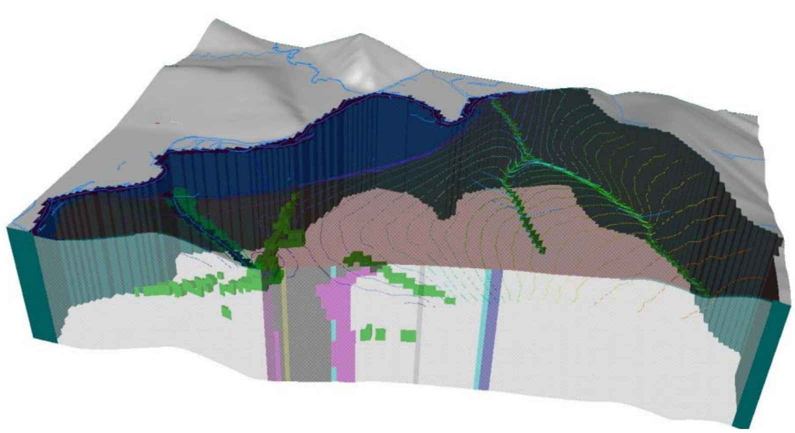
2014 Groundwater Model for Pogo Mine in Alaska

Report Prepared for

Sumitomo Metal Mining Pogo LLC



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SRK Consulting (U.S.), Inc.
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1 Introduction

SRK constructed a numerical groundwater flow model for Sumitomo Metal Mining Pogo LLC (Pogo) for the purpose of predicting inflow to, and support the permitting of, the East Deep expansion. The predictions will be used to inform future decisions about upgrades to the underground water management system and to plan for potential water treatment and discharge. The model encompasses an area that includes the entirety of the local drainages, and a reach of the Goodpaster River above and below Pogo operations. The base map of Hydrogeological Study Area and lateral extent of numerical groundwater model is shown on **Figure 1**.

This model simulates water levels, direction of groundwater flow, and components of the hydrogeologic budget for pre-mining and existing mining conditions, and is reasonably calibrated to groundwater levels, mine water discharge, surface-water flows, and hydraulic test results.

Groundwater modeling was completed using the 3-D finite-difference flow code MODFLOW-SURFACT version 3.0 (SWS 2011 and HGL 2006), a commercially available package that is an industry standard and fully accepted by regulators and environmental agencies.

Sources of data and information used in the model included:

- Previous hydrogeological studies completed by Golder (1998, 2000, 2012), AGRA(2000), ABC (2001,2009);
- 2012 - 2013 field hydrogeological studies completed by SRK (2013b, 2014);
- Available geological and structural models developed by the Pogo Geology Department; and
- Proposed mining plans for East Deep, North Zone and Liese Mine expansion provided by the Pogo Engineering Department.

2 Conceptual Hydrogeological Model

2.1 Geology and Structures

The current geologic block model developed and used by the Pogo Geology Department represents the most advanced knowledge of subsurface conditions in and immediately surrounding the mine. The Vulcan-based geologic model is continuously refined by Pogo as new information is compiled through ongoing exploration drilling and mining operations. The identity and location of faults and other geological units presented in this report, and simulated by the numerical flow model, come directly from the Vulcan model. The inflow behavior of the faults and veins are simulated according to conditions observed underground and to mapped seeps and larger inflows. The majority of the faults that have been mapped by Pogo do not produce water. Those that have, or are considered most likely to as the mine expands into East Deep, are included in the numerical flow model.

The margin of the diorite intrusive has produced the largest inflows to the mine to date. The geometry of the diorite has been incorporated into the flow model as provided by Pogo. Hydraulic conductivity data compiled from past investigations by others as well as by SRK during 2012 and 2013 are described in Sections 2.6 and 3.2.1. Geology and structures incorporated in the flow model are as follows:

- Diorite intrusive;

- Faults: D3_3 (fault package that includes the Liese and Graphite, N1, N2, W, NE2, D3_4, D3_5a/5b, D3_7a/7b, Z and Ray);
- Bedrock (all lithologies including granite/granodiorite and gneissic metamorphics);
- Goodpaster River Alluvium;
- Liese Creek Alluvium;
- Colluvium; and
- Permafrost.

2.2 Climatic Data

The sub-arctic climate in east-central Alaska is characterized by cold winters and short warm summers. Annual precipitation is rather light with regional data suggesting a range between 10 to 16 inches. Approximately one-third of the precipitation falls as snow (Adrian Brown Consultants, 2009). The average precipitation for the Pogo Mine site, based on various site meteorological stations in operation between 2000 and 2012, is taken as 13.7 inches including snowfall (**Table 1**). Precipitation exceeds evaporation on an annual basis, which creates the generally moist environment, despite the relatively low precipitation (Adrian Brown Consultants, 2009). The average annual temperature from the long-term record at Big Delta is approximately 28 degrees Fahrenheit (Adrain Brown Consultants, 2009).

2.3 Rivers and Creeks

Goodpaster River, Liese Creek, Pogo Creek, and Ringer/North Creek are located in the vicinity of Pogo Mine. The Goodpaster River is the major drainage through the region. The creeks are considered perennial, although surface flow may at times infiltrates into the permeable alluvial sediments.

Flows in the Goodpaster River are sufficiently large (on the order of hundreds to thousands of cubic feet per second) that any changes in the exchange between the river and the groundwater system induced by mining will not measurably affect river flows or stage. The creeks flow at tens to hundreds of gallons per minute. Liese and Pogo creeks are within the cone of drawdown induced by mine dewatering; North and Ringer creeks are not.

2.4 Permafrost

Pogo mine is located in an area of discontinuous “warm” permafrost. The areal distribution of permafrost zones for the purpose of numerical groundwater flow model is based on:

- SRK analysis of ground temperature profiles from the 14 instrumented sites in the vicinity of Pogo Mine; and
- An estimation of annual incoming solar radiation for the Pogo Mine site completed by SRK.

2.5 Major Hydrogeological Units

The site hydrogeology consists of bedrock and surficial alluvial deposits in the drainage bottoms. Bedrock includes three rock types – granite/granodiorite, diorite intrusive, and gneissic metamorphic. Colluvium covers all but the drainage bottoms, but contains only perched and discontinuous zones of saturation. Based on test data, bedrock across the site exhibits a relatively uniform hydraulic conductivity. For the purposes of the model, most of the bedrock is simulated as a single unit of low hydraulic conductivity (this unit includes granite/granodiorite and gneissic metamorphic); the exception to this is diorite bedrock and bedrock within fault structures. Based on hydraulic test data and observations underground, the diorite intrusive is conceptualized as a low permeability core with a slightly higher-permeability fractured zone around the diorite core. Faults are observed underground and have proven, based on hydraulic test data, to exhibit a similar average hydraulic conductivity as the surrounding country rock. Although the average value is relatively low, the largest inflows observed underground have been in two locations where the Graphite and Liese faults cut the margin of the diorite. **Table 2** provides a compilation of all hydraulic conductivity data available from testing of bedrock. Alluvium is the unit with the highest hydraulic conductivity at the site, with values several orders of magnitude above those of the bedrock. Field-derived data for the alluvium are presented in **Table 3**. Both alluvial and bedrock data are summarized in **Table 4**.

2.6 Measured Hydraulic Conductivity Values

SRK completed analysis of all available data related to the hydraulic conductivity of alluvium, bedrock, diorite, and faults. They are presented in **Tables 2 through 4** and **Figure 2** as follows:

- **Table 2** presents 125 values of bedrock hydraulic conductivity;
- **Table 3** presents 19 values of alluvium hydraulic conductivity (15 for Goodpaster River and 4 for Liese Creek);
- **Table 4** presents a summary of the measured hydraulic conductivity values (number of tests, minimum, maximum, averaged and geomean values); and
- **Figure 2** presents the hydraulic conductivity data for the bedrock and faults plotted against test midpoint elevation (**Figures 2a through 2d**); also shown on **Figure 2** is a histogram of logarithmically-distributed hydraulic conductivity (**Figure 2e**).

Sources of data are shown in **Tables 2 and 3** for bedrock and alluvium, respectively.

Results of conducted analysis of hydraulic conductivity data indicate that:

- Goodpaster River alluvium is very permeable with average hydraulic conductivity of 56 ft/d;
- Liese Creek alluvium is less permeable with average hydraulic conductivity of 0.14 ft/d;
- Hydraulic conductivity values of bedrock vary within 4 orders of magnitude (from 0.0002ft/d to 0.9 ft/d) with a geometric mean value of about 0.009 ft/d;
- There is no significant difference in hydraulic conductivity of bedrock compared to veins (based on completed 41 and 58 hydrogeological tests, respectively and shown in **Table 4**; and
- An average hydraulic conductivity of bedrock estimated from hydrogeological testing in surface and underground core holes is about one order magnitude less than estimated from the underground water-producing holes. The estimates from water-producing holes are considered to be overestimates from analysis by the Thiem steady state equation for flow (transmissivity was estimated as flow divided by shut-in pressure (Golder, 2012)).

2.7 Measured Water Levels

Water levels were measured in 84 monitoring wells during pre-mining conditions (37 within bedrock, 36 within Goodpaster River alluvium, and 11 within Liese Creek Alluvium). Additionally, 9 monitoring wells were installed during mining operations, and SRK conducted water level measurements in 11 locations during fall 2012. SRK installed 4 monitoring wells and 8 underground piezometers in 2013.

Measured water levels in a total of 116 locations are shown in **Table 5** and were used in the steady state calibration (described in Section 3.3).

Water levels were measured in 17 monitoring wells during mine operations (shown in **Table 5**) and used for transient calibration of the groundwater model (described in Section 3.5). Only one complete set of measured water levels during mining from 1999 through 2013 is available in bedrock monitoring well MW99-216, located on Pogo ridge near its terminus at the Goodpaster valley. Data from that well indicates no significant change in water level since the mine began operations. However the well is located away from the mine workings and is probably outside the cone of depression induced by the mine.

Measured water levels vary from 1,318 ft amsl to 2,763 ft amsl and generally mimic ground surface elevation.

2.8 Measured Mine Inflow

Mine inflow has been measured indirectly as the result of differences between total mine discharge minus temporary transfers into the mine and changes in sump storage. As a result, actual inflow to the workings cannot be precisely calculated. Two records of mine inflow are available:

- Inflow to the initial exploration drift (mid 1999 through end of 2001), and
- Total mine water discharge (mid 2006 through October 2013).

Pogo has successfully implemented a comprehensive grouting program to reduce mine inflow, which reduces active dewatering of the rock and, in effect, decreases values for transmissivity. SRK used the mine-water discharge graph (shown on **Figure 3**) as the preliminary target for transient calibration of the model. This graph indicates that mine-water discharge:

- Gradually increased from about 60 gpm in mid-2006 to about 150 gpm in mid-2011;
- Significantly increased from 150 gpm to 275 gpm in July to August 2011; and
- Stayed relatively constant in the trend in September 2011 to March 2012 with an average flow rate of about 290 gpm (varied from 209 gpm to 343 gpm).

The dramatic increase in discharge in mid-2011 was interpreted as an intersection of highly transmissive water bearing portions of the D3_3 fault zone (includes Liese Creek and Graphite Faults) and contact with the southern margin of the diorite intrusive. Additional increases in mine-water discharge observed in September 2013 correspond to the groundwater flow hits in Z and Ray faults.

2.9 Description of Preliminary Conceptual Hydrogeological Model

Groundwater originates as recharge from precipitation at higher elevations and flows to lower topographic areas where it discharges to surface-water bodies. During mining, a portion of this flow is captured as mine inflow and is discharged to the water treatment plan. Surface water bodies can start to recharge the groundwater system, if vertical or lateral gradients become reversed. The rate of inflow to current and future underground workings depends on the permeability of surrounding bedrock and faults. Water levels above mine workings will be lowered in time due to mine dewatering as the induced cone of depression propagates laterally from the mine.

3 Description of Numerical Groundwater Flow Model

SRK's preliminary groundwater-flow model is based on:

- The results of the 2012 and 2013 Hydrogeological Field Programs (SRK 2013b and SRK 2014);
- 3D geological/structural model developed by Pogo; and
- Mine plans provided by Pogo.

SRK used the finite-difference code Visual MODFLOW-SURFACT version 3.0 (SWS 2011 and HGL 2006) to develop the groundwater-flow model to simulate inflow to the existing Pogo underground mine and proposed developments (East Deep, Liese expansion, and North zone), and associated effects on the groundwater system.

3.1 Grid Discretization and Model Boundaries

The groundwater model domain encompasses about 9 square miles in the vicinity of the existing Pogo underground operation. The finite-difference grid contains 151,086 cells (169 rows by 149 columns) within 16 layers (**Figures 4 through 7**). The horizontal dimension of cells is 100 ft, and the vertical thickness of the cells varies from 35 to 400 ft. The total thickness of the model is 3,000 ft (1,380 ft below the planned deepest part of the mine).

All outer model boundaries were chosen as no-flow along topographical divides assuming that they represent groundwater divides. The western model boundary was chosen along the Goodpaster River assuming that all groundwater from both sides of the valley discharges into the river. Constant heads (CHEAD) within the first layer of the model were assigned along the western model boundary to represent the Goodpaster River and will be discussed in Section 3.2.5.

It should be noted that model domain was chosen to be sufficiently large to eliminate the potential for drawdown to intersect the boundaries of the model.

The bottom of the model was assigned as a no-flow boundary. The upper boundary of the model follows the ground surface elevation, which was incorporated into the model using a detailed topographic map.

3.2 Simulation of Hydrogeological Features

3.2.1 Simulation of Hydrogeology

In the finite-difference block-centered method, hydraulic properties are assigned to cells, and hydraulic heads and fluxes are associated with the center of each cell. Every cell in the model is assigned to a model "zone", as depicted in the plan-view on **Figures 5 and 6** and in the cross section on **Figure 7**. Each model zone has values for horizontal and vertical hydraulic conductivity (K_h and K_v, respectively), specific storage (S_s), and specific yield (S_y) based on historic aquifer testing data. Specific yield is only used if the water table occurs within the model cell.

Hydraulic properties were assigned in the model for the 17 hydrogeological units as follows:

- Alluvium (Goodpaster River) in Layers 1-2;
- Alluvium (Liese Creek) in Layers 1-2;
- Colluvium in Layer 1;
- Discontinuous Permafrost in Layer 2;
- Bedrock in Layers 2-3 through 16;
- Diorite in Layers 2-3 through 16;
- Diorite Contact in Layers 2-3 through 16; and
- Ten faults in Layers 2-3 through 16, including:
  - D3_3 Fault (includes Liese Creek and Graphite faults);
  - N1 Fault;
  - N2 Fault;
  - W Fault;
  - NE2 Fault;
  - D3_4 Fault;
  - D3_5a/5b Fault;
  - D3_7a/b Fault;
  - Ray Fault; and
  - Z fault.

The values of hydraulic parameters used in the model are provided in **Table 6**. Initial hydraulic conductivity values, prior to model calibration, were assigned geometric mean values from the field test results (shown in **Table 4**). Storage parameters (shown in **Table 6**) were assigned according to common values published in research literature and SRK's experience in groundwater modeling of similar projects.

3.2.2 Simulation of Permafrost

The Pogo mine is located in a zone of "discontinuous warm permafrost". Based on ground temperature and annual incoming solar radiation analyses, it was assumed that permafrost exists only on north-facing slopes.

It was assumed that existing relative "warm" permafrost is leaky and does not fully eliminate the infiltration of precipitation that falls at the ground surface. Permafrost was simulated as separate hydrogeological unit within model layer 2 (shown in **Table 6** and **Figures 5 and 7**) as a low permeable unit with a K of 1×10^{-3} ft/d (the same hydraulic conductivity as used in the ABC 2009 model) and low storage parameters $S_y=10^{-4}$ and $S_s= 3 \times 10^{-8}$ ft^{-1}. An average thickness of permafrost was assumed to be 35 ft. The permafrost layer is located below the 35-foot thick first layer of the model. That first layer is modeled as alluvium and colluvium.

3.2.3 Simulation of Recharge from Precipitation

According to the climate records from rainfall stations at various elevations, it is estimated that the average annual precipitation at the Pogo mine area is about 13.7 inches/yr (averaged for period of 2000-2007).

Recharge from precipitation was applied to the first model layer within 5 zones as follows:

- 4 in/yr (or about 29.2% of precipitation) within the Goodpaster River valley where permafrost does not exist;

- 2 in/yr (or about 14.6% of precipitation) within the Goodpaster River valley where permafrost exists;
- 4 in/yr (or about 29.2% of precipitation) within the Liese Creek alluvium;
- 2 in/yr (or about 14.6% of precipitation) within the valley slopes where permafrost may exist; and
- 4.5 in/yr (or about 32.8% of precipitation) within the slopes without permafrost.

An exception (zero recharge zone) was the area of the Goodpaster River along the western model boundary where recharge was not applied due to use of constant head cells to simulate the river (described below).

The distribution of recharge applied in the model is depicted on **Figure 8**. The seasonal variations of recharge from precipitation were not considered in the preliminary model and averaged recharge rates were applied uniformly as annual values.

It should also be noted that all cells within the first layer of the model were specified as seepage face cells to simulate groundwater discharge into small tributaries and springs within creek valleys where surface topography slopes. These seepage face cells are features of the MODFLOW-SURFACT code (HGL, 2006) allowing rejection of recharge to the groundwater system when simulated heads exceed the ground surface elevation. In the latter case, instead of "recharge-in", "recharge-out" is simulated as runoff. In other words:

- The specified discharge rates were applied in the areas where the simulated water table is below ground surface; and
- These areas' total recharge values can vary in time during transient simulations depending on hydraulic stress applied to the groundwater system.

In SRK's opinion, the applied recharge represents a conservative scenario that simulates a maximum inflow to the proposed East Deep expansion of the Pogo mine.

3.2.4 Simulation of Goodpaster River and Creeks

Surface water bodies (Goodpaster River, Liese, Pogo, Ringer, and North Creeks) within the model domain were modeled in the first layer of the model as shown on **Figure 4**.

The Goodpaster River as a large surface-water body was modeled by CHEAD boundary conditions allowing simulation of groundwater/river interaction in both directions. Four hundred CHEAD cells were used to model the Goodpaster River with river stage varying from 1,397 ft amsl to 1,317 ft amsl.

Liese Creek, located adjacent to and above the Pogo underground mine was simulated by RIVER cells (**Figure 4**), where the groundwater/river interactions were simulated according to the following equations:

$$Q_R = \begin{cases} C_L \ x \ (H_R - H), & \text{if } H > Z_{bot} \\ C_L \ x \ (H_R - Z_{bot}), & \text{if } H < Z_{bot} \end{cases} \qquad (1)$$

Where:

Q_R = groundwater discharge to river (if negative) or river recharge to groundwater (if positive) in ft^3/d
H_R = river stage (ft)
H = hydraulic head (ft)
Z_{bot} = river bottom elevation (ft)

$C_L = L\ x\ W\ x\ L_k$ – river cell conductance (ft^2/d) (2)

Where:

W = width of river (ft)
L = length of river within model cell (ft)
L_k = leakance factor of river bed sediments (d^{-1})

Liese Creek was modeled with 154 RIVER cells using a creek stage varying from 2,980 ft amsl to 1,374 ft amsl.

Groundwater discharge into Pogo, Ringer and North Creeks, which are located relatively far from the mine, was simulated by DRAIN cells (assuming hydraulic connection in one direction toward to creek) according to the following equation:

$$Q_{cr} = \begin{cases} C_L \times (H - Z), & \text{if } H>Z \\ 0, & \text{if } H<Z \end{cases} \quad (3)$$

Where:

Q_{cr} = groundwater discharge to creek (ft^3/d)
H = hydraulic head (ft)
Z = surface elevation (ft)
C_L= conductance (ft^2/d) depending on actual size of cell and its hydraulic conductivity

Pogo Creek was simulated wiht 74 DRAIN cells with a surface elevation (creek stage) varying from 2,692 ft amsl to 1,331 ft amsl; the Ringer/North Creek was simulate with 175 DRAIN cells with a creek stage varying from 3,187 ft amsl to 1,400 ft amsl.

The groundwater model assumes that:

- The width of the creeks is about 10 ft; and
- The leakance factor of the creek beds is L_k=0.15 d^{-1} (see footnote).[1]

Drain cells were used to simulate the courses of principal drainages (Liese, Pogo, North, Ringer). Seepage face cells were used to simulate their valleys with smaller tributaries and springs (as discussed in Section 3.2.3).

[1] Corresponds to a hydraulic conductivity of creek bed sediments K=0.14 ft/d divided by a thickness of about 1.07 ft.

3.3 Steady State Calibration to Pre-Mining Conditions

A steady state calibration was completed to reproduce the measured water levels in 84 monitoring wells (**Table 5**) and the direction of groundwater flow. The calibration was achieved by adjusting:

- The amount of recharge from precipitation;
- The hydraulic conductivity of seven faults;
- The hydraulic conductivity values for key hydrogeological units (with the intent to keep them as a geometric mean of field values as shown in **Table 4**, if possible); and
- The leakance factors of river and drain cells used to simulate groundwater discharges into surface water bodies.

The results of the steady-state model calibrations are presented on **Figures 9 through 11**. **Figure 9** depicts the simulated water table in plan-view, the direction of groundwater flow under pre-mining steady-state conditions, and the locations of the monitoring wells with measured water levels used for model calibration. **Figure 10** shows the simulated water table on cross-sections. **Figure 11** shows the distribution of measured versus simulated water levels under steady state conditions. This figure also includes quantitative calibration results (model statistics).

Modeled components of the groundwater balance for pre-mining conditions are shown in **Table 7** and include:

- Recharge from precipitation into the groundwater system of 665 gpm;
- Recharge from the Liese Creek (upper part only) of 13 gpm; and
- Groundwater discharge into surface-water bodies (rivers and creeks) of 678 gpm, distributed as follows:
    - Liese Creek: 167 gpm;
    - Ringer/North Creek: 93 gpm; and
    - Pogo Creek: 46 gpm.

The model incorporates both the shallow (colluvium/alluvium) and deep (bedrock) groundwater systems. As an example, the model simulates that only about 56% (or about 370 gpm) of recharge from precipitation reaches the bedrock groundwater system. The remaining 44% enters shallow colluvium and alluvium and discharges back into the small creeks. This amount of “rejected” recharge was simulated by using seepage (“recharge out”) cells, described in Section 3.2.3.

3.4 Simulation of Underground Developments

Underground excavations were simulated using DRAIN cells, which extract groundwater from the model depending on the water level elevation and drain cell conductance. Flow to the drain cells was calculated according to the following equation:

$$Q_d = \begin{cases} C_L \times (H - Z_d), \text{ if } H > Z_d \\ 0, \text{ if } H < Z_d \end{cases} \qquad (4)$$

Where:

Q_d = inflow to drain cell (ft^3/d)
H = hydraulic head (ft)
Z_d= elevation of bottom of development (ft)
C_L= drain cell conductance (ft^2/d)

SRK incorporated monthly as-built mine workings over the period August 1999 through October 2013. The workings include the waste management tunnels (raises, exploration openings, ramps, and other excavations). Stopes were excluded from the model as they occur as open features on a temporary short-term basis owing to paste backfill operations as ore is extracted. Future waste management tunnels were simulated during 2013 on monthly basis and on an annual basis in years 2014-2017. All existing and planned workings simulated by the groundwater model are shown on **Figure 12**.

Pogo has a grouting program for controlling mine inflow. This program partially reduces transmissivity of some portion of the fractures (especially highly conductive ones). The effect of historic grouting is taken into account in the model by decreasing the conductance of drain cells used to simulate the waste management tunnels. Conductance is a calibration parameter to match measured groundwater inflow to the underground mine. The effect of future grouting is taken into account by assuming that future grouting will be consistent with and have comparable results with existing procedures.

The total number of simulated drain cells used to simulate excavation of underground development includes:

- Historical – 985 cells; and
- Future– 463 cells.

The applied conductance values of drain cells vary from 0.1 to 100 ft^2/d and were obtained by calibration to the measured mine water discharge. Their distribution along different developments is shown on **Figure 13**.

Hydrogeological studies completed in 2013 from underground did not confirm that the faults in the Deep East area are permeable. Based on these field data, drain cell conductance for the future underground workings was set to 0.1 ft^2/d (for the both faults and bedrock units).

For the conservative Sensitivity scenario, SRK used a Base Case prediction from preliminary groundwater modeling (SRK, 2013a). This scenario assumed that future developments intersecting faults would be permeable and groundwater discharge would be similar to that observed during 2011 when the discharge rate doubled. Conductance values for the drain cells used for this scenario were assumed to be 100 ft^2/d (SRK, 2013a). In SRK's opinion, this scenario describes the most conservative prediction of groundwater inflow to the Pogo underground mine in the future.

3.5 Transient Calibration to Mining Conditions

Transient calibration of the groundwater model was done by varying conductance of drain cells representing the waste management tunnels to:

- Measured mine flow; and
- Changes in groundwater levels during mining conditions.

Results of the transient calibration to an estimated mine inflow are shown on **Figure 14**. The simulated water levels at the current mining conditions in plan-view and cross-sections are shown on **Figures 15 and 16**, respectively. Results of the transient calibration of the model in the form of comparing simulated to measured water levels during mining are shown on **Figures 17 and 18**. The simulated changes in water levels at the current mining conditions compared to pre-mining are shown on **Figure 19**. The simulated groundwater budget under current mining conditions is presented in **Table 8**.

Based on results of the transient calibration, SRK concludes that:

- The groundwater model reasonably reproduces total mine water discharge rates during mining conditions. The significant increase of mine inflow in 2011 was simulated by assigning larger conductance (100 ft^2/d) for the waste management tunnel drain cells in two areas (**Figure 13**);
- The majority of mine inflow is coming from depletion of groundwater storage (50%) and intersecting of groundwater flow that originally discharged to surface water bodies (36%). The other sources of inflow are additional recharge from Liese Creek and precipitation (about 14%);
- The groundwater model reasonably reproduces a trend of changes in groundwater levels in the vicinity of the mine and simulates the lowest water table elevation at 1,350 ft amsl at the current mining area; and
- The groundwater model simulates a maximum drawdown up to 400 ft in the central part of the current underground mine and lateral propagation of 50 ft cone of drawdown to the distance of 0.4 miles up to 0.7 miles (shown on **Figure 18**).

