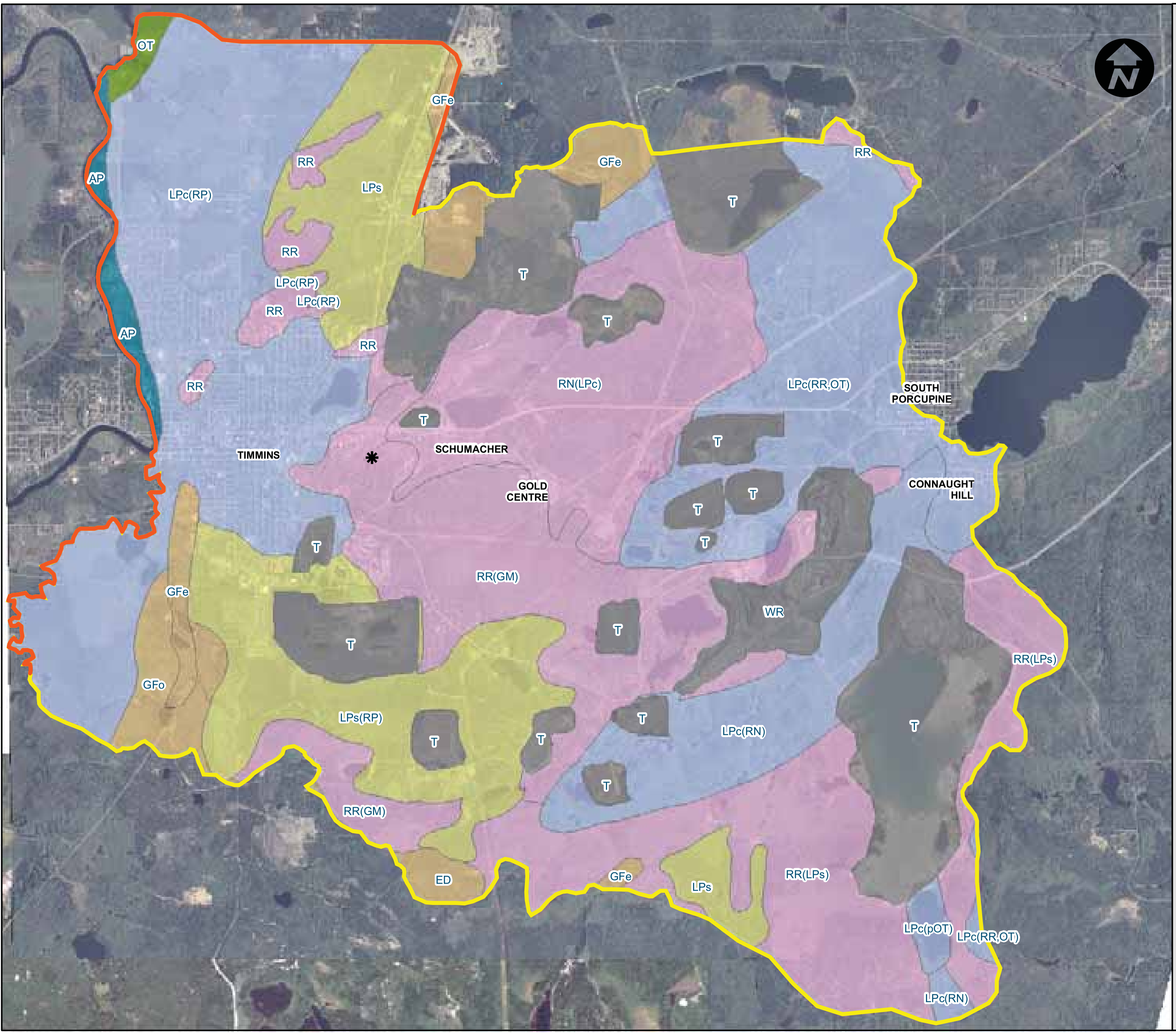

Legend:

✱ Proposed Hollinger Pit Centroid

Study Area (Watershed Boundary)

Study Area (Riverine and Road Boundary)

Surficial Geology Types

1, RR - Rock ridge

2, RR(GM) - Rock ridge (ground moraine)
(subordinate landform types are shown in brackets)

3, RN(LPc) - Rock knob (lacustrine plain - clay/silt)

4, RR(LPs) - Rock ridge (lacustrine plain - sand)

5, LPc(RR,OT) - Lacustrine plain - clay/silt (rock ridge/organic terrain)

6, LPc(RN) - Lacustrine plain - clay/silt (rock knob)

7, LPc(RP) - Lacustrine plain - clay/silt (rock plain)

8, LPs(RP) - Lacustrine plain - sand (rock plain)

9, LPs - Lacustrine plain - sand

10, LPc(OT) - Lacustrine plain - clay/silt (organic terrain)

11, GFo - Glacial-fluvial outwash - sand

12, GFe - Glacial-fluvial esker - sand

13, ED - Dunes - sand

14, AP - Alluvial plain

15, OT - Organic terrain

16, T - Tailings

17, WR - Waste rock

SOURCE: Northern Ontario Engineering Geology Terrain Study
Base Maps - Timmins (Map 5029) and pamour (Map 5026)

0 1 2 3
Kilometers

1:53,000

amec

HOLLINGER BASELINE STUDIES
TIMMINS ONTARIO

**Overburden
(Surficial Geology)**

SCALE: 1:53,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 22 REV: 1

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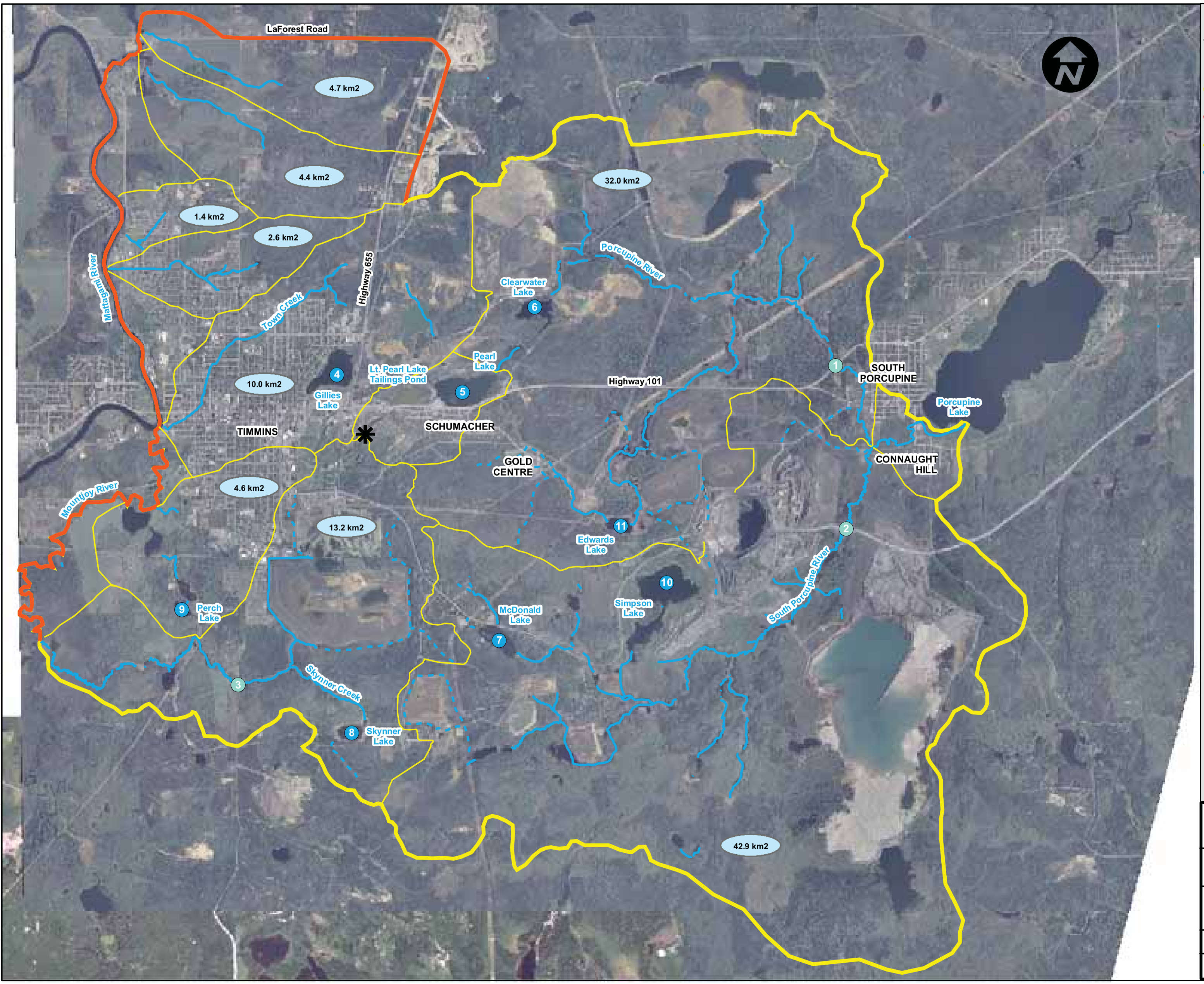

Legend:

✱ Proposed Hollinger Pit Centroid

Study Area (Watershed Boundary)

Study Area (Riverine and Road Boundary)

Watersheds

River or Creek

FLOW MONITORING LOCATIONS

① Porcupine River near Highway 101

② South Porcupine River near Pamour pit haul road

③ Skynner Creek near the Pine Street South crossing

WATER LEVEL MONITORING LOCATIONS

④ Gillies Lake

⑤ Pearl Lake

⑥ Clearwater Lake

⑦ McDonald Lake

⑧ Skynner lake

⑨ Perch Lake

⑩ Simpson Lake

⑪ Edwards Lake

0 1 2 3

Kilometers

1:53,000

HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Flow and Water Level Monitoring Network

SCALE: 1:53,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 23 REV: 1

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TABLE 1A
PORCUPINE RIVER MONTHLY FLOW DATA - MEASURED AT WSC STATION 04MD004, HOYLE 401 km^2 (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1977	0.826	0.432	2.75	17.4	7.12	2.39	1.6	0.98	6	3.03	7.39	2.08	4.32
1978	0.833	0.555	0.41	2.61	27.5	10.2	7.25	1.33	1.71	7.67	2.47	1.4	5.38
1979	0.893	0.826	1.36	21	31.6	9.95	2.12	1.02	3.73	10.3	5.74	2.32	7.6
1980	1.06	1.21	0.595	22.4	15.5	4.22	3.1	1.91	4.56	6.5	3.09	1.36	5.44
1981	0.736	1.47	3.19	25.9	13	2.73	1.3	0.557	0.525	3.47	3.46	1.36	4.8
1982	1.07	0.788	0.829	9.33	21.1	2.75	4.75	0.949	4.86	13.3	5.98	2.75	5.75
1983	0.976	0.614	1.7	7.29	35.9	8.62	1.28	1.34	4.02	6.36	3.65	1.9	6.19
1984	1.13	1.83	1.77	19.5	6.54	11.7	6.64	1.19	1.25	2.51	5.03	3.67	5.2
1985	1.47	0.784	0.811	18.1	12.6	3.36	6.98	2.91	1.59	5.28	6.62	2.12	5.23
1986	1.09	0.904	1.01	21.7	12.9	2.42	1.92	5.04	4.88	9.04	4.35	1.89	5.6
1987	1.31	0.971	1.64	10.7	4.49	3.42	4.3	5.19	4.22	7.58	4.07	2.33	4.2
1988	1.41	1.26	1.29	16.7	22.6	2.57	1.07	7.62	5.66	6.63	13.9	4.07	7.07
1989	1.29	1.08	1.02	12.3	27.9	7.79	2.87	3.33	1.44	2.91	5.54	1.95	5.81
1990	1.26	1.09	5.1	20.7	17.1	6.62	6.72	1.76	2.51	11.5	6.89	2.81	7.04
1991	1.19	0.856	1.43	23.9	8.08	1.48	0.498	1.14	1.78	4.18	3.61	2.34	4.2
1992	0.957	0.838	0.806	15.1	17.3	1.26	0.634	2.27	7	7.35	5.25	2.48	5.11
1993	1.29	0.649	0.949	13.8	23.4	7.34	3.85	2.4	3.68	6.92	3.64	2.05	5.86
1994	0.852	0.802	1.04	13.5	12.5	6.49	3.87	4.59	3.54				
Mean	**1.091**	**0.942**	**1.539**	**16.218**	**17.618**	**5.295**	**3.375**	**2.529**	**3.498**	**6.737**	**5.334**	**2.287**	**5.576**

TABLE 1B
PORCUPINE RIVER WATERSHED MONTHLY RUNOFF EQUIVALENTS (mm/d)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1977	0.178	0.093	0.593	3.749	1.534	0.515	0.345	0.211	1.293	0.653	1.592	0.448	0.931
1978	0.179	0.120	0.088	0.562	5.925	2.198	1.562	0.287	0.368	1.653	0.532	0.302	1.159
1979	0.192	0.178	0.293	4.525	6.809	2.144	0.457	0.220	0.804	2.219	1.237	0.500	1.638
1980	0.228	0.261	0.128	4.826	3.340	0.909	0.668	0.412	0.983	1.400	0.666	0.293	1.172
1981	0.159	0.317	0.687	5.580	2.801	0.588	0.280	0.120	0.113	0.748	0.745	0.293	1.034
1982	0.231	0.170	0.179	2.010	4.546	0.593	1.023	0.204	1.047	2.866	1.288	0.593	1.239
1983	0.210	0.132	0.366	1.571	7.735	1.857	0.276	0.289	0.866	1.370	0.786	0.409	1.334
1984	0.243	0.394	0.381	4.201	1.409	2.521	1.431	0.256	0.269	0.541	1.084	0.791	1.120
1985	0.317	0.169	0.175	3.900	2.715	0.724	1.504	0.627	0.343	1.138	1.426	0.457	1.127
1986	0.235	0.195	0.218	4.676	2.779	0.521	0.414	1.086	1.051	1.948	0.937	0.407	1.207
1987	0.282	0.209	0.353	2.305	0.967	0.737	0.926	1.118	0.909	1.633	0.877	0.502	0.905
1988	0.304	0.271	0.278	3.598	4.869	0.554	0.231	1.642	1.220	1.429	2.995	0.877	1.523
1989	0.278	0.233	0.220	2.650	6.011	1.678	0.618	0.717	0.310	0.627	1.194	0.420	1.252
1990	0.271	0.235	1.099	4.460	3.684	1.426	1.448	0.379	0.541	2.478	1.485	0.605	1.517
1991	0.256	0.184	0.308	5.150	1.741	0.319	0.107	0.246	0.384	0.901	0.778	0.504	0.905
1992	0.206	0.181	0.174	3.253	3.727	0.271	0.137	0.489	1.508	1.584	1.131	0.534	1.101
1993	0.278	0.140	0.204	2.973	5.042	1.581	0.830	0.517	0.793	1.491	0.784	0.442	1.263
1994	0.184	0.173	0.224	2.909	2.693	1.398	0.834	0.989	0.763				
Mean	**0.235**	**0.203**	**0.332**	**3.494**	**3.796**	**1.141**	**0.727**	**0.545**	**0.754**	**1.452**	**1.149**	**0.493**	**1.202**

TABLE 2
PORCUPINE RIVER MONTHLY RETURN PERIOD FLOW DATA (mm/d)

Return Period (yrs)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Low Flow Condition													
2	0.231	0.191	0.274	3.140	3.286	0.927	0.552	0.425	0.630	1.304	1.054	0.471	1.184
5	0.194	0.142	0.164	1.978	2.011	0.519	0.275	0.232	0.355	0.860	0.747	0.364	1.023
10	0.178	0.122	0.125	1.553	1.556	0.384	0.191	0.169	0.263	0.692	0.625	0.318	0.947
20	0.165	0.107	0.100	1.272	1.260	0.299	0.141	0.130	0.205	0.578	0.539	0.284	0.889
50	0.152	0.093	0.078	1.016	0.992	0.226	0.101	0.097	0.155	0.472	0.455	0.251	0.828
100	0.144	0.084	0.066	0.875	0.847	0.187	0.080	0.080	0.129	0.413	0.408	0.230	0.790
High Flow Condition													
2	0.231	0.191	0.274	3.140	3.286	0.927	0.552	0.425	0.630	1.304	1.054	0.471	1.184
5	0.274	0.257	0.458	4.987	5.367	1.653	1.107	0.779	1.119	1.977	1.487	0.610	1.372
10	0.299	0.301	0.598	6.350	6.936	2.237	1.593	1.068	1.511	2.457	1.779	0.698	1.481
20	0.322	0.342	0.747	7.751	8.570	2.871	2.152	1.387	1.936	2.940	2.064	0.781	1.578
50	0.350	0.395	0.959	9.709	10.883	3.806	3.020	1.862	2.561	3.600	2.440	0.885	1.694
100	0.370	0.434	1.132	11.273	12.752	4.589	3.783	2.263	3.083	4.118	2.726	0.962	1.777

Note: Data calculated using the 2 parameter log normal distribution

TABLE 3
PORCUPINE RIVER EXTREME LOW FLOW RETURN PERIOD STATISTICS

Return Period (years)	Calculated River Station Flow Statistics (m^3/d)	Calculated Watershed Runoff Equivalents (mm/d)
7Q2	47,304	0.118
7Q5	34,908	0.087
7Q10	28,848	0.072
7Q20	24,049	0.060
7Q50	18,865	0.047
7Q100	15,531	0.039

TABLE 4
TIMMINS AREA EXTREME VALUE RAINFALL
PLUS SNOWMELT RUNOFF MODEL 1 PREDICTIONS (mm)

Duration (days)	Return Period (years)					
	2	5	10	25	50	100
1	30.35	37.47	42.20	48.16	52.58	56.97
2	48.30	58.56	65.37	73.95	80.32	86.65
3	65.55	79.49	88.74	100.40	109.05	117.65
4	81.81	99.56	111.35	126.21	137.23	148.18
5	94.26	115.51	129.61	147.39	160.57	173.69
6	105.62	130.77	147.46	168.50	184.11	199.63
7	115.49	143.83	162.63	186.34	203.93	221.42
8	124.92	155.60	175.96	201.63	220.67	239.60
9	133.61	166.80	188.83	216.60	237.20	257.69
10	142.02	176.71	199.74	228.77	250.30	271.71
15	174.76	213.58	239.35	271.84	295.93	319.90
20	204.15	253.76	286.69	328.21	359.00	389.63
25	226.15	284.76	323.22	371.73	407.70	443.47
30	243.71	307.31	349.52	402.75	442.22	481.47

Notes: Data provided by AES for the period 1955 – 2006, based on the modified Gumbel statistical distribution.

TABLE 5
TIMMINS AREA EXTREME VALUE RAINFALL PREDICTIONS (mm)

Duration (days)	Return Period (years)						
	2	5	10	25	50	100	Probable Maximum
1	44.58	61.00	71.90	85.64	95.83	105.97	386.7
2	50.52	68.02	79.64	94.29	105.15	115.96	403.1
3	55.43	72.95	84.59	99.25	110.13	120.95	411.9
4	59.64	79.11	92.03	108.33	120.42	132.43	458.4
5	62.68	82.62	95.85	112.55	124.92	137.23	472.1
6	66.01	86.42	99.97	117.05	129.71	142.31	486.5
7	70.07	91.51	105.74	123.69	136.99	150.23	511.9
8	73.65	94.86	108.94	126.70	139.86	152.96	511.6
9	76.72	98.10	112.28	130.17	143.44	156.64	518.3
10	80.32	101.36	115.32	132.93	145.99	158.64	515.4
15	99.15	123.62	139.86	160.33	175.52	190.62	604.0
20	115.37	141.21	158.35	179.98	196.01	211.96	648.5
25	133.33	159.98	177.67	199.97	216.51	232.96	682.3
30	147.01	176.02	195.26	219.54	237.54	255.44	744.8

Notes: Data provided by AES for the period 1955 – 2006, based on the modified Gumbel statistical distribution.

TABLE 6
HOLLINGER PROJECT BASELINE WATER QUALITY DATA - PORCUPINE RIVER SYSTEM

Parameters	Units	PWQO CRITERIA	CEQG PAL CRITERIA	ODWS CRITERIA	CDWQG CRITERIA	Porcupine River System										South Porcupine River System					
						Pearl Lake		River DS of Pearl Lake	Edwards Creek US	Edwards Lake	River at Hwy 101		River Outlet to Porcupine Lake	River Outlet to Porcupine Lake		River DS-1 Dome Discharge	River DS-2 Dome Discharge	River US Dome Discharge		River DS Dome Discharge	
Source →						Goldcorp		Minnow 2001	AMEC 2007	AMEC 2007	Minnow 2005		Beak 1999	Minnow 2005		Beak 1999	Beak 1999	Minnow 2005		Minnow 2005	
Time Interval →						Jan 06 - Oct 08		Oct 01	Sep 07	Sep 07	Jun 03 - Sep 04		Sep/Oct 97	Jun 03 - Sep 04		Sep/Oct 97	Sep/Oct 97	Jun 03 - Sep 04		Jun 03 - Sep 04	
Statistic →						O.R.	Mean n = 28	N = 3	SS	SS	O.R.	Mean n = 11/12	SS	O.R.	Mean n = 9	Mean n = 3	Mean n = 2	O.R.	Mean n = 11/12	O.R.	Mean n = 11/12
Acidity	(mg/L)					2.5 - 65.8	13.8	9.5	4.2	11.7			14			25.3	5				
Ammonia as N	(mg/L)					<0.07 - 2.4	<0.29	0.005	<0.07	<0.07	<0.1 - 0.5	0.2	0.11	<0.1 - 4.2	1.7	<0.11	<0.05	<0.1 - 0.3	0.1	<0.1 - 9.2	4.6
Chloride	(mg/L)			250 (AO)	250 (AO)	30.7 - 168	91.70		231	86	55 - 100	73	42	37 - 76	53	40	47	11 - 21	15	15 - 54	39
Conductivity	(µs/cm)					630 - 2672	2070	1991	1111	662	520 - 1930	1238	1070	463 - 1650	1141	897	1205	227 - 618	448	331 - 1330	969
Dissolved Organic Carbon	(mg/L)					3.9 - 7.8	6	5.7			6.5 - 12.0	9.6	7.5	4.6 - 9.5	7.0	7.7	6.3	7.4 - 16.0	10.1	3.3 - 9.6	6.3
Hardness (CaCO3)	(mg/L)			80-100 (OG)		263 - 1740	1191	889	202	220	236 - 787	452	532	219 - 450	326	314	564	119 - 340	240	171 - 347	267
Nitrate as N	(mg/L)		13	10 $^{+}$		<0.005 - 13.7	<1.06		<0.005	<0.005	<0.05 - 0.10	0.06	3.27	0.73 - 6.21	3.56	0.84	7.3	<0.01 - 0.53	0.12	0.72 - 5.44	3.62
Nitrite as N	(mg/L)		0.05	1		<0.01	<0.01		<0.01	<0.01	<0.06	<0.06	<0.01	<0.06 - 0.59	0.25	<0.01	<0.01	<0.01 - <0.06	<0.06	<0.01 - 0.58	0.17
pH	units	6.5 - 8.5	6.5 - 9	6.5 - 8.5	6.5-8.5	7.34 - 8.24	7.9	7.69	8.04	7.85	6.58 - 8.01	7.49	8.0	7.05 - 7.95	7.38	7.77	8.2	6.77 - 8.66	7.41	6.96 - 8.5	7.38
Phosphate	(mg/L)					<0.001	<0.001		<0.1	<0.1	<1	<1		<1	<1			<1	<1	<1	<1
Sulphate	(mg/L)			500(AO)$^{++}$	500 (AO)$^{++}$	176 - 3315	1095	770	11.1	35.4	160 - 760	450	348	140 - 650	406	209	382	51 - 150	107	94 - 460	326
Total Alkalinity (CaCO3)	(mg/L)			30-500 (OG)		71 - 312	159	173	170	188	82 - 174	141	212	86 - 145	113	206	198	76 - 238	159	82 - 152	107
Total Cyanide	(mg/L)					<0.005 - 0.007	<0.005	0.011	<0.005	<0.005	<0.01	<0.01	<0.002	<0.01	<0.01	<0.002	<0.002	<0.01	<0.01	<0.01 - 0.02	<0.01
Total Dissolved Solids	(mg/L)			500 (AO)	500 (AO)	429 - 2812	1860.0	1449	682	459	406 - 1430	944	781	367 - 1170	808	597	863	189 - 486	364	246 - 857	669
Total Organic Carbon	(mg/L)							6.2			7.7 - 12.0	10.8		5.2 - 10.1	7.7			8.1 - 16.0	10.8	3.8 - 11.0	7.1
Total Suspended Solids	(mg/L)					1.3 - 133	12.1	<1	1.9	<1	<2 - 11	3.0	4	<2 - 5	2	3.7	2.5	<1 - 4	<2	<2.0 - <3.0	<2.1
Total Phosphorus	(mg/L)	0.03*				<0.05 - 0.124	<0.053	0.023	<0.1	<0.1	<0.03 - 0.10	0.05	0.02	<0.03 - 0.12	0.05	0.02	0.015	0.01 - 0.08	0.04	<0.03 - 0.14	0.05
Turbidity	NTU												0.7			1.6	0.4				
Aluminum (filtered)	(mg/L)	0.075**	0.1	0.10 (OG)	0.10 (OG)	<0.00004 - 0.0479	<0.0075	0.009*	0.0082	0.007	<0.01 - 0.15*	0.05*	0.006	0.02 - 0.11*	0.05*	0.0057	<0.006	<0.01 - 0.05*	0.02*	<0.01 - 0.04*	0.02*
Antimony	(mg/L)	0.02*			0.006 ^{II}				<0.003	<0.003	<0.05	<0.05	0.0009	<0.05	<0.05	0.0012	0.0018	<0.05	<0.05	<0.05	<0.05
Arsenic	(mg/L)	0.1 (0.005*)	0.005	0.025 ^{I}	0.025 ^{II}	<0.0002 - 0.0146	<0.0016	<0.002	<0.002	<0.002	<0.005	<0.005	0.005	0.006 - 0.016	<0.012	0.019	0.011	0.024 - 0.110	0.050	0.012 - 0.028	0.019
Cadmium	(mg/L)	0.0002	0.000017	0.005	0.005	<0.00004 - 0.0011	<0.00015	<0.0001	<0.0005	<0.0005	<0.0001 - 0.0002	<0.00012	0.00005	<0.0001 - 0.0003	<0.00013	<0.00005	<0.00005	<0.0001 - <0.002	<0.0003	<0.0001 - <0.002	<0.0003
Calcium	(mg/L)					135 - 400	301	192	67	52.9	56.9 - 144	111.1	134	52.2 - 116	92.4	95.9	151	27.6 - 78.4	60.7	40.1 - 95.8	72.9
Chromium	(mg/L)	0.0089 (as Cr III)	0.0089 (as Cr III)	0.05	0.05	<0.00003 - 0.366	<0.0259		0.0004	<0.0004	<0.02	<0.02	0.0008	<0.02	<0.02	0.00093	0.00085	<0.02	<0.02	<0.02	<0.02
Cobalt	(mg/L)	0.0009				<0.00006 - 0.0053	<0.00057		<0.0005	<0.0005	<0.01	<0.01	0.003	<0.01 - 0.07	0.05	0.0089	0.0054	<0.01	<0.01	<0.01 - 0.10	0.06
Copper	(mg/L)	0.005	0.004	1.0 (AO)	1.0 (AO)	<0.00006 - 0.0128	<0.0040	0.0015	0.0043	0.0016	0.008 - 0.012	0.010	0.0093	0.008 - 0.073	0.031	0.019	0.013	<0.005 - 0.012	<0.006	<0.006 - 0.117	0.041
Iron	(mg/L)	0.3	0.3	0.30 (AO)	0.30 (AO)	0.018 - 1.23	0.130	0.1	0.0998	0.0494	0.15 - 0.29	0.21	0.17	0.08 - 0.30	0.17	0.157	0.17	0.11 - 0.41	0.17	0.05 - 0.41	0.13
Lead	(mg/L)	0.025 (0.005)*	0.007	0.01	0.010	<0.0002 - 0.0666	<0.0049	<0.0007	<0.008	<0.008	<0.02	<0.02	0.0002	<0.02	<0.02	<0.0001	<0.0001	<0.02	<0.02	<0.01 - <0.02	<0.02
Magnesium	(mg/L)					18.1 - 180	119		8.48	21.5	22.7 - 76.1	55.6	40.2	21.6 - 45.4	35.0	27.2	41.1	12.1 - 39.0	28.4	17.0 - 31.3	22.2
Manganese	(mg/L)				0.05(AO)	0.017 - 1.63	0.200		0.0193	0.0909	0.019 - 0.075	0.04	0.0196	0.02 - 0.06	0.04	0.084	0.066	0.007 - 0.467	0.113	0.007 - 0.225	0.079
Mercury	(mg/L)	0.0002	0.000026	0.001	0.001	<0.0001	<0.0001	<0.00005			<0.0001 - 0.0003	<0.00012	<0.0001	<0.0001 - 0.0003	<0.00012	<0.0001	<0.0001	<0.0001 - 0.0002	<0.0001	<0.0001 - <0.002	<0.0001
Molybdenum	(mg/L)	0.04*	0.073			<0.00009 - 0.009	<0.0034	0.0047	0.0032	<0.002	<0.02	<0.02	0.0072	<0.02	<0.02	0.0074	0.013	<0.02	<0.02	<0.02 - 0.02	<0.02
Nickel	(mg/L)	0.025	0.15			<0.00005 - 0.0088	<0.003	0.002	0.0007	0.0026	<0.02	<0.02	0.033	<0.02	<0.02	0.037	0.068	<0.02	<0.02	<0.02 - 0.04	0.05
Potassium	(mg/L)					1.53 - 13	8.51		1.36	0.989	1.76 - 5.34	3.46	12.1	2.15 - 27.80	15.19	17.9	20.4	0.61 - 2.16	1.42	1.9 - 35.3	19.6
Sodium	(mg/L)			200 (AO), (20)^{2}	200 (AO), (20)^{2}	23.5 - 100	76.9		174	50.2	21.8 - 56.2	43.3	50.9	17.5 - 116.0	76.3	60.9	65	5.87 - 17.6	13.0	9.1 - 128	85.7
Vanadium	(mg/L)	0.006*				<0.00004 - 0.001	<0.00026		0.002	<0.00004	<0.002 - 0.007	0.003	<0.002	<0.002 - 0.006	0.003	<0.002	<0.002	<0.002 - 0.003	0.002	<0.002 - 0.004	0.003
Zinc	(mg/L)	0.03 (0.02)*	0.03	5.0 (AO)	5.0 (AO)	<0.002 - 0.053	<0.0112	0.017	0.005	0.0049	<0.01 - 0.03	<0.012	0.018	<0.01 - 0.04	<0.014	0.0033	0.008	0.002 - 0.29	0.04	<0.01 - 0.05	<0.014

🟩	Individual sample or sample mean exceeds PWQO
🟩	Upper end of observed range exceeds PWQO
🟧	Individual sample or sample mean exceeds CEQG PAL
🟨	Upper end of observed range exceeds CEQG PAL
🟪	Individual sample or sample mean exceeds PWQO and CEQG PAL
⬜	Upper end of observed range exceeds PWQO and CEQG PAL

* Interim Objective

** Value based on filtered samples (Aluminum values with single [*] are unfiltered)

TABLE 7
HOLLINGER PROJECT BASELINE SEDIMENT QUALITY DATA - PORCUPINE RIVER SYSTEM

Parameters	**Units**	**PSQG LEL**[a]	**PSQG SEL**[b]	**CEQG PEL**[c]	**Porcupine River System**							
					Pearl Lake	**River DS of Pearl Lake**	**River at Hwy 101**		**River US Porcupine Lake**		**River US Porcupine Lake**	
Source →					**Minnow 2001**	**Minnow 2001**	**Minnow 2005**		**Beak 1999**		**Minnow 2005**	
Time Interval →					**Oct 01**	**Oct 01**	**Sep 04**		**Oct 97**		**Sep 04**	
Statistic →					**N = 3**	**N = 3**	**O.R**	**Mean n = 5**	**O.R**	**Mean n = 5**	**O.R**	**Mean n = 5**
Predominant Substrate					sand / silt	sand / silt				silt / clay		
Loss on Ignition (LOI)	%								9.6 - 11	10.3		
pH	units											
Total Kjeldahl Nitrogen	µg/g	550	4,600				650 - 1,900	1300			1,000 - 1,900	1400
Total Organic Carbon	% solids	1	10		6.6	13	1.3 - 3.7	2.2	2.4 - 3.4	2.9	1.3 - 2.9	2.10
Total Phosphorus	µg/g	600	2,000				340 - 540	450			380 - 550	470
Aluminum	µg/g				4833	3933	7,900 - 15,000	11,000	8,400 - 11,000	9340	7,500 - 13,000	9,600
Antimony	µg/g				1.8	1.1	<0.2 - 0.3	0.2	0.2 - 0.4	0.28	0.3 - 0.3	0.3
Arsenic	µg/g	6	33	17	42.7	12.0	21 - 51	38	59 - 98	79	51 - 110	75
Barium	µg/g				84.7	34.7	21 - 42	27	23 - 43	33.2	15 - 25	20
Beryllium	µg/g				<0.2	<0.2	<0.2 - 0.3	0.2	0.2 - 0.4	0.26	<0.2 - 0.2	0.2
Bismuth	µg/g				1.8	0.4	0.2 - 0.3	0.3	<0.2	<0.2	<0.2 - 0.2	0.2
Cadmium	µg/g	0.6	10	3.5	7.3	2.1	0.2 - 0.4	0.3	0.4 - 0.6	0.54	0.2 - 0.4	0.3
Calcium	µg/g				79000	8400			11,500 - 21,368	18863		
Chromium	µg/g	26	110	90	34.7	26.0	24 - 40	32	39 - 50	44.8	32 - 57	41
Cobalt	µg/g				29.0	21.7	11 - 23	17	21 - 33	28.2	19 - 26	22
Copper	µg/g	16	110	197	1,467	517	160 - 520	280	260 - 560	384	170 - 260	200
Iron	µg/g	20,000	40,000		20,667	7,533	24,000 - 47,000	37,000	23,000 - 30,000	26800	22,000 - 39,000	29,000
Lead	µg/g	31	250	91.3	115.0	36.3	7.1 - 12	10	15 - 22	19.8	8.0 - 19	11
Magnesium	µg/g				8,900	2,867			10,708 - 17,688	15727		
Manganese	µg/g	460	1,100		1,187	207	670 - 1,500	1,000	580 - 830	742	430 - 720	580
Mercury	µg/g	0.2	2	0.486	1.6	0.40	0.74 - 1.7	1.2	0.99 - 1.4	1.2	0.54 - 1.1	0.75
Molybdenum	µg/g				23.0	11.4	0.6 - 2.8	1.4	2.0 - 3.9	3.2	1.4 - 2.0	1.7
Nickel	µg/g	16	75		68.3	49.3	29 - 58	42	110 - 170	148	66 - 93	76
Phosphorus	µg/g				767	577						
Potassium	µg/g				413.0	247.0						
Selenium	µg/g				5.0	3.7			1.2 - 2.3	1.9		
Silver	µg/g				7.6	1.7	0.3 - 1	0.6	0.7 - 1.7	1.3	0.4 - 0.6	0.5
Sodium	µg/g				563.0	483.0						
Sulphur	µg/g				13,833	9,167						
Vanadium	µg/g				16.0	9.2	19 - 33	27	25 - 31	28	19 - 32	24
Zinc	µg/g	120	820	315	4,100	1,133	110 - 170	140	150 - 210	182	91 - 160	110

🟩	Individual sample or sample mean exceeds PSQG LEL
🟩	Upper end of observed range exceeds PSQG LEL
🟧	Individual sample or sample mean exceeds PSQG SEL
🟨	Upper end of observed range exceeds PSQG SEL
🟥	Anomalous value

TABLE 8
SUMMARY OF LITTORAL ZONE AQUATIC VEGETATION IN LAKE SYSTEMS WITHIN THE LOCAL STUDY AREA

Waterbody	Shoreline Type	Littoral Zone Depth: 0-1 m						Littoral Zone Depth: 1-2 m						Littoral Zone Depth: 2-5 m					
		Vegetation Type						Vegetation Type						Vegetation Type					
		Emergent		Floating		Submergent		Emergent		Floating		Submergent		Emergent		Floating		Submergent	
		% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)	% Coverage	Dominant Species (%)
Pearl Lake	Type 1A	0%	-	0%	-	0%	-	0%	-	0%	-	80%	100% Stonewort	0%	-	0%	-	40%	100% Stonewort
Pearl Lake	Type 2A	40%	80% Cattail, 20% Bulrush	0%	-	65%	100% Stonewort	10%	80% Cattail, 20% Bulrush	0%	-	35%	100% Stonewort	0%	-	0%	-	20%	100% Stonewort
Pearl Lake	Type 3	10%	80% Cattail, 20% Bulrush	0%	-	70%	100% Stonewort	0%	-	0%	-	50%	100% Stonewort	0%	-	0%	-	40%	100% Stonewort
Clearwater Lake	Type 2A	40%	100% Cattail	0%	-	40%	50% Northern Water Milfoil, 50% Stonewort	10%	100% Cattail	0%	-	20%	50% Northern Water Milfoil, 50% Stonewort	0%	-	0%	-	n/a	no visual

TABLE 9
SUMMARY OF SUPRALITTORAL AND EULITTORAL VEGETATION IN LAKE SYSTEMS WITHIN THE LOCAL STUDY AREA

Waterbody	Littoral Zone	Eulittoral				Supralittoral	
		Graminoid	Ericaceous	Trees and Shrubs	Average Width of Zone (m)	% Coniferous	% Deciduous
Pearl Lake	Type 1A	60% (Grasses 50%, Sedges 50%)	0	40% (Alder 50%, Red-osier Dogwood 30%, Willow 20%)	5	40% (Black Spruce 50%, Cedar 30%, White Spruce 10%, Balsam Fir 10%)	60% (Trembling Aspen 40%, White Birch 20%, Tamarack 20%, Willow 10%, Maple 10%)
Pearl Lake	Type 2A	20% (Grasses 50%, Sedges 50%)	0	80% (Alder 60%, Red-osier Dogwood 30%, White Birch 10%)	4	60% (Black Spruce 50%, Cedar 30%, White Spruce 10%, Balsam Fir 10%)	40% (Trembling Aspen 50%, White Birch 40% and Tamarack 10%)
Pearl Lake	Type 3	60% (Grasses 50%, Sedges 50%)	0	40% (Alder 60%, Red-osier Dogwood 35%, Trembling Aspen 5%)	1.5	No supralittoral vegetation present	
Clearwater Lake	Type 2A	50% (Grasses 50%, Sedges 50%)	0	50% (Alder 50%, Red-osier Dogwood 50%)	5	50% (Black Spruce 100%)	50% (Trembling Aspen 60% and White Birch 40%)

TABLE 10
LITTORAL ZONE DIMENSIONS AND SUBSTRATES IN LAKE SYSTEMS WITHIN THE LOCAL STUDY AREA

Waterbody	Littoral Zone	Littoral Zone Depth: 0-1m											Littoral Zone Depth: 1-2m								Littoral Zone Depth: 2-5m							
		Zone Dimensions			Substrate Composition (%)								Substrate Composition (%)								Substrate Composition (%)							
		Length (m)	Average Width (m)	Area (m^2)	Boulder	Cobble	Gravel	Silt/Sand	Clay	Bedrock	Muck	Detritus	Boulder	Cobble	Gravel	Silt/Sand	Clay	Bedrock	Muck	Detritus	Boulder	Cobble	Gravel	Silt/Sand	Clay	Bedrock	Muck	Detritus
Pearl Lake	Type 1A	637	3.5	2228	20	40	15	20	0	0	0	5	5	10	10	50	0	0	20	5	0	0	0	70	0	0	25	5
Pearl Lake	Type 2A	890	6	5341	0	0	0	70	0	0	20	10	0	0	0	70	0	0	20	10	0	0	0	80	0	0	20	0
Pearl Lake	Type 3	956	7	6692	15	40	20	20	0	0	0	5	5	10	20	40	0	0	20	5	0	0	0	80	0	0	20	0
Clearwater Lake	Type 2A	2083	10	20830	0	0	0	0	20	0	40	40	0	0	0	0	20	0	40	40	0	0	0	0	20	0	40	40

TABLE 11
REACH TYPE CLASSIFICATION SUMMARY FOR HOLLINGER AREA WATERCOURSES

Reach Type	Common Characteristics
1	- Flat gradient - Flat morphology - Low flow velocity - Depositional environment with variable substrates - Riparian margin forested or dominated by shrubs - Width greater than 5 m
3	- Flat gradient - Well defined channel linked to functional floodplain - Flat and run morphology - Low to moderate velocity - Stable bedload environment - Riparian margin dominated by shrubs and meadow vegetation - Width less than 5 m
4	- Flat gradient area impounded by beaver dams and topography - Large open water ponded area - Poorly defined channel - Low to no discernable flow velocity - Depositional environment - Uniform open water depths (1 to 1.5 m) - Riverine marsh vegetation boarders impounded area - Width greater than 20 m
5	- Flat gradient - No to minor areas of poorly define channel and very limited open water - Low to no discernable flow velocity - Expansive and dense areas of emergent aquatic vegetation - Depositional environment - Uniform open water depths (1 to 1.5 m) - Dense riverine marsh vegetation community throughout watercourse - Floodplain width varies depending on surrounding valley corridor
6B	- Anthropogenically influenced - Combination of channelized watercourse, beaver impounded area characterized by marsh vegetation - Depositional environment - Width greater than 5 m
9A	- Moderate gradient - Well defined meandering channel - Riffle/run/pool morphology - Moderate flow velocity - Erosive environment in granular bed and bank materials - Riparian vegetation forest and shrubs contributing to channel form - Width less than 5 m
9B	- Moderate gradient - Defined meandering channel - Riffle/run/pool morphology - Moderate flow velocity - Erosive environment in silt and fine sand bed and bank materials - Riparian vegetation forest and shrubs contributing to channel form - Width less than 5 m
12	- Flat gradient - No to poorly define channel and sporadic pooling water - Low to no discernable flow velocity - Dense alder thicket, herbaceous groundcover, and marsh vegetation community throughout - Width greater than 20 m

TABLE 12
HYDROSTRATIGRAPHIC UNITS

Hydrostratigraphic Unit	Approximate Range in Thickness (m)	Composition	Expected Hydraulic Conductivity
Unit 1 (surficial layer, unconfined aquifer)	0 to 12	Fill material, peat, sands	Moderate (sand) to high (waste rock and peat)
Unit 2 (middle aquitard)	0 to 5	Silt, clay and clayey silts	Low
Unit 3 (lower overburden aquifer)	0 to >70	Sands, glacial till	Moderate
Unit 4 (shallow fractured bedrock aquifer)	0 to 30 m into bedrock	Slates, greywackes, conglomerates and volcanics	Moderate to low
Unit 5 (intermediate Regional Bedrock System)	30 to 120 m into bedrock	Slates, greywackes, conglomerates and volcanics	Typically low (potentially higher hydraulic conductivity along fault and fracture zones)
Unit 6 (deep regional bedrock system)	120 to 400 m into bedrock	Slates, greywackes, conglomerates and volcanics	Typically low (potentially higher hydraulic conductivity along fault and fracture zones)

TABLE 13
VOID DEWATERING RATE REQUIRED FOR OPEN PIT SEQUENCING

Year	End-of-Year Elevation Below Grade (m)	Void Volume Requiring Dewatering (m^3)	Void Dewatering Rate (m^3/d)
1	36	1,979,976	5,425
2	60	1,541,458	4,223
3	126	2,993,480	8,201
4	138	787,650	2,158
5	150	362,770	994
6	222	3,367,464	9,226
7	240	662,309	1,815
Total	240	11,695,107	-

TABLE 14
TOTAL DEWATERING RATES REQUIRED FOR OPEN PIT SEQUENCE DEWATERING

Year	Void Dewatering Rate (m^3/d)	Minimum Seepage Dewatering Rate (m^3/d)	Maximum Seepage Dewatering Rate (m^3/d)	Minimum Dewatering Rate (m^3/d)	Maximum Dewatering Rate (m^3/d)
1	5,425	7,000	9,200	12,425	14,625
2	4,223	8,500	12,100	12,723	16,323
3	8,201	9,300	13,900	17.501	22,100
4	2,158	9,400	13,300	11,558	15,458
5	994	9,000	12,800	9,994	13,794
6	9,226	9,000	12,600	18,226	21,826
7	1,815	8,800	12,500	10,615	14,315

TABLE 15
HOLLINGER MINE WATER DISCHARGE - TOTAL AMMONIA CONCENTRATION PROJECTIONS

Water Production Rate	Explosives Consumption (kg/tonne)	Ammonium Nitrate (kg/tonne)	Ammonia-N (kg/tonne)	Ammonia Residuals to Water @ 10% for ANFO and 3% for Emulsion (kg/tonne)	Rock Production (tonnes/day)	Ammonia Residuals (kg/day)	Modelled Seepage Water Inflow (m^3/day)	Predicted Effluent Ammonia-N Concentration (mg/L)
Expected - ANFO	0.270	0.254	0.044	0.00444	50,000	222.1	10,000	22.21
	0.270	0.254	0.044	0.00444	50,000	222.1	30,000	7.40
Expected - Emulsion	0.270	0.203	0.035	0.00106	50,000	53.2	10,000	5.32
	0.270	0.203	0.035	0.00106	50,000	53.2	30,000	1.77

Assumptions:

ANFO explosives @ 94% ammonium nitrate (NH_4NO_3)

Emulsion explosives @ 75% ammonium nitrate (NH_4NO_3)

Comments / Notes:

Rock production of 50,000 tpd assumes 40,000 from the open pit, and 10,000 from UG

TABLE 16
CALCULATED PEARL LAKE UN-IONIZED AMMONIA CONCENTRATIONS

Season / Condition	Initial Phase	Later Phases
Winter		
Mine water production (m^3/d)	30,000	10,000
Runoff (m^3/d)	0	0
Mine water total ammonia (mg/L)	1.77	5.32
Un-ionized ammonia conversion factor (pH 7.85, 0°C)	0.0059	0.0059
Calculated un-ionized ammonia concentration (mg/L)	**0.010**	**0.031**
Summer		
Mine water production (m^3/d)	30,000	10,000
Runoff (m^3/d)	4,510	4,510
Mine water total ammonia (mg/L)	1.77	5.32
Reduction factor due to runoff dilution	0.869	0.689
Un-ionized ammonia conversion factor (pH 7.85, 20°C)	0.0275	0.0275
Calculated un-ionized ammonia concentration (mg/L)	0.042	0.101
Reduction factor due to biological activity and volatilization	0.1	0.1
Revized un-ionized ammonia concentration (mg/L)	**0.004**	**0.010**
Pearl Lake volume (m^3)	1,560,000	1,560,000
Annual mine water production (m^3)	10,950,000	3,650,000

APPENDIX A

PTTW AND C. OF A. AMENDMENT SIGNED APPLICATION FORMS

Ontario

Ministry of the Environment

Ce formulaire est disponible en français

Application for Approval of Industrial Sewage Works

For Office Use Only			
Reference Number	Payment Received $	Date *(y/m/d)*	Initials

General Information and Instructions

General:

Information requested in this form is collected under the authority of the *Ontario Water Resources Act,* R.S.O. 1990 (OWRA) and the *Environmental Bill of Rights*, C. 28, Statues of Ontario, 1993, (EBR) and will be used to evaluate applications for approval of industrial sewage works under Section 53 OWRA.

Instructions:

1. When completing this form, please refer to the "Guide for Applying for Approval of Industrial Sewage Works, Section 53, OWRA " (referred to as the Guide) and "Guide - Application Cost for Sewage works, S. 53, OWRA." Questions regarding completion and submission of the application should be directed to the Environmental Assessment & Approvals Branch, 2 St. Clair Avenue West, Floor 12A, Toronto, Ontario, M4V 1L5, telephone number 1-800-461-6290 or (416) 314-8001, or to your local District Office of the Ministry of the Environment.

2. This form must be completed with respect to all the requirements of the Guide in order for it to be considered as an application for approval. INCOMPLETE APPLICATIONS WILL BE RETURNED TO THE APPLICANT.

3. A complete application consists of:
   (1) a completed and signed application form, including the attached "Costs for OWRA S. 53 Application - Supplement to Application for Approval";
   (2) all supporting information as requested by this form and by the Guide, and
   (3) a certified cheque or money order, in Canadian funds, made payable to the *Minister of Finance* for the applicable application fee.
   The Ministry may require additional information during the technical review of any application accepted as complete.

4. The original application, along with the supporting information and the application fee, must be sent to:
   The Ministry of the Environment,
   Director, Environmental Assessment and Approvals Branch,
   2 St Clair Avenue West, Floor 12A, Toronto, Ontario M4V 1L5.
   A copy of the application and the supporting information must be sent to the local Ministry District Office which has jurisdiction over the area where the facilities are located.

5. Information contained in this application is not considered confidential and will be made available to the public upon request. Information submitted as supporting information may be claimed as confidential but will be subject to the *Freedom of Information and Protection of Privacy Act* (FOIPPA) and *EBR*. If you do not claim confidentiality at the time of submitting the information, the Ministry may make the information available to the public without further notice to you.

6. If the Client submits with the application a copy of their Master Business Licence (MBL) obtained from the Ministry of Government Services, the **shaded sections within this form do not need to be completed.** For additional information on the MBL please refer to the "Guide."

1. Client Information

Client Name *(legal name of individual or organization as evidenced by legal documents)*: Goldcorp Canada Ltd. - Porcupine Gold Mines

Business Identification Number: 137623435

Business Name *(the name under which the entity is operating or trading if different from the Client Name - also referred to as trade name)*:

Client Type:
☒ Corporation
☐ Individual
☐ Partnership
☐ Sole Proprietor
☐ Federal Government
☐ Municipal Government
☐ Provincial Government
☐ Other *(describe)*:

Activity Classification Code/Standard Industrial Classification Code *(if unknown please complete Business Activity Description)*: METAL MINING, EXTRACTION REFINING

Business Activity Description *(a narrative description of the business endeavour, this may include products sold, services provided or machinery/equipment used, etc.)*:

Is the client a MISA Discharger? ☒ Yes ☐ No

If Yes, name the industrial sector: Metal mining sector

2. Client Physical Address - *Complete A, C and D* **or** *B, C and D*

A. Civic Address - Street information *(applies to an address that has civic numbering and street information - includes street number, name, type and direction)* 4315 Gold Mine Road	Unit Identifier *(identifies type of unit, such as suite & number)*

B. Survey Address *(used for a rural location specified for a subdivided township, an unsubdivided township or unsurveyed territory)*

Lot and Conc.: used to indicate location within a subdivided township and consists of a lot number and a concession number.	Lot	Conc.	Part and Reference: used to indicate location within an unsubdivided township or unsurveyed territory, and consists of a part and a reference plan number indicating the location within that plan. Attach copy of the plan.	Part	Reference Plan

C. Municipality/Unorganized Township	County/District	Province/State	Country	Postal Code
South Porcupine		Ontario	Canada	P0N 1H0

D. Telephone Number *(including area code & extension)*	Fax Number *(including area code)*	E-mail Address
(705) 235-6720	(705) 235-6598	laszlo.gotz@goldcorp.com

3. Client Mailing Address - *Complete A and C* **or** *B and C*

A. Civic Address - Street information *(includes street number, name, type and direction)* ☒ Same as Client Physical Address	Unit Identifier *(identifies type of unit, such as suite & number)*

B. Delivery Designator: ☐ Rural Route ☐ Suburban Service ☐ Mobile Route ☐ General Delivery

Delivery Identifier *(a number identifying a Rural Route, Suburban Service or Mobile Route delivery mode)*

C. Municipality	Postal Station	Province/State	Country	Postal Code

4. Site Information - *(location where activity/works applied for is to take place)*

Site Name	MOE District Office	Legal Description *(attach copy of a legal survey)*
Hollinger Project	Timmins	

A. Site Address - Street information *(applies to an address that has civic numbering and street information - includes street number, name, type and direction)* ☐ Same as Client Physical Address McIntyre Mine Road	Unit Identifier *(identifies type of unit, such as suite & number)*

B. Survey Address *(used for a rural location specified for a subdivided township, an unsubdivided township or unsurveyed territory)* *NOTE:* Do not complete "B" if you completed "A."

Lot and Conc.: used to indicate location within a subdivided township and consists of a lot number and a concession number.	Lot 9	Conc. 3	Part and Reference: used to indicate location within an unsubdivided township or unsurveyed territory, and consists of a part and a reference plan number indicating the location within that plan. Attach copy of the plan.	Part	Reference Plan

Non Address Information *(includes any additional information to clarify clients' physical location)*

Geo Reference

Map Datum	Zone	Accuracy Estimate	Geo Referencing Method	UTM Easting	UTM Northing
42A/6	17	+/- 10 m	NTS	478110	5369949

Municipality/Unorganized Township	County/District	Postal Code
City of Timmins	District of Cochrane	

Adjacent Land Use

☒ Industrial ☒ Commercial ☒ Recreational

☒ Residential ☐ Agricultural ☐ Other *(specify)*:

Is the Site located in an area of development control as defined by the Niagara Escarpment Planning & Development Act (NEPDA)?

☐ Yes (If Yes, attach copy of NEPDA permit for the proposed activity/work) ☒ No

Is the Client the operating authority? ☒ Yes ☐ No

If No, attach the operating authority name, address and phone number.

Is the Client the owner of the land (site)? ☒ Yes ☐ No

If No, attach the owner's name, address and consent for the installation and operation of the facilities.

Is the Site located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (ORMCP), a regulation made under the Oak Ridges Moraine Conservation Act (ORMCA)?

☐ Yes **(If yes please attach proof of Municipal planning approval for the proposed activity/work)**

☒ No

5. Project Technical Information Contact - *Complete A, B, D and E* ***or*** *A, C, D, and E*

A. Name: Laszlo Gotz

Company: Goldcorp Canada Ltd. - Porcupine Gold Mines

☒ Same as Client Name

Contact Address

B. Civic Address - Street information *(includes street number, name, type and direction)*: 4315 Gold Mine Road

☐ Same as Client Mailing Address

Unit Identifier *(identifies type of unit, such as suite & number)*:

C. Delivery Designator: ☐ Rural Route ☐ Suburban Service ☐ Mobile Route ☐ General Delivery

Delivery Identifier *(a number identifying a Rural Route, Suburban Service or Mobile Route delivery mode)*:

D. Municipality	Postal Station	Province/State	Country	Postal Code

E. Telephone Number *(including area code & extension)*	Fax Number *(including area code)*	E-mail Address

6. Project Information

Type of Application: ☐ New Certificate of Approval ☒ Amendment to current Certificate of Approval

Current Certificate of Approval Number: 8572-4L8GYF (notice 2)

Date of Issue *(y/m/d)*: 2001/04/04

Project Description Summary *(If EBR is applicable, this summary will be used in the EBR posting notice)*

Modification of the existing Hollinger and McIntyre Mine dewatering system, with discharge to Little Pearl Tailings Pond (LPTP), with such modification to include: a new discharge point at the west end of LPTP; increased rate of pumping of mine water from the existing McIntyre No. 11 shaft to LPTP; use of a silt curtain or rockfill berm to partition LPTP into two sections; and reconstruction of the LPTP outlet to allow for more accurate flow measurements.

Project Name *(Project identifier to be used as a reference in correspondence)*	Receiver of Effluent Discharge	Watershed Name
Hollinger Project	Pearl Lake	Porcupine River

Project Schedule

Estimated date for start of construction/installation	Estimated date for start of operation
December 1, 2010	April 2011

7. Other Approvals / Permits

List all other environmental approvals/permits applied for related to this project or received in relation to this project under the *Environmental Protection Act* (discharges to air, waste management, etc.) and the *Ontario Water Resources Act* (water works).

Amendment to Permit to Take Water 0248-6UJMBL, dated October 13, 2006

8. Public Consultation/Notification

Specify all public consultation/notification *(such as public hearings, notification of First Nations, etc.)* related to the project that has been completed or is in the process of being completed.

Open house meetings for the general public were held on March 29, 2007; October 2, 2008; May 19 and 20, 2010. A further open house session is planned for October 2010. Goldcorp is also engaging local First Nations and the Metis. Details are provided in the attached document.

9. Environmental Bill of Rights Requirements

Is this a proposal for a Prescribed instrument under EBR?	If "Yes," is it excepted from public participation?	If it is excepted from public participation provide reason:	
☒ Yes ☐ No	☐ Yes ☒ No	☐ Equivalent Public Participation ☐ Emergency	☐ Environmentally Insignificant Amendment or Revocation ☐ EAA or Tribunal Decision

Documentation is support of the above noted exception must be provided (refer to "Guide")

10. Supporting Information Checklist - *This is a list of all supporting information to this application and is subject to the FOIPPA and EBR*

Supporting information	Attached	Reference	Can be disclosed
General			
Pre-application consultation record	☒ Yes ☐ No	see attached report	☒ Yes ☐ No
Proof of Legal Name of Client	☒ Yes ☐ No		☒ Yes ☐ No
Copy of NEPDA Permit	☐ Yes ☐ No	na	☐ Yes ☐ No
Name, Address and Phone Number of the Operating Authority	☒ Yes ☐ No		☐ Yes ☒ No
Name, Address and consent of land/site owner for the installation/construction and operation of the works/facility	☒ Yes ☐ No		☐ Yes ☐ No
Documentation in support of EBR Public Participation Exception	☐ Yes ☐ No	na	☐ Yes ☐ No
Proof of Public Consultation/Notification	☒ Yes ☐ No		☒ Yes ☐ No
Financial Assurance	☐ Yes ☐ No	na	☐ Yes ☐ No
Technical			
Description of the Industrial Processes (sources of sewage)	☒ Yes ☐ No	see attached report	☒ Yes ☐ No
Sewage Quantity and Quality Characteristics	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Detailed Description of the Proposed Works	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Design Brief/Report	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Hydraulic and Process Calculations	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Process Sludge Handling Program	☐ Yes ☐ No	na	☐ Yes ☐ No
Process /Effluent Monitoring Program	☒ Yes ☐ No	see attached report	☒ Yes ☐ No
Site Plan	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Engineering Drawings and Specifications	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Environmental Impact Analysis (surface water)	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Environmental Impact Analysis (ground water)	☒ Yes ☐ No	" " "	☒ Yes ☐ No
Environmental Impact Analysis (odour and noise)	☐ Yes ☐ No	na	☐ Yes ☐ No
Final Effluent Criteria Accepted by Regional Office of the Ministry	☐ Yes ☒ No	to be determined	☐ Yes ☐ No
Site and Soil Assessment Report	☐ Yes ☐ No	na	☐ Yes ☐ No
Stormwater Management Report	☒ Yes ☐ No		☒ Yes ☐ No
Other Attached Information	☒ Yes ☐ No		☒ Yes ☐ No

11. Payment Information

Amount Enclosed: $ 9,200 *Please attach completed "Costs for EPA s.53 Applications – Supplement to Application for Approval" (PIBS 4107).*

Method of Payment

☐ Certified Cheque ☐ Money Order ☐ VISA ☐ MasterCard ☐ American Express

Credit Card Information *(if paying by VISA, MasterCard or American Express)**

Name on Card *(please print)*

Credit Card Number

Expiry Date (mm/yy)

Cardholder Signature

Date *(y/m/d)*

**NOTE: credit card accepted for payments UNDER $10,000.00 only.*

12. Statement of Client

I, the undersigned hereby declare that, to the best of my knowledge, the information contained herein and the information submitted in support of this application is complete and accurate in every way and that the Project Technical Information Contact identified in section 5 of this form is authorized to act on my behalf for the purpose of obtaining approval under Section 53 of the OWRA for the sewage works identified herein.

Name *(please print)*

Title

Signature

Date *(y/m/d)*

Ministry of the Environment **Ministère de l'Environnement**

Ontario

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COSTS FOR OWRA s.53 APPLICATIONS
SUPPLEMENT TO APPLICATION FOR APPROVAL

This form is to be completed for all applications under the ***Ontario Water Resources Act****, s.53 received by the Environmental Assessment & Approvals Branch. Please submit this form with your completed application form. For instructions/assistance completing this form, please refer to publication number 4180 titled: "Guide: Application Costs for Sewage Works, s.53 OWRA". This form and associated publications are available on the Ministry of the Environment web site at www.ene.gov.on.ca or by contacting the Environmental Assessment and Approvals Branch at 1-800-461-6290.*

Company Name:	**Application/Certificate of Approval Number (if known)**
GOLDCORP CANADA LTD. - PORCUPINE GOLD MINES	8572 -4L 8GYF (notice 2)

Application Cost: ***Indicate the applicable aspect(s) of the application and complete the corresponding section(s) of this form.***

☐ Administrative amendment of an existing approval (Section 1)	**Total Cost**
☐ Fee exempted amendment or revocation of an existing approval (Section 2)	**$**
☐ Approval, amendment or revocation requiring technical review (Section 3)	

SECTION 1: ***Administrative Amendment of an Existing Approval***

Description	Cost	(✓)
Administrative amendments (no technical review involved)	$ 100	☐
TOTAL COST:	$	

SECTION 2: ***Fee Exempted Amendment or Revocation of an Existing Approval***

Description	Cost	(✓)
Administrative revocation (no technical review involved)	$ 0	☐
Any revocation requested as a result of requirements imposed by conditions of an existing approval	$ 0	☐
Any amendment requested as a result of requirements imposed by conditions of an existing approval	$ 0	☐
TOTAL COST:	$	

SECTION 3: ***Complete tables 1, 2 & 3 and enter your information in the summary table below.***

Description	Cost	(✓)
Administrative processing	$ 200	✓
Wastewater Treatment and Disposal (Table 1)	$	☐
Wastewater Disposal (Table 2)	$	☐
Review (Table 3)	$ 9,000	☑
Hearing (if required)	$ 18,000	☐
TOTAL COST:	$ 9,200	

Table 1: Wastewater Treatment and Disposal

When completing this table, please note the following:

Category 1 Amendment:
The application relates to an amendment to an existing treatment plant approval to include additional facilities to increase the approved rated capacity of the plant, including the expansion, re-rating, or upgrading of an existing facility.

Category 2 Amendment:
The application relates to an amendment to an existing treatment plant approval to include additional facilities that do not increase the approved rated capacity of the plant, including new tertiary treatment facilities, plant process waste stream treatment and disposal facilities, new treatment facilities to replace deteriorated facilities and the establishment, alteration, expansion or replacement of an outfall.

Category 3 Amendment:
If the application relates to the alteration, extension or replacement of treatment plant equipment or processes that do not involve the addition of new facilities, including:

A. the alteration, extension or replacement of a pumping system, an aeration system, a chemical storage or application system, filter media or a standby power supply system,
B. the provision of additional points of process chemical application, and
C. the provision of odour control equipment facilities.

Category 4 Amendment:
Any other case of amendment requiring technical review.

Description	Maximum Design Capacity	Application Type	Amendment Category	Cost	(✓)	Ref.
A municipal or private facility for the treatment and disposal of sewage including a lagoon or stabilization pond or a sewage treatment plant	≤ 4,550 m³/day	Approval or Revocation*	N/A	$ 5,000	☐	1.1.1
		Amendment	Category 1	$ 5,000	☐	1.1.2
			Category 2	$ 3,600	☐	1.1.3
			Category 3	$ 1,800	☐	1.1.4
			Category 4	$ 600	☐	1.1.5
	> 4,550 m³/day	Approval or Revocation*	N/A	$ 10,000	☐	1.1.6
		Amendment	Category 1	$ 10,000	☐	1.1.7
			Category 2	$ 3,600	☐	1.1.8
			Category 3	$ 1,800	☐	1.1.9
			Category 4	$ 600	☐	1.1.10
A facility for attenuating stormwater runoff peak flow rate or volume or for managing stormwater runoff quality such as detention or retention ponds, underground chambers, oversized sewers, rooftop storage, parking lot storage, oil, grit and silt separators, flow control outlet structures, infiltration wells, perforated sewers, and trenches or outfalls	N/A	Approval or Revocation*	N/A	$ 2,000	☐	1.2.1
		Amendment	Category 1	$ 2,000	☐	1.2.2
			Category 2			
			Category 3			
			Category 4	$ 600	☐	1.2.3
A facility for the treatment and disposal of leachate	N/A	Approval or Revocation*	N/A	$ 6,000	☐	1.3.1
		Amendment	Category 1	$ 6,000	☐	1.3.2
			Category 2	$ 3,600	☐	1.3.3
			Category 3	$ 1,800	☐	1.3.4
			Category 4	$ 600	☐	1.3.5
A facility for the treatment and disposal of industrial process wastewater, including contact cooling water.	N/A	Approval or Revocation*	N/A	$ 6,000	☐	1.4.1
		Amendment	Category 1	$ 6,000	☐	1.4.2
			Category 2	$ 3,600	☐	1.4.3
			Category 3	$ 1,800	☐	1.4.4
			Category 4	$ 600	☐	1.4.5
			TOTAL COST:	$		

** revocation requiring technical review*

Table 2: ***Wastewater Disposal***

Description	Design Capacity	Application Type	Increase in Design Capacity?	Cost	(✓)	Ref.
A subsurface disposal facility	≤ 15 m³/day	Approval or Revocation*	N/A	$ 600	☐	2.1.1
		Amendment	Yes	$ 600	☐	2.1.2
	> 15 m³/day, ≤ 50 m³/day	Approval or Revocation*	N/A	$ 1,500	☐	2.1.3
		Amendment	Yes	$ 1,500	☐	2.1.4
	> 50 m³/day	Approval or Revocation*	N/A	$ 3,000	☐	2.1.5
		Amendment	Yes	$ 3,000	☐	2.1.6
A facility for the disposal of spent water from a non-contact industrial cooling process.	N/A	Approval or Revocation*	N/A	$ 1,000	☐	2.2.1
		Amendment	Yes	$ 1,000	☐	2.2.2
Storm and sanitary sewers and appurtenances	N/A	Approval or Revocation*	N/A	$ 900	☐	2.3.1
		Amendment	Yes**	$ 900	☐	2.3.2
Storm and sanitary pump stations, force mains, and sanitary sewage detention chambers or oversized sewers.	N/A	Approval or Revocation*	N/A	$ 1,800	☐	2.4.1
		Amendment	Yes	$ 1,800	☐	2.4.2
			TOTAL COST:	$		

** revocation requiring technical review*

*** expansion of existing sewers*

Table 3*: Review*

Description	Cost	(✓)
Review of Hydrogeological Assessment	$ 3,000	☑
Review of effluent quality criteria assessment for stormwater management, cooling water or soil remediation facilities	$ 1,400	☐
Review of effluent quality criteria assessment for municipal or private sewage, industrial process wastewater or leachate treatment plant	$ 6,000	☑
TOTAL COST:	$ 9,000	

Ontario
Ministry of the Environment

Application for Permit to Take Water

Ce formulaire est disponible en français

For Office Use Only			
Reference Number	Payment Received $	Date *(y/m/d)*	Initials

General Information and Instructions

General:

Information requested in this form is collected under the authority of the *Ontario Water Resources Act,* R.S.O. 1990 (OWRA) and the *Environmental Bill of Rights*, C. 28, Statutes of Ontario, 1993, (EBR) and will be used to evaluate applications for a Permit to Take Water as required by Section 34 (OWRA).

Instructions:

1. **Applicants are responsible for ensuring that they complete the most recent application form.** When completing this form, please refer to the "Guide to Permit to Take Water Application Form" (referred to as the Guide). Application forms and supporting documentation are available from your local Regional or District Office of the Ministry of the Environment, and in the "Publications" section of the Ministry of the Environment website at http://www.ene.gov.on.ca/envision/gp/index.htm.

2. Questions regarding completion and submission of this application should be directed to local Regional Office of the Ministry of the Environment. Contact information for these offices is available in the Guide or on the Ministry of the Environment website at http://www.ene.gov.on.ca/envision/org/op.htm

3. This form must be completed with respect to all the requirements of the Guide for it to be considered an application for approval. **Incomplete applications will be returned to the applicant.**

4. A complete application consists of:

   (1) a completed, signed application form
   (2) all required supporting information identified in this form and the Guide, and
   (3) a certified cheque or money order, in Canadian funds, made payable to the ***Ontario Minister of Finance*** for the application fee when required. Payment may also be made by Visa, MasterCard or American Express,

   The Ministry may require additional information during the technical review of any application initially accepted as complete.

5. The original application, along with supporting information and the application fee should be sent to:

   Ministry of the Environment,
   Attention: Permit to Take Water
   Director, Environmental Assessment and Approvals Branch,
   2 St. Clair Avenue West, Floor 12A
   Toronto, Ontario, M4V 1L5

6. Information contained in this application form is not considered confidential and will be made available to the public upon request. Information submitted as supporting information may be claimed as confidential but will be subject to the *Freedom of Information and Protection of Privacy Act* (FOIPPA) and the *EBR*. If you do not claim confidentiality at the time of submitting the information, the Ministry of the Environment may make the information available to the public without further notice to you. If you are identifying confidential material, please indicate why you believe the information is confidential.

1. Permit Administration

Please indicate if this is an application for a:
☐ New Permit
☒ Amendment to Permit (attach a photocopy of permit)
☐ Renewal of Permit (attach a photocopy of permit)

2. Classification

Classification	Fee Required	No Fee Required
☐ Category 1	☐ $750	☐ Reason ____
☐ Category 2	☐ $750	☐ Reason ____
☒ Category 3	☒ $3,000	☐ Reason ____

3. Applicant Information

Applicant Name *(legal name of individual or organization as evidenced by legal documents such as a copy of Driver's Licence or Master Business Licence)*: Goldcorp Canada Ltd. - Porcupine Gold Mines

Business Identification Number: ?

Business Name *(the name under which the entity is operating or trading if different from the Applicant Name - also referred to as trade name)*:

Applicant Type:

- ☒ Corporation
- ☐ Individual
- ☐ Partnership
- ☐ Sole Proprietor
- ☐ Federal Government
- ☐ Municipal Government
- ☐ Provincial Government
- ☐ Other *(describe)*:

North American Industry Classification System (NAICS) Code: 2 1 2 2 2 0

4. Applicant Physical Address

Civic Address - Street information *(street number/name/type/direction/unit/suite/emergency 911 location number and street)*: 4315 Gold Mine Road

Municipality/Unorganized Township	County/District	Province/State	Country	Postal Code
South Porcupine		ON	Canada	P0N 1H0

Telephone Number *(including area code)*	Fax Number *(including area code)*	E-mail Address
(705) 235-6521	(705) 235-6598	laszlo.gotz@goldcorp.com

5. Applicant Mailing Address

Same as Applicant Physical Address? ☒ Yes ☐ No **If no, complete below**

Civic Address - Street information *(street number/name/type/direction/unit/suite/emergency 911 location number and street/P.O.Box/Rural Route Number)*:

Municipality	Province/State	Country	Postal Code

6. Project Technical Information Contact

Same as Applicant? ☒ Yes ☐ No **If no, complete below**

Name: LASZLO GOTZ

Company: GOLDCORP CANADA LTD. PORCUPINE GOLD MINES

Address Information:

Same as Applicant Mailing Address? ☐ Yes ☐ No **If no, please provide technical information contact mailing address below**

Civic Address - Street information *(street number/name/type/direction/unit/suite/emergency 911 location number and street/P.O.Box/Rural Route Number)*:

Municipality	Province/State	Country	Postal Code

Telephone Number *(including area code & extension)*	Fax Number *(including area code)*	E-mail Address

7. Source Information – *Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.*

Number of Water Taking Sources Included in this Application *(do not include domestic uses that do not require a permit)*

Total Number of Wells	Total Number of Lake Intakes	Total Number of Ponds	Total Number of Watercourse Intakes
2			

Source Location Information *(if multiple sources are included in application, provide information for each source)*

Civic Address - Street information *(street number/name/type/direction/unit/suite/emergency 911 location number and street)*

McIntyre No. 11 Shaft

Lot	Concession	Part	Reference Plan
9	3		

Municipality/Unorganised Township	County/District	Original Geographic Township
City of Timmins	District of Cochrane	

Geographic (GPS) Coordinates *(to be provided in Datum NAD83)*

Method of Collection	Accuracy Estimate	UTM Zone	Easting	Northing
LiDAR	+/- 10 m	17	478110	5369949

Is the Applicant the owner of the site where water taking will occur?

☒ Yes

☐ No **if no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location**

Is the site where water taking will occur located in an area of development control as defined by the *Niagara Escarpment Planning & Development Act*?

☐ Yes ☒ No

Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the *Oak Ridges Moraine Conservation Act*)?

☐ Yes ☒ No

Are you aware of any complaints or impacts resulting from water takings at the site?

☒ Yes **if yes, please describe:** possibly (but unlikely) impact on area wells

☐ No

Will water from the site be packaged in a container (bottled water, tanks)?

☐ Yes **If yes, what size of containers?** ☐ greater than 20 litres ☐ 20 litres or less

☒ No

Are wells located within 500 m of the site where water taking will occur?

☐ Yes

☒ No **if no, what is the distance to the nearest well?** approximately 1.2 km

Is municipal water available to all dwellings within 500m of the site where water taking will occur?

☒ Yes ☐ No ☐ Unknown

Estimated start date of water taking

Water taking to extend for a period of: 15 ☐ days ☐ weeks ☐ months ☒ years ☐ indefinite

Is activity subject to the *Environmental Assessment Act*?

☐ Yes **if yes, please attach approval or Notice of Completion**

☒ No

If yes, did the project receive any Part II Orders / Bump-Up requests?

☐ Yes **if yes, what was the date of the Minister's Decision?** ☐ Decision pending

☒ No

List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.)

Open house for public held 3/29/2007; 10/2/2008; 5/19&20/2010. An open house planned for 10/2008. Goldcorp also engaging local First Nations and Metis. Details provided in attached doc.

☐ **Watercourse** - *please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)*

Watercourse Name	Tributary to

Does flow in the watercourse stop at any time during the year?

☐ Yes **if yes, during which months?** For what period of time?

☐ No

Do you move/relocate the water intake (pump)?

☐ Yes **if yes, please provide primary and secondary locations on attached map**

☐ No

☐ **Well -** *please complete this table if applying to take water from a well (includes sumps for mines and quarries)*

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
McIntyre No.11 shaft		

Has the well been deepened?

☐ Yes **if yes, what was the date of deepening?** ____________

☒ No

Type of Well: ☐ Drilled ☐ Bored ☒ Dug ☐ Driven or Jetted (sandpoints/wellpoints)

If 'Driven or Jetted', provide the following:

Total number of sandpoints/wellpoints: ____________

Number of interconnected sandpoint/wellpoint systems: ____________

Can you measure the depth to water in this well?

☒ Yes **if yes, what is the depth to static water level?** ~30 m Date Measured: ____________

☐ No

Has a pumping test been done?

☐ Yes **if yes, please attach report**

☒ No MINE SHAFT - MAXIMUM PRODUCTION CALCULATED AT 1,200 - 1,900 m^3/d.

☐ **Lake -** *please complete this table if applying to take water from a lake*

Lake Name

☐ **Pond/Reservoir -** *please complete this table if applying to take water from a pond/reservoir*

Pond Name / Identifier

Was the pond constructed (man made)?

☐ Yes **if yes, please provide date of construction** ____________

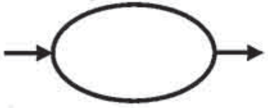
☐ No

Pond Size

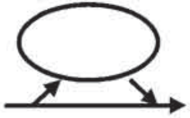
Average Length	Average Width	Average Depth of Water	Maximum Depth of Water	Approximate Volume of Pond

Pond Type

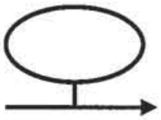
Select the diagram that most accurately resembles your pond:



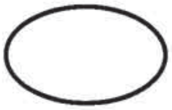
☐ online



☐ by-pass



☐ connected



☐ dugout

Source of pond water (select all that apply)

☐ Seepage / springs / groundwater

☐ Surface water runoff (including tile drains, does not include watercourse or open channel)

☐ Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse)

☐ Flowing water (watercourse, open drains, ditches, etc.)

If "flowing water",

1. Does water flow into the pond (inflow)? ☐ Yes ☐ No

If yes, is there a structure to regulate the inflow? ☐ Yes ☐ No If yes, describe: ____________

2. Does water flow out of the pond (outflow)? ☐ Yes ☐ No

If yes, is there a control structure to regulate the outflow? ☐ Yes ☐ No If yes, describe: ____________

8. Public Consultation / Environmental Bill of Rights (EBR) Requirements

Is this application for water taking to extend for a period of less than one year?

☐ Yes ☒ No If no, this application may be subject to posting and/or public consultation requirements under the Environmental Bill of Rights. For more information, please refer to the Guide.

Is this application for agricultural use or aquaculture?

☐ Yes ☒ No If no, this application may be subject to posting and/or public consultation requirements under the Environmental Bill of Rights. For more information, please refer to the Guide.

9. Water Taking Volumes

	Purpose Options for Water Taking
	Purpose
Agriculture	irrigation of (includes frost protection): field and pasture crops; fruit orchard; market garden/flowers; nursery; sod farm; tender fruits; tobacco, other (must specify)
Commercial	aquaculture, bottled water, golf course irrigation, mall/business; snowmaking, other (must specify)
Dewatering	pits and quarries; construction; other (must specify)
Industrial	aggregate washing, brewing/soft drinks, cooling water, food processing, manufacturing; pipeline testing; power generation; other (must specify)
Institutional	school, hospital, other (must specify)
Recreation	aesthetic, fish pond, wetland, other (must specify)
Remediation	groundwater; other (must specify)
Water Supply	campground, communal, municipal, other (must specify)
Miscellaneous	dam/reservoir, heat pump, wildlife conservation, pumping test, other (must specify)

Water Source Information – Table A (Units in Litres)

Source Name	Purpose (select from "purpose" column in table above)	Maximum rate per minute	Maximum number of hours of taking a day	Maximum volume per day	Typical volume per day	Maximum number of days of taking in a year	Earliest calendar date of taking (mm/dd)	Latest calendar date of taking (mm/dd)
Hollinger UG	industrial		24	40,000,000	15,000,000	365	01/01	12/31
Hollinger sumps	industrial		24	10,000,000	1,000,000	365	01/01	12/31

10. Attachments

The following must be attached for all applications (Category 1, 2 and 3) to be complete:

☒ Map Requirements
On a 1:10 000 OBM (Ontario Base Map) (1:50 000 only acceptable in locations where 1:10 000 is not obtainable), mark and label:

- all existing and proposed water taking locations with sources corresponding with source name
- all of the following features within 500m of each source: existing wells (indicate use of existing well, springs, watercourses, wetlands, water bodies, property lines, locations and name of property owners, nearest road intersection, dwellings.

☒ Describe **in detail** how, where and when all water is obtained, stored, transferred, used and returned to the environment (if applicable). Details must include the source of all water takings (and corresponding source name if applicable), purpose of the water taking, period of water taking, and maximum quantity requested (see Guide for further instruction).
Note: If your application is subject to posting on the Environmental Bill of Rights (EBR) Registry, this description will be used to create the Proposal Notice. The ministry may change the wording as required, to meet the EBR posting requirements.

☒ Describe how water taking needs (rates, amounts and time periods) were determined. Provide all relevant information and calculations to demonstrate the water takings requested are warranted. Calculation worksheets are available. Refer to Appendix E of the Guide.

☒ Attach completed water conservation Schedule 1.

The following must be attached for all Category 2 applications:

☐ Completed Schedule 2 and/or Schedule 3 signed by a Qualified Person.

The following must be attached for all Category 3 applications:

☒ Study attached report

11. Statement/Signature of Applicant

I, the undersigned, hereby declare that to the best of my knowledge:

- The information contained herein and the information submitted in support of this application is complete and accurate in every way and I am aware of the penalties against providing false information.
- The Project Technical Information Contact identified in Section 6 if this form is authorized to act on my behalf for the purpose of obtaining this approval.

Print Name	Signature	Date (yyyy/mm/dd)

Application for Permit to Take Water

Ce formulaire est disponible en français

Ministry of the Environment

For Office Use Only			
Reference Number	Payment Received $	Date *(y/m/d)*	Initials

12. Payment Information

Application Category ☐ Category 1 ($750) ☐ Category 2 ($750) ☒ Category 3 ($3000)	Amount Enclosed $ 3,000.00 ☐ no fee required

Method of Payment

☐ Certified Cheque ☐ Money Order ☐ VISA ☐ MasterCard ☐ American Express

Credit Card Information *(if paying by VISA, MasterCard or American Express)**

Name on Card *(please print)*	Credit Card Number	Expiry Date (yy/mm)

Cardholder Signature	Date *(y/m/d)*

**NOTE: credit card accepted for payments UNDER $10,000.00 only.*

Appendix E

Schedule for Water Conservation Measures

Schedule 1 – Implementation of Water Conservation in accordance with Best Management Practices and Standards for the Relevant Sector

General Information and Instructions

Section 1: General Information

Information on this Schedule is collected under the authority of the *Ontario Water Resources Act, R.S.O. 1990* (OWRA), and the new *Environmental Bill of Rights, C.* 28. Statutes of Ontario, 1993, and will be used to evaluate applications for a Permit to Take Water as required by Section 34 (OWRA).

Instructions:

1. This Schedule forms part of the Permit to Take Water application form and is subject to all provisions and instructions where applicable.
2. All questions of Section 2 of this Schedule must be answered for this Schedule to be considered complete.

Purpose:
The purpose of this Schedule is to allow persons applying for a permit required by the Ministry to document in the application all water conservation measures and practices that are currently being undertaken or that is anticipated to be undertaken for the duration of the permit.
Persons applying for a permit are encouraged to take all reasonable and practical measures to conserve water and to be up to date with sector-specific best management practices and standards for water conservation (i.e. whether you are currently implementing or anticipate implementing water conservation best water management standards and practices relevant to your sector).
Various sector associations publish information on best practices that may be useful in determining practices and standards for water conservation. Examples of these sector-specifc assocations include the following:

- **Municipal Sector** – Ontario Water Works Association
- **Agricultural Sector** – Ontario Ministry of Agriculture (Fact Sheets and Guides on Best Management Practices containing information on efficient irrigation systems, staggering irrigation schedules and preparing Environmental Farm Plans)
- **Other Sectors** – For information on up-to-date best management practices and measures for water conservation, contact your relevant sector association.

Please note that this schedule may not be directly applicable to certain takings, such as pumping tests, instream uses, site dewatering and certain industrial processes. In these cases, consideration must be given to the fate of the water or system design requirements.

Section 2: Water Conservation Best Management Practices and Standards

Use this section of the Schedule to indicate what conservation measures and practices you are currently implementing or anticipate implementing. Where relevant, additional information can be attached as an appendix to this Schedule.

State your goals for reducing the use, loss or waste of water or for increasing the efficiency of water use (e.g., litres per day per unit of production or litres per day per capita for the residential sector).

Schedule 1 continued

Check off which of the following water conservation best management measures and practices that you have implemented or will implement for the duration of the permit:

	Implemented	**To be Implemented**
Water Use Audit	☐	☐
Universal metering of all users (municipalities)	☐	☐
Water Efficient Fixtures/Equipment/Technology	☐	☐
Develop and Implement an Overall Water Conservation and Efficiency Program	☐	☐
Leak Detection/Loss Prevention/Control Program	☐	☐
Public/Employee Information/Education/Outreach	☐	☐
Landscaping techniques/Site and Urban Design Principles	☐	☐
Water Efficient production processes/practices (e.g. re-use of water)	☐	☐
Economic Incentives/Cost-Share/Full Costing recovery/ tax credits/rebate programs	☐	☐

Other (please specify): ______________________________

Of the measures and practices checked off above, provide specific details of the best management practices applied or to be applied including equipment (e.g. pump specification), processes, such as water used for industrial production and/or irrigation system(s), current and proposed technology, approach, processes and procedures:

Not applicable - Proponent will limit water take to the point of maintaining a safe mining environment

For the above measures and practices, list information relevant for your sector and/or other sources of information used in determining water conservation and efficiency management practices and measures:

Not applicable

List dates of when the best management measures and practices were or will be applied for the duration of the permit:

Identify any approval or certification that you have received for implementing water conservation and efficiency best management practices, e.g. Environmental Farm Plan, Audubon Cooperative Sanctuary Program for Golf Courses:

Business Name Registration
CONFIRMATION OF FILING

Registration Submit Date: Oct 12, 2007 11:16 am

ONCORP Tracking Number: 18628 Official ONBIS ID: 9626863		THIS COPY PRINTED:	Oct 12, 2007 @ 11:17 am
Reference Info: Docket Info:	CODE#106(ALW/KAC) 36499-1	Registration Type:	Business/Style/Trade Name for Corporation New Registration

Business Name: PORCUPINE GOLD MINES

Business Identification Number: 171094154
Effective Date: Oct 12, 2007
Expiry Date: Oct 11, 2012

Address of Principal Place of Business: **4315 GOLD MINE ROAD, SOUTH PORCUPINE, ON, CANADA, P0N 1H0**

Mailing Address: **666 BURRARD STREET, 3400, VANCOUVER, BC, CANADA, V6C 2X8**

Registrant Information:

Corporation Info.:

Corp. Name	GOLDCORP CANADA LTD.
Corp. Number	001217701
Corp. Status	01
Establishment Type	R
Jurisdiction	CANADA
Incorporation Date	1/1/1997

Business Activity Description: MINING AND MILLING OF GOLD

Notification Details

Program Notification(s) Requested	
EHT Application	No
RST Application	No
WSIB Application	No

Name of Person Authorizing Registration: TUDELA ANNA M.

CANADA)
)
PROVINCE OF ONTARIO)
)
CITY OF TORONTO)
)
TO WIT:)

I, NICHOLAS JAMES HAYDUK, a Notary Public in and for the Province of Ontario, by Royal Authority duly appointed, residing in the City of Toronto, in the said Province DO HEREBY CERTIFY that the paper writings hereto annexed, all of which are stamped with an impression of my seal, are a true and correct photostatic copy of the **CERTIFICATE AND ARTICLES OF AMENDMENT OF GOLDCORP CANADA LTD. (CORPORATION NUMBER 332664-1)** as certified and issued by Industry Canada on May 25, 2006 and dated May 19, 2006, the said photostatic copy having been compared by me, page for page, with the said original document, an act whereof being requested I have granted the same under my hand and notarial seal of office to serve and avail as occasion shall or may require.

DATED at Toronto this 30th day of MAY, 2006.

A Notary Public in and for
the Province of Ontario

Industry Canada Industrie Canada

Canada Business Corporations Act
Loi canadienne sur les sociétés par actions

I HEREBY CERTIFY THAT THE ATTACHED IS A TRUE COPY OF THE DOCUMENT MAINTAINED IN THE RECORDS OF THE DIRECTOR.	JE CERTIFIE, PAR LES PRÉSENTES, QUE LE DOCUMENT CI-JOINT EST UNE COPIE EXACTE D'UN DOCUMENT CONTENU DANS LES LIVRES TENUS PAR LE DIRECTEUR.

Deputy Director - Directeur adjoint

Date MAY MAI 2 5 2006

Canada

Industry Canada Industrie Canada

Certificate of Amendment	**Certificat de modification**
Canada Business Corporations Act	**Loi canadienne sur les sociétés par actions**

Goldcorp Canada Ltd.	332664-1
Name of corporation-Dénomination de la société	Corporation number-Numéro de la société

I hereby certify that the articles of the above-named corporation were amended:		Je certifie que les statuts de la société susmentionnée ont été modifiés:
a) under section 13 of the *Canada Business Corporations Act* in accordance with the attached notice;	☐	a) en vertu de l'article 13 de la *Loi canadienne sur les sociétés par actions*, conformément à l'avis ci-joint;
b) under section 27 of the *Canada Business Corporations Act* as set out in the attached articles of amendment designating a series of shares;	☐	b) en vertu de l'article 27 de la *Loi canadienne sur les sociétés par actions*, tel qu'il est indiqué dans les clauses modificatrices ci-jointes désignant une série d'actions;
c) under section 179 of the *Canada Business Corporations Act* as set out in the attached articles of amendment;	☑	c) en vertu de l'article 179 de la *Loi canadienne sur les sociétés par actions*, tel qu'il est indiqué dans les clauses modificatrices ci-jointes;
d) under section 191 of the *Canada Business Corporations Act* as set out in the attached articles of reorganization;	☐	d) en vertu de l'article 191 de la *Loi canadienne sur les sociétés par actions*, tel qu'il est indiqué dans les clauses de réorganisation ci-jointes;

	May 19, 2006 / le 19 mai 2006
Richard G. Shaw Director - Directeur	Date of Amendment - Date de modification

Canada

Industry Canada Industrie Canada

Canada Business Corporations Act — Loi canadienne sur les sociétés par actions

ELECTRONIC TRANSACTION REPORT — RAPPORT DE LA TRANSACTION ÉLECTRONIQUE

ARTICLES OF AMENDMENT (SECTIONS 27 OR 177) — CLAUSES MODIFICATRICES (ARTICLES 27 OU 177)

Processing Type - Mode de traitement: E-Commerce/Commerce-É

1 Name of Corporation - Dénomination de la société	2. Corporation No. - N° de la société
PLACER DOME (CLA) LIMITED PLACER DOME (CLA) LIMITEE	332664-1

3. The articles of the above-named corporation are amended as follows:
Les statuts de la société mentionnée ci-dessus sont modifiés de la façon suivante:

1.☐by changing the name of the Corporation from Placer Dome (CLA) Limited/Placer Dome (CLA) Limitee to Goldcorp Canada Ltd.; and

2.☐ by changing the province or territory where the registered office is situated from British Columbia to Ontario.

Date	Name - Nom	Signature	Capacity of - en qualité
2006-05-19	ANNA M. TUDELA		AUTHORIZED OFFICER

Canada

goldcorp
CANADA LTD.

TORONTO OFFICE
Suite 3201
130 Adelaide Street West
Toronto, Ontario
Canada M5H 3P5

TEL (416) 363-5255
FAX (416) 363-5950
www.goldcorp.com

December 12, 2008

CONFIDENTIAL

Ministry of Environment
Environmental Assessment and Approvals Branch,
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

RE: Environmental Permit Applications

To Whom It May Concern,

I hereby grant signing approval to László Götz, Environmental Manager, Goldcorp Canada Ltd., Porcupine Gold Mines, for environmental permit applications regarding the Ontario Water Resources Act and the Ontario Environmental Protection Act. If you have any questions please do not hesitate to contact me at (416) 363-0722.

Sincerely,

George R Burns

George Burns
Vice President, Canada & US
Goldcorp Canada Ltd.

APPENDIX B

EXISTING PERMITS

1. Amended PTTW #0248-6UJMBL, dated October 13, 2006, which provides for the taking of up to 13,402 m^3/d of water from the McIntyre No. 11 Shaft, and up to 1,000 m^3/d from the Hollinger Main Shaft
2. C. of A. #8572-4L8GYF, dated July 6, 2000, which provides for mine water discharge from the McIntyre No. 11 Shaft to Little Pearl Tailings Pond
3. Notice No. 1 to C. of A. #8572-4L8GYF, dated October 13, 2000
4. Notice No. 2 to C. of A. #8572-4L8GYF, dated April 4, 2001

Ontario
Ministry of the Environment
Ministère de l'Environnement

AMENDED PERMIT TO TAKE WATER
Ground Water
NUMBER 0248-6UJMBL

RECEIVED
NOV 0 6 2006

Pursuant to Section 34 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

Goldcorp Canada Ltd.
P.O. Box 70, 4315 Gold Mine Road
South Porcupine, Ontario, P0N 1H0
Canada

For the water taking from: 1) Hollinger Main Shaft
2) McIntyre Shaft No. 11

Located at: Lot 11, Concession 2, Tisdale Geo. Twp.
Timmins, District of Cochrane

Lot 9, Concession 3, Tisdale Geo. Twp.
Timmins, District of Cochrane

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

(a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34, OWRA.

(b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.

(c) "Ministry" means Ontario Ministry of the Environment.

(d) "District Office" means the Timmins District Office.

(e) "Permit" means this Permit to Take Water No. 0248-6UJMBL including its Schedules, if any, issued in accordance with Section 34 of the OWRA.

(f) "Permit Holder" means Goldcorp Canada Ltd..

(g) "OWRA " means the *Ontario Water Resources Act,* R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated August 1, 2006 and signed by Christopher Cormier, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.

1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.

1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections
The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act*, R.S.O. 1990, the *Pesticides Act*, R.S.O. 1990, or the *Safe Drinking Water Act,* S. O. 2002.

2.2 Other Approvals
The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act*, and the *Environmental Protection Act*, and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.2.1 No water taken from the McIntyre Mine, Shaft No. 11 under the authority of this Permit may be discharged directly to the natural environment without prior treatment in accordance with OWRA, Section 53, Industrial Sewage Works Approval, Certificate of Approval No. 8572-4L8GYF, as amended.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 Expiry

This Permit expires on **April 16, 2010**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	Hollinger Main Shaft	Well Bored	Other - Industrial	Industrial	695	24	1,000,000	365	17 476701 5368955
2	McIntyre Shaft No. 11	Well Bored	Other - Industrial	Industrial	9,306	24	13,401,728	365	17 478120 5369914
						Total Taking:	14,401,728		

4. Monitoring

4.1 The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings, and the total measured amounts of water pumped per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request.

4.2 The Permit Holder shall submit to the Director, Section 34, OWRA, and the Area Supervisor, Timmins District Office, a quarterly monitoring report which presents and interprets the monitoring data, pursuant to Condition 4.1 above. The report shall include monthly total volumes of water pumped, daily average pumped, and daily maximum pumped during the reporting period. The quarterly reports shall be submitted as follows:

Reporting Period	Quarterly Report Due Date
Quarter 1 (January 1 to March 31)	April 30
Quarter 2 (April 1 to June 30)	July 31
Quarter 3 (July 1 to September 30)	October 31
Quarter 4 (October 1 to December 31)	January 31

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

6. Director May Amend Permit

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act*, Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.

2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.

3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Environmental Commissioner, ***Environmental Bill of Rights****, R.S.O. 1993, Chapter 28, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, as amended provides that the Notice requiring a hearing shall state:*

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Permit to Take Water number;
6. The date of the Permit to Take Water;
7. The name of the Director;
8. The municipality within which the works are located;

This notice must be served upon:

The Secretary
Environmental Review Tribunal
2300 Yonge Street, Suite 1700
Toronto, Ontario M4P 1E4

AND

The Environmental Commissioner
1075 Bay Street
6th Floor, Suite 605
Toronto, Ontario M5S 2W5

AND

The Director, Section 34
Ministry of the Environment
331-435 James St S
Thunder Bay ON P7E 6S7
Fax: (807)475-1754

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by telephone at (416) 314-4600 ***by fax at (416) 314-4506*** ***by e-mail at www.ert.gov.on.ca***

This instrument is subject to Section 38 of the ***Environmental Bill of Rights*** *that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek to appeal for 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry, you can determine when the leave to appeal period ends.*

This Permit cancels and replaces Permit Number 6123-6P3JD4, issued on 2006/04/24.

Dated at Thunder Bay this 13th day of October, 2006.

Dave Hollinger
Director, Section 34

Ontario Water Resources Act, R.S.O. 1990

Schedule A

This Schedule "A" forms part of Permit To Take Water 0248-6UJMBL, dated October 13, 2006.

- Permit to Take Water 01-P-6003, issued to Kinross Gold Corporation on March 13, 2001
- Amendment to Permit to Take Water 01-P-6003, issued to Kinross Gold Corporation on March 23, 2001
- Permit to Take Water 6486-6M9NJB, issued to Placer Dome (CLA) Limited on February 22, 2006
- Permit to Take Water 6123-6P3JD4, issued to Placer Dome (CLA) Limited on April 24, 2006

cc: LG. ✓

Ministry of the Environment
Northern Region
Technical Support Section
Water Resources
331-435 James St S
Thunder Bay ON P7E 6S7
Fax: (807)475-1754
Telephone: (807)475-1734

Ministère de l'Environnement
Bureau principal de la région du Nord
Section du Soutien Technique
Ressource en eau
331-435 rue James S
Thunder Bay ON P7E 6S7
Télécopieur: (807)475-1754
Téléphone : (807)475-1734

Ontario

October 13, 2006

Goldcorp Canada Ltd.
P.O. Box 70, 4315 Gold Mine Road
South Porcupine, Ontario, P0N 1H0
Canada

Attention: Christopher Cormier

RE: Permit to Take Water 0248-6UJMBL
Reference Number 4040-6SGPW2

Dear Mr. Cormier,

Please find attached Permit to Take Water (PTTW) 0248-6UJMBL, the amendment to PTTW 6123-6P3JD4. The amended PTTW grants the taking of water from the Hollinger Mine, Main Shaft and the McIntyre Mine, Shaft No. 11, located in the Geographic Township of Tisdale, City of Timmins, District of Cochrane, for the industrial purpose (cooling water and mine dewatering). An amended has been issued in order to increase the amount of water permitted to be taken from the Hollinger Mine, Main Shaft, and to decrease the amount of water permitted to be taken from McIntyre Mine, Shaft No. 11. The rate of taking from the Hollinger Main Shaft shall not exceed a maximum of 695 litres per minute or 1,000,000 litres per day, while the rate of taking from the McIntyre Shaft No. 11 shall not exceed a maximum of 9,306 litres per minute or 13,401,728 litres per day. The Permit is still valid until April 16, 2010.

The Terms and Conditions are shown on pages 2-5 of the Permit.

This application was posted on the Environmental Bill of Rights electronic registry for 30 days September 9, 2006. No comments were received.

This Permit does not relieve you, or Goldcorp Canada Ltd. as the proponent, from compliance with provisions of any of the applicable Federal or Provincial statutes, regulations or other legal requirements.

Should you have any questions or concerns, please contact this office as soon as possible.

Yours truly,

Jacinth Gilliam-Price
Pttw Coordinator
Northern Region

File Storage Number: TS 31-02 PTTW 01-P-6003 (Goldcorp Canada Ltd.)

MAC SHAFT.

Ontario
Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS
NUMBER 8572-4L8GYF

See Notice No. 1

Kinross Gold Corporation
P.O. Box 1000
Timmins, Ontario
P0N 1G0

Site Location: McIntrye Mine
Lot 9, Concession 3, McIntyre Mine Road
Timmins City, District Of Cochrane
P0N 1G0

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

the establishment of sewage works for the collection, transmission, treatment and disposal of minewater effluent as follows:

- one (1) approximately 7280 litres per minute (1600 Imperial gallons per minute) pumping system in the McIntyre No. 11 Shaft with the top of the pump intake located at elevation 300 metres (987 Feet), or approximately 30.5 metres (100 Feet) below the shaft collar;

- transmission of minewater 30.5 metres (100 Ft.) up the shaft and through an approximately 183 metres (600 Ft.) long temporary surface pipeline extending approximately 15.2 metres (50 Ft.) from the shoreline on floats for discharge into Pearl Lake;
  Little Pearl

all in accordance with the Application for Approval of Indistrial Sewage Works received on June 6, 2000 and signed by Lianne Kentish, Environmental Coordinator, Kinross Gold Corporation, Timmins Operations and all supporting information.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

(1) "certificate" means this entire certificate of approval document, issued in accordance with Section 53 of the *Ontario Water Resources Act*, and includes any schedules;

(2) "Director" means any Ministry employee appointed by the Minister pursuant to section 5 of the *Ontario Water Resources Act*;

(3) "Ministry" means the Ontario Ministry of the Environment;

(4) "Regional Director" means the Regional Director of the Northern Region of the Ministry;

(5) "District Manager" means the District Manager of the Timmins District Office of the Ministry's Northern Region;

(6) "Owner" means Kinross Gold Corporation and includes its future successors and assignees;

(7) "works" means the sewage works described in the Owner's application, this certificate and in the supporting documentation referred to herein, to the extent approved by this certificate;

(8) "sewage treatment plant" means the entire sewage treatment system, including the effluent discharge facilities;

(9) "grab sample" means an individual sample of at least 1000 millilitres collected in an appropriate container at a randomly selected time over a period of time not exceeding 15 minutes;

(10) "composite sample" means a sample made up of at least three individual sub-samples collected at approximately equal time intervals over a time period of 24 consecutive hours, and combined manually or automatically, or obtained from a slip-stream into an on-line analyzer;

(11) "weekly sample" means a sample collected once a week on a rotating day and time schedule to reflect the overall performance of the sewage works under all operating flow conditions;

(12) "daily concentration" means the concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required;

(13) "monthly average concentration" means the arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. EFFLUENT LIMITS

(1) The Owner shall operate the works such that the concentrations of the materials named in the table below as effluent parameters are not exceeded in the minewater effluent calculated in accordance with subsections (3) and (4):

EFFLUENT PARAMETER	DAILY CONCENTRATION LIMIT	MONTHLY AVERAGE CONCENTRATION LIMIT	SAMPLING FREQUENCY (When Discharging)
Oil and Grease	-	15.0 mg/L	Weekly
Total Suspended Solids	30 mg/L	15.0 mg/L	Weekly
Copper	0.6 mg/L	0.3 mg/L	Weekly
Lead	0.4 mg/L	0.2 mg/L	Weekly
Nickel	1.0 mg/L	0.5 mg/L	Weekly
Zinc	1.0 mg/L	0.5 mg/L	Weekly

changed to objective

(2) The pH of the minewater effluent discharged shall be between 6.0 and 9.5 at all times.

(3) For the purposes of determining compliance with and enforcing subsection (1), exceedence of a daily concentration is deemed to have occurred when any daily single grab sample, analysed for a parameter named above is greater than the corresponding daily concentration set in subsection (1).

(4) For the purposes of determining compliance with and enforcing subsection (1), exceedence of a monthly average concentration for total suspended solids, copper, lead, nickel and zinc is deemed to have occurred when the arithmetic mean concentration of all samples taken in a calendar month, analysed for a parameter named above is greater than the corresponding monthly average concentration set in subsection (1).

(5) In the event that the monthly average limit are exceeded for any one of the effluent parameters, the schedule on which the discharge will be sampled will be changed to thrice weekly.

(6) The Owner shall ensure that the minewater effluent shall be non-lethal to rainbow trout and Daphnia Magna at all times.

(7) For the purposes of determining compliance with and enforcing subsection (5), the effluent is deemed to be non-lethal if the test results, required pursuant to Condition 3, show mortality for no more than 50 percent of the test organisms in undiluted effluent samples.

2. SAMPLES AND MEASUREMENTS

changed.

(1) Effluent samples shall be taken from a take-off valve on the discharge pipeline. end of pipe

(2) For the purposes of sampling effluents, the methods and protocols for sampling, analysis, and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(i) Ministry of the Environment,"Protocol for the Sampling and Analysis of

Industrial/Municipal Wastewater" (dated August, 1994), as amended from time to time by more recently published editions; and,

(ii) "Standard Methods for the Examination of Water and Wastewater" (19th edition, dated 1995), as amended from time to time by more recently published editions.

(iii) in respect of any parameters not mentioned in (i) and (ii), the written permission of the District Manager shall be obtained prior to sampling.

3. LETHALITY MEASUREMENTS

(1) The Owner shall perform one each of rainbow trout acute lethality test and *Daphnia Magna* acute lethality test when discharging minewater effluent according to procedures published in Environment Canada publications entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout", dated July 1990 and "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to *Daphnia Magna*", dated July 1990.

(2) The acute lethality tests shall be carried out on a grab sample as a single concentration test using 100 per cent minewater effluent.

4. FLOW MEASUREMENT

Little

(1) The Owner shall measure and record the flowrate of the minewater effluent discharged to Pearl Lake.

(2) The flow measurement devices shall be capable of an accuracy to within plus or minus 15 per cent of the actual flowrate.

5. RECEIVING WATER MONITORING

(1) The receiving water shall be sampled monthly during discharge and during the ice-free period at the Pearl Lake Discharge Point for the parameters listed below:

Total Suspended Solids
Total Lead
Total Copper
Total Zinc
Total Nickel
Total Iron

(2) The said monitoring outlined in subsection (1) shall continue six months beyond the cessation of minewater effluent discharge into Pearl Lake.

RECORDING/REPORTS

(1) The Owner shall report to the District Manager any exceedence of the effluent concentration limits set out in Condition 1, orally and in writing as soon as reasonably possible.

(2) A quarterly activity report shall be submitted to the District Manager both in an electronic format acceptable to the District Manager and in hard copy no later than 45 days after the end of each quarter. The said report shall contain, for each month in the quarter, the following in a format that is acceptable to the District Manager:

- (a) A summary of the information generated under the requirements of Conditions 2, 3, 4, and 5; samples, toxicity, flows, receiving waters
- (b) A summary and interpretation of all analytical data collected relative to the sewage works facility during the period being reported;
- (c) A summary and interpretation of all calibration and maintenance procedures carried out during the reporting period.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition No. 1 is imposed to establish enforceable effluent quality and lethality limits which the Owner is obligated to strive to achieve on an ongoing basis.
2. Condition Nos. 2, 3, 4, 5 and 6 are related to sampling, monitoring, reporting. They have been imposed to require the Owner to demonstrate on a continual basis that, the performance of the approved works is at a level consistent with the design for the achievement of the effluent limits and objectives specified in the Certificate, and does not cause any impairment to the receiving watercourse.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Appeal Board
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* **Further information on the Environmental Appeal Board's requirements for an appeal can be obtained directly from the Board at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 6th day of July, 2000

Mohamed Dhalla, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

KD/
c: District Manager, MOE Timmins
Lianne Kentish, Kinross Gold Corporation

Ministry of the Environment
Ministère de l'Environnement
Ontario

AMENDMENT TO CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS
NUMBER 8572-4L8GYF
Notice No. 1

Kinross Gold Corporation
P.O. Box 1000
Timmins, Ontario
P0N 1G0

Site Location: McIntrye Mine
Lot 9, Concession 3, McIntyre Mine Road
Timmins City, District Of Cochrane
P0N 1G0

You are hereby notified that I have amended Certificate of Approval No. 8572-4L8GYF issued on July 6, 2000 for the establishment of sewage works for the collection, transmission, treatment and disposal of minewater effluent, as follows:

PART I - SEWAGE WORKS DESCRIPTION

The sewage works description beginning with, "transmission of minewater", and ending with, "on floats for discharge into Pearl Lake", is hereby revoked and replaced with the following:

- transmission of minewater 30.5 metres (100 Ft.) up the shaft and through an approximately 457 metres (1500 Ft.) of pipeline, discharging into a riprap channel and pad underlain with filter fabric into Little Pearl Lake;

all in accordance with the Application for Approval of Industrial Sewage Works dated September 22, 2000 and signed by Andre Perreault, P.Eng., Environmental Engineer, Kinross Gold Corporation, Timmins Operations and all supporting information.

PART II - TERMS AND CONDITIONS

1. Condition 1(1) is hereby revoked and replaced with the following:

   1(1) The Owner shall operate the works such that the concentrations of the materials named in the table below as effluent parameters are not exceeded in the minewater effluent calculated in accordance with subsections (3) and (4):

EFFLUENT PARAMETER	DAILY CONCENTRATION LIMIT	MONTHLY AVERAGE CONCENTRATION LIMIT	SAMPLING FREQUENCY (When Discharging)
Oil and Grease	-	15.0 mg/L	Weekly
Copper	0.6 mg/L	0.3 mg/L	Weekly
Lead	0.4 mg/L	0.2 mg/L	Weekly
Nickel	1.0 mg/L	0.5 mg/L	Weekly
Zinc	1.0 mg/L	0.5 mg/L	Weekly

2. The following additional Condition is hereby imposed on the said Certificate:

   1(8). The total suspended solids of the minewater effluent shall have a daily effluent objective concentration of 30 milligrams per litre.

3. Subsection 2(1) under Samples and Measurements is hereby revoked and replaced with the following:

   2(1). Effluent samples shall be taken from the discharge pipeline.

4. Subsection 4(1) under Flow Measurement is hereby revoked and replaced with the following:

   4(1). The Owner shall measure and record the flowrate of the minewater effluent discharged to Little Pearl Lake.

5. Subsection 5(2) under Receiving Water Monitoring is hereby revoked and replaced with the following:

   5(2). The said monitoring outlined in subsection 5(1) shall continue six months beyond the cessation of minewater effluent discharge into Little Pearl Lake.

The reason for this amendment to the Certificate of Approval is as follows:

The Owner wants to discharge the minewater effluent into Little Pearl Lake instead of into Pearl Lake as previously approved in order to improve total suspended solids control.

This Notice shall constitute part of the approval issued under Certificate of Approval No. 8572-4L8GYF dated July 6, 2000.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Appeal Board
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* **Further information on the Environmental Appeal Board's requirements for an appeal can be obtained directly from the Board at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 13th day of October, 2000

Mohamed Dhalla, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

KD/

c: District Manager, MOE Timmins
Andre Perreault, Kinross Gold Corporation

Ministry of the Environment
Ministère de l'Environnement
Ontario

AMENDMENT TO CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS
NUMBER 8572-4L8GYF
Notice No. 2

Kinross Gold Corporation
P.O. Box 1000
Timmins, Ontario
P0N 1G0

Site Location: McIntrye Mine
Lot 9, Concession 3, McIntyre Mine Road
Timmins City, District Of Cochrane
P0N 1G0

You are hereby notified that I have amended Certificate of Approval No. 8572-4L8GYF issued on July 6, 2000 for establishment of sewage works for the collection, transmission, treatment and disposal of minewater effluent, as follows:

PART I - SEWAGE WORKS DESCRIPTION

The sewage works description beginning with, "one (1) approximately 7280 litres per minute", and ending with, "below the shaft collar", is hereby revoked and replaced with the following:

- one (1) approximately 10,000 litres per minute (2200 Imperial gallons per minute) pumping system in the McIntyre No. 11 Shaft with the top of the pump intake located at elevation 300 metres (987 Feet), or approximately 30.5 metres (100 Feet) below the shaft collar;

all in accordance with the Application for Approval of Industrial Sewage Works dated February 5, 2001 and signed by Harri S. Ollila, Environmental Superintendent, Kinross Gold Corporation and all supporting information.

The reason for this amendment to the Certificate of Approval is as follows:

Increased discharge of minewater effluent to prevent flooding during the spring melt.

This Notice shall constitute part of the approval issued under Certificate of Approval No. 8572-4L8GYF dated July 6, 2000.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Appeal Board
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* **Further information on the Environmental Appeal Board's requirements for an appeal can be obtained directly from the Board at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 4th day of April, 2001

THIS IS A TRUE COPY OF THE
ORIGINAL NOTICE MAILED
ON April 11, 2001
SIGNED

Mohamed Dhalla, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

KD/
c: District Manager, MOE Timmins
Andre Perreault, Kinross Gold Corporation ✓

APPENDIX C

GROUNDWATER MODELLING FOR HOLLINGER AND MCINTYRE MINE DEWATERING

Memo

To	**Dave Simms, Simon Gautrey**	File no	**TC81525**
From	**Jacob Zaidel**	cc	**Dave Bucar, Peter Andrews (Goldcorp)**
Tel			
Fax			
Date	**September 2010**		

Subject **Estimating Pumping Rates Required for the Dewatering of Mine Workings at the Hollinger-McIntire Mine Sites in Support of the Hollinger PTTW Application**

Introduction

The following memo describes the approach used to estimate pumping rates required to dewater the Hollinger-McIntire mine workings. The following two water inflow components were taken into account in these estimates: (1) water released from storage in the existing mine workings; and (2) groundwater seepage into the workings. Computation of both components is discussed below. Note that potential water inflows into the mine workings associated with short term surface run-off and direct precipitation events were not taken into account in these calculations. Groundwater seepage rates do, however, take into account average annual precipitation rates as input into the groundwater regime.

Water Released from Storage

The amount of water released from storage in the existing mine workings due to their dewatering was calculated based on stage-storage curves (Figure 1). These curves were developed using the 3D block model data provided by Goldcorp to AMEC in 2007. This block model includes information on the spatial distribution and volume of the existing mine workings from an elevation of 350 mASL down to the -248 mASL level. According to these data the total void space of the mine workings (excluding backfill) located within this elevation interval is 40,573,862 m^3. The following additional assumptions were utilized in the calculations:

- Total backfill volume was assumed to be 673,946,364 ft^3 (18,870,498 m^3) based on the information provided by Golder (1997). Backfill material was assumed to be uniformly distributed within the existing mine workings;

- Spatial variations of the water levels in the mine workings were neglected, i.e., increased pumping from the McIntyre #11 Shaft is assumed to result in the instantaneous reduction of water levels throughout the entire network of the interconnected mine workings; and,

- Current water level in the mine workings was assumed to be about 304 mASL, based on the water levels recorded in the McIntyre #11 Shaft.

According to the curve, representing the mine void volume corrected for backfill (Figure 1) the net volume of water in the mine, corresponding to the current elevation of 304 mASL is about 20,525,900 m^3. Similar net volumes, corresponding to other elevations, calculated as 304 mASL minus the prescribed change in the water levels due to the mine dewatering, can be obtained from the same curve. Pumping rates associated with water released from storage are calculated as a change in net void volume corresponding to two different water levels divided by a time-period over which the prescribed water level decline is expected to occur.

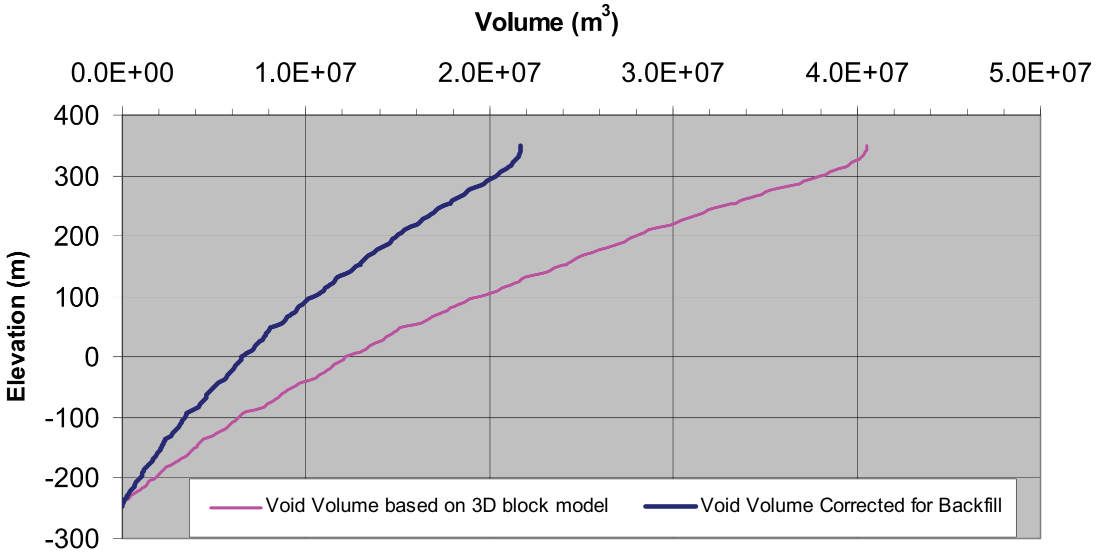


Figure 1: Mine Workings' Volume vs. Elevation

Groundwater Seepage into the Mine

Groundwater seepage rates into the existing mine workings and proposed open pits (Central Pit, Millerton Pit and 92 Pit) were estimates using a numerical (MODFLOW) three-dimensional groundwater flow model. Prior to using this model as a predictive tool it was calibrated to the following targets:

- Water levels in 32 observation wells screened in the overburden and bedrock;
- Observed water level in Gillies, Clearwater and Charlebois Lakes;
- Reported daily average pumping rate of 1,200 to 1,900 m^3/d from the McIntyre #11 Shaft, required to maintain its water level at the elevation of about 304 mASL; and,
- The reported historic pumping rate of about 3,800 to 7,600 m^3/d (1,000,000 to 2,000,000 US gallons per day) from the Hollinger and McIntyre mine workings (Golder, 1997).

The details of the Hollinger groundwater flow model development and calibration are presented in the attached AMEC (2009) report. Two predictive variants were simulated by the model: (1) the base case scenario, corresponding to the "best-fit" combination of the model input parameters and (2) a more conservative variant with the increased hydraulic conductivity of rock a depth of 140 to180 m (AMEC, 2009). Simulating both variants in a transient mode over a period of seven years, corresponding to the various stages of excavation, it was assumed that the water level in the underground openings is maintained at the elevation of the pit bottom minus 20 m. Figure 2 shows model predicted seepage rates into the proposed pits, main access ramp and the remaining mine workings (i.e., mine workings located outside of the proposed pits' perimeters and below their bottoms).

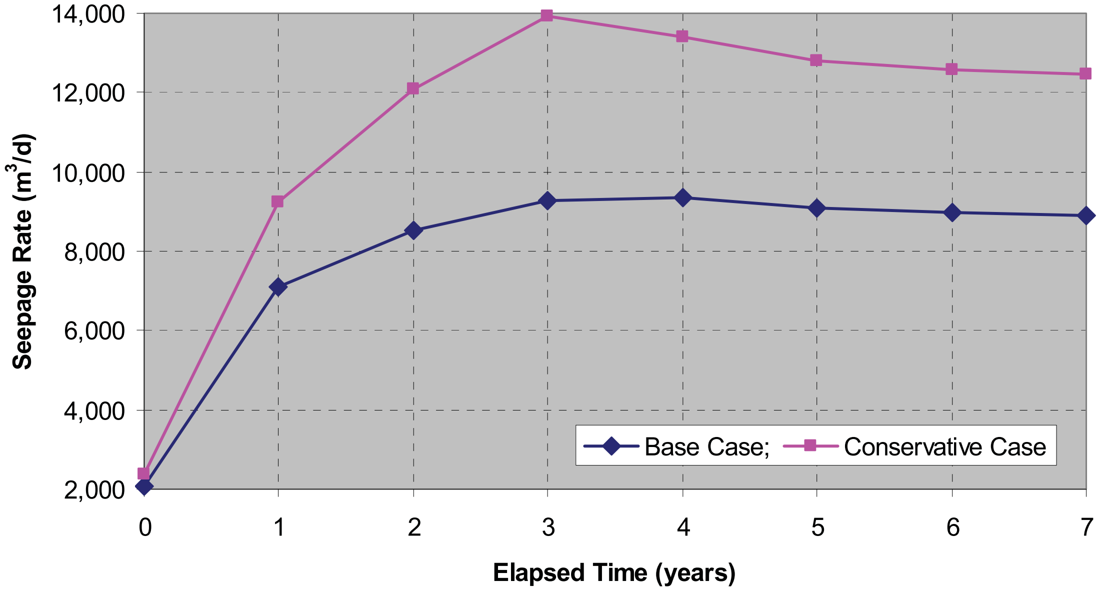


Figure 2: Hollinger Model Predicted Groundwater Seepage Rates

According to the simulated base case scenario, the total groundwater seepage is expected to reach a maximum of about 9,400 m^3/d after the third year of excavation and then gradually to decline to about 8,900 m^3/d at the end of the seventh year. The simulated conservative scenario shows significantly higher seepage rates, compared with the base case scenario. For example, the total seepage rate the end of year seven is predicted to reach 12,400 m^3/d compared with the rate 8,900 m^3/d for the Base Case Scenario (Figure 2).

References

AMEC Earth & Environmental Limited, 2009. Hydrogeological Assessment in Support of PTTW and C. of A. Application for the Hollinger Project.

Golder Associated Ltd., 1997. Report on Timmins Mine Water Study, 97-1201.

GOLDCORP CANADA LTD.
HOLLINGER PROJECT

HYDROGEOLOGICAL ASSESSMENT IN

SUPPORT OF PTTW AND C. of A. APPLICATION FOR THE HOLLINGER PROJECT

Submitted to:

Goldcorp Canada Ltd. – Porcupine Gold Mines
4315 Gold Mine Road, P.O. Box 70
South Porcupine, Ontario
P0N 1H0

Submitted by:

AMEC Earth & Environmental
a Division of AMEC Americas Limited
160 Traders Blvd. E., Suite 110
Mississauga, Ontario
L4Z 3K7

September 2010
TC 81525

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1.0 INTRODUCTION

Porcupine Gold Mines (PGM), a joint venture between Goldcorp Canada Ltd. (51%) and Goldcorp Inc. (49%), (Goldcorp), is planning to redevelop the former Hollinger and McIntyre Mine area, in Timmins, as a new open pit and underground (UG) mining complex (Figure 1). The open pit complex would involve the sequential development of four staged phases that would be used to access shallow ore zones within 200 to 250 metres (m) of the ground surface. The UG portion of the mine complex would involve the development of two new UG ramps and associated future shafts that would be used to access deeper ore zones.

The four staged pit phases are generally referenced as the 92 Pit, the Millerton Pit, the Central Pit, and the Vipond Pit (Figures 1 and 2). The UG operations would consist of the Millerton and Central Porphyry Zone (CPZ) operations. Ramps developed at the Millerton and CPZ locations would be developed to approximately 400 m below grade. Mining beyond that point would likely involve shaft mining, potentially using the existing Hollinger No. 26 Shaft to develop the Millerton UG, and the McIntyre No. 11 Shaft to develop the CPZ UG. Ramp development and associated UG exploration would be used to confirm UG ore resources, and the viability of UG mining.

The former Hollinger and McIntyre Mines both support extensive historic and interconnected UG workings that extend to a maximum depth of more than 2,000 m below surface, and both mine sites are currently in a state of closure. To manage mine water levels in the area, Goldcorp currently pumps water from the McIntyre No. 11 Shaft to Little Pearl Tailings Pond (LPTP). Pumping generally occurs at a rate sufficient to maintain the water table in the McIntyre site UG workings at a position approximately 25 m below grade, and at more distant southern locations, near the Shania Twain Centre, at a level of about 10 m below grade. Pumping in this manner prevents groundwater from the UG workings, from breaking surface in an uncontrolled fashion, and allows the groundwater to be managed at one location – LPTP.

Water management at the sites is carried out in accordance with the terms and conditions specified in Amended Permit to Take Water (PTTW) 0248-6UJMBL, dated October 13, 2006; and in Amended Certificate of Approval (C. of A.) 8572-4L8GYF, dated July 6, 2000, as amended by Notice No. 1, dated October 13, 2000, and Notice No. 2, dated April 4, 2001.

PTTW 0248-6UJMBL allows pumping at a maximum rate of 13,402 cubic metres per day (m^3/d) from the McIntyre No. 11 Shaft, and 1,000 m^3/d from the Hollinger No. 26 Shaft. C. of A. 8572-4L8GYF provides for pumping groundwater from the McIntyre No. 11 Shaft to a silt-curtain enclosed area on the north side of LPTP.

To manage groundwater associated with future, planned mining operations, mine water from the McIntyre No. 11 Shaft would initially be pumped at a greater rate of up to 40,000 m^3/d for approximately the first 2 years of operations, and at a lesser rate of up to approximately 25,000 m^3/d thereafter, until mining operations are completed over a period of up to approximately 15 years, depending on whether or not UG operations proceed. Water pumped from the McIntyre No. 11 Shaft will contain suspended solids, residual ammonia from the use of ammonium-nitrate based blasting agents, reduced iron (Fe^{2+} state), and lesser quantities of other heavy metals.

To better manage the mine water discharge, the current point of discharge into LPTP would be shifted from the north side to the northwest end of the pond. The entire pond would then be used for mine water treatment. Water treatment in the LPTP would be assisted through the use of flocculants and silt curtains (or rock fill berms), as required to promote the settlement of total suspended solids (TSS). Residual ammonia would be managed through the use of emulsion, or emulsion blend explosives, as required to control soluble ammonia residuals at source.

The outflow from LPTP would be reconfigured from its current condition of a single 36-inch diameter culvert without controls, to the use of a thin-plate, concrete weir, connecting to a single larger concrete box culvert, sufficient to provide for the continuous measurement of flows from the treatment works to an accuracy of ±15% in accordance with Ontario Regulation (O. Reg.) 560/94.

The purpose of this submission is to support application for amendments to PTTW 0248-6UJMBL and C. of A. 8572-4L8GYF, to allow for increased mine water pumping rates, and the treatment of such water, as described above. Copies of the current PTTW and C. of A. are included as Appendix A.

1.1 Site History

The Hollinger gold deposit was discovered in 1909, as one of the three original major Timmins properties, along with that of the Dome and McIntyre Mines. The main Hollinger Mine operated from 1910 to 1968 and further mining took place in the 1970's and 1980's. The Hollinger, McIntyre and Coniaurum underground mine workings are all interconnected, along with those of a number of other smaller mines in the area.

Because of their connection to the McIntyre Mine, the Hollinger underground workings were kept dry while McIntyre operations continued until 1988, when the McIntyre Mine was shut down. The pumps at Hollinger and McIntyre Mines were shut down in 1991, and the underground working allowed to flood. A surface pump was installed in the McIntyre No 11 Shaft in 2000 and currently the upper mine levels are dewatered to a level ranging between 24 to 34 m below ground surface (mbgs), to help manage near-surface groundwater levels in the area. Mine water from the Hollinger, McIntyre and Coniaurum Mines is managed through the McIntyre No. 11 Shaft, with discharge to Little Pearl Tailings Pond. The McIntyre Mine operated from 1911 to 1988.

1.2 Project Overview

Goldcorp, through PGM, is planning to develop the Hollinger Project by redeveloping the former Hollinger and McIntyre Mines area as a new open pit and UG mining complex. The open pit complex would involve the sequential development of an open pit, through a series of phased pushbacks that would be used to access shallow ore zones within 200 to 250 mbgs. The UG portion of the mine complex would involve the potential development of two new UG ramps and associated ventilation raises that would be used to access deeper ore zones (Figure 1.2).

Development of the new Hollinger Project would require comparatively limited new infrastructure, as ore from the Project Site would be hauled to and processed at the existing Dome Mill, with tailings from ore processing to be discharged to the existing Dome Mine tailings deposition area.

The UG operations would consist of the Millerton and Central Porphyry Zone (CPZ) UG operations. Ramps developed at the Millerton and CPZ locations would be developed to approximately 400 mbgs. Mining beyond that point would likely involve shaft hoisting. Opportunities to use existing infrastructure for the deeper mining could potentially involve using the existing Hollinger No. 26 Shaft to develop the Millerton UG, and the McIntyre No. 11 Shaft to develop the CPZ UG. Ramp development and associated UG exploration would be used to confirm UG ore resources, and the viability of UG mining.