4 Predictive Underground Mine Inflow Simulations

The 3D groundwater-flow model, developed and calibrated by SRK, was used to make predictive simulations of:

- Passive inflow to the proposed underground mine and mine discharge requirements;
- Changes in water levels and propagation of drawdown during future dewatering; and
- Changes in groundwater discharge to rivers and creeks.

4.1 Predicted Passive Inflow

Predicted total inflow to the underground mine through the end of 2017 (end of excavation of waste management tunnels) is shown on **Figure 20**. The model predicts a maximum inflow rate of 440 gpm at the beginning of year 2016.

The predicted groundwater budget at the end of mining is shown in **Table 9**. The model predicts an inflow rate of 419 gpm coming from:

- Depletion of groundwater storage – 32%;
- Intersection of groundwater flow originally discharged into Liese Creek and creek inflow – 34%;
- Reduction of groundwater inflow into Goodpaster River – 17%;
- Increase of recharge from precipitation – 5%; and

- Increase of recharge from Liese Creek – 12%.

The model predicts the distribution of inflow between different parts of the mine at the end of mining as follows:

- 94 gpm (or 22%) from East Deep;
- 14 gpm (or 3%) from the North Zone expansion; and
- 311 gpm (75%) from expansion of the Liese mine area.

It should be noted that predicted inflows listed above are averaged and assuming implementation of comprehensive grouting practice which was successfully used by the Pogo mine in the past.

4.2 Predicted Changes in Water Levels

The predicted water table at the end of mining (end of 2017) is shown on **Figure 21** (plan-view) and **Figure 22** (cross sections), indicating that the predicted lowest water table elevation would be about 1,300 ft amsl at the North Zone Expansion. The cone of drawdown (50 foot contour) will propagate to a distance from 0.5 miles to 1.2 miles from the center of the underground workings (shown on **Figure 23**).

4.3 Predicted Changes in Groundwater Discharge to Rivers and Creeks

Predicted changes in groundwater discharge to the Goodpaster River, Liese Creek, Ringer/North Creek, and Pogo Creek at the end of the mining are shown in **Table 9**.

The model predicts a:

- Reduction of groundwater discharge to the Goodpaster River of up to 71 gpm with no reversal gradient from the river (no inflow to the mine workings from the river);
- Reduction of groundwater inflow to Ringer/North and Pogo Creeks up to 6 gpm and 22 gpm, respectively; and
- Significant reduction of groundwater discharge to Liese Creek (up to 113 gpm) in its lower reaches and an increased recharge to the groundwater system in its upper reaches of up to 51 gpm, resulting in a total impact to the creek of up to 164 gpm.

4.4 Results of Sensitivity Analysis

The Base Case scenario and the results of the predictions assume that the waste management tunnels would have the same inflow conditions as those during the middle of 2011 when the D3 faults were intersected in the Liese mine area.

To evaluate a more conservative scenario of predicted mine inflow, an additional Sensitivity Scenario was considered assuming that the waste management tunnels would have the same inflow conditions as those during the middle of 2011 when the N2, NE2, and D3_7a/7b faults would be intersected in the East Deep area. This scenario was evaluated as Base Case Scenario during previous preliminary groundwater modeling work (SRK, 2013a) and simulated by increasing of conductance of the drain cell intersecting the faults in East Deep area from 0.1 ft^2/d to 100 ft^2/d (shown on **Figure 13** of SRK, 2013a).

The results of the completed sensitivity analysis are shown on **Figure 24**. This figure shows comparison of the Base Case mine inflow prediction for this study (green line) with range of predicted inflows in SRK (2013a) – maximum inflow (all faults in the East Deep area are permeable, blue line) and minimum inflow (no permeable faults in the East Deep area, red line).

The sensitivity analysis shows that the maximum groundwater inflow to the fully expanded mine varies between 400 gpm to 650 gpm based on transmissivity of faults intersected.

5 Limitation of Groundwater Model

Analysis of the available geological and hydrogeological data and the results of the completed groundwater modeling indicate that there remain gaps in the understanding of the hydrogeological conditions at Pogo related to the location geological structures to be intersected by future underground developments and their hydrogeological parameters. Due to these gaps developed by SRK, the groundwater model has the limitations as follows:

- Inability to predict short-term inflows. The model is based on equivalent porous media approach (EPM), uses the averaged hydraulic conductivity values, and, as result of this, predicts an average long-term flow conditions. This means that inflows from individual discrete fractures and faults can be larger than predicted for short period of time;
- Inability to predict inflows from unknown faults with hydraulic parameters significant higher than observed up to date. The model is based on the known geological structures and calibrated to limited amount of hydrogeological parameter characterizing them. It is possible that total inflow can be larger than predicted in the case if unknown more transmissive than previously observed faults would be intersected; and
- Inability to predict inflows if Pogo mine grouting procedures would be significantly changed. The model is calibrated to mine inflow under existing grouting conditions and predicts inflow to the future developments, assuming that they will be constructed under the same successfully implemented grouting program.

6 Conclusions and Recommendations

Analysis of available data and groundwater modeling completed by SRK suggest the following conclusions:

- A 3-D numerical Groundwater flow model developed for Pogo East Deep Expansion is based on equivalent porous media approach. Major known geological structures are incorporated in the model;
- The final model was reasonably calibrated to site-specific water levels and groundwater inflow to existing underground developments; and
- The model predicts:
  - Total average inflow to mine in 2017 of about 419 gpm under Base Case scenario;
  - Inflow to proposed East Deep of about 94 gpm;
  - Inflow to proposed North Expansion up to 14 gpm;
  - Inflow to expanded Liese mine area up to 311 gpm;
  - Predicted drawdown of 50 will propagate to a distance from 0.5 miles to 1.2 miles from the center of the underground workings;

  - o Reduction of groundwater discharge to the Goodpaster River (71 gpm) and creeks (141 gpm) and additional recharge from Liese Creek (51 gpm); and
  - o No reversing of the groundwater gradient toward the Goodpaster River.
- There are uncertainties due to the complexity in the permeability of the major faults, resulting in the uncertainties in predictions for total mine inflow. Sensitivity analyses predicts a range in total mine inflow between about 400 gpm and 650 gpm.

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (U.S.) Inc., (SRK) by Sumitomo Metal Mining Pogo LLC (Pogo). These opinions are provided in response to a specific request from Pogo to do so, and are subject to the contractual terms between SRK and Pogo. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report.

Tables

Table 1: Precipitation Data for the Pogo Project

Site Name	Alias	Active/ Inactive	Start of Record	End of Record	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Liese Ridge Met Site	(MS-LRD)	Inactive	1/1/2001	3/31/2010	-	-	-	11.88	9.39	13.95	14.83	17.37	18.94	13.29	-	-	-	14.24
Lower Liese Creek Met Site	(MS-LIE)	Inactive	5/1/1997	9/27/2010	-	-	-	9.32	6.71	14.14	15.86	24.72	16.48	9.47	10.23	0	0	13.37
MRG	Manual Rain Guage	Active	6/7/2005	9/29/2012	-	-	-	-	-	12.56	12.44	12.72	12.32	8.59	10.4	11.42	11.74	11.51
Pogo Ridge Met Site	Pogo Ridge Met Site	Inactive	1/1/2000	5/30/2009	-	-	-	14.53	13.72	18.45	18.32	12.72	16.8	3.91	0	0	0	15.76
PRG	Pogo Ridge Meteorological Station	Active	10/1/2011	6/30/2012	-	-	-	-	-	-	-	-	-	-	-	0.58	7.43	4.01
PAR	Pogo Airstrip Meteorological Station	Active	10/1/2011	6/30/2012	-	-	-	-	-	-	-	-	-	-	-	0.52	8.07	4.29
(MS-COL)	Co-Located or PSD	Inactive	9/1/1998	6/1/2008	16.07	14.22	16.56	14.43	13.72	18.91	17.43	2.7	5.25	-	-	-	-	15.91
(MS-TAB)	Table Top	Inactive	4/1/2001	9/1/2002	6.41	9.75	13.76	-	-	-	-	-	-	-	-	-	-	9.97
Big Delta	Big Delta	Active	4/20/1905	Poor data 2011-12	9.73	7.87	12.03	7.87	7.67	9.71	10.63	11.64	12.28	8.71	12.02	-	-	10.01
																	Best Site Estimate	**13.72**

Note: Shaded cells used to calculate best estimate of average annual precipitation.

Table 2: Measured Hydraulic Conductivity Values for Bedrock

Borehole ID	Coordinates			Total Depth (ft bgs)	Azimuth	Inclination	Test Interface		Test Midpoint Elevation (ft amsl)	Estimated Hydraulic Conductivity K (ft/d)	Associated Structure	Source of Data
	Easting	Northing	Elevation (ft amsl)				From (ft bgs)	To (ft bgs)				
12-559	1,813,342	3,822,625	2,166	2250	171	-77	400	1066	1,452	3.36E-02	Diorite Margin	SRK 2012 Field Program
12-630	1,815,408	3,821,683	2,371	1450	294	-83	400	917	1,717	3.57E-03	Close to Diorite Margin	SRK 2012 Field Program
12-630	1,815,408	3,821,683	2,371	1450	294	-83	407	1450	1,449	1.95E-03	Close to Diorite Margin	SRK 2012 Field Program
98-105	1,812,104	3,822,341	1,696	807	0	-90	433	490	1,235	1.04E-01	Close to D3_3 and Diorite Margin	Golder, 1998
98-105	1,812,104	3,822,341	1,696	807	0	-90	433	807	1,076	2.51E-02	Close to D3_3 and Diorite Margin	Golder, 1998
98-105	1,812,104	3,822,341	1,696	807	0	-90	433	490	1,235	1.30E-01	Close to D3_3 and Diorite Margin	Golder, 1998
98-105	1,812,104	3,822,341	1,696	807	0	-90	490	807	1,048	1.04E-03	Close to D3_3 and Diorite Margin	Golder, 1998
13Hydro-06A	1,812,199	3,822,644	1,067	202	225	27	UG hole	UG hole	1,113	6.20E-02	D3-3 Fault and Diorite	SRK 2013 Field Program
13Hydro-02	1,812,596	3,821,217	1,090	500	33	23	UG hole	UG hole	1,188	1.10E-03	N1 Fault, Diorite, D3_3 Fault	SRK 2013 Field Program
LD-2	1,815,811	3,820,432	2,160	45	0	-90	35	45	2,120	5.67E-01	Diorite	AGRA 1999
LD-5	1,815,111	3,820,756	2,040	100	0	-90	65	80	1,968	2.83E-01	Diorite	AGRA 1999
LT-5	1,817,444	3,818,785	2,340	124	0	-90	64	84	2,266	2.83E-01	Diorite	AGRA 1999
LT-5	1,817,444	3,818,785	2,340	124	0	-90	84	104	2,246	5.67E-01	Diorite	AGRA 1999
LT-5	1,817,444	3,818,785	2,340	124	0	-90	104	124	2,226	2.83E-01	Diorite	AGRA 1999
LT-7	1,816,398	3,819,532	2,200	109	0	-90	42	59	2,150	1.13E+00	Diorite	AGRA 1999
LT-7	1,816,398	3,819,532	2,200	109	0	-90	64	79	2,129	8.50E-01	Diorite	AGRA 1999
LT-7	1,816,398	3,819,532	2,200	109	0	-90	79	99	2,111	2.83E-01	Diorite	AGRA 1999
LT-7	1,816,398	3,819,532	2,200	109	0	-90	99	109	2,096	8.50E-01	Diorite	AGRA 1999
LT-7a	1,816,398	3,819,532	2,200	109	0	-90	88.5	98.5	2,107	1.37E-01	Diorite	AGRA 1999
LT-7a	1,816,398	3,819,532	2,200	109	0	-90	88.5	98.5	2,107	4.55E-01	Diorite	AGRA 1999
LD-2	1,815,811	3,820,432	2,160	45	0	-90	23.6	35	2,131	2.83E-01	Diorite	AGRA 1999
LD-3	1,815,307	3,820,688	2,060	74	0	-90	44	54	2,011	1.13E+00	Diorite	AGRA 1999
LD-4	1,815,041	3,820,551	2,125	64	0	-90	13	64	2,087	2.27E-01	Diorite	AGRA 1999
13Hydro-03	1,814,608	3,821,731	887	218	260	30	UG hole	UG hole	942	3.30E-03	Diorite	SRK 2013 Field Program
LD-3	1,815,307	3,820,688	2,060	74	0	-90	54	64	2,001	1.42E+00	Diorite and NE2 Fault	AGRA 1999
13Hydro-05	1,815,302	3,821,243	1,218	600	129	31	UG hole	UG hole	1,373	2.40E-04	Diorite and NE2 Fault	SRK 2013 Field Program
12-594	1,816,140	3,822,047	2,660	1200	119	-68	706	1216	1,769	1.93E-01	NE2 Fault	SRK 2012 Field Program
13Hydro-01	1,815,297	3,821,248	1,215	464	76.4	21	UG hole	UG hole	1,298	8.10E-04	N2 fault	SRK 2013 Field Program
13Hydro-04	1,815,296	3,821,254	1,217	425	48.4	15	UG hole	UG hole	1,272	2.60E-03	N2 fault	SRK 2013 Field Program
00U98C	1,811,965	3,821,308	1,376	791	35	-5	0	791	1,342	7.40E-03	Graphite (D3_3)	ABC, 2001
00U98D	1,811,969	3,821,303	1,377	803	68	0	0	803	1,377	1.04E-02	High N1, Graphite	ABC, 2001
00U98B	1,811,960	3,821,309	1,376	313	0	5	0	313	1,390	1.71E-01	Graphite (D3_3)	ABC, 2001

Borehole ID	Coordinates			Total Depth (ft bgs)	Azimuth	Inclination	Test Interface		Test Midpoint Elevation (ft amsl)	Estimated Hydraulic Conductivity K (ft/d)	Associated Structure	Source of Data
	Easting	Northing	Elevation (ft amsl)				From (ft bgs)	To (ft bgs)				
98-109	1,812,104	3,822,341	1,696	746	215	-70	510	647	1,153	3.63E-03	Liese Creek	Golder, 1998
98-109	1,812,104	3,822,341	1,696	746	215	-70	470	647	1,171	3.89E-02	Liese Creek	Golder, 1998
98-109	1,812,104	3,822,341	1,696	746	215	-70	470	510	1,236	1.38E-01	Liese Creek	Golder, 1998
98-112	1,812,354	3,822,052	1,708	736	215	-57	330	504	1,358	1.12E-01	Liese Creek	Golder, 1998
98-114	1,812,104	3,822,341	1,696	593	215	-81	389	593	1,211	1.38E-03	Close to D3_3	Golder, 1998
13Hydro-06B	1,812,207	3,822,663	1,062	453	86.4	18.4	UG hole	UG hole	1,133	2.80E-03	Z fault, diorite, N3 vein	SRK 2013 Field Program
12-628	1,816,140	3,822,047	2,660	1500	230	-78	835	1115	1,706	7.94E-03	None	SRK 2012 Field Program
12-627	1,816,140	3,822,047	2,660	1200	153	-75	301	1201	1,935	6.93E-03	None	SRK 2012 Field Program
12-630	1,815,408	3,821,683	2,371	1450	294	-83	907	1450	1,201	2.42E-04	None	SRK 2012 Field Program
12-628	1,816,140	3,822,047	2,660	1500	230	-78	1115	1515	1,374	2.00E-03	None	SRK 2012 Field Program
00U039	1,811,110	3,820,880	1,275	245	316	39	0	245	1,352	2.74E-04	None	ABC, 2001
00U40A	1,811,114	3,820,876	1,276	214	316	65	0	214	1,373	2.74E-04	None	ABC, 2001
00U041	1,811,114	3,820,876	1,277	233	136	89	0	233	1,393	2.74E-04	None	ABC, 2001
00U045	1,811,168	3,820,958	1,280	211	316	84	0	211	1,385	2.74E-04	None	ABC, 2001
98-107	1,811,355	3,820,762	2,370	967	34.5	-75	753	910	1,567	3.37E-04	None	1998. Tech Memo 1
00U98F	1,811,960	3,821,308	1,383	263	0	36	0	263	1,460	8.22E-04	None	ABC, 2001
98-113	1,811,355	3,820,762	2,370	1038	35	-64	981	1038	1,462	8.64E-04	None	1998. Tech Memo 1
00U034	1,811,056	3,820,790	1,271	324	316	37	0	324	1,369	1.10E-03	None	ABC, 2001
00U044	1,811,163	3,820,965	1,280	211	316	47	0	211	1,357	1.10E-03	None	ABC, 2001
98-104	1,812,118	3,820,903	2,186	1015.8	228.5	-73.5	527	826	1,537	1.73E-03	None	1998. Tech Memo 1
00U038	1,811,110	3,820,880	1,271	299	316	21	0	299	1,325	2.74E-03	None	ABC, 2001
00U033a	1,811,055	3,820,790	1,268	448	316	19	0	448	1,341	4.38E-03	None	ABC, 2001
00U037	1,811,062	3,820,783	1,273	303	136	73	0	303	1,418	5.75E-03	None	ABC, 2001
98-113	1,811,355	3,820,762	2,370	1038	35	-64	851	1038	1,521	6.31E-03	None	1998. Tech Memo 1
00U46a-a	1,811,164	3,820,964	1,271	426	316	6	0	426	1,294	7.40E-03	None	ABC, 2001
98-113	1,811,355	3,820,762	2,370	1038	35	-64	851	981	1,547	8.55E-03	None	1998. Tech Memo 1
97-78	1,812,118	3,820,903	2,175	1158	4	-90	382.5	579.5	1,694	8.64E-03	None	Hydrogeological Investigations 1998
00U033b	1,811,055	3,820,790	1,268	448	316	19	0	448	1,341	1.42E-02	None	ABC, 2001
00U069	1,811,416	3,821,430	1,242	191	316	47	0	191	1,311	1.45E-02	None	ABC, 2001
98-108	1,812,354	3,822,052	1,708	667	219.5	-74	510	667	1,142	1.81E-02	None	1998. Tech Memo 1
00U95B	1,811,956	3,821,306	1,378	268	316	17	0	268	1,418	2.00E-02	None	ABC, 2001
00U043	1,811,162	3,820,966	1,275	307	316	21	0	307	1,330	2.03E-02	None	ABC, 2001
00U40b	1,811,109	3,820,881	1,269	389	316	7	0	389	1,293	2.05E-02	None	ABC, 2001
00U46a-b	1,811,164	3,820,964	1,271	426	316	6	0	426	1,294	2.55E-02	None	ABC, 2001
00U042	1,811,116	3,820,874	1,276	267	136	71	0	267	1,402	2.77E-02	None	ABC, 2001
00U083a	1,811,577	3,821,544	1,216	253	316	22	0	253	1,263	4.52E-02	None	ABC, 2001

Borehole ID	Coordinates			Total Depth (ft bgs)	Azimuth	Inclination	Test Interface		Test Midpoint Elevation (ft amsl)	Estimated Hydraulic Conductivity K (ft/d)	Associated Structure	Source of Data
	Easting	Northing	Elevation (ft amsl)				From (ft bgs)	To (ft bgs)				
00U98A	1,811,946	3,821,299	1,378	303	316	10	0	303	1,404	4.60E-02	None	ABC, 2001
00U055	1,811,327	3,821,233	1,273	323	316	20	0	323	1,328	4.99E-02	None	ABC, 2001
00U083b	1,811,577	3,821,544	1,216	253	316	22	0	253	1,263	6.33E-02	None	ABC, 2001
00U98B	1,811,960	3,821,309	1,376	313	0	5	0	313	1,390	6.68E-02	None	ABC, 2001
00U061	1,811,365	3,821,332	1,256	221	316	21	0	221	1,296	6.99E-02	None	ABC, 2001
00U075a	1,811,502	3,821,484	1,219	281	316	19	0	281	1,264	8.33E-02	None	ABC, 2001
00U075b	1,811,502	3,821,484	1,219	281	316	19	0	281	1,264	8.71E-02	None	ABC, 2001
00U51a-a	1,811,277	3,821,141	1,278	359	316	6	0	359	1,297	9.23E-02	None	ABC, 2001
00U051a	1,811,277	3,821,141	1,280	250	316	23	0	250	1,329	1.46E-01	None	ABC, 2001
00U51a-b	1,811,277	3,821,141	1,278	359	316	6	0	359	1,297	2.16E-01	None	ABC, 2001
00U051b	1,811,277	3,821,141	1,280	250	316	23	0	250	1,329	2.48E-01	None	ABC, 2001
00U068a	1,811,414	3,821,432	1,237	262	316	21	0	262	1,284	2.66E-01	None	ABC, 2001
00U068b	1,811,414	3,821,432	1,237	262	316	21	0	262	1,284	3.51E-01	None	ABC, 2001
00U95B	1,811,956	3,821,306	1,378	268	316	17	0	268	1,418	1.62E-02	None	ABC, 2001
97-78	1,812,118	3,820,903	2,175	1158	4	-90	741	998	1,306	8.64E-03	None	Hydrogeological Investigations 1998
00L309	1,811,509	3,821,476	1,217	571	141	-69	0	571	950	1.89E-02	None	ABC, 2001
98-080	1,809,050	3,820,403	1,590	500	0	-90	195	390	1,298	8.64E-03	None	1998 Hydrogeological Regime Goodpaster River Valley
98-080	1,809,050	3,820,403	1,590	500	0	-90	195	390	1,298	8.64E-03	None	1998 Hydrogeological Regime Goodpaster River Valley
98-080	1,809,050	3,820,403	1,590	500	0	-90	355	500	1,163	8.64E-04	None	1998 Hydrogeological Regime Goodpaster River Valley
98-081	1,809,836	3,819,386	1,841	1000	0	-90	195	279	1,604	4.32E-02	None	1998 Hydrogeological Regime Goodpaster River Valley
98-081	1,809,836	3,819,386	1,841	1000	0	-90	345	500	1,418	1.73E-02	None	1998 Hydrogeological Regime Goodpaster River Valley
98-081	1,809,836	3,819,386	1,841	1000	0	-90	485	769	1,214	1.73E-02	None	1998 Hydrogeological Regime Goodpaster River Valley
98-081	1,809,836	3,819,386	1,841	1000	0	-90	740	1000	971	8.64E-03	None	1998 Hydrogeological Regime Goodpaster River Valley
98-113	1,811,355	3,820,762	2,370	1038	35	-64	680	837	1,688	2.07E-04	None	Golder, 1998
98-111	1,812,118	3,820,903	2,186	1045	215	-60	297	504	1,839	2.51E-04	None	Golder, 1998
98-082	1,810,357	3,819,873	2,090	1000	0	-90	72.5	113	1,997	2.59E-04	None	1998 Hydrogeological Regime Goodpaster River

Borehole ID	Coordinates			Total Depth (ft bgs)	Azimuth	Inclination	Test Interface		Test Midpoint Elevation (ft amsl)	Estimated Hydraulic Conductivity K (ft/d)	Associated Structure	Source of Data
	Easting	Northing	Elevation (ft amsl)				From (ft bgs)	To (ft bgs)				
												Valley
98-082	1,810,357	3,819,873	2,090	1000	0	-90	111.5	152	1,958	6.05E-04	None	1998 Hydrogeological Regime Goodpaster River Valley
98-082	1,810,357	3,819,873	2,090	1000	0	-90	36.5	74.2	2,034	8.64E-04	None	1998 Hydrogeological Regime Goodpaster River Valley
00U96A	1,811,956	3,821,307	1,381	228	316	37	0	228	1,450	1.10E-03	None	ABC, 2001
97-76	1,811,218	3,820,813	2,360	998	7	-90	571	798	1,676	1.73E-03	None	Hydrogeological Investigations 1998
12-633	1,815,145	3,822,267	2,541	1900	208	-80	900	1171	1,521	3.38E-03	None	SRK 2012 Field Program
00U98E	1,811,957	3,821,307	1,379	262	344	15	0	262	1,413	3.56E-03	None	ABC, 2001
98-113	1,811,355	3,820,762	2,370	1038	35	-64	418.4	525.4	1,946	3.80E-03	None	1998. Tech Memo 1
00L306	1,811,279	3,821,140	1,274	510	317.5	-77	0	510	1,026	4.11E-03	None	ABC, 2001
00L302	1,811,367	3,821,328	1,248	784	320	-64.5	0	784	894	4.38E-03	None	ABC, 2001
97-79	1,810,221	3,822,066	2,065	1395	253	-90	259	586	1,643	5.18E-03	None	Hydrogeological Investigations 1998
98-113	1,811,355	3,820,762	2,370	1038	35	-64	418.4	478.4	1,967	6.22E-03	None	1998. Tech Memo 1
12-628	1,816,140	3,822,047	2,660	1500	230	-78	465	835	2,024	6.50E-03	None	SRK 2012 Field Program
12-633	1,815,145	3,822,267	2,541	1900	208	-80	307	636	2,077	7.35E-03	None	SRK 2012 Field Program
00L311	1,811,508	3,821,477	1,217	485	319	-61	0	485	1,005	8.22E-03	None	ABC, 2001
97-77	1,811,425	3,821,704	2,039	911.5	96	-72	317	517	1,643	8.64E-03	None	Hydrogeological Investigations 1998
97-77	1,811,425	3,821,704	2,039	911.5	96	-72	507	764	1,435	8.64E-03	None	Hydrogeological Investigations 1998
98-113	1,811,355	3,820,762	2,370	1038	35	-64	478.4	525.4	1,919	1.04E-02	None	Golder, 1998
12-628	1,816,140	3,822,047	2,660	1500	230	-78	205	465	2,332	1.44E-02	None	SRK 2012 Field Program
97-76	1,811,218	3,820,813	2,360	998	7	-90	381	578	1,881	1.73E-02	None	Hydrogeological Investigations 1998
97-79	1,810,221	3,822,066	2,065	1395	253	-90	419	586	1,563	3.46E-02	None	Hydrogeological Investigations 1998
12-594	1,816,140	3,822,047	2,660	1200	119	-68	396	1216	1,913	9.06E-02	None	SRK 2012 Field Program
97-75	1,812,798	3,820,462	2,265	1368.5	215	-40	1106	1309	1,489	1.73E-01	None	Hydrogeological Investigations 1998
97-79	1,810,221	3,822,066	2,065	1395	253	-90	69	266	1,898	6.05E-01	None	Hydrogeological Investigations 1998
97-79	1,810,221	3,822,066	2,065	1395	253	-90	659	836	1,318	7.78E-01	None	Hydrogeological Investigations 1998
97-79	1,810,221	3,822,066	2,065	1395	253	-90	574	671	1,443	8.64E-01	None	Hydrogeological Investigations 1998
97-79	1,810,221	3,822,066	2,065	1395	253	-90	827	964	1,170	8.64E-01	None	Hydrogeological Investigations 1998

Borehole ID	Coordinates			Total Depth (ft bgs)	Azimuth	Inclination	Test Interface		Test Midpoint Elevation (ft amsl)	Estimated Hydraulic Conductivity K (ft/d)	Associated Structure	Source of Data
	Easting	Northing	Elevation (ft amsl)				From (ft bgs)	To (ft bgs)				
00U98E	1,811,957	3,821,307	1,379	262	344	15	UG hole	UG hole	1,413	3.84E-03	None	ABC, 2001
13-H3	1,812,235	3,820,041	2,520	718	0	-90	102	718	2,110	4.90E-02	None	SRK 2013 Field Program
13-562	1,813,342	3,822,625	2,166	2772.8	277	-82	238	2773	661	7.10E-04	None	SRK 2013 Field Program
13-695	1,812,922	3,823,509	2,192	2963.1	192	-81	196	2963	612	1.40E-04	None	SRK 2013 Field Program
13-651	1,813,573	3,818,867	2,578	1777.6	80	-71	74	1778	1,652	7.50E-04	None	SRK 2013 Field Program

Table 3: Measured Hydraulic Conductivity Values for Alluvium

Site	Well ID	Easting	Northing	Ground Elev. (ft amsl)	Test Type	Test Interval Top (ft bgs)	Test Interval Bottom (ft bgs)	Source of Data	Estimated Hydraulic Conductivity K (ft/d)	Average K (ft/d)	Geometric Mean K (ft/d)
Goodpaster River	98-3	1807875	3819087	1328.27	Packer-Slug Test	8	30	Golder 1998	20	140	56
	98-4	1807629	3819130	1327.53	Packer-Slug Test	20	30	Golder 1998	39		
	98-6	1807498	3819863	1329.98	Packer-Slug Test	20	30	Golder 1998	44		
	98-9	1807796	3819123	1327.78	Packer-Slug Test	35	47	Golder 1998	16		
	98-10a	1808271	3819914	1329.64	Packer-Slug Test	64	76.5	Golder 1998	77		
	98-10b	1808271	3819914	1329.33	Packer-Slug Test	19	30	Golder 1998	27		
	98-11a	1808171	3819400	1328.91	Packer-Slug Test	65	81.5	Golder 1998	156		
	98-11b	1808171	3819400	1329.02	Packer-Slug Test	26	40	Golder 1998	156		
	98-13	1808247	3820775	1331.91	Slug Test	51	84	Golder 1998	9		
	98-14	1808241	3820353	1330.00	Slug Test	48.5	66.5	Golder 1998	4		
	MW-001a	1810789	3826337	1361.10	Long Term Pumping Test	47	67	SRK Fall 2012	325		
	LL-25	1811048	3826384	1354.64	Pumping Test	2.5	59.5	AGRA 2000	99		
	LL-30	1811027	3826433	1353.36	Pumping Test	20	60	AGRA 2000	224		
	LL-26	1811021	3826427	1354.64	Pumping Test	2	59	AGRA 2000	25		
	LL-25b	1811048	3826384	1354.64	Pumping Test	2.5	59	AGRA 2000	879		
Liese Creek	LT-7b	1816398	3819532	2200.00	Slug Test	27	37	AGRA 1999	1.56E-01	1.4E-01	0.065
	LD-3	1815307	3820688	2060.00	Slug Test	23	33	AGRA 1999	3.55E-01		
	LD-5	1815111	3820756	2040.00	Slug Test	44	54	AGRA 1999	3.70E-02		
	LL-2	1809804	3824605	Unknown	Slug Test	Not Reported		AGRA 1999	8.72E-03		

Table 4: Summary of Measured Hydraulic Conductivity Values

Hydrogeological Unit		Hydraulic Conductivity (ft/d)				
		No. Tests	Min	Max	Average	Geometric Mean
Alluvium	Goodpaster Alluvium	15	4.32	878.7	139.9	56
	Liese Alluvium	4	0.009	0.36	0.14	0.065
Bedrock/veins	Bedrock Incl. Veins	87	0.0001	0.86	0.07	0.009
	Bedrock Not Incl. Veins	41	0.0002	0.86	0.10	0.007
	Bedrock- Veins Only	58	0.0002	0.35	0.05	0.011
	Bedrock- Water Producing Drill Holes (1)	44	0.0080	3.13	0.24	0.13
Diorite/Diorite Contact Margin		23	0.0010	1.13	0.33	0.09
Faults	Graphite	10	0.001	0.22	0.09	0.04
	Liese	5	0.004	0.14	0.06	0.03
	D3_3 (includes Liese Creek, Graphite)	15	0.001	0.22	0.08	0.04
	NE2	3	0.0002	1.42	0.54	0.04
	N1	3	0.001	0.49	0.18	0.03
	N2	2	0.001	0.003	0.002	0.001
	Z	1	0.003	0.003	0.003	0.003

Notes: 1 - Estimated by Thiem method

Table 5: Measured Water Levels Used for Steady State and Transient Model Calibrations

Monitoring Well ID	Coordinates			Screen interval (ft)		Depth to Water Levels (ft)	Measured Water level (ft amsl)	Hydrogeological Unit	Date	Monitoring Wells used for Calibration			
	X	Y	Elevation (ft amsl)	From	To					Monitoring Well used for Pre-mining Steady State	Monitoring Well used for Mining Transient	Water Level used for Transient Calibration (ft amsl) Maximum	Minimum
98-9	1,807,796	3,819,123	1,327.8	42	47	6.8	1,321	Goodpaster River Alluvium	Pre-mining	Yes	No		
98-10A	1,808,271	3,819,914	1,329.6	69	77	7.6	1,322	Goodpaster River Alluvium	Pre-mining	Yes	No		
98-10B	1,808,271	3,819,914	1,330.1	25	30	8.1	1,322	Goodpaster River Alluvium	Pre-mining	Yes	No		
98-11A	1,808,171	3,819,400	1,329.2	73	78	7.2	1,322	Goodpaster River Alluvium	Pre-mining	Yes	No		
98-11B	1,808,171	3,819,400	1,329.2	33	38	7.2	1,322	Goodpaster River Alluvium	Pre-mining	Yes	No		
98-5	1,807,487	3,819,613	1,329.9	25	30	7.9	1,322	Goodpaster River Alluvium	Pre-mining	Yes	No		
INJ-2	1,808,191	3,819,442	1,330.0	62	75	8.0	1,322	Goodpaster River Alluvium	Pre-mining	Yes	Yes	1324	1322
MW99-016	1,807,742	3,818,627	1,323.8	21	31	1.8	1,322	Goodpaster River Alluvium	Pre-mining	Yes	No		
INJ-1	1,808,208	3,819,454	1,330.0	62	75	7.0	1,323	Goodpaster River Alluvium	Pre-mining	Yes	No		
98-7	1,807,490	3,820,267	1,331.3	15	30	7.3	1,324	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-003	1,808,924	3,825,666	1,347.2	18	30	8.2	1,339	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-004	1,808,864	3,825,216	1,348.0	15	25	9.0	1,339	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-029	1,809,134	3,825,843	1,349.2	49	59	8.2	1,341	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-001	1,809,619	3,824,942	1,351.3	37	47	7.3	1,344	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-002	1,809,473	3,824,465	1,369.5	47	57	25.5	1,344	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-005	1,809,656	3,825,982	1,349.3	20	30	5.3	1,344	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-008B	1,810,174	3,825,448	1,351.5	38	43	6.5	1,345	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-024	1,810,204	3,826,283	1,352.3	20	30	7.3	1,345	Goodpaster River	Pre-mining	Yes	No		

Monitoring Well ID	Coordinates X	Coordinates Y	Coordinates Elevation (ft amsl)	Screen interval (ft) From	Screen interval (ft) To	Depth to Water Levels (ft)	Measured Water level (ft amsl)	Hydrogeological Unit	Date	Monitoring Well used for Pre-mining Steady State	Monitoring Well used for Mining Transient	Water Level used for Transient Calibration (ft amsl) Maximum	Water Level used for Transient Calibration (ft amsl) Minimum
								Alluvium					
LL-009A	1,810,580	3,825,024	1,352.7	64	47	5.7	1,347	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-010A	1,810,663	3,825,865	1,351.8	55	65	4.8	1,347	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-010B	1,810,663	3,825,865	1,351.8	15	25	4.8	1,347	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-028	1,810,682	3,826,263	1,350.5	47	59	2.5	1,348	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-030	1,811,027	3,826,433	1,353.4	20	60	5.4	1,348	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-006A	1,810,906	3,826,701	1,354.1	40	50	5.1	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-006B	1,810,906	3,826,701	1,354.1	9	19	5.1	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-023	1,811,130	3,826,210	1,355.3	15	25	6.3	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-025	1,811,048	3,826,384	1,354.6	3	60	5.6	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-026	1,811,021	3,826,427	1,354.6	2	59	5.6	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-027	1,810,990	3,826,482	1,353.2	2	59	4.2	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-14	1,811,928	3,826,826	1,356.9	40	50	7.9	1,349	Goodpaster River Alluvium	Pre-mining	Yes	No		
MW12-001A	1,810,789	3,826,337	1,361.1	47	67	12.1	1,349	Goodpaster River Alluvium	Fall 2012	No	No		
LL-012A	1,811,621	3,826,531	1,355.1	65	75	5.1	1,350	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-021	1,811,801	3,826,404	1,355.8	34	44	5.8	1,350	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-12B	1,811,621	3,826,531	1,355.1	65	75	5.1	1,350	Goodpaster River Alluvium	Pre-mining	Yes	No		
LL-007	1,811,435	3,827,559	1,356.2	19	29	5.2	1,351	Goodpaster River Alluvium	Pre-mining	Yes	No		
LB-8-2	1,809,398	3,824,147	1,395.0	0	42	25.0	1,370	Goodpaster River	Pre-mining	Yes	No		

Monitoring Well ID	Coordinates			Screen interval (ft)		Depth to Water Levels (ft)	Measured Water level (ft amsl)	Hydrogeological Unit	Date	Monitoring Wells used for Calibration			
	X	Y	Elevation (ft amsl)	From	To					Monitoring Well used for Pre-mining Steady State	Monitoring Well used for Mining Transient	Water Level used for Transient Calibration (ft amsl) Maximum	Minimum
								Alluvium					
LL04-031	1,811,383	3,827,794	1,390.0	0	60	7.0	1,383	Goodpaster River Alluvium	Mining	Yes	Yes	1383	1351
LL04-032	1,811,491	3,828,095	1,391.0	0	59	7.2	1,384	Goodpaster River Alluvium	Mining	No	Yes	1384	1353
MW03-501	1,814,608	3,820,857	1,951.0	0	53	15.0	1,936	Liese Creek Alluvium	Mining	No	Yes	1936	1917
MW03-502	1,814,603	3,820,839	1,949.0	0	37	12.0	1,937	Liese Creek Alluvium	Mining	No	Yes	1947	1928
MW03-500	1,814,608	3,820,882	1,955.0	0	60	16.0	1,939	Liese Creek Alluvium	Mining	No	Yes	1939	1919
LD-005	1,815,111	3,820,756	2,012.7	44	54	20.7	1,992	Liese Creek Alluvium	Pre-mining	Yes	No		
LD-003	1,815,329	3,820,673	2043.5	23	33	20.5	2,023	Liese Creek Alluvium	Pre-mining	Yes	No		
LD-21-2	1,815,385	3,820,746	2,050.0	39	77	21.0	2,029	Liese Creek Alluvium	Pre-mining	Yes	No		
LD-17	1,815,269	3,820,775	2,040.0	32	63	32.0	2,008	Liese Creek Alluvium	Pre-mining	Yes	No		
LD-21-1	1,815,385	3,820,746	2,050.0	0	21	21.0	2,029	Liese Creek Alluvium	Pre-mining	Yes	No		
LD-19	1,815,284	3,820,546	2,065.0	10	21	4.0	2,061	Liese Creek Alluvium	Pre-mining	Yes	No		
LD-18-1	1,815,343	3,820,973	2,085.0	0	108	89.0	1,996	Liese Creek Alluvium	Pre-mining	Yes	No		
MW11-001B	1,815,772	3,820,237	2,136.0	0	75	39.0	2,097	Liese Creek Alluvium	Mining	No	Yes	2097	2037
MW11-001A	1,815,772	3,820,237	2,136.0	0	39	32.0	2,104	Liese Creek Alluvium	Mining	No	Yes	2104	2045
LT99-009	1,816,057	3,819,767	2,172.4	0	29	19.4	2,153	Liese Creek Alluvium	Pre-mining	Yes	Yes	2153	2120
LT-007B	1,816,305	3,819,615	2183.33	27	37	8.8	2,175	Liese Creek Alluvium	Pre-mining	Yes	No		
LT-003	1,818,009	3,817,853	2479.5	17	27	17.7	2,462	Liese Creek Alluvium	Pre-mining	Yes	No		
LT-22B	1,815,473	3,819,011	2,660.0	0	25	0.0	2,660	Liese Creek	Pre-mining	Yes	No		

Monitoring Well ID	Coordinates			Screen interval (ft)		Depth to Water Levels (ft)	Measured Water level (ft amsl)	Hydrogeological Unit	Date	Monitoring Wells used for Calibration			
	X	Y	Elevation (ft amsl)	From	To					Monitoring Well used for Pre-mining Steady State	Monitoring Well used for Mining Transient	Water Level used for Transient Calibration (ft amsl) Maximum	Minimum
								Alluvium					
LB-001	1,810,867	3,823,215		28	38	-1,529.2	1,529	Liese Creek Alluvium	Pre-mining	No	Yes	1533	1525
559-1A	1,813,342	3,822,625	2,166.0	400	1066	317.0	1,849	Bedrock	Fall 2012	No	No		
12-594 [1]	1,816,140	3,822,047	2,660.0	396	1216	245.7	2,414	Bedrock	Fall 2012	No	No		
12-627 [1]	1,816,140	3,822,047	2,660.0	1201	1909	228.9	2,431	Bedrock	Fall 2012	No	No		
12-628	1,816,140	3,822,047	2,660.0	205	1515	135.6	2,524	Bedrock	Fall 2012	No	Yes	2533	2511
12-630	1,815,408	3,821,683	2,371.0	200	417	53.3	2,318	Bedrock	Fall 2012	No	Yes	2318	2277
12-633	1,815,145	3,822,267	2,541.0	307	1171	148.0	2,393	Bedrock	Fall 2012	No	Yes	2393	2309
12-684 [2]	1,814,764	3,823,114	2,703.0	60	2505	134.0	2,569	Bedrock	Fall 2012	No	No		
12-685	1,814,764	3,823,114	2,703.0	60	1404	270.7	2,432	Bedrock	Fall 2012	No	Yes	2445	2421
12-731	1,815,007	3,822,745	2,867.0	40	2715	103.4	2,764	Bedrock	Fall 2012	No	Yes	2764	2669
97-53	1,810,726	3,821,429	2,253.5	0	1321	642.5	1,611	Bedrock	Pre-mining	Yes	No		
97-79	1,810,221	3,822,066	2,074.9	0	1395	371.9	1,703	Bedrock	Pre-mining	Yes	No		
98-105	1,812,104	3,822,341	1,696.1	0	603	110.1	1,586	Bedrock	Pre-mining	Yes	No		
98-108	1,812,354	3,822,341	1,708.2	0	967	87.2	1,621	Bedrock	Pre-mining	Yes	No		
LB-10	1,813,529	3,822,392	2,150.0	47	57	48.0	2,102	Bedrock	Pre-mining	Yes	No		
LB-12	1,813,818	3,822,177	2,150.0	50	60	45.5	2,105	Bedrock	Pre-mining	Yes	No		
LB-6B	1,811,782	3,823,604	1,825.0	59	69	52.5	1,773	Bedrock	Pre-mining	Yes	No		
LB-8-1	1,809,398	3,824,147	1,395.0	0	21	25.0	1,370	Bedrock	Pre-mining	Yes	No		
LB-9	1,809,375	3,824,115	1,395.0	40	50	27.4	1,368	Bedrock	Pre-mining	Yes	No		
LB-14	1,814,348	3,821,854	2,195.0	47	57	42.0	2,153	Bedrock	Pre-mining	Yes	No		
LD-18-2	1,815,343	3,820,973	2,085.0	0	54	89.0	1,996	Bedrock	Pre-mining	Yes	No		
LD-22	1,815,362	3,820,861	2,075.0	0	40	33.0	2,042	Bedrock	Pre-mining	Yes	No		
LT-007A	1,816,303	3,819,616	2,183.3	89	99	4.3	2,179	Bedrock	Pre-mining	Yes	No		
LT-14B	1,816,455	3,820,531	2,400.0	0	33	32.0	2,368	Bedrock	Pre-mining	Yes	No		
LT-15	1,817,519	3,819,761	2,560.0	0	22	12.0	2,548	Bedrock	Pre-mining	Yes	No		
LT-16	1,818,298	3,819,160	2,600.0	0	47	0.0	2,600	Bedrock	Pre-mining	Yes	No		
LT-20	1,817,529	3,817,822	2,635.0	0	19	7.0	2,628	Bedrock	Pre-mining	Yes	No		
LT-22	1,815,473	3,819,011	2,660.0	0	17	3.0	2,657	Bedrock	Pre-mining	Yes	No		
MW97-041	1,810,974	3,821,077	2,313.7	930	960	392.7	1,921	Bedrock	Pre-mining	Yes	Yes	1921	1864
MW97-066	1,811,421	3,821,703	2,012.7	0	855	353.7	1,659	Bedrock	Pre-mining	Yes	No		
MW97-071	1,811,492	3,821,214	2,210.0	726	796	295.0	1,915	Bedrock	Pre-mining	Yes	Yes	1916	1894
MW97-076	1,811,218	3,820,813	2,360.0	921	1001	433.0	1,927	Bedrock	Pre-mining	Yes	Yes	1927	1626

Monitoring Well ID	Coordinates			Screen interval (ft)		Depth to Water Levels (ft)	Measured Water level (ft amsl)	Hydrogeological Unit	Date	Monitoring Wells used for Calibration			
	X	Y	Elevation (ft amsl)	From	To					Monitoring Well used for Pre-mining Steady State	Monitoring Well used for Mining Transient	Water Level used for Transient Calibration (ft amsl)	
												Maximum	Minimum
MW98-003	1,807,875	3,819,087	1,324.3	25	30	3.3	1,321	Bedrock	Pre-mining	Yes	No		
MW98-004	1,807,629	3,819,130	1,324.1	25	30	3.1	1,321	Bedrock	Pre-mining	Yes	No		
MW98-006	1,807,498	3,819,863	1,326.5	25	30	4.5	1,322	Bedrock	Pre-mining	Yes	No		
MW98-011A	1,808,171	3,819,400	1,326.5	73	78	4.5	1,322	Bedrock	Pre-mining	Yes	No		
MW98-013	1,808,247	3,820,775	1,331.9	64	74	5.9	1,326	Bedrock	Pre-mining	Yes	No		
MW98-080	1,809,175	3,818,970	1,590.0	460	500	253.0	1,337	Bedrock	Pre-mining	Yes	No		
MW98-081	1,809,836	3,819,386	1,840.6	416	456	310.6	1,530	Bedrock	Pre-mining	Yes	Yes	1532	1498
MW98-082	1,810,357	3,819,873	2,087.0	735	773	386.0	1,701	Bedrock	Pre-mining	Yes	Yes	1702	1362
MW98-133	1,811,980	3,821,387	2,027.0	620	660	263.0	1,764	Bedrock	Pre-mining	Yes	Yes	1764	1669
MW99-189	1,813,356	3,820,289	2,349.5	830	850	524.5	1,825	Bedrock	Pre-mining	Yes	Yes	1838	1825
MW99-202	1,812,654	3,820,563	2,203.0	895	925	422.0	1,781	Bedrock	Pre-mining	Yes	Yes	2192	1753
MW99-204	1,812,425	3,820,976	2,070.0	388	428	213.0	1,857	Bedrock	Pre-mining	Yes	Yes	1857	1843
MW99-213	1,810,090	3,823,389	1,472.0	450	500	16.0	1,456	Bedrock	Pre-mining	Yes	Yes	1464	1455
MW04-213	1,810,076	3,823,871	1,510.0	0	153	40.0	1,470	Bedrock	Mining	No	Yes	1470	1379
MW11-216	1,808,547	3,822,010	1,505.0	0	234	158.0	1,347	Bedrock	Mining	No	Yes	1421	1347
MW12-001B	1,810,938	3,826,262	1,359.3	130	160	10.3	1,349	Bedrock	Fall 2012	No	Yes	1349	1349
PS-11	1,814,595	3,819,473	2,665.0	24	34	4.0	2,661	Bedrock	Pre-mining	Yes	No		
MW99-216	1,808,999	3,821,901	1,678.0	450	500	297.0	1,381	Bedrock	Pre-mining	Yes	Yes	1476	1328
13-H3	1,812,235	3,820,041	2,520.0	97	718	139.2	2,381	Bedrock	Summer 2013	No	Yes	2423	2381
13-562	1,813,342	3,822,625	2,166.0	240	2773	240.0	1,928	Bedrock	Summer 2013	No	Yes	1928	1928
13-695	1,812,922	3,823,509	2,192.0	201	2963	200.5	1,992	Bedrock	Summer 2013	No	Yes	1996	1992
13-651	1,813,573	3,818,867	2,578.0	79	1778	78.9	2,503	Bedrock	Summer 2013	No	Yes	2504	2504
13Hydro-01 [3]	1,815,297	3,821,248	1,215.0	1215	1049	-182.3	1,397	Bedrock	Summer 2013	No	No		
13Hydro-02 [3]	1,812,596	3,821,217	1,090.0	1090	895	-255.7	1,346	Bedrock	Summer 2013	No	No		
13Hydro-03 [3]	1,814,608	3,821,731	887.0	887	778	-145.4	1,032	Bedrock	Summer 2013	No	No		
13Hydro-04 [3]	1,815,296	3,821,254	1,217.0	1217	1107	-606.3	1,823	Bedrock	Summer 2013	No	No		
13Hydro-05 [3]	1,815,302	3,821,243	1,218.0	1218	909	-507.5	1,725	Bedrock	Summer 2013	No	No		
13Hydro-06A [3]	1,812,199	3,822,644	1,067.0	1067	975	-219.7	1,287	Bedrock	Summer 2013	No	No		
13Hydro-06B [3]	1,812,207	3,822,663	1,062.0	1062	919	-272.2	1,334	Bedrock	Summer 2013	No	No		
13U283 [3]	1,809,979	3,821,867	568.0	568	568	-297.1	865	Bedrock	Summer 2013	No	No		

Notes:
1 Water levels recorded directly after packer testing. May not be representative of static conditions.
2 Water levels recorded directly after stub well installation. May not be representative of static conditions.
3 Negative Depth to Water Levels indicates height of water above the collar of horizontal underground borehole.