Under the current open pit design, there would be a requirement for the disposal of approximately 37,000,000 m^3 of mine rock. The majority of the mine rock (estimated at 20,000,000 to 30,000,000 m^3) would be retained on the Hollinger Project Site and would be used to backfill and overfill the initially excavated phased mine pits. Rock will also be used to build the Environmental Control Berm and the Transportation Corridor with the remainder being stored at the Dome Mine site.

Infrastructure used and/or developed to support the Hollinger Project would include:

- At the Hollinger Project Site:
  - permanent mine rock and overburden stockpiles;
  - site water collection and drainage systems (if required);
  - potentially some small fuel and petroleum product storage facilities (if required);
  - electrical connections from nearby, currently in place, Hydro One infrastructure; and,
  - natural gas (if required) from nearby, currently in place, Union Gas infrastructure.

- Off the Hollinger Project Site:
  - the approximately 4.8 km long Transportation Corridor linking the Hollinger Project Site with the Dome Mill;
  - potentially additional mine rock stockpiles (at the Dome site) (if required); and,
  - mine dewatering system from McIntyre No. 11 Shaft to Little Pearl Tailings Pond.

In addition, the Project would include the construction of an Environmental Control Berm around the Hollinger Project Site. This is a key feature of the Project with the main purpose of the Environmental Control Berm being to manage noise and other effects on nearby receptors.

Throughout the operations phase, mine rock material would be used to progressively backfill the phased mined pits. At closure, the remaining pit will be allowed to flood, and the pit discharge will likely be routed by gravity flow south to either the Skynner Creek or Perch Lake systems, both of which drain to the Mountjoy River. All remaining Project infrastructure would be removed at closure, and the Project Site would be rehabilitated in accordance with established mine closure protocols. In addition, closure will be carried out such that existing safety hazards would be removed. Part of the Closure Plan would be to ensure, through stakeholder input and working collaboration with the

City of Timmins' Planning Department, that the Project Site would be landscaped in an aesthetically pleasing manner.

1.3 General Setting

The Timmins area is characterized by a mix of urban and industrial development superimposed on a background of coniferous and mixed deciduous coniferous boreal forest. The City of Timmins consists of a major downtown urban area, as well as a number of other smaller urban centres scattered throughout the area, with Schumacher, South Porcupine, and Connaught Hill being the more prominent of these smaller centres. Various other smaller hamlets also occur throughout the area, such as Gold Centre, the Aunor, Buffalo-Ankerite and Delnite areas, and several other small clusters of residences. Many or most of these communities have grown up around former mine sites. All of these areas, together with a much larger surrounding region, were amalgamated in 1973 to form the City of Timmins.

The City of Timmins provides municipal water to area residents within the city, and only a few residents in outlying areas rely on private wells for their water supply.

South Porcupine and other communities to the east are linked to Timmins by Highway 101, with a commercial strip occurring along this highway between downtown Timmins and Schumacher. Highway 655 extends north from Highway 101, with linkages to the Timmins airport via Airport Road, and linkages further north to Xstrata Copper's Kidd Mine site and Highway 11. Several major transmission, gas, water, and sewer lines pass through the area, as well as local services.

Timmins was founded as a mining centre, with the three prominent original mines being the Hollinger Mine, the McIntyre Mine, and the Dome Mine. Of these, only the Dome Mine is still in operation within the study area. Numerous other smaller mines also operated in the local area; many of which were or became linked to the three major mines at one time or another. None of these smaller mines are currently active. Above and below grade tailings, associated with these active and former mine sites, are widespread throughout the study area (Figure 1.1). Prominent waste rock stockpiles are associated with the Dome Mine. There is little evidence of waste rock stockpiles associated with the other mining operations, because all the mines, except for the Dome open pit operation, were underground mines. Waste rock produced by these underground mines was typically used as material for construction and backfill operations.

Topography in the Timmins area is dominated by its location at the transition of Precambrian Shield terrain to flat-lying glaciolacustrine silt and clay plains. An extensive glaciolacustrine sand plain area lies to the south of Timmins, including dune formations, and extends into the lower, southwest portion of the study area (Figure 1.3). A prominent esker system extends immediately adjacent and parallel to the east side of Highway 655, north from Highway 101. The local topography reaches a maximum elevation of about 365 m above mean sea level (amsl) in the area just southeast of the Hollinger site and north of Gold Mine Road. Further east towards South Porcupine, and within the glaciolacustrine silt and clay plains, the local topography decreases to as little as 280 m elevation.

The bedrock geology of the Timmins area is structurally complex, and includes several major fault zones, and anticline / syncline systems, many of which control surface topographic expressions. The Pearl Lake / Little Pearl Tailings Pond, and the Gillies Lake area are controlled by these features, and as a result are the site of deeper sediment accumulations. Bedrock exposures are widespread and frequent throughout the major portion of the study area, but with much reduced expression in the areas dominated by glaciolacustrine silt, clay and sand plains.

Several small lakes and numerous ponds are scattered throughout the area, with larger numbers of ponds having formed along low gradient creek valleys as a result of beaver activity. Most of the area's drainage is captured by the Porcupine and South Porcupine Rivers, which flow east, converging just upstream of Porcupine Lake, northeast of the Dome Mine site. The Porcupine River is a low gradient system that has its headwaters in the area just north and east of the Hollinger site. The Porcupine River drains into Night Hawk Lake and the Frederick House River system. Areas south and west of the Hollinger site drain to either the Skynner Creek or Perch Lake systems, both of which drain to the Mountjoy River, which flows into the Mattagami River. Areas north and west of the Hollinger site drain to Gillies Lake and the Town Creek system, which drains to the Mattagami River; or slightly further north there are a number of smaller drainages that drain directly west to the Mattagami River.

Virtually all drainages in the area have been affected by existing or past mining activities, which have affected water quality, and to a lesser extent drainage patterns themselves.

The majority of the landscape that has not been developed for urbanization or mining remains in forest cover, with the exception of principal agricultural areas to the north and south of Timmins, near to the Mattagami River, and a number of smaller parcels of land in and around the Porcupine Lake area. Forest communities in the area are virtually all second growth as a result of past logging activities, and fires. Throughout the generally lower-lying, eastern portion of the study area, forest communities are dominated by varying mixtures of black spruce and poplar (trembling aspen and balsam poplar), with white spruce, jack pine, balsam fir, larch and white birch as common associates. Central portions of the study area, where rock outcroppings are common, show similar forest community types, but with a somewhat stronger representation of jack pine. Sandy areas north of Gillies Lake bordering Highway 655, and south and west of the Kayorum (Hollinger) tailings stack, show a dominance of jack pine, or jack pine with poplar. The abundance of poplar in the area is indicative of the level of past disturbance, as poplar species are typically successional and not characteristic of mature forest communities. Virtually all major forest blocks are transected by roads, transmission lines, trails, or other such linear features.

1.4 Spatial and Temporal Boundaries

To encompass potential development areas and immediate drainages there from, including potential developments associated with earlier, more aggressive mine development scenarios which are no longer contemplated, Local Study Area (LSA) boundaries for natural environment investigations were focused on watershed and riverine boundaries, with the exception of the northwest study area boundary, which was defined by Laforest Road and a narrow strip of land bordering the east side of Highway 655 (Figure 1.1).

1.5 Study Objectives

The main objectives of this study were to provide:

- A characterization of the existing groundwater conditions (flow direction, velocities and ultimate discharge points [i.e., receivers]);
- A conceptual and numerical model of the proposed mine;
- A prediction of potential effects of dewatering on the local groundwater flow system as a result of pit expansion;
- Identify conceptual mitigation plans and strategies; and,
- Support for the application for a PTTW and C. of A. for dewatering.

2.0 METHODS

This hydrogeological assessment builds upon both historical hydrogeology studies and work undertaken by AMEC in 2007 and 2008 to infill data gaps identified in the pre-feasibility studies. The above information was used to develop a numerical groundwater model. The model was correlated to historical dewatering data from the historical mine and to current conditions, and then used to predict groundwater inflows into the proposed mine.

2.1 Existing Data Sources

Existing data sources which can be used to characterize Timmins area hydrogeological conditions include:

- Detailed topographic mapping (Lidar imaging) conducted for the Timmins area for Goldcorp during 2006, with contour intervals at 0.3 m elevation;
- Historic pumping records – McIntyre Porcupine Mines Limited (1967);
- Historic Pumping records for the Dome Mine;
- A summary of a geological interpretation developed by Panterra Geoservices Inc.;
- A Gillies Lake Geotechnical Report prepared by Golder Associates (1988) for the Timmins Gold Tailings Project;
- Exploration borehole data provided by Goldcorp including bedrock surfaces;
- Three dimensional data on the location of historical workings in a VULCAN model database;
- Water Well Records in the MOE database;
- Climatic statistics available from the Timmins airport;
- Timmins Mine Water Study (Golder, 1997);
- Timmins Mine Water Management Plan (Aquafor Beech Limited, June 2000); and,
- Storm Water Management Plan – Mine Water Discharge to Gillies Lake (Aquafor Beech Limited, September 2000).

The Lidar imaging was extremely valuable for delineating local watershed boundaries and conditions because of its digital format; high resolution coloured air photo background; and detailed contour mapping that can be manipulated to contour sets with detail down to 0.3 m.

The historic pumping records are useful as this information provides real data with respect to the volume of water that the bedrock aquifer produces under activity mining operations. These data were used to assist in model calibration in that these volumes have been extracted (historically) from underground without producing large scale dewatering of the numerous adjacent surface water features.

Existing geological and geotechnical data were used to help in characterizing the geological setting in the immediate vicinity of the proposed project and allow interpolation and extrapolation of the conditions observed during AMEC's field studies. This information was supplemented with information from water wells in the area obtained from the MOE Water Well Information System database. Goldcorp also provided a three dimensional interpretation of the local geology developed from an extensive data base of exploration holes and maps of the underground workings in a VULCAN geologic model format. This model was used to map the locations of the underground workings that are part of the former McIntyre and Hollinger Mines and provided a bedrock surface map.

The Timmins airport climatic station meets World Meteorological Organization (WMO) standards for temperature and precipitation, and includes a nearly complete set of climatic parameters necessary for inputs required for the hydrogeological modeling, and is therefore regarded as a quality climate station.

The Timmins Mine Water Study, Water Management Plan and Storm Water Management Plan provide an understanding of the interaction between the existing mine workings, the watersheds and the current dewatering efforts.

2.2 Identified Data Gaps

In 2007, AMEC conducted an initial review of existing information to identify potential data gaps. Historically, a number of monitoring wells were installed in various locations around the Hollinger site as part of different projects. These wells were installed near the west end of the proposed pit complex to assist in the investigation of a series of near surface mine workings, and to the north of the east end of the proposed works associated with McIntyre Mine site and tailings impoundments. The logs of these wells were reviewed to assist in development of the hydrogeological model for the site and surrounding area. The majority of these wells were installed in the overburden deposits and presented a data gap as to the bedrock conditions.

In addition to available borehole logs, Water Well Records in the MOE database were also reviewed (Appendix C). Most of these wells were completed in either the overburden or the shallow bedrock and provided little information on the deep bedrock.

Based on the data requirements to assess hydrogeological conditions at the site, AMEC developed an initial work program in 2007 to address the following data gaps:

- Deep bedrock conditions in the vicinity of the proposed workings (limited borehole and monitoring well data);

- Potential for fault/shear zone controlled features in the bedrock;

- Hydraulic conductivity of rock formations;

- Horizontal and vertical extent of overburden deposits (limited borehole and stratigraphic data);

- The existing Zone of Influence related to the current, ongoing dewatering efforts associated with the existing mine workings and the mine water management plan; and,

- Potential for significant hydraulic connection with surface water features in close proximity to proposed mine workings.

In order to address these data gaps AMEC worked with Goldcorp personnel to select accessible, representative locations for intrusive investigations of each of the overburden, shallow bedrock and deep bedrock aquifers. Special consideration with respect to the location of the existing underground workings was made during location of the deep bedrock aquifer instrumentation to ensure that these voids were not intercepted.

2.3 2007 Drilling and Monitoring Well Installation Program

Based on a review of the available information, AMEC prepared a drilling and monitoring well installation program that included drilling at a total of 13 locations around the proposed pit complex area in 2007 (Figure 2.1). The 2007 program included packer testing and the installation of multi-level monitoring wells in order to:

- Determine the composition and extent of the overburden and bedrock deposits;

- Characterize aquifer conditions and properties; and,

- Provide information as to the existing or potential for interference with surrounding land use and/or surface water features.

The overburden and shallow bedrock aquifers were investigated through the use of a track-mounted, standard soils auger drilling rig, equipped with split-spoon sampling and NQ bedrock coring equipment and capabilities provided by Marathon Drilling Limited. Soil samples were collected via the split-spoon sampling equipment throughout the overburden deposits on 0.76 m intervals and bedrock coring and samples were completed continuously throughout shallow bedrock in 1.5 m runs. The four deep bedrock aquifer boreholes were completed using a truck mounted water well drilling rig, supplied by Davidson Well Drilling, using 150 mm diameter dual rotary drilling technology, to depths between 134 and 183 m below.

In accordance with O. Reg. 903, AMEC retained licensed water well drillers to complete the installation of all monitoring wells. Following drilling and sampling, the boreholes were instrumented with 50 mm ID PVC monitoring wells complete with 3 m screened interval (#10 slot screen) set at the borehole base. The monitoring wells were completed with a solid PVC riser casing, including an above ground allowance of approximately 1 m, and the casing annulus was sealed using a granular bentonite and drill cuttings backfill mix. A lockable steel protective post was installed over the PVC casing and grouted into place to ensure secured access and that these wells could serve as long-term monitoring stations.

Well construction details for the monitoring wells are included in the borehole logs provided in Appendix B. The locations of these monitoring wells are provided in Figure 2.1.

In order to characterize the hydraulic properties of the bedrock aquifer in the vicinity of the proposed mine development AMEC conducted packer testing and slug testing of the bedrock holes located around the perimeter of the proposed open pit complex. The packer testing program involved the testing of bulk hydraulic conductivities of the entire open borehole for the shallow bedrock holes (Marathon Drilling Limited), as well as targeting discrete fractured intervals and other zones of hydraulic significance (i.e., weathered versus unweathered zones, etc). A number of other bulk tests covering certain intervals of the holes were also completed. The deep bedrock holes were subjected to continuous packer testing on 20 m wide intervals over the entire depth of the hole (Davidson Well Drilling). The data were used assist in the development of a representative computer model.

2.4 2008 Pearl Lake Drilling Program

A preliminary groundwater numerical model was constructed using information from historical sources and the 2007 field program. Because of the proximity of the proposed pit complex to LPTP and Pearl Lake, the model was determined to be sensitive to the type of geologic materials assumed to be present under the lake. To reduce the uncertainty in the model, additional drilling was completed on Pearl Lake in March 2008 using a drill rig driven onto the frozen lake.

The 2008 Pearl Lake drilling was conducted by Marathon Drilling Limited under AMEC supervision following a methodology similar to that of the 2007 drilling program, although in this case, no monitoring wells were installed. The 2008 program included three boreholes drilled to depths of 4.3 to 6.4 m below the lake bottom. For each borehole, the geologic material below the organic lake bed was continuously split spoon sampled to obtain a continuous log of the lake bed material. The logs of these boreholes are included in Appendix B.

2.5 2008 Stream Flow Measurement Program

Stream flow measurements were begun in 2008 at three stations with the Local Study Area, with the aim of establishing rating curves for subsequent stream flow monitoring. The locations of the stream flow measurement stations are shown in Figure 3.1. Stream flow measurements have been taken in the early winter of 2009, in the spring of 2009 and early summer of 2009. The results of the stream flow monitoring are described in Section 3.1.

3.0 SITE CHARACTERISTICS

3.1 Surface Water and Drainage

Watersheds that could potentially be affected by project related developments are shown in Figure 3.1. Potentially affected watersheds are defined to include those that could be affected by mine water discharge, runoff from possible waste rock stockpile areas, and Hollinger pit discharge at closure. The Hollinger site itself is located at the apex of three watersheds, namely those of the Porcupine River to the east, Skynner Creek to the southwest, and the Gillies Lake / Town Creek system to the northwest. The precise delineation of watershed boundaries in the immediate Hollinger site area is difficult, even with the benefit of 0.3 m Lidar contour intervals, because of extensive open-pitting and underground stope breakthroughs in this area. Gillies Lake is connected to Town Creek by way of a buried pipeline outfall that flows north from the lake.

Boundaries of a number of other LSA watersheds have also been influenced by past mining operations. This is especially true of areas in the vicinity of the Kayorum, McIntyre, ERG, Delnite and Dome tailings areas, as well as areas affected by the Dome open pit and waste rock stockpiles.

Porcupine River System

The dominant watersheds draining the area surrounding the Hollinger site area are those of the Porcupine and South Porcupine Rivers, which to the point of their confluence just west of Porcupine Lake, measure 32.0 km^2 and 42.7 km^2, respectively (Figure 3.1). Beyond their confluence, these two systems pass into the southwest end Porcupine Lake. From Porcupine Lake, the Porcupine River flows in a north-northeasterly direction, looping around the Kidd Metsite tailings areas, before turning south to Night Hawk Lake, and the Frederick House River system. The North Porcupine River, which drains the northern portion of the ERG tailings area and adjacent areas north of the Porcupine watershed boundary shown in Figure 3.1, enters the main branch of the Porcupine River near the northwest margin of the Kidd Metsite tailings. Near where the Porcupine River crosses Highway 101, at Hoyle, just upstream of its confluence with Night Hawk Lake, Environment Canada maintained the Porcupine River WSC flow gauging station (04MD004) from January 1977 to September 1994. The station was re-established in 2008.

Headwaters of the Porcupine River drain LPTP, Pearl Lake, Clearwater Lake, and the southern portion of the ERG tailings area. Current underground pumping at the McIntyre #11 Shaft headframe discharges to LPTP, and hence to the Porcupine River. Water quality within the Porcupine River is influenced by past mining activities, as is the water quality of virtually all other watersheds shown in Figure 3.1, except those of the Perch Lake system and the series of smaller creeks shown in the northwest portion of the figure.

The Porcupine River is a low gradient system, with the river mainstem, downstream of Pearl Lake exhibiting a gradient of 0.44 % (i.e., a drop of 4.4 m vertical per 1,000 m horizontal). The river flow and that of its tributaries is interrupted by numerous beaver dams, both active and historic. The elevations of LPTP (313.2 m amsl) and Pearl Lake (313.0 m amsl) are important to future considerations involving the re-flooding of the Hollinger open pit, at mine closure, because both of these water bodies exhibit elevations which may, or may not be above any future pit lake water level.

The South Porcupine headwaters drain McDonald and Simpson Lakes, as well as the existing Dome tailings containment facility, and the Dome waste rock storage area (Figure 3.1). South Porcupine River characteristics are similar to those of the Porcupine River, being characterized by a mainstem gradient of 0.33 % (3.3 m vertical drop per 1,000 m horizontal), and numerous beaver dams.

Skynner Creek and Perch Lake System Watersheds

Skynner Creek originates at Skynner Lake in the extreme southeast of the watershed, but also drains the southern portion of the City of Timmins proper and the Kayorum tailings area. Its watershed measures approximately 13.4 km^2 (Figure 3.1). The northeastern portion of the watershed has been strongly altered by the Kayorum tailings area, and by headwater channelling to the north in the vicinity of the Hollinger Golf Club. Skynner Creek drains to the Mountjoy River, which flows into the Mattagami River. This creek is also a low gradient system, being characterized by a mainstem gradient of 0.54 % (5.4 m vertical drop per 1,000 m horizontal), and numerous beaver dams.

Skynner Creek is of interest to the Hollinger project from three perspectives. First, the southernmost portion of the Hollinger site drains south to the Skynner Creek system. Second, much of the Skynner Creek drainage system passes through terrain dominated by glaciofluvial sand deposits. Hence, there is the potential for stronger surface water / groundwater interconnections in this area. And third, because of its lower elevation, it would be possible to induce gravity flow from a future flooded Hollinger pit (following mine closure) to the Skynner Creek system.

The Perch Lake system is a smaller drainage system, located adjacent to the Skynner Creek watershed, which also flows to the Mountjoy River. Similar to the Skynner Creek system, much of the Perch Lake watershed is founded on glaciofluvial sand deposits, and therefore potentially exhibits a strong surface water / groundwater interconnection. Similar to the Skynner Creek system, the Perch Lake system is positioned at a lower elevation such that it would also be possible to induce gravity flow from a future flooded Hollinger pit (following mine closure) to the Skynner Creek or Perch Lake systems.

Town Creek and Smaller North Mattagami River Watersheds

The Town Creek system drains Gillies Lake, low gradient tailings areas to the east of Highway 655, and significant portions of the City of Timmins proper (Figure 3.1). The connection between Gillies Lake and Town Creek is subsurface, by way of a buried pipeline that exits to the Town Creek drainage system in the area of Murray Street Park. The low gradient tailings to the east of Highway 655 (the Hollinger tailings) were reportedly deposited in the former northeastward extension of Gillies Lake during the 1920's and 1930's (Kees Pols per. comm., Mattagami Region Conservation Authority, October 5, 2007). A small portion of these tailings are partially sulphide concentrate tailings and are therefore potentially acid generating. Management of these tailings is being addressed through a separate closure plan.

Past consideration has been given to draining Hollinger Mine workings to the Gillies Lake / Town Creek system. However, concerns over the potential flooding of portions of the City adjacent to lower reaches of the Town Creek system argue against this proposal, and against directing passive drainage from any future flooded Hollinger pit lake (after mine closure) to the Town Creek system.

In addition to Town Creek, there are four other smaller watersheds that drain the area west of Highway 655 and north of the Town Creek system. All of these smaller watersheds drain directly or indirectly (through Craft Creek) to the Mattagami River. These smaller watersheds are included in the LSA for the sole reason that consideration was given to stockpiling waste rock in the area west of Highway 655 and north of the Timmins hospital. Further considerations argued against using this area for waste rock storage, hence no specific efforts have been directed at characterizing these smaller watersheds, other than to define their boundaries.

Stream Flow Monitoring

AMEC began conducting stream flow monitoring at three of the watersheds in 2008 as part of the long term strategy to develop rating curves for the local streams. The locations of the stream flow monitoring stations are shown in Figure 3.1. To date there have been up to four stream measurements at these locations (Table 3.1). Additional stream flow measurements will be required to develop a rating curve for each station. While all the stream flow measurements have generally occurred in periods of higher flow, they are listed here to provide an indication of the range of flows that might be expected in the watersheds.

Flows for the different systems were sometimes carried out at different days within the same approximate time periods, under sometimes differing hydrological conditions (e.g., rain events). It is therefore premature to draw any conclusions from this limited data set regarding comparative watershed yields.

3.2 Overburden

As described in Section 2.2, gaps in the existing overburden data set were addressed through the advancement of 13 multi-level monitoring wells, surrounding the proposed pits and three boreholes into the bed of Pearl Lake.

The overburden geology generally consists of glacial deposits, overlain in places by thin peat deposits and fill (mostly mine tailings).

Generally, the oldest overburden unit in the area is the Matheson boulder-sand-silt till, which is typically found overlying the bedrock surface in depressions in the bedrock surface. The deposition of the till took place beneath the Wisconsin ice sheet, along with sand and gravel esker deposits. A significant esker deposit is located in the northern part of the study area running parallel to Highway 655.

The Wisconsin ice front retreated to the north approximately 10,000 years ago. As the glacial front receded, pro-glacial lake Barlow-Ojibway formed in front of glaciers. Meltwaters from the glacier carried significant quantities of material into the glacial lake. Silty sands and gravels were deposited in ice contact and outwash deposits in front of the receded glacier at locations where the meltwater discharged to the lake creating a variable distribution of coarse grained material.

Away from the meltwater discharge points, significant quantities of silt and clay were deposited as a blanket across the region in low-lying areas as either varved or massive silt and clay deposits. This includes the lake bed sediments of Gilles Lake, which is located within the mapped lacustrine plain, and which is reported to be composed of clay and silt (Klohn-Crippen, 1998 and SENES, 2007).

In general, the esker complex formed before the silts and clays were deposited, and consequently the silts and clays tend to overlie portions of the esker sands and gravels. However, deposits of sand can be found over the clay as a result of erosion and reworking of the esker and ice-contact deltas. This may have occurred beneath Pearl Lake. Finally, with time, peat and organic soils have formed in shallow wet areas.

In historical times, significant thickness of fill material, mostly in the form of mine tailings and waste rock has been placed in the area (Figure 1.1). The LPTP and to a lesser extent, Pearl Lake are reported to have tailings as bottom sediments in some areas (Golder, 1985).

The horizontal extent of these deposits is presented in plan view in Figure 3.2 and an overburden thickness map was derived from exploration borehole data along transects shown in Figure 3.3. In general, the overburden sediments are thin in the area of the proposed pits and areas east of the pits, where the overburden generally occurs as a thin veneer of till across and between areas dominated by bedrock highs. The overburden thicknesses increases to the west of the site into areas mapped as lacustrine plain sediments, which are likely underlain by older till and outwash sediments.

The thickest overburden sediments occur beneath the local lakes with overburden thickness reaching greater than 20 m beneath Gilles Lake and more than 60 m beneath Pearl Lake. The overburden geology in cross-section is illustrated Figures 3.4 and 3.5. The thick overburden sediments beneath Pearl Lake are interpreted to include a thin silt layer beneath the Lake, and thicker deeper silt layer at depth. The silt layers are interpreted to be separated and underlain by sand layers. The interpreted overburden sediments beneath Gilles Lake are also interpreted to include a significant silt layer based on surficial geologic mapping (Figure 3.5) and a reports by Klohn-Crippen (1998) and SENES (2007).

In the area of the proposed pits, the cross-sections show the overburden to be thin to absent. Thicker overburden sediments on the order of 3 to 8 m thick occur to the southwest of the proposed pits. Borehole logs and water well records from this area indicate that the overburden is primarily sand or gravel with silt at surface in some locations.

3.3 Bedrock

The Hollinger-McIntyre deposit is hosted by mafic volcanic rocks of the central and upper Tisdale assemblages that are intruded by porphyritic intrusions. Mafic volcanic rocks in the deposit have generally been divided into three units: the Northern, Central and Vipond Formations (Figure 3.6).

The Hollinger Mine historically was developed on gold bearing veins which are structurally controlled by lithologic contacts and deformation zones associated with altered Central and Vipond Formation volcanics. These units strike N55E and 70 SE, and are folded into an anticline. The Northern formation occurs in the core of Central Tisdale Anticline. The Central Formation hosts most of the major veins systems in the Hollinger and McIntyre mines. It is comprised of a heterogeneous sequence and the basal units in the Central Formation are the most important ore hosts in the deposit. The Vipond Formation is the youngest volcanic package in the deposit area (J. Floyd, email, Goldcorp Canada Ltd., September 24, 2007).

The lavas have been intruded by a group of porphyry stocks, the largest of which is the Pearl Lake Porphyry. The porphyries are generally conformable to the folds within enclosed rocks and plunge at 45 to 50 degrees E. The porphyry deposits occur in areas of bedrock depressions beneath the lakes, suggesting that they are softer and more prone to erosion than the mafic volcanic rock units that they intrude into.

The core of the Hollinger-McIntyre deposits is an elliptical area of high strain developed along the south limb of the Central Tisdale anticline which surrounds the Pearl Lake porphyry and is approximately 450 to 600 m wide by more than 3 km in length. The elliptical fold of Central Tisdale anticline contains a series of subsidiary folds including the Northern anticline, Hollinger syncline and the Hollinger anticline. The elliptical nature of this structure in plan is due to the non-cylindrical, doubly plunging properties that closes the structure to both the east and west.

3.4 Hydrostratigraphic Layers

Previous studies, as well as the current intrusive investigations characterized the Hollinger Mine site into six hydrostratigraphic units as outlined in Table 3.2.

This table summarizes the general stratigraphy in the study area; however, Units 1, 2 and 3 are not present or continuous across the entire site, and are absent in areas with bedrock highs, while Unit 2 occurs less frequently to the north.

3.5 Private Water Wells

The City of Timmins provides municipal water to local residents and businesses and there are few private water wells in the area. A search of the MOE Water Well Record database identified severl records within a kilometre of the site (Figure 3.7). Of these, two are likely geotechnical boreholes, two are likely pvc monitoring wells, and only three are listed a water supplies. Two of the water supply wells are large diameter, likely dug wells that are completed in the overburden at depths of 10 to 20 m (MOE 165673 to the north and MOE 1605674 to the southwest). The third is a 73 m deep drilled well completed in bedrock to the southwest of the site.

The static water level is only recorded for the deep bedrock hole which was completed in 1980 at a time when the historical Hollinger Mine was in operation. At this time, the static water level was approximately 12 m below ground level, which is similar the water levels collected in 2007 from monitoring wells installed as part of this program (Section 3.4) suggesting that the historical mine workings had little effect on the water level in this well.

3.6 Hydraulic Conductivity Test Results

In order to characterize the hydraulic properties of the bedrock aquifer in the vicinity of the proposed mine development AMEC conducted constant head packer testing in the four deep bedrock holes located around the perimeter of the proposed open pit in 2007 (BH07HO-03, BH07HO-05, BH07HO-09 and BH07HO-13), as well as in 10 of the shallow bedrock holes. Several monitoring wells subsequently constructed in the boreholes were also slug tested to provide additional information on the permeability of the bedrock.

The packer testing program involved testing of bulk hydraulic conductivities of the entire open borehole (for the shallow holes), as well as targeting discrete fractured intervals and other zones of potential hydraulic significance (i.e., weathered versus unweathered zones, etc). The packer tests in the shallow bedrock holes were completed using both single and double packer techniques with the test interval ranging from 3 to 9 m. The deep bedrock holes were subject to continuous packer testing, using the double packer technique for the open hole (uncased) interval with a 20 m interval. A summary of these estimations is provided in Table 3.3. Where similar intervals in the shallow bedrock were tested using both constant head and falling head methodologies, the results were generally similar.

Generally the results of hydraulic conductivity testing showed that the hydraulic conductivity of the rock was between 10^{-4} and 10^{-8} cm/s, with higher hydraulic conductivities (10^{-4} to 10^{-5} cm/s) reported in the shallow bedrock at most locations, presumably due to weathering or fracturing of the shallow bedrock. The presence of higher permeabilities near the surface of the bedrock also applied in areas with thick overburden conditions, such as BH-07-05 near Pearl Lake.

Testing in the deeper bedrock indicates that the hydraulic conductivity decreased by approximately two orders of magnitude within 10 to 20 m of surface, and generally displayed tight rock properties with hydraulic conductivities on the order of 10^{-8} cm/s until depths of approximately 100 m, but increased below this depth. The increase in hydraulic conductivity results at depths below 100 m was unexpected given that bedrock generally becomes tighter with depth and no drilling fluid losses or fractures were identified during drilling. Subsequent to the field program, it was determined that the packers were likely not sufficiently inflated to overcome the hydrostatic pressures, and therefore had an inadequate seal against the bedrock at depths of 100 m or more. As a result, these results of the packer tests were not considered representative of the bedrock at depth.

3.7 Monitoring Well Installations in 2007

Following completion of the packer tests, a monitoring well was installed in each of the boreholes completed in bedrock. In addition, a number of these instruments were twinned with shallower multi-level installations in either bedrock or overburden (if adequate depth of such materials permitted).

AMEC staff obtained water level data during the weeks of July 19, September 25, and November 12, 2007. A table of water level depths is provided along with the well screen installation depths (below existing grade) in Table 3.4. The seasonal groundwater fluctuations observed between the monitoring events is apparent in Table 3.4 and is on the order of 0.5 to 1.5 m for the monitoring period.

A map of the groundwater potentiometric surface was generated using groundwater levels from the shallow bedrock monitoring wells, the lake elevations and the water level elevation in the existing mine workings (Figure 3.8). The shallow groundwater table was generally found to be relatively shallow (i.e., within a few metres at most locations), indicating that the water table surface will closely follow the surface topography. The results indicate that there is a groundwater high in the area to the southwest of the proposed mine site and between Gillies Lake and Pearl Lake, with groundwater discharge to the lakes and Skyner Creek. There may also be one or more very localised cones of depression around the former open pits at the Hollinger mine that are presently being dewatered from the McIntyre Mine Shaft 11 to allow access to the upper part of the mine for tours.

The water level data in Table 3.4 also indicate that downward gradients were measured in the multi-level wells BH07HG03, BH07HG05, BH07HG09 and BH07HG13. The downward gradients are significantly stronger for the sites completed on high ground (BH07HG03 and BH07HG13) suggesting that much of the downward gradient at these locations can be explained by a “perched” water table forming in the upper weathered bedrock aquifer. However, small downward gradients were also measured in relatively low-lying areas (BH07HG05 and BH07HG09) that are close to surface water features (Pearl Lake and Skyner Creek) where upward gradients would be expected. The presence of downward gradients at these two wells might reflect a deep cone of depression associated with the existing mine workings that are partially dewatered.

Alternatively, the water levels in some deep groundwater monitors, which were completed in relatively tight bedrock material, may not be in equilibrium. As such the apparent downward gradients may change with additional measurements.

3.8 Groundwater Chemistry

As part of the November monitoring event, AMEC collected representative groundwater samples from 16 of the 18 monitoring wells installed on-site (two of the monitoring wells were dry). The groundwater monitoring wells were instrumented with dedicated Waterra tubing and foot valves to facilitate well development, purging and sampling requirements. The portion of the sample collected for metals analysis was field filtered using 0.45 micron inline Waterra filter, prior to preservation in the laboratory prepared bottles. In order to increase efficiency and for ease of labelling the laboratory prepared bottles AMEC shortened the boreholes names BH07HG-## to MW-## during the groundwater sampling program.

Samples were submitted under chain of custody, in a temperature-controlled setting (i.e., cooler on ice) to a CAEAL accredited laboratory sub-contractor, Maxxam Analytics (Maxxam), in Mississauga, Ontario for analysis. The analytical results were then forwarded to AMEC. Laboratory Certificates of Analysis are provided in Appendix C. As a quality assurance measure, laboratory blanks as well as two field duplicates (Dup-1 and Dup-2) were used to ensure sample integrity. Dup-1 is a field duplicate of MW-12 and Dup-2 is a field duplicate of MW-6. In general these sample show good correlation between samples and suggest that any errors or anomalous data is not likely attributed to field sampling or laboratory protocols.

A discussion of the various groupings of groundwater data is discussed in the sections below. Groundwater quality data are compared to Ontario Drinking Water Standards (ODWS), however, these guidelines are based on a potable water supply and thus do not directly apply to the baseline groundwater data. There are no groundwater users in the vicinity of these monitoring wells. The lab results for the groundwater samples are summarized in Table 3.4.

In general, the groundwater quality in the vicinity of the proposed Hollinger project is characterized by elevated concentrations of alkalinity, conductivity, hardness, sulphate, TDS and various metals including iron and manganese. Hardness and manganese exceed the ODWS for every monitoring well sampled during the fall 2007 monitoring event and are considered representative of background conditions for the area.

The lowest quality groundwater is quantified for monitoring wells locations MW-4, located near the LPTP. ODWS exceedences at MW-4 include alkalinity, dissolved organic carbon (DOC), hardness (10 times the average of the remainder of the samples), pH, sulphate (20 times the average of the remainder of the samples), total dissolved solids (TDS), cadmium, copper, iron, lead, manganese and zinc. These elevated concentrations are likely associated with previous mining activities on the subject site (i.e., a large amount of waste rock present on surface).

3.9 2008 drilling results from Pearl Lake

In March 2008, three boreholes were drilled into the lake bed at Pearl Lake to investigate the nature of the lake bed sediments in this area (Figures 3.3 and 3.4). Previously, exploration drilling indicated that the overburden in the area of Pearl Lake was up to 70m thick, and drilling results from BH07-HO05 drilled adjacent to the lake indicated that the deeper overburden sediments were sandy material potentially forming a significant local aquifer.

The three boreholes were drilled in the lake bed sediments to depths of up to 6.4 m below the organic lake bed sediments, and therefore only intercepted the top 10% of the overburden sediments beneath the lake. The drilling results showed that the organic sediments were underlain by one to 3 m of very soft clay and silt (>85% silt and clay material) that were in turn underlain by silty sand to sandy silt material, displaying a fining upwards sequence. The presence of the clay and silt material indicates that the lake bottom is underlain by an aquitard.

For comparison, the borehole log for BH07-HO05 that was drilled on the spit of land that divides the LPTP from Pearl Lake at a slightly higher elevation than the lake, reported sand material underlying a 7.7 m thick silt deposit that was present from 9.1 to 16.8 m below ground level, with a second, 0.5 m thick soft silt layer at a depth of 4.6 m. The spit of land with BH07-HO05 is thought to be composed partly of fill and the upper 4.6 m of the log of BH07-HO05 is likely fill material. As such, the clay and silt deposits on the lake floor may correlate to the upper 0.5 m thick silt layer in BH07-HO05. The deeper 7.7 m thick silt layer at BH07-HO05 may also extend under the lake but present at depth and not encountered by the lake bed drilling program. The deeper silt layer, if present, would form a second aquitard beneath the lake (Figure 3-4).

3.10 Numerical Groundwater Flow Model

A numerical three-dimensional steady-state groundwater flow model was developed and used to estimate the seepage rate into the proposed Hollinger pits and to assess the likely effect of its dewatering on the groundwater flow system.

The Modular Finite-Difference Groundwater Flow Model (MODFLOW) developed by McDonald and Harbaugh (1988) for the United States Geological Survey (USGS) was used to simulate groundwater flow in the study area. MODFLOW is a groundwater flow simulator that has been accepted by regulatory agencies and used extensively for a variety of applications. It allows the simulation of steady state and transient flow regimes in both two and three dimensions. A detailed description of MODFLOW is provided in the software package manual (McDonald and Harbaugh, 1988; Harbaugh and McDonald, 1996; Harbaugh et al., 2000). Prior to the model application as a predictive tool for the proposed pit, the model was calibrated to the following data:

- Static water levels in 18 monitoring wells, 13 local private wells and 1 municipal well (Winding Woods Subdivision);

- Static water levels in Gillies, Clearwater and Charlebois Lakes;

- The reported daily average pumping rate of 1,200 m^3/d – 1,900 m^3/d from the McIntyre #11 Shaft, required to maintain the water levels in the flooded mine workings at the elevation of 300 masl – 309 masl; and

- The reported historic pumping rate of about 3,800 m^3/d to 7,600 m^3/d (1,000,000 to 2,000,000 US gallons per day) out of the existing underground mine workings, corresponding to the mine operation period (Golder, 1997; Kaczmarek, 2009).

The developed model was used to simulate groundwater flow in both the overburden and bedrock aquifer zones. Although MODFLOW was primarily developed to simulate flow in porous media it is often used for groundwater flow modelling in fractured rocks if they behave as equivalent porous media at the scale of study. This assumption was utilized in the presented study.

A fully integrated pre- and post-processor - Visual MODFLOW (Version 4.2) developed by Waterloo Hydrogeologic Software, Inc. (Guiguer and Franz, 2006) - was used to assemble the input data for the Hollinger groundwater flow model and post-process the MODFLOW simulated results.

3.10.1 Model Domain Geologic Setting

The developed conceptual model is based on the hydrogeological conditions for the study area described earlier in this section 3.

According to the regional scale geology map (Lee, 1979) the Hollinger mine site is located within a glaciolacustrine sand and clay plain surrounded by bedrock outcrops (Figure 2.1). Field studies conducted by AMEC in 2007 show that the overburden encountered on site consists primarily of silty sand, till, silty clay, organics and tailings. Along the boundary of the proposed pit overburden thickness varies from almost 0 to about 20 m (Klohn-Crippen 1998). Thick overburden sediments (up to 70 m) were reported in exploration borehole data between LPTP and Pearl Lake. These water bodies overly a depression in the bedrock surface, which is likely filled with sand and silt deposits. Silty clay/clayey silt deposits were reported to be present underneath Gillies Lake and Gillies Pond (Klohn-Crippen, 1998; SENES, 2007) and were recently found underneath Pearl Lake (Section 3.9).

Thin overburden or bedrock dominated terrain (outcrops) is located to the southeast of the mine site. Thick esker/outwash deposits (10 to 30 m) exist to the north and southwest from the Hollinger mine site. Coarse sand and gravel material appears to be replaced by the finer sand and till deposits further away from the esker/outwash area. The thickness of the silty clay unit varies from a few metres to 20 m and more between the esker and the Mattagami River. The average clay thickness in the area outside of the esker is about 10 m. In the areas covered by surficial clay, a basal sand unit occurs at the overburden-rock interface (AMEC, 2006).

The overburden material at the site is underlain by Precambrian rock. The shallow rock is known to be weathered and relatively pervious with the bulk K-value estimated to be in the order of 10^{-4} cm/s (Section 3.1.3; Klohn-Crippen, 1998).

3.10.2 Adjacent Surface Water Body Bathymetry

Little Pearl Tailings Pond

Bathymetry of the LPTP indicated a water column of up to 11 m deep. Lakebed sediments are comprised primarily of tailings and silty sand (Golder, 1985).

Pearl Lake

The bathymetry of Pearl Lake indicated a water column of up to 13 m deep. Based on information collected to date, lakebed sediments are comprised primarily of silty sand, however, some tailings may be expected due to spill over from LPTP. Recent drilling conducted by AMEC in the winter of

2008 also encountered a 1 to 3 m thick silty clay layer underneath Pearl Lake at a depth of 10 to 12 m.

Gillies Lake

Gillies Lake has a mean depth of about 2 m with a maximum depth of about 5 m. Lakebed sediments are comprised primarily of clay/silt (Klohn-Crippen, 1998; SENES, 2007).

3.10.3 Recharge and Discharge Zones

Groundwater recharge in the study area is assumed to be primarily from precipitation. Most significant recharge is expected to occur in the esker/outwash areas. Relatively small recharge is expected to occur through the surficial silty clay unit and in the bedrock dominated terrain. LPTP and Pearl Lake most likely acted as recharge zones during the mine operation period since water pumped out of the mine workings was discharged into these water bodies (Golder, 1985, 1997).

Under the non-pumping condition, groundwater in the vicinity of the mine site is expected to discharge into LPTP, and to Pearl and Gillies Lakes. West of the Hollinger Mine site groundwater is expected to discharge primarily into Mattagami River. South of the mine site groundwater is expected to discharge primarily into Skynner Creek and the Mountjoy River. East of the Mine site groundwater is expected to discharge primarily into Porcupine River. Some groundwater in this area is also discharging into the Dome Mine represented by an open pit and underground mine workings. Current groundwater pumping at the Dome Mine is at a rate of about 4,000 m^3/d (average daily pumping rate in 2006, according to the data presented by Goldcorp).

During the historic mine operation period, a discharge rate of up to about 7,600 m^3/d was reported to occur into the existing dewatered mine workings (Golder, 1997). Currently, due to the pumping from the McIntyre Mine, some groundwater discharges into the existing flooded mine workings, as a result of the induced head differential from this pumping.

3.10.4 Mine Workings

Extensive mine workings, associated with the Hollinger and McIntyre Mines exist in the study area. Goldcorp provided AMEC with the digital information from a VULCAN model showing a 3D distribution of the existing mine workings down to the elevation of -246 masl. Their locations in plan view are shown in Figure 3.9. The total volume of voids, associated with these workings is about 41,500,000 m^3. The mine workings are currently flooded and for the most part are not backfilled.

According to the Goldcorp data, pumping from the McIntyre mine workings occurs at a rate of about 4,500 m^3/d in order to control groundwater levels to accommodate the Timmins Gold Mine Tour and to maintain water levels below a number of openings to surface which would otherwise discharge to the environment if not controlled. It should be noted that this rate corresponds to the pumping periods only, i.e., when the pumps were actually turned on. According to the same data, the average daily pumping rate (including both pumping and non-pumping periods) was estimated to be in the order of 1,200 m^3/d – 1,900 m^3/d.

The McIntyre headframe is located about 200 m from LPTP (and also from Pearl Lake) into which the mine water is currently discharged. Given the sand around LPTP and Pearl Lake, these water bodies are expected to be the source of much of the groundwater seeping into the mine.

3.11 MODFLOW Models

The model domain for the developed Hollinger groundwater flow model is shown in Figure 3.10. In order to avoid potential interaction of the model boundaries with the estimated effect of groundwater extraction from the proposed pit and the existing Hollinger and McIntyre mine workings, the model domain extends over a significant distance in all directions from the mine site.

The model domain extends over about 9 km to the south (Mountjoy River), 9 km to the east (Porcupine River and Lake), about 3 km to the west (Mattagami River) and 20 km to the north, to the outflow of Bigwater Lake into North Porcupine River. In the vertical direction the model extends from the ground surface down to a depth of about 500 to 600 m. Groundwater flow below this depth and beyond the boundaries of the model domain is expected to provide negligible contribution to the simulated seepage into the proposed pit and existing underground mine workings.

The total number of model layers equals 41. Model layer 1 corresponds primarily to the overburden unit. Model layers 2 to 10 (total thickness of about 30 m) correspond to the shallow rock, except for the areas underneath LPTP and Pearl Lake, where deep overburden sediments were encountered. Model layers 11 to 24 represent intermediate rock (total thickness of about 120 m), and model layers 25 to 41 represent deep bedrock (total thickness of about 400 m). Within each model layer the numerical finite-difference grid consisted of 186 rows and 258 columns. The horizontal sizes of the numerical cells varied from 15 m at the mine site, to about 100 m close to the model domain boundary. A finer grid spacing of 3 m was utilized to calculate the relatively coarse grid drain conductances associated with the underground mine workings (Section 3.6.3).

3.11.1 Boundary Conditions

Constant head values of 270 masl to 273 masl, corresponding to the water levels of the Mattagami and Mountjoy Rivers, were specified along the western boundary of the model domain. Constant head values of 277 masl to 278 masl, corresponding to the water levels in Porcupine River and Lake were specified along the eastern boundary of the model domain. This boundary condition reflects shallow groundwater water discharge into the rivers and potential for the deep groundwater flow across these boundaries. To simulate currently existing conditions constant head values of 313.5 masl and 313 masl were specified in LPTP and Pearl Lake, respectively.

Streams (creeks), located within the model domain, were represented by the so-called drain nodes in the uppermost model layer 1. The drain nodes were also used to simulate the historical pumping from the existing mine workings. Their locations were imported into the MODFLOW model from the output generated by the Goldcorp VULCAN model.

A series of groundwater extraction wells located along the perimeter of the Dome Pit were used to simulate groundwater extraction from this mine, reported to be about 4,000 m^3/d. This simplifying assumption on the location of the imaginary extraction wells with the prescribed total pumping rate is not expected to affect noticeably the Hollinger model results since (a) there are no calibration targets associated with the Dome Mine site (i.e., observed water levels and/or flows) and (b) no significant interference the Hollinger and the Dome mine sites, located at a distance of about 5,000 m from each other, is expected to occur.

3.11.2 Input Parameters

Due to the limited information available over a large model domain a simplified approach was utilized in this study, as per the following:

- Overburden was simulated as a single model layer over the majority of the model domain with horizontal and vertical hydraulic conductivities representing an average over the layer thickness values of these parameters.

- Uniform horizontal hydraulic conductivity of the overburden was applied everywhere outside eskers/outwash sand, till and alluvial deposits area. This bulk hydraulic conductivity value, expected to be in the order of 10^{-4} cm/s, represents silty sand, tailings and an average horizontal hydraulic conductivity value of the overburden material comprised of surficial silty clays and basal sand unit.

- Vertical hydraulic conductivity of the overburden was assumed to be equal to the horizontal one (isotropic conditions) in the areas with no consistent clay/silt layer. Vertical hydraulic conductivity of the overburden was assumed to be significantly lower than the horizontal one in the areas where a clay/silt layer was known to be present (e.g., glaciolacustrine plain with surficial clay/silts at surface).

- Under the simulated base case scenario hydraulic conductivity of rock was assumed to vary only with respect to depth. Three bedrock aquifer zones were simulated: shallow, intermediate and deep, with progressively decreasing hydraulic conductivity with depth. An additional variant with high K-zone in rock at a depth of about 140 to 180 m, consistent with the packer test results (Section 3.2) was also simulated. Rock was simulated to be isotropic.

- Recharge rates were assigned in accordance with the dominant surficial material zone, identified based on the existing quaternary geology maps and site specific data.

Input parameters (hydraulic conductivities and recharge rates) initially assigned to the various overburden and bedrock aquifer zones are summarized in Table 3.6. These parameters were modified through the process of model calibration.

An artificially high hydraulic conductivity value of 1 cm/s was assigned in the numerical cells coinciding with Gillies, Clearwater and Charlebois Lakes. This approach represents the so-called "high K" technique often used for simulating lake-aquifer interactions using MODFLOW (Lee, 1996). According to this technique, the lake stage is computed for lake cells with the same equations used to compute aquifer heads. Because the hydraulic conductivity is high, little or no spatial variation in head (stage) will occur in numerical cells representing a lake.

Figures 3.11 and 3.12 show distributions of the various model simulated hydraulic conductivity zones in model layer 1, and in the south-north cross-section, drawn through the area of the proposed pits.

3.11.3 Model Calibration

The calibration of a groundwater flow model is a demonstration that the model is capable of reproducing field measured heads and flows: the so-called calibration values (Anderson and Woessner, 1992). Calibration of the model is achieved by adjusting the physical and hydraulic parameters that are associated with highest degree of uncertainty in order to obtain a reasonable match between computed and observed (measured) data.

Simulating the existing conditions the developed groundwater flow model was calibrated to the following targets:

- Water levels in 18 monitoring wells, 13 local private wells and 1 municipal well (Winding Woods Subdivision) screened in the overburden and bedrock aquifer zones (note private wells near the pit were not used as calibration targets as they either lacked water level data or were drilled during periods of active mining and could not therefore be calibrated to pre-mining conditions);

- Water level (elevation of 308 masl) in Gillies Lake;

- Water level (elevation of 312 masl) in Clearwater Lake;

- Water level (elevation of 306 masl) in Charlebois Lake;

- Reported daily average pumping rate of 1,200 to 1,900 m^3/d from the McIntyre #11 Shaft, required to maintain its water level at the elevation of 300 to 309 masl; and,

- Simulating the mine operational period (prior to 1988), the developed groundwater flow model was calibrated to the reported historic pumping rate of about 3,800 to 7,600 m^3/d (1,000,000 to 2,000,000 US gallons per day) from the Hollinger and McIntyre mine workings, (Golder, 1997; Kaczmarek, 2009).

Utilizing numerical cells that are several times larger than mine shafts and drifts (15 m versus 3 m) required special calculation of the drain conductances, associated with these workings. The reason for this is that the application of 3 m grid spacing, consistent with the characteristic diameter of the shafts and drifts is not practical given the very extensive network of mine workings at the site. Such detail would result in the model that is impossible to operate and run using the currently available software and hardware tools. Drain conductances for a relatively coarse grid were calculated using an approach developed for the petroleum reservoir simulation of unconventional wells (Wolfsteiner, Durlofsky and Aziz, 2003). According to this approach, first, the simplified steady-state flow problem is solved either using a semi-analytical or numerical method with a fine enough grid. At the second stage, this reference solution is used to calculate flows into each well (or drain) segment and then mapped onto the target coarser grid model. At the third stage, the coarser grid model is run with sinks being defined at the previous stages. At the final fourth stage, the upscaled drain conductance (Cond) for each drain node is calculated using the following formula (Wolfsteiner, Durlofsky and Aziz, 2003):

$$\mathrm{Cond} = q/(H-h)$$

where q is the seepage rate into the drain node obtained from the reference (fine grid) solution; H is the model simulated hydraulic head, corresponding to a coarse grid solution with specified q values, and h is a drain elevation. Details of the well index upscaling technique are provided by Wolfsteiner, Durlofsky and Aziz (2003).

Drain conductances associated with 15 x15 m cells of the Hollinger groundwater flow model were originally computed using a uniform bulk rock hydraulic conductivity value of 10^{-5} cm/s. Resultant conductances varied from $2\text{x}10^{-9}$ m^2/d (dewatered cells located primarily inside simulated stopes) to 0.69 m^2/d (individual shafts or drifts). According to the ‘well index’ theory, drain conductance is directly proportional to the hydraulic conductivity of isotropic rock (Peaceman, 1983). Therefore, the drain conductances originally computed for the hydraulic conductivity value of 10^{-5} cm/s, were increased or decreased proportionally to the modified hydraulic conductivity of rock. Applicability of this approach for predicting groundwater seepage with a relatively coarse numerical grid was verified by simulating seepage into the underground mine workings at the Pamour Mine site using 5 and 25 m cell sizes. Seepage rates simulated by the coarse grid model (25 x 25 m cells) with the drain conductances computed as outlined above, appeared to deviate from the fine grid model (5 x 5 m cells) results by only about 2 to 5%.

The simulated groundwater flow system obtained at the end of model calibration to the existing conditions is shown in Figure 3.13 (model layer 3). Despite some noticeable local discrepancies between computed and observed hydraulic heads (Table 3.7) the model replicates properly the overall water levels and expected groundwater flow system. The correlation between computed and observed hydraulic heads is shown in Figure 3.14. The results presented in this figure demonstrate a relatively good agreement between computed and observed data: mean, mean absolute and root mean squared errors (discrepancies between computed and observed heads) are -0.2 m, 2.8 m, and 3.7 m, respectively. The ratio of the root mean squared error to the total head loss (or water table relief) in the area of interest is approximately 7.8%. Therefore, the errors represent only a small portion of the overall model response (Anderson and Woessner, 1992).

Assuming that water level in the flooded mine workings is currently at the average elevation of 304 masl, resulted in the model predicted seepage rate of about 2,000 m^3/d into the existing workings – a conservative approximation of the reported daily average pumping rate (1,200 to 1,900 m^3/d) from the McIntyre #11 Shaft. Note that some overestimation of the seepage rate by the model was expected since in reality water levels in the backfilled mine workings should be somewhat higher than in the McIntyre #11 Shaft. However, the developed MODFLOW model conservatively ignores the spatial variation in water levels/hydraulic heads within the flooded underground workings.

In simulating groundwater flow for the past mine operational condition, only the water level in Pearl Lake was specified at 313 masl since water pumped out of the mine workings was discharged back into this lake while there was very little water in LPTP at that time (Golder, 1985;1997). The water level in Gillies Lake was also fixed at 308 masl since: (a) it is known that this lake had a configuration which is comparable to the current condition (based on historic aerial photographs), most likely due to the presence of the 2 to 5 m thick layer of the fine-textured sediments (clay/silt) underlying fine tailings deposited at the bottom of the lake (Klohn-Crippen, 1998; SENES, 2007); and (b) numerical problems associated with a MODFLOW simulation of a perched water condition.

The groundwater seepage rate into the fully dewatered existing underground mine workings was computed to be about 5,700 m^3/d, i.e., within the reported range of pumping rates from 3,800 m^3/d to 7,600 m^3/d, corresponding to the mine operational period. Note that the developed model was not expected to match exactly the upper limit of the reported daily average pumping rate, i.e., 7,600 m^3/d or 2 million US gpd, for the following two major reasons:

- Not all of the existing mine workings were simulated by the model. The mine workings included in the Goldcorp VULCAN model and incorporated into the AMEC groundwater flow model extend down to a maximum depth of about 600 m. However, in reality, the mine workings are known to extend deeper, down to the mine level of 5,450 ft, i.e., 1,662 m. Furthermore, while the VULCAN model is likely the most complete map available, it may not include some undocumented or poorly documented underground workings; and,

- The reported pumping rate may actually include some surface runoff component in addition to the groundwater seepage. Comparing the estimated time required to flood the existing underground mine workings with the actual one, Golder (1997) concluded that the reported rate of 7,600 m^3/d for the mine water inflow may be an overestimation of the actual rate.

The model predicted seepage rate of about 5,700 m^3/d also appears to be consistent with the reported dewatering rate of about 4,000 m^3/d for the somewhat smaller Dome mine. Based on the above, model predicted seepage rate of 5,700 m^3/d was considered to provide an acceptable match to the reported inflow rate observed during the mine operational period.

The calibrated model was then used to estimate seepage rates into the proposed pits, main access ramps and the remaining mine workings as well as to assess the potential zone of influence likely to be caused by the dewatering of the proposed excavations.

3.11.4 Predictive Simulations – Zone of Influence of Proposed Open Pits

The groundwater flow model described above in Sections 3.6.1 to 3.6.3 corresponds to the current and historical mine operation conditions. After being calibrated, this model was modified in order to simulate the transient groundwater flow regime associated with the proposed excavation of three open pits and their Zone of Influence. According to the information provided by Goldcorp to AMEC, the pits are supposed to be mined in overlapping sequence. The mining rate is expected to be close to 48 vertical metres per year. The life-span of the open pit mining is expected to be approximately 7 years, potentially followed by UG development. During the excavation of the proposed pits water levels in the existing underground mine workings is expected to be maintained about 20 m below the bottom of the excavation(s).

Outlines of the simulated excavations at the end of year seven (ultimate pits) are shown in Figure 3.9. To simulate gradual excavation and dewatering of the proposed pits over a period of seven years, the following modifications were made to the developed and calibrated groundwater flow model:

- The steady-state groundwater flow model was converted to a series of seven transient models, corresponding to years 1 to 7 of the proposed excavation, i.e., for each year of the excavation a separate transient flow model was constructed;

- Each of the seven transient models was constructed in accordance with the mine plan provided to AMEC by Goldcorp;

- For each of the seven models, representing various stages of excavation, inactive cells were specified within the excavation, with the exception of the relatively thin band of cells along the pits' walls and immediately above their bottoms;

- Additional drain nodes were specified along the face of the simulated excavations and at their bottoms. These drain nodes were used to simulate the potential seepage face along the proposed open pits' walls and groundwater inflow through their bottoms;

- Underground mine workings remaining outside of the excavation were simulated as drain nodes with head values being equal either to the local elevation of the mine workings (potential seepage face in the dewatered underground openings located above the lowest pit bottom) or to the elevation of the pit bottom minus 20 m (flooded portion of workings below the excavation); and,

- Water levels in LPTP and Pearl Lake were specified at the projected elevations of 312.85 masl and 312.7 masl, respectively.

Each transient period of one year was subdivided into 12 stress-periods and 36 time-steps to ensure gradual transition between hydraulic heads corresponding to the beginning and to the end of simulated period.

In addition to the hydraulic conductivities and recharge rates transient model runs required specification of storage input parameters. Storage parameters (specific storage and specific yield), specified based the available literature data are shown in Table 3.8.

Two predictive variants were simulated: first, the base case scenario corresponding to the "best-fit" combination of the model input parameters shown in Table 3.6; and second, a more conservative variant with an increased hydraulic conductivity of rock at a depth of 140 to180 m. The latter variant was more consistent with the packer test results showing a noticeably more pervious rock zone at depth in boreholes BH 07-03, BH 07-05 and BH 07-09 (Table 3.3).

Base Case Scenario

According to the simulated base case scenario, the total groundwater seepage into the proposed pits and mine workings located outside of the proposed pits' perimeters and below their bottom (flooded mine workings) is expected to reach a maximum of about 9,400 m^3/d after the third year of excavation and then gradually to decline to about 8,900 m^3/d at the end of the seventh year (Figure 3.15). This represents a 56% increase in the seepage rate compared with the model predicted steady-state inflow into the existing workings occurring during the mine operational period. Note that: (a) about 1,000 m^3/d out of 8,900 m^3/d is predicted to be coming out of storage in the overburden and shallow rock, suggesting that the system will not have reached the steady-state condition at the end of the excavation period of seven years; and (b) about 2,500 m^3/d out of 8,900 m^3/d is predicted to be coming out of LPTP and Pearl Lake, resulting in some short-circuiting of water that will be pumped back into this pond. The remaining pumping rate of 5,400 m^3/d (i.e., 8,900 m^3/d minus 1,000 m^3/d and minus 2,500 m^3/d) appears to be close to the model predicted steady-state seepage rate of about 5,700 m^3/d into the existing workings, that occurred during the mine operational period (Section 3.6.3). As a result, the model predicted zone-of-influence, defined as a simulated 1 m drawdown in shallow rock, corresponding to the pumping from the proposed Hollinger pits, main access ramp and remaining mine workings at the end of year seven, appears to be similar to the zone-of-influence, corresponding to the historical pumping from the mine workings (Figure 3.16).

Figure 3.17 shows the model simulated cone of depression associated with groundwater extraction from the proposed pits, main access ramp and the remaining mine workings. There may also be some localised drawdown in areas where unknown or poorly mapped underground workings that are not included in the model, but connected to the Hollinger Mine approach the ground surface.

Additional Conservative Scenario

According to the packer test results presented in Section 3.2, higher K-values were reported in the bottom of boreholes BH 07-03, BH 07-05 and BH 07-09 (Table 3.3). While these higher K-values are likely attributed to equipment limitations, an additional conservative scenario that assumes a deeper zone of more permeable rock, possibly associated with the existing mine workings, was modelled to assess the effect of a deep high K zone scenario. For this scenario, a geometric mean K-value of rock within the lower 40 m to 60 m thick zone was estimated to be about $2x10^{-4}$ cm/s, i.e., similar to the typical hydraulic conductivity of the shallow weathered rock. Based on the above an additional predictive variant was simulated by the model incorporating a more permeable zone at the contact between intermediate and deep bedrock. The extent of such a permeable zone is unknown, and assumed to be present at both Hollinger and McIntyre mine sites including a 500 m buffer surrounding the existing mine workings. The zone was assumed to be 40 m thick. Making the zone significantly greater than 40 m thick would have lead to unrealistic historical inflow rates and was not considered.

The groundwater flow model results for this scenario show a noticeably higher total seepage rate into the proposed pits, main access ramp and the remaining mine workings at the end of year seven (12,400 m^3/d), compared with the Base Case Scenario (8,900 m^3/d), described above (Figure 3.16). Therefore, the additionally simulated variant with the high K-zone at a depth of 140 to 180 m should be considered as a conservative scenario. Figure 3.18 shows the model predicted zone-of-influence (defined as a simulated 1 m drawdown in shallow rock) corresponding to the pumping from the proposed Hollinger pits, main access ramp and remaining mine workings at the end of year seven for this scenario. This zone-of-influence (ZOI) is predicted to be larger than the similar ZOI corresponding to the Base Case scenario (Figure 3.15). However, the ZOI computed at the end of the simulated excavation period (year seven) and the ZOI corresponding to the long-term historical pumping from the mine workings appear to be close to each other, similar to Base Case scenario.

Therefore, according to both the Base Case and Conservative Scenarios, the overall impact of the dewatering of the proposed Hollinger pits, main access ramp and remaining workings on the groundwater flow system is expected to be similar to the historical impacts observed during the mine operational period, i.e., to pre-1988 conditions.

4.0 DISCUSSION

During the study, a single numerical groundwater flow model, with two hydraulic conductivity variants, was developed and calibrated in order to estimate distinct groundwater related objectives. The first objective was to provide an estimate of the long-term seepage rate into the proposed open pit and existing underground workings; and the second objective was to determine if such a seepage rate and corresponding groundwater extraction rate would be likely to result in effects on adjacent surface water features or nearby groundwater users.