Table 6: Hydraulic Parameters Used in Model

Hydrogeological Unit	Hydraulic Conductivity (ft/d)		Specific Storage	Specific Yeld
	Horizontal (K_h)	Vertical (K_v)	S_s (1/ft)	S_y (-)
Goodpaster River Alluvium	56	56	1.00E-06	0.2
Liese Creek Alluvium	0.14	0.14	1.00E-06	0.1
Colluvium	0.02	0.02	1.00E-06	0.05
Bedrock	0.009	0.009	1.00E-06	0.005
Diorite	0.01	0.01	1.00E-06	0.005
Diorite Contact	0.02	0.02	1.00E-06	0.005
Fault D3_3 (includes Liese Creek and Graphite Fault)	0.04	0.04	1.00E-06	0.005
Fault N1	0.01	0.01	1.00E-06	0.005
Fault N2	0.01	0.01	1.00E-06	0.005
Fault W	0.01	0.01	1.00E-06	0.005
Fault NE2	0.01	0.01	1.00E-06	0.005
Fault D3_4	0.01	0.01	1.00E-06	0.005
Fault D3_5a/5b	0.01	0.01	1.00E-06	0.005
Fault D3_7a/7b	0.01	0.01	1.00E-06	0.005
Fault Z	0.01	0.01	1.00E-06	0.005
Fault Ray	0.01	0.01	1.00E-06	0.005
Permafrost	0.001	0.001	3.00E-08	0.0001

Table 7: Simulated Groundwater Budget for Pre-Mining Steady State Conditions

Groundwater Budget Component		Flow (gpm)
Inflow	Recharge from Precipitation	665
	Recharge from Liese Creek	13
	Total	**678**
Outflow	Discharge to Goodpaster River	372
	Total Discharge to Creeks	**306**
	Liese Creek	167
	Ringer/North Creek	93
	Pogo Creek	46
	Total	**678**

Table 8: Simulated Groundwater Budget at Current Mining Conditions

Groundwater Budget Component		Flow (gpm)		
		Pre-Mining (Steady State)	**Current (End of October 2013)**	**Change Relative to Pre-Mining Conditions**
Inflow	Recharge from Goodpaster River	0	0	0
	Recharge from Precipitation[1]	665	678	13
	Depletion of Groundwater Storage	0	173	173
	Recharge from Liese Creek	13	48	35
	Total	**678**	**899**	**221**
Outflow	Discharge to Goodpaster River	372	346	-26
	Total Discharge to Creeks	**306**	**206**	**-100**
	Liese Creek	167	83	-84
	Ringer/North Creek	93	91	-2
	Pogo Creek	46	32	-14
	Inflow to Mine Developments	**0**	**347**	**347**
	Liese Zone	0	319	319
	East Deep Zone	0	24	24
	North Zone	0	4	4
	Total	**678**	**899**	**221**

Notes: 1 - Recharge was increased by 13 gpm due to lowering water table (simulated with “Recharge Out” capability of MODFLOW-SURFACT)

2- Negative change in flow compared to pre-mining conditions indicate decreasing of groundwater inflow

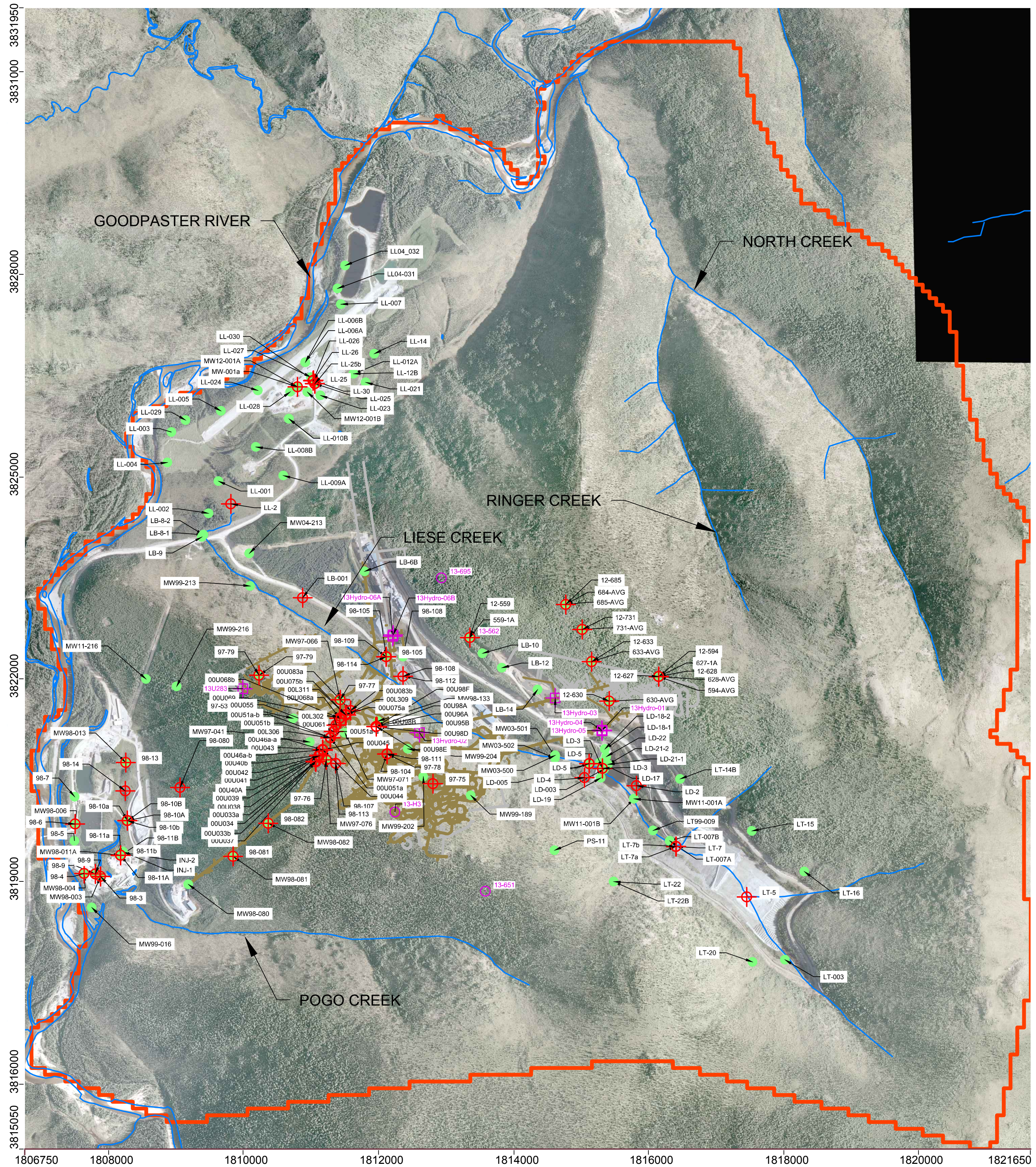
Table 9: Predicted Groundwater Budget at End of Mining Conditions

Groundwater Budget Component		Flow (gpm)		
		Pre-Mining (Steady State)	**End of Mining (December 2017)**	**Change Relative to Pre-Mining Conditions**
Inflow	Recharge from Goodpaster River	0	0	0
	Recharge from Precipitation[1]	665	686	20
	Depletion of Groundwater Storage	0	134	134
	Recharge from Liese Creek	13	64	51
	Total	**678**	**884**	**206**
Outflow	Discharge to Goodpaster River	371	300	-71
	Total Discharge to Creeks	**306**	**165**	**-141**
	Liese Creek	167	55	-113
	Ringer/North Creek	93	87	-6
	Pogo Creek	46	24	-22
	Inflow to Mine Developments	0	419	419
	Liese Zone	0	311	311
	East Deep Zone	0	94	94
	North Zone	0	14	14
	Total	**678**	**884**	**206**

Notes: 1 - Recharge was increased by 13 gpm due to lowering water table (simulated with “Recharge Out” capability of MODFLOW-SURFACT)

2- Negative change in flow compared to pre-mining conditions indicate decrease in groundwater inflow

Figures



LEGEND:

- EXISTING MINE
- PROPOSED MINE
- GROUNDWATER MODEL BOUNDARY
- MW-0 HOLES/WELLS WITH MEASURED WATER LEVELS
- MW-0 HOLES/WELLS WITH MEASURED HYDRAULIC CONDUCTIVITY
- MW-0 HOLES/WELLS WITH MEASURED WATER LEVELS AND HYDRAULIC CONDUCTIVITY
- 13-0 SURFICIAL WELLS CONSTRUCTED IN 2013
- 13-0 UNDERGROUND WELLS CONSTRUCTED IN 2013
- CREEKS/RIVERS

N

0 1000 2000

SCALE IN FEET

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SUMITOMO METAL MINING CO., LTD.

HYDROGEOLOGICAL STUDY

BASE MAP OF HYDROGEOLOGICAL STUDY AREA

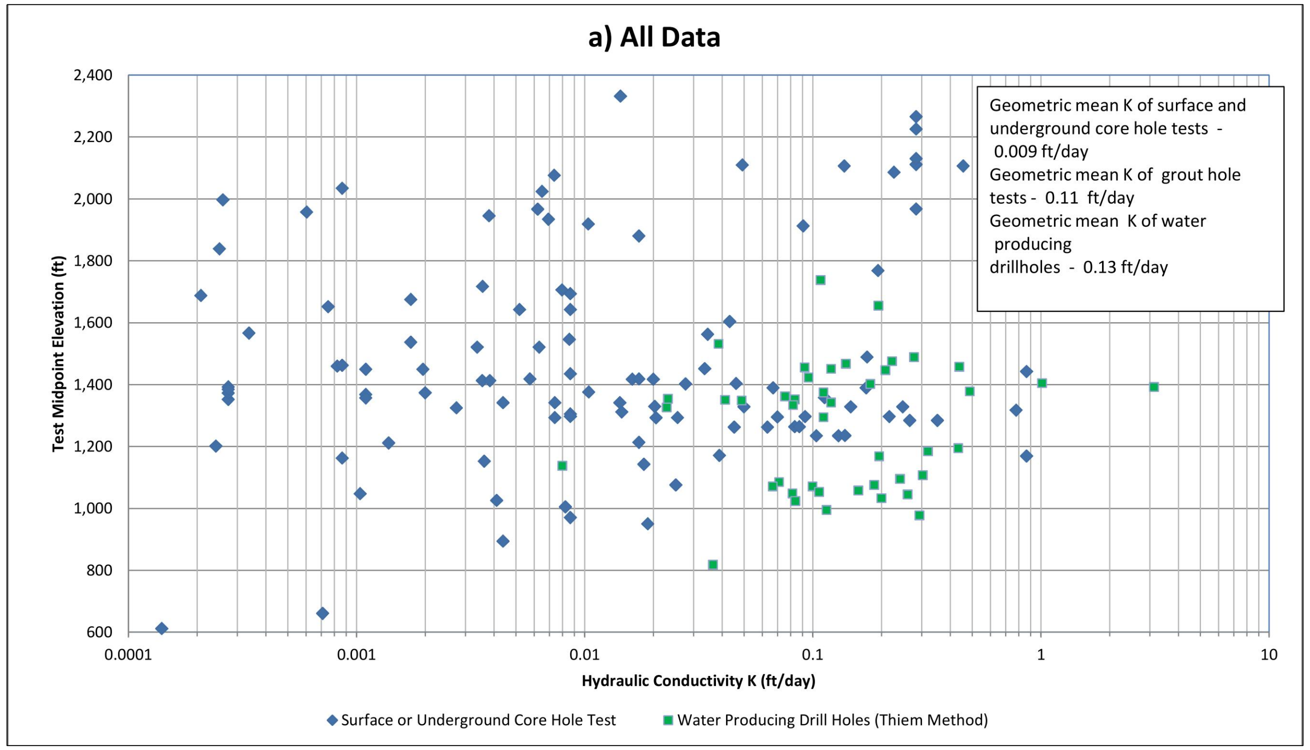
SRK JOB NO.: 147900.020

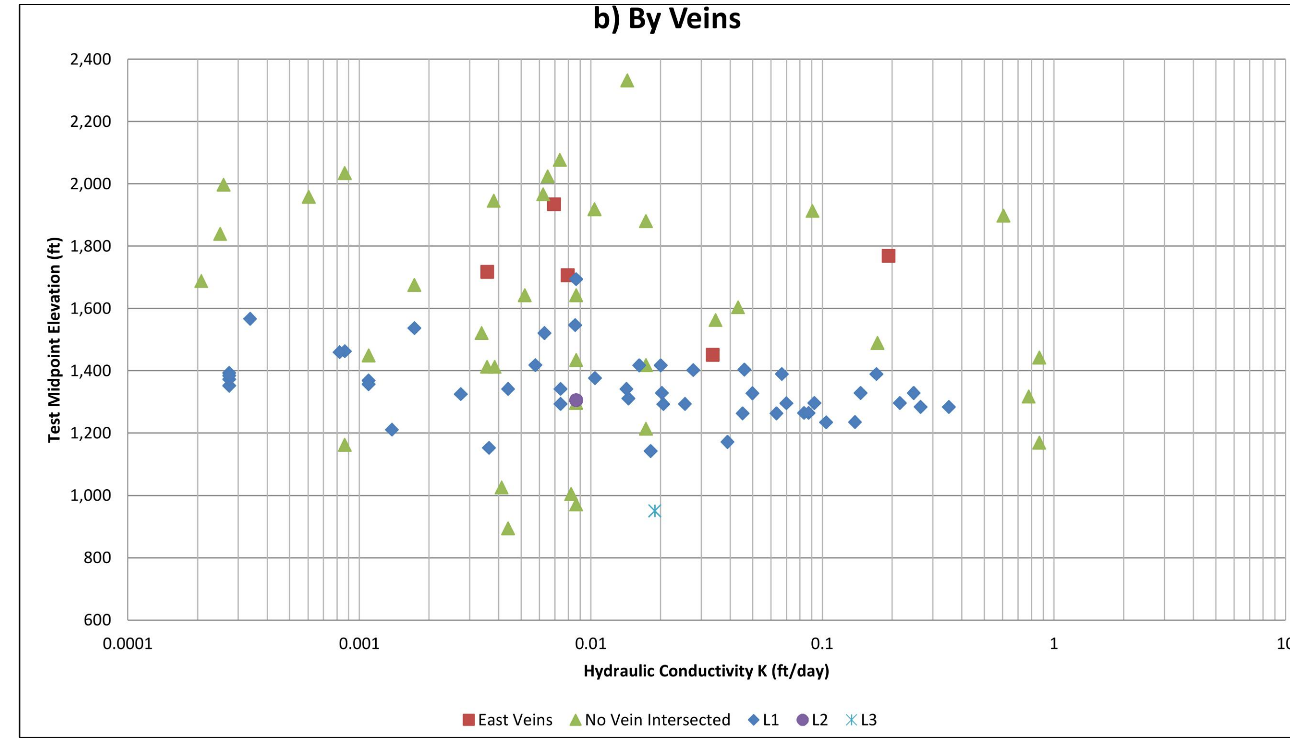
FILE NAME: 147900.020.Rev.B.Figure.1.Base.Map.Of.Hydrogeological.Study.Area.2013-12-02.dwg

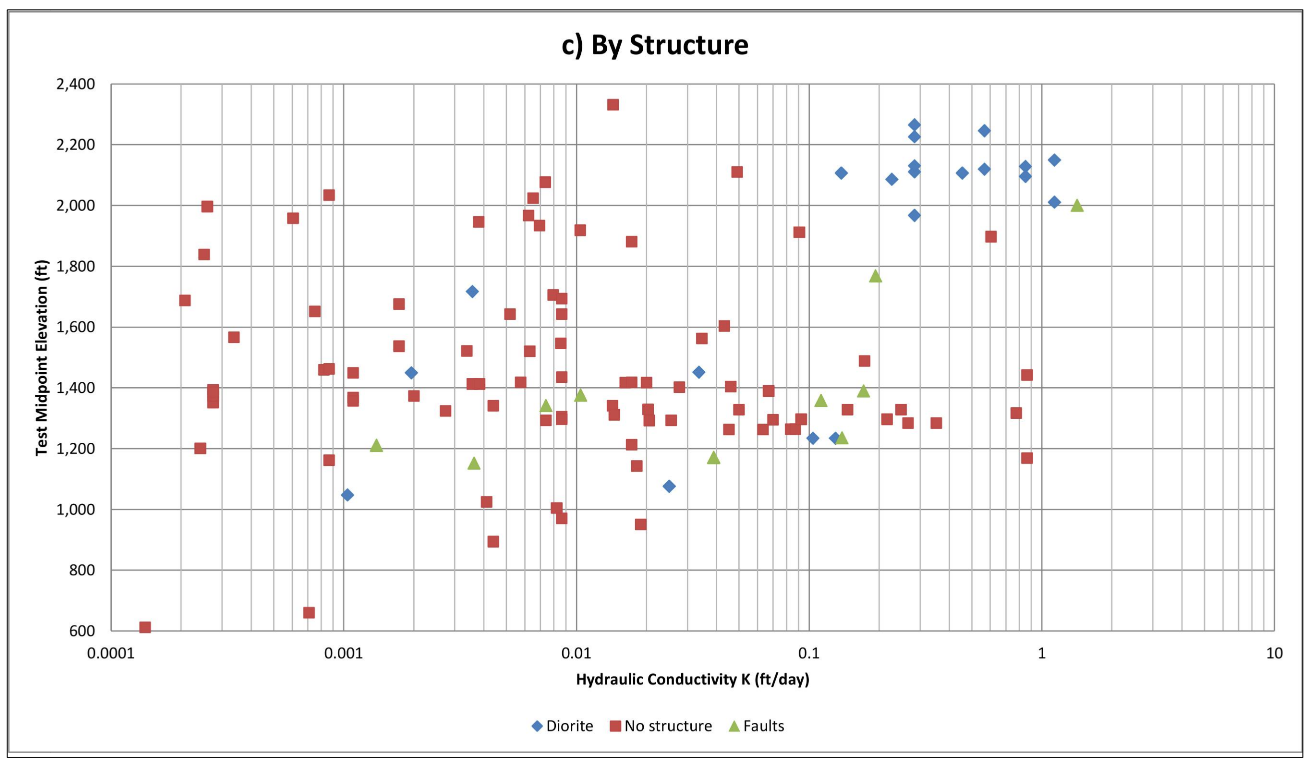
POGO UNDERGROUND MINE IN ALASKA

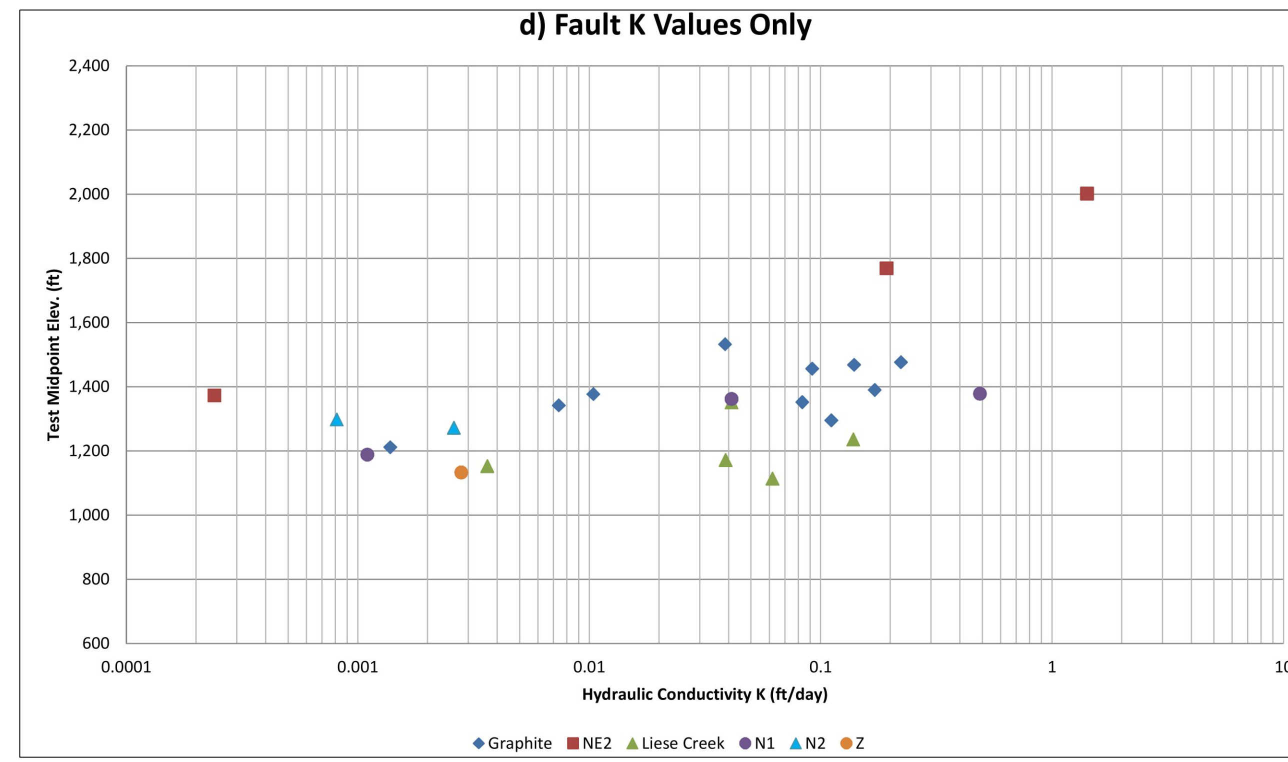
DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	1	B

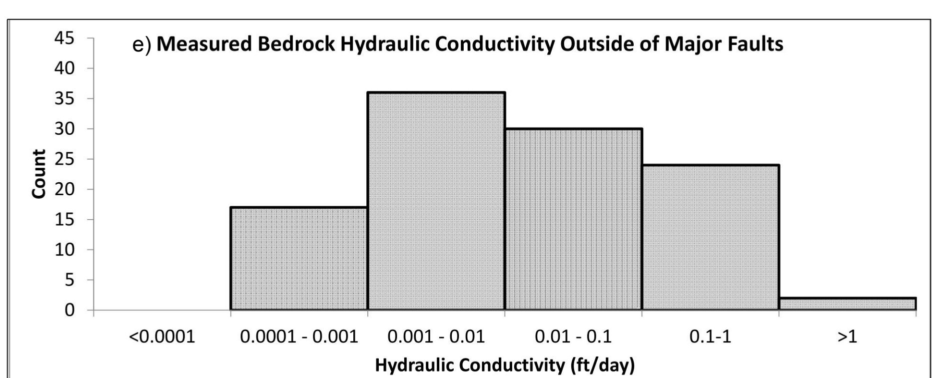
T:\Pogo Mine Alaska\East Deep Hydrogeo Project 147900.020\040_AutoCAD\Figures_Rev.B Final Report Figures 2013-12\147900.020 Rev.B Figure.1 Base Map Of Hydrogeological Study Area 2013-12-02.dwg











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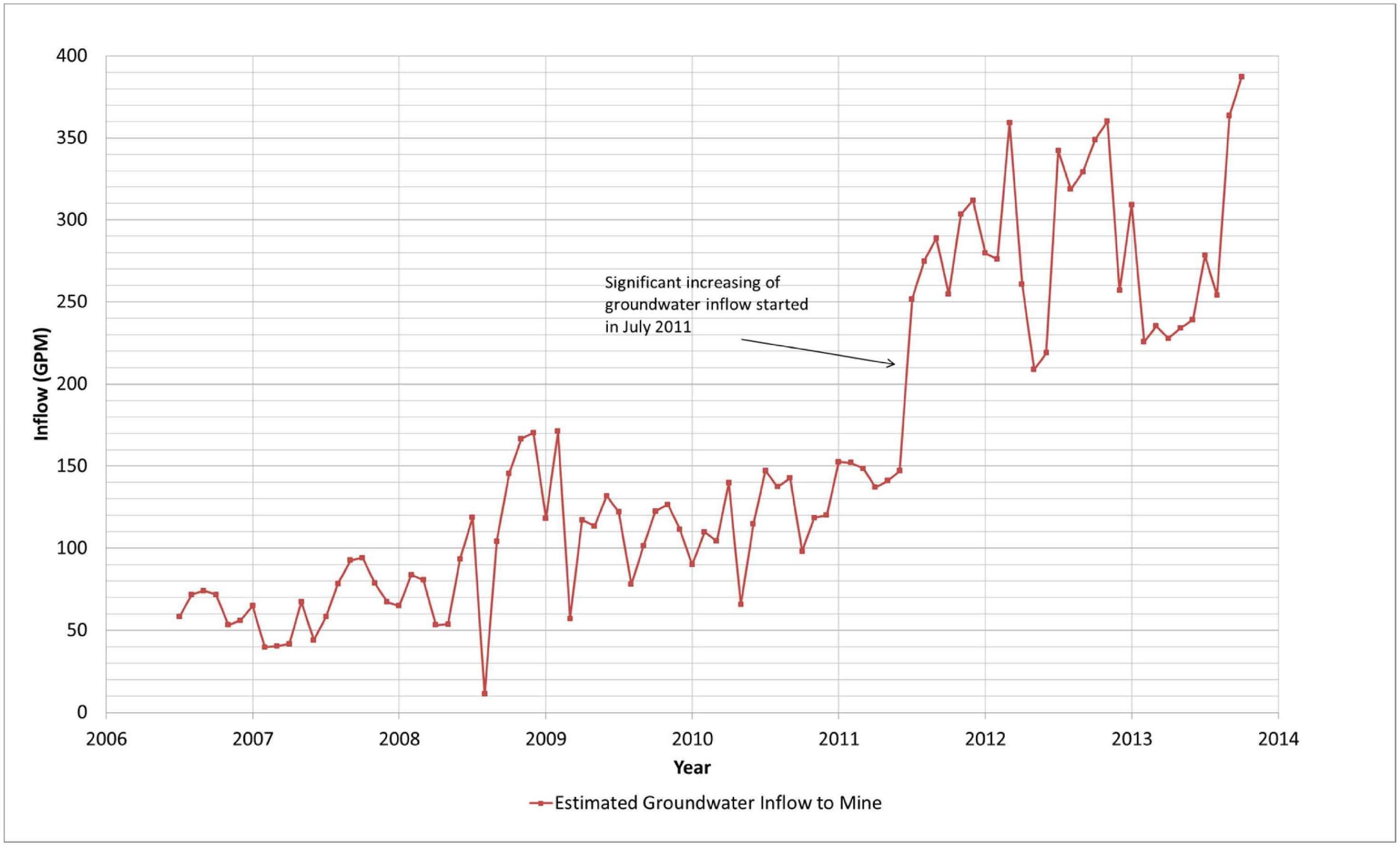
HYDROGEOLOGICAL STUDY

MEASURED HYDRAULIC CONDUCTIVITY VALUES

POGO UNDERGROUND MINE IN ALASKA

SRK JOB NO.:	147900.020
FILE NAME:	147900.020.Rev.B.Figure.2.Measured.Hydraulic.Conductivity.Values.2013-12-02.dwg

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	2	B



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HYDROGEOLOGICAL STUDY

ESTIMATED GROUNDWATER INFLOW TO MINE

POGO UNDERGROUND GOLD MINE IN ALASKA

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.3.Measured.Groundwater.Inflow.To.Mine.2013-12-02.dwg

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	3	B

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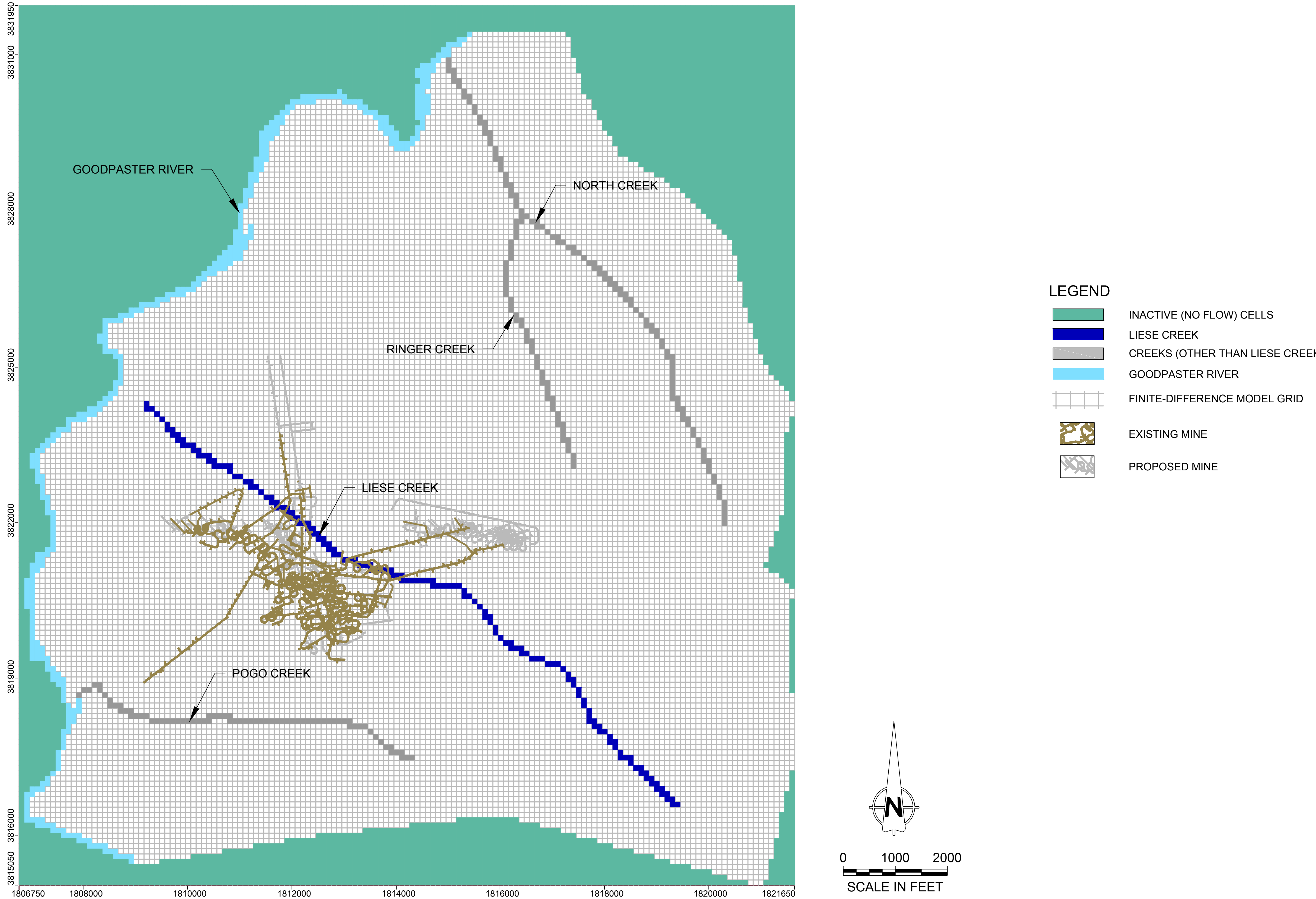
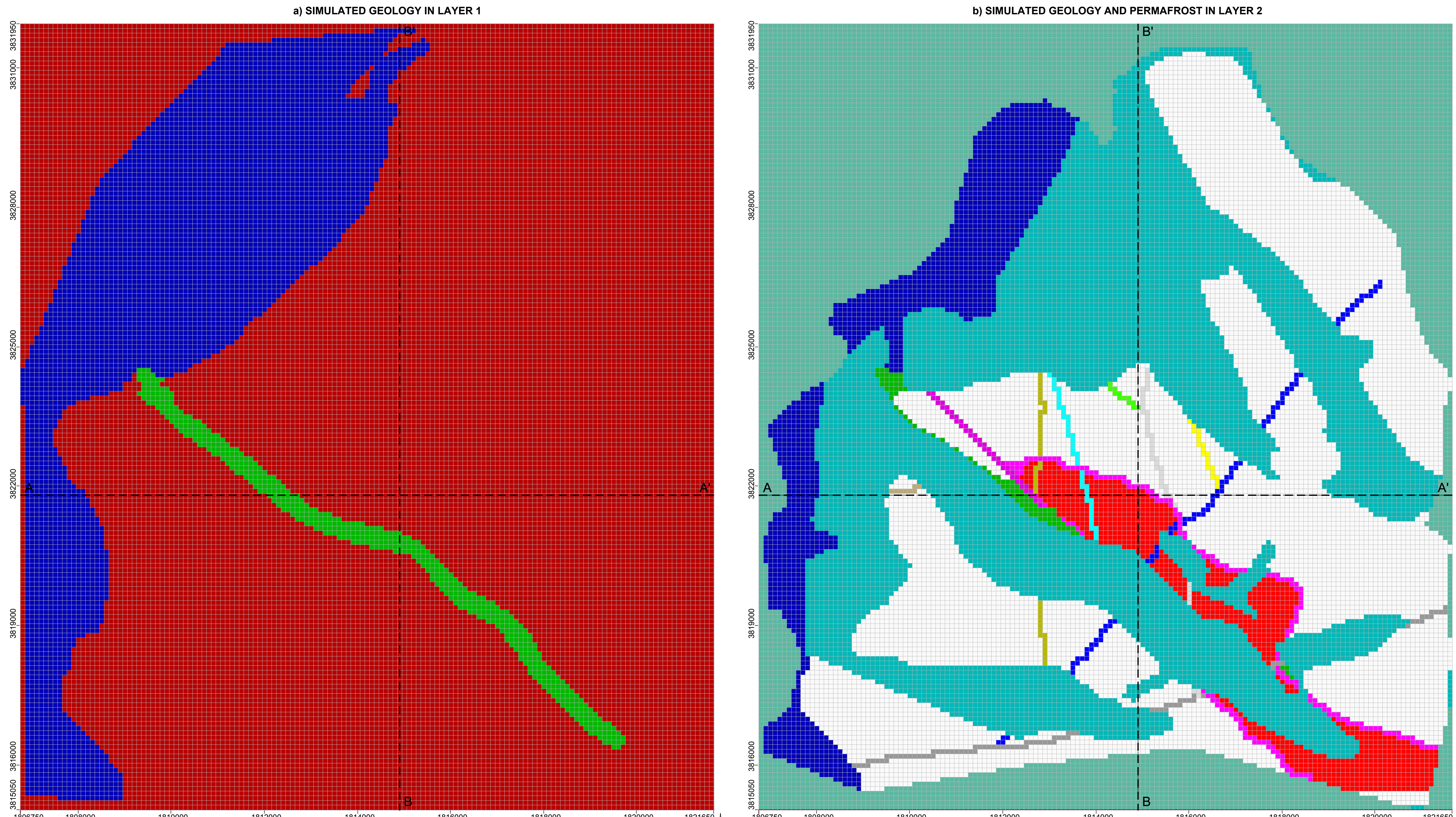


srk consulting	SUMITOMO METAL MINING CO., LTD.	HYDROGEOLOGICAL STUDY
		MAP VIEW OF FINITE-DIFFERENCE GRID AND BOUNDARY CONDITIONS
SRK JOB NO.: 147900.020	POGO UNDERGROUND MINE IN ALASKA	DATE: DEC 2013 / APPROVED: VU / FIGURE: 4 / REVISION NO. B
FILE NAME: 147900.020.Rev.B.Figure.4.Map.View.Of.Finite.Difference.Grid.And.Boundary.2013-12-02.dwg		



LEGEND

- INACTIVE (NO FLOW) CELLS
- FINITE-DIFFERENCE MODEL GRID
- CROSS-SECTION LINE

LEGEND - GEOLOGY:

- BEDROCK
- GOODPASTER RIVER ALLUVIUM
- LIESE CREEK ALLUVIUM
- PERMAFROST
- COLLUVIUM
- FAULT D_3 (INCLUDES LIESE CREEK AND GRAPHITE FAULT)
- FAULT N1
- FAULT N2
- FAULT W
- FAULT NE2
- FAULT D3_4
- FAULT D3_5a/5b
- FAULT D3_7a/7b
- FAULT Z
- FAULT RAY
- DIORITE
- DIORITE CONTACT

0 1000 2000

SCALE IN FEET

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HYDROGEOLOGICAL STUDY

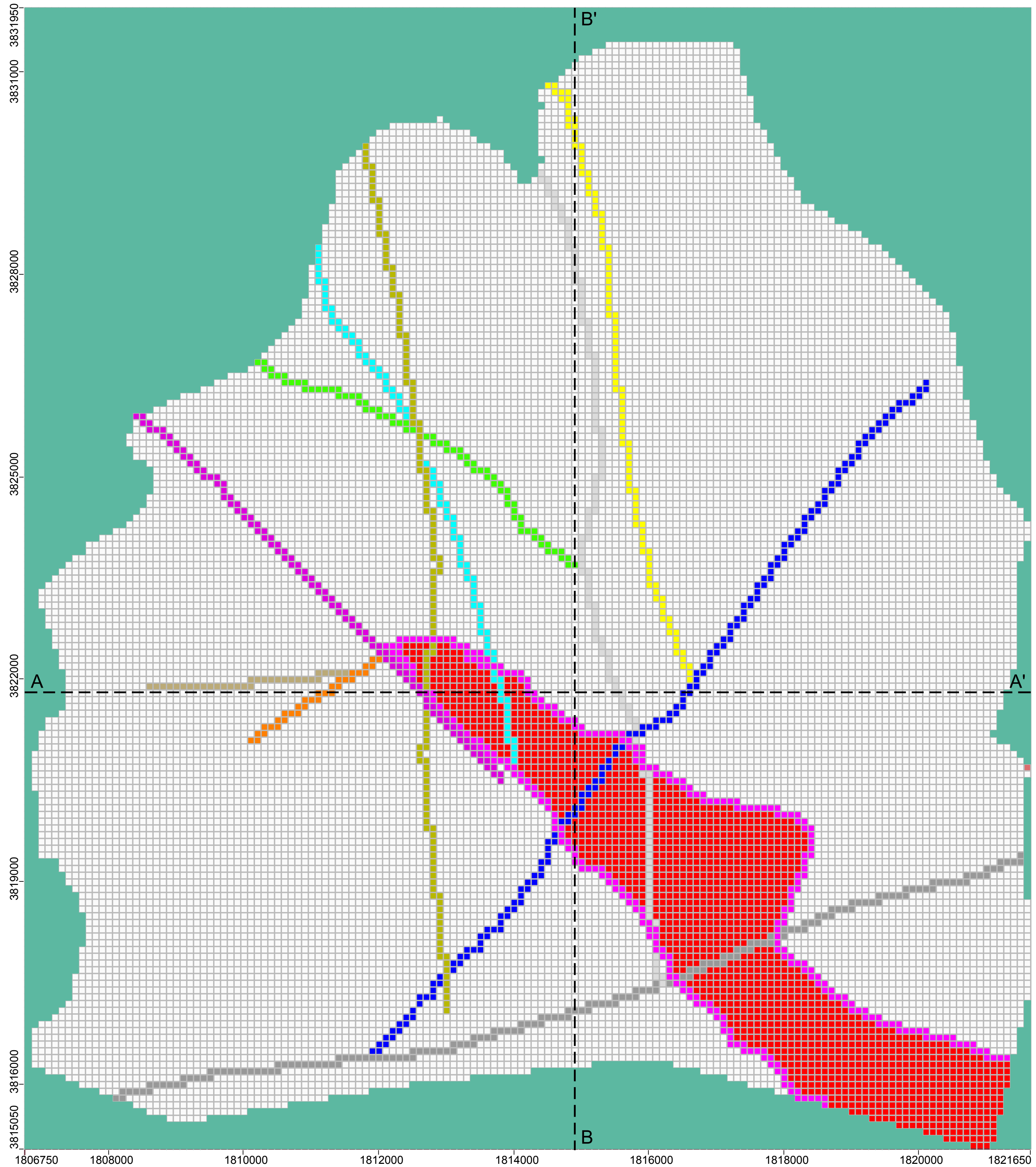
GEOLOGY SIMULATED IN LAYER 1 AND 2 OF NUMERICAL MODEL

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.5.Geology.Simulated.In.Layer.1.And.2.Of.Numerical.Model.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	5	B

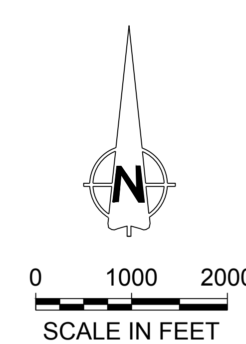


LEGEND -

- INACTIVE (NO FLOW) CELLS
- FINITE-DIFFERENCE MODEL GRID
- CROSS-SECTION LINE

LEGEND - GEOLOGY:

- BEDROCK
- FAULT D_3 (INCLUDES LIESE CREEK AND GRAPHITE FAULT)
- FAULT N1
- FAULT N2
- FAULT W
- FAULT NE2
- FAULT D3_4
- FAULT D3_5a/5b
- FAULT D3_7a/7b
- FAULT Z
- FAULT RAY
- DIORITE
- DIORITE CONTACT



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SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.6.Geology.Simulated.In.Layers.3.Thru.16.2013-12-02.dwg

SUMITOMO METAL MINING CO., LTD.

POGO UNDERGROUND MINE IN ALASKA

HYDROGEOLOGICAL STUDY

GEOLOGY SIMULATED IN LAYERS 3 THROUGH 16

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	6	B

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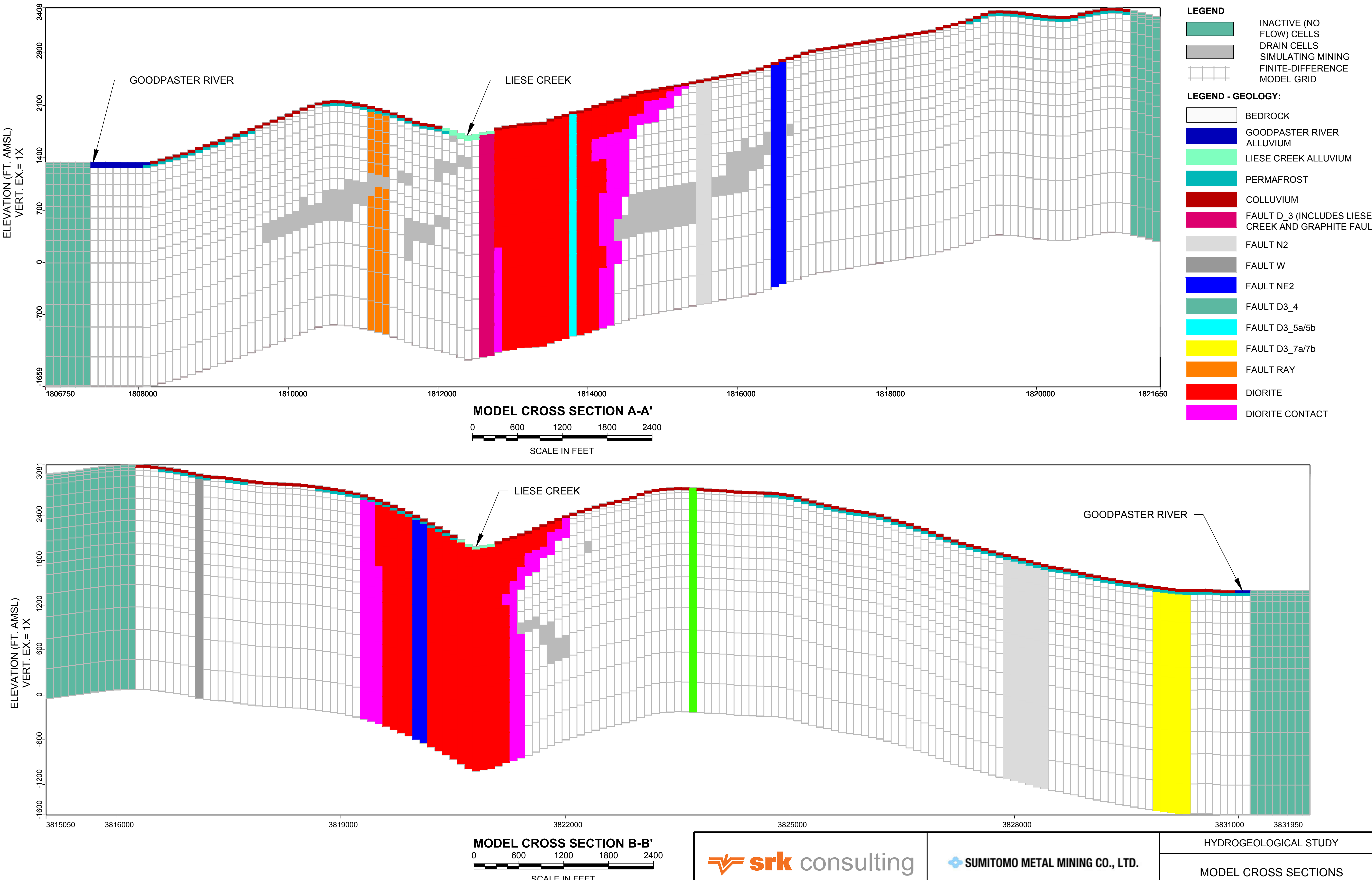

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SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.7.Model.Cross.Sections.A.And.B.2013-12-02.dwg

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POGO UNDERGROUND MINE IN ALASKA

HYDROGEOLOGICAL STUDY

MODEL CROSS SECTIONS A-A' AND B-B'

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	7	B

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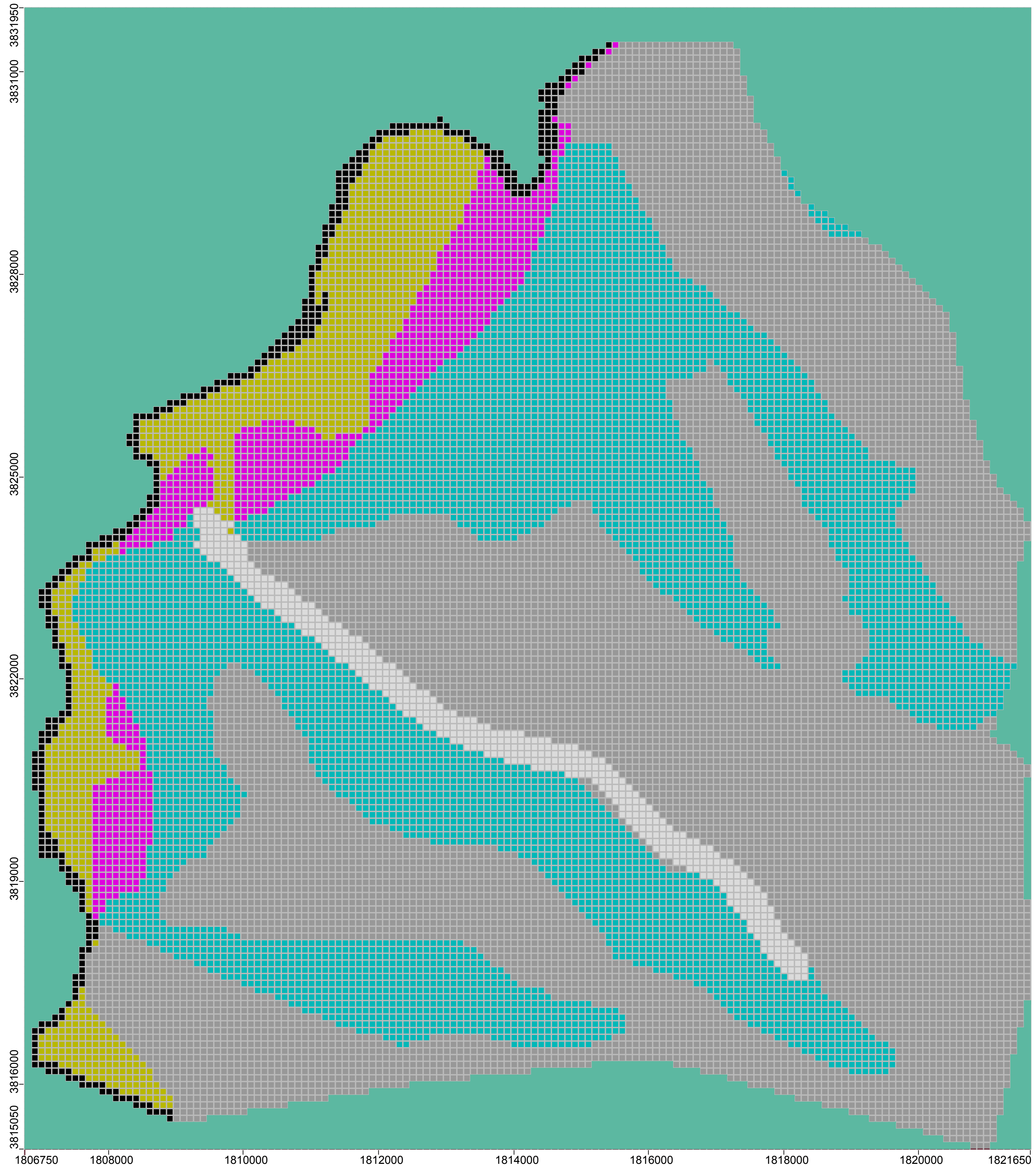
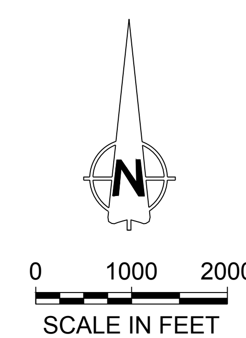


LEGEND:

(olive)	RECHARGE OF 4 IN/YR. - GOODPASTER RIVER ALLUVIUM
(magenta)	RECHARGE OF 2 IN/YR. - GOODPASTER RIVER ALLUVIUM WITH PERMAFROST IN LAYER 2
(light grey)	RECHARGE OF 4 IN/YR. - LIESE CREEK - ALLUVIUM
(grey)	RECHARGE OF 4.5 IN/YR. - COLLUVIUM/BEDROCK
(cyan)	RECHARGE OF 2 IN/YR. - COLLUVIUM/BEDROCK WITH PERMAFROST IN LAYER 2
(black)	RECHARGE OF 0 IN/YR. - GOODPASTER RIVER
(green)	INACTIVE (NO FLOW) CELLS
(grid)	FINITE-DIFFERENCE MODEL GRID

NOTE:
RECHARGE OUT CAPABILITY OF MODFLOW-SURFACT WAS APPLIED OUTSIDE THE GOODPASTER RIVER ALLUVIUM. WHERE HYDRAULIC HEADS ARE ABOVE THE GROUND SURFACE RECHARGE IS REJECTED.



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HYDROGEOLOGICAL STUDY

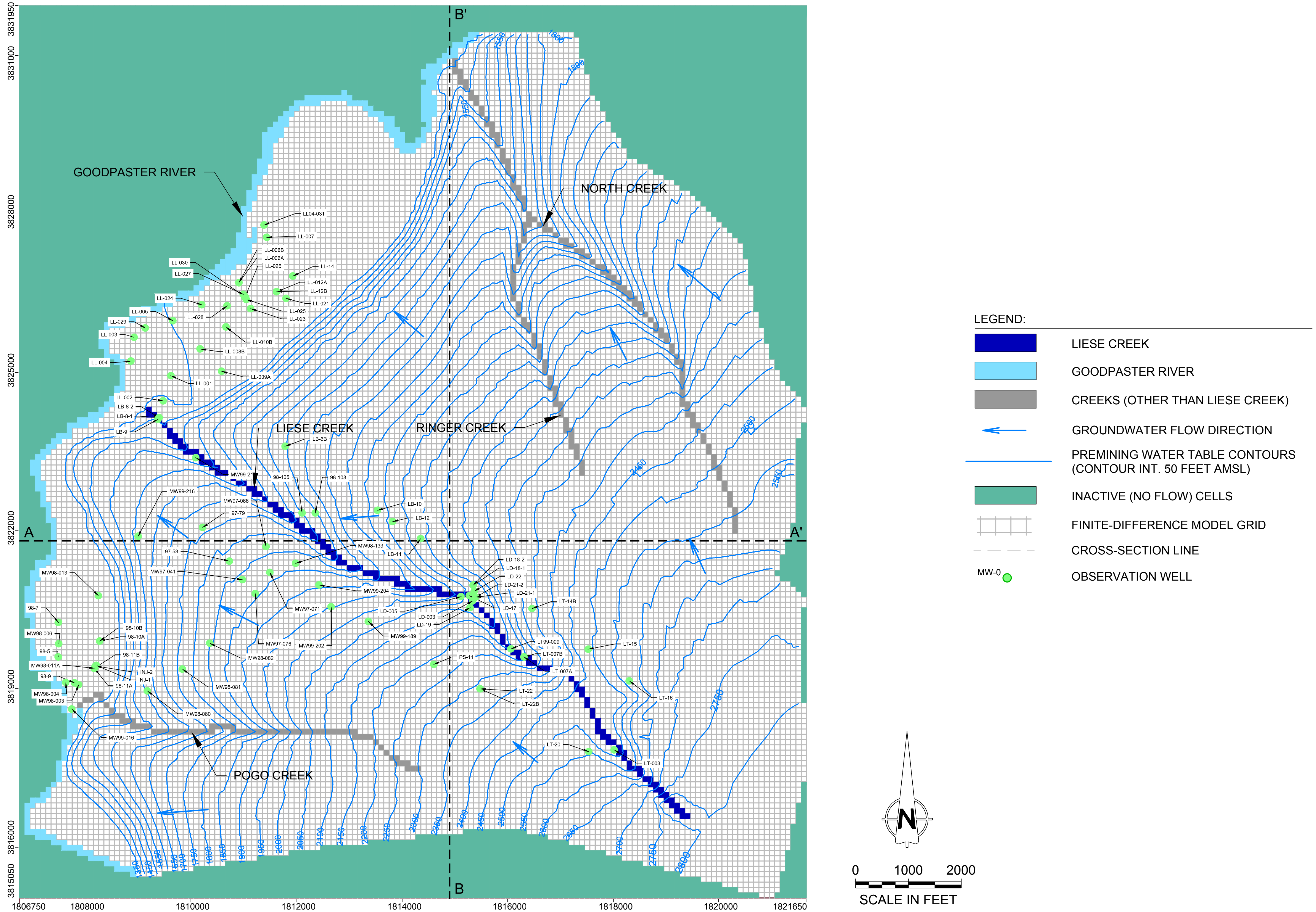
RECHARGE FROM PRECIPITATION INCORPORATED INTO GROUNDWATER MODEL

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.8.Recharge.From.Precipitation.Incorporated.Into.Groundwater.Model.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	8	B



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SUMITOMO METAL MINING CO., LTD.