4.1 Groundwater – Surface Water Interactions

Of particular importance to the Hollinger Project is the linkage between groundwater and surface water systems. Groundwater recharge is a special case of runoff storage, but on a longer time scale. Groundwater systems are important to the maintenance of vegetation communities, including wetlands, as well as to the maintenance of creek and river baseflows, when available precipitation is lacking, such as during periods of drought; and in the case of creek and river baseflow in winter when precipitation is largely locked up in the form of ice and snow. Groundwater systems are replenished through the infiltration of precipitation (and runoff) into the subsurface, the rate of which is a function of soil porosity and runoff storage potential. Groundwater release is similarly a function of soil porosity and other factors such as the expression of drainage networks and the presence of aquitards.

Mine dewatering has the potential to affect surface water systems through the reduction of baseflow or groundwater discharge to lakes. More specifically, by drawing down the local groundwater table, groundwater discharge sources that normally serve to maintain creek and river baseflow, and wetland environments, can potentially become diminished or depleted. There is also the potential for enhanced direct leakage from surface water systems, such as lakes and ponds, to depressurized groundwater systems. To evaluate these potentials, it is important to determine the extent of expected groundwater removal, and subsurface soil conditions associated with local aquatic systems and wetlands.

Zones of porous soil are most problematic, where these exhibit a direct connection to bedrock. The Pearl Lake system - is characterized by extensive sandy terrain. If these permeable deposits are in direct contact with the bedrock, and if the bedrock becomes depressurized as a result of mine dewatering activities, these surface hydrological systems could be adversely affected. Sediments beneath Pearl Lake also appear to be comprised principally of sandy materials interbedded with layers of silt. Any such potential adverse effects would have to be assessed through ongoing monitoring of potential groundwater/ surface water interactions.

The Zone of Influence is estimated to extend from the mine out to distances of two km in the seven years of proposed mining. In comparison to historical activities at the site, which was actively mined for a period of approximately 80 years until 1988, the Zone of Influence is expected to smaller than the one created by historical activities as the proposed mine will have significantly less than 80 years to remove water from storage than the historical mine, and the removal of water from storage will attenuate the growth of the Zone of Influence. As there are no known reports of creeks going dry during the historical mining period, and no creeks are predicted to be affected by the numerical model, no significant environmental effects on local surface water features are expected, assuming similar dewatering practices are followed for the new and historical mine. Historic air photo coverage of the Timmins area from 1969, when both the Hollinger and McIntyre Mines were fully dewatered (or nearly so – the Hollinger Mine was just beginning to flood, having been closed in 1968), shows lake forms and margins consistent with those of today (Figure 4.1).

Of the 8,900 m^3/d of seepage expected to report to the proposed pit towards the end of mining in the base case scenario, the single biggest source of water was the LPTP that is located close to the pit and was modelled without a clay bottom. The largest source of water from a natural surface water feature is approximately 2,500 m^3/d predicted to be recycled from the Pearl Lake system, which is also likely underdrained by ongoing dewatering at the McIntyre head frame to allow the upper part of the mine to stay open for the Timmins gold mine tour. The remaining water includes 1,000 m^3/d taken from storage, and 5,400 m^3/d that is mostly captured precipitation.

For comparison, stream flow measurements collected in nearby water courses during 2008 indicate that flows in local creeks have flows on the order of at least 10,000 m^3/d suggesting that small declines in groundwater discharge to these features anticipated, with the possible exception of the Pearl Lake system are not significant.

These estimates suggest that mitigative measures will be required to maintain the current water levels in Pearl Lake. Presently water levels in Pearl Lake are supplemented by discharge from the McIntyre Mine, and it is proposed to continue this practice for the proposed mine.

4.2 Private Wells

The City of Timmins provides municipal water to residents and businesses within the urban area, and it is expected that there are no private wells that would effected by mine dewatering close to the mine. Municipal water is not available in the rural areas, further to the southwest of the proposed mine, and a search of the water well records and local maps indicates that there are a few residents in this area that likely rely water wells for their water supply. However, the closest of these is more than 1 km from the mine near the edge of the Zone of Influence. At this distance, it is not anticipated that the operation of these wells will be affected by mine dewatering. However, any active wells in this area should be monitored to confirm expected conditions.

4.3 Other Pumping Requirements in Addition to Groundwater Seepage

In addition to the removal of 8,900 to 9,400 m^3/d of groundwater seepage from the mine, a PTTW must include an allowance for the removal of surface water runoff into the open pit and down the access ramp, and for the removal of water already in the flooded existing mine workings.

Estimation of Surface Water Runoff into the Mine

Surface water runoff into the mine was estimated by looking at the detailed topography of the site and historical climate data. The area around the mine through which surface water may runoff into the mine workings was estimated using the Lidar mapping and the proposed mine design. A series of ditches and berms will be used to minimise surface water runoff into the mine entrances; however these are unlikely to be completely effective in preventing seasonal flooding or rapid transmission of water through fractures in the unsaturated zone not included in the groundwater model.

The Lidar map and diagrams provided by Goldcorp indicate that the area over which runoff may be directed to the mine is approximately 95.9 ha. A review of past historical rain events, indicates that the Timmins area may reasonably expect to receive up to 116 mm of rain in a single day, corresponding to the 24-hr, 100-year rainfall storm event. If all the rainfall landing in the area was directed towards the mine, the resulting volume of water would be approximately 103,600 m^3, based on a model simulated runoff depth of 108 mm. The underground working within 20 m of the pit flow occupies an average volume of approximately 500,000 m^3, which is sufficient to contain the storm event volume.

A more common scenario would involve the rapid melting of snow accumulation from the winter in the spring combined with a spring melt. Such an event could create a similar surface water inflow into the mine as a single large storm event, requiring a similar pumping allowance.

There would also be a small volume of process water introduced into the mine for drill rig cooling and dust suppression, but the volume is small enough to be adequately covered by the above estimate of captured surface water runoff.

Removal of Water in the Former Open Pits and Underground Workings

There is a large volume of water presently contained within the former open pits and underground workings that would need to be removed. The volume of combined former open pits and underground workings was estimated using the VULCAN three dimensional model provided by Goldcorp as 40.5 million m^3, of which approximately 19 million m^3 was reported to be back filled (Golder 2007). This information was used to develop a storage stage curve assuming the back fill material was evenly distributed through every level in the mine.

As the upper part of the former underground mine and open pits are dewatered via the McIntrye headframe to allow access for the Timmins Gold Mine Tour, this part of the mine does not need to be dewatered. Based on the storage stage curve, approximately 21 million m^3 of water remain in the voids of the former mine. The water needs to be removed to below the working level of the mine before mining can begin. Removal of this storage water is also required to induce increased groundwater inflow into the mine above current volumes.

The volume of the voids decreases rapidly with depth once the base of the former open pits is reached, and the volume of water to be removed per metre of water level lowering is much higher in the upper part of the mine compared to the lower parts of the mine where there are only underground workings. The volume of water in the upper part of the mine is estimated to be 11 million m^3. To remove this water in approximately one year would require a dewatering rate of approximately 30,000 m^3/d.

Summary of Requested PTTW Volumes

The long term groundwater withdrawal from the bedrock is estimated to be approximately 10,000 m^3/day; however, a pumping rate of 30,000 m^3/day is requested to remove water from the flooded historical open pits during the initial phase of mining. Once the flooded open pits are dewatered to 200m, the amount of water released from the former mines will decrease as the former pits are smaller at depth and the volume of water in the former underground workings is relatively small. During the later periods, however, it will be important to have pumping capacity to remove runoff entering the mine through the open pits and access ramps, as this can cause rapid flooding of the mine when it is deeper and operating as an underground mine with only a small volume of active tunnels which may flood quickly. Therefore maintaining the permit allowance of 30,000 m^3/day is requested throughout the mine life to allow rapid removal of surface water runoff, in addition to small volumes of groundwater inflow.

4.4 Mine Closure

At mine closure, the most likely method of open pit rehabilitation will be to flood the pit. An inspection of the local topography indicates that it would not be possible to affect passive drainage north to the Porcupine River system. The only other options for passive outflow are therefore development of a constructed drainage way (or partially buried pipeline) leading to the Skynner Creek or Perch Lake systems.

4.5 Monitoring Recommendations

Work undertaken during this study, has indicated that with the exception of the LPTP facility and Pearl Lake, there will be no significant affect on local surface water features or the use of local water wells. To confirm that the Zone of Influence expands at a rate consistent with the predictions made using the numerical groundwater flow model and that there are no significant effects on local surface water systems the following monitoring activities are proposed.

- Groundwater levels in the existing monitoring wells installed as part of the 2007 drilling program be collected on a monthly basis for two years and then on a quarterly basis thereafter to assess the growth of the drawdown cone.

- Water levels within the mine and pumping from the mine be measured on a daily basis to identify periods when high levels of pumping are associated with dewatering of the existing flooded workings and when low levels of pumping are representative of groundwater seepage into the mine.

- Rating curves be fully developed for the three stream flow measurement stations and that continuous stream flow (water level) monitoring data loggers continue to be downloaded on a quarterly basis to that confirm impacts to stream flows are minimal.

- Surface water levels continue to be recorded on a daily basis using pressure transducers from each of Pearl Lake, Gillies Lake and LPTP.

- A report describing the monitoring data collected above and comparing the above information to climate data, be prepared on an annual basis and submitted to the MOE, until five years after mine closure.

Sincerely yours,
AMEC Earth & Environmental Limited
a division of AMEC Americas Limited

Prepared by:

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SIMON J. GAUTREY
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Sept 27 2010

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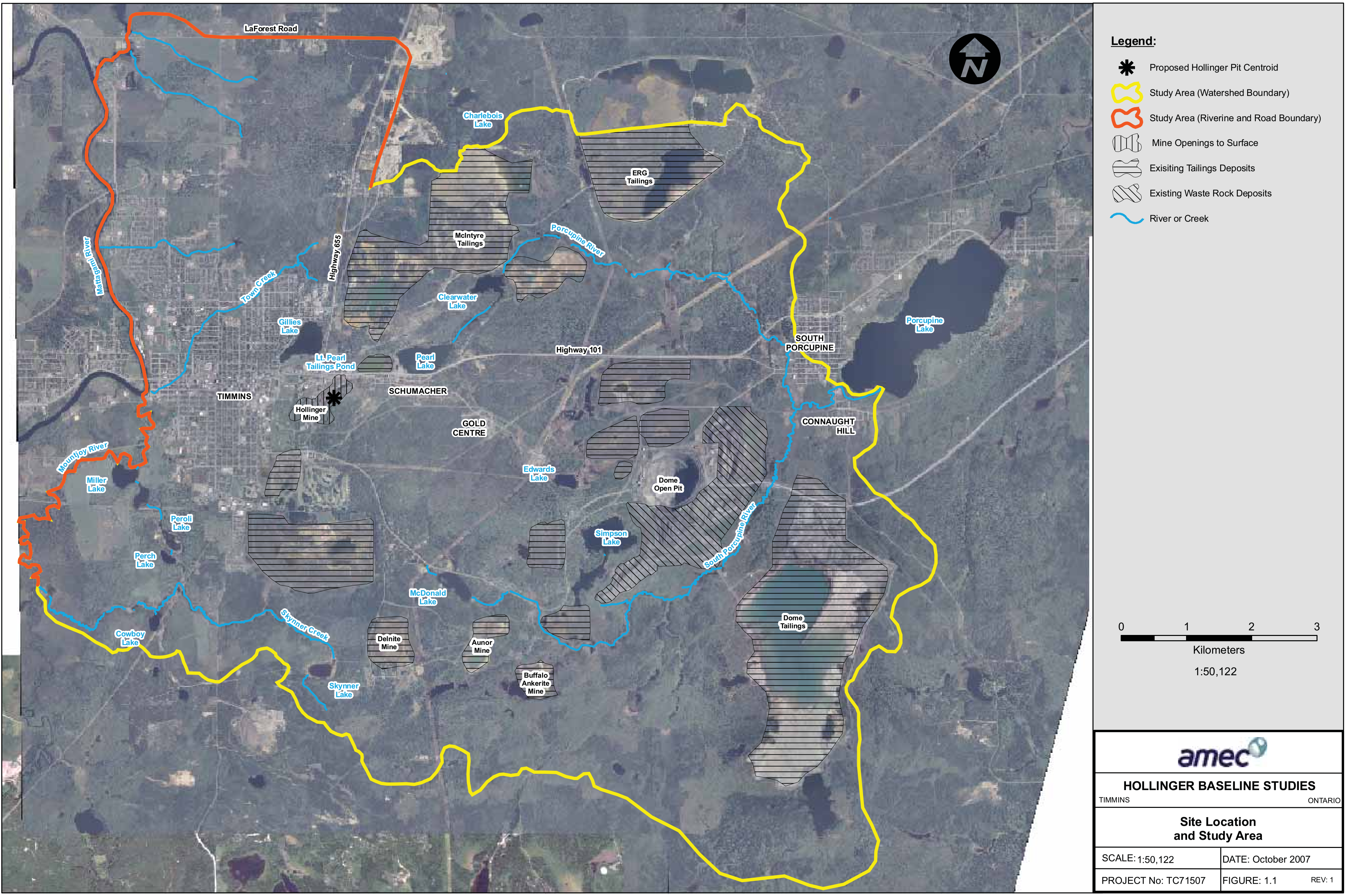

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HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

**Site Location
and Study Area**

SCALE: 1:50,122 DATE: October 2007

PROJECT No: TC71507 FIGURE: 1.1 REV: 1

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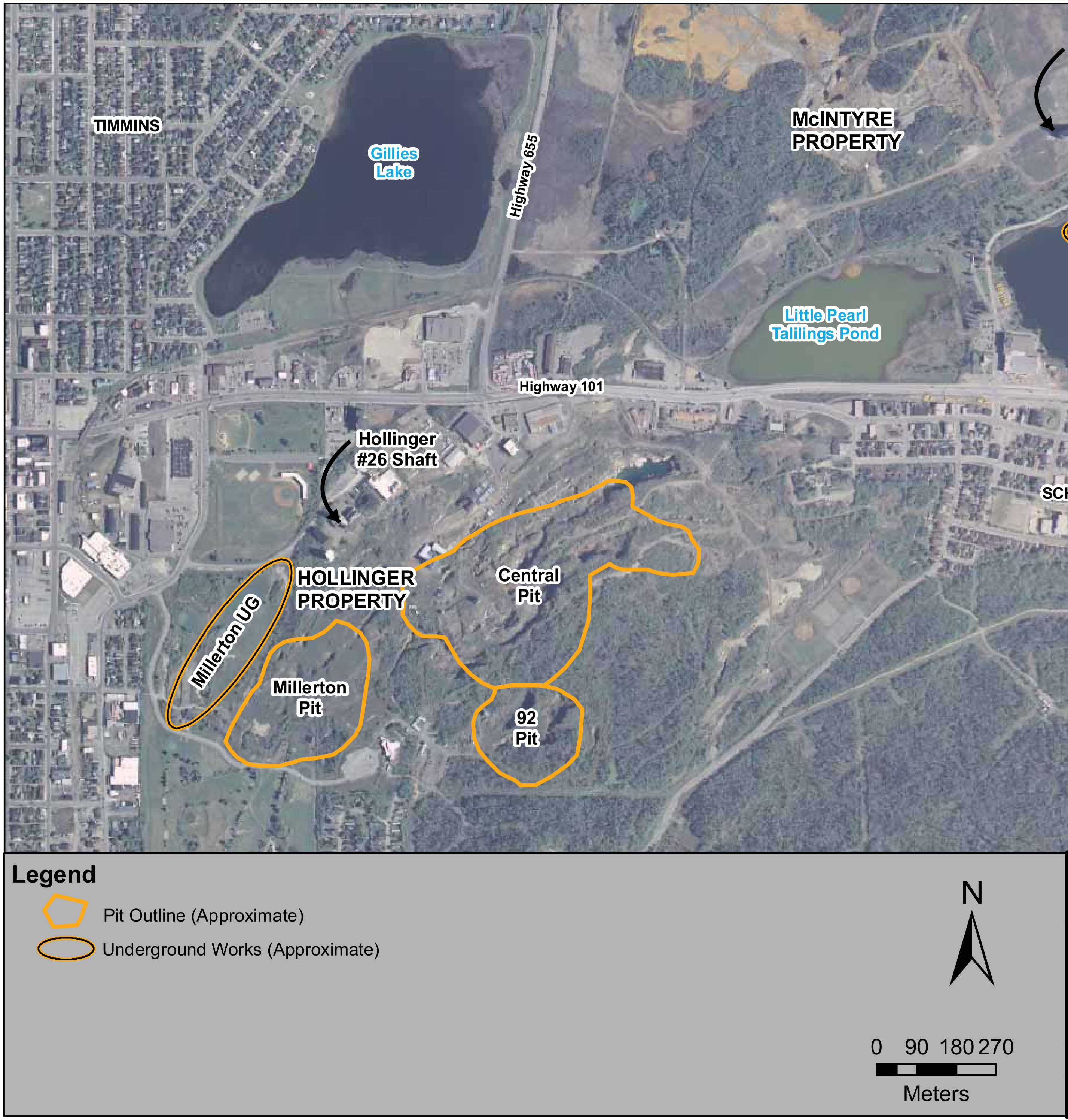

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HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Site Plan

SCALE: 1:12,750

DATE: APRIL 2009

PROJECT No: TC81525

FIGURE: 1.2

REV: 1

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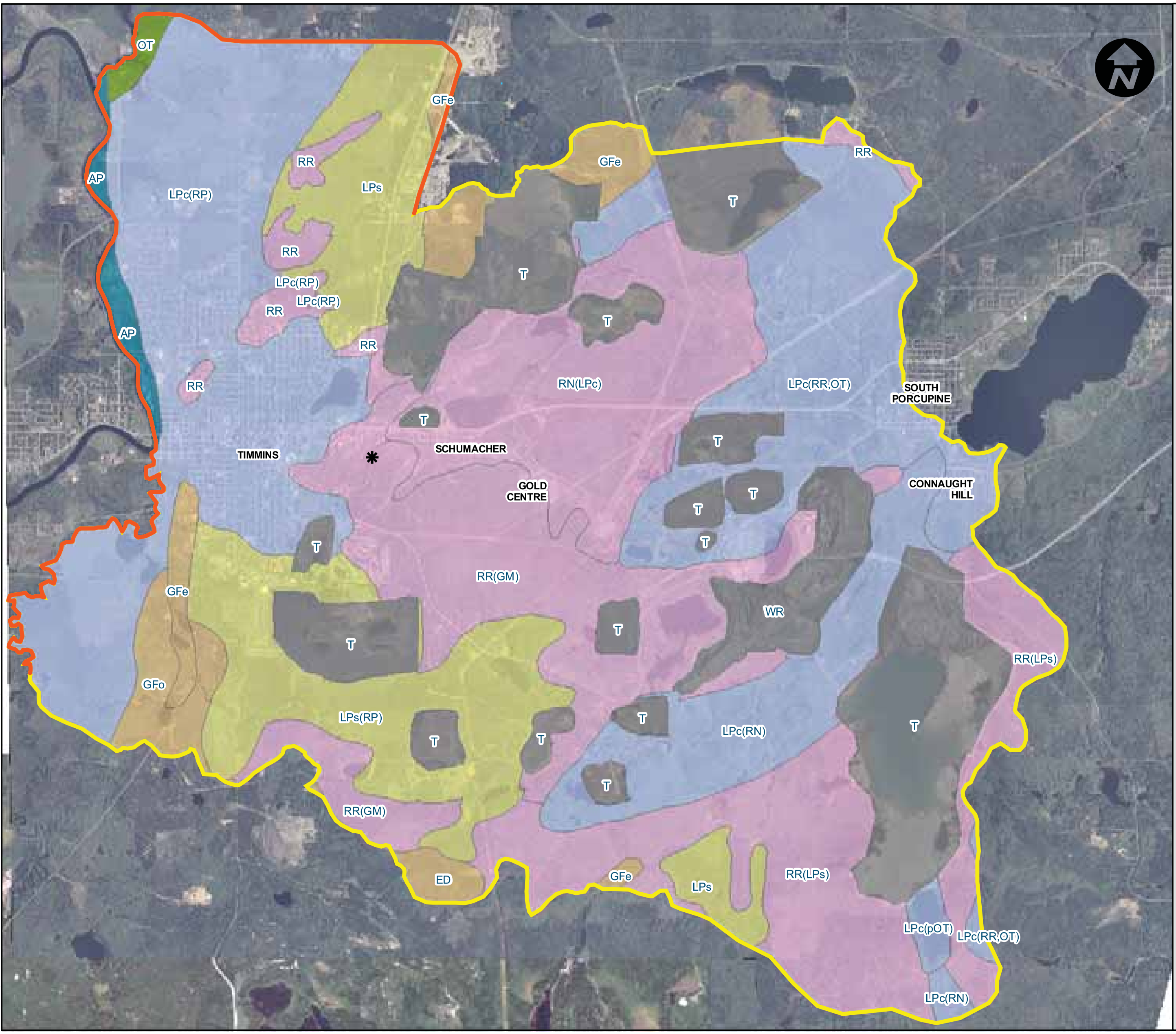

P:\EMI\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_CofA_April2009\Figure 15 - Geology.mxd

Legend:

- ✱ Proposed Hollinger Pit Centroid
- Study Area (Watershed Boundary)
- Study Area (Riverine and Road Boundary)

Surficial Geology Types

- 1, RR - Rock ridge
- 2, RR(GM) - Rock ridge (ground moraine)
  (subordinate landform types are shown in brackets)
- 3, RN(LPc) - Rock knob (lacustrine plain - clay/silt)
- 4, RR(LPs) - Rock ridge (lacustrine plain - sand)
- 5, LPc(RR,OT) - Lacustrine plain - clay/silt (rock ridge/organic terrain)
- 6, LPc(RN) - Lacustrine plain - clay/silt (rock knob)
- 7, LPc(RP) - Lacustrine plain - clay/silt (rock plain)
- 8, LPs(RP) - Lacustrine plain - sand (rock plain)
- 9, LPs - Lacustrine plain - sand
- 10, LPc(OT) - Lacustrine plain - clay/silt (organic terrain)
- 11, GFo - Glacial-fluvial outwash - sand
- 12, GFe - Glacial-fluvial esker - sand
- 13, ED - Dunes - sand
- 14, AP - Alluvial plain
- 15, OT - Organic terrain
- 16, T - Tailings
- 17, WR - Waste rock

SOURCE: Northern Ontario Engineering Geology Terrain Study
Base Maps - Timmins (Map 5029) and pamour (Map 5026)

0 1 2 3
Kilometers

1:53,000

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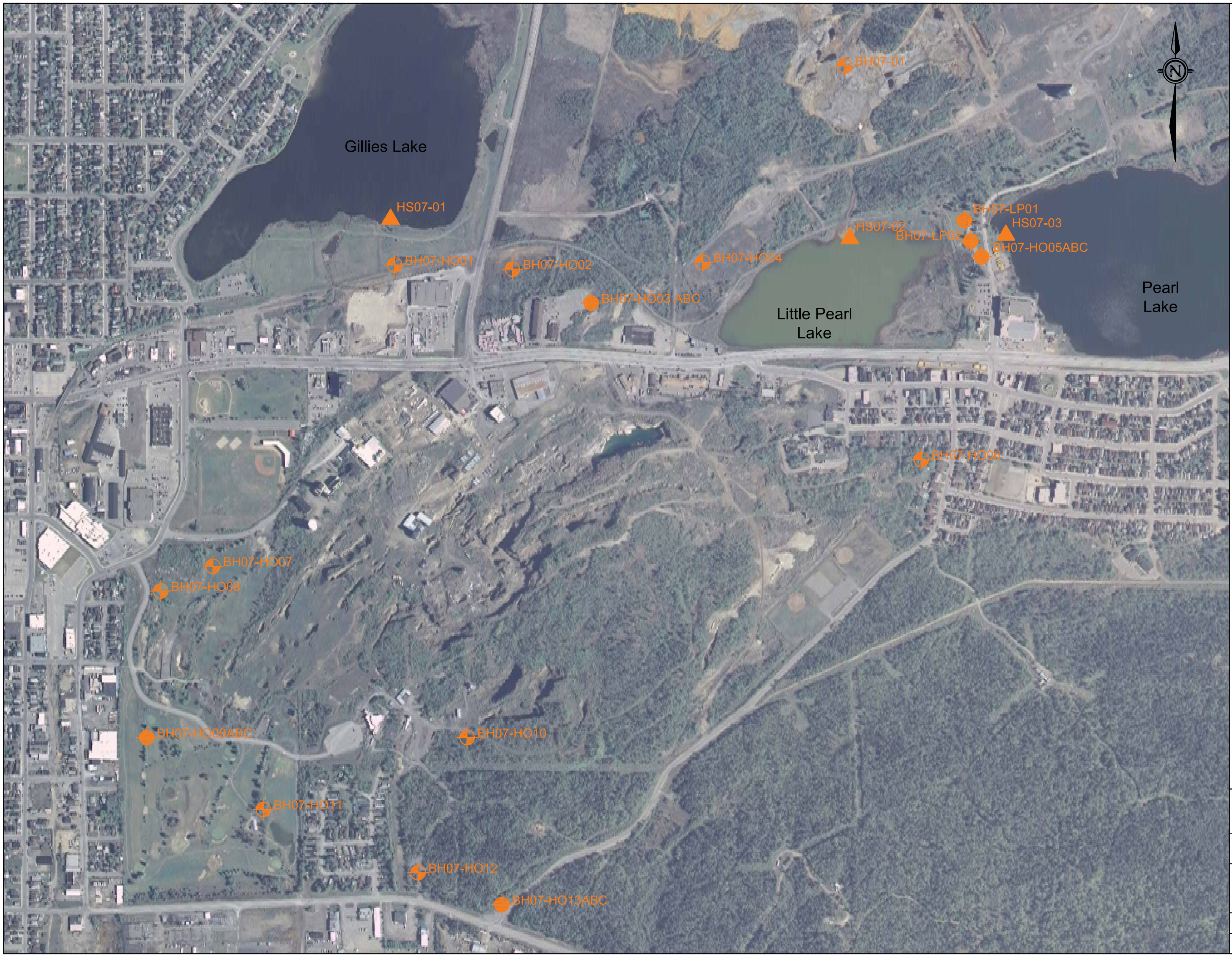
HOLLINGER BASELINE STUDIES
TIMMINS ONTARIO

Surficial Geology

SCALE: 1:53,000	DATE: APRIL 2009
PROJECT No: TC81525	FIGURE: 1.3 REV: 1



Legend:

▲	Hand Sample
●	Borehole Multi-Level (200 m max)
⊕	Borehole Shallow (12 m max)

0 100 200 300 400 500
Approximate Scale (m)

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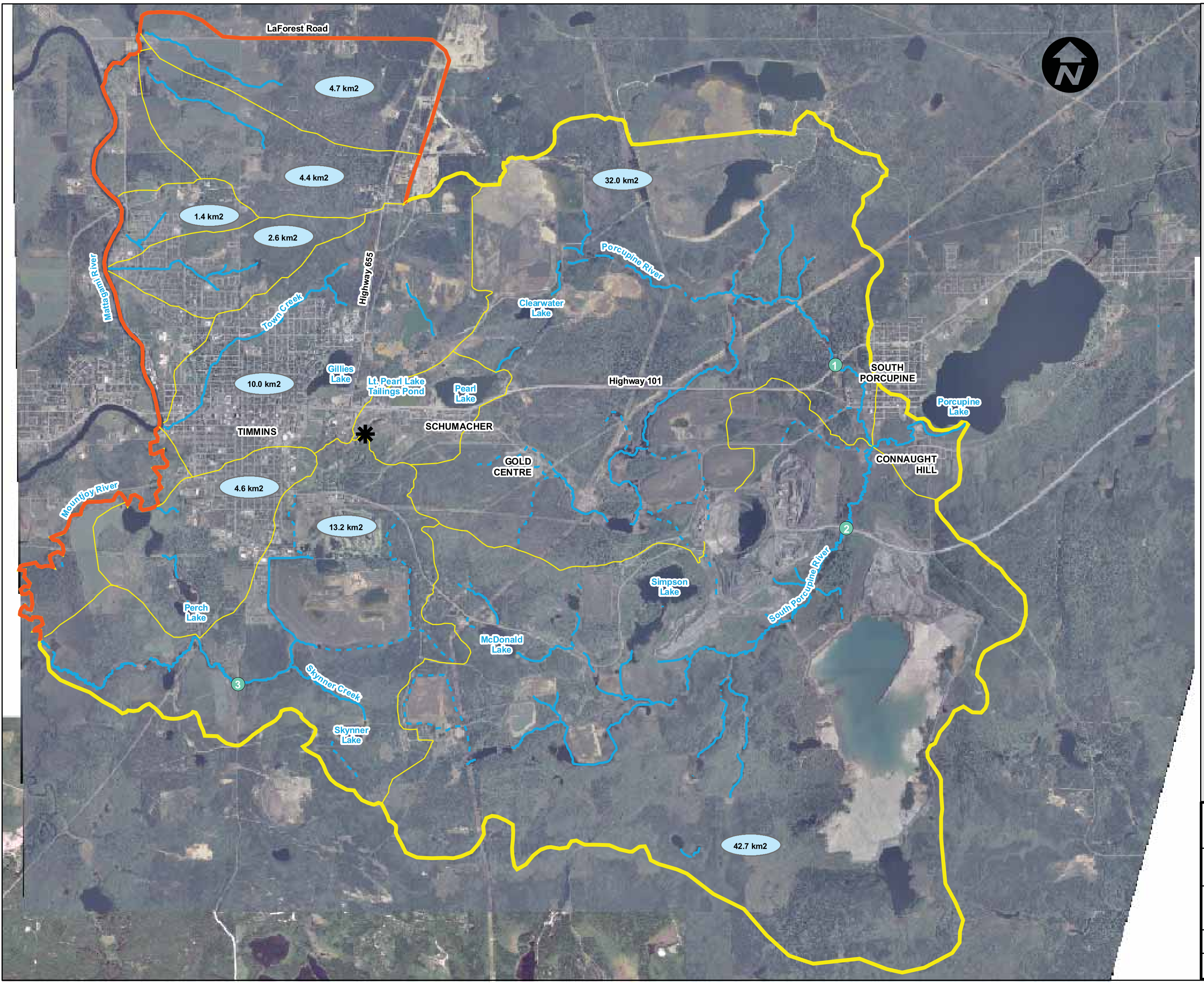
HOLLINGER BASELINE STUDIES
HYDROGEOLOGY STUDY

Monitoring Well Location Plan

Scale: 1:10000	Date: November 2007
Project No: TC71507	Figure No: 2.1



Legend:

- ✱ Proposed Hollinger Pit Centroid
- Study Area (Riverine and Road Boundary)
- Study Area (Watershed Boundary)
- Watersheds
- River or Creek
- Intermittent Watercourse

Flow Monitoring Locations

- ① Porcupine River near Highway 101
- ② South Porcupine River near Pamour pit haul road
- ③ Skynner Creek near the Pine Street south crossing

0 1 2 3
Kilometers
1:53,000

amec

HOLLINGER BASELINE STUDIES
TIMMINS ONTARIO

Watersheds and Flow Monitoring Locations

SCALE: 1:53,000	DATE: October 2007
PROJECT No: TC71507	FIGURE: 3.1 REV: 1

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Legend:

- ▲ Hand Sample
- ● Borehole Multi-Level (200 m max)
- ⊕ Borehole Shallow (12 m max)
- ▨ Rock Ridge (lacustrine plain - clay/silt)
- ▨ Lacustrine plain
- ▨ Tailings

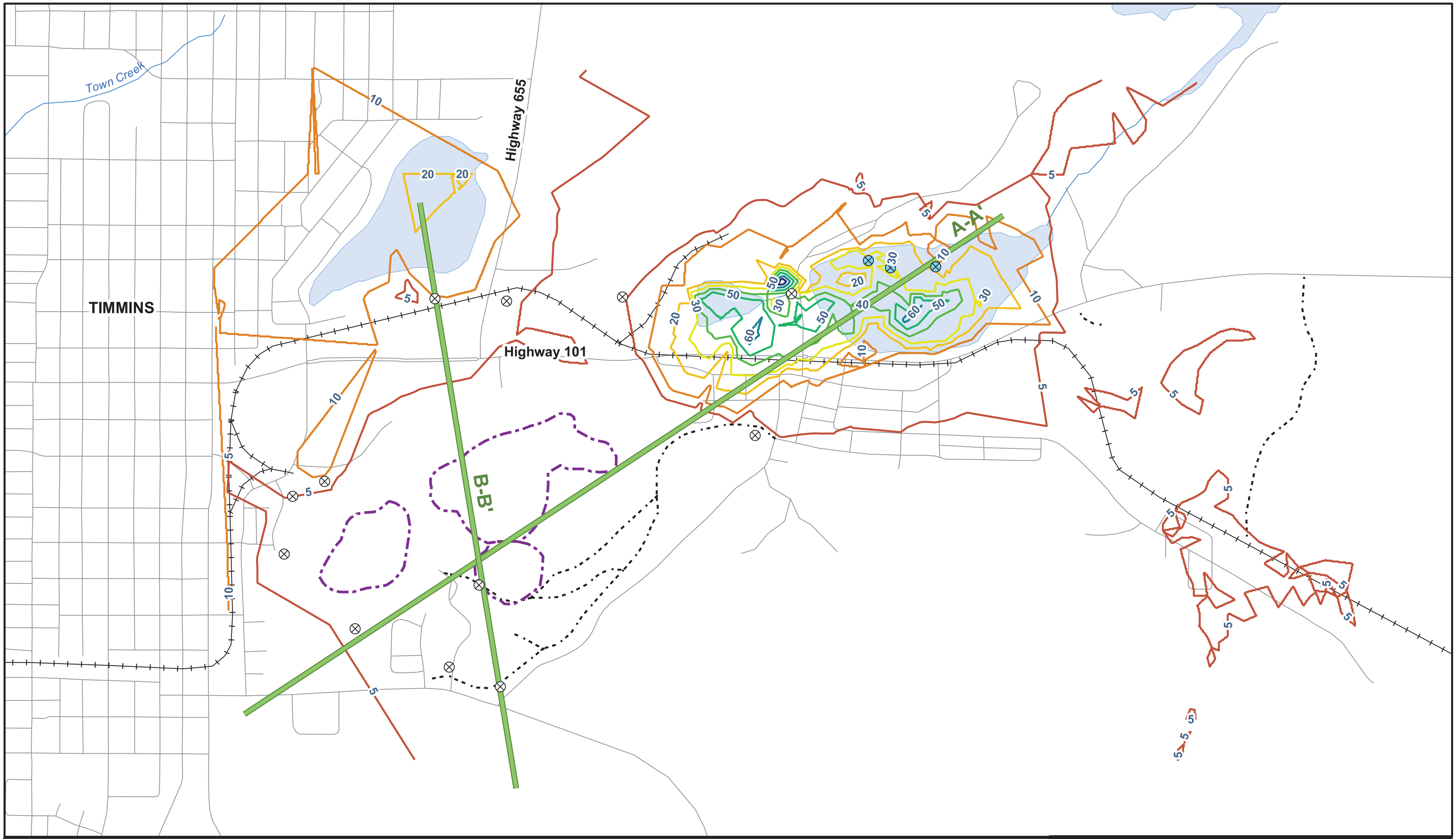
0 100 200 300 400 500
Approximate Scale (m)

amec

HOLLINGER BASELINE STUDIES
HYDROGEOLOGY STUDY

Overburden Geology

Scale: 1:10000	Date: November 2007
Project No: TC71507	Figure No: 3.2



Legend

- ⊗ AMEC Monitoring well
- ⊗ AMEC Borehole (drilled through lake ice)
- ⬠ Municipal Pumping well
- ▬ Cross Section Locations
- ▭ Pit Outlines

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HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Overburden Thickness and Cross Section Locations

SCALE: 1:20,000	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.3 REV: 1

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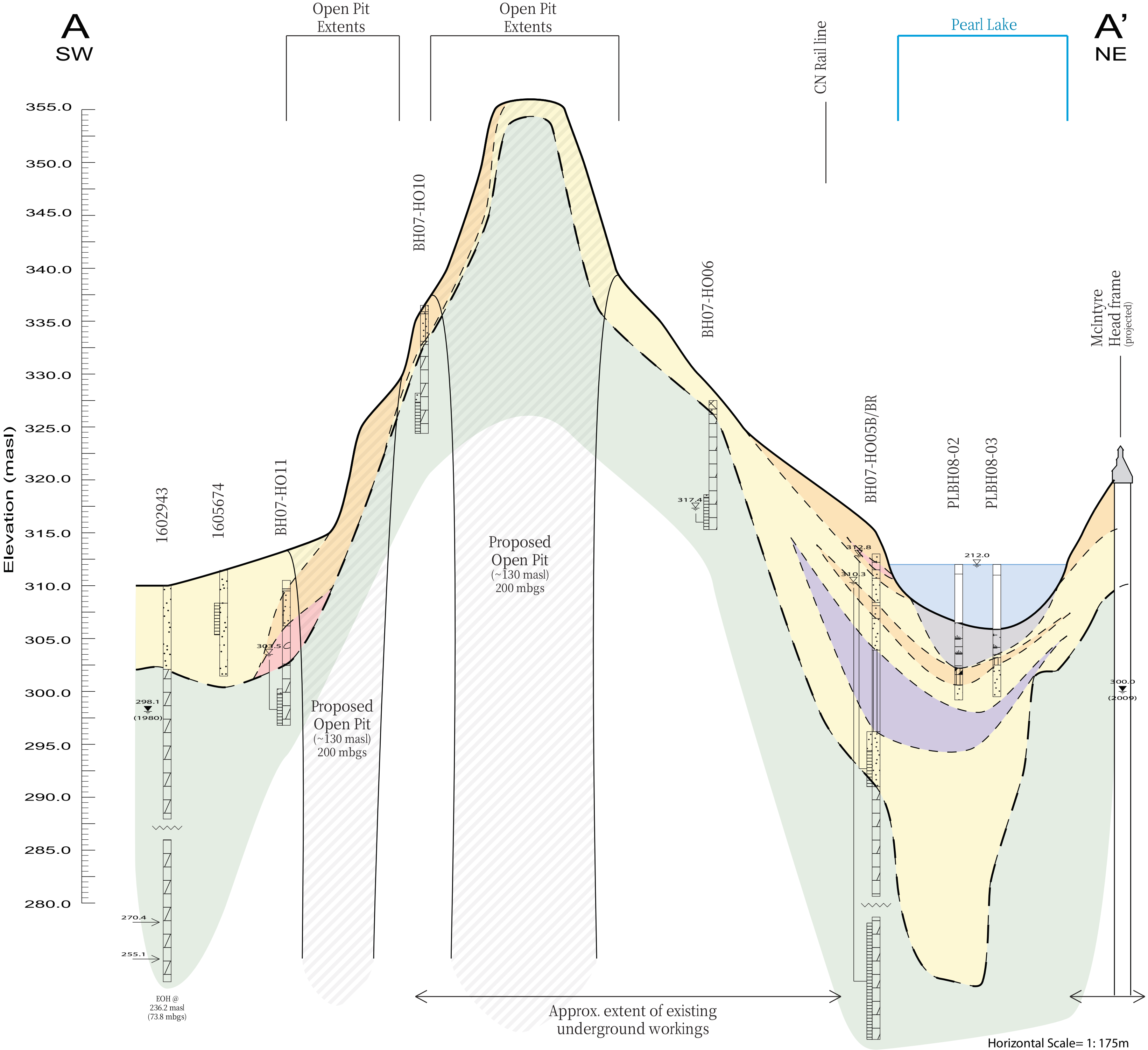


Note Geologic information from MOE Water Well records and AMEC drilled boreholes (2007).

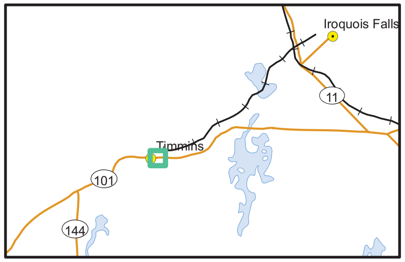
HYDROGEOLOGICAL ASSESSMENT
HOLLINGER MINE

Figure 3.4

Regional Hydrostratigraphic Cross Section A-A'

Legend

- Organics
- Clay
- Silt
- Sand
- Silty Sand to Sandy Silt
- Gravel
- Bedrock
- 271.7 Monitoring well screened interval and sand pack
- 150.2 ▼ Static Water level from other sources (year)
- ← 271 Water Found interval



Source: National Topographic Database (Canvec) base map shapefiles, 1:10 000 nominal scale.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project # TC81525*1300
Date: July 2009
Client:

Drawn by: RM
Checked by: SG
Revision No.: 2

UTM NAD 83
Zone 17N

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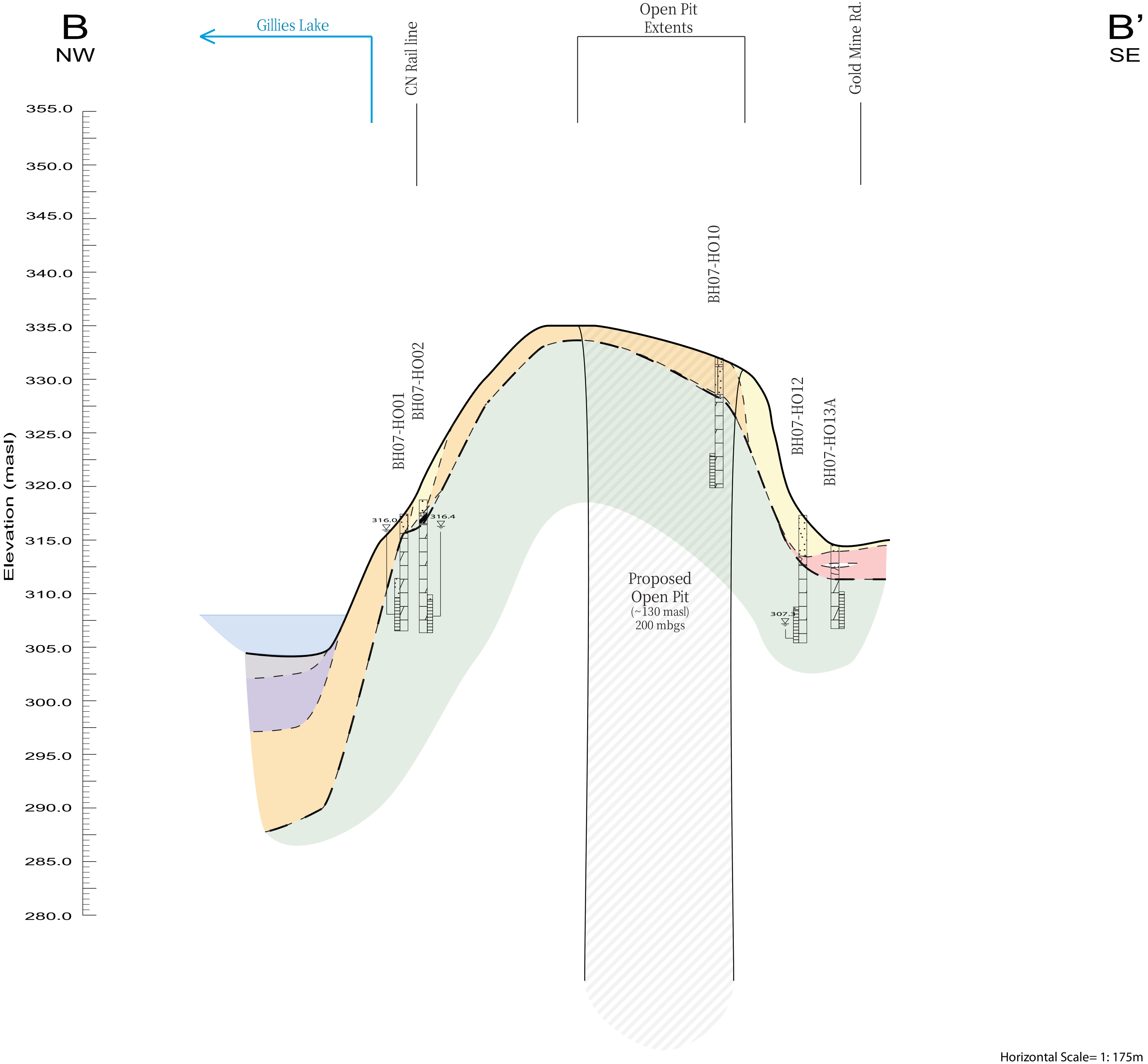
505 Woodward Ave.
Hamilton, ON L8H 6N6



Horizontal Scale= 1: 175m
Vertical Scale= 1: 5m
VE= 35x

Note Geologic information from MOE Water Well records and AMEC drilled boreholes (2007).

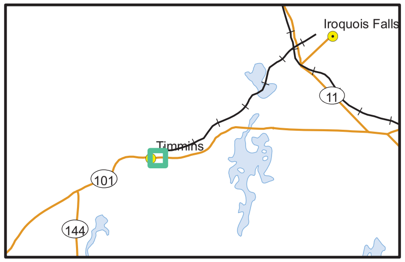
HYDROGEOLOGICAL ASSESSMENT
HOLLINGER MINE

Figure 3.5

Regional Hydrostratigraphic
Cross Section B-B'

Legend

- ▨ Organics
- ▨ Clay
- ▨ Silt
- ▨ Sand
- ▨ Silty Sand to Sandy Silt
- ▨ Gravel
- ▨ Bedrock (Greenstone)
- 271.7 Monitoring well screened interval and sand pack
- 150.2 Static Water level from other sources
- ← 271 Water Found interval



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Conditions encountered in the field may be different from the interpreted information presented on this figure.

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Date: July 2009
Client:

Drawn by: RM
Checked by: SG
Revision No.: 2

UTM NAD 83
Zone 17N

Meters
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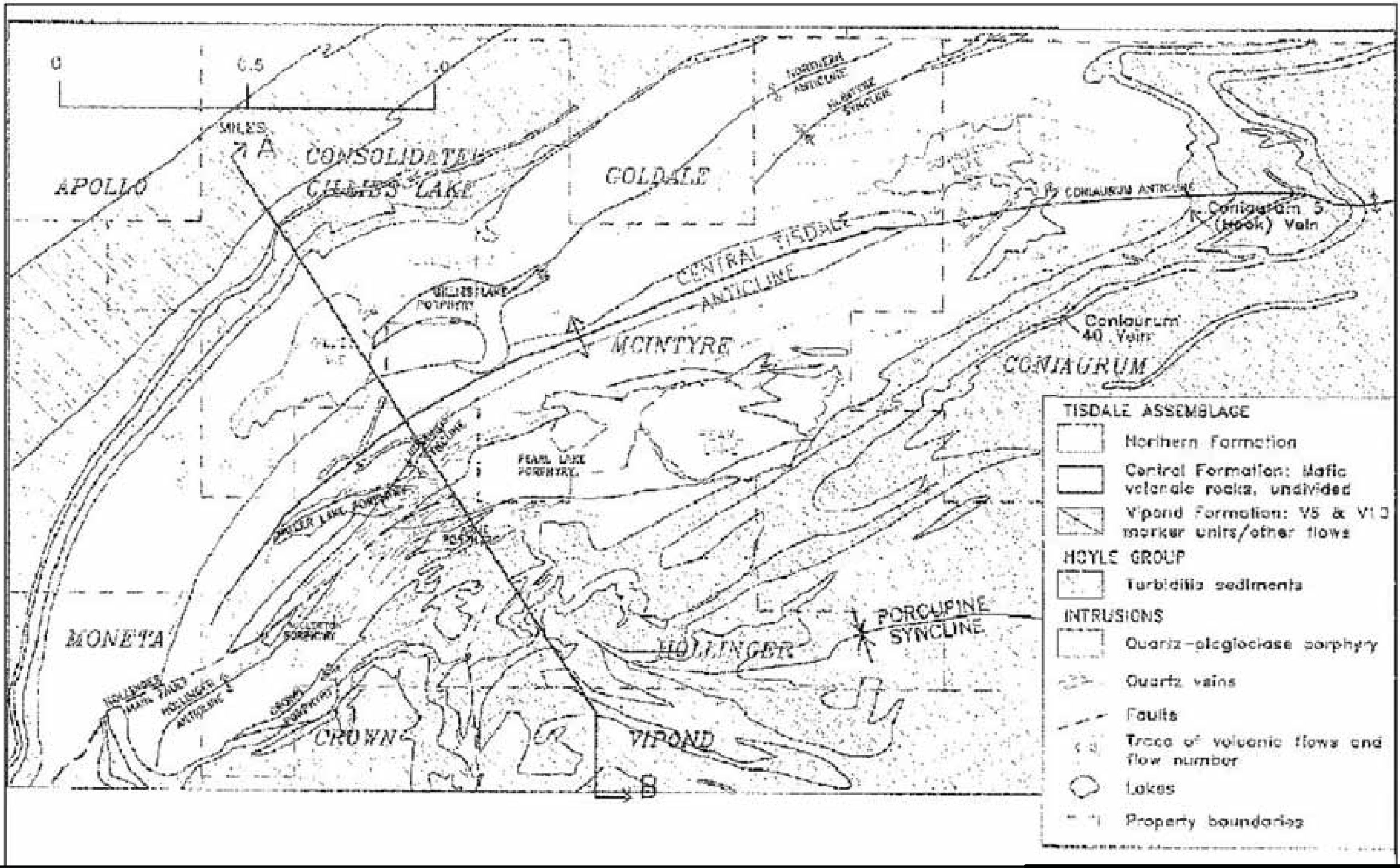

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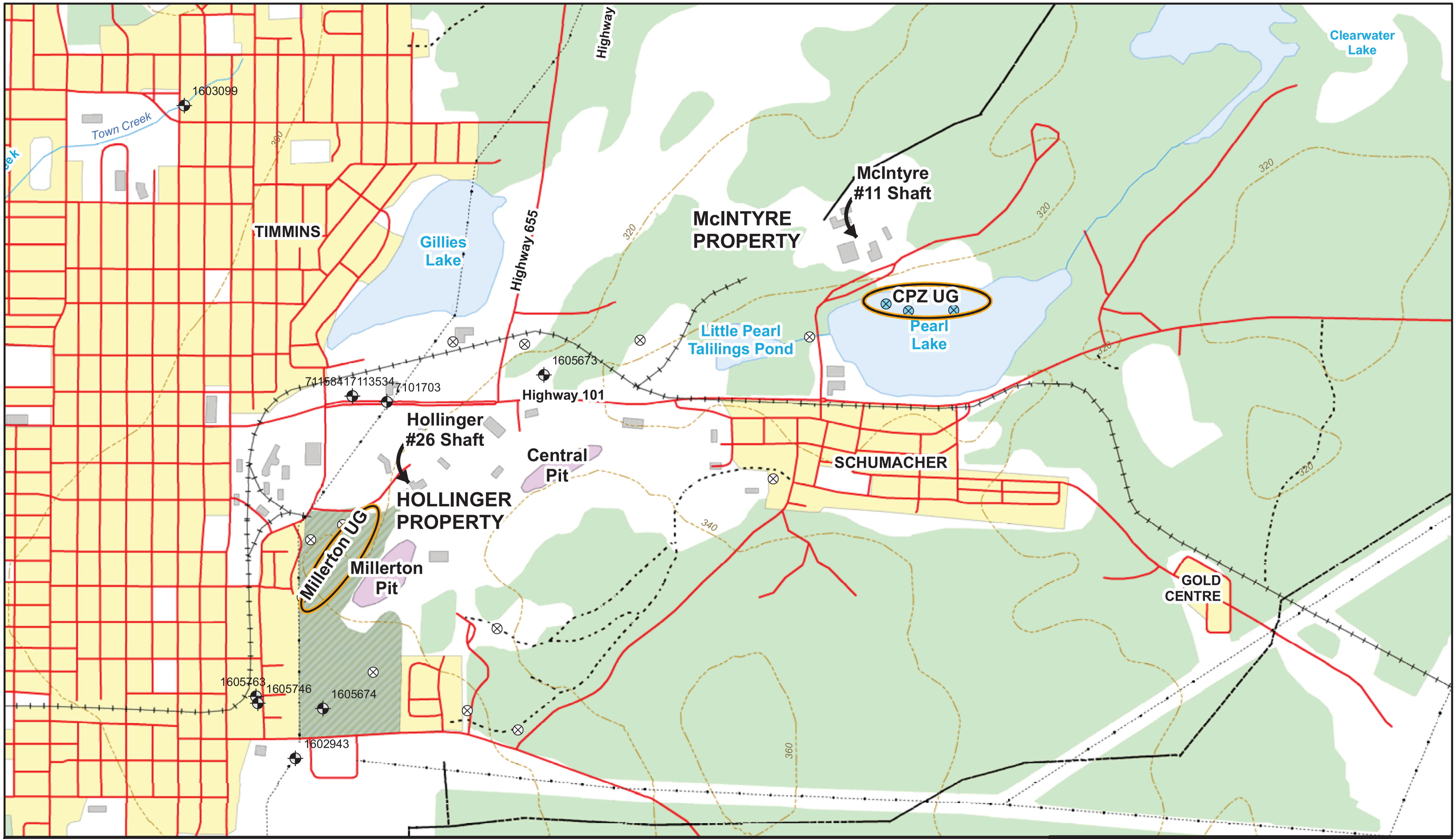
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Bedrock Geology

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.6 REV: 1



HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Locations of Private Wells in the MOE WWR database

SCALE: 1:20,000	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.7 REV: 1

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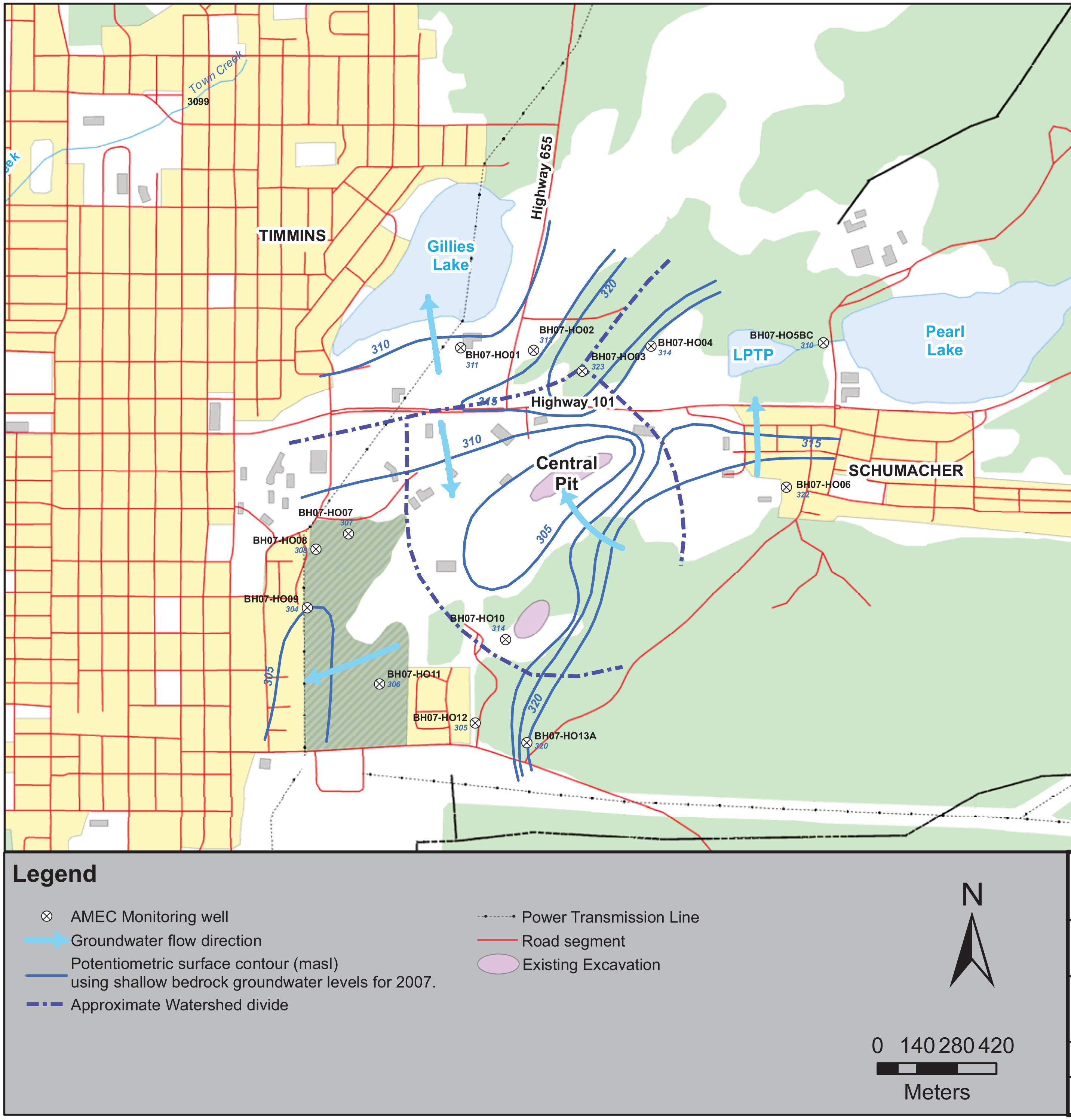

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HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Interpreted Shallow Groundwater Flow System (Plan View)

SCALE: 1:20,000	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.8 REV: 1

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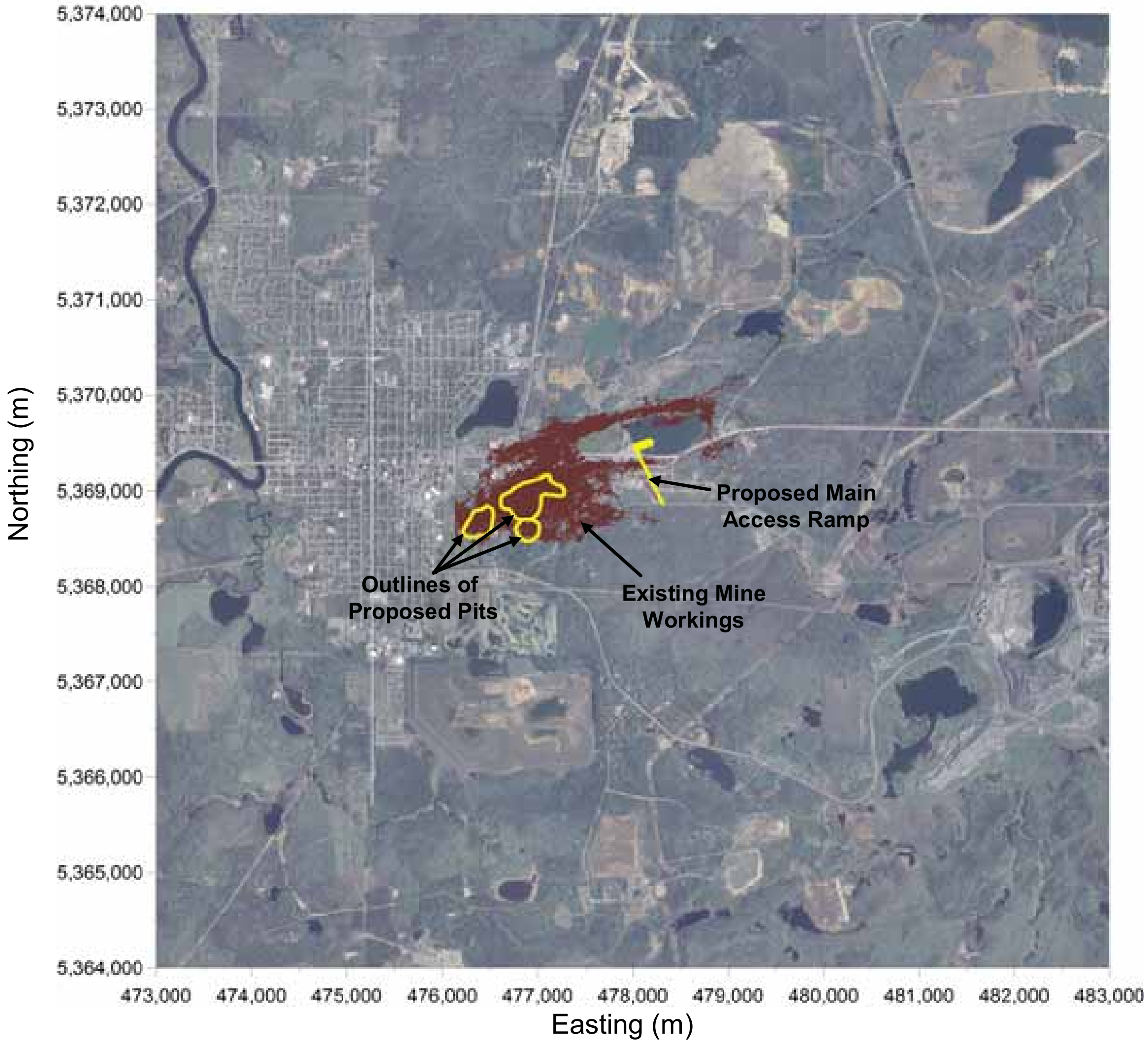


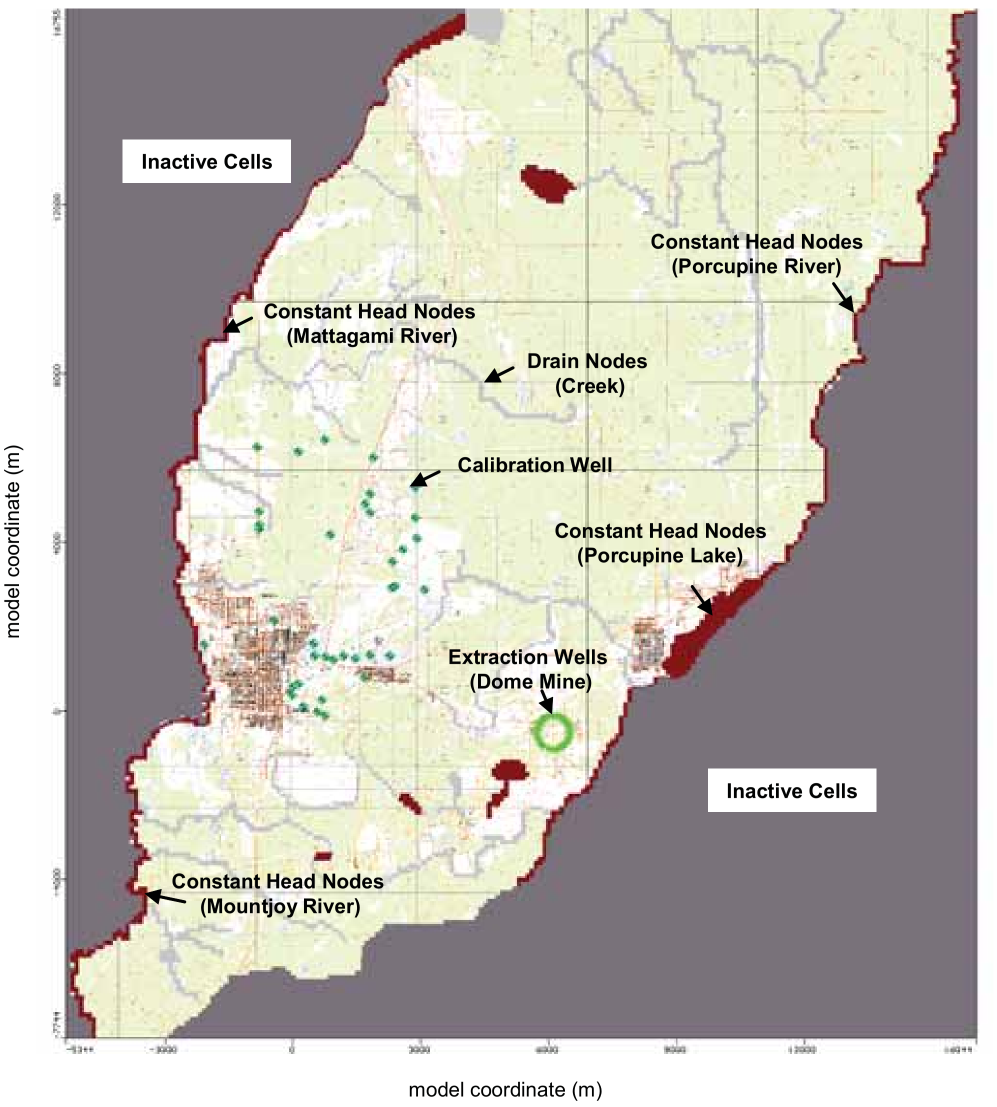
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Hollinger Model
Simulated Mine Workings

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.9 REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-9 - Mine Workings.mxd



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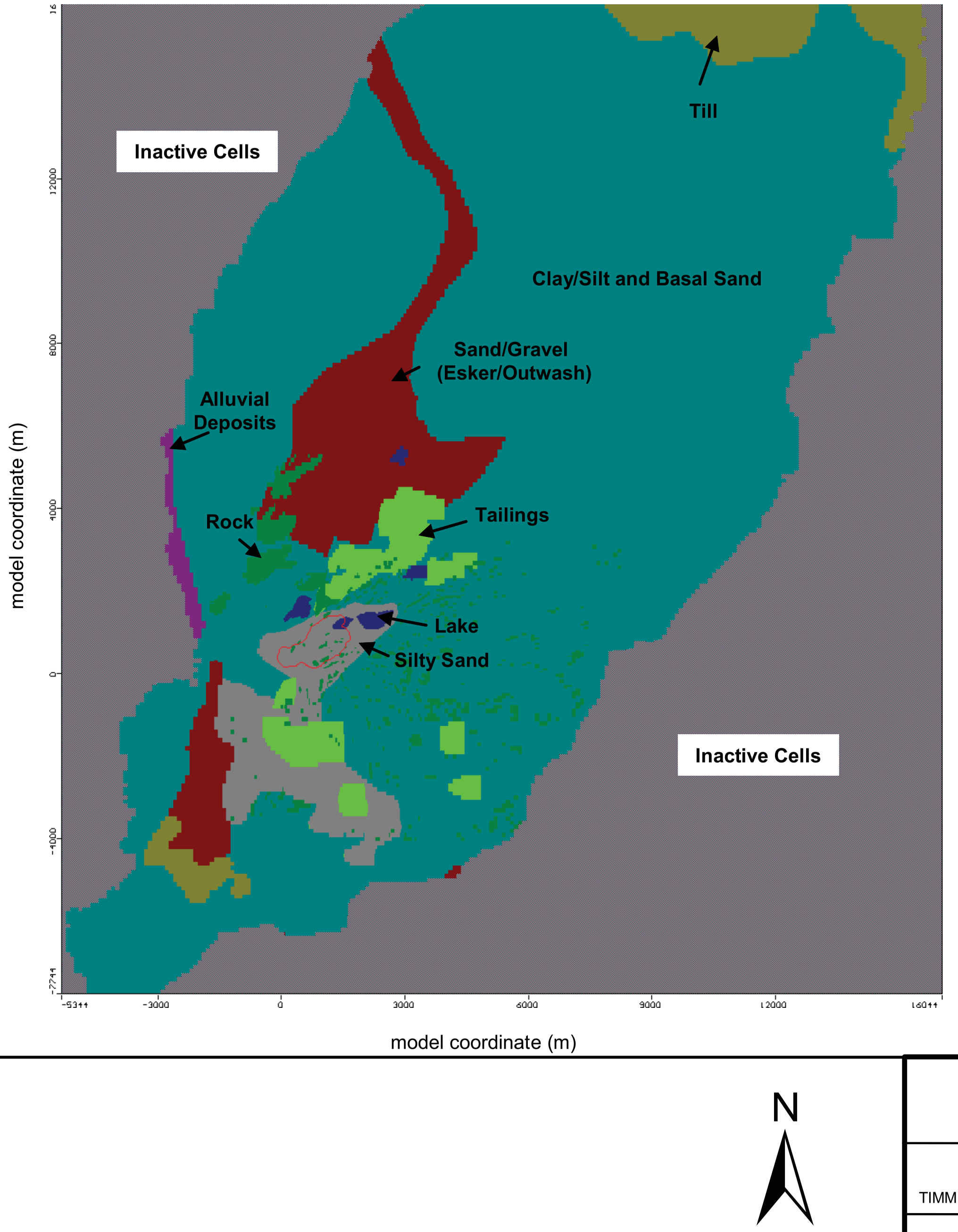
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Hollinger Model
Domain and Boundary Conditions

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.10 REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-10 - Domian and Boundary Conditions.mxd



HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Plan Veiw of Hollinger Model Hydraulic Conductivities

SCALE: As Shown

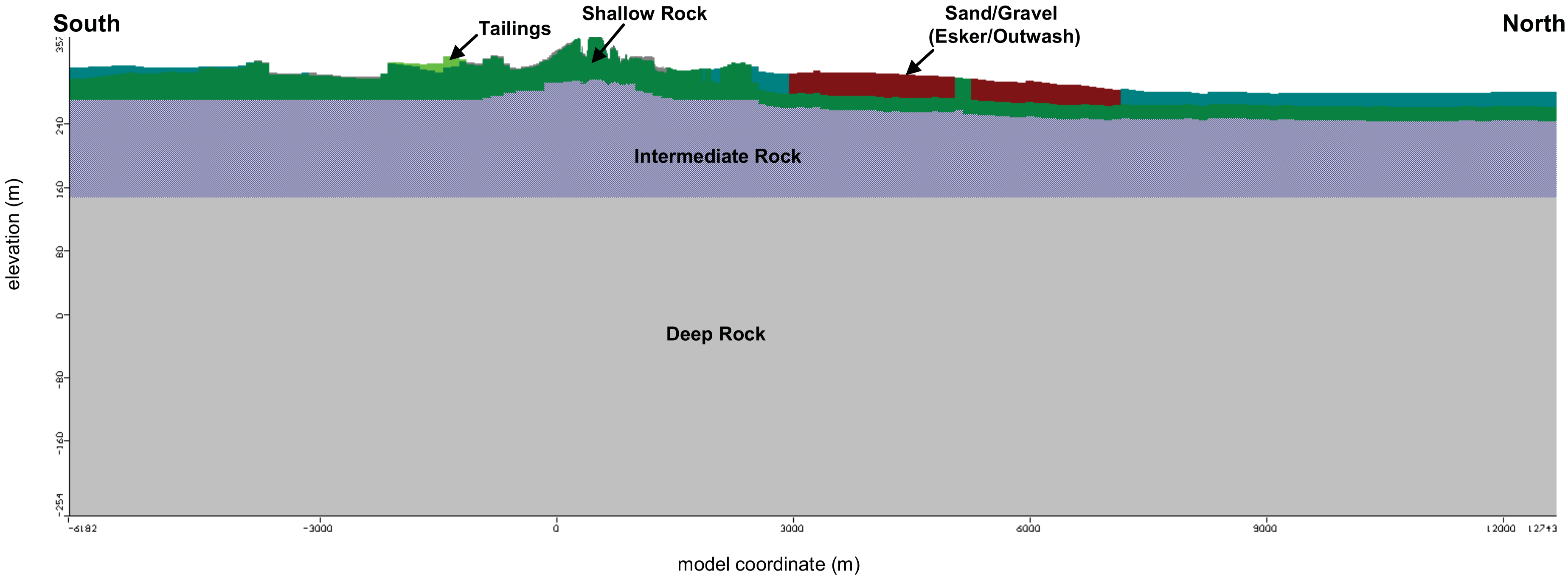
DATE: JULY 2009

PROJECT No: TC81525

FIGURE: 3.11

REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-11 - Hydraulic Conductivities.mxd



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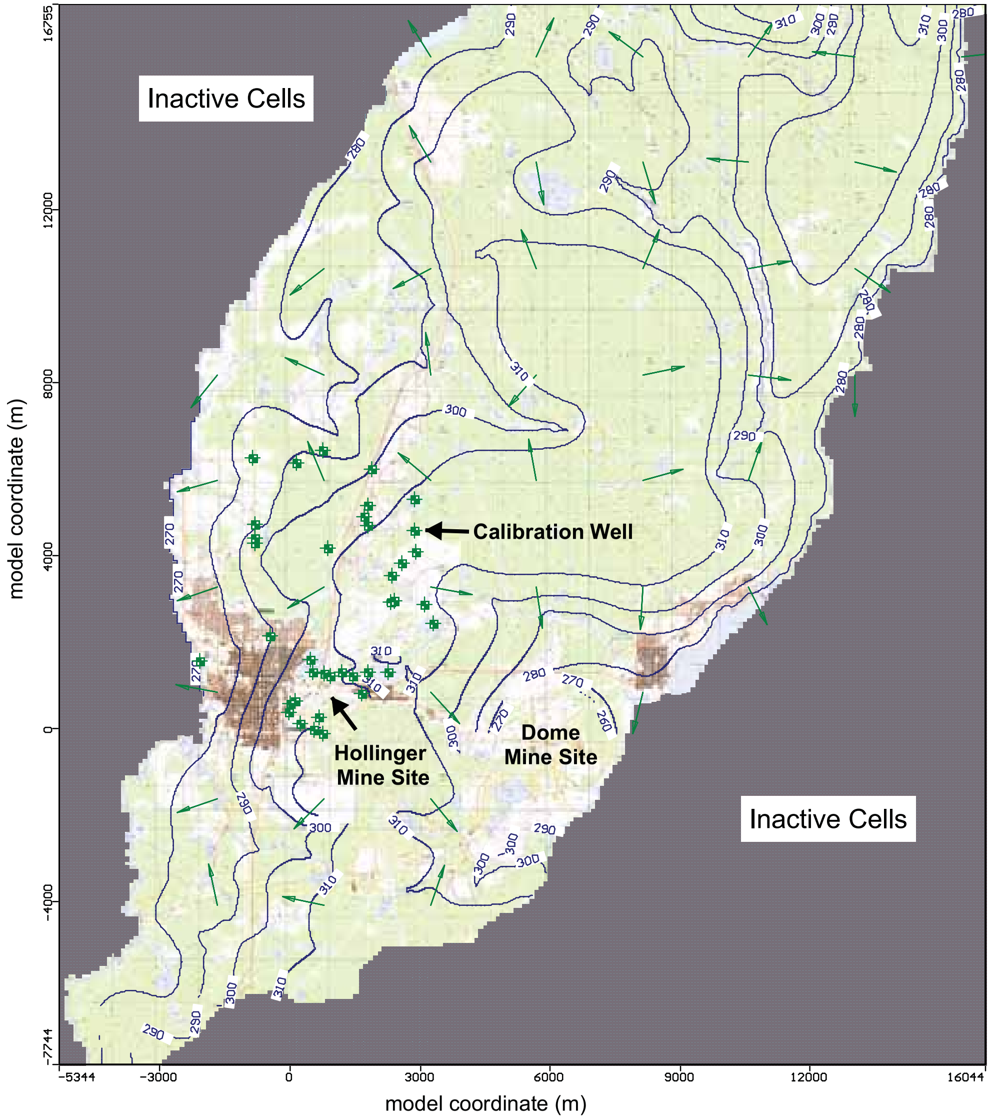
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Cross Section (North-South) of Hollinger Model Hydraulic Conductivities

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.12 REV: 1



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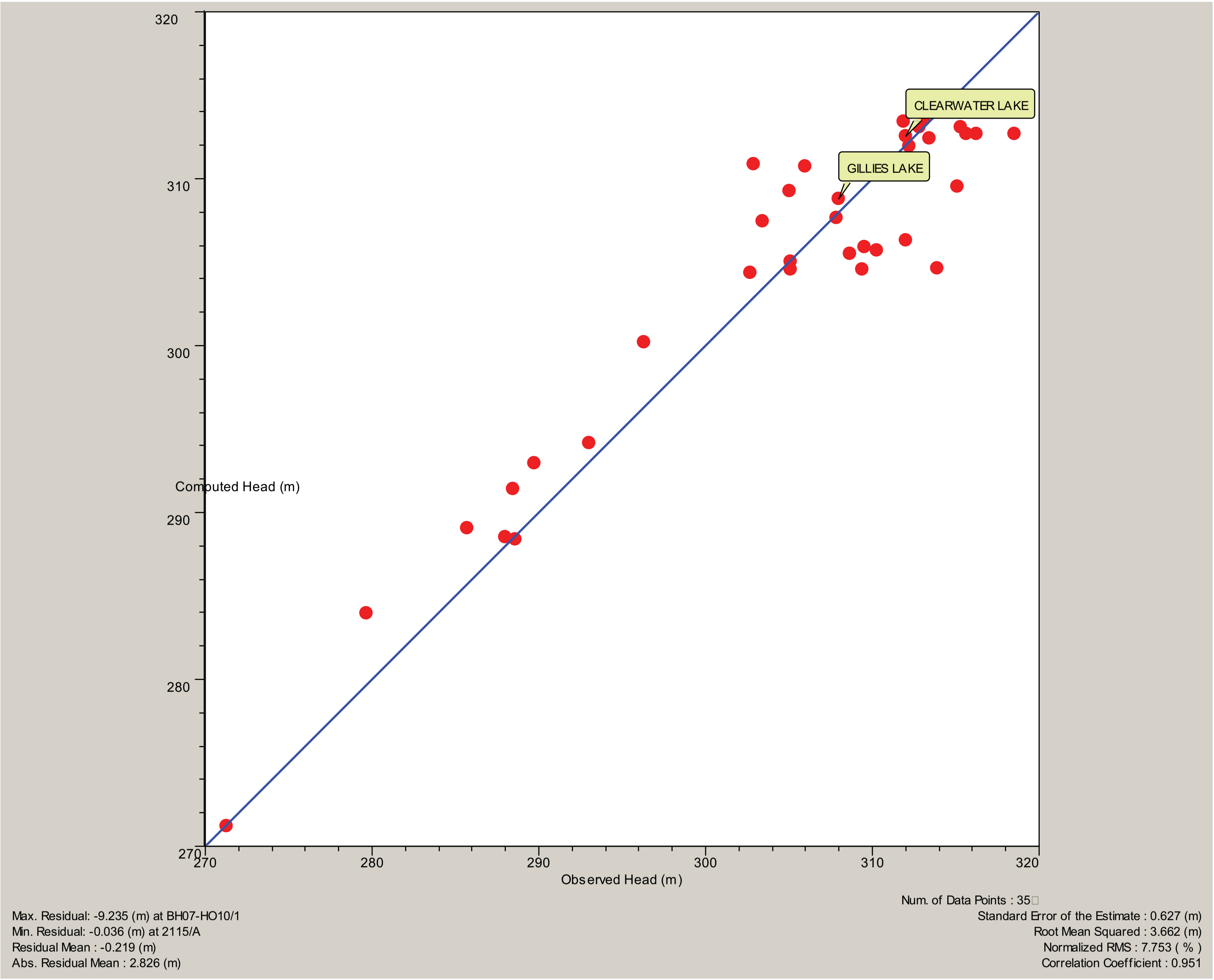
HOLLINGER BASELINE STUDIES

TIMMINS
ONTARIO

Hollinger Model Simulated Groundwater Flow System in Overburden and Shallow Rock (Current Conditions)

SCALE: As Shown
DATE: JULY 2009
PROJECT No: TC81525
FIGURE: 3.13
REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-13 - Groundwater Flow.mxd



Max. Residual: -9.235 (m) at BH07-HO10/1
Min. Residual: -0.036 (m) at 2115/A
Residual Mean : -0.219 (m)
Abs. Residual Mean : 2.826 (m)

Num. of Data Points : 35
Standard Error of the Estimate : 0.627 (m)
Root Mean Squared : 3.662 (m)
Normalized RMS : 7.753 (%)
Correlation Coefficient : 0.951

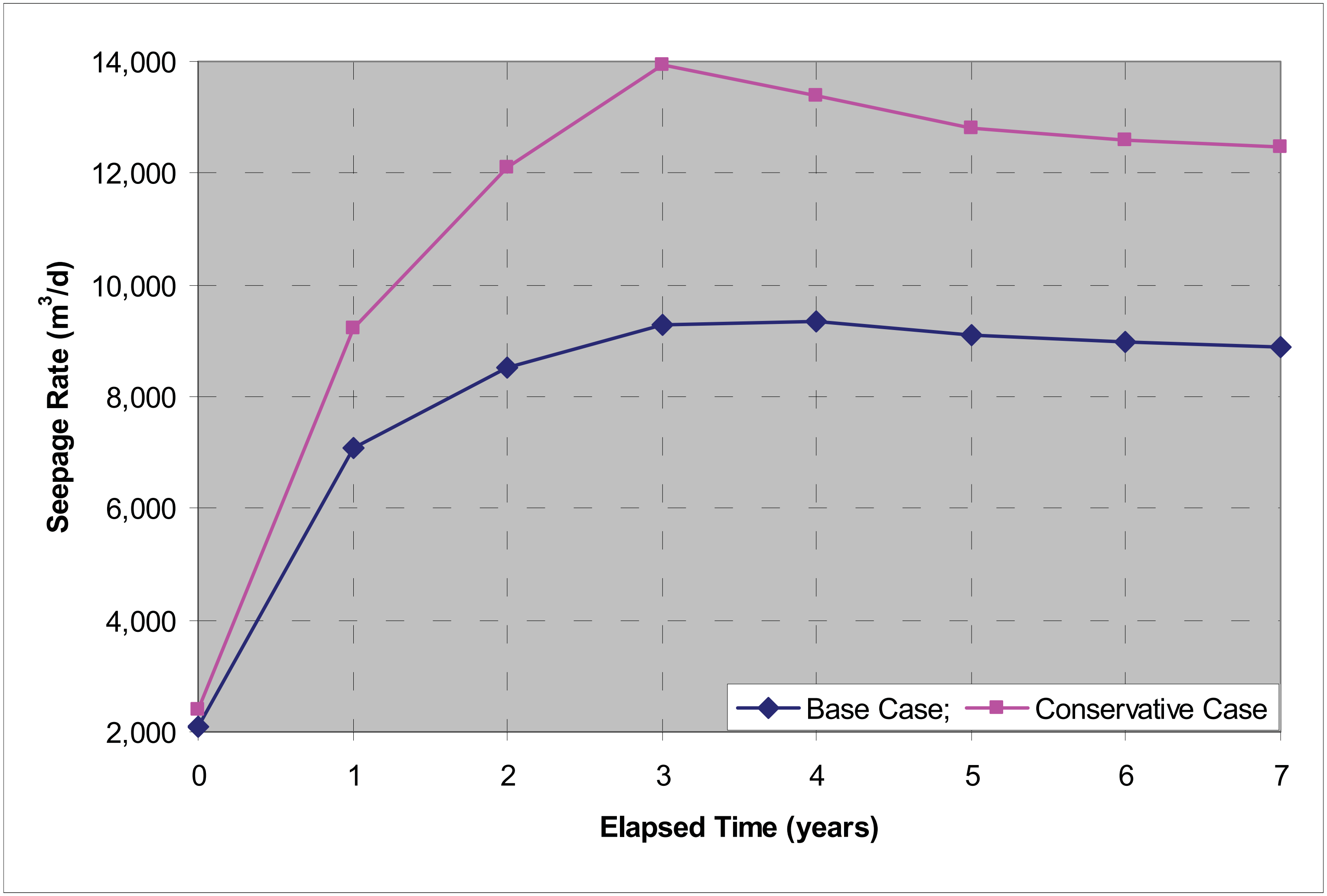
amec

HOLLINGER BASELINE STUDIES
TIMMINS ONTARIO

Compute versus Observed Hydraulic Heads (Current Conditions)

SCALE: As Shown
DATE: JULY 2009
PROJECT No: TC81525
FIGURE: 3.14
REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-14 - Hydrualic Heads.mxd



amec

HOLLINGER BASELINE STUDIES

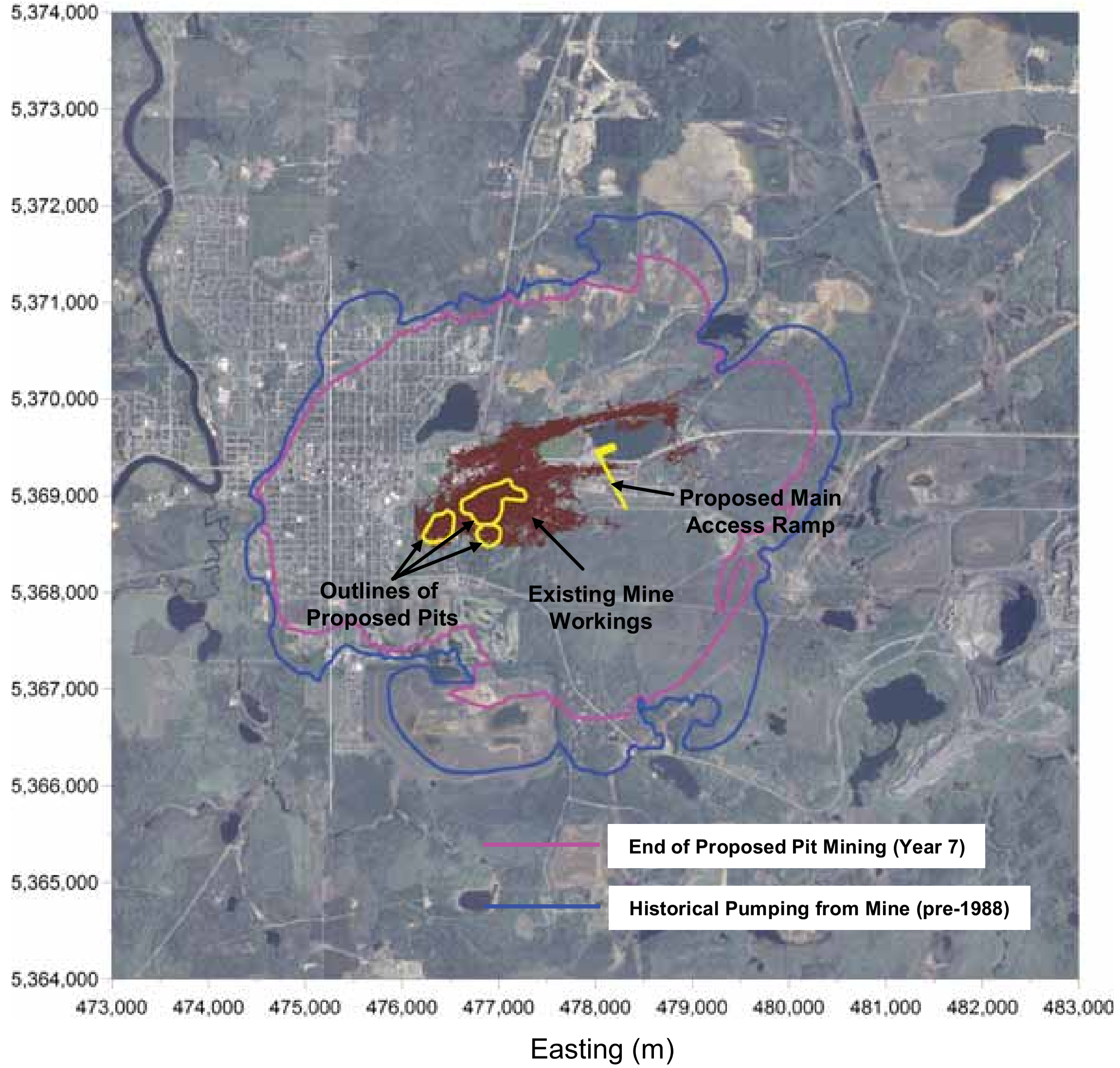
TIMMINS ONTARIO

Predicted Seepage Rates into Proposed Pits, main Access Ramp and Existing Mine Workings

SCALE: As Shown DATE: JULY 2009

PROJECT No: TC81525 FIGURE: 3.15 REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-15 - Seepage Rates.mxd



N

amec

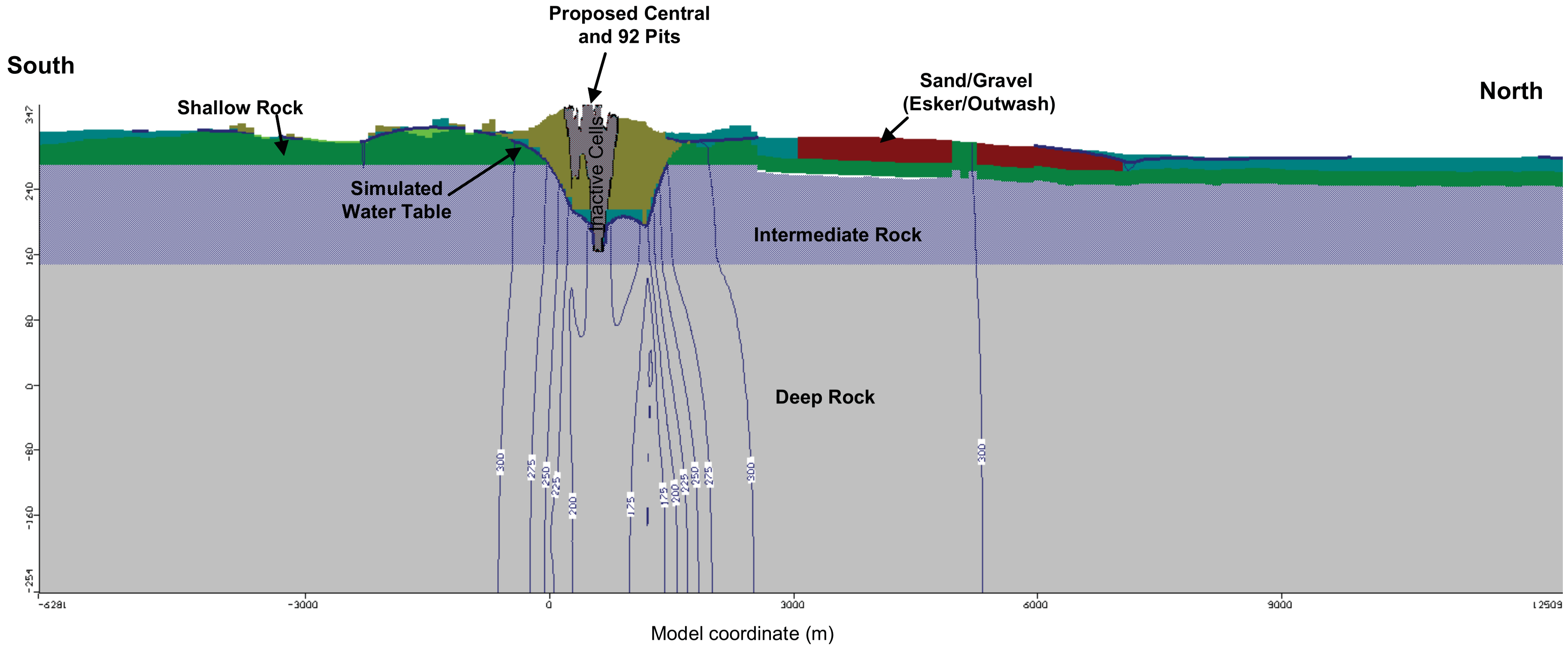
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Model Predicted 1 m Drawdown in Shallow Rock (Base Case)

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.16 REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-16 - Shallow Rock Drawdown.mxd



amec

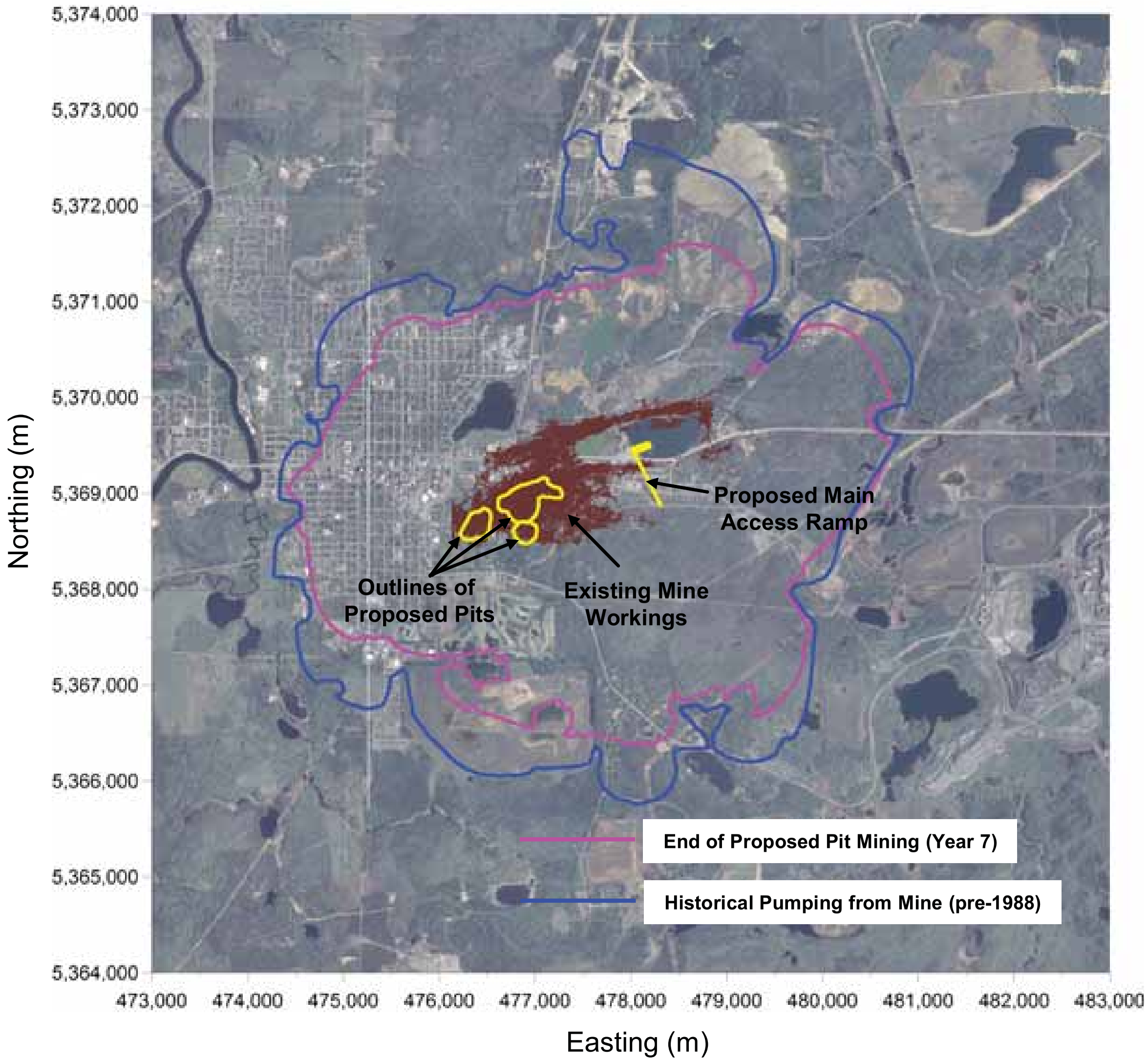
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Hollinger Pit Model Simulated Water Table Configuration at the End of Excavation (South - North Cross Section)

SCALE: As Shown
DATE: JULY 2009
PROJECT No: TC81525
FIGURE: 3.17
REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-17 - Water Table.mxd



N

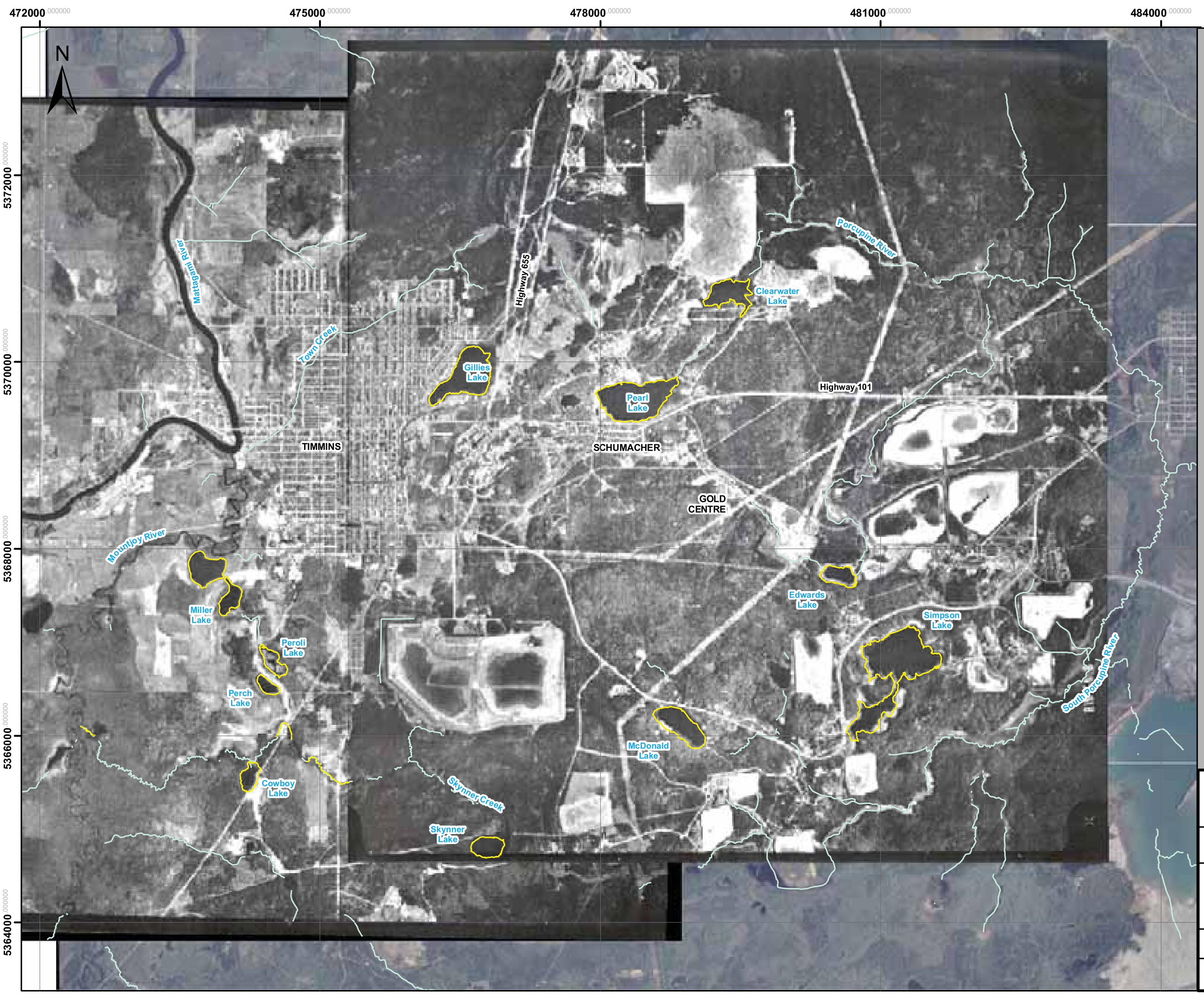
HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Model Predicted1 m Drawdown in Shallow Rock (Conservative Case)

SCALE: As Shown	DATE: JULY 2009
PROJECT No: TC81525	FIGURE: 3.18 REV: 1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS_Data\NEW_DATA_2009\Figure 3-18 - Drawdown.mxd



amec

HOLLINGER PROJECT

Historic Expression of Area Lakes and Ponds (Photo 1969)

SCALE: 1:40,000	DATE: December 2007
PROJECT No: TC71507	FIGURE: 4.1

P:\EM\Projects\2007\TC71507 Hollinger Baseline Studies\GIS data\Aquatics Mapping\1969_AirPhoto.mxd

TABLE 3.1
FLOW MEASUREMENTS (m^3/d) FROM 2008

	South Porcupine	North Porcupine	Skynner Creek
November 2008	7,800	24,800	-
Early May 2009	154,000	265,000	55,500
Mid May 2009	-	110,000	16,300
June 2009	18,300	14,400	5,300

TABLE 3.2
HYDROSTRATIGRAPHIC UNITS

Hydrostratigraphic Unit	Approximate Range in Thickness (m)	Composition	Expected Hydraulic Conductivity
Unit 1 (surficial layer, unconfined aquifer)	0 to 12	Fill material, peat, sands	Moderate (sand) to high (waste rock and peat)
Unit 2 (middle aquitard)	0 to 5	Silt, clay and clayey silts	Low
Unit 3 (lower overburden aquifer)	0 to >70	Sands, glacial till	Moderate
Unit 4 (shallow fractured bedrock aquifer)	0 to 30 into bedrock	Slates, greywackes, conglomerates and volcanics	Moderate to low
Unit 5 (intermediate Regional Bedrock System)	30 to 120 into bedrock	Slates, greywackes, conglomerates and volcanics	Typically low (potentially higher hydraulic conductivity along fault and fracture zones)
Unit 6 (deep regional bedrock system)	120 to 400 into bedrock	Slates, greywackes, conglomerates and volcanics	Typically low (potentially higher hydraulic conductivity along fault and fracture zones)

TABLE 3.3

SUMMARY OF CONSTANT HEAD PACKER TEST AND FALLING HEAD MONITORING WELL TEST RESULTS

Borehole ID	Depth (m)	Pressure 1 (psi)	Hydraulic Cond. (m/s)	Pressure 2 (psi)	Hydraulic Cond. (m/s)	Pressure 3 (psi)	Hydraulic Cond. (m/s)	Geometric Mean (m/s)
BH 07- 01	5.5-10.88							3.70E-06
Falling head	7.52 - 10.88							6.70E-06
BH 07- 02	3.05-12.19	10	6.64E-10	20	7.09E-08	30	7.59E-08	1.53E-08
	6.10-12.19			20	2.05E-10	30	2.65E-10	2.33E-10
	9.14-12.19	10	5.26E-10	20		30		5.26E-10
BH 07- 03	8.53-27.73	20	5.89E-08	40	3.21E-08	80	1.16E-07	6.02E-08
	27.73-46.93	20	9.81E-09	40	9.03E-09	90	4.84E-09	7.54E-09
	46.93-66.14	20	2.94E-08	40	9.03E-09	80	4.84E-09	1.09E-08
	66.14-85.34	20	2.94E-08	40	1.30E-07	80	2.02E-07	9.18E-08
	85.34-104.54	20	9.81E-09	40	7.22E-09	80	4.73E-09	6.94E-09
	104.54-123.74	20	9.81E-09	40	7.22E-09	80	9.38E-08	9.38E-08
	123.74-142.95	10	9.48E-08	30	4.72E-07	50	8.51E-08	1.56E-07
	142.95-162.15	3	1.79E-07	6	1.38E-06			4.98E-07
	162.15-181.05	10	1.81E-05	20	1.48E-06	30	6.38E-07	2.57E-06
BH 07- 03 Shallow	0.00-2.13	10		30		50	3.38E-08	3.38E-08
BH 07- 04	6.10-12.10	20	1.21E-09	30	2.02E-10	40	1.67E-10	3.44E-10
	3.48-12.10	20	6.52E-10	30		50	2.01E-09	1.14E-09
	9.14-12.10	15		25		40	4.81E-10	4.81E-10
falling head test								
	3.048 - 12.1							2.04E-08
	6.0 -12.1							9.73E-08
	9.1-12.1							9.86E-08
BH 07- 05	85.34-104.54	8	5.85E-06					5.85E-06
	104.54-123.74	Falling head						3.65E-06
	123.74-142.64	20	1.79E-06	40	8.60E-07	44	9.40E-07	1.13E-06
	142.64-161.84	10	1.48E-06	20	7.69E-07	40	8.17E-07	9.75E-07
	161.84-181.05	0	3.85E-05					3.85E-05
BH 07- 06	3.05-12.19	10	7.87E-08	20	8.02E-08	30	6.68E-08	7.50E-08
	3.09-12.19	10	2.36E-07	20	7.27E-08	30	7.23E-08	1.07E-07
	9.14-12.92	10	1.87E-08	20	6.20E-09	30	8.78E-09	1.01E-08
BH 07- 08	Falling Head							6.59E-07
BH 07- 09	14.02-33.22	6	2.09E-06					2.09E-06
	33.22-52.43	0	2.71E-06					2.71E-06
	52.43-71.63	10	1.94E-08	20	1.48E-08	30	1.07E-08	1.45E-08
	71.63-90.83	10	5.25E-08	20	1.48E-08	30	1.19E-08	2.10E-08
	90.83-110.03	0	1.39E-05					1.39E-05
	110.03-129.24	0	5.62E-06					5.62E-06
BH 07-09 Shallow	3.81-9.14	10	1.22E-06	20	3.67E-07	30	3.18E-07	5.22E-07
	6.09-9.14	10	8.49E-07	20	3.01E-07	30	3.60E-07	4.51E-07
BH 07- 10	6.09-11.92	10	4.26E-07	20	1.43E-07	30	1.35E-07	2.02E-07
	9.14-11.92	10	4.03E-07	20	1.33E-07	30	1.52E-07	2.01E-07
BH 07-11								
Falling Head	10-13.7							1.80E-07
BH 07- 12	9.14-12.19	10	5.54E-08	20	1.42E-07		1.19E-07	9.77E-08
	9.14-12.19	10	6.80E-07	20				6.80E-07
BH 07- 13	8.84-28.04	4	6.07E-06					6.07E-06
	28.04-47.24	10	2.03E-08	20	1.96E-08	30	7.80E-09	1.46E-08
	47.24-66.45	10	2.28E-08	20	1.71E-08	30	1.37E-08	1.75E-08
	66.45-85.65	0	4.37E-07					4.37E-07
	85.65-104.85	10	5.22E-08	20	6.10E-08	30	1.68E-07	8.12E-08
	104.85-124.05	10	6.06E-08	20	6.80E-08	30	1.55E-07	8.62E-08
	124.05-143.26	10	9.15E-08	20	1.74E-07	30	4.09E-07	1.87E-07
	143.26-162.46	10	1.31E-07	20	1.37E-07	30	2.57E-06	3.58E-07
	162.46-181.66	10	1.46E-07	20	5.48E-07	30	2.57E-06	5.90E-07

TABLE 3.4
GROUNDWATER LEVEL DATA

Monitoring Well ID	Ground Elevation[1] (masl)	Water Levels (mtoc)			Top of Screen (mbgl)	Bottom of Screen (mbgl)
		Event 1	Event 2	Event 3		
BH07HG01	311.0	1.65	1.83	0.9	7.9	10.9
BH07HG02	312.5	1.90	2.30	1.39	9.4	12.4
BH07HG03	362.0	3.60	Lost	Lost	3.1	6.1
BH07HG03D	326.0	NC	22.50	21.32	145	155
BH07HG04	321.0	11.85	12.60	8.29	9.1	12.1
BH07HG05C	313.0	NC	0.52	0.42	3.1	4.6
BH07HG05BR	313.0	NC	2.8	2.6	172	182
BH07HG06	327.5	9.70	9.93	5.76	9.2	12.2
BH07HG07	314.0	NC	9.08	8.49	8.9	11.9
BH07HG08	320.0	NC	11.01	11.80	9.2	12.2
BH07HG09A	314.5	7.58	Dry	Dry	6.8	9.8
BH07HG09B	314.5	NC	12.73	12.4	35	45
BH07HG09C	314.5	NC	12.50	13.59	101	111
BH07HG010	326.5	Dry	Dry	Dry	9.1	12.1
BH07HG011	310.5	NC	6.40	5.91	10.7	13.7
BH07HG012	313.0	9.60	9.58	9.38	8.9	11.9
BH07HG013A	324.0	NC	5.90	4.77	4.8	7.8
BH07HG013B	324.0	NC	11.71	10.68	13	23
BH07HG013C	324.0	NC	13.84	12.71	143	153

Notes:
[1] from LIDAR ground surface
Event 1 – week of July 19, 2007
Event 2 – week of September 25, 2007
Event 3 –week of November 12, 2007
NC = the well was not complete at the time of this event
mtoc = metres below top of casing (assume 1m stick-up)
mbgl = metres below ground level

TABLE 3.5
GROUNDWATER CHEMISTRY

Parameters	Units	ODWS	MW-1	MW-2	MW-3	MW-4	MW-5A	MW-5B	MW-6	MW-7	MW-8	MW-9B	MW-9C	MW-11	MW-12	MW-13A	MW-13B	MW-13C
General Chemistry			BH07HG-01	BH07HG-02	BH07HG-03	BH07HG-04	BH07HG-05A	BH07HG-05B	BH07HG-06	BH07HG-07	BH07HG-08	BH07HG-09B	BH07HG-09C	BH07HG-03	BH07HG-12	BH07HG-13A	BH07HG-13B	BH07HG-13C
Alkalinity (as CaCO3)	mg/L	30-500 OG	269	319	288	**<1**	301	191	346	**531**	269	265	328	233	257	183	215	193
Conductivity	uS/cm		1280	1180	1470	7120	1390	980	1040	2150	1250	1030	1100	603	1140	1320	846	925
DOC	mg/L	5 AO	3.4	3.9	4	**17**	4.7	2.1	1.4	3.9	3.1	4.4	2.2	0.5	1	1.8	**5.1**	1
Hardness (as CaCO3)	mg/L	80-100 OG	**410**	**920**	**200**	**5200**	**750**	**460**	**500**	**1600**	**840**	**30**	**350**	**280**	**440**	**440**	**17**	**330**
Nitrate (as N)	mg/L	10 MAC	<0.1	<0.1	2.1	3.2	0.3	<0.1	0.2	0.8	5.1	1	1.3	1	0.4	<0.1	<0.2	0.3
Nitrite (as N)	mg/L	1 MAC	<0.001	<0.001	0.07	0.01	<0.01	<0.01	0.02	0.02	0.03	0.6	<0.01	0.02	<0.01	<0.001	0.2	<0.01
pH	pH Units	6.5-8.5	7.9	8	8.2	3.9	7.9	8	8	7.9	8	**8.6**	8	8	8	8	**9.4**	8
Sulphate	mg/L	500 AO	142	250	318	**6060**	424	248	196	**808**	363	146	90	73	57	435	145	64
Total Dissolved Solids (TDS)	mg/L	500 AO	404	433	**620**	**1220**	441	376	358	**549**	454	**527**	450	283	466	476	484	396
Metals																		
Arsenic	mg/L	0.025 IMAC	0.001	0.003	0.001	<0.005	0.008	0.02	0.006	<0.001	<0.001	0.008	0.001	<0.001	<0.001	<0.001	**0.16**	0.002
Cadmium	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	**0.12**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.05 MAC	<0.005	<0.005	<0.005	<0.030	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	1 AO	0.001	0.001	0.002	**2.5**	0.002	<0.001	0.003	0.005	0.003	0.008	0.002	0.002	<0.001	0.002	0.007	0.003
Iron	mg/L	0.3 AO	**0.38**	**0.88**	<0.100	**61**	**3**	**0.37**	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Lead	mg/L	0.01 MAC	<0.0005	<0.0005	<0.0005	**0.007**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese	mg/L	0.05 AO	**0.24**	**0.9**	**0.068**	**130**	**0.52**	**0.19**	**0.047**	**0.25**	**0.42**	**0.068**	**0.036**	**0.006**	**0.3**	**0.49**	**<0.002**	**0.007**
Zinc	mg/L	5 AO	0.067	0.032	0.018	**33**	0.02	0.015	0.018	0.015	0.02	0.03	0.016	0.01	<0.005	0.024	0.01	0.021

Notes:

Parameters expressed as mg/L, unless otherwise noted. Exceedences of the ODWS are indicated by **BOLD** entries.

ODWS - Ontario Drinking Water Standards (Ministry of the Environment, 2003)

MAC - Maximum Acceptable Concentration IMAC - Interim Maximum Acceptable Concentration AO - Aesthetic Objective OG - Operational Guideline

TABLE 3.6
INITIAL AND CALIBRATED GROUNDWATER FLOW MODEL INPUT PARAMETERS

Simulated Aquifer Units and Zones	Initial(1)	Calibrated	Comments/Expected Range(2)
Hydraulic Conductivity (cm/s)			
Overburden			
Sand/gravel	$1x10^{-2}$	$1x10^{-2}$	Esker, outwash areas 10^{-2} cm/s - 10^{-1} cm/s
Silty sand/tailings	$1x10^{-4}$	$5x10^{-4}$	Expected to be in the order of 10^{-4} cm/s
Clay/silt and basal sand	$1x10^{-4}/1x10^{-6}$(3)	$5x10^{-4}/5x10^{-6}$	Horizontal hydraulic conductivity value represents average over depth hydraulic conductivity of clay/silt and basal sand zones. Vertical hydraulic conductivity value represents hydraulic conductivity of clay/silt zone.
Till	$1x10^{-4}$	$1x10^{-4}$(4)	10^{-5} cm/s to 10^{-4} cm/s
Silty clay	$1x10^{-6}$	$3x10^{-6}$ and $1x10^{-6}$	Underneath Pearl Lake and Gillies Lake, respectively Expected to be in the order 10^{-6} cm/s to 10^{-5} cm/s
Alluvial deposits	$1x10^{-3}$	$1x10^{-3}$(4)	Relatively small area along Mattagami River
Bedrock			
Shallow rock(5)	$1x10^{-4}$	$1x10^{-4}$	10^{-5} cm/s to 10^{-4} cm/s
Intermediate rock(6)	$1x10^{-5}$	$2x10^{-5}$(7)	10^{-6} cm/s to 10^{-4} cm/s
Deep rock	$1x10^{-6}$	$1x10^{-6}$	10^{-7} cm/s to 10^{-5} cm/s
Recharge Rate (mm/year)			
Esker/outwash	300	300	250 to 350 mm/yr
Silty sand/sandy silt	100	100	Expected to vary from 20 to 60 mm/yr (thin overburden) to 100 to 200 mm/yr
Till	100	100(4)	100 to 200 mm/yr
Silty clay	30	40	20 to 60 mm/yr
Bedrock outcrop	30	30	20 to 40 mm/yr

Notes:
(1) Initially assigned input parameters were modified through the model calibration process
(2) Combination of literature (Freeze and Cherry, 1979; Anderson and Woessner, 1992) and site-specific data
(3) $1x10^{-4}/1x10^{-5}$ – horizontal over vertical hydraulic conductivity value
(4) Not subject to calibration, model is not sensitive to this parameter
(5) Upper 30 m thick bedrock zone
(6) Upper 120 m thick bedrock zone located below the shallow rock zone
(7) An additional variant with higher hydraulic conductivity zone of $2x10^{-4}$ cm/s located at the contact between intermediate and deep rock was simulated as part of the predictive sensitivity analysis (Section 3.6.3)

TABLE 3.7
OBSERVED AND COMPUTED WATER LEVELS FOR CURRENT CONDITIONS

Well/Lake ID	Easting (m)	Northing (m)	Observed Head (m)	Computed Head (m)	Discrepancy (m)	Comment
1500	475,314	5,373,002	288.0	288.5	0.5	MOE database
1522	476,254	5,374,427	288.4	291.4	3.0	MOE database
1598	476,864	5,374,707	288.6	288.4	-0.1	MOE database
1858	477,914	5,372,977	315.1	309.5	-5.6	MOE database
2115	474,039	5,369,848	271.3	271.2	0.0	MOE database
2545	477,914	5,373,427	312.0	306.3	-5.7	MOE database
2546	478,014	5,374,277	296.3	300.2	3.9	MOE database
2569	477,815	5,373,175	307.9	307.7	-0.2	MOE database
3099	475,664	5,370,427	285.7	289.0	3.3	MOE database
3635	475,314	5,372,577	293.1	294.2	1.1	MOE database
3636	475,314	5,372,677	289.7	292.9	3.2	MOE database
867	475,264	5,374,527	279.7	283.9	4.3	MOE database
BH-M-03-03	479,205	5,371,157	316.3	312.7	-3.5	McIntyre Mine
BH-M-03-06	478,435	5,371,202	311.9	313.4	1.5	McIntyre Mine
BH-M-03-07	478,521	5,371,247	313.1	313.5	0.4	McIntyre Mine
BH-M-03-08	478,455	5,371,806	313.4	312.4	-1.0	McIntyre Mine
BH-M-03-09	478,978	5,372,859	312.2	312.0	-0.2	McIntyre Mine
BH-M-03-11	478,688	5,372,094	315.7	312.7	-3.0	McIntyre Mine
BH-M-04-12	479,026	5,372,368	315.3	313.1	-2.2	McIntyre Mine
BH07-HO01	476,630	5,369,576	309.6	305.9	-3.7	
BH07-HO02	476,887	5,369,567	310.2	305.7	-4.5	
BH07-HO04	477,303	5,369,582	308.7	304.4	1.7	
BH07-HO05B	477,912	5,369,594	312.8	305.5	-3.2	
BH07-HO06	477,780	5,369,083	317.4	NA	NA	
BH07-HO07	476,233	5,368,918	305.1	304.6	-0.5	
BH07-HO08	476,119	5,368,864	309.4	304.6	-4.8	
BH07-HO09	476,088	5,368,656	<305.1(dry)	305.0	>-0.1	
BH07-HO10	476,788	5,368,544	<313.9(dry)	304.6	>-9.2	
BH07-HO11	476,343	5,368,387	303.5	307.5	4.0	
BH07-HO12	476,681	5,368,249	302.9	310.9	8.0	
BH07-HO13B	476,864	5,368,179	318.5	312.7	-5.8	
Charlebois Lake	478,977	5,373,580	306.0	310.8	4.8	
Clearwater Lake	479,423	5,370,724	312.0	312.6	0.6	
Gillies Lake	476,590	5,369,874	308.0	308.8	0.8	
PW87	476,995	5,372,452	305.0	309.3	4.3	Winding Woods water supply well

NA- Not available, computed head is below the well screen

TABLE 3.8
STORAGE INPUT PARAMETERS UTILIZED IN TRANSIENT MODEL RUNS(1)

Simulated Aquifer Material/Zone	Specific Storage (m^{-1})	Specific Yield (-)
Overburden		
Sand/gravel	$1x10^{-5}$	$2x10^{-1}$
Silty sand/tailings	$1x10^{-4}$	$1x10^{-1}$
Clay/silt and basal sand(2)	$1x10^{-4}$	$5x10^{-2}$
Till	$1x10^{-4}$	$1x10^{-1}$
Silty clay	$5x10^{-4}$	$2x10^{-2}$
Alluvial deposits	$1x10^{-5}$	$1x10^{-1}$
Bedrock		
Shallow weathered rock	$1x10^{-5}$	$1x10^{-2}$
Intermediate rock	$1x10^{-6}$	$1x10^{-3}$
Deep rock	$1x10^{-6}$	$1x10^{-3}$

Notes:
(1) Literature data (Anderson and Woessner, 1992; Walton, 1988; Johnson, 1967; Rusmussen, 1963)
(2) Lumped properties of the overburden layer comprised of the upper silty clay and lower basal sand units

APPENDIX A

CURRENT PTTW AND C. OF A. (see Appendix B of main report)

APPENDIX B

BOREHOLE LOGS

RECORD OF MONITORING WELL No. BH07-HO01 Co-Ord. 0476630 E, 5369576 N

amec

Project Number:	**TC71507.100**	Drilling Location:		Logged by:	**SRL**
Project Client:	**PJV**	Drilling Method:	**200 mm Hollow Stem Augers**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Track Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started:	**26 Jul 07** Date Completed: **27 Jul 07**	Revision No.:	**2, 07/11/07**

LITHOLOGY PROFILE — SOIL SAMPLING — FIELD TESTING — LAB TESTING — INSTRUMENTATION INSTALLATION — COMMENTS

Field Testing: Penetration Testing: ○ SPT ● DCPT; MTO Vane*: △ Intact ▲ Remould; Nilcon Vane*: ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Lab Testing: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit; ✳ Passing 75 um (%); ○ Moisture Content (%) 20 40 60 80

Comments:

- 1 flushmount in bentonite
- 1 riser pipe in bentonite
- 1 riser pipe in sand
- 1 slotted pipe in sand

Geodetic Ground Surface Elevation: 311.10 m

DESCRIPTION	Elevation (m) / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Moisture Content (%)
ORGANICS	310.8 0.3					
brown SILTY SAND trace gravel, moist, compact		AU				
		SS	1	24	12	14 13
	309.3 1.8	SS	2	40	50/10cm	
TCR: 54% RQD: 20%	307.8 3.3	RC	3			
TCR: 73% RQD: 32%	306.3 4.8	RC	4			
TCR: 90% RQD: 27%	304.8 6.3	RC	5			
TCR: 80% RQD: 23%	303.3 7.8	RC	6			
TCR: 100% RQD: 66%	301.8 9.3	RC	7			
TCR: 100% RQD: 23%	300.2 10.9	RC	8			
END OF BOREHOLE						

DEPTH (m): 5, 10

ELEVATION (m): 310, 309, 308, 307, 306, 305, 304, 303, 302, 301

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Page: 1 of 1

RECORD OF MONITORING WELL No. BH07-HO02 Co-Ord. 0476887 E, 5369567 N

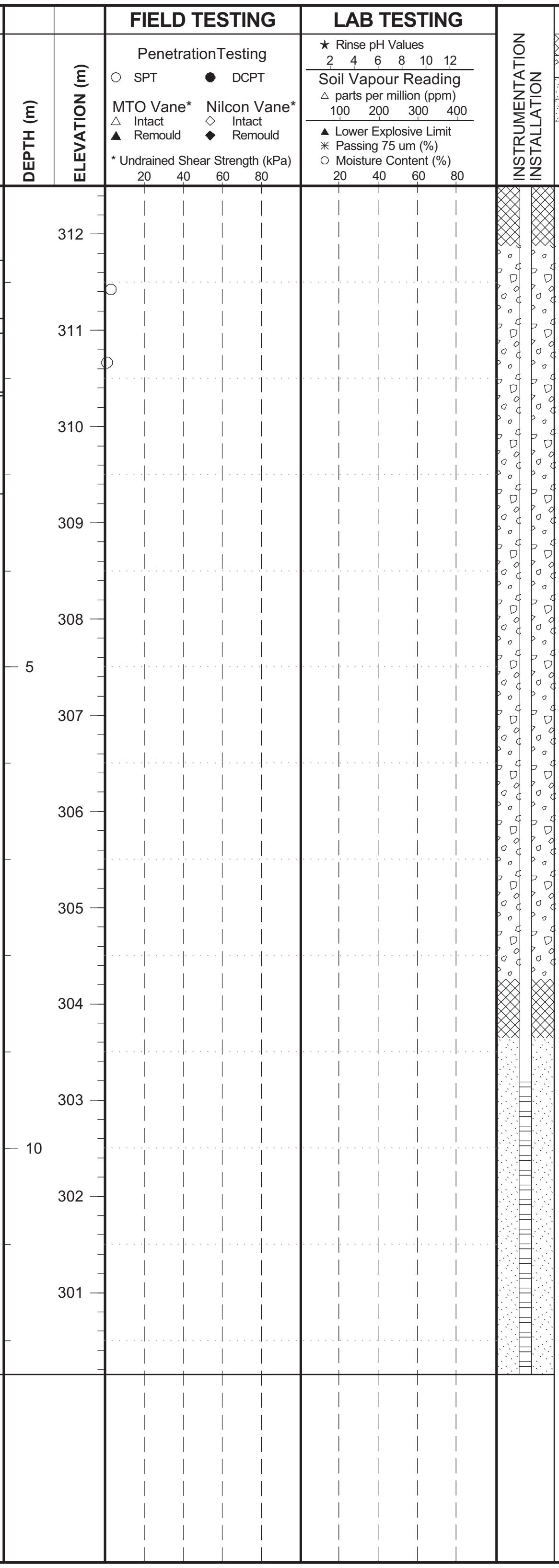
amec

Project Number:	**TC71507.100**	Drilling Location:		Logged by:	**AM**
Project Client:	**PJV**	Drilling Method:	**200 mm Hollow Stem Augers**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Track Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started:	**27 Jul 07** Date Completed: **27 Jul 07**	Revision No.:	**2, 07/11/07**

LITHOLOGY PROFILE

Geodetic Ground Surface Elevation: 312.50 m

DESCRIPTION	Elevation / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ORGANICS over SAND	311.7 0.8				
brown / grey SAND trace silt, very loose	311.3 1.2	SS	1	25	3
grey SILTY CLAY moist, soft	311.0 1.5	SS	2	41	1
grey / blue CLAY some silt, wet, very soft	310.3 2.2				
TCR: 93% RQD: 48%	300.2 12.4	RC			
END OF BOREHOLE (no refusal)					



COMMENTS

- ▩ 1 riser pipe in bentonite
- ▨ 1 riser pipe in backfill
- ░ 1 riser pipe in sand
- ▥ 1 slotted pipe in sand