HYDROGEOLOGICAL STUDY

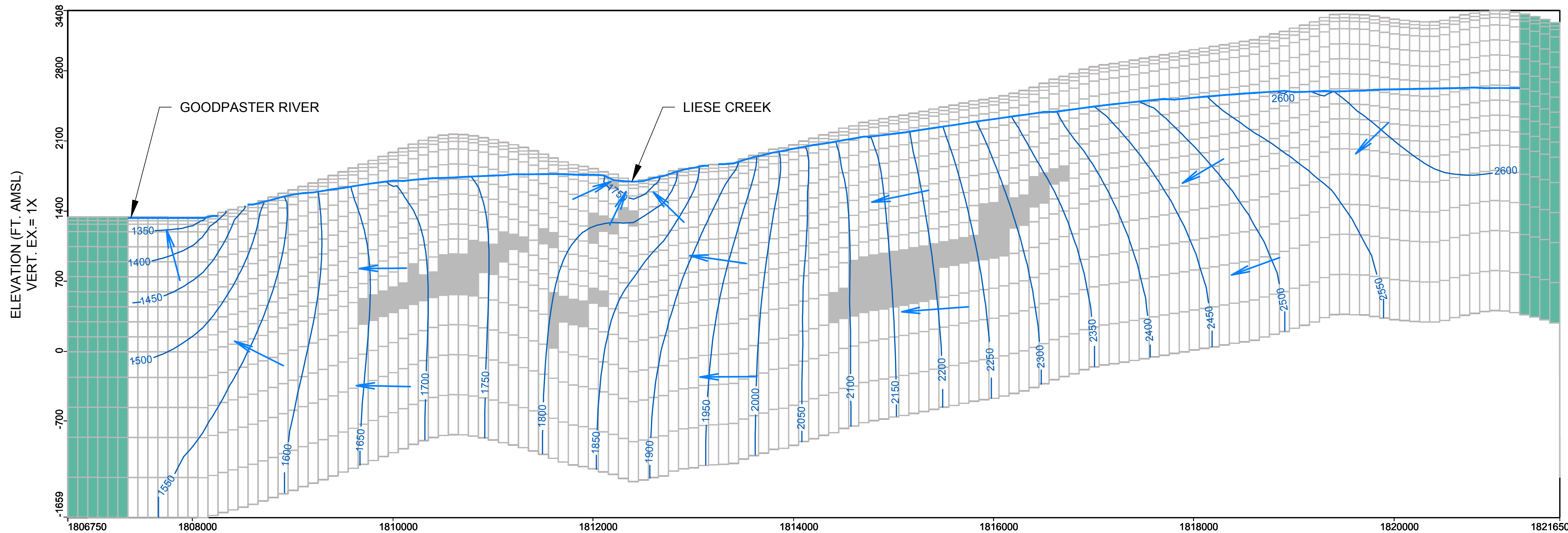
SIMULATED PRE-MINING WATER TABLE UNDER STEADY STATE CONDITIONS

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.9.Simulated.Pre.Mining.Water.Table.Under.Steady.State.Conditions.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	9	B



MODEL CROSS SECTION A-A'

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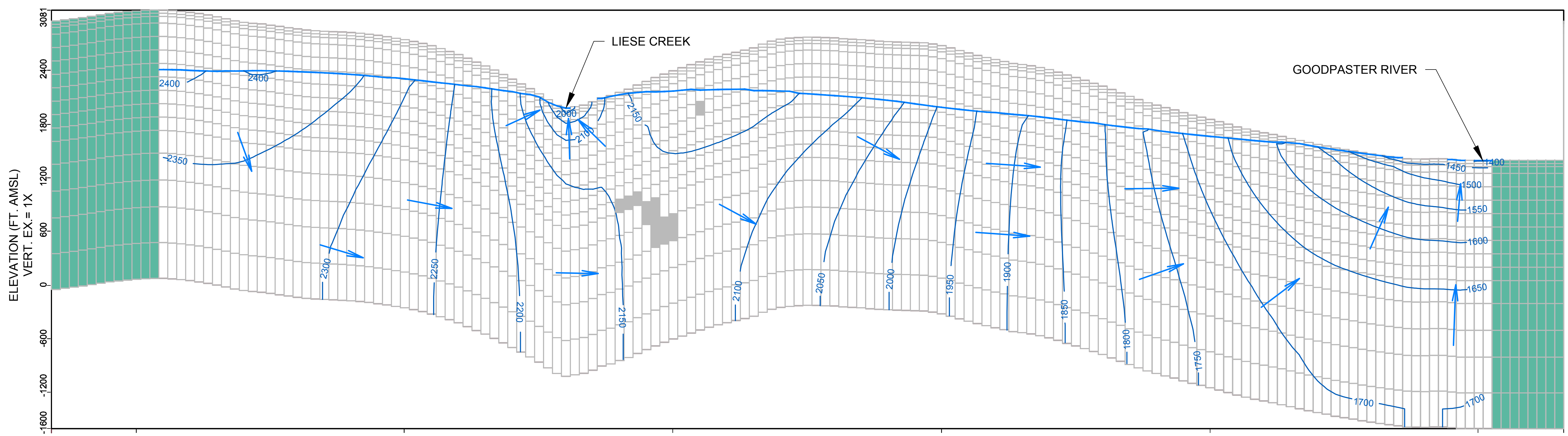
SCALE IN FEET



MODEL CROSS SECTION B-B'

0 600 1200 1800 2400
SCALE IN FEET

GROUNDWATER FLOW DIRECTION

PRE-MINING WATER TABLE

EQUIPOTENTIAL CONTOUR LINE (50 FEET INT. AMSL)

DRAIN CELLS SIMULATING MINE INFLOW (NOT USED FOR PRE-MINING SIMULATIONS; SHOWN FOR DEMONSTRATION PURPOSE)

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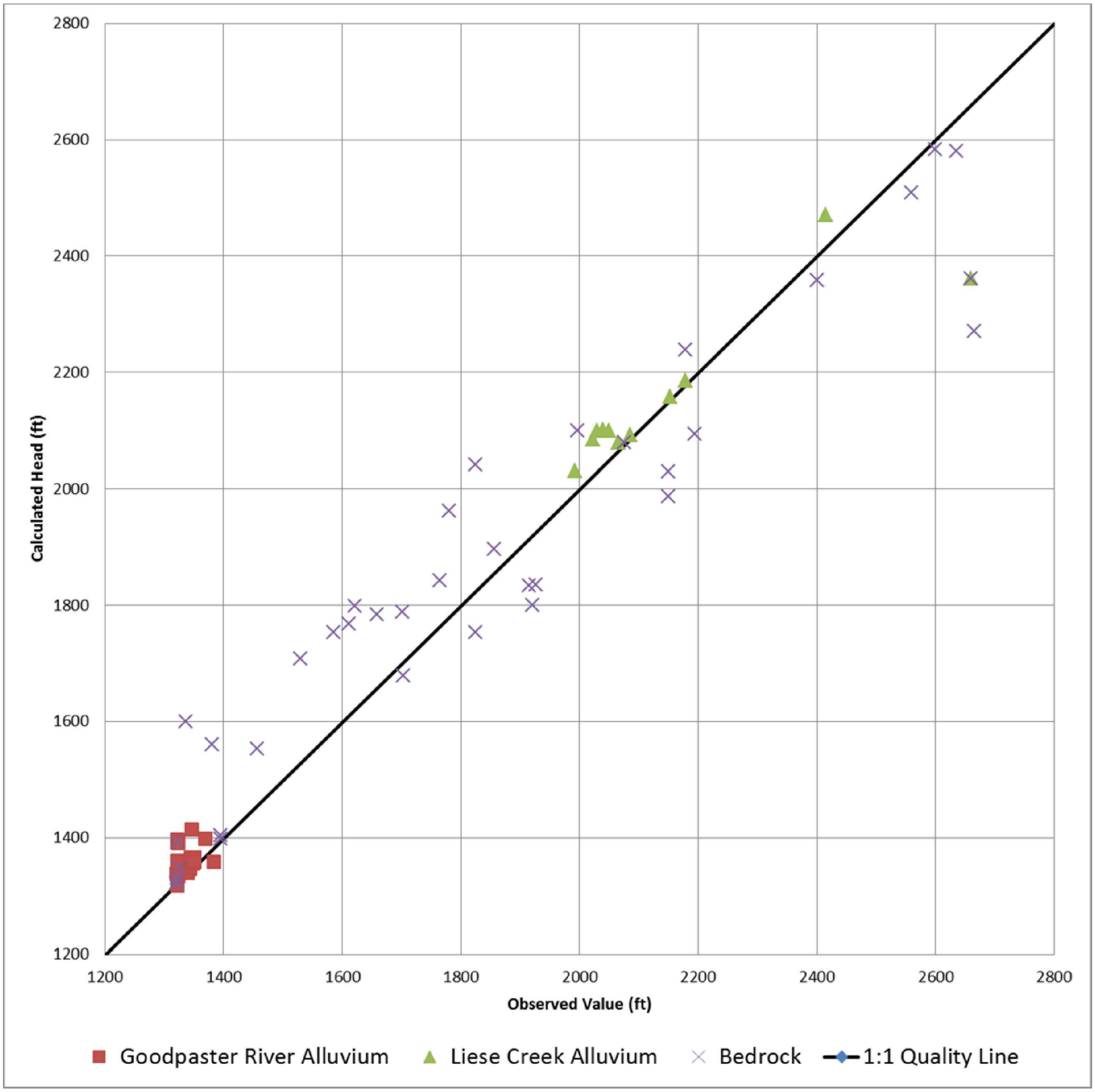
HYDROGEOLOGICAL STUDY

CROSS SECTIONS SHOWING SIMULATED PRE-MINING WATER TABLE UNDER STEADY STATE CONDITIONS

POGO UNDERGROUND MINE IN ALASKA

SRK JOB NO.:	147900.020
FILE NAME:	147900.020.Rev.B.Figure.10.Cross.Sections.Showing.Simulated.Pre.Mining.Water.Table.2013-12-02.dwg

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	10	B



Calibration Statistic	Value
Average Error (Measured – Simulated) (ft)	-16.1
RMSE (ft)	99.8
Normalized RMSE	7.4%

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HYDROGEOLOGICAL STUDY

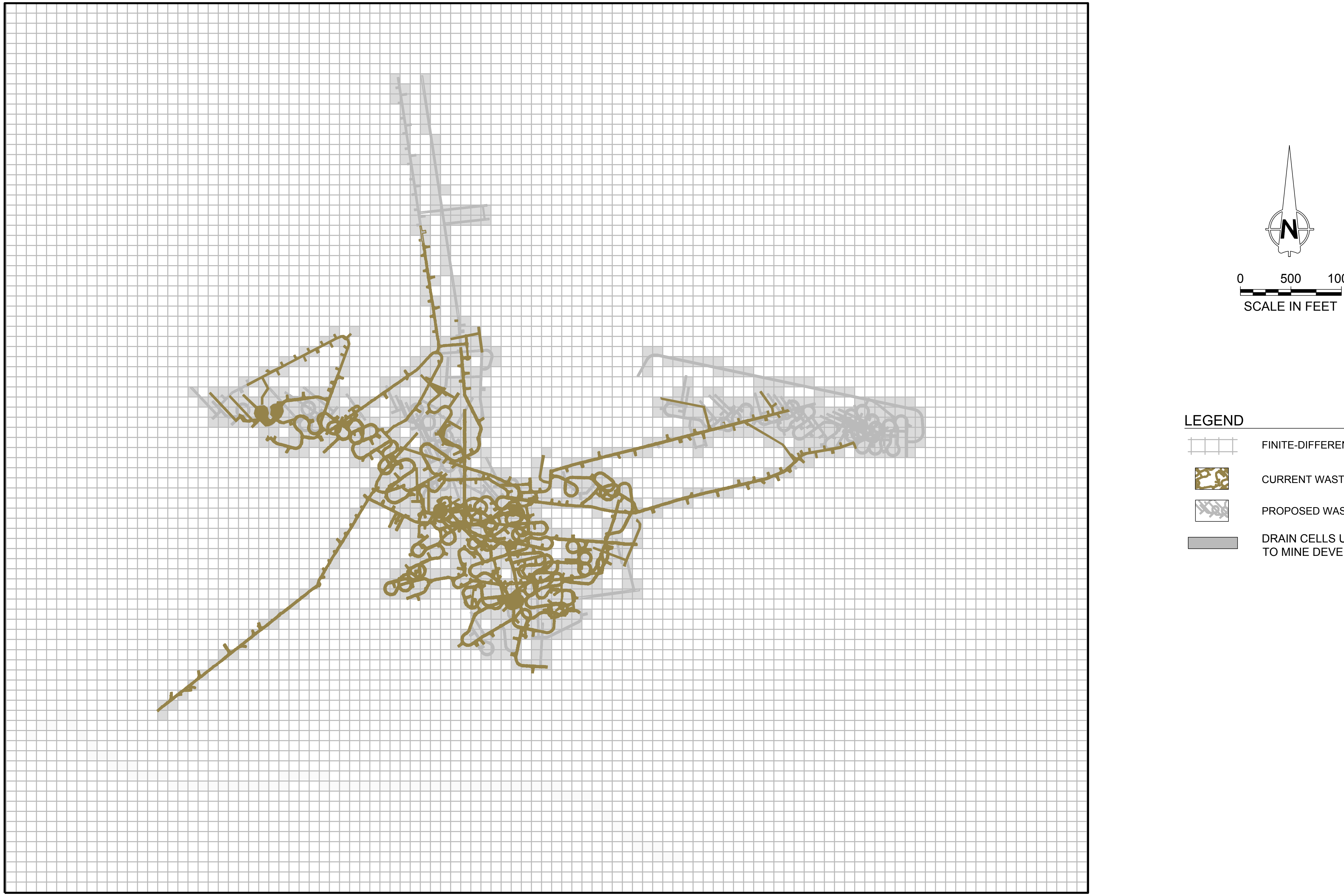
RESULTS OF STEADY STATE CALIBRATION OF MODEL TO MEASURED WATER LEVELS

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.11.Results.Of.Steady.State.Calibration.2013-12-02.dwg

POGO UNDERGROUND GOLD MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	11	B



LEGEND

- FINITE-DIFFERENCE MODEL GRID
- CURRENT WASTE MANAGEMENT TUNNELS
- PROPOSED WASTE MANAGEMENT TUNNELS
- DRAIN CELLS USED TO SIMULATE INFLOW TO MINE DEVELOPMENTS

NOTES:
1. DRAIN CELLS FROM ALL MODEL LAYERS ARE SHOWN IN THIS FIGURE.
2. EXISTING MINE DEVELOPMENTS ARE SHOWN AS OF OCTOBER 2013.

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HYDROGEOLOGICAL STUDY

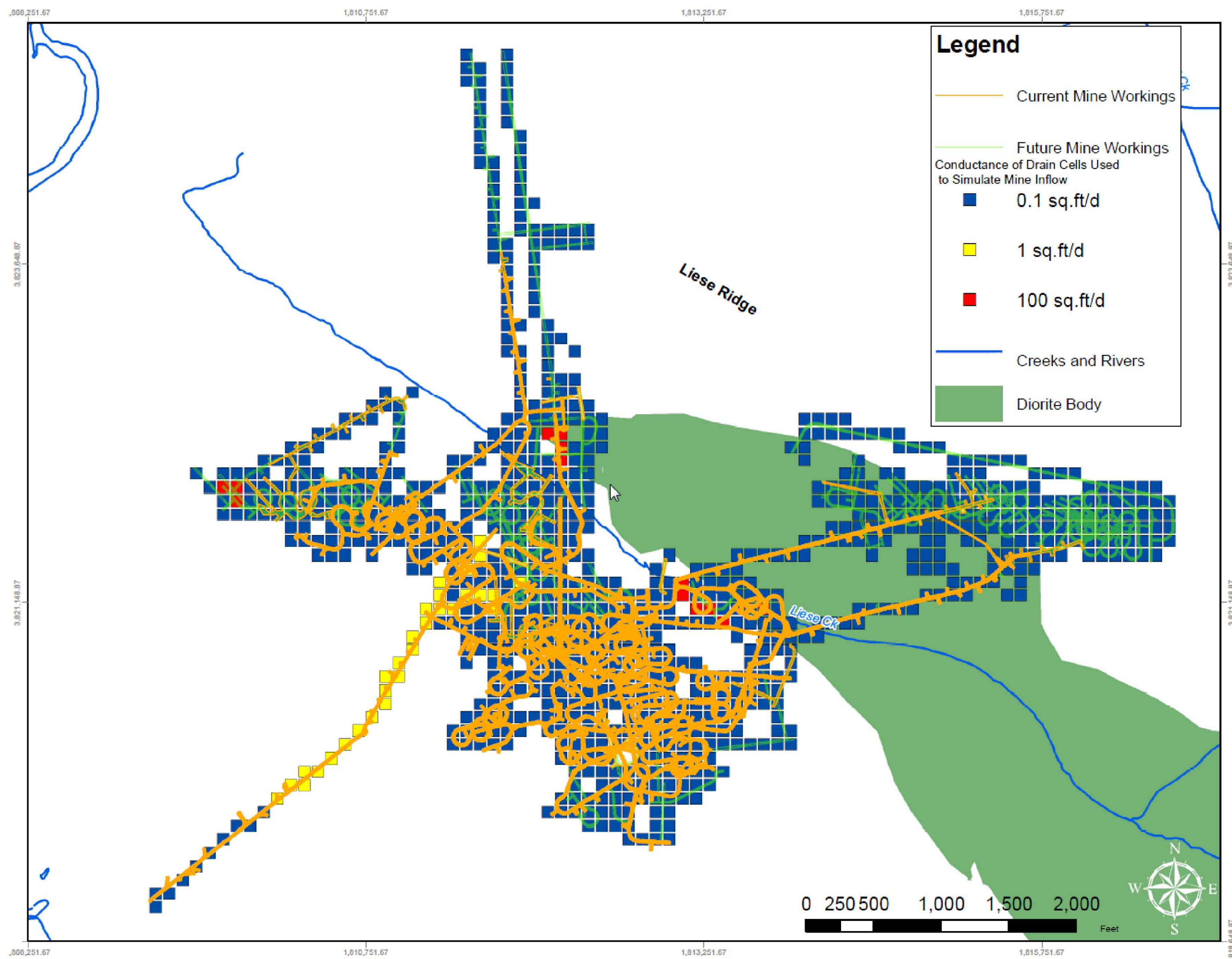
MINE PLANS INCORPORATED INTO MODEL

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.12.Mine.Plans.Incorporated.Into.Model.2013-12-02.dwg

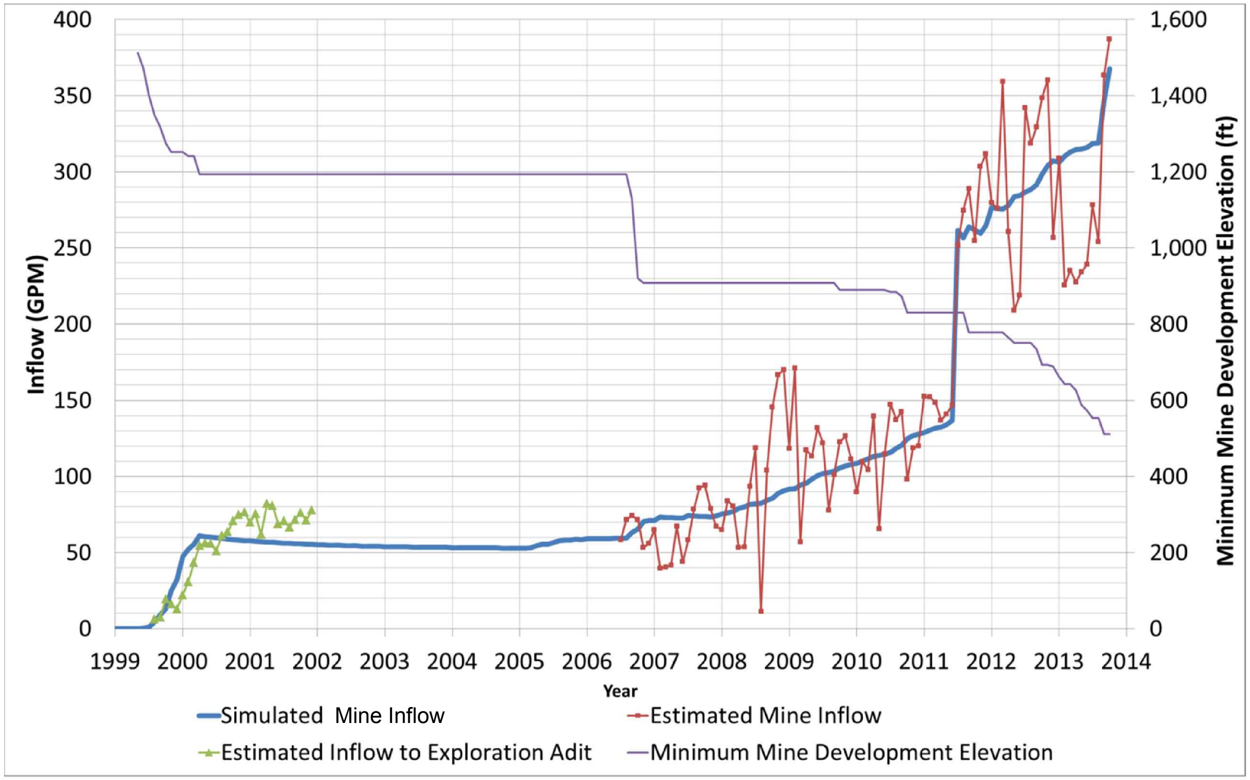
POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	12	B



NOTE:
HIGH CONDUCTANCE VALUES OF 100 FT^2/DAY WERE APPLIED
IN THE AREAS WHERE THE MAJOR INFLOWS OCCURRED.

srk consulting	SUMITOMO METAL MINING CO., LTD.	HYDROGEOLOGICAL STUDY
SRK JOB NO.: 147900.020	POGO UNDERGROUND MINE IN ALASKA	DRAIN CELL CONDUCTANCE USED TO SIMULATE UNDERGROUND DEVELOPMENTS
FILE NAME: 147900.020.Rev.B.Figure.13.Drain.Cell.Conductance.2013-05-12-02.dwg		DATE: DEC 2013 / APPROVED: VU / FIGURE: 13 / REVISION NO. B



NOTE THAT ESTIMATED INFLOW IS A CALCULATION FROM PUMP UP RATE FROM UG TO WTP

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HYDROGEOLOGICAL STUDY

RESULTS OF TRANSIENT CALIBRATION OF MODEL TO MEASURED MINE INFLOW

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.14.Results.Of.Transient.Calibration.2013-12-02.dwg

POGO UNDERGROUND GOLD MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	14	B

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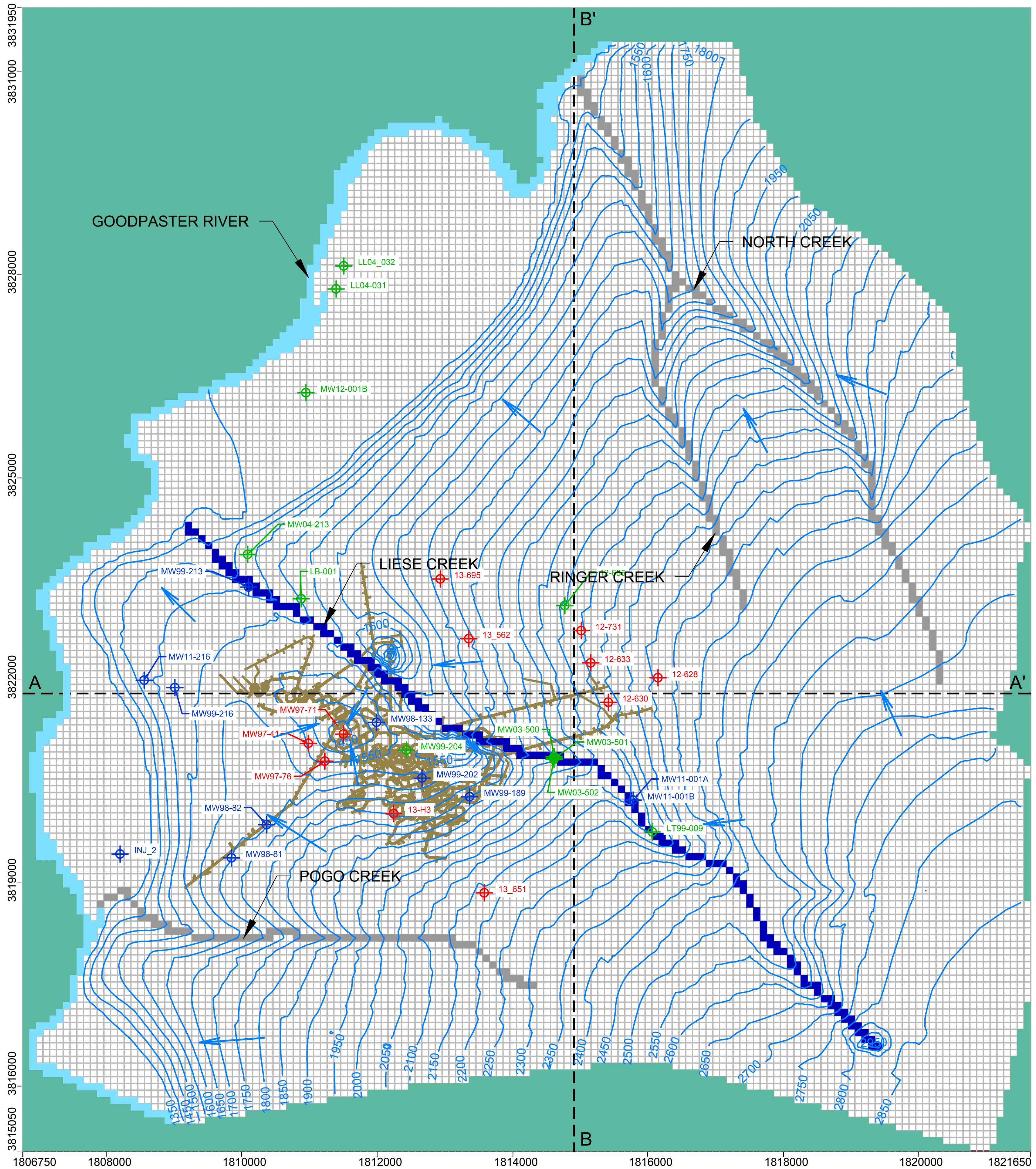