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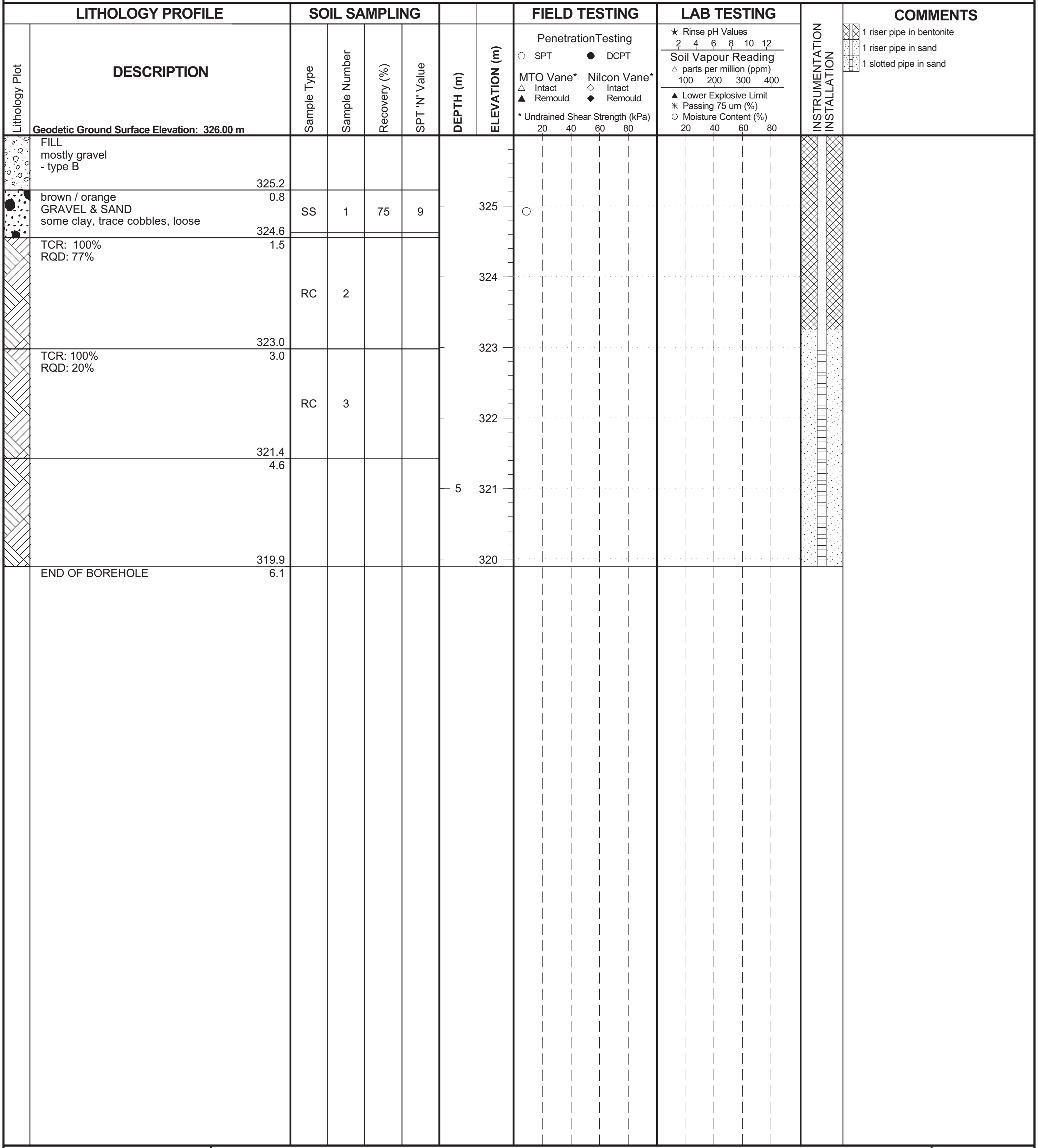
RECORD OF MONITORING WELL No. BH07-HO03 Co-Ord. 0477059 E, 5369493 N

Project Number:	**TC71507.100**	Drilling Location:		Logged by:	**AM**
Project Client:	**PJV**	Drilling Method:	**200 mm Hollow Stem Augers**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Track Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started:	**27 Jul 07** Date Completed: **27 Jul 07**	Revision No.:	**2, 07/11/07**



Geodetic Ground Surface Elevation: 326.00 m

DESCRIPTION	Elevation / Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
FILL mostly gravel - type B	325.2 0.8				
brown / orange GRAVEL & SAND some clay, trace cobbles, loose	324.6 1.5	SS	1	75	9
TCR: 100% RQD: 77%	323.0 3.0	RC	2		
TCR: 100% RQD: 20%	321.4 4.6	RC	3		
	319.9 6.1				
END OF BOREHOLE					

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RECORD OF MONITORING WELL No. BH07-HO04 Co-Ord. 0477303 E, 5369582 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**
Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **17 Jul 07** Date Completed: **17 Jul 07**
Logged by: **AM**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

LITHOLOGY PROFILE

Geodetic Ground Surface Elevation: 321.00 m

DESCRIPTION	Elevation (m)	DEPTH (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Moisture Content (%)
UNSAMPLED	320.7	0.3	AU				
red SILTY SAND damp	320.2	0.8	SS	1	77		26
brown SAND and GRAVEL trace silt and clay, damp	319.8	1.2	SS	2	90		18
TCR: 91% RQD: 41%	319.3	1.7	RC	3			
TCR: 100% RQD: 66%	318.0	3.1	RC	4			
TCR: 94% RQD: 62%	316.3	4.7	RC	5			
TCR: 100% RQD: 100%	314.8	6.2	RC	6			
TCR: 100% RQD: 52%	313.4	7.6	RC	7			
TCR: 77% RQD: 59%	311.9	9.1	RC	8			
TCR: 100% RQD: 86%	310.6	10.4	RC	9			
TCR: 91% RQD: 13%	308.9	12.1	RC	10			
END OF BOREHOLE							

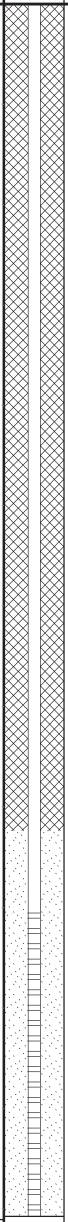
FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS

▨ 1 riser pipe in bentonite
▤ 1 riser pipe in sand
▥ 1 slotted pipe in sand

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Page: 1 of 1

RECORD OF MONITORING WELL No. BH07-HO05B Co-Ord. 0477912 E, 5369594 N

amec

Project Number:	TC71507.100	Drilling Location:		Logged by:	SRL
Project Client:	PJV	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Environmental Baseline Study	Drilling Machine:	Track Mounted Drill	Reviewed by:	TIM
Project Location:	Hollinger, Timmins, Ontario	Date Started: 27 Jul 07	Date Completed: 28 Jul 07	Revision No.:	2, 07/11/07

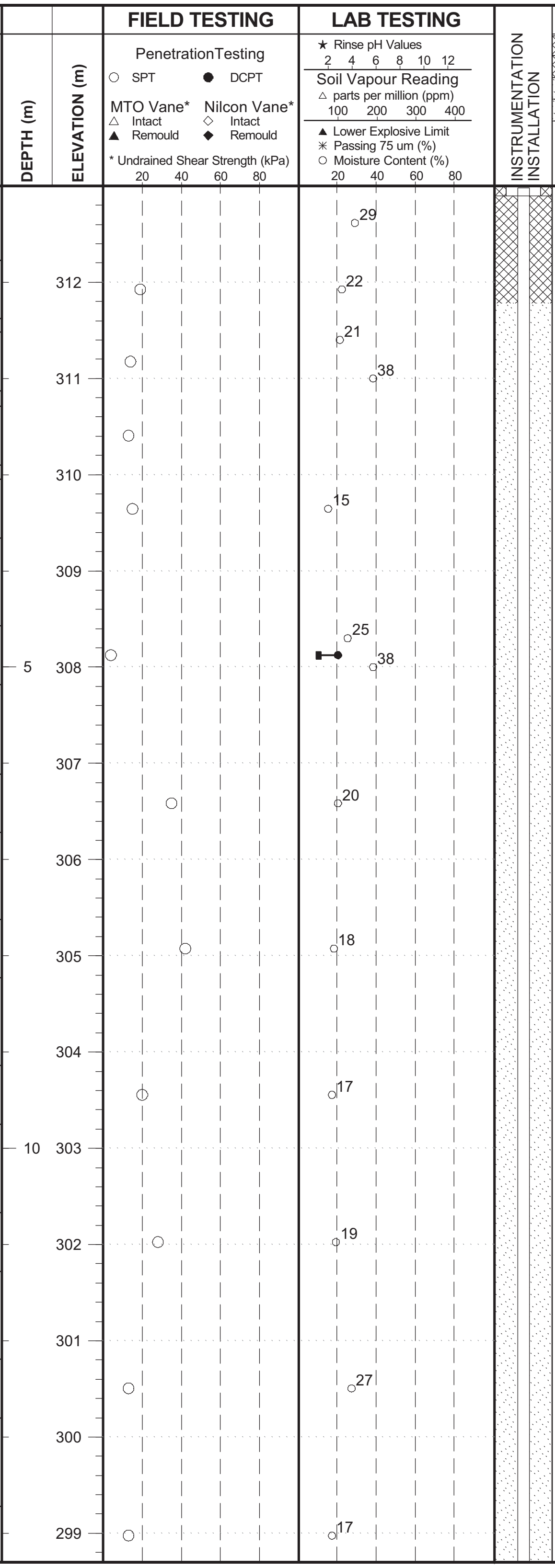
LITHOLOGY PROFILE

Geodetic Ground Surface Elevation: 313.00 m

DESCRIPTION	Elevation (m) / Depth (m)
GRASS over black SILTY SAND - moist	312.2 0.8
GRAVEL trace silt, sand, organics, wet, compact	311.5 1.5
grey SANDY SILT trace clay, compact	311.2 1.8
grey SILTY SAND some organics, compact	310.7 2.3
grey SAND trace silt, compact	308.4 4.6
grey CLAYEY SANDY SILT trace gravel, firm	308.1 4.9
grey SANDY SILT trace clay, wet, loose	306.9 6.1
grey SAND trace silt, wet, dense	303.9 9.1
grey SILT variable sand, trace clay, wet, compact	

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
AU	1		
SS	2	13	19
SS	3	16	14
SS	4	51	13
SS	5	51	15
SS	6	100	4
SS	7	92	35
SS	8	92	42
SS	9	89	20
SS	10	92	28
SS	11	84	13
SS	12	97	13



COMMENTS

▨ 1 flushmount in bentonite
▨ 1 riser pipe in bentonite
▨ 1 riser pipe in sand
▨ 1 slotted pipe in sand

heaved 610 mm

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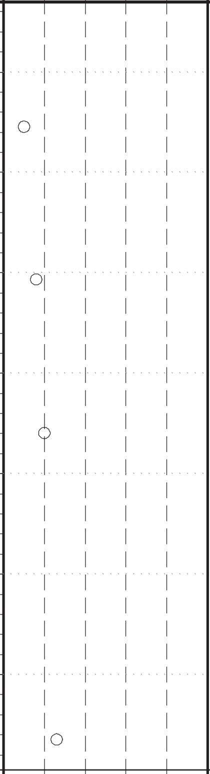
Continued on Next Page

RECORD OF MONITORING WELL No. BH07-HO05B Co-Ord. 0477912 E, 5369594 N

amec

Project Number: **TC71507.100**
Drilling Location:
Logged by: **SRL**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING
DESCRIPTION	Elevation / Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT	○ Moisture Content (%)
grey SILT variable sand, trace clay, wet, compact	297.8 15.2					15	298		
grey SILT trace clay and sand, wet, compact	296.2 16.8	SS	13	100	10		297	○	27
grey SAND some silt, wet, compact		SS	14	92	16		296	○	20
		SS	15		20		295 294	○	20
	291.1 22.0	SS	16	92	26	20	293 292	○	22
END OF BOREHOLE									



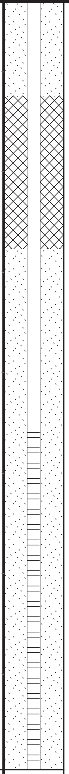
FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS

- ▥ 1 flushmount in bentonite
- ▩ 1 riser pipe in bentonite
- ▨ 1 riser pipe in sand
- ▤ 1 slotted pipe in sand

RECORD OF MONITORING WELL No. BH07-HO05C Co-Ord. 0477912 E, 5369594 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**
Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **27 Jul 07** Date Completed: **28 Jul 07**
Logged by: **SRL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

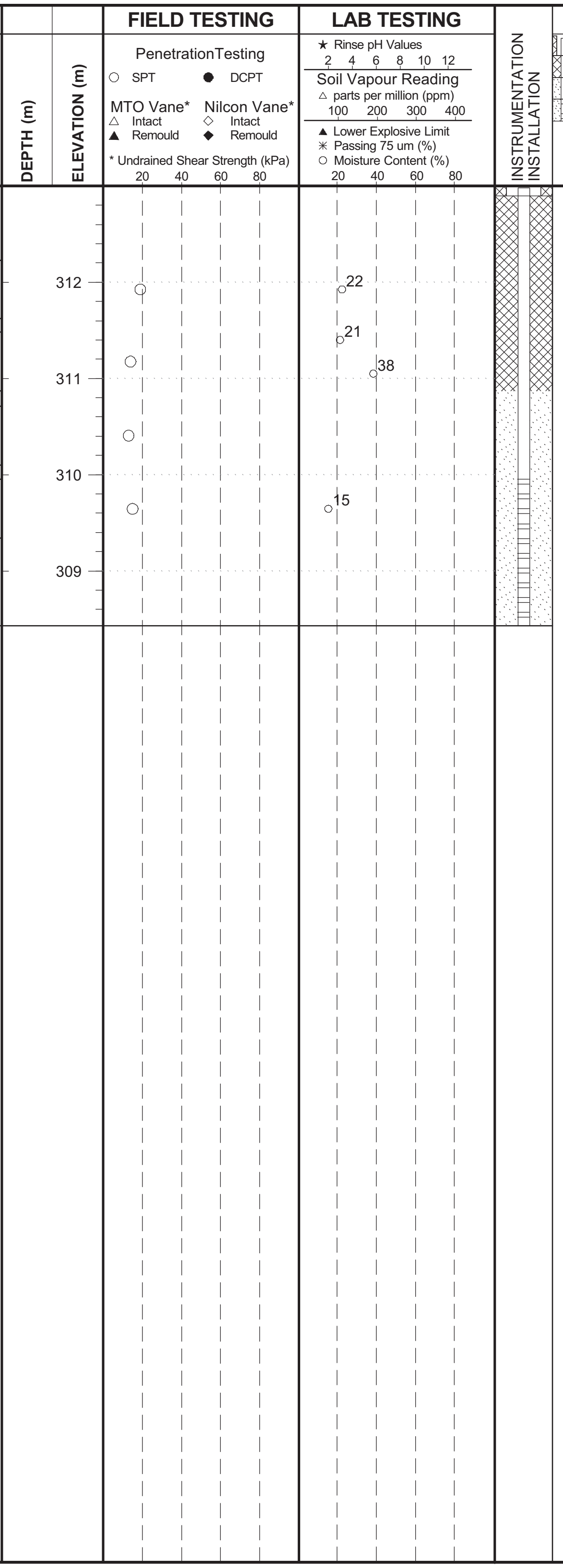
LITHOLOGY PROFILE

Geodetic Ground Surface Elevation: 313.00 m

DESCRIPTION	Elevation / Depth (m)
GRASS over black SILTY SAND - moist	312.2 0.8
GRAVEL trace silt, sand, organics - wet	311.5 1.5
grey SAND trace silt	311.2 1.8
grey SILTY SAND some organics	310.7 2.3
grey SAND trace silt	308.4 4.6
END OF BOREHOLE	

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
AU	1		
SS	2	13	19
SS	3	16	14
SS	4	51	13
SS	5	51	15



COMMENTS

▥ 1 flushmount in bentonite
▨ 1 riser pipe in bentonite
░ 1 riser pipe in sand
░ 1 slotted pipe in sand

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RECORD OF MONITORING WELL No. BH07-HO06 Co-Ord. 0477780 E, 5369594 N

amec

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**
Drilling Location: **Guy Back Yard**
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **20 Jul 07** Date Completed: **20 Jul 07**
Logged by: **AC**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

LITHOLOGY PROFILE / SOIL SAMPLING

Geodetic Ground Surface Elevation: 327.50 m

DESCRIPTION	Elevation (m) / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
FILL mostly gravel, trace organics	326.7	AU			
brown / orange SAND some clay, silt, trace organics, compact	0.8 326.2	SS	1	36	28
TCR: 94% RQD: 86%	1.3 324.5	RC	1		
TCR: 101% RQD: 91%	3.0 323.2	RC	2		
TCR: 100% RQD: 100%	4.3 321.4	RC	3		
TCR: 88% RQD: 75%	6.1 319.9	RC	4		
TCR: 100% RQD: 100%	7.6 319.5	RC	5		
TCR: 100% RQD: 93%	8.0 318.0	RC	6		
TCR: 100% RQD: 95%	9.5 316.5	RC	7		
TCR: 100% RQD: 100%	11.1 315.3	RC	8		
END OF BOREHOLE	12.2				

DEPTH (m): 5, 10

ELEVATION (m): 327, 326, 325, 324, 323, 322, 321, 320, 319, 318, 317, 316

FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

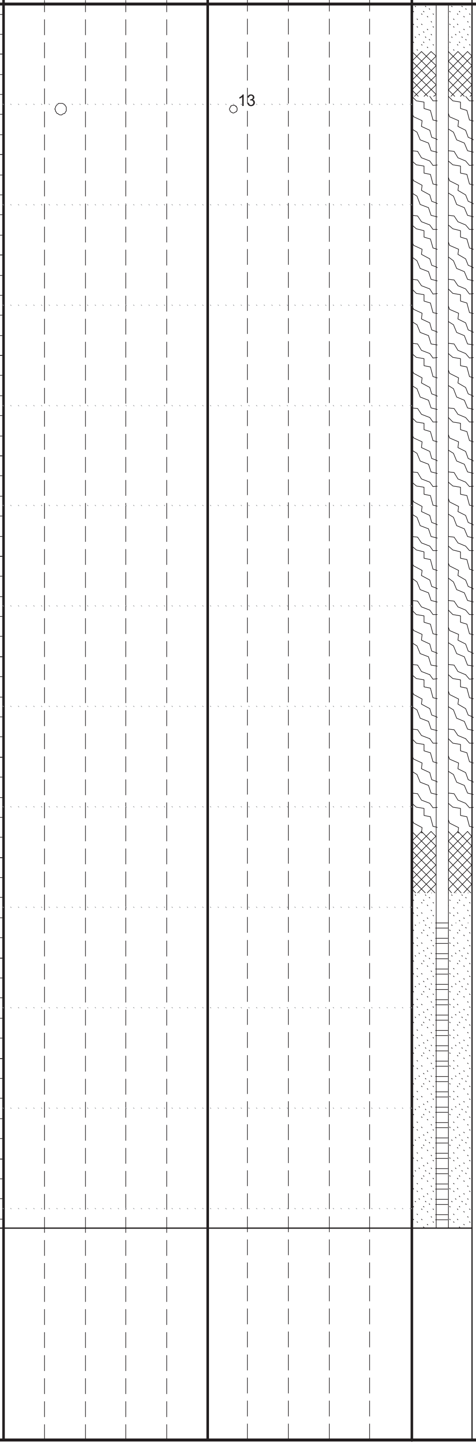
LAB TESTING

★ Rinse pH Values 2 4 6 8 10 12
Soil Vapour Reading △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%) 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

- 1 riser pipe in sand
- 1 riser pipe in bentonite
- 1 riser pipe in cuttings
- 1 slotted pipe in sand



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RECORD OF MONITORING WELL No. BH07-HO07 Co-Ord. 0476233 E, 5368918 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

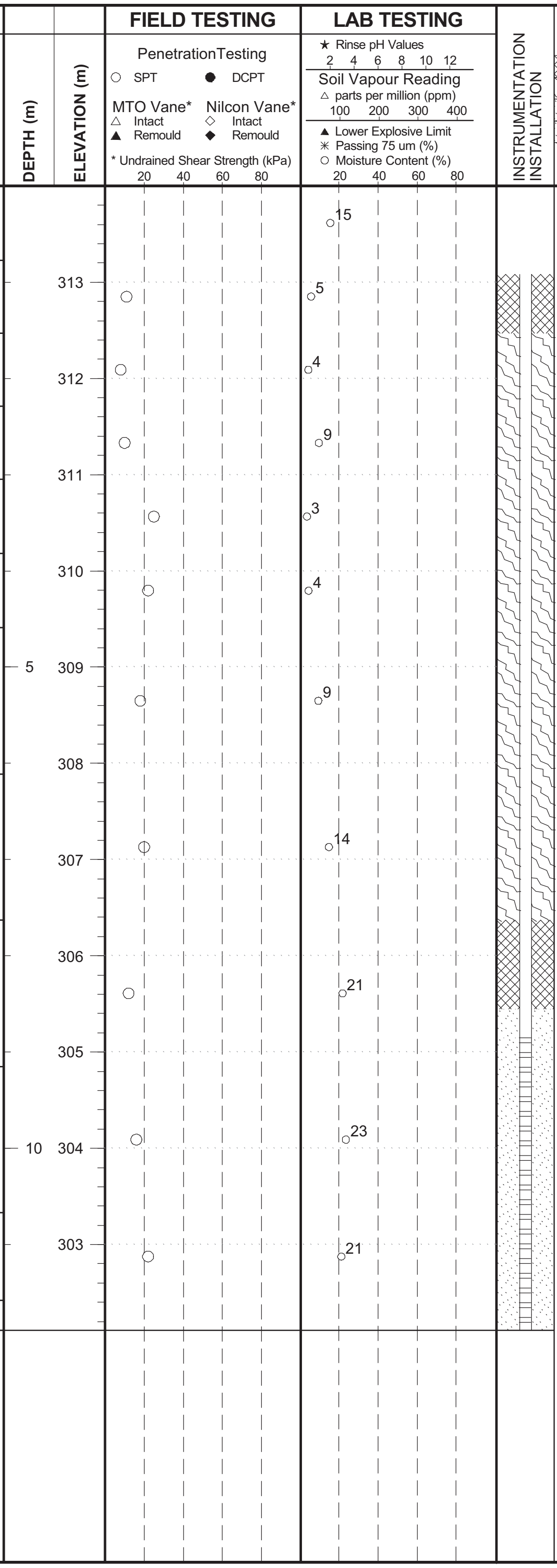
Drilling Location: **Close to Gate "D"**
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **17 Jul 07** Date Completed: **18 Jul 07**

Logged by: **AC**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

LITHOLOGY PROFILE / SOIL SAMPLING

Geodetic Ground Surface Elevation: 314.00 m

DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ORGANICS over orange / brown SAND some gravel, trace organics - dry, compact	AU			
312.5	SS	1	33	11
1.5 brown / light brown SAND trace silt, dry, loose 311.7	SS	2	26	8
2.3 light brown SILTY SAND trace clay, moist / dry, compact	SS	3	33	10
310.2	SS	4	26	25
3.8 light brown SAND trace silt, dry, compact 309.4	SS	5	40	22
4.6 light brown SILTY SAND trace clay, moist, compact	SS	6	27	18
	SS	7	34	20
304.9	SS	8	20	12
9.2 brown SAND trace silt, wet, compact	SS	9	27	16
302.4	SS	10	62	22
11.6 brown / light brown SAND trace rock, wet 302.1 11.9	AU			
END OF BOREHOLE DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS OR BEDROCK				



COMMENTS

▨ 1 riser pipe in bentonite
▧ 1 riser pipe in cuttings
░ 1 riser pipe in sand
▤ 1 slotted pipe in sand

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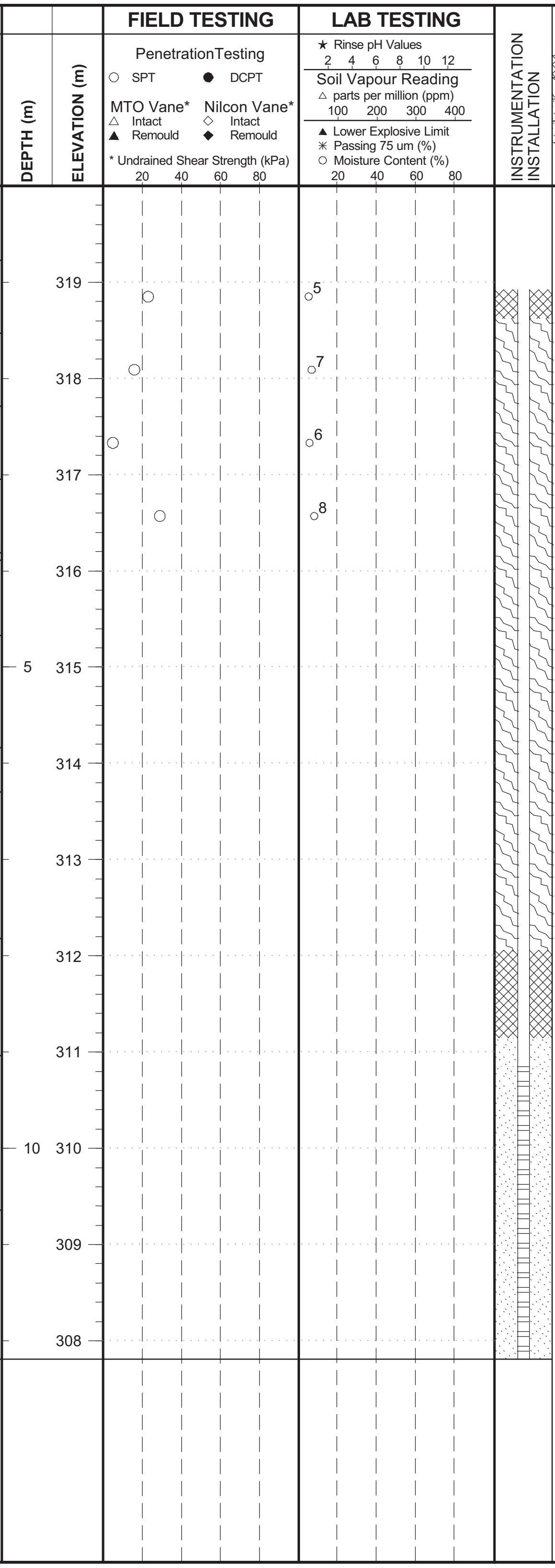
RECORD OF MONITORING WELL No. BH07-HO08 Co-Ord. 0476119 E, 5368864 N

Project Number:	**TC71507.100**	Drilling Location:	**Old Tee Off on Golf Course**	Logged by:	**AC**
Project Client:	**PJV**	Drilling Method:	**200 mm Hollow Stem Augers**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Track Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started:	**18 Jul 07** Date Completed: **19 Jul 07**	Revision No.:	**2, 07/11/07**

LITHOLOGY PROFILE

Geodetic Ground Surface Elevation: 320.00 m

DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ORGANICS over brown / orange SAND some gravel, moist, compact to loose to compact		AU			
		SS	1	13	23
		SS	2	7	16
		SS	3	20	5
		SS	4	26	29
	316.1	SS	5		
TCR: 43% RQD: 0%	3.9 315.3	RC	1		
TCR: 94% RQD: 0%	4.7 314.2	RC	2		
TCR: 94% RQD: 94%	5.8 313.7	RC	3		
TCR: 95% RQD: 82%	6.3 312.2	RC	4		
TCR: 50% RQD: 27%	7.8 311.0	RC	5		
TCR: 100% RQD: 95%	9.0 309.4	RC	6		
TCR: 100% RQD: 90%	10.6 307.8	RC	7		
END OF BOREHOLE	12.2				



COMMENTS

- ▨ 1 riser pipe in bentonite
- ▨ 1 riser pipe in cuttings
- ▨ 1 riser pipe in sand
- ▨ 1 slotted pipe in sand

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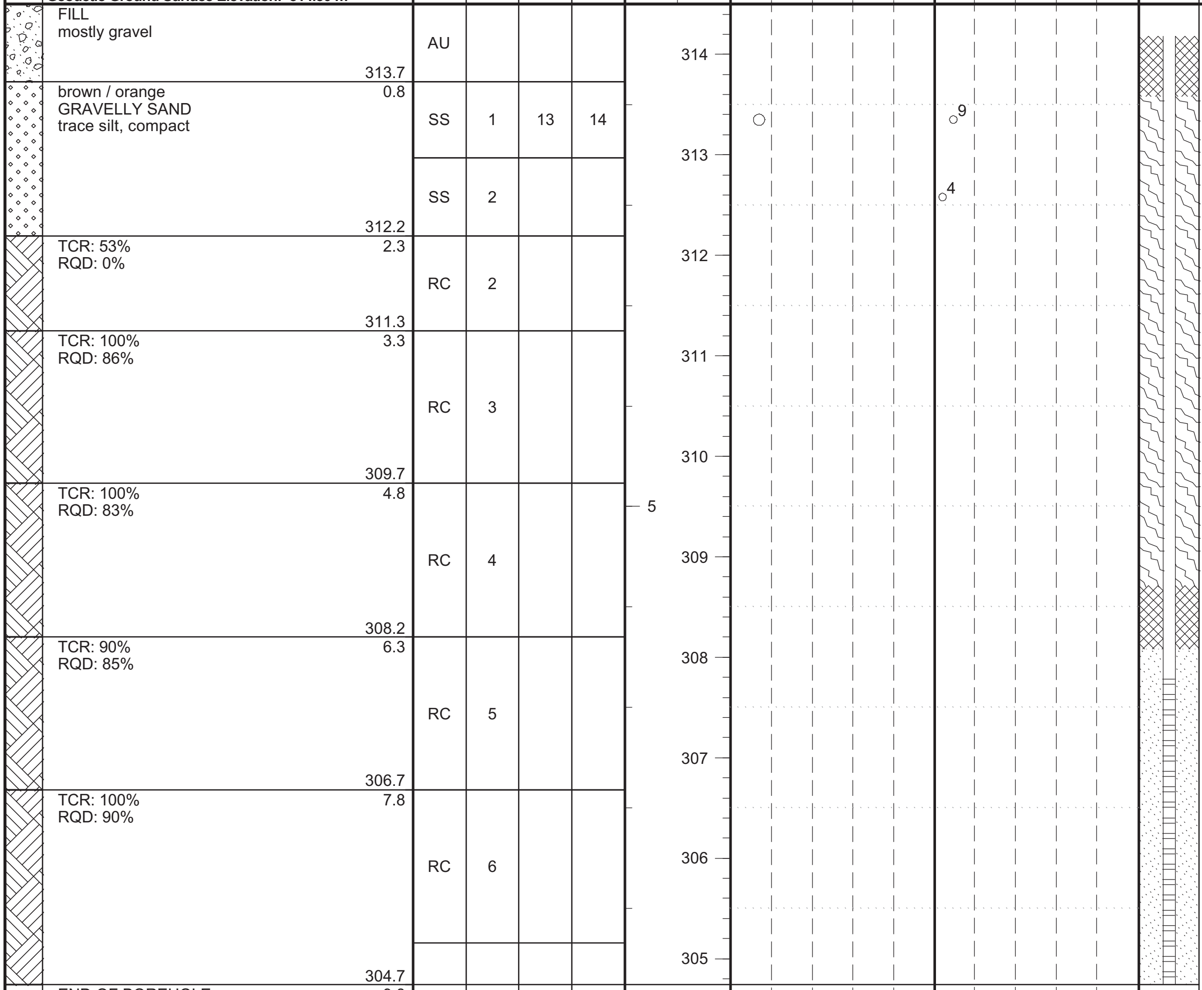
Scale: 1 : 75

RECORD OF MONITORING WELL No. BH07-HO09 Co-Ord. 0476088 E, 5368656 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**
Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **19 Jul 07** Date Completed: **19 Jul 07**
Logged by: **AC**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

Geodetic Ground Surface Elevation: 314.50 m

DESCRIPTION	Elevation / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Moisture Content (%)
FILL mostly gravel	313.7	AU				
brown / orange GRAVELLY SAND trace silt, compact	0.8	SS	1	13	14	9
	312.2	SS	2			4
TCR: 53% RQD: 0%	2.3 311.3	RC	2			
TCR: 100% RQD: 86%	3.3 309.7	RC	3			
TCR: 100% RQD: 83%	4.8 308.2	RC	4			
TCR: 90% RQD: 85%	6.3 306.7	RC	5			
TCR: 100% RQD: 90%	7.8 304.7	RC	6			
END OF BOREHOLE	9.8					



FIELD TESTING
Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING
★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS
▨ 1 riser pipe in bentonite
▧ 1 riser pipe in cuttings
░ 1 riser pipe in sand
▤ 1 slotted pipe in sand

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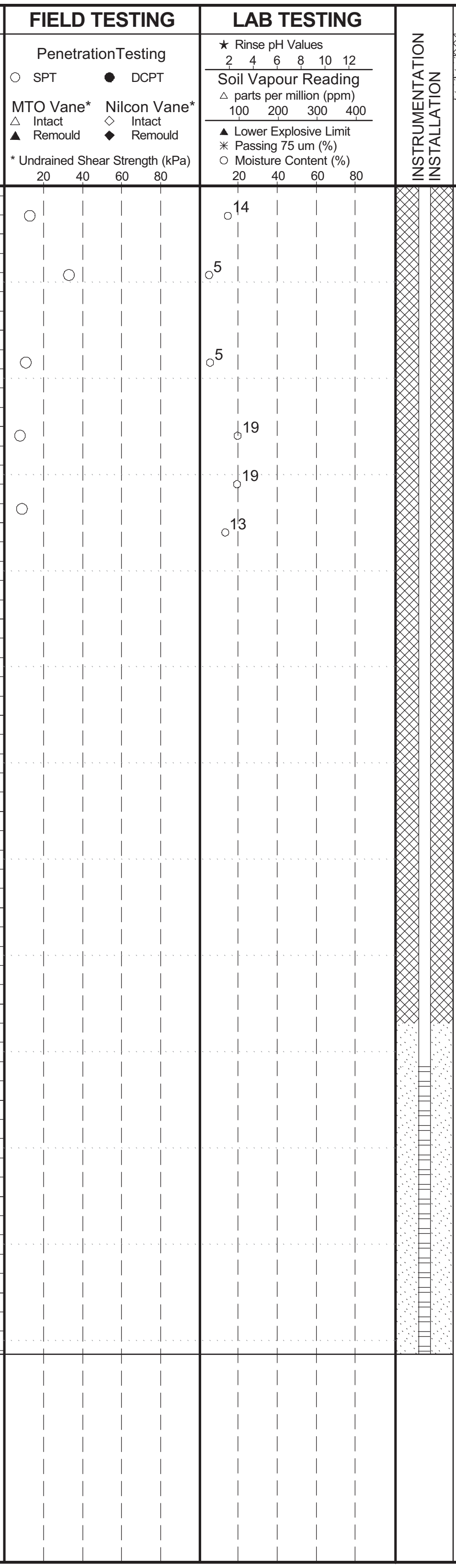
Scale: 1 : 75

RECORD OF MONITORING WELL No. BH07-HO10 Co-Ord. 0476788 E, 5368544 N

Project Number:	**TC71507.100**	Drilling Location:	**Mine Tour**	Logged by:	**AC**
Project Client:	**PJV**	Drilling Method:	**200 mm Hollow Stem Augers**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Track Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started: **20 Jul 07**	Date Completed: **20 Jul 07**	Revision No.:	**2, 07/11/07**

Geodetic Ground Surface Elevation: 326.50 m

LITHOLOGY PROFILE DESCRIPTION	Elevation (m) / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
150 mm of ORGANICS over SILTY SAND damp, compact	325.9 0.6	SS	1	63	13
brown SAND	325.7 0.8	SS	2	59	33
brown SANDY SILT damp, dense	325.0 1.5				
brown SANDY SILT trace gravel and clay, compact to loose	323.1 3.4	SS	3	67	11
		SS	4	75	8
		SS	5	64	9
brown SAND some gravel and silt, wet, loose	322.8 3.7				
BEDROCK TCR: 100% RQD: 97%	322.7 3.8	RC	6		
TCR: 52% RQD: 48%	322.2 4.3	RC	7		
TCR: 97% RQD: 80%	320.4 6.1	RC	8		
TCR: 94% RQD: 83%	318.9 7.6	RC	9		
TCR: 100% RQD: 98%	317.5 9.0	RC	10		
TCR: 98% RQD: 89%	315.9 10.6	RC	11		
END OF BOREHOLE	314.4 12.1				



COMMENTS

- ▨ 1 riser pipe in bentonite
- ▨ 1 riser pipe in sand
- ▨ 1 slotted pipe in sand

Grain Size Analysis
Sand 28% / Silt 69%

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Scale: 1 : 75

RECORD OF MONITORING WELL No. BH07-HO11 Co-Ord. 0476343 E, 5368387 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**
Drilling Location: **Golf Course**
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **19 Jul 07** Date Completed: **19 Jul 07**
Logged by: **AC**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

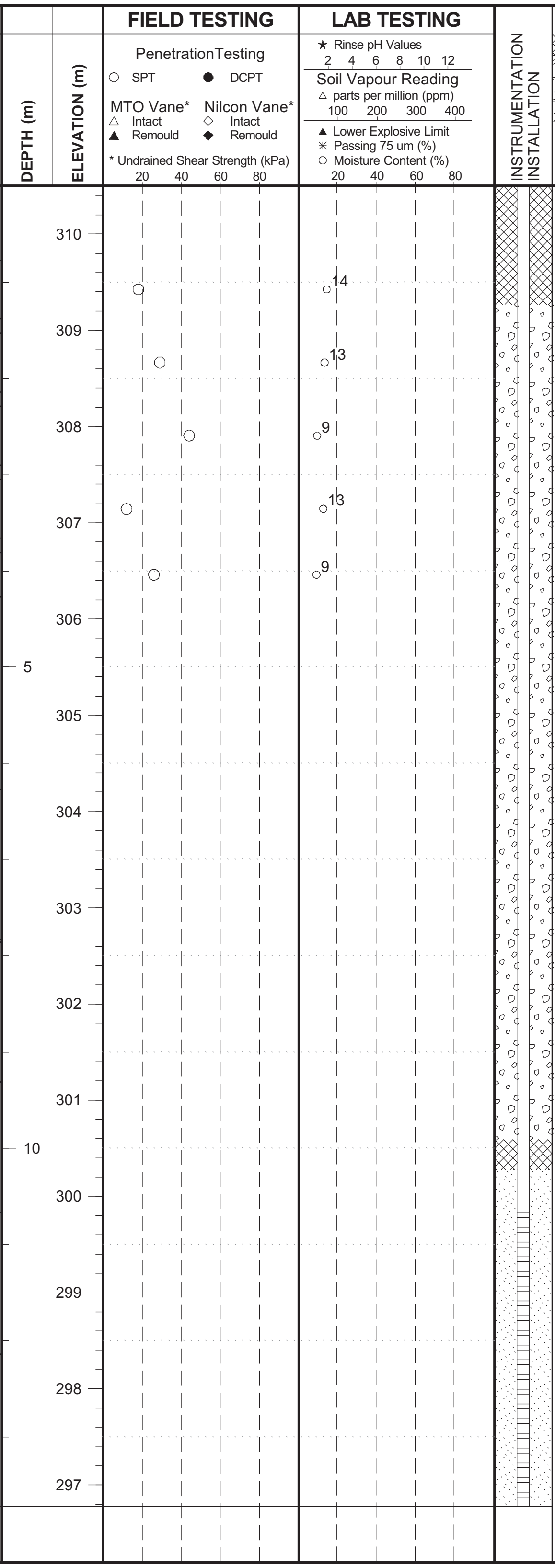
LITHOLOGY PROFILE

Geodetic Ground Surface Elevation: 310.50 m

DESCRIPTION	
UNSAMPLED	309.7
brown SAND	309.6 0.8
grey SILT trace sand, damp, compact	1.0 308.2
brown to grey / brown SANDY SILT trace gravel and clay at depth, moist, dense to compact	2.3 306.2
BOULDERS	4.3 302.6
TCR: 70%	7.9 301.2
TCR: 60%	9.3 299.8
TCR: 100% RQD: 38%	10.7 298.4
TCR: 64%	12.1 296.8
END OF BOREHOLE	13.7

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
SS	1	84	18
SS	2	92	29
SS	3	56	44
SS	4	80	12
SS	5	85	26
RC	6		
RC	7		
SS	8		
RC	9		
RC	10		
RC	11		
RC	12		



COMMENTS

- ▨ 1 riser pipe in bentonite
- ▨ 1 riser pipe in backfill
- ▨ 1 riser pipe in sand
- ▨ 1 slotted pipe in sand

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Scale: 1 : 75

RECORD OF MONITORING WELL No. BH07-HO12 Co-Ord. 0476681 E, 5368249 N

amec

Project Number:	TC71507.100	Drilling Location:		Logged by:	AC
Project Client:	PJV	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Environmental Baseline Study	Drilling Machine:	Track Mounted Drill	Reviewed by:	TIM
Project Location:	Hollinger, Timmins, Ontario	Date Started:	26 Jul 07 Date Completed: 26 Jul 07	Revision No.:	2, 07/11/07

LITHOLOGY PROFILE / SOIL SAMPLING

Geodetic Ground Surface Elevation: 313.00 m

DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ORGANICS over SAND	312.2 0.8				
brown SAND some silt, moist, loose to compact		SS	1	33	4
		SS	2	41	12
		SS	3	84	14
	309.2 3.8	SS	4	84	17
BOULDERS		SS	5		
	308.4 4.6	SS	6		
TCR: 100% RQD: 0%	307.9 5.1	RC	7		
TCR: RQD:	306.0 7.0	RC	8		
TCR: 100% RQD: 0%	305.7 7.3	RC	9		
TCR: 64% RQD: 55%	305.4 7.6	RC	10		
TCR: 83% RQD: 78%	303.9 9.1	RC	11		
TCR: 100% RQD: 85%	302.4 10.6	RC	12		
TCR: 97% RQD: 82%	301.1 11.9	RC	13		
END OF BOREHOLE					

FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* Nilcon Vane*
△ Intact ◇ Intact
▲ Remould ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

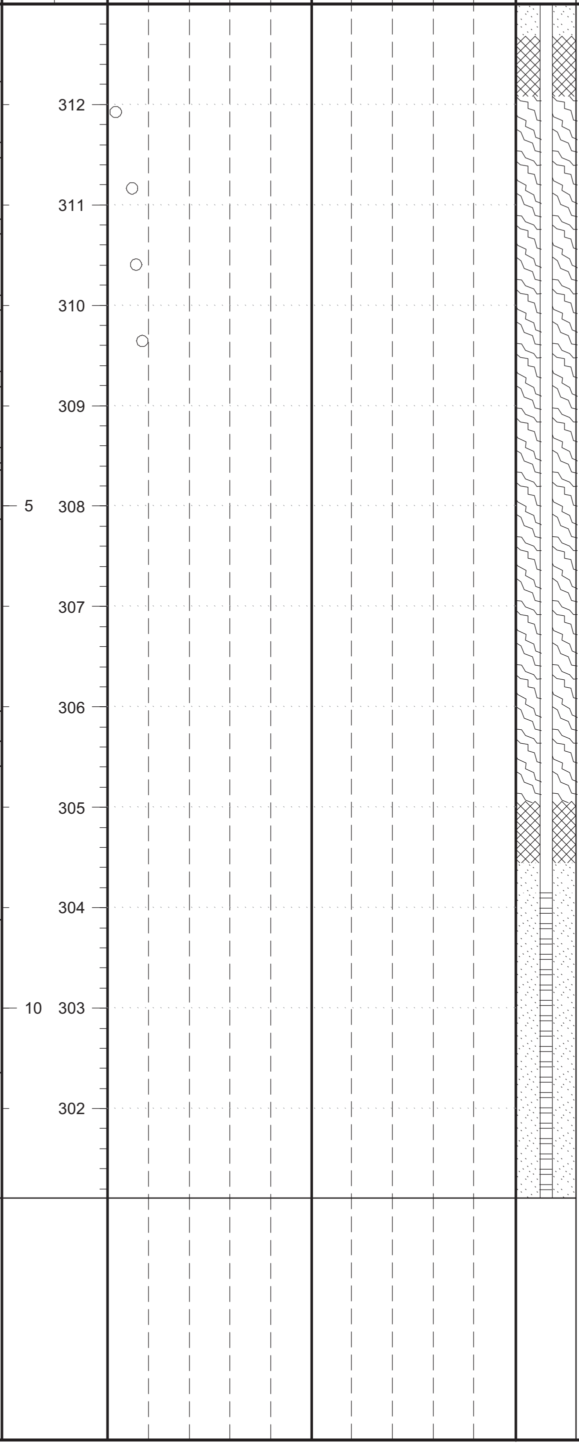
LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

- ⬚ 1 riser pipe in sand
- ▨ 1 riser pipe in bentonite
- ▧ 1 riser pipe in cuttings
- ▤ 1 slotted pipe in sand



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Scale: 1 : 75

RECORD OF MONITORING WELL No. BH07-HO13A Co-Ord. 0476864 E, 5368179 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **26 Jul 07** Date Completed: **26 Jul 07**

Logged by: **SRL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **2, 07/11/07**

Geodetic Ground Surface Elevation: 324.00 m

LITHOLOGY PROFILE – DESCRIPTION	Elevation (m) / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Moisture Content (%)	COMMENTS
brown SAND some silt, trace gravel, organics, rootlets	323.4 0.6	AU	1			9	79 cm stick up
COBBLES TCR: 36% RQD: 0%	322.8 1.3	RC	2				
COBBLES TCR: 27% RQD: 0%	322.3 1.7	RC	3				
brown SANDY SILT trace clay, gravel	321.9 2.1	SS	4	33	50 / 0.9	14	
BOULDER TCR: 37% RQD: 30%	320.8 3.2	RC	5				
TCR: 75% RQD: 58%	319.3 4.7	RC	6				
TCR: 93% RQD: 88%	317.8 6.3	RC	7				
TCR: 105% RQD: 105%	316.2 7.8	RC	8				
END OF BOREHOLE							

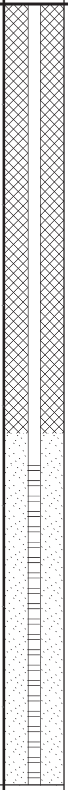
DEPTH (m): 5
ELEVATION (m): 323, 322, 321, 320, 319, 318, 317

FIELD TESTING: Penetration Testing ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit; ✳ Passing 75 um (%); ○ Moisture Content (%) 20 40 60 80

INSTRUMENTATION INSTALLATION

▨ 1 riser pipe in bentonite
▨ 1 riser pipe in sand
▨ 1 slotted pipe in sand



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RECORD OF MONITORING WELL No. BH07-03D Co-Ord. 0477061 E, 5399490 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**
Drilling Location:
Drilling Method: **200 mm Dual Rotary**
Drilling Machine: **Truck Mounted Drill**
Date Started: **08 Sep 07** Date Completed: **08 Sep 07**
Logged by:
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 07/11/07**

LITHOLOGY PROFILE

Lithology Plot

DESCRIPTION

Geodetic Ground Surface Elevation:

FILL
mostly gravel
- type B

brown / orange
GRAVEL & SAND
some clay, trace cobbles, loose

TCR: 100%
RQD: 77%

TCR: 100%
RQD: 20%

0.8
1.5
3.0
4.6
6.

SOIL SAMPLING

Sample Type | Sample Number | Recovery (%) | SPT 'N' Value

DEPTH (m)

ELEVATION (m)

5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180

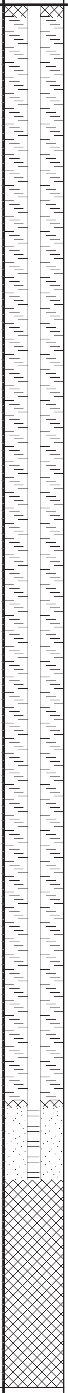
FIELD TESTING

PenetrationTesting
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
⁎ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS

▨ 1 riser pipe in bentonite
▤ 1 riser pipe in grout
▦ 1 riser pipe in sand
▥ 1 slotted pipe in sand
▩ no installation, only bentonite

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RECORD OF MONITORING WELL No. BH07-05BR Co-Ord. 0477910 E, 5369595 N

Project Number: **TC71507.100**
Drilling Location:
Logged by:
Project Client: **PJV**
Drilling Method: **200 mm Dual Rotary**
Compiled by: **KKJ**
Project Name: **Environmental Baseline Study**
Drilling Machine: **Truck Mounted Drill**
Reviewed by: **TIM**
Project Location: **Hollinger, Timmins, Ontario**
Date Started: **09 Sep 07**
Date Completed: **11 Sep 07**
Revision No.: **1, 07/11/07**

LITHOLOGY PROFILE

Lithology Plot

DESCRIPTION

Geodetic Ground Surface Elevation:

GRASS over 0.8
1.5
black 1.8
SILTY SAND 2.
GRAVEL 4.
trace silt, sand, organics, compact 4.
grey 6.
SANDY SILT 9.
trace clay, compact 15.
grey 16.
SILTY SAND 22.
some organics, compact

grey
SAND
trace silt, compact

grey
CLAYEY SANDY SILT
trace gravel, low plasticity, soft

grey
SANDY SILT
trace clay, loose

grey
SAND
trace silt, dense

grey
SILT
variable sand, trace clay, compact

grey
SILT
trace clay and sand, compact

grey
SAND
some silt, compact

SOIL SAMPLING

Sample Type | Sample Number | Recovery (%) | SPT 'N' Value

DEPTH (m) | **ELEVATION (m)**

5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180

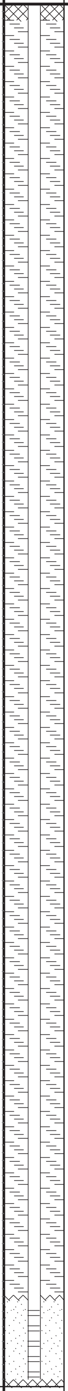
FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS

- ▨ 1 riser pipe in bentonite
- ▤ 1 riser pipe in grout
- ░ 1 riser pipe in sand
- ▥ 1 slotted pipe in sand
- ☒ no installation, only bentonite

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RECORD OF MONITORING WELL No. BH07-09B/C Co-Ord. 0476085 E, 5368656 N

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

Drilling Location:
Drilling Method: **200 mm Dual Rotary**
Drilling Machine: **Truck Mounted Drill**
Date Started: **12 Sep 07** Date Completed: **14 Sep 07**

Logged by:
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 07/11/07**

LITHOLOGY PROFILE

Lithology Plot

DESCRIPTION

Geodetic Ground Surface Elevation:

FILL mostly gravel	0.8
brown / orange GRAVELLY SAND trace silt, compact	2.3 3.3 4.8
TCR: 53% RQD: 0%	6. 7.8 9.
TCR: 100% RQD: 86%	
TCR: 100% RQD: 83%	
TCR: 90% RQD: 85%	
TCR: 100% RQD: 90%	

SOIL SAMPLING

Sample Type | Sample Number | Recovery (%) | SPT 'N' Value

DEPTH (m) | ELEVATION (m)

FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

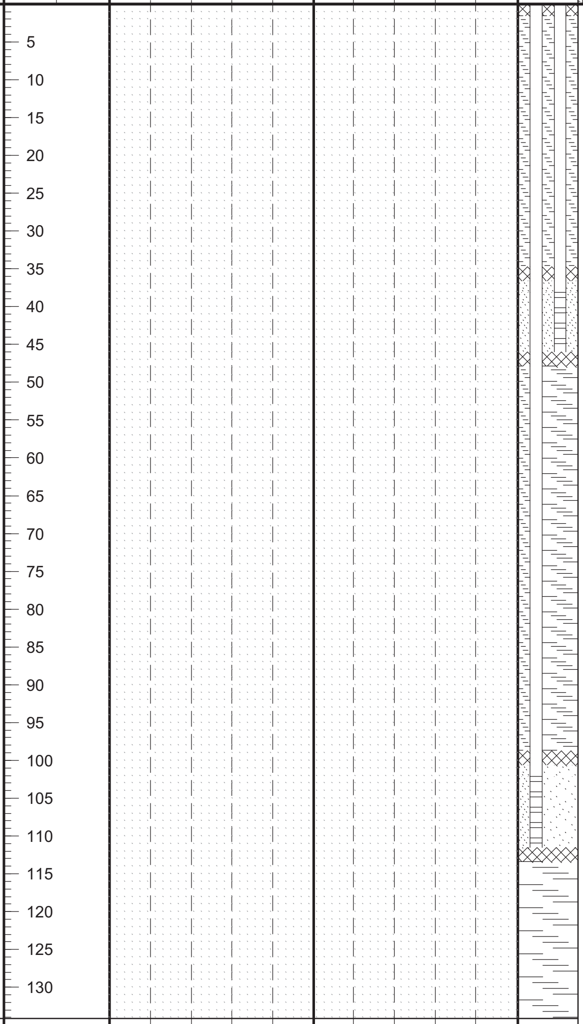
LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

▨	2 riser pipes in bentonite
▤	2 riser pipes in grout
▒	2 riser pipes in sand
▥	1 slotted pipe on right, 1 riser on left in sand
☒	1 riser pipe in bentonite on left side
▤	1 riser pipe in grout on left side
▒	1 riser pipe in sand on left side



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Scale: 1 : 1000

RECORD OF MONITORING WELL No. BH07-13B/C Co-Ord. 0476862 E, 5368180 N

amec

Project Number:	**TC71507.100**	Drilling Location:		Logged by:	
Project Client:	**PJV**	Drilling Method:	**200 mm Dual Rotary**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Truck Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started:	**05 Sep 07** Date Completed: **07 Sep 07**	Revision No.:	**1, 07/11/07**

LITHOLOGY PROFILE

Lithology Plot

DESCRIPTION

Geodetic Ground Surface Elevation:

DESCRIPTION	
brown SAND some silt, trace gravel, organics, rootlets	0.6 1.3 1.7
COBBLES TCR: 36% RQD: 0%	2.1 3.2 4.
COBBLES TCR: 27% RQD: 0%	6. 7.
brown SANDY SILT trace clay, gravel	
COBBLES TCR: 37% RQD: 30%	
TCR: 75% RQD: 58%	
TCR: 93% RQD: 88%	
TCR: 105% RQD: 105%	

SOIL SAMPLING

Sample Type | Sample Number | Recovery (%) | SPT 'N' Value

DEPTH (m)

5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180

ELEVATION (m)

FIELD TESTING

Penetration Testing

○ SPT ● DCPT

MTO Vane* Nilcon Vane*

△ Intact ◇ Intact

▲ Remould ◆ Remould

* Undrained Shear Strength (kPa)

20 40 60 80

LAB TESTING

★ Rinse pH Values

2 4 6 8 10 12

Soil Vapour Reading

△ parts per million (ppm)

100 200 300 400

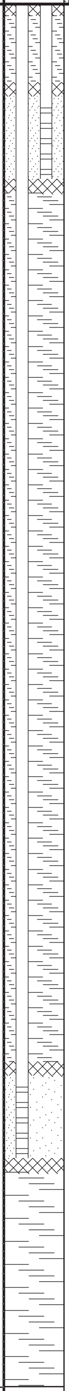
▲ Lower Explosive Limit

✳ Passing 75 um (%)

○ Moisture Content (%)

20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS

- ▨ 2 riser pipes in bentonite
- ▤ 2 riser pipes in grout
- ░ 2 riser pipes in sand
- ▥ 1 slotted pipe on right, 1 riser on left in sand
- ▨ 1 riser pipe in bentonite on left side
- ▤ 1 riser pipe in grout on left side
- ░ 1 riser pipe in sand on left side

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Scale: 1 : 1000

Page: 1 of 1

RECORD OF BOREHOLE No. HS07-01A

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **29 Jul 07** Date Completed: **29 Jul 07**

Logged by: **SRL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 07/11/07**

FIELD TESTING
PenetrationTesting
○ SPT ● DCPT
MTO Vane* Nilcon Vane*
△ Intact ◇ Intact
▲ Remould ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING
★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%)
20 40 60 80

LITHOLOGY PROFILE		SOIL SAMPLING									
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	WATER					▽					
	brown SAND & GRAVEL 0.1	AU	1								
	END OF HANDHOLE DUE TO SLOUGHING 0.5										

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▽ Groundwater level recorded on completion at a depth of: 0 m.

Scale: 1 : 10

RECORD OF BOREHOLE No. HS07-01B

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **29 Jul 07** Date Completed: **29 Jul 07**

Logged by: **SRL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 07/11/07**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS
Lithology Plot	**DESCRIPTION** **Local Ground Surface Elevation:**	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	**DEPTH (m)**	**ELEVATION (m)**	PenetrationTesting ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	
	WATER					▽					
	grey SAND trace gravel, silt increasing with depth — 0.1	AU	1								
	END OF HANDHOLE DUE TO SLOUGHING — 0.6										

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▽ Groundwater level recorded on completion at a depth of: 0 m.

Scale: 1 : 10

RECORD OF BOREHOLE No. HS07-02A

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **29 Jul 07** Date Completed: **29 Jul 07**

Logged by: **SRL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 07/11/07**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	
	brown to grey ORGANICS some silt, decomposed wood - wet, very soft	AU	1								
		AU	2			▽					
	grey 0.5 FILL 0.5 mostly gravel, crushed stone	AU	3								
	END OF HANDHOLE DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS OR BEDROCK										

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▽ Groundwater level recorded on completion at a depth of: 0.31 m.

Scale: 1 : 10

RECORD OF BOREHOLE No. HS07-02B

Project Number:	**TC71507.100**	Drilling Location:		Logged by:	**SRL**
Project Client:	**PJV**	Drilling Method:	**200 mm Hollow Stem Augers**	Compiled by:	**KKJ**
Project Name:	**Environmental Baseline Study**	Drilling Machine:	**Track Mounted Drill**	Reviewed by:	**TIM**
Project Location:	**Hollinger, Timmins, Ontario**	Date Started:	**29 Jul 07** Date Completed: **29 Jul 07**	Revision No.:	**1, 07/11/07**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS
Lithology Plot	**DESCRIPTION** **Local Ground Surface Elevation:**	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	**DEPTH (m)**	**ELEVATION (m)**	Penetration Testing ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	
	brown to grey SILTY SAND possible tailings - wet	AU	1								
		AU	2			▽					
	brown 0.9 SAND trace gravel	AU	3			1					
	END OF HANDHOLE 1.2										

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▽ Groundwater level recorded on completion at a depth of: 0.76 m.

Scale: 1 : 10

RECORD OF BOREHOLE No. HS07-03A

Project Number: **TC71507.100**
Drilling Location:
Logged by: **SRL**
Project Client: **PJV**
Drilling Method: **200 mm Hollow Stem Augers**
Compiled by: **KKJ**
Project Name: **Environmental Baseline Study**
Drilling Machine: **Track Mounted Drill**
Reviewed by: **TIM**
Project Location: **Hollinger, Timmins, Ontario**
Date Started: **29 Jul 07**
Date Completed: **29 Jul 07**
Revision No.: **1, 07/11/07**

FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING

★ Rinse pH Values 2 4 6 8 10 12
Soil Vapour Reading △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%) 20 40 60 80

LITHOLOGY PROFILE		SOIL SAMPLING									
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	WATER 0.0					▽					
	grey SILTY SAND some gravel, trace organics, occasional cobbles	AU	1						○ 16		
	END OF HANDHOLE 0.5 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS OR BEDROCK										

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▽ Groundwater level recorded on completion at a depth of: 0 m.

Scale: 1 : 10

Page: 1 of 1

RECORD OF BOREHOLE No. HS07-03B

Project Number: **TC71507.100**
Project Client: **PJV**
Project Name: **Environmental Baseline Study**
Project Location: **Hollinger, Timmins, Ontario**

Drilling Location:
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **29 Jul 07** Date Completed: **29 Jul 07**

Logged by: **SRL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 07/11/07**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS
Lithology Plot	DESCRIPTION **Local Ground Surface Elevation:**	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	
▨	WATER					▽					
	END OF HANDHOLE 0.2 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS OR BEDROCK										

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▽ Groundwater level recorded on completion at a depth of: 0 m.

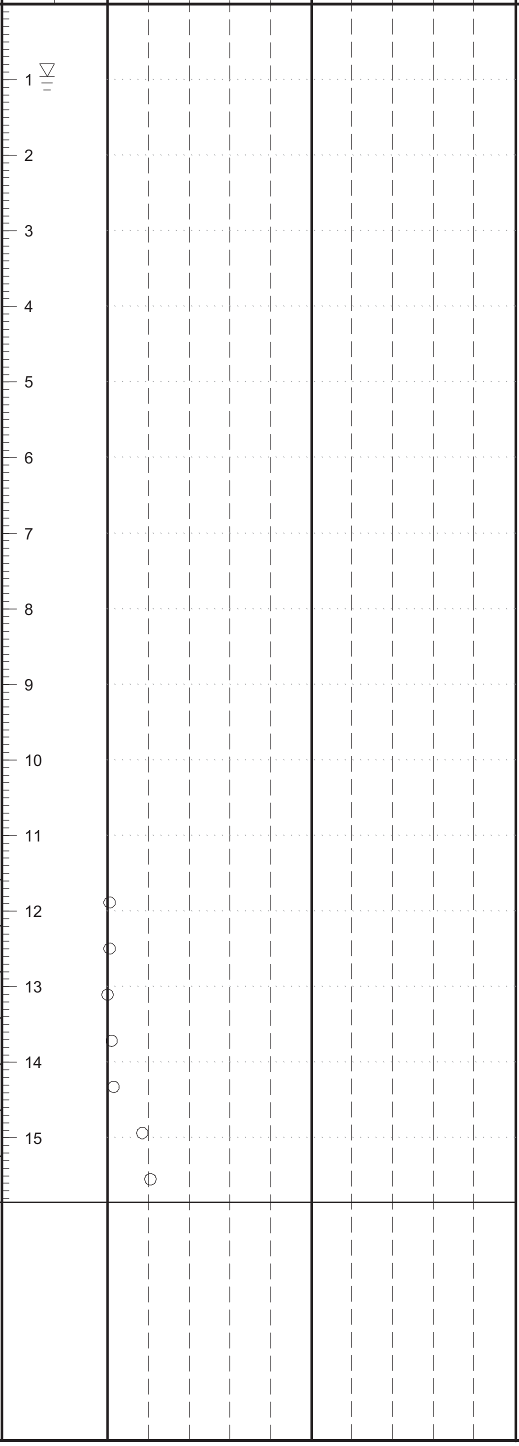
Scale: 1 : 10

Page: 1 of 1

RECORD OF BOREHOLE No. PLBH08-01 Co-Ord. 0478187 E, 5369713 N

Project Number: **TC71507**
Project Client: **Goldcorp**
Project Name: **Pearl Lake Soils Investigation**
Project Location: **Timmins, Ontario**
Drilling Location: **Pearl Lake**
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **20 Mar 08** Date Completed: **20 Mar 08**
Logged by: **RGL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 23/06/08**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80		
	ICE										
	WATER 0.9					1 ▽					
	dark grey ORGANICS wet 5.8										
	grey SAND some silt, trace clay, wet, very loose 11.6	SS	1	100	1						
		SS	2	100	1						
	grey SAND some silt, wey, very loose to compact 12.8	SS	3	100	0						
		SS	4	100	2						
		SS	5	100	3						
	grey SAND wet, compact 14.6	SS	6	100	17						
		SS	7	100	21						
	END OF BOREHOLE (no refusal) 15.9										



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▽ Groundwater level recorded on completion at a depth of: 0.94 m.

Scale: 1 : 100

RECORD OF BOREHOLE No. PLBH08-02 Co-Ord. 0478267 E, 5369687 N

amec

Project Number: **TC71507**
Project Client: **Goldcorp**
Project Name: **Pearl Lake Soils Investigation**
Project Location: **Timmins, Ontario**
Drilling Location: **Pearl Lake**
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **26 Mar 08** Date Completed: **26 Mar 08**
Logged by: **RGL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 23/06/08**

LITHOLOGY PROFILE | SOIL SAMPLING | FIELD TESTING | LAB TESTING | COMMENTS

Lithology Plot | DESCRIPTION | Local Ground Surface Elevation:

DEPTH (m) | ELEVATION (m)

FIELD TESTING: Penetration Testing ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit; ✳ Passing 75 um (%); ○ Moisture Content (%) 20 40 60 80

INSTRUMENTATION INSTALLATION

DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ICE				
WATER 0.9				
ORGANICS 5.5				
grey CLAYEY SILT wet, vert loose 9.8	SS	1	100	0
grey SILT some sand, trace clay, wet 10.4	SS	2	100	0
	SS	3	100	1
grey SAND some silt, wet, very loose to compact 11.4	SS	4	60	18
grey SAND wet, compact 12.2	SS	5	84	20
END OF BOREHOLE (no refusal) 12.8				

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Scale: 1 : 100

RECORD OF BOREHOLE No. PLBH08-03 Co-Ord. 0478429 E, 5369690 N

Project Number: **TC71507**
Project Client: **Goldcorp**
Project Name: **Pearl Lake Soils Investigation**
Project Location: **Timmins, Ontario**
Drilling Location: **Pearl Lake**
Drilling Method: **200 mm Hollow Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **26 Mar 08** Date Completed: **26 Mar 08**
Logged by: **RGL**
Compiled by: **KKJ**
Reviewed by: **TIM**
Revision No.: **1, 23/06/08**

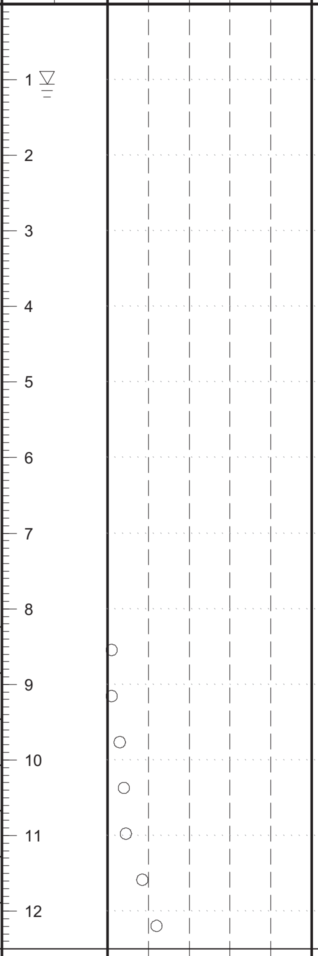
LITHOLOGY PROFILE / SOIL SAMPLING

Local Ground Surface Elevation:

DESCRIPTION	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ICE					
WATER	1.0				
ORGANICS	6.1				
grey SAND trace silt, wet, very loose	8.5	SS	1	59	2
grey SILT some clay, wet	8.8	SS	2	84	2
grey SAND trace clay, wet, loose	9.5	SS	3	59	6
		SS	4	77	8
		SS	5	100	9
grey SAND wet, compact	11.6	SS	6	84	17
		SS	7	59	24
END OF BOREHOLE (no refusal)	12.5				

FIELD TESTING

Penetration Testing
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)



LAB TESTING

★ Rinse pH Values 2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit
✳ Passing 75 um (%)
○ Moisture Content (%) 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

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▽ Groundwater level recorded on completion at a depth of: 1.04 m.

Scale: 1 : 100

Page: 1 of 1

APPENDIX C

LOCAL WATER WELL RECORDS

TOWNSHIP CONCESSION (LOT)	UTM[1]	DATE [2] CNTR [3]	CASING DIA [4]	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # (AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
TISDALE TOWNSHIP CON 04(010)	17 477335 5372832^L	1990/07 2401	05 05	FR 0084	006 / 015 075 / 1:0	DO		1604386 (74126) SAND CLAY LYRD 0050 GRVL HPAN LYRD 0076 ROCK FCRD 0085
TISDALE TOWNSHIP CON 04(010)	17 477914 5372977^W	1973/08 3404	07	FR 0065	016 / 041 040 / 4:0	DO	0069 08	1601858 () BRWN SAND SILT 0023 BLUE CLAY 0045 GREY FSND SILT 0065 GREY FSND 0077
TISDALE TOWNSHIP CON 05(008)	17 478870 5373683^L	2003/10 1737	03	FR 0077	/ 020 / 1:0	NU	0067 10	1605591 (261907) BRWN FSND 0030 GREY CSND 0042 GREY MSND 0075 BLCK ROCK HARD 0077
TISDALE TOWNSHIP CON 05(009)	17 477914 5373427^W	1978/06 3424	06	FR 0085	027 / 080 007 / 4:0	DO	0081 08	1602545 () BRWN SAND LYRD 0004 GREY SAND LYRD 0039 RED SAND SILT 0089
TISDALE TOWNSHIP CON 05(009)	17 478014 5374277^W	1978/07 3424	06	FR 0069	026 / 051 030 / 3:40	 DO	0065 08	1602546 () BRWN SAND LYRD 0003 GREY SAND LYRD 0038 RED GRVL ROCK LYRD 0073
TISDALE TOWNSHIP CON 05(009)	17 478014 5373577^W	1984/04 2401	05 04	FR 0110	085 / 110 005 / 1:0	DO	0109 03	1603526 () SAND 0112
TISDALE TOWNSHIP CON 05(010)	17 477271 5373692^L	1998/05 2401	06 05	FR 0086	008 / 085 010 / 1:0	CO DO	0086 03	1605232 (187487) SAND GRVL 0045 CLAY SAND LYRD 0060 SAND 0089
TISDALE TOWNSHIP CON 05(010)	17 477814 5373177^W	1978/08 2401	06 06	UK 0072	020 / 070 025 / 2:0	CO		1602569 () SAND 0068 GRVL 0070 SPST 0102
TISDALE TOWNSHIP CON 05(011)	17 476064 5374377^W	1981/05 2401	05 05	FR 0048	009 / 040 040 / 1:0	DO		1603076 () SAND 0020 CLAY 0025 SAND 0035 HPAN BLDR 0045 GRSN STNS 0062
TISDALE TOWNSHIP CON 05(011)	17 476254 5374427^W	1969/10 2401	02	FR 0048	010 / 030 001 / 1:0	DO	0043 07	1601522 () MSND 0047 GRVL 0050
TISDALE TOWNSHIP CON 05(011)	17 476464 5373694^L	1995/11 2401	05	FR 0060	/ 022 009 / 1:0	DO		1605030 (165749) CLAY 0045 SAND GRVL 0060
TISDALE TOWNSHIP CON 05(011)	17 476335 5374325^L	1990/08 2401	05	FR 0062	008 / 060 010 / 1:0	DO		1604402 (74139) SAND 0050 SAND GRVL 0060 BLCK ROCK 0062
TISDALE TOWNSHIP 04(010)	17 477323 5371403^L	1988/03 3424	09	FR 0025	004 / 032 085 / 48:0	PS	0058 20	1604083 () FILL 0003 BLCK MUCK 0004 BRWN SAND 0014 SAND CLAY 0025 SAND 0080 HPAN 0080
TISDALE TOWNSHIP 11(005)	17 476327 5374327^W	2006/07 7133	06		008 / 015 010 / 1:0	DO		1605857 (Z41317) A033522 BRWN SAND LOOS 0014 GREY FSND LOOS 0038 GREY ROCK DNSE 0043
TIMMINS TOWN 04(010)	17 477021 5371506^W	1987/08 3424	06	FR 0025	003 / 032 084 / 8:0	DO	0059 12	1604016 () FILL 0003 BLCK MUCK 0004 BRWN SAND 0014 CLAY SAND 0025 SAND MGRD 0069 HPAN BLDR 0077 ROCK 0077
TIMMINS TOWN 05(009)	17 478113 5374330^W	2007/11 7037	79	FR 0102	013 / 013 007 / 1:0	DO		7053074 (Z70616) A055058 GREY SAND ROCK GRVL 0092 GREY GRVL SAND ROCK 0102

TOWNSHIP CONCESSION (LOT)	UTM^{1}	DATE ^{2} CNTR ^{3}	CASING DIA ^{4}	WATER^{5,6} DETAIL	STAT LVL/PUMP LVL^{7} RATE^{8}/TIME HR:MIN	WATER USE^{9}	SCREEN INFO^{10}	WELL # (AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND^{5,11}
TIMMINS TOWN 05(010)	17 477460 5372943^{W}	1987/07 2401	05 05	FR 0105 FR 0115	009 / 300 003 / 1:0	DO		1604015 (00700) SAND 0025 CLAY 0050 HPAN 0105 GRSN 0302
TIMMINS TOWN 05(011)	17 476084 5374406^{W}	1987/07 2401	05 05	FR 0080 FR 0050 FR 0075	011 / 080 003 / 1:0	DO		1603996 (00692) FSND 0040 GRVL 0048 GRSN 0090

Notes:
1. UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
2. Date Work Completed
3. Well Contractor Licence Number
4. Casing diameter in inches
5. Unit of Depth in Feet
6. See Table 4 for Meaning of Code
7. STAT LVL: Static Water Level in Feet ; PUMP LVL: Water Level After Pumping in Feet
8. Pump Test Rate in GPM, Pump Test Duration in Hour : Minutes
9. See Table 3 for Meaning of Code
10. Screen Depth and Length in feet
11. See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	...	Code	Description	...	Code	Description	...	Code	Description	...	Code	Description
BLDR	BOULDERS		FCRD	FRACTURED		IRFM	IRON FORMATION		PORS	POROUS		SOFT	SOFT
BSLT	BASALT		FGRD	FINE-GRAINED		LIMY	LIMY		PRDG	PREVIOUSLY DUG		SPST	SOAPSTONE
CGRD	COARSE-GRAINED		FGVL	FINE GRAVEL		LMSN	LIMESTONE		PRDR	PREV. DRILLED		STKY	STICKY
CGVL	COARSE GRAVEL		FILL	FILL		LOAM	TOPSOIL		QRTZ	QUARTZITE		STNS	STONES
CHRT	CHERT		FLDS	FELDSPAR		LOOS	LOOSE		QSND	QUICKSAND		STNY	STONEY
CLAY	CLAY		FLNT	FLINT		LTCL	LIGHT-COLOURED		QTZ	QUARTZ		THIK	THICK
CLN	CLEAN		FOSS	FOSILIFEROUS		LYRD	LAYERED		ROCK	ROCK		THIN	THIN
CLYY	CLAYEY		FSND	FINE SAND		MARL	MARL		SAND	SAND		TILL	TILL
CMTD	CEMENTED		GNIS	GNEISS		MGRD	MEDIUM-GRAINED		SHLE	SHALE		UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE		GRNT	GRANITE		MGVL	MEDIUM GRAVEL		SHLY	SHALY		VERY	VERY
CRYS	CRYSTALLINE		GRSN	GREENSTONE		MRBL	MARBLE		SHRP	SHARP		WBRG	WATER-BEARING
CSND	COARSE SAND		GRVL	GRAVEL		MSND	MEDIUM SAND		SHST	SCHIST		WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED		GRWK	GREYWACKE		MUCK	MUCK		SILT	SILT		WTHD	WEATHERED
DLMT	DOLOMITE		GVLY	GRAVELLY		OBDN	OVERBURDEN		SLTE	SLATE			
DNSE	DENSE		GYPS	GYPSUM		PCKD	PACKED		SLTY	SILTY			
DRTY	DIRTY		HARD	HARD		PEAT	PEAT		SNDS	SANDSTONE			
DRY	DRY		HPAN	HARDPAN		PGVL	PEA GRAVEL		SNDY	SANDY			

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Water Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial		
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

Well Computer Print Out Data as of July 6 2009

TOWNSHIP CONCESSION (LOT)	UTM^{1}	DATE ^{2} CNTR ^{3}	CASING DIA ^{4}	WATER^{5,6} DETAIL	STAT LVL/PUMP LVL^{7} RATE^{8}/TIME HR:MIN	WATER USE^{9}	SCREEN INFO^{10}	WELL # (AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND^{5,11}
TISDALE TOWNSHIP CON 01(009)	17 477683 5367497^{L}	1998/07 2401	06 06		/ 200 025 / 1:0	DO		1605238 (187521) SAND BLDR 0022 GREN ROCK 0344
TISDALE TOWNSHIP CON 02(010)	17 476956 5369457^{W}	2004/10 7284	20				0025 0051 10	1605673 (Z17181) A014697 BRWN SAND SILT 0025 GREY SILT SAND 0035 BRWN SAND SILT 0026 BRWN SAND GRVL SILT 0060
TISDALE TOWNSHIP CON 02(011)	17 476064 5368077^{W}	1980/07 2401	05 05	FR 0180 FR 0130	039 / 240 004 / 1:0	DO		1602943 () SAND 0026 GRSN 0242
TISDALE TOWNSHIP CON 03(012)	17 475664 5370427^{W}	1977/09 3404	06	FR 0061	015 / 060 007 / 1:30	DO	0059 04	1603099 () BRWN SAND LYRD 0065
TISDALE TOWNSHIP ()	17 475923 5368300^{W}	2005/09 6894	04			NU	0010 10	1605763 (Z08564) A008469 BRWN FSND MSND 0015 SILT WBRG 0020
TISDALE TOWNSHIP ()	17 475929 5368275^{W}	2005/06 6894	04			NU	0010 10	1605746 (Z23123) A008468 BRWN FSND 0015 GREY SILT 0020
TIMMINS TOWN ()	17 476268 5369381^{W}	2008/10 7383						7115841 (M02075) A072189
TIMMINS TOWN ()	17 476163 5368256^{W}	2004/09 1752	40	FR 0005			0010 20	1605674 (Z14276) A014235 BRWN LOAM 0000 BRWN SAND 0010 GREY SAND 0033
TIMMINS TOWN ()	17 476268 5369381^{W}	2008/07 7383						7113534 (M01189) A072189
TIMMINS TOWNSHIP (UN ()	17 476393 5369360^{W}	2007/10 7284			/ / :0	NU		7101703 (Z68505)

APPENDIX D

LITTLE PEARL TAILINGS POND OUTLET FACILITY CONCEPTUAL DESIGN

Memo

To	**David Simms**	File no	**TC81525**
From	**Jie Yang**	cc	
Date	**January 20, 2009**		

Subject **Little Pearl Tailings Pond**
Outlet Facility Conceptual Design,
Pocupine Gold Mines, Timmins, Ontario

Design Considerations

The outflow from Little Pearl Tailings Pond (LPTP) to Pearl Lake (PL) will be changed from its current condition of a 36” culvert connection, to one using a weir structure that will allow flows from the pond to be measured to the prescribed accuracy of ±15%, as required by *O. Reg. 560/94.*

- a thin-plate, concrete weir (as part of a decant / weir box) would be constructed within the existing LPTP outlet channel;

- the weir would have two identical side by side 1.5 m openings, with the two openings to be used at higher pumping rates (20,000-30,000 m^3/d) during the first 2 years of dewatering, and with the second opening to be closed at lower pumping rates (10,000-15,000 m^3/d) after approximately year two of operations, during the winter (November to March);

- the intake channel approach to the weir may have to be excavated to a deeper configuration, and a deeper narrow channel would preferably be dredged within the eastern portion of the LPTP to connect the channel with deep pond waters (the eastern end of LPTP is very shallow <0.5 m, and would be prone to freezing if the pumps go down for a few days during severe freezing conditions);

- the weir structure would be enclosed within a heated building (shed) to prevent the system from freezing, and to maintain flow measurement accuracy during the winter; and,

- the outflow from the weir box would be a dredged channel leading to a concrete box culvert that connects to Pearl Lake (replacing the existing culvert).

Design Peak Runoffs

The LPTP outflow system is designed to convey the 1:25 year storm event. Table 1 summarizes the rainfall Intensity-Duration-Frequency values from the Atmospheric Environment Service (AES) for the Timmins A climate station (data 1952 to 2003).

Table 1 - Rainfall (mm) Intensity-Duration Frequency Values

Duration	Return Period (years)					
	2	5	10	25	50	100
5 min	6.9	9.1	10.6	12.5	13.9	15.3
10 min	9.9	13.6	16.0	19.0	21.3	23.6
15 min	11.7	16.1	19.0	22.6	25.3	28.0
30 min	15.0	21.5	25.9	31.4	35.4	39.5
1 hr	18.0	25.4	30.2	36.3	40.9	45.4
2 hr	21.8	29.3	34.2	40.5	45.1	49.7
6 hr	29.0	38.6	44.9	53.0	58.9	64.8
12 hr	35.1	48.3	57.0	68.1	76.2	84.4
24 hr	43.8	63.1	75.9	92.1	104.1	116.0

Sources: AES Timmins A Station historical records (data 1952 to 2003).

The drainage area of the LPTP and the Pearl Lake subwatersheds are 102.3 ha and 106.9 ha, respectively, as shown on Figure 1.

The hydrologic and hydraulic model MIDUSS was used to determine the peak runoffs for the study areas. The modelling results indicate that the peak runoffs into the LPTP and PL during a 24-hour 1:25 year storm are at approximately 7.1 m^3/s and 7.7 m^3/s, respectively.

Pond Hydrologic Routings

The LPTP and PL are routed for the low flow (during dry period) and high flow (24-hour 1:25 year storm) scenarios. The design hydrologic parameters and pond inflow/outflow/levels are summarized in Table 2.

Table 2 – Summary of the Pond Hydrological Routing Parameters

Watershed	Catchment Area		Operation Period[1]	Design Parameters			
	Pond	Total (pond included)		Scenario	Inflow	Outflow	Pond Level[2]
	(ha)	(ha)			(m^3/s)	(m^3/s)	(m)
Little Pearl Tailings Pond	9.0	102.3	first two years	Low Flow	0.35	0.35	312.85
				High Flow	7.45	1.49	313.12
			3rd year and after	Low Flow	0.17	0.17	312.85
				High Flow	7.27	1.26	313.08
Pearl Lake	27.0	106.9	first two years	Low Flow	0.35	0.35	312.73
				High Flow	8.64	1.71	312.91
			3rd year and after	Low Flow	0.17	0.17	312.70
				High Flow	7.27	1.45	312.88

[1] Assume mine water discharge to the LPTP at 30,000 m^3/d during the first two years of operation and at 15,000 m^3/d during the following years. Assume one weir will be closed from the 3rd operational year in the winters.

[2] Current LPTP pond level was based on the survey information provided by Talbot Survey Ltd. on Dec. 17, 2008.

Figure 2 and Figure 3 show the stage-storage curves and the design pond levels for the two ponds, respectively.

Figure 4 presents the LPTP inflow/outflow hydrographs and pond level variations during a 24-hour 1:25 year storm event. The figure indicates that following a 25 year flood event, the pond level will drawdown to the normal level within 3 days.

LPTP Outflow Facility Hydraulic Evaluation

The LPTP outflow facilities connecting to the PL are shown on Figure 5 and Figure 6.

Discharge from the LPTP will be monitored and controlled by a weir structure. Two thin metal plate rectangular weirs with 1.5 m openings are designed to measure both low flows and high flows.

The weir crest is designed at 312.7 m, same as the LPTP water level surveyed by Talbot Survey Ltd. on Dec 17, 2008. This design level needs to be reviewed and adjusted in the detail design period when more monitored lake level data are available.

From Table 2, the LPTP pond level will be at about 0.15 m above the weir invert level during normal conditions, and about 0.4 m above weir invert during extreme flood events.

The rectangular weir box is designed at 5.1 m long and 2 m wide, with a bottom elevation of 311.7 m and a top elevation of 312.2 m.

The weirs are designed as sharp-crested weirs using the equation:

$$Q = Ce\frac{2}{3}\sqrt{2g}b_c h_1^{1.5}$$

where
"Q" is discharge rate in m^3/s;
"C_e" is the weir coefficient;
"b_c" is the width of the weir; and
"h_1" is the water head above the weir invert

The head-discharge rating curves with design weir dimensions are presented in Figure 4.

The existing culvert connecting the two ponds will be replaced by a rectangular concrete box culvert. The box culvert is designed as 3 m wide, 1.5 m high, with a longitude slope of 0.2%. The culvert will be submerged by more than 1 m water during operation for winter freezing protection. The upstream culvert invert elevation is designed at 311.6 m.

The inlet and outlet of the culverts will be lined with rock scour protection to prevent scour and erosion during the culvert service period.

The information provided in this write-up is a conceptual level study intended to support planning and permitting functions. Detailed hydraulic evaluation and structure design for the LPTP outflow facilities would be required during the next stage of study.

amec

HOLLINGER PERMITTING

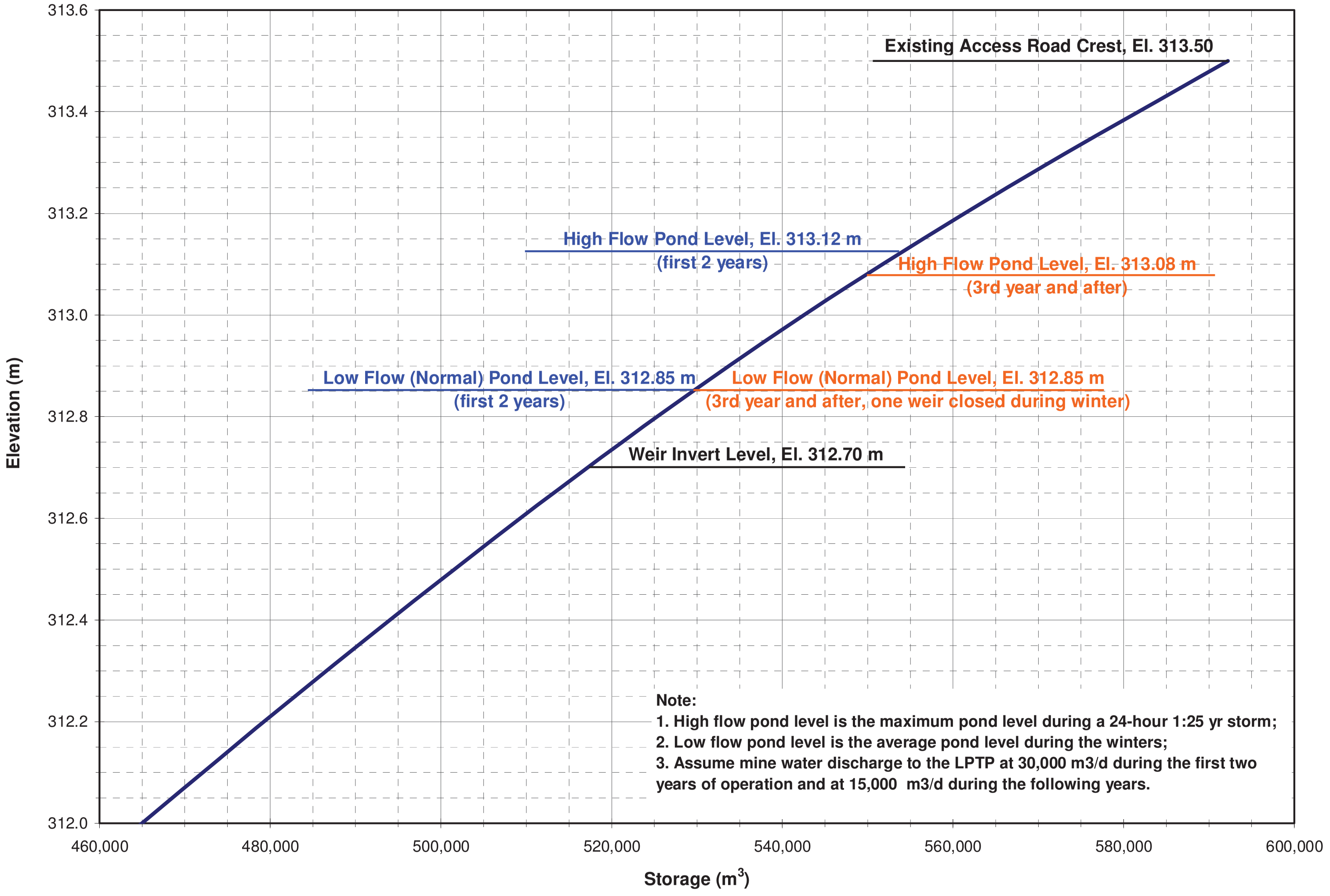
TIMMINS ONTARIO

Subwatershed Areas

SCALE: 1:10,000	DATE: January 2009
PROJECT No: TC81525	FIGURE: 1 REV: A

P:\EM\Projects\2008\TC81525 Hollinger Permitting\GIS_Data\PTTW_Investigation_Dec2008\Pearl Lake Watershed.mxd

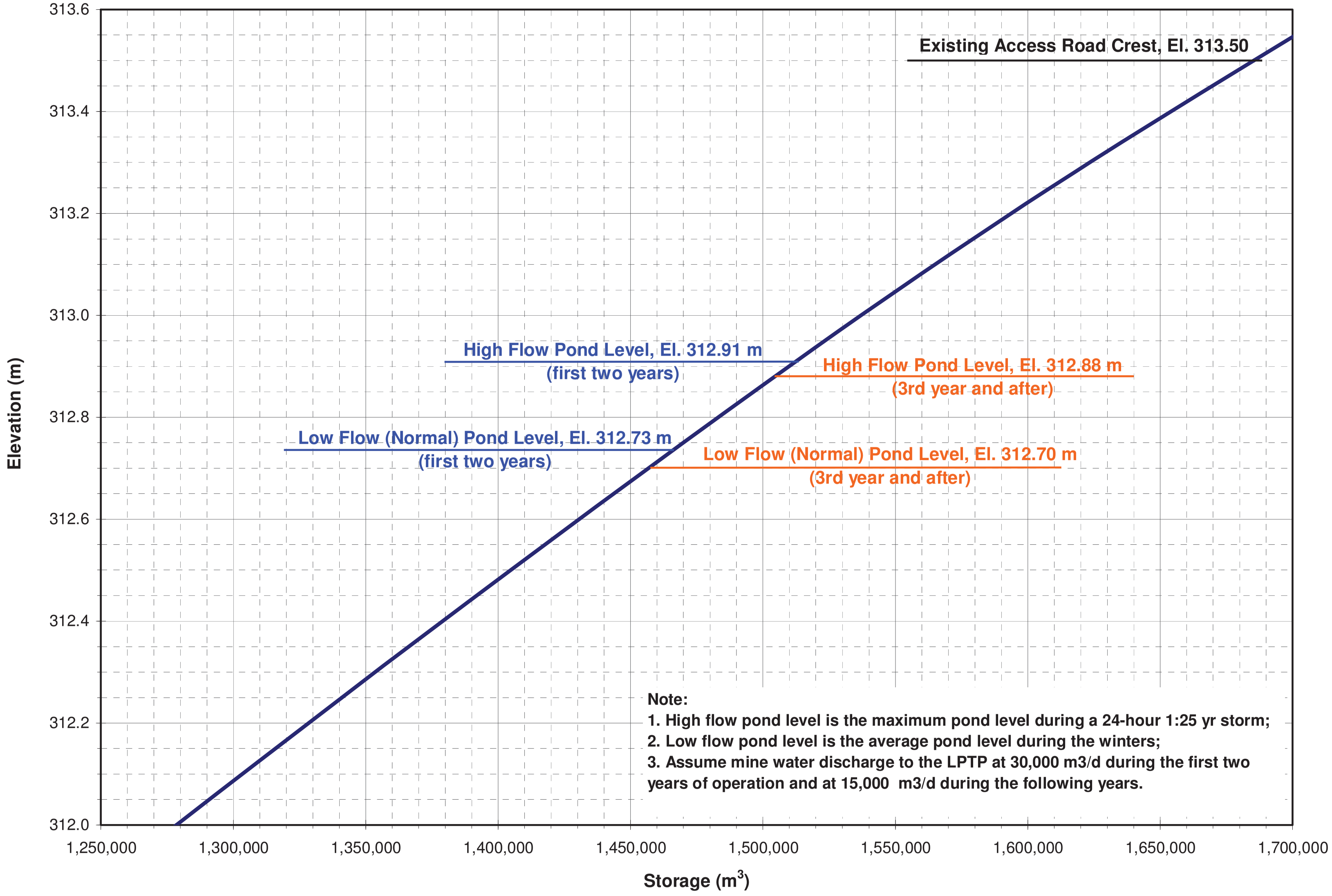
Figure 2 – Little Pearl Tailings Pond Stage-Storage Curve and Pond Levels



Note:

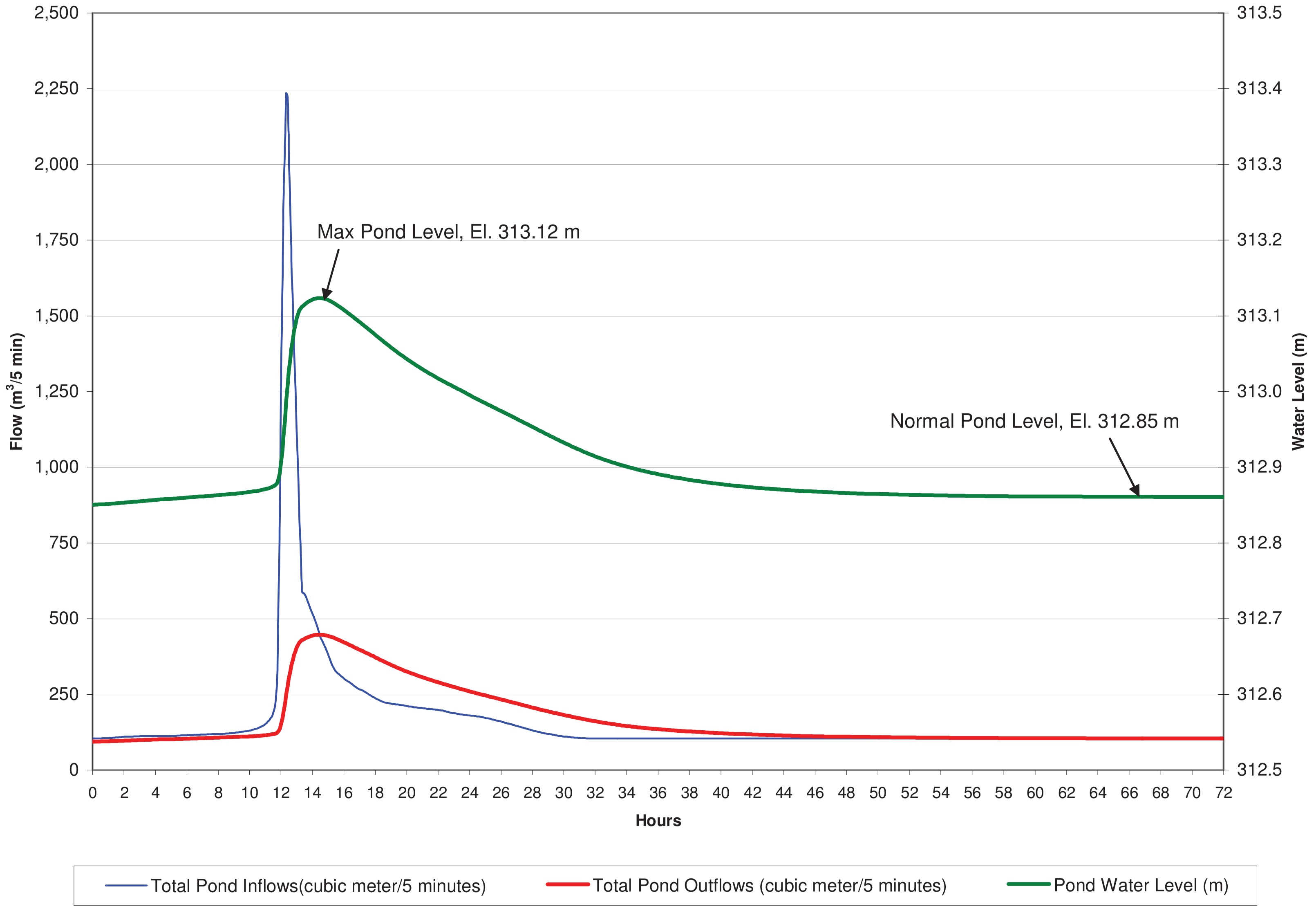
1. High flow pond level is the maximum pond level during a 24-hour 1:25 yr storm;
2. Low flow pond level is the average pond level during the winters;
3. Assume mine water discharge to the LPTP at 30,000 m3/d during the first two years of operation and at 15,000 m3/d during the following years.

Figure 3 – Pearl Lake Stage-Storage Curve and Pond Levels



Note:
1. High flow pond level is the maximum pond level during a 24-hour 1:25 yr storm;
2. Low flow pond level is the average pond level during the winters;
3. Assume mine water discharge to the LPTP at 30,000 m3/d during the first two years of operation and at 15,000 m3/d during the following years.

Figure 4 – Little Pearl Tailings Pond Flood Routing during 24-hour 1:25 year Storm



NOTES:

1. ALL ELEVATIONS, GRIDS AND DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
2. TOPOGRAPHIC SURVEY WAS PROVIDED BY TALBOT SURVEY LTD. ON DECEMBER 17, 2008.
3. THIS DRAWING IS A CONCEPTUAL LEVEL DESIGN. DETAILED DESIGN FOR THE LPTP OUTLET FACILITIES WOULD BE REQUIRED DURING THE NEXT STAGE OF STUDY.

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	ENG.	APPR.
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A	20	01	2009	ISSUED FOR PERMITTING	J.Y.	D.S.

Client Logo:

Client:

GOLDCORP CANADA LTD.
PORCUPINE GOLD MINES

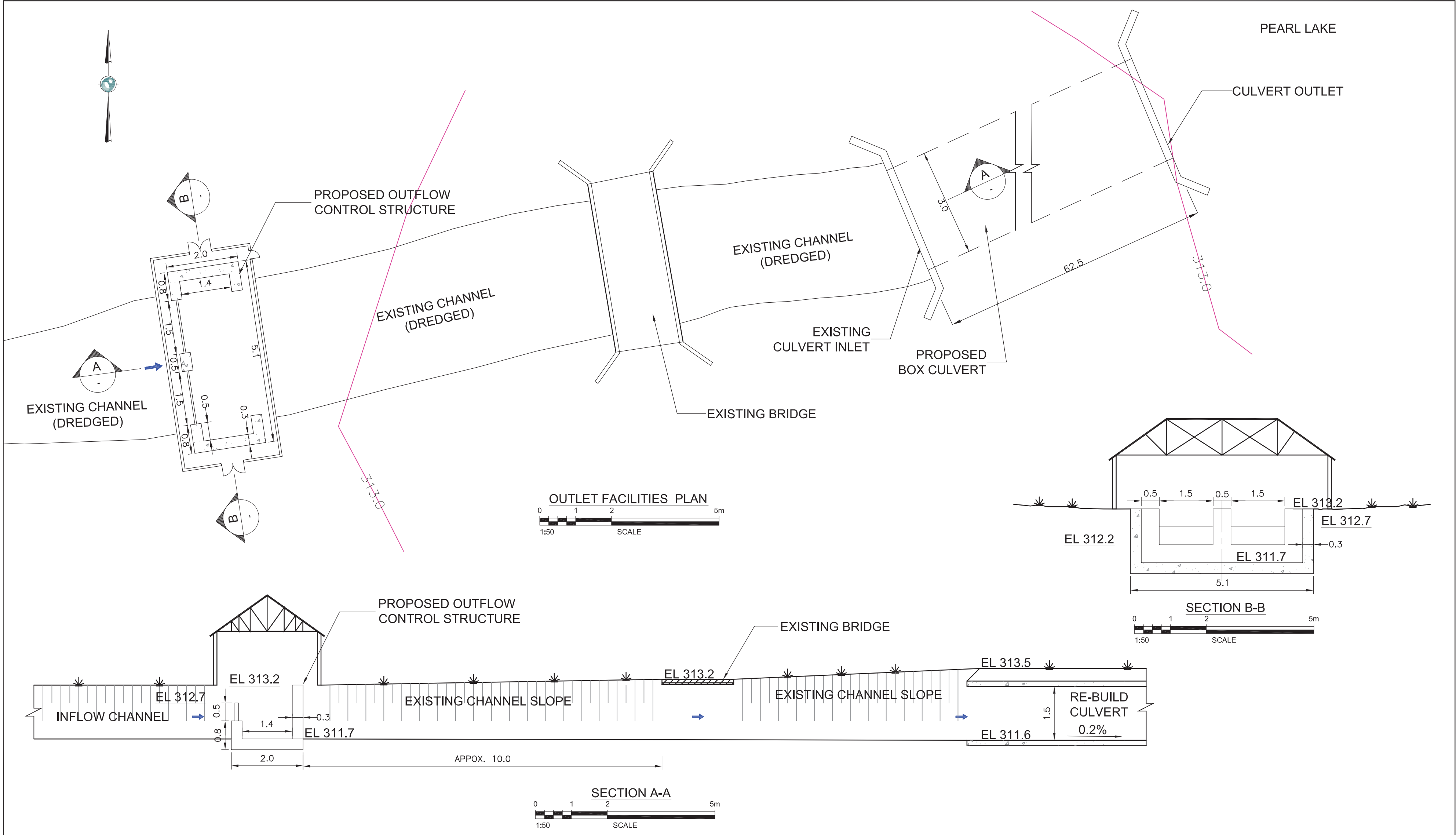
AMEC Earth & Environmental
160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

DRAWN BY:	P.L.
DESIGNED BY:	J.Y.
CHECKED BY:	D.S.
REVIEWED BY:	D.S.
APPROVED BY:	D.S.

PROJECT:
HOLLINGER PERMITTING

TITLE:
LITTLE PEARL TAILINGS POND
OUTLET FACILITIES CONCEPTUAL DESIGN
GENERAL LAYOUT

PROJECT NO.:	TC81525
REVISION NO.:	A
DATE:	JANUARY 2009
SCALE:	AS SHOWN
DRAWING NO.:	FIGURE 5



OUTLET FACILITIES PLAN

SECTION B-B

SECTION A-A

NOTES:

1. ALL ELEVATIONS, GRIDS AND DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
2. TOPOGRAPHIC SURVEY WAS PROVIDED BY TALBOT SURVEY LTD. ON DECEMBER 17, 2008.
3. THIS DRAWING IS A CONCEPTUAL LEVEL DESIGN, DETAILED DESIGN FOR THE LPTP OUTLET FACILITIES WOULD BE REQUIRED DURING THE NEXT STAGE OF STUDY.

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	ENG.	APPR.
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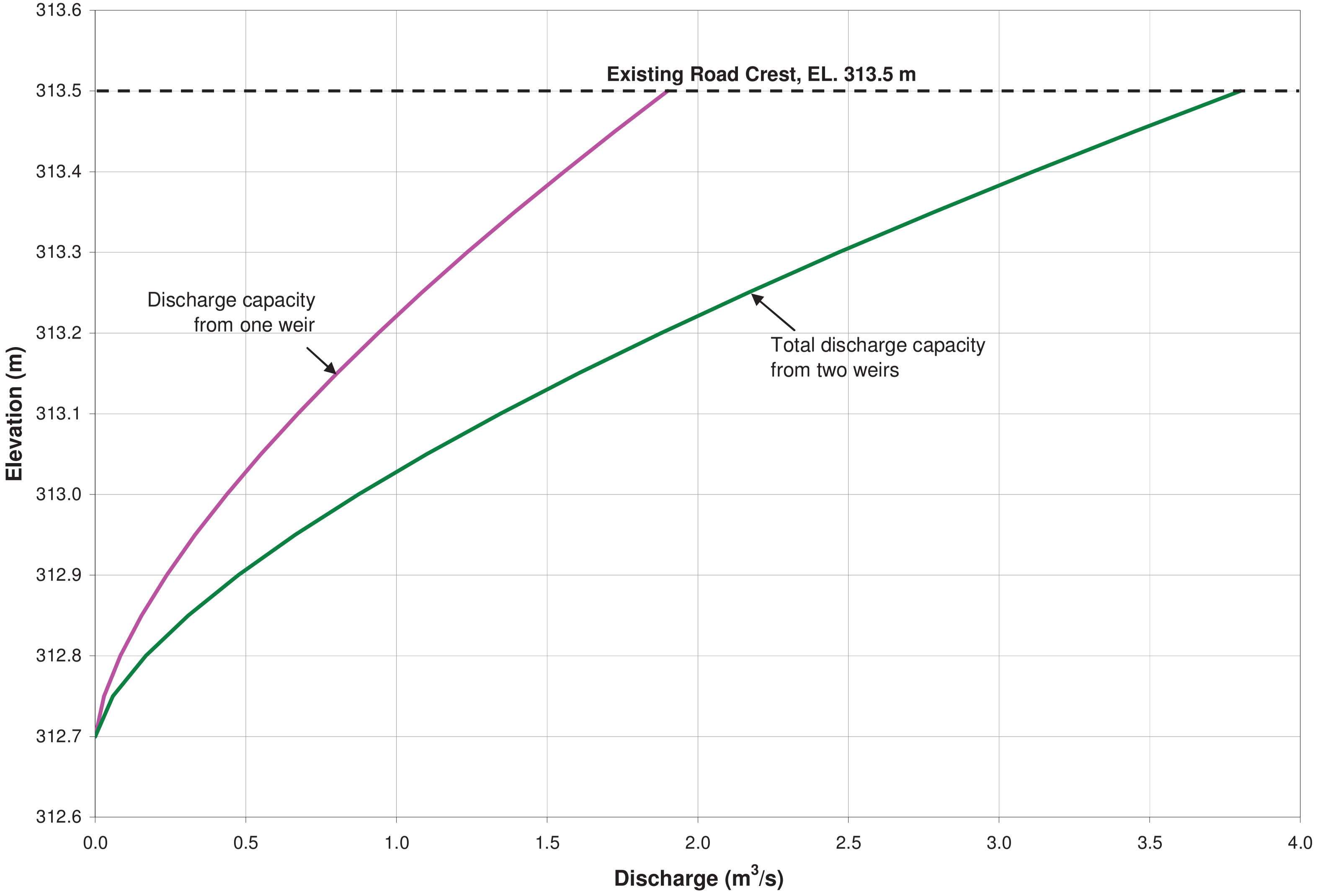
REVIEWED BY: D.S.
APPROVED BY: D.S.

PROJECT: HOLLINGER PERMITTING

TITLE:
LITTLE PEARL TAILINGS POND
OUTLET FACILITIES CONCEPTUAL DESIGN
PLAN AND SECTIONS

PROJECT NO.: TC81525
REVISION NO.: A
DATE: JANUARY 2009
SCALE: AS SHOWN
DRAWING NO.: FIGURE 6

Figure 7 - LPTP Weir Structure Head-Discharge Rating Curves



APPENDIX E

MEETING MINUTES AND CORRESPONDENCE

1. Inter-agency government meeting minutes February 24, 2009
2. Ministry of the Environment meeting materials March 19, 2009
3. Groundwater model memo April 8, 2009 and attached e-mails
4. Porcupine Gold Mines Hollinger Project consultation program April 2009

goldcorp
PORCUPINE GOLD MINES

Interagency Government Meeting
Hollinger Project Permitting Requirements

Date: February 24, 2009
File No.: 002
Location: White Pines Board Rm. Government Complex
Written By: B.Taylor

Present:
Dave Bucar – PGM
Peter Andrews – PGM
Rob Ferguson – MNDM
Stan Kaczmarek – MNDM
Paula Allen – MOE
Janet Ronne – CofT
David Laverdiere – EC
Laszlo Gotz – PGM
Kees Pols –MRCA
Deb Stephenson – MNDM
Denis Durocher – MOE
Glen MacFarlane – MNR
Norm Bruce – CofT
Randy Chin - MOE
Robin Price - PGM
Dave Simms - AMEC
Brian Atkinson - MNDM
Carol Leith – MOE
Andre Robichaud - CofT
Essa Saarela – CofT
Connie Smith - DFO

Welcome and Introduction of Participants

1.0 Hollinger Project, Tisdale Township

1.1 Dave Bucar, Strategic Development Manager for PGM and Dave Simms, Amec Consultant gave an overview of the Hollinger Project. They went over the current status of the Environmental Baseline Studies and Consultation to date as well as outlined assumed permitting requirements. (Power point file of presentation is attached). **DB/DS**

2.0 Round Table Discussions

2.1 The various government agency representatives voiced questions and concerns as outlined below:

2.2 Ministry of Environment

2.2.1 Dave Bucar was asked to clarify the steps that were involved in choosing the current offset limits for the project. They are as follows: **MOE, CofT**

MOE's D-6 Guideline "Compatibility Between Industrial Facilities and Sensitive Land Uses" was used as a starting point to help determine the offset distances between Industrial operations and residential/commercial residences. The Guideline states that the influence area for Industrial Facilities should be established through appropriate studies. In the absence of studies, the ministry recommends a separation distance of 1000m. Technical Studies can be conducted to justify a minimum separation distance of 300m. Less than the minimum separation distance may be acceptable, subject to a justifying impact assessment. MOE may be able to provide some technical assistance to the City of Timmins to determine if the proposed separation distances will be acceptable. The City of Timmins Official Plan (once accepted) references the MOE D-6 guideline with respect to required offset distances. If PGM feels that it is necessary to amend this distance to a lower number then it will be necessary for PGM to submit Engineering Studies as part of the review. MOE may be able to provide some technical assistance to the City of Timmins on this review. A third party may be required to help facilitate the review, at the cost of PGM. **Further research into the definition of "sensitive area" is necessary, especially in relation to hotels.**

PGM will be required to sign a Site Plan Control Agreement once these issues are resolved.

2.2.2 What measures will be put in place to mitigate the noise generated while constructing the noise berm?

The construction of the noise berm will fall under the construction guidelines for noise. Construction will be limited to daylight hours and the berm will likely be built in various stages depending on the location of the operations. It is estimated that the construction of the berm could take a year.

2.2.3 Would the height of the berm exceed 20m? **PGM**

The berm will be built to above the height of the highest rock pile at a standard 3:1 slope. The initial berm will be built up to 20m in height, though it may be less dependent on the engineering studies that are under review. Subsequent berms will be required in areas where rock storage will take place on site to ensure all placement of rock occurs behind a berm.

2.2.4 How will you mitigate subsidences in the areas of the berm? **PGM, MNDM**

Once plans are finalized for the Open Pit design, a detailed review will take place on the berm location. The ground stability will be reviewed and any stopes that fall within the footprint of the berm or rock storage area will be analyzed in detail to ensure a proper Closure Measure is in place to ensure safety. An intensive consultation with MNDM will take place to ensure the safety of the workers and the public.

2.2.5 Will a program be put in place to monitor the downstream water **PGM, MRCA**

quality from Pearl Lake?
This area is currently being monitored as part of our dewatering activities at the McIntyre Mine. This is covered under an existing Certificate of Approval through MOE. The monitoring programs will continue and be enhanced further once the site begins Operating.
The downstream Pearl and Clearwater Lakes are monitored for beaver activity to ensure there is no substantial backup of water. This will also continue.

2.2.6 How will you ensure water quality in the pit once it is allowed to flood?
This area will be added to the existing water quality monitoring program. It is anticipated that as the precipitation and groundwater fill the open pit, any iron in solution from the interaction with the mine workings will oxidize and precipitate out. Once the pit lake is at surface and drains naturally to the environment, oxygen levels at surface will allow for this process to continue preventing the precipitation of iron downstream.

3.0 Permitting Discussion

3.1 **MNR** - Confirm if LRIA will be required for work on weir/berm system upgrade at the outflow of Little Pearl Tailings Pond and for the culvert upgrade between Little Pearl Tailings Pond and Pearl Lake. There will be restrictions on construction timing due to Fish Spawning (Work in Water) periods. Plans and specs will likely have to be approved by MNR.

PGM, MNR

3.2 **MNR** – Depending on the location of the Haul Road there may be permitting necessary for placement of culverts for water drainage as well as an application to harvest crown held trees on patent land.

PGM, MNR

PGM will need to finalize a Haul Road location to determine any potential culvert requirements.

PGM will need to complete a land title search to determine tree ownership. If there are crown trees an ‘A’ Level EA Screening will likely be required along with First Nation consultation.

3.3 **MOE** – C of A amendment for discharge of water to Little Pearl. PGM is proposing to reroute the water from the existing channel in the centre of Little Pearl to the western end. A new silt curtain system or rock berm would be placed across the entirety of Little

PGM, MOE

Pearl before the outlet to provide water treatment. MOE will be involved in the Groundwater/Surface Water review. A receiving water assessment will likely be required in consideration of changing from an inactive to active operation. MOE offered to set up a pre-application consultation meeting with technical support staff to discuss supporting information required for permit applications.

3.4 **MOE**- C of A Air may be necessary for ventilation from underground operations. There are currently no triggers for a C of A Air for the Open Pit operation other than any new crusher systems. There are no planned crushers at the Hollinger Mine site, all crushing will take place at the Dome Mine which has its own C of A Air. **PGM, MOE**

MOE recommended that the Noise D-1-3 Guidelines to be checked for the definition of "sensitive receptors" to understand requirements for offset distances.

3.5 **MOE** - Discussions should take place with MOE - Air Support department before the air monitors are installed. **PGM, MOE**

3.6 **ALL** - Confirmation is necessary to determine if any Class EA's will be triggered. Possible triggers discussed included: **PGM, MOE, CofT, MNDM, MNR**

- Municipal – Road crossings – to be determined
- MNDM – Mining – unlikely if no crown land
- MNR – Crown Land – none known at this time

3.7 **MNDM** – greatly concerned about the effects of dewatering on the existing subsidence areas and mine workings (stability of backfilled sand in the mine workings). This will have to be closely researched before dewatering begins. It is anticipated that dewatering will take place slow enough as to not cause concern. All mine workings prone to subsidence are located within fence-lines. A Mitigation Plan will be required. **PGM, MNDM**

There is also concern with respect to the effects of dewatering on the surrounding lands. There is also concern at closure of the effect of groundwater level rebound on the stability of backfilled mine workings.

3.8 **MNDM** – PGM is planning to submit an amendment to the Hollinger Industrial Site Closure Plan for the Hollinger Open Pit **PGM, MNDM** project and an amendment to the McIntyre Industrial Site Closure Plan for the CPZ underground project. There will be no formal requirement for a public consultation process in regarding of the amended Closure Plan. The proposed overall all Consultation Program described by PGM should be more than adequate to cover public issues. A Notice of Project Status will be required.

3.9 **MNDM** – PGM plans to backfill open mine workings with rock generated from the open pit operations. All open workings will likely have fill subsidence due to blasting, so rock will be used to fill the void to the underground and then rock will be placed overtop to bridge the voids. MNDM would like a rigorous review of any backfilling process as part of the mine closure.

PGM, MNDM

MNDM expressed their concern over the stability of noise-barrier rock-berm being constructed over backfilled stopes.

3.10 **MRCA** – would like to work with MNR for any LRIA reviews necessary for this project.

PGM, MNR, MRCA

3.11 **MRCA**- PGM is proposing to discharge water from the Open Pit via a gravity drainage channel, south of the property to the Skynner Creek system. MRCA is concerned with the final disposal of water from the pit to Skinner's Creek.

PGM, MRCA

This area will be added to the existing water quality monitoring program.

3.12 **DFO** – would like to see further information on the culvert intended to replace existing culvert in Little Pearl Tailings Pond as well as a site plan. (The site plan will be forwarded as part of the presentation). DFO will likely provide a Letter of Advice for this work. Final drawings will be submitted to DFO for review once available.

PGM, DFO

3.13 **City of Timmins** – Official plan is expected to be sent for approval early this spring. The approval process may take up to 6 months to complete.

CofT, MMAH

In regards to the mine's offset distances, a "Site Plan Control Agreement" may be necessary between the C of T and PGM. MOE indicated that some form of public notification and consultation on the Site Plan Control Agreement should take place.

3.14	**City of Timmins** - Haul Rd. – may trigger a Municipal Class EA depending on the location and size of the road crossings at Vipond Road and Gold Mine Road. City and MNR also discussed concerns with numerous stakeholders who use the land where the Haul Road is proposed (Snowmobile Club, Ski Runners). PGM to have further discussions once location is confirmed.	**PGM, CofT, SC/PSR**
3.15	**City of Timmins** – will the water tank be affected? There are ongoing vibration studies to determine the effects of blasting on the water tank and water lines adjacent to the property. At this time the planned 200m offset shows no effect on the water tower. Demolition permits will be required for taking down all buildings on site.	**PGM, CofT**
3.15	**MTO** – stated they had no concerns thus far with regards to this project but wish to be kept in the communication loop.	**PGM, MTO**
3.16	**EC** – Once the Hollinger Project becomes a Mine under Development as defined by the MMER, MMER monitoring requirements and EEM study requirements will begin (Section 1(2) and 2(1). EC and MNDM to discuss when the project might meet the definition of mine production under the Mining Act. Further discussion with EC determined that dewatering beyond current pumping limits with the plan for commercial mine development (Open Pit) would be the trigger for MMER. Fisheries Act 36(3) is more stringent than the MMER. Dewatering for exploration purposes only (CPZ Underground) would likely not trigger the MMER but would be subject to Fisheries Act 36(3). The project as described does not have any federal environmental assessment triggers related to the MMER.	**PGM, EC, MNDM**
3.17	**MOL –** MOL was not present at the meeting. It is anticipated that there will not be any specific permits other than normal Construction Project notices to be submitted.	**PGM, MOL**

4.0 General

4.1	PGM - PTTW/CA are near ready for submission as long as there are not any further requirements	**PGM, AMEC, MOE**
4.2	PGM to meet with MOE - Technical Support as soon as possible. MNDM will attend as well.	**PGM, MOE,**

4.3	PGM – to outline the consultation process and send out for review to all agencies There was a recommendation from MNDM that all parties review Section 7.4 of the Project Description - **PUBLIC AND FIRST NATION CONSULTATION**, and note any comments, omissions, concerns, suggestions.	**MNDM** **PGM,** **MNDM,** **MOE,** **MRN,** **CofT**
4.4	PGM will look at uploading all submitted permits to the website to ensure public knowledge and transparency	**PGM**
4.5	PGM will set up a site visit for all agencies to tour the Dome and existing haul road to Pamour to further educate interested parties.	**PGM**
4.6	Coordination will be necessary for any consultation process (Community and First Nation) so as not to overlap. MNDM agreed to liaise with the other government agencies to determine collective First Nation consultation needs, with respect to the different permit requirements, and to convey this information back to PGM. A coordinated FN consultation program is preferred by the agencies (and PGM) rather than to attempt a permit by permit consultation effort.	**PGM,** **MNDM**

Simms, David

From:	Simms, David
Sent:	Thursday, March 19, 2009 12:12 PM
To:	Kentish, Lianne (ENE); Brown, Alisdair (ENE); Chin, Randy (ENE); carroll.leith@ontario.ca
Cc:	Peter Andrews; Dave Bucar
Subject:	materials for today's telecon on Hollinger
Attachments:	Figures for discussion.pdf; Memo-LPTP Outlet Facility Conceptual Design_20090120.pdf; Hollinger Project Notes for Discussion.doc; Hollinger Mine Water Permitting Discussion.doc

Lianne, Alisdair, Randy and Carroll:

Please find attached materials for today's meeting / telecon on the Hollinger Project. Lianne could you please pass this e-mail on to Stan and Nadine, as I don't have their e-mails.

Sorry for the delay in getting these materials out, but Goldcorp was having e-mail problems earlier today.

Dave

Hollinger Mine Water Permitting Discussion
White Pine Board Room
South Porcupine Government Complex
March 19, 2009

Suggested Agenda

1. Purpose of Meeting
2. Attendee introductions
3. Review of proposed operations, permitting requirements, existing conditions, and anticipated environmental effects
4. Discussion of information needs for permitting
5. Scheduling
6. Next steps

Hollinger Project Notes for Discussion
March 19, 2009
Prepared by D. Simms, AMEC

1. Project Description

1) Develop an open pit complex on the site of the former Hollinger Mine workings, with pit depths to approximately 220 m below grade;

2) Develop two associated underground operations, one on the site of the former McIntyre Mine (CPZ UG) and one at the Hollinger site (Millerton UG);

3) Dewater the area of the pits and UG operations from the existing McIntyre No. 11 shaft, with mine water discharge to Little Pearl Tailings Pond (LPTP);

4) Construct an outlet control structure (weir) on LPTP that is capable of measuring flows to ±15%, that will not result in appreciable water level changes to LPTP;

5) Replace the existing 36-inch culvert connection between LPTP and downstream Pearl Lake with a large concrete box culvert to prevent any backpressure from developing on the to-be-constructed weir;

6) Move the existing McIntyre No. 11 shaft mine water discharge point to the west side of LPTP, and install a silt curtain (or rockfill berm) across LPTP to improve settling of suspended solids;

7) Install a flocculant addition system to aid with suspended solids settling;

8) Install a lime addition system to aid with management of pH;

9) Anticipated mine water discharge volumes are 20,000 to 30,000 m^3/d during the first 2 years of operation, followed by an approximate 10,000 to 15,000 m^3/d dewatering rate thereafter;

10) The initial higher dewatering rate is required to dewater existing flooded mine workings in advance of mine development (open pit / or underground);

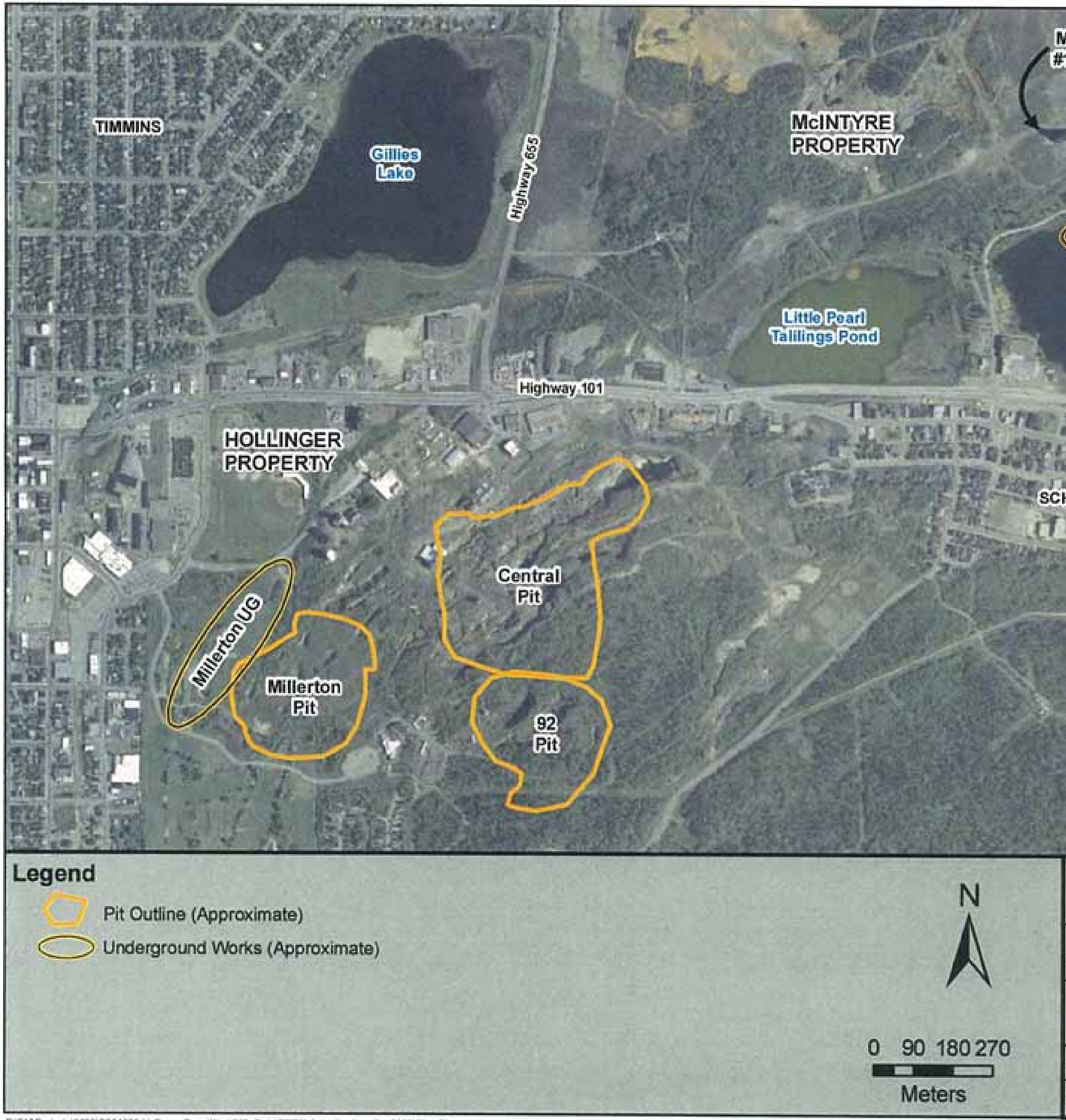
11) The historic mine workings of Hollinger and McIntyre are interconnected;

2. Permitting

12) Active dewatering of the existing historic workings is presently taking place in accordance with PTTW 0248-6UJMBL and C. of A. 8572-4L8GYF

13) This dewatering is occurring to manage local groundwater levels in the area to a depth of from 10 to 25 m below grade depending on location, to prevent groundwater water day-lighting at various locations

14) The current PTTW allows for water taking from the McIntyre No. 11 shaft at rates up to 13,402 m^3/d;



amec

HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Site Plan

SCALE: 1:12,750	DATE: January 2009
PROJECT No: TC81525	FIGURE: 1 REV: 1

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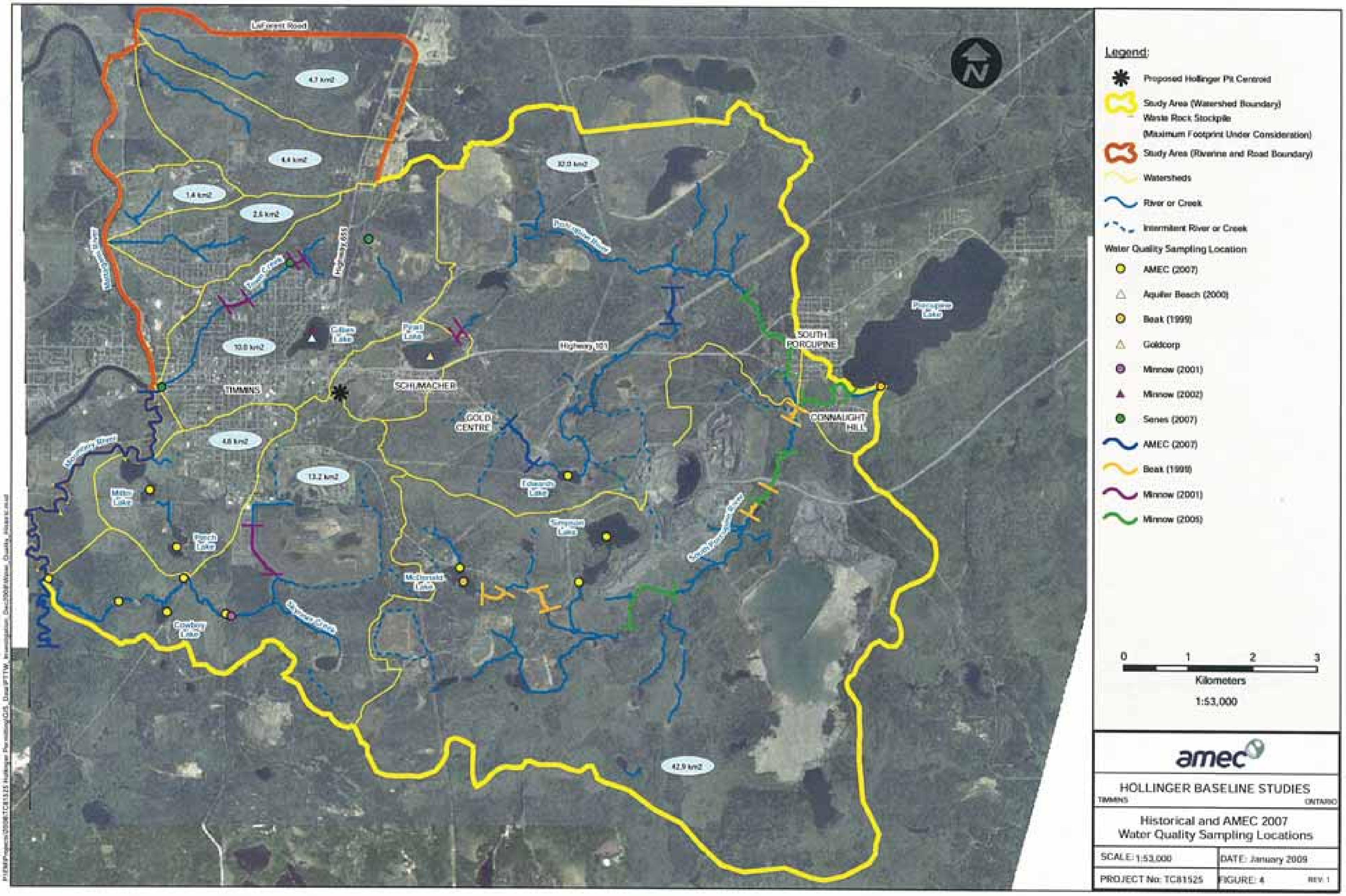
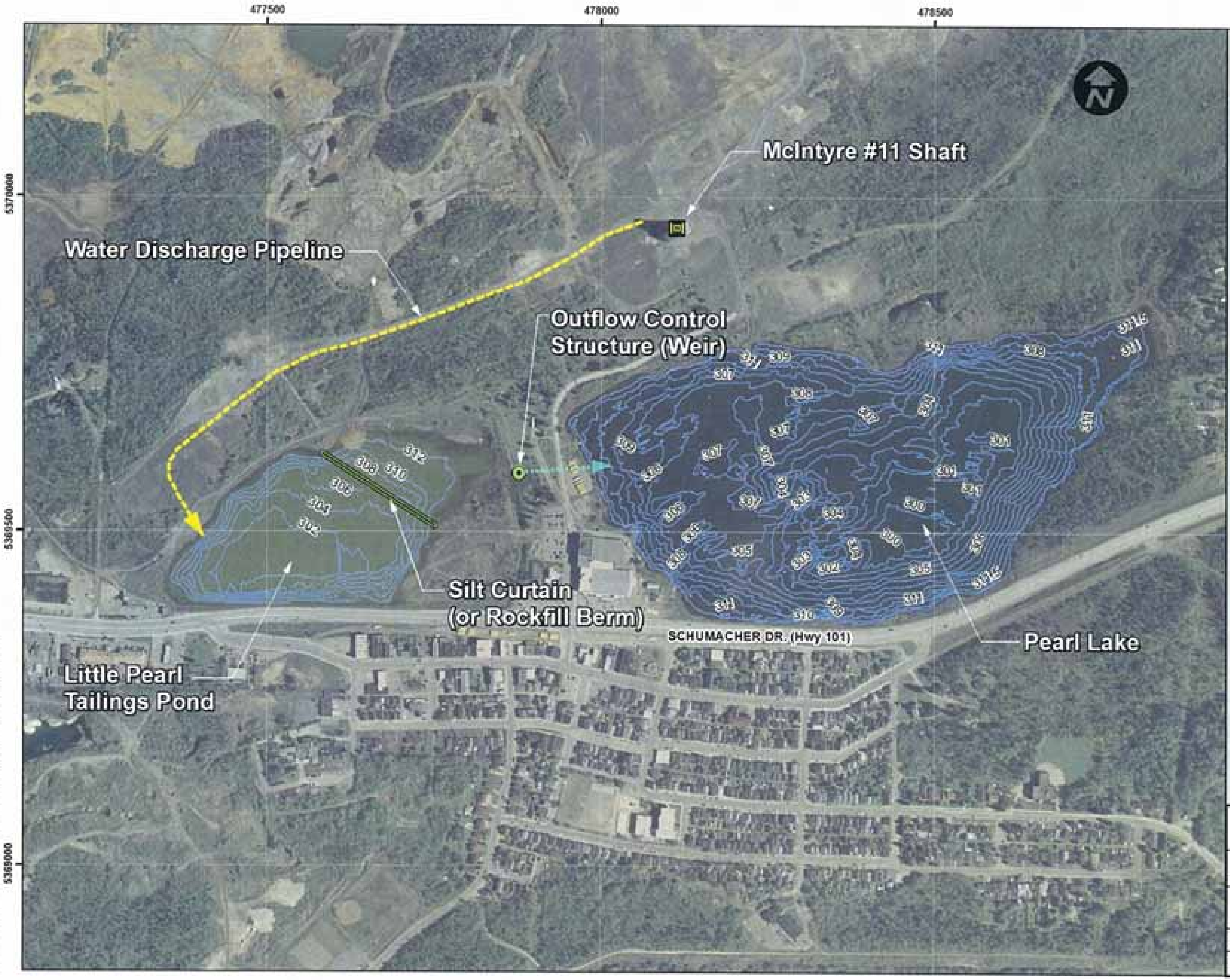


HOLLINGER BASELINE STUDIES

TIMMINS ONTARIO

Historical and AMEC 2007
Water Quality Sampling Locations

SCALE: 1:53,000	DATE: January 2009
PROJECT No: TC81525	FIGURE: 4 REV: 1



Legend:

302 Bathymetry Contours
- metres above sea level

0 100 200 300
Meters
1:5,500

amec

HOLLINGER BASELINE STUDIES
TIMMINS ONTARIO

Water Management

SCALE: 1:5,500	DATE: January 2009
PROJECT No. TC81525	FIGURE: 9 REV. 1

Memo

To	**David Simms**	File no	**TC81525**
From	**Jie Yang**	cc	
Date	**January 20, 2009**		

Subject **Little Pearl Tailings Pond**
Outlet Facility Conceptual Design,
Pocupine Gold Mines, Timmins, Ontario

Design Considerations

The outflow from Little Pearl Tailings Pond (LPTP) to Pearl Lake (PL) will be changed from its current condition of a 36" culvert connection, to one using a weir structure that will allow flows from the pond to be measured to the prescribed accuracy of ±15%, as required by *O. Reg. 560/94*.