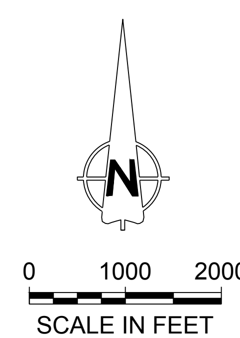

LEGEND:

- LIESE CREEK
- GOODPASTER RIVER
- CREEKS (OTHER THAN LIESE CREEK)
- INACTIVE (NO FLOW) CELLS
- FINITE-DIFFERENCE MODEL GRID
- CROSS-SECTION LINE
- SIMULATED CURRENT WATER TABLE (CONTOUR 50 FEET INT. AMSL)
- GROUNDWATER FLOW DIRECTION
- EXISTING MINE

WELLS WITH WATER LEVELS USED FOR TRANSIENT MODEL CALIBRATION:

- MW-00 MODELED WATER LEVEL IS GREATER THAN MEASURED
- MW-00 MODELED WATER LEVEL IS WITHIN TOLERANCE WITH MEASURED
- MW-00 MODELED WATER LEVEL IS LESS THAN MEASURED

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HYDROGEOLOGICAL STUDY

SIMULATED WATER TABLE AT CURRENT MINING CONDITIONS (PLAN VIEW)

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.15.Simulated.Water.Levels.At.Current.Mining.Conditions.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	15	B

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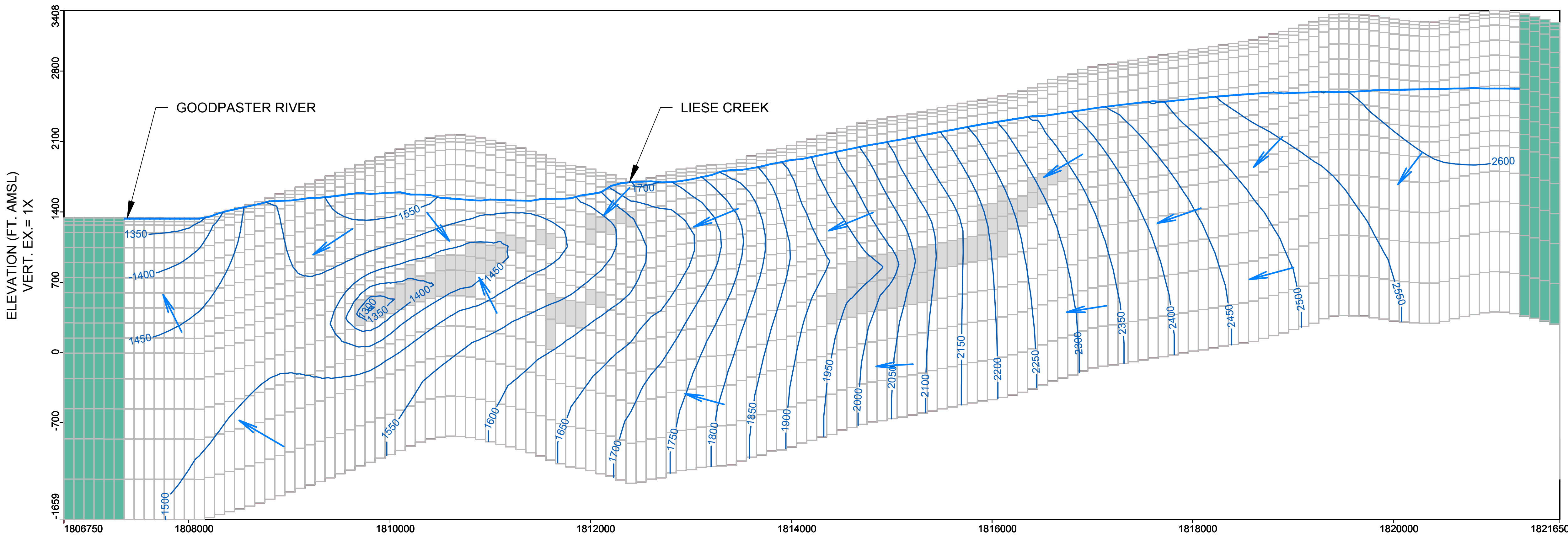
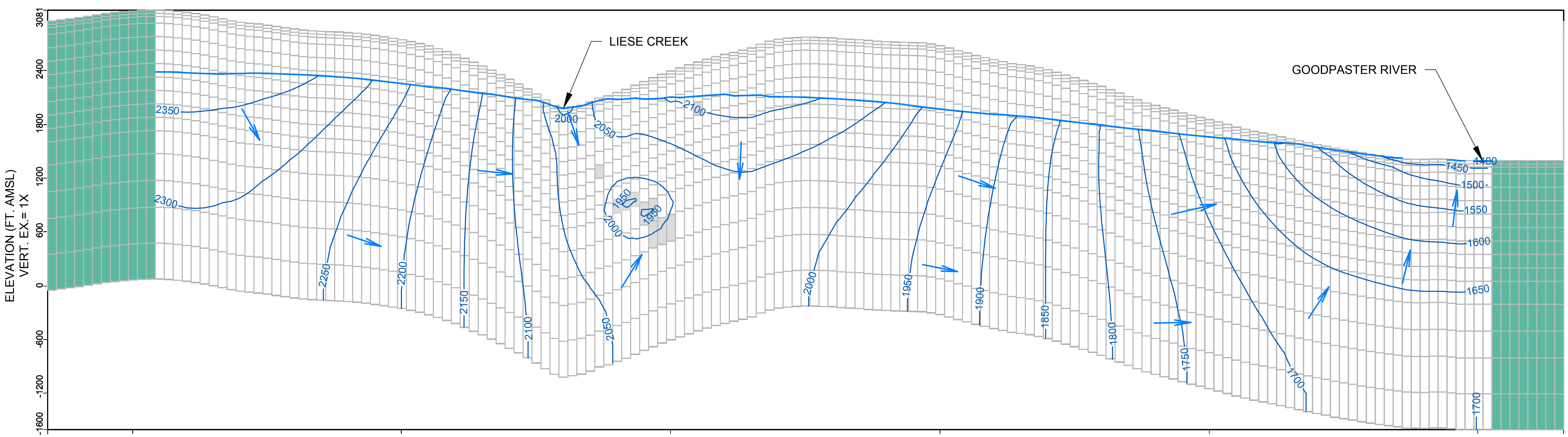


MODEL CROSS SECTION A-A'

0 600 1200 1800 2400

SCALE IN FEET



MODEL CROSS SECTION B-B'

0 600 1200 1800 2400

SCALE IN FEET

GROUNDWATER FLOW DIRECTION

WATER TABLE AT CURRENT MINING CONDITIONS

DRAIN CELLS SIMULATING MINE INFLOW

EQUIPOTENTIAL CONTOUR LINE
(50 FEET INT. AMSL)

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SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.16.Cross.Sections.Simulated.Water.Levels.2013-12-02.dwg

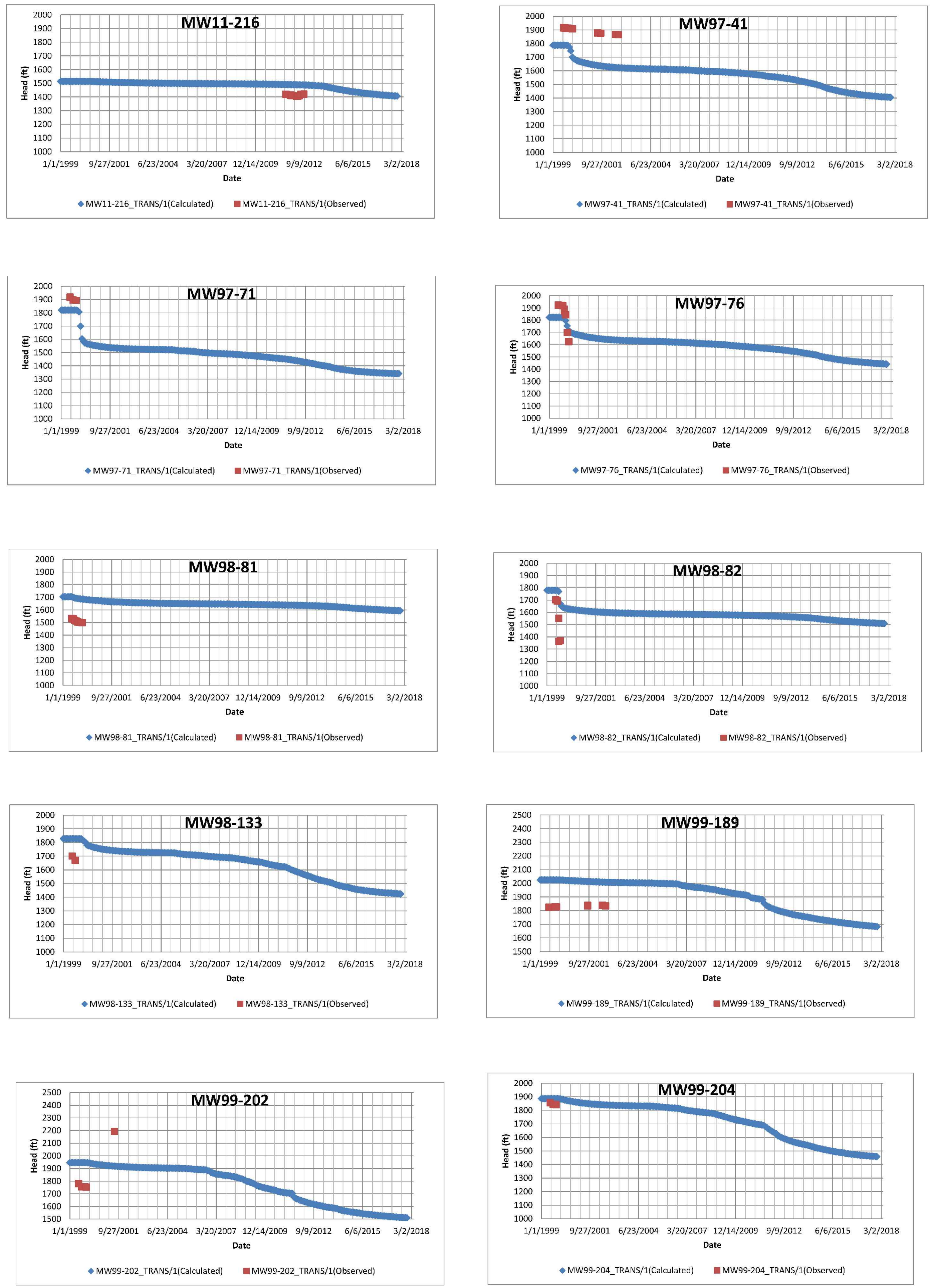
POGO UNDERGROUND MINE IN ALASKA

HYDROGEOLOGICAL STUDY

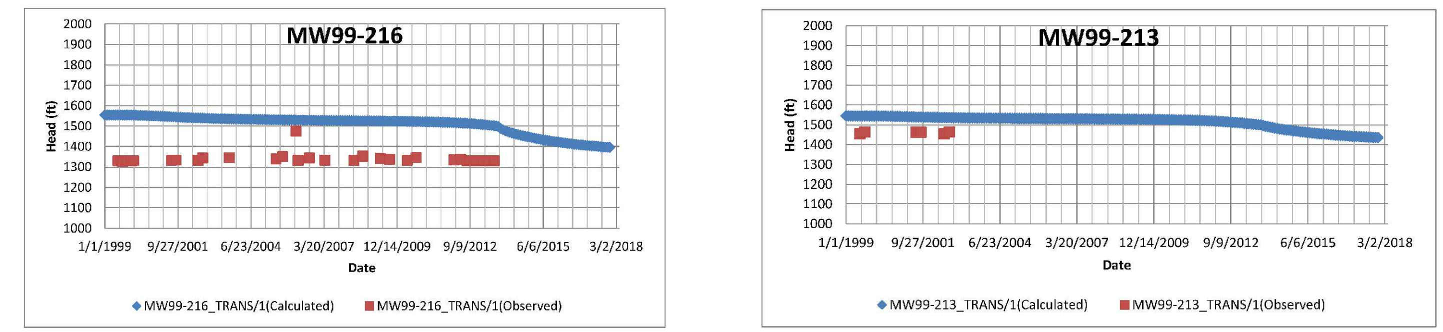
SIMULATED WATER TABLE AT CURRENT MINING CONDITIONS (CROSS SECTIONS)

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	16	B

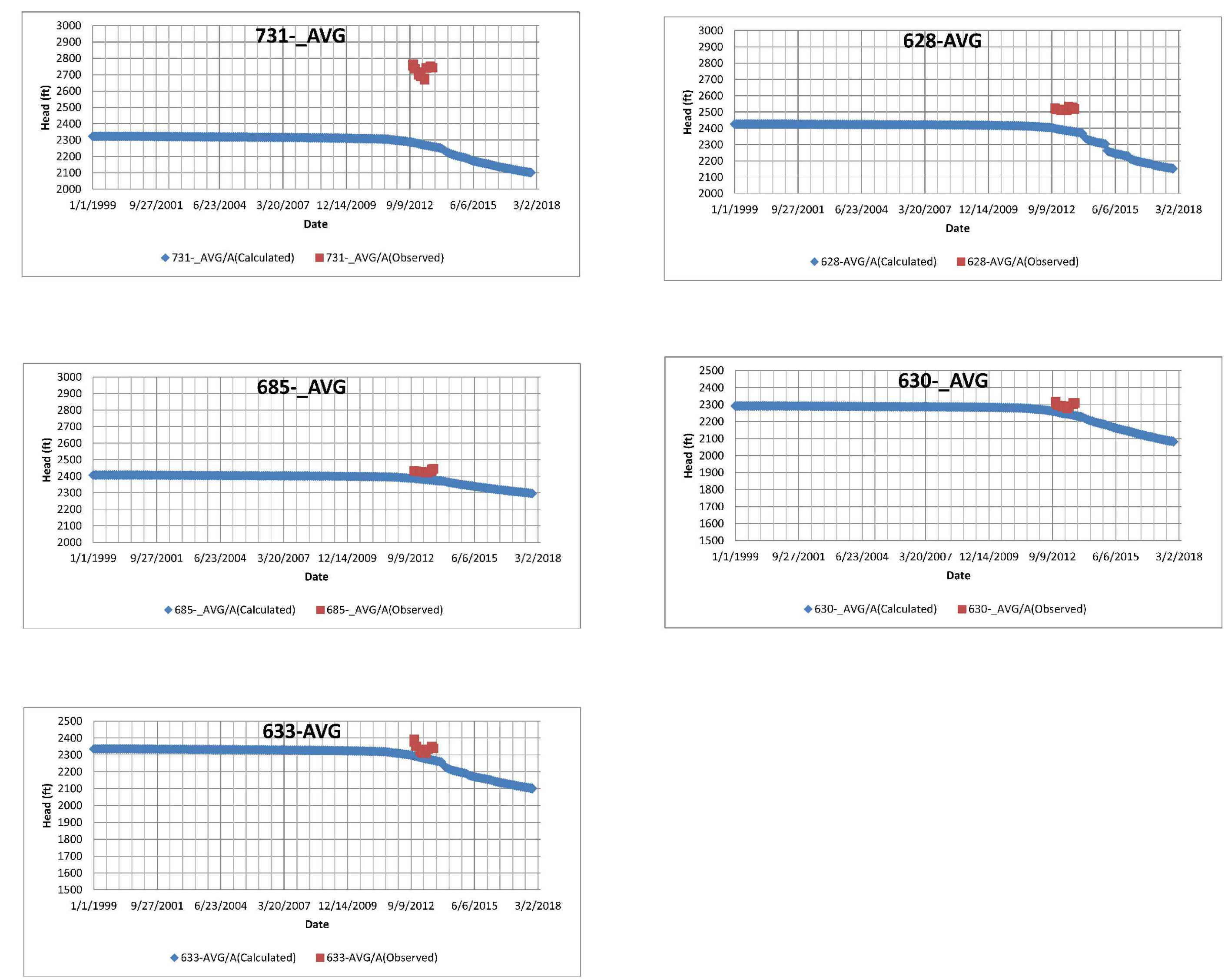
a) POGO RIDGE



a) POGO RIDGE



b) EAST DEEP



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SUMITOMO METAL MINING CO., LTD.

HYDROGEOLOGICAL STUDY

RESULTS OF TRANSIENT CALIBRATION OF MODEL TO MEASURED WATER LEVELS IN POGO RIDGE AND EAST DEEP

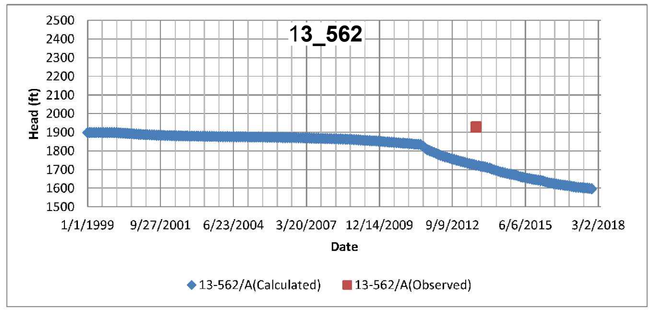
SRK JOB NO.: 147900.020

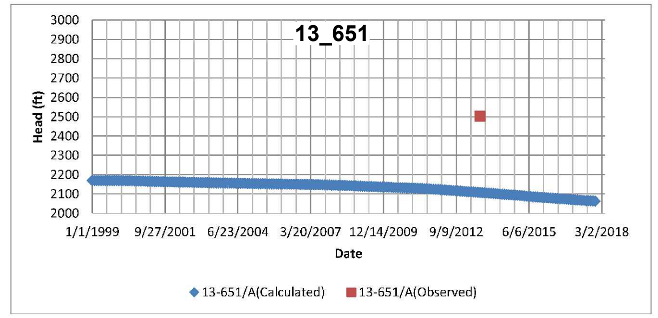
FILE NAME: 147900.020.Rev.B.Figure.17.Results.Of.Transient.Calibration.Of.Model.2013-12-02.dwg

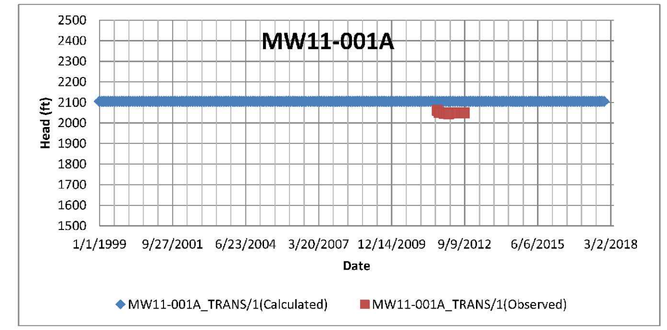
POGO UNDERGROUND MINE IN ALASKA

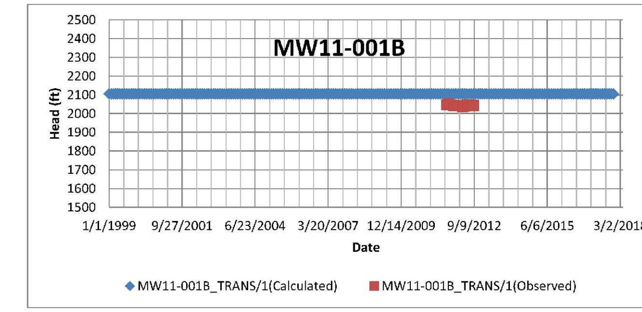
DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	17	B