- a thin-plate, concrete weir (as part of a decant / weir box) would be constructed within the existing LPTP outlet channel;
- the weir would have two identical side by side 1.5 m openings, with the two openings to be used at higher pumping rates (20,000-30,000 m^3/d) during the first 2 years of dewatering, and with the second opening to be closed at lower pumping rates (10,000-15,000 m^3/d) after approximately year two of operations, during the winter (November to March);
- the intake channel approach to the weir may have to be excavated to a deeper configuration, and a deeper narrow channel would preferably be dredged within the eastern portion of the LPTP to connect the channel with deep pond waters (the eastern end of LPTP is very shallow <0.5 m, and would be prone to freezing if the pumps go down for a few days during severe freezing conditions);
- the weir structure would be enclosed within a heated building (shed) to prevent the system from freezing, and to maintain flow measurement accuracy during the winter; and,
- the outflow from the weir box would be a dredged channel leading to a concrete box culvert that connects to Pearl Lake (replacing the existing culvert).

Design Peak Runoffs

The LPTP outflow system is designed to convey the 1:25 year storm event. Table 1 summarizes the rainfall Intensity-Duration-Frequency values from the Atmospheric Environment Service (AES) for the Timmins A climate station (data 1952 to 2003).

Table 1 - Rainfall (mm) Intensity-Duration Frequency Values

Duration	Return Period (years)					
	2	5	10	25	50	100
5 min	6.9	9.1	10.6	12.5	13.9	15.3
10 min	9.9	13.6	16.0	19.0	21.3	23.6
15 min	11.7	16.1	19.0	22.6	25.3	28.0
30 min	15.0	21.5	25.9	31.4	35.4	39.5
1 hr	18.0	25.4	30.2	36.3	40.9	45.4
2 hr	21.8	29.3	34.2	40.5	45.1	49.7
6 hr	29.0	38.6	44.9	53.0	58.9	64.8
12 hr	35.1	48.3	57.0	68.1	76.2	84.4
24 hr	43.8	63.1	75.9	92.1	104.1	116.0

Sources: AES Timmins A Station historical records (data 1952 to 2003).

The drainage area of the LPTP and the Pearl Lake subwatersheds are 102.3 ha and 106.9 ha, respectively, as shown on Figure 1.

The hydrologic and hydraulic model MIDUSS was used to determine the peak runoffs for the study areas. The modelling results indicate that the peak runoffs into the LPTP and PL during a 24-hour 1:25 year storm are at approximately 7.1 m^3/s and 7.7 m^3/s, respectively.

Pond Hydrologic Routings

The LPTP and PL are routed for the low flow (during dry period) and high flow (24-hour 1:25 year storm) scenarios. The design hydrologic parameters and pond inflow/outflow/levels are summarized in Table 2.

Table 2 – Summary of the Pond Hydrological Routing Parameters

Watershed	Catchment Area		Operation Period[1]	Design Parameters			
	Pond	Total (pond included)		Scenario	Inflow	Outflow	Pond Level[2]
	(ha)	(ha)			(m^3/s)	(m^3/s)	(m)
Little Pearl Tailings Pond	9.0	102.3	first two years	Low Flow	0.35	0.35	312.85
				High Flow	7.45	1.49	313.12
			3rd year and after	Low Flow	0.17	0.17	312.85
				High Flow	7.27	1.26	313.08
Pearl Lake	27.0	106.9	first two years	Low Flow	0.35	0.35	312.91
				High Flow	8.64	1.71	312.73
			3rd year and after	Low Flow	0.17	0.17	312.70
				High Flow	7.27	1.45	312.88

[1] Assume mine water discharge to the LPTP at 30,000 m^3/d during the first two years of operation and at 15,000 m^3/d during the following years. Assume one weir will be closed from the 3rd operational year in the winters.

[2] Current LPTP pond level was based on the survey information provided by Talbot Survey Ltd. on Dec. 17, 2008.

Figure 2 and Figure 3 show the stage-storage curves and the design pond levels for the two ponds, respectively.

Figure 4 presents the LPTP inflow/outflow hydrographs and pond level variations during a 24-hour 1:25 year storm event. The figure indicates that following a 25 year flood event, the pond level will drawdown to the normal level within 3 days.

LPTP Outflow Facility Hydraulic Evaluation

The LPTP outflow facilities connecting to the PL are shown on Figure 5 and Figure 6.

Discharge from the LPTP will be monitored and controlled by a weir structure. Two thin metal plate rectangular weirs with 1.5 m openings are designed to measure both low flows and high flows.
The weir crest is designed at 312.7 m, same as the LPTP water level surveyed by Talbot Survey Ltd. on Dec 17, 2008. This design level needs to be reviewed and adjusted in the detail design period when more monitored lake level data are available.

From Table 2, the LPTP pond level will be at about 0.15 m above the weir invert level during normal conditions, and about 0.4 m above weir invert during extreme flood events.

The rectangular weir box is designed at 5.1 m long and 2 m wide, with a bottom elevation of 311.7 m and a top elevation of 312.2 m.

The weirs are designed as sharp-crested weirs using the equation:

$$Q = Ce\frac{2}{3}\sqrt{2g}b_c h_1^{1.5}$$

where
"Q" is discharge rate in m^3/s;
"C_e" is the weir coefficient;
"b_c" is the width of the weir; and
"h_1" is the water head above the weir invert

The head-discharge rating curves with design weir dimensions are presented in Figure 4.

The existing culvert connecting the two ponds will be replaced by a rectangular concrete box culvert. The box culvert is designed as 3 m wide, 1.5 m high, with a longitude slope of 0.2%. The culvert will be submerged by more than 1 m water during operation for winter freezing protection. The upstream culvert invert elevation is designed at 311.6 m.

The inlet and outlet of the culverts will be lined with rock scour protection to prevent scour and erosion during the culvert service period.

The information provided in this write-up is a conceptual level study intended to support planning and permitting functions. Detailed hydraulic evaluation and structure design for the LPTP outflow facilities would be required during the next stage of study.

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TIMMINS ONTARIO

Subwatershed Areas

SCALE: 1:10,000
DATE: January 2009
PROJECT No: TC81525
FIGURE: 1
REV A

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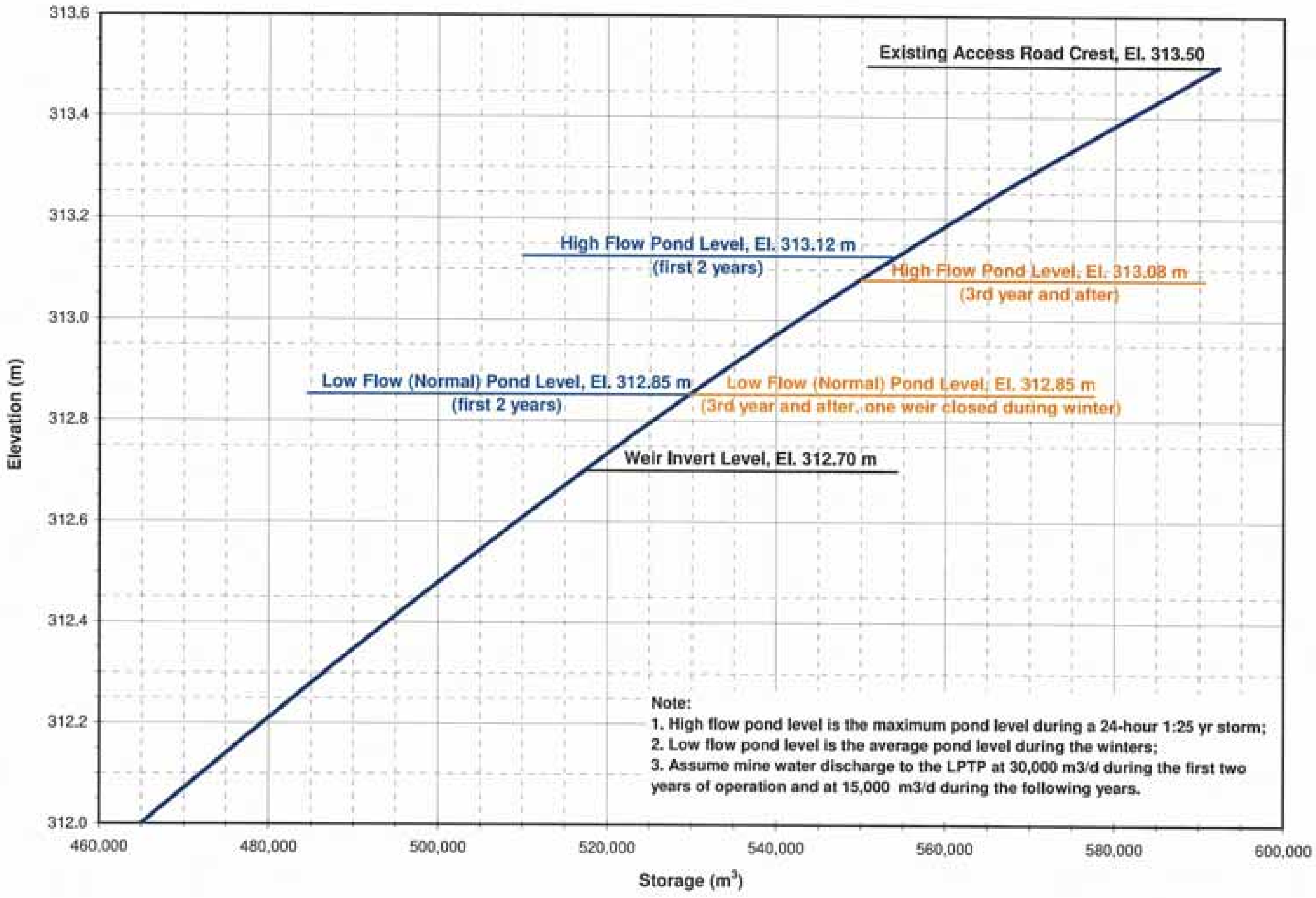
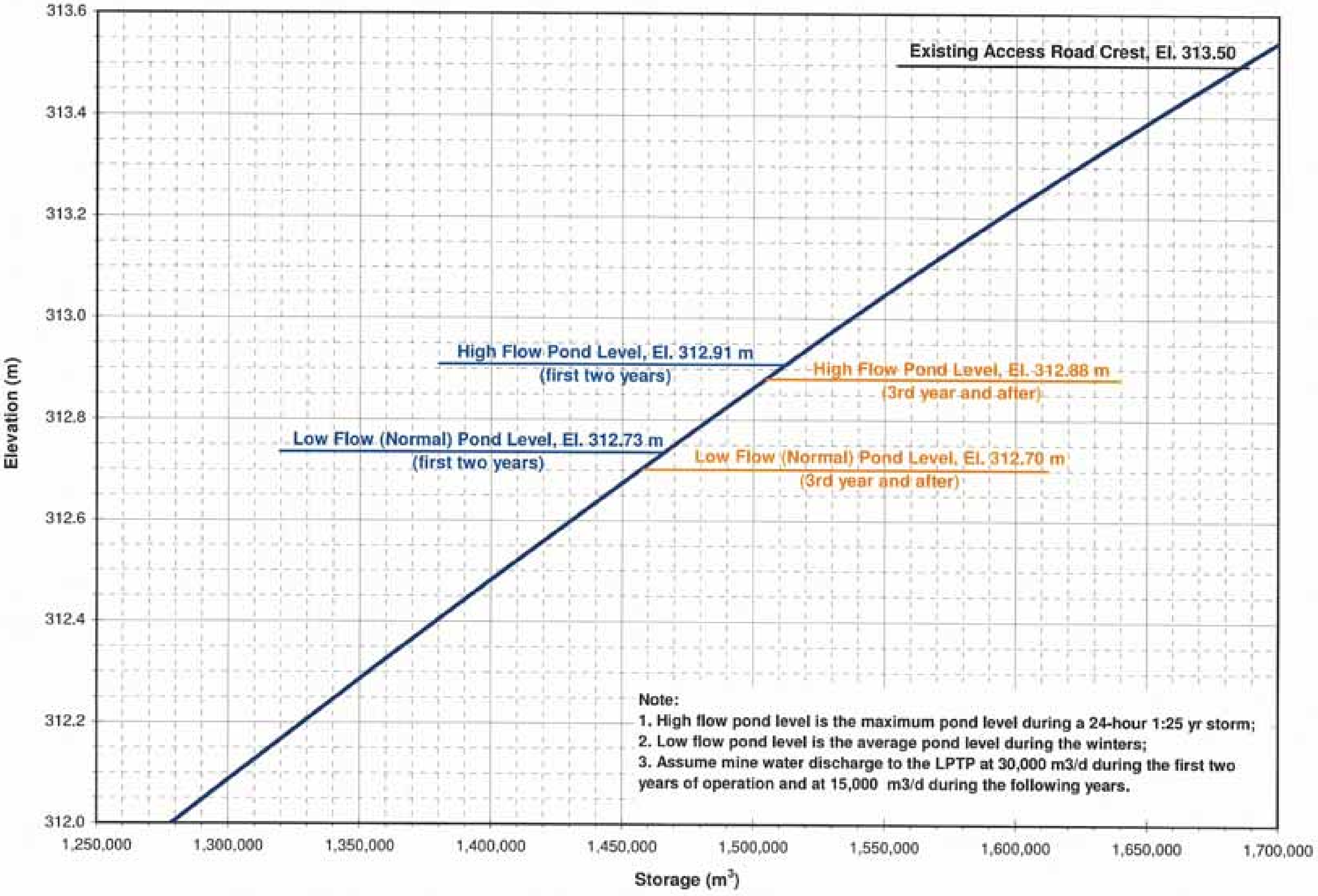
Figure 2 – Little Pearl Tailings Pond Stage-Storage Curve and Pond Levels



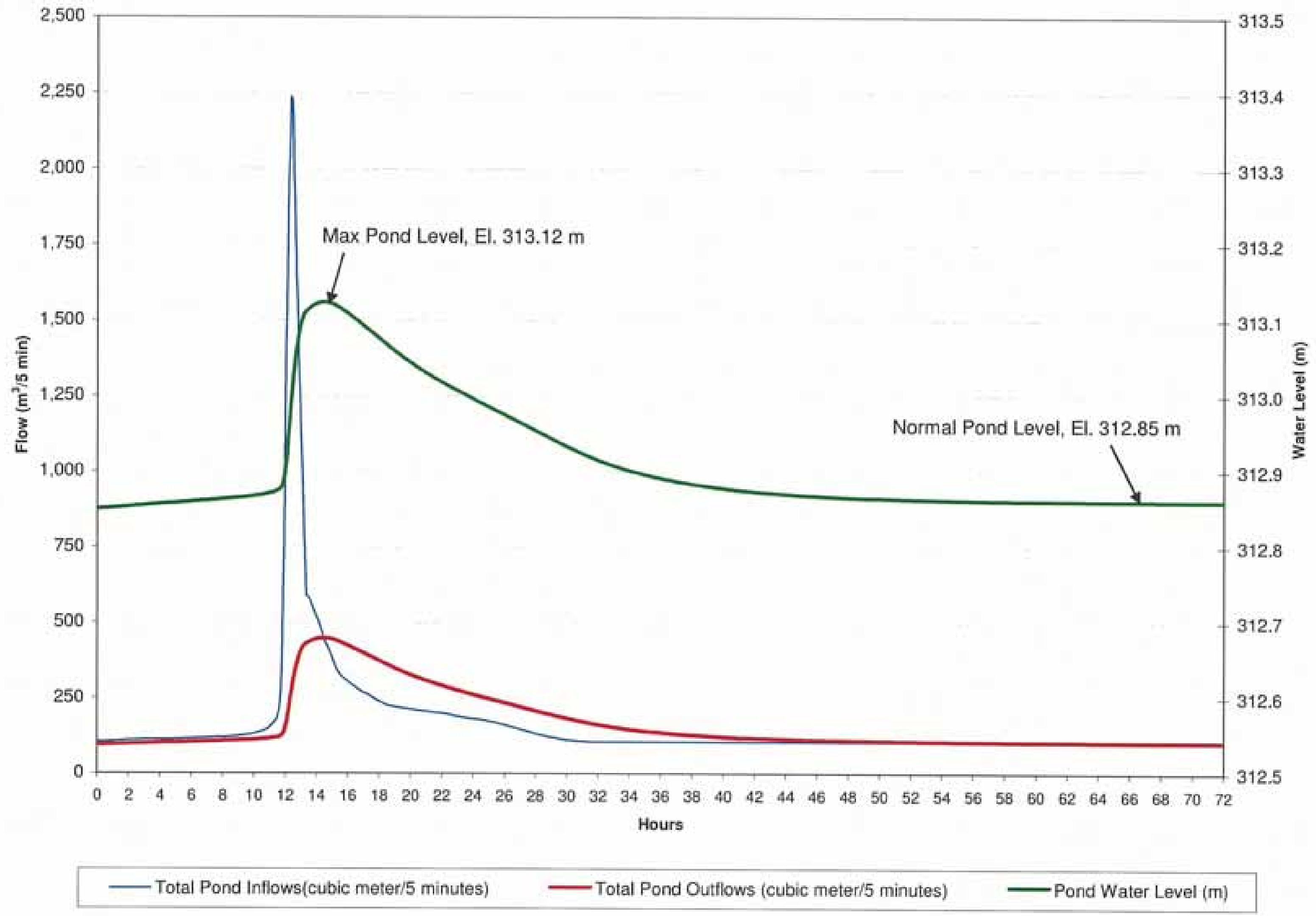
Note:
1. High flow pond level is the maximum pond level during a 24-hour 1:25 yr storm;
2. Low flow pond level is the average pond level during the winters;
3. Assume mine water discharge to the LPTP at 30,000 m3/d during the first two years of operation and at 15,000 m3/d during the following years.

Figure 3 – Pearl Lake Stage-Storage Curve and Pond Levels



Note:
1. High flow pond level is the maximum pond level during a 24-hour 1:25 yr storm;
2. Low flow pond level is the average pond level during the winters;
3. Assume mine water discharge to the LPTP at 30,000 m3/d during the first two years of operation and at 15,000 m3/d during the following years.

Figure 4 – Little Pearl Tailings Pond Flood Routing during 24-hour 1:25 year Storm



NOTES:

1. ALL ELEVATIONS, GRIDS AND DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
2. TOPOGRAPHIC SURVEY WAS PROVIDED BY TALBOT SURVEY LTD. ON DECEMBER 17, 2008.
3. THIS DRAWING IS A CONCEPTUAL LEVEL DESIGN. DETAILED DESIGN FOR THE LPTP OUTLET FACILITIES WOULD BE REQUIRED DURING THE NEXT STAGE OF STUDY.

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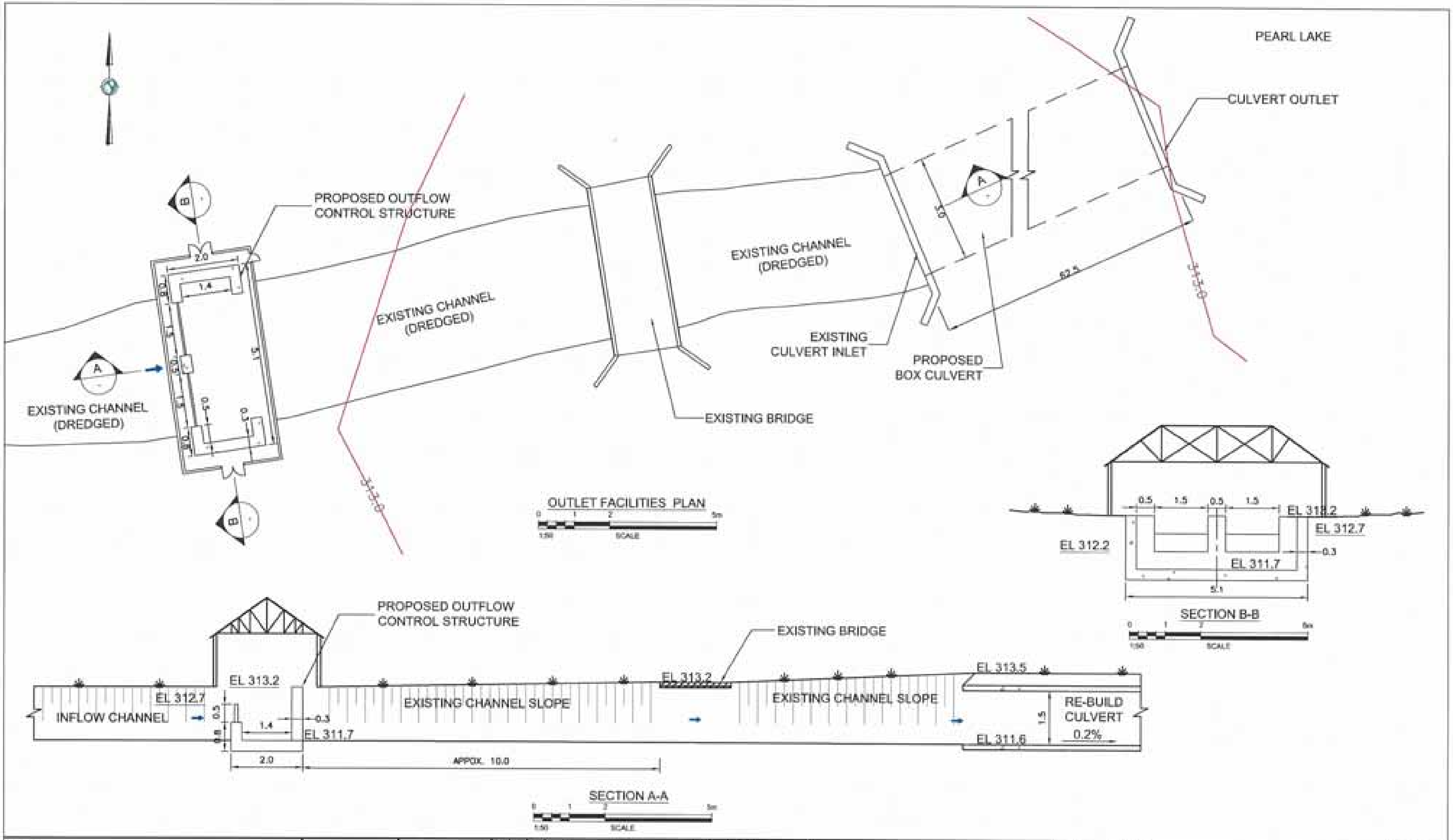
LITTLE PEARL TAILINGS POND
OUTLET FACILITIES CONCEPTUAL DESIGN
GENERAL LAYOUT

A

FIGURE 5



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GOLDCORP CANADA LTD.
PORCUPINE GOLD MINES

AMEC Earth & Environmental

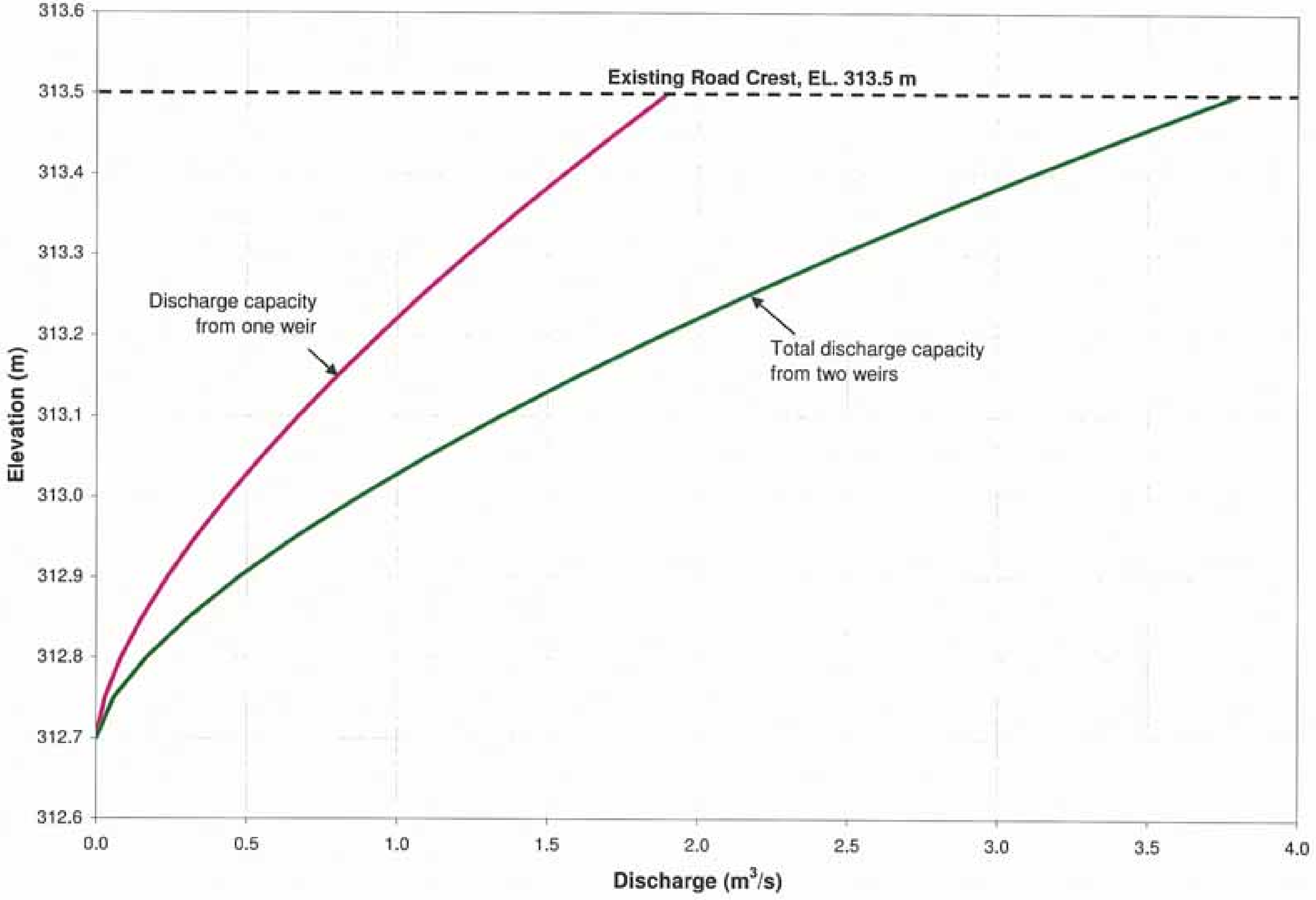
P.L.
J.T.
D.S.
D.S.
D.S.

HOLLINGER PERMITTING

LITTLE PEARL TAILINGS POND
OUTLET FACILITIES CONCEPTUAL DESIGN
PLAN AND SECTIONS

A
JANUARY 2009
AS SHOWN
FIGURE 6

Figure 7 - LPTP Weir Structure Head-Discharge Rating Curves



Memo

To	**Alisdair Brown – MOE**	File no	**TC81525**
From	**Jacob Zaidel**	cc	**Dave Simms, AMEC** **Peter Andrews, Goldcorp** **Dave Bucar, Goldcorp** **Carroll Leith, MOE** **Lianne Kentish, MOE**
Tel	**905-568-2929**		
Fax	**905-568-1686**		
E-mail	**jacob.zaidel@amec.com**		
Date	**April 8, 2009**		

Subject: Groundwater Modeling for Hollinger Open Pit

The modeling approach utilized by AMEC, in development of the groundwater flow model for existing conditions at the Hollinger Mine Site and the earlier open pit configuration (2007), is described below in Sections 1.1 and 1.2. Modifications to this model, based on the additional information obtained from the drilling underneath Pearl Lake (winter 2008) and recent updates in the Goldcorp mine plan, are described in Section 1.3.

1.1 Modeling Approach and Conceptual Model

A numerical three-dimensional steady-state groundwater flow model was developed and used to estimate the seepage rate into the proposed Hollinger pit and to assess the likely impact of its dewatering on the groundwater levels in the aquifer.

The Modular Finite-Difference Groundwater Flow Model (MODFLOW) originally developed by McDonald and Harbaugh for the United States Geological Survey (USGS) was used to simulate groundwater flow in the study area.

Prior to the model application as a predictive tool for the proposed pit, the model was calibrated to the currently observed water levels and to the reported historic pumping rate from the existing underground mine workings, corresponding to the mine operation period.

The developed model was used to simulate groundwater flow in both the overburden and bedrock aquifer zones. Although MODFLOW was primarily developed to simulate flow in porous media it is often used for groundwater flow modelling in fractured rocks if they behave as equivalent porous media at the scale of study. This assumption was utilized in the present study.

1.1.1 Geologic Setting

The Hollinger mine site is located within an area of variable terrain consisting of a mix of bedrock outcrop and glaciolacustrine sand and clay plain deposits. Field studies conducted by

AMEC in 2007 show that the overburden encountered on site consists primarily of silty sand, till, silty clay, organics and tailings. Along the boundary of the proposed open pit overburden thickness varies from 0 to about 20 m. Thick overburden sediments (up to 70 m) were encountered between Little Pearl Tailings Pond and Pearl Lake. These waterbodies are located within a sand channel possibly extending further northeast, towards Clearwater Lake. Silty clay/clayey silt deposits are known to be present underneath Gillies Lake and Gillies Pond. Thin overburden or bedrock dominated terrain (outcrops) is located to the southeast of the mine site. Thick esker/outwash deposits (10 m to 30 m) exist to the north and southwest from the Hollinger mine site. Coarse sand and gravel material appears to be replaced by the finer sand and till deposits further away from the esker/outwash area. The thickness of the silty clay unit varies from a few meters to 20 m or more between the esker and the Mattagami River. The average clay thickness in the area outside of the esker is about 10 m. In the areas covered by surficial clay, a basal sand unit occurs at the overburden-rock interface.

The overburden material at the site is underlain by Precambrian rock. The shallow rock is known to be weathered and relatively pervious.

1.1.2 Recharge and Discharge Zones

Groundwater recharge in the study area is assumed to be primarily from precipitation. Most significant recharge is expected to occur in the esker/outwash areas. Relatively small recharge is expected to occur through the surficial silty clay unit and in the bedrock dominated terrain. Little Pearl Tailings Pond and Pearl Lake most likely acted as recharge zones during the historic mine operation period since water pumped out of the mine workings was discharged into these waterbodies.

Under the non-pumping condition, groundwater in the vicinity of the mine site is expected to discharge mainly into Little Pearl Tailings Pond, and to Pearl and Gillies Lakes. West of the Hollinger Mine site groundwater is expected to discharge primarily into Mattagami River. South of the mine site groundwater is expected to discharge primarily into Mountjoy River. East of the Mine site groundwater is expected to discharge primarily into Porcupine River. Some groundwater in this area is also discharging into the Dome Mine represented by an open pit and underground mine workings.

During the historic mine operation period, a seepage rate of up to about 7,600 m^3/d was reported to occur into the existing dewatered mine workings. Currently some groundwater discharges into the existing flooded mine workings due to pumping from the McIntyre Mine. This pumping is required to control groundwater levels at the Timmins Gold Mine Tour and to maintain water levels below a number of openings to surface which would otherwise discharge to the environment if not controlled.

1.1.3 Mine Workings

Extensive mine workings, associated with the Hollinger and McIntyre Mines exist in the study area. Goldcorp provided AMEC with the digital information showing a 3D distribution of the existing mine workings down to the elevation of -246 masl. The total volume of voids, associated with these workings is about 41,500,000 m^3.

1.2 MODFLOW Numerical Model

To avoid potential interaction of the model boundaries with the estimated zone of impact of groundwater extraction from the proposed pit and the existing Hollinger and McIntyre mine workings, the model domain extends over a significant distance in all directions from the mine site.

The model domain extends approximately 9 km to the south (Mountjoy River), 9 km to the east (Porcupine River and Lake), about 3 km to the west (Mattagami River), and 20 km to the north, to the outflow of Bigwater Lake into North Porcupine River. In the vertical direction the model extends from the ground surface down to a depth of about 500 to 600 m. Groundwater flow below this depth and beyond the boundaries of the model domain is expected to provide negligible contribution to the simulated seepage into the proposed pit and existing underground mine workings.

1.2.1 Boundary Conditions

Constant head values of 270 to 273 masl, corresponding to the water levels of the Mattagami and Mountjoy Rivers, were specified along the western boundary of the model domain. Constant head values of 277 to 278 masl, corresponding to the water levels in Porcupine River and Lake were specified along the eastern boundary of the model domain. This boundary condition reflects shallow groundwater water discharge into the rivers and the potential for deep groundwater flow across these boundaries.

Streams (creeks), located within the model domain, were represented by the so-called drain nodes in the uppermost model layer 1. The drain nodes were also used to simulate the historical pumping from the existing mine workings. Their locations were imported into the MODFLOW model from the output generated by the Goldcorp VULCAN model.

A series of groundwater extraction wells located along the perimeter of the Dome Pit were used to simulate groundwater extraction from this mine, reported to be about 4,000 m^3/d.

1.2.2 Input Parameters

Due to the limited information available over a large model domain, a simplified approach was utilized in this study, as per the following:

- Overburden was simulated as a single model layer almost over the entire model domain with horizontal and vertical hydraulic conductivity values averaged over its thickness;
- Uniform horizontal hydraulic conductivity of the overburden was applied everywhere outside of the eskers/outwash sand, till and alluvial deposits area. This bulk hydraulic conductivity value, expected to be in the order of 10^{-4} cm/s, represents silty sand, tailings and an average horizontal hydraulic conductivity value of the overburden material comprised of surficial silty clays and basal sand unit;
- Vertical hydraulic conductivity of the overburden was assumed to be equal to the horizontal one (isotropic conditions) in the areas with no consistent clay/silt layer. Vertical hydraulic conductivity of the overburden was assumed to be significantly lower than the horizontal conductivity in the areas where a clay/silt layer was known to be present (e.g., glaciolacustrine plain with surficial clay/silts at surface);

- Under the simulated base case scenario, the hydraulic conductivity of the bedrock was assumed to vary only with respect to depth. Three bedrock aquifer zones were simulated: shallow, intermediate and deep, with progressively decreasing hydraulic conductivity with depth. An additional variant with high K-zone within the bedrock at a depth of about 140 to 180 m, consistent with the packer test results, was also simulated. Bedrock hydraulic conductivity was simulated to be isotropic; and,

- Recharge rates were assigned in accordance with the dominant surficial material zone, identified based on quaternary geology maps and site specific data.

Input parameters (hydraulic conductivities and recharge rates), initially assigned to the various overburden and bedrock aquifer zones, were modified through the process of model calibration.

1.2.3 Model Calibration

Simulating the non-pumping condition the developed groundwater flow model was calibrated to the following targets:

- Water levels in 18 monitoring wells, 13 local private wells and 1 municipal well (Winding Woods Subdivision) screened in the overburden and bedrock aquifer zones;

- Water level (elevation of 308 masl) in Gillies Lake;

- Water level (elevation of 313.5 masl) in Little Pearl Tailings Pond;

- Water level (elevation of 313 masl) in Pearl Lake;

- Water level (elevation of 312 masl) in Clearwater Lake; and,

- Water level (elevation of 306 masl) in Charlebois Lake.

To simulate the mine operational period (prior to 1988), the developed groundwater flow model was calibrated to the reported total pumping rate of about 7,600 m^3/d from the Hollinger and McIntyre mine workings.

The calibrated model was then used to estimate seepage rates into the proposed pit and the remaining mine workings as well as to assess the potential zone of influence likely to be caused by open pit dewatering.

1.2.4 Predictive Simulations – Earlier Open Pit Configuration

The groundwater flow model described above corresponds to current and historical mine operation conditions. After being calibrated, the model was modified in order to simulate groundwater flow associated with the proposed open pit excavation and its’ dewatering.

To simulate these conditions, the following modifications were introduced into the developed groundwater flow model with the existing mine workings:

- Inactive cells were specified within the entire proposed open pit excavation, with the exception of the relatively thin band of cells along the pit walls and above its bottom (elevation -90 masl);

- Additional drain nodes were specified along the face of the proposed pit and at the pit bottom. These drain nodes were used to simulate the potential seepage face along the proposed open pit walls and groundwater inflow through its bottom;

- A 3 m wide dam core with a hydraulic conductivity value of $1x10^{-5}$ cm/s located inside Little Pearl Tailings Pond, as well as a 10 m deep grout curtain (1 m thick) with the same hydraulic conductivity, were simulated by using the horizontal-flow-barrier package of MODFLOW; and,

- The water level in Little Pearl Tailings Pond was specified at the currently observed elevation of 313.5 masl in addition to the specified water level in Pearl Lake (elevation 313 masl).

Two predictive variants were simulated: first, the base case scenario, corresponding to the “best-fit” combination of the model input; and second, a more conservative variant providing for increased hydraulic conductivity of the bedrock at the depth range of 140 to 180 m. This variant is more consistent with the packer test results showing a noticeably more pervious rock zone at depth in boreholes BH 07-03, BH 07-05 and BH 07-09.

1.3 Expected Modifications to the Previously Developed Model

The following modifications are expected to me made to the previously developed model, described in Sections 1.1 and 1.2:

- In accordance with drilling program results, obtained by AMEC in the winter of 2008, a clay layer will be added beneath a 5 to 6 m layer of the fined grained organics at the bottom of Pearl Lake;

- The extent and the depth of the proposed open pit will be re-entered into the model, in accordance in the most recent changes in the Goldcorp mine plan. Three open pits (Central, Millerton and 92 Pit) will be simulated by the model;

- In addition to the existing mine workings and the proposed open pits, groundwater extraction from a possible 250 to 300 m deep, underground access ramp will be also incorporated into the model; and,

- Proposed pit development and dewatering will be modelled in a transient mode, assuming that the mining rate will be close to 48 vertical meters per year and that the life of the open pit mining will be between 5 to 7 years (Goldcorp, Personal Communication).

Jacob Zaidel, Ph.D.
Associate Numerical Modeller

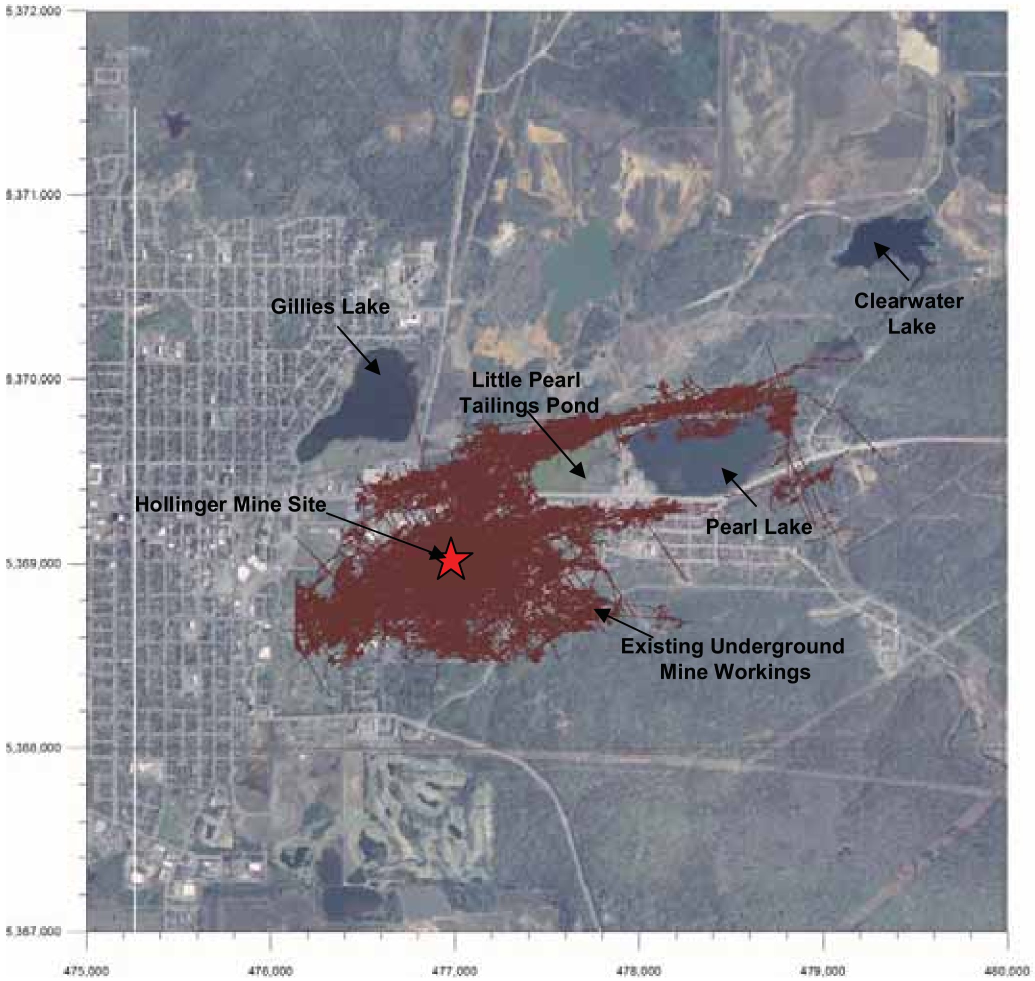


Figure 1: Hollinger Model Simulated Mine Workings

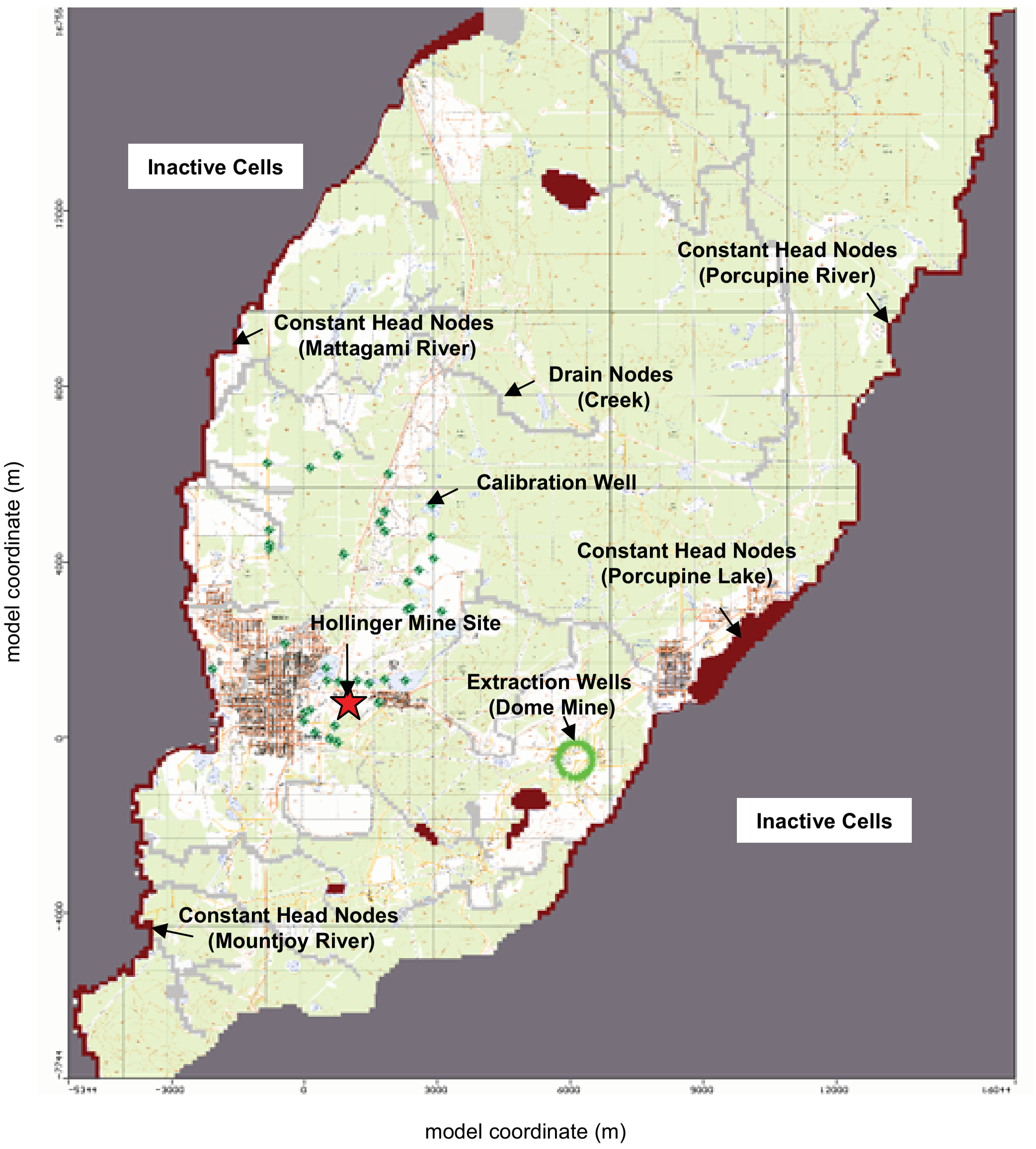


Figure 2: Hollinger Mine Model Domain and Boundary Conditions (Layer 1)

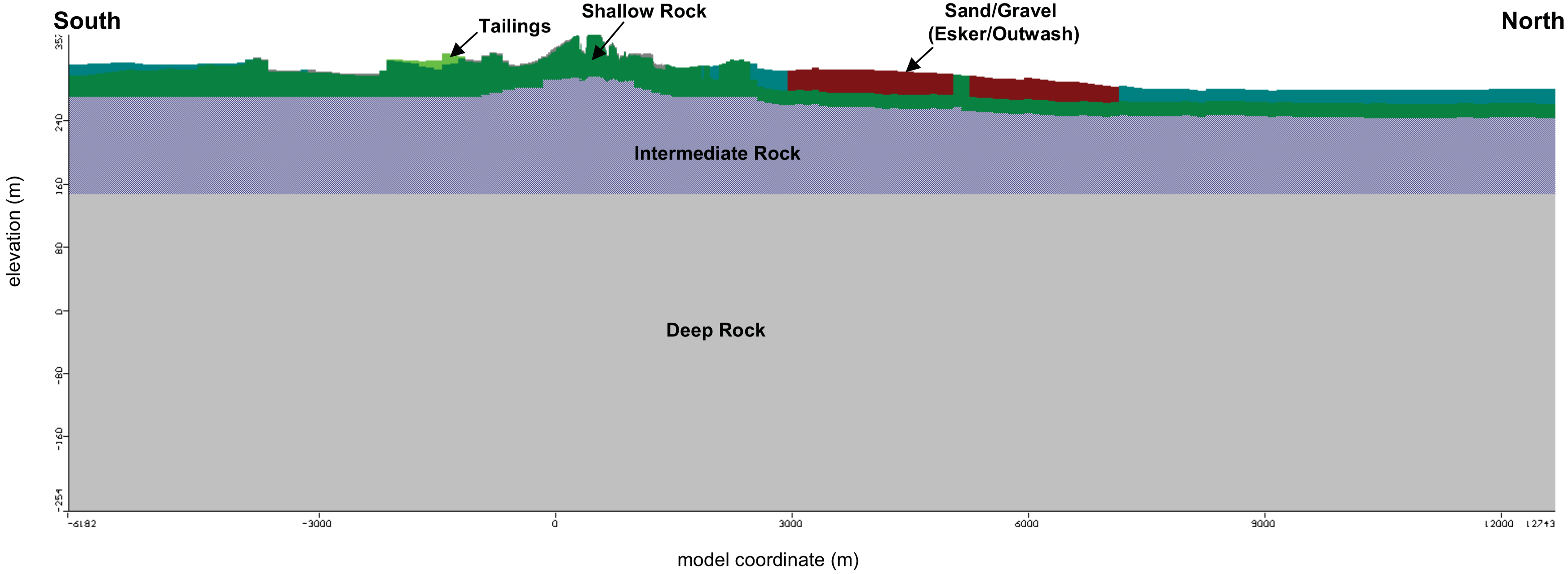


Figure 3: Hollinger Mine Model K-zones
(South-North Cross-Section)

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PORCUPINE GOLD MINES

HOLLINGER PROJECT

CONSULTATION PROGRAM

April 2009

INTRODUCTION

The Hollinger Project is one of the most significant projects that Porcupine Gold Mines is considering for future development as part of our Strategic Business Plan. Some key aspects of the project include the following:

- A major expansion of the historic underground Hollinger Mine into a single open pit operation
- Removal of mine hazards via open pit mining of all near surface mine workings, including crown pillars and existing micro pits, to extract remaining resources
- Transport of ore from the Hollinger Mine to the Dome Mill
- Ore processing at the Dome Mill
- Tailings storage at the Dome Mine site
- Rock storage near the Hollinger Mine site
- Exploration of Underground Mining opportunities at Hollinger and McIntyre Mine sites
- Advanced Exploration of these opportunities through underground development and drilling
- Establishment of all other required infrastructure to support the operation

CONSULTATION

Porcupine Gold Mines is looking to actively communicate our project to the community, listen to people's questions and concerns and integrate those concerns into our final planning stages for the Hollinger Mine project. The permitting process was initiated in February 2009 through initial consultations with the provincial and federal government agencies, and through this process will allow the public to view in more detail our plans and requirements. We will continue with our site monitoring programs to gather additional baseline environmental data, which will allow us to compare mine operating conditions to the current condition before mining commences. The newly renovated and updated **Hollinger Project Information Centre** will allow for people to talk with our company on a one-to-one basis and find out more details about the project and how it may affect them.

PGM has been active in engaging all relevant stakeholders to date. We will be proactive in the following areas in the upcoming months to clearly define our Project Goals and Message Track:

- Continue to provide updates of the Project to the **City of Timmins** to ensure alignment of both parties long-term objectives
- Work with the existing **Porcupine Watchful Eye** community liaison group as it takes a bigger role in reviewing the Project
- Continue to provide further, more detailed information to **government agencies** as we move into Feasibility and Construction. Permit requirements will be determined from this interaction.
- The **Hollinger Project Information Centre** will be a key focus point for providing information to the public about the Project.
- Continue to give updates to the **community** through Open House sessions, stakeholder group meetings and individual land owner meetings.

Key stakeholders in the vicinity of the project are detailed below.

Ontario provincial government ministries:

- Ministry of Environment (MOE)
- Ministry of Northern Development and Mines (MNDM)
- Ministry of Natural Resources (MNR)
- Ministry of Transportation (MTO)
- Ministry of Labour (MOL)
- Ministry of Culture (MCL)
- Ministry of Municipal Affairs and Housing (MMAH)

Canadian federal government ministries:

- Department of Fisheries and Oceans (DFO)
- Transport Canada (TC)
- Canadian Environmental Assessment Agency (CEAA)
- Environment Canada (EC)
- Natural Resources Canada (NRCAN)

Municipal governments and their citizens:

- City of Timmins and Council
- Timmins Economic Development Council
- Timmins Chamber of Commerce

CONTINUED Page 3

- Mattagami Region Conservation Authority

First Nations:

- Wabun Tribal Council and member First Nation communities
- Metis

Local business and residents:

- Numerous Commercial businesses
- Numerous Residents in Timmins and Schumacher
- Various stakeholder groups including Porcupine Watchful Eye, Porcupine Ski Runners, Timmins Snowmobile Club, etc.
- Union Gas, the natural gas utility
- Hydro One, the Ontario power utility

The upcoming 12 to 18 months will be critical in terms of interactions with all stakeholders to not only ease any concerns that the public might have regarding their input into the Project, but also to gain public support by demonstrating the benefits that a mining operation with today's safety and environmental standards can be a beneficial option for the remediation of historic mine hazards. PGM will be taking a very interactive role with various community liaison groups including the existing **Porcupine Watchful Eye** to ensure that the public has its opportunity to voice an opinion and work together with PGM to provide an opportunity for a sustainable future for all stakeholders.

Even though the mining industry is well known and supported in the community, there is a potential that the project will generate some concerns. For example, potential areas of concern could include the close proximity of the mine to the some neighbourhoods and businesses, impacts of the new ore transportation corridor between the Hollinger Mine open pit and the Dome Mill as well as the proposed rock pile locations. Public consultation on these and other areas of concern will be critical.

EXISTING PROGRAMS

Public consultation and regular reporting of our progress will be an integral component of our activity on the project. Initial open house sessions have already successfully attracted much community interest and curiosity. The **Hollinger Project Information Centre** has attracted upwards of 500 interested community members over the past 2 years to find out more about the project.

PGM has developed a **website** - www.porcupinegoldmines.ca - as an alternative method of providing information to the greater population.

As the project advances and grows, so must our **partnerships** with all stakeholders in the Community.

PERMITTING

With the permitting process underway as of February 2009, initiated through detailed discussions with both the provincial and federal government agencies, as well as with the City of Timmins, a more detailed process is required to ensure that the public has proper opportunity for consultation. The Hollinger Open Pit requires numerous 'permits' from a variety of municipal, provincial and federal government agencies (see attached list of permit requirements identified at the February 24, 2009 Inter-Agency meeting). Please see attached Permitting Schedule in **Appendix A**. The following are the expected public consultation requirements for the various permits and approvals

Pubic Consultation Requirements

Permit to Take Water – minimum 30 day EBR
Certificate of Approval – minimum 30 day EBR
Closure Plan – – 30 day EBR

Site Plan Control Agreement Consultation

Municipal EA – Haul Road Culvert Crossing of Vipond Road – Public Open Houses

First Nation Consultation Requirements

Permit to Take Water – minimum 2-3 Letters to communities
Certificate of Approval – minimum 30 day EBR
Closure Plan – Consultation

Class -EA Process – Crown Dispositions

CONSULTATION PROCESS

PGM will work with the various government agencies involved in the permitting process to determine a path forward for consultation with the local and Aboriginal communities. It is the goal of PGM to have a consistent, transparent process to allow all interested stakeholders the time and attention they deserve to review and understand the project. It will be in everyone's best interest to use a common approach for all permit requirements in terms of **notification of application**, public and government **available information and review period**, **comment opportunities**, **access to PGM and Government**, and **notification decisions**.

With this common approach PGM and government regulators can integrate the various regulatory requirements into the overall comprehensive consultation process.

Project Impact Study

PGM will develop a detailed Project Impact Study that will be made available for public comment. This Project Impact Study will consist of a detailed project description, baseline studies, and predicted environmental effects, such as noise, dust and other impacts. In addition the study will discuss alternative means of carrying out the project, proposed mitigation measures, monitoring programs and provide details of proposed mine site closure and remediation programs.

Using this study, PGM will carry-out a thorough consultation process with government, city residences and businesses, interested aboriginal communities and key stakeholders. Details of this process will be jointly developed by PGM, government representatives and key stakeholders.

It is expected that this **Consultation Program** will be a dynamic process that will be responsive to community needs and concerns.

CONTINUED Page 6

NEXT STEPS

Goldcorp will develop a proposed scope of study for the Project Impact Study as well as outline a proposed consultation schedule for review and comment by government and city officials.

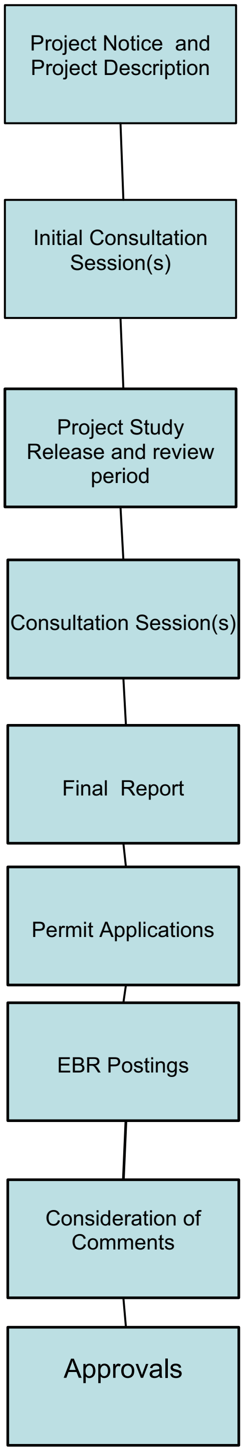
APPENDIX A

PERMIT SCHEDULE

CONTINUED Page 8

APPENDIX B

CONSULTATION PROCESS FLOW CHART



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APPENDIX C

REVIEW STAGES AND TIMELINES

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HOLLINGER PROJECT
ENVIRONMENTAL REVIEW STAGES AND TIMELINES

1 Day	Notice of Project (Optional)	Jun 1 – Jul 31	Publish notice in local newspaper(s) sometime between Jun 1 and Jul 31 and provide direct contact to identified stakeholders describing Project and Environmental Review and permitting processes, with contacts for further information (or could include as part of Sep 1 Public Notice and skip this step)
90 Days	Draft Environmental Study Report (ESR)	Jun 1 – Aug 31	Prepare draft ESR which would include: Introduction, Project Description, Review of Alternatives, Summary of Background Environmental Conditions, Summary of Consultation Programs, Predicted Environmental Effects and Mitigation Measures, and Monitoring Programs
35 Days	Public Notice & Open House	Sep 1 – Oct 5	Notify government agencies, general public and First Nations of availability of draft ESR through newspaper adds and direct contact to identified stakeholders, and allow 30 days for submission of comments. Hold public open house on or about Sep 15. Open house would also be used for consultation on the Closure Plan and MOE / MNR permits, and possibly Class EAs for bridges if required.
	Consider Public & Agency Input	Sep 1 – Nov 5	
30 Days	Final ESR	Oct 6 – Nov 5	Based on comments from government agencies, the general public and First Nations complete the final ESR, expanding upon the earlier draft ESR, including a full documentation of comments received and how these comments have been addressed in the final Project plan
35 Days	Notice of Completion	Nov 6 – Dec 15	Notify government agencies, general public and First Nations of availability of final ESR through newspaper adds and direct contact to identified stakeholders, and allow 30 days for submission of comments. Hold public open house on or about Nov 25. Provide government agencies with a summary of final comments.