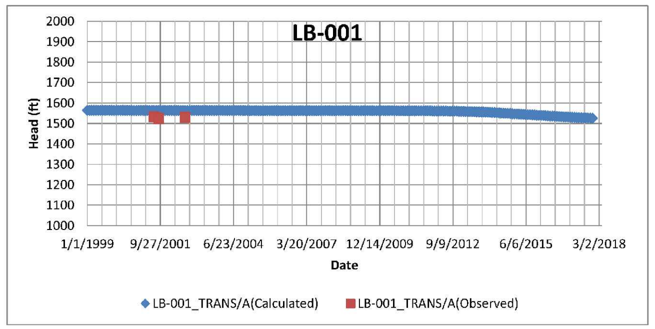
c) LIESE CREEK VALLEY

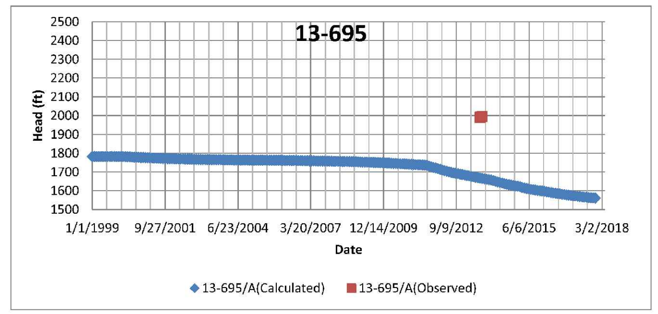


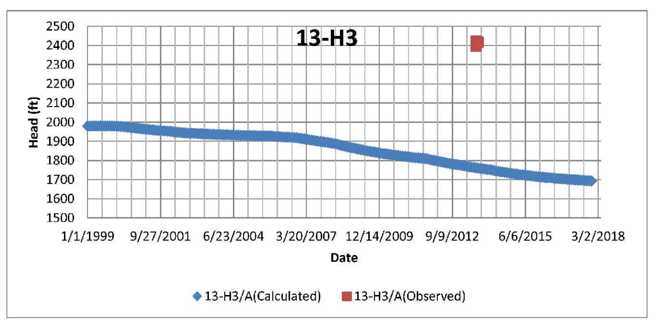


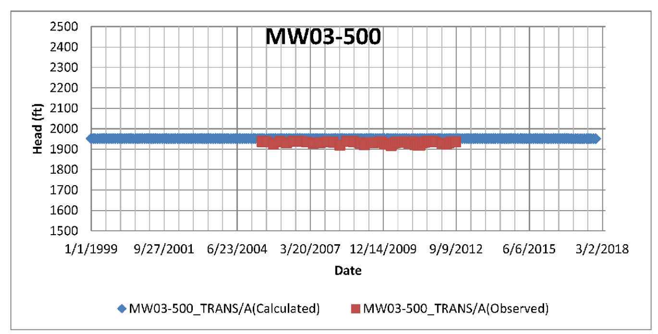


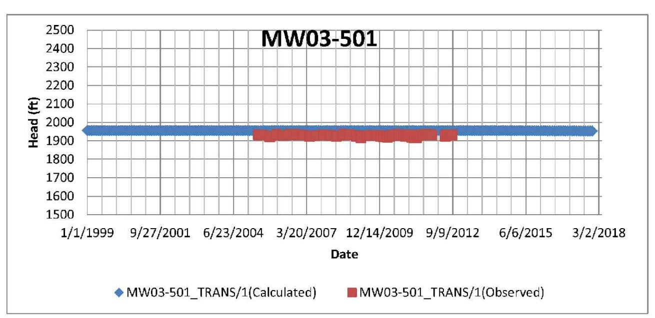


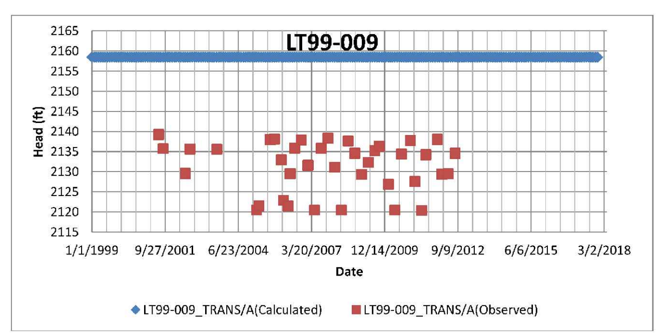


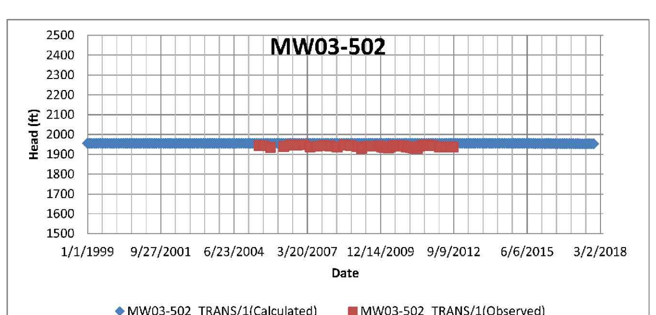


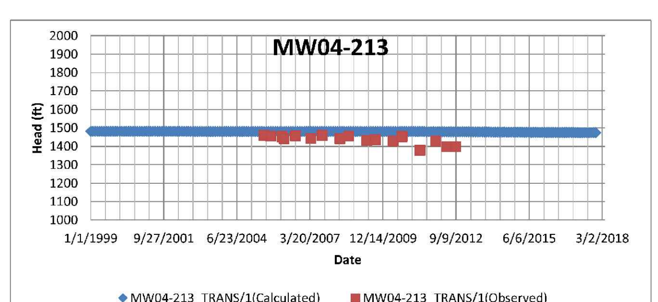




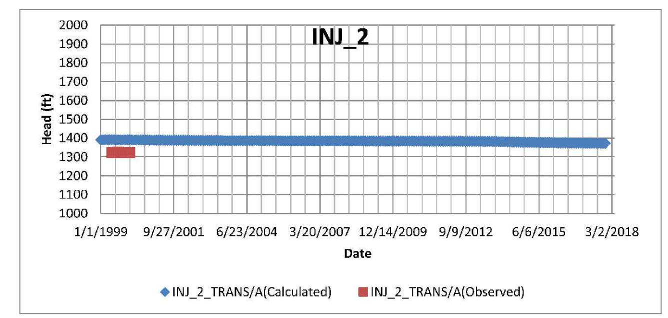


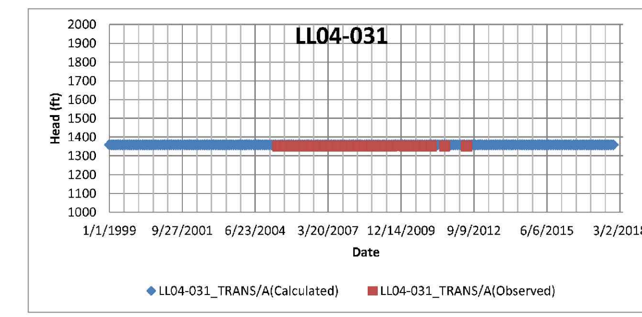


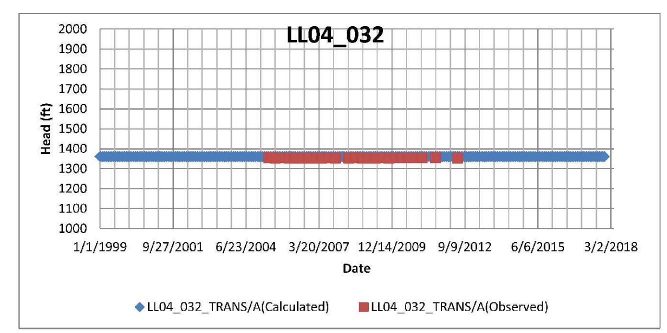


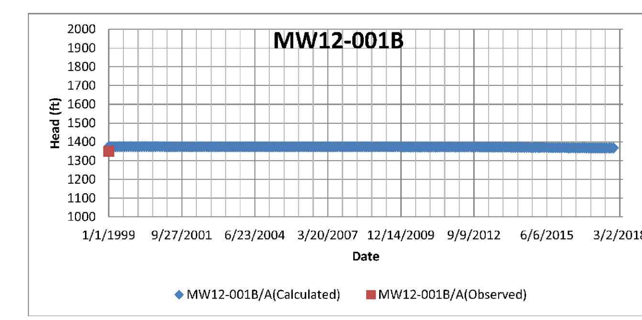


d) GOODPASTER RIVER VALLEY









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HYDROGEOLOGICAL STUDY

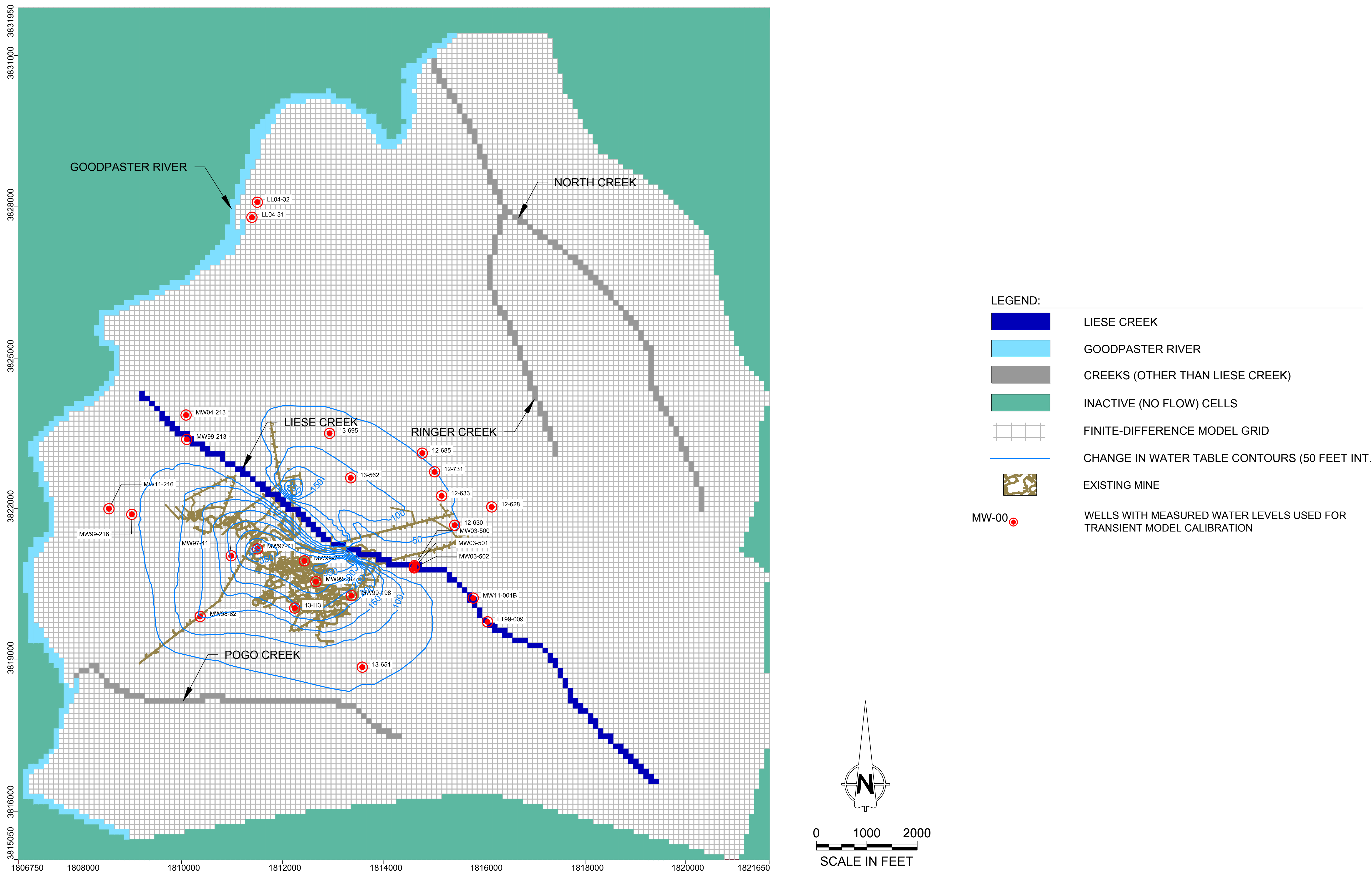
RESULTS OF TRANSIENT CALIBRATION OF MODEL TO MEASURED WATER LEVELS IN LIESE CREEK AND GOODPASTER RIVER VALLEYS

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev B.Figure.18.Results.Of.Transient.Calibration.Of.Model.Sheet.2.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	18	B



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HYDROGEOLOGICAL STUDY

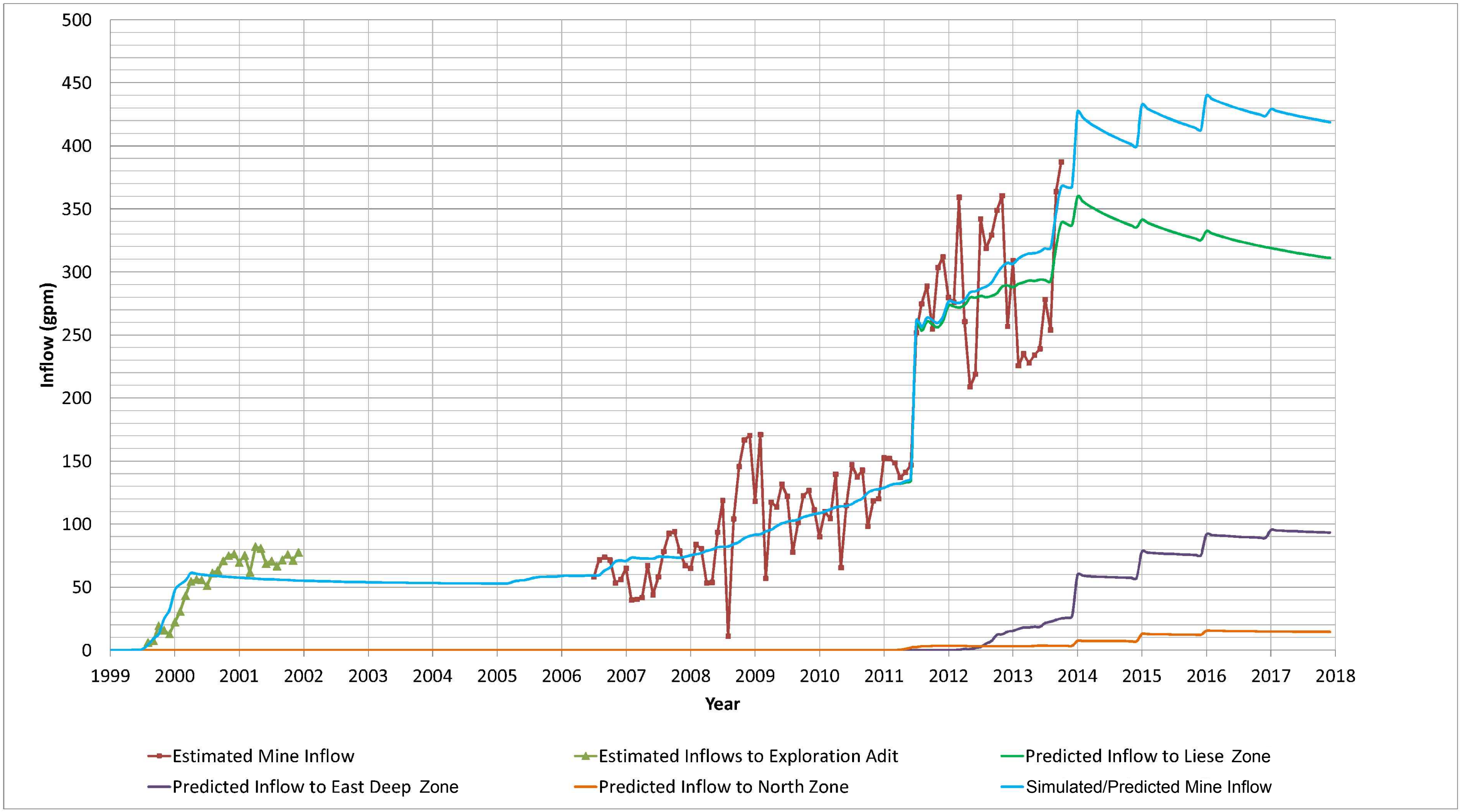
SIMULATED CHANGES IN WATER TABLE AT CURRENT MINING CONDITIONS (PLAN VIEW)

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.19.Simulated.Changes.In.Water.Table.At.Current.Mining.Conditions.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	19	B



srk consulting	SUMITOMO METAL MINING CO., LTD.	HYDROGEOLOGICAL STUDY
SRK JOB NO.: 147900.020	POGO UNDERGROUND GOLD MINE IN ALASKA	PREDICTED INFLOW TO MINE (LIESE CREEK, EAST DEEP AND NORTH ZONES)
FILE NAME: 147900.020.Rev.B.Figure.20.Predicted.Inflow.To.Mine.2013-12-02.dwg		DATE: DEC 2013 · APPROVED: VU · FIGURE: 20 · REVISION NO. B

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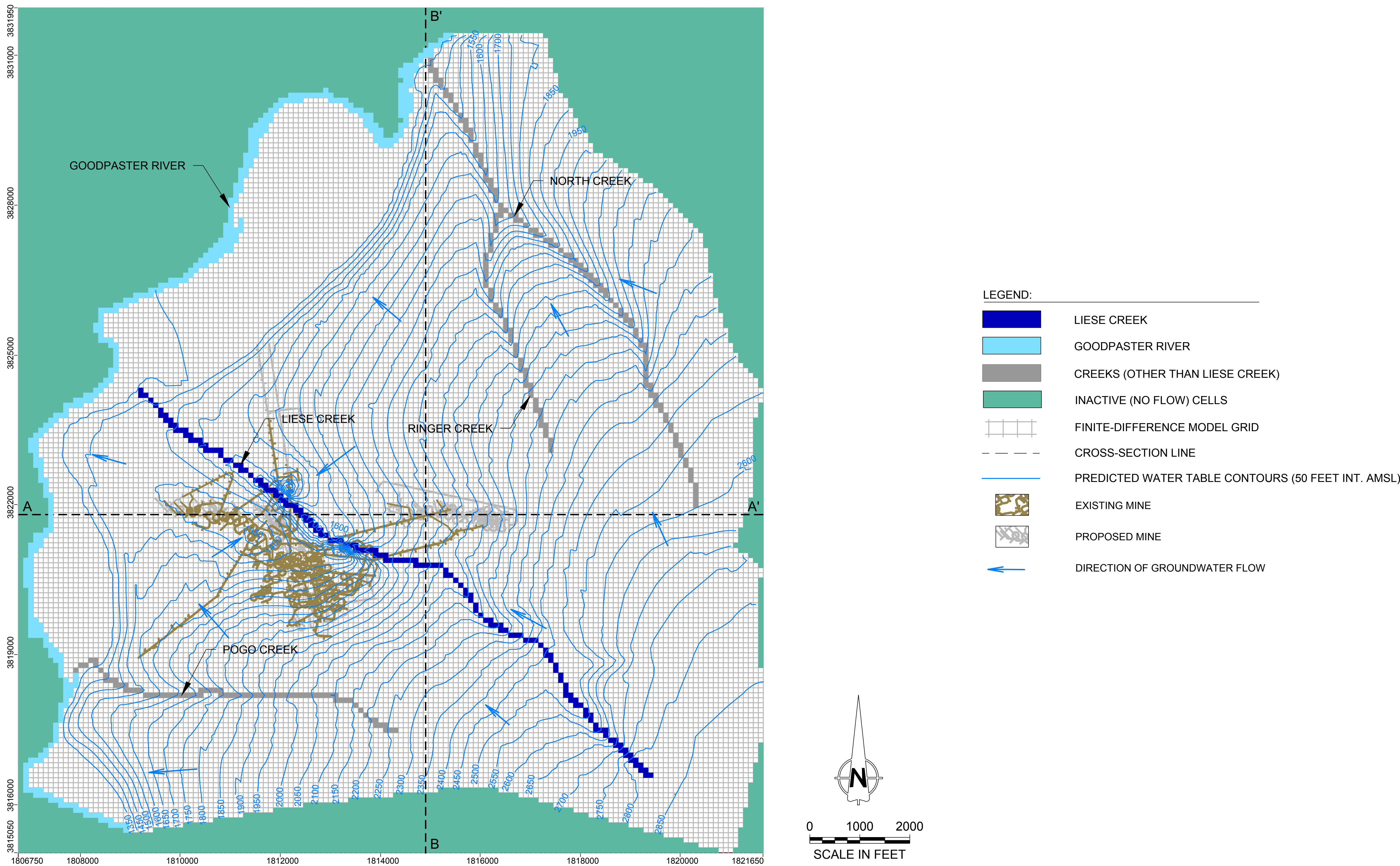

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POGO UNDERGROUND MINE IN ALASKA

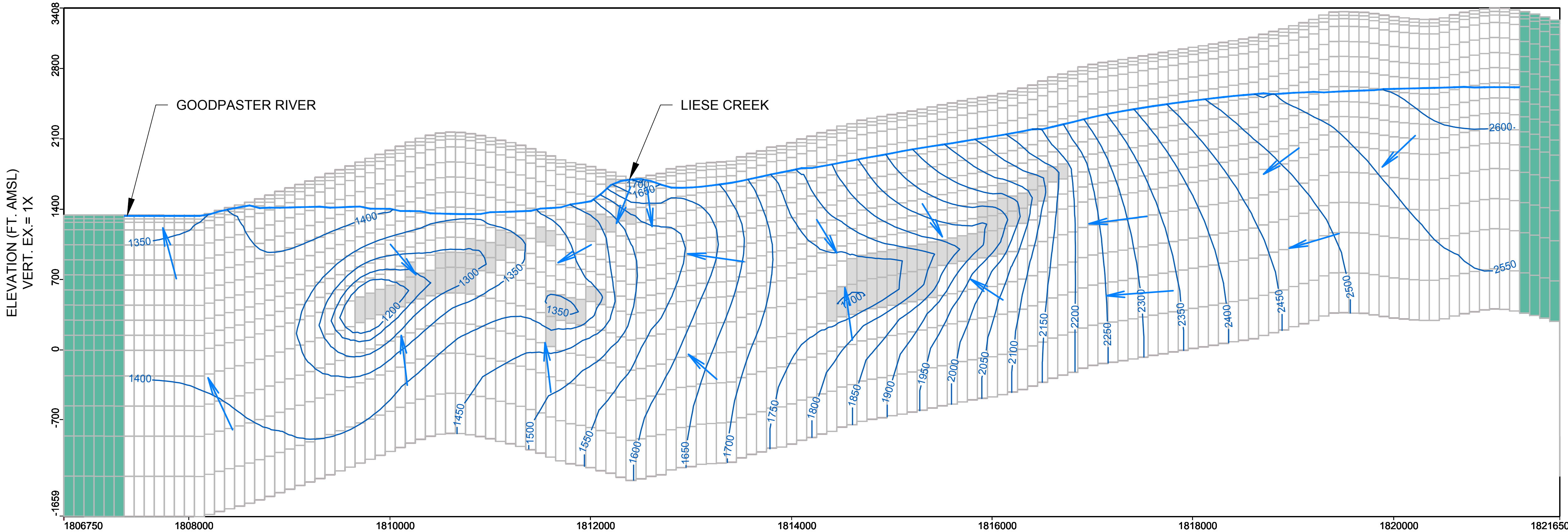
HYDROGEOLOGICAL STUDY

PREDICTED WATER TABLE AT END OF MINING (PLAN VIEW)

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.21.Simulated.Water.Levels.At.End.Of.Mining.2013-12-02.dwg

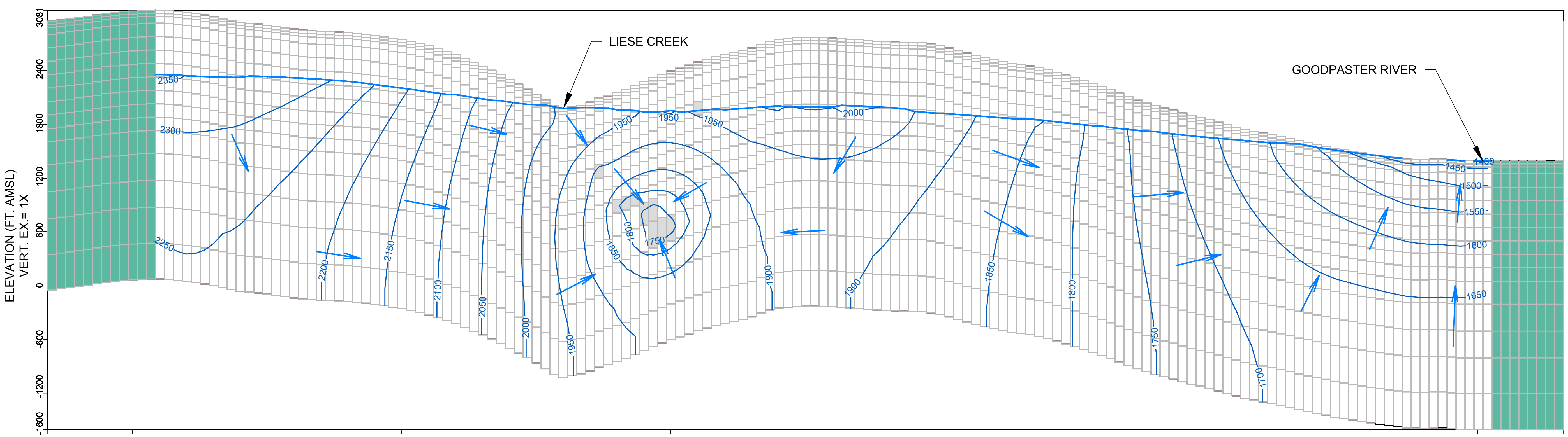
DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	21	B



MODEL CROSS SECTION A-A'

0 600 1200 1800 2400

SCALE IN FEET



MODEL CROSS SECTION B-B'

0 600 1200 1800 2400

SCALE IN FEET

GROUNDWATER FLOW DIRECTION

PREDICTED WATER TABLE AT END OF MINING

EQUIPOTENTIAL CONTOUR LINE
(50 FEET INT. AMSL)

DRAIN CELLS SIMULATING MINE INFLOW

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SUMITOMO METAL MINING CO., LTD.

HYDROGEOLOGICAL STUDY

CROSS SECTIONS SHOWING PREDICTED WATER TABLE AT END OF MINING

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.22.Cross.Sections.Showing.Simulated.End.Of.Mining.Water.Table.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	22	B

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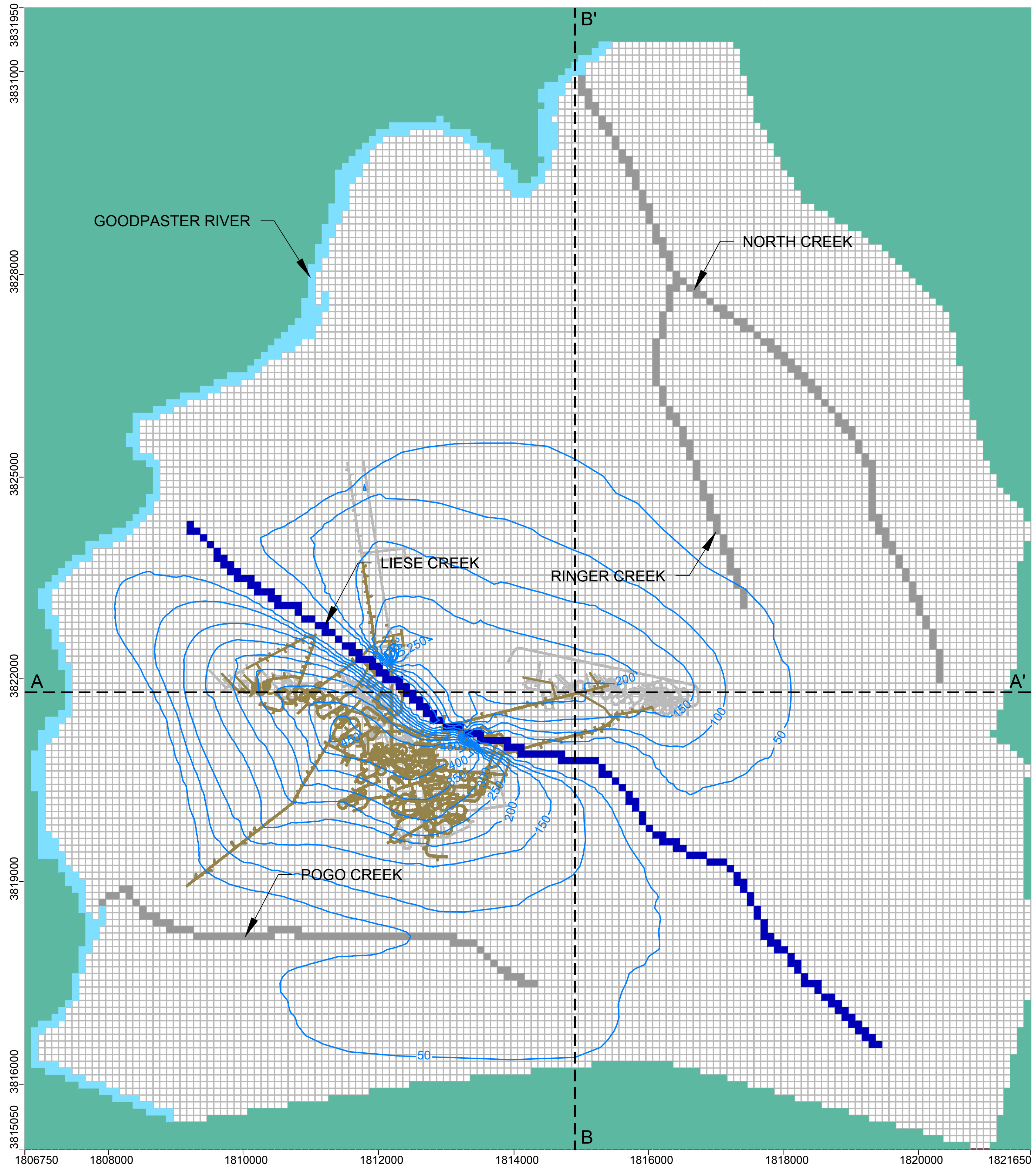

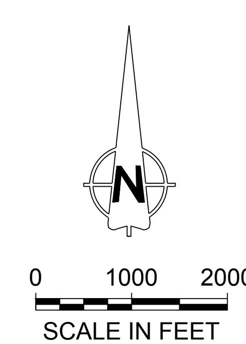

LEGEND:

- LIESE CREEK
- GOODPASTER RIVER
- CREEKS (OTHER THAN LIESE CREEK)
- INACTIVE (NO FLOW) CELLS
- FINITE-DIFFERENCE MODEL GRID
- SIMULATED CHANGE IN WATER TABLE CONTOUR (50 FEET INT.)
- EXISTING MINE
- PROPOSED MINE

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SUMITOMO METAL MINING CO., LTD.

HYDROGEOLOGICAL STUDY

PREDICTED CHANGES IN WATER TABLE AT END OF MINING (PLAN VIEW)

SRK JOB NO.: 147900.020

FILE NAME: 147900.020.Rev.B.Figure.23.Simulated.Changes.In.Water.Table.At.End.Of.Mining.2013-12-02.dwg

POGO UNDERGROUND MINE IN ALASKA

DATE:	APPROVED:	FIGURE:	REVISION NO.
DEC 2013	VU	23	B

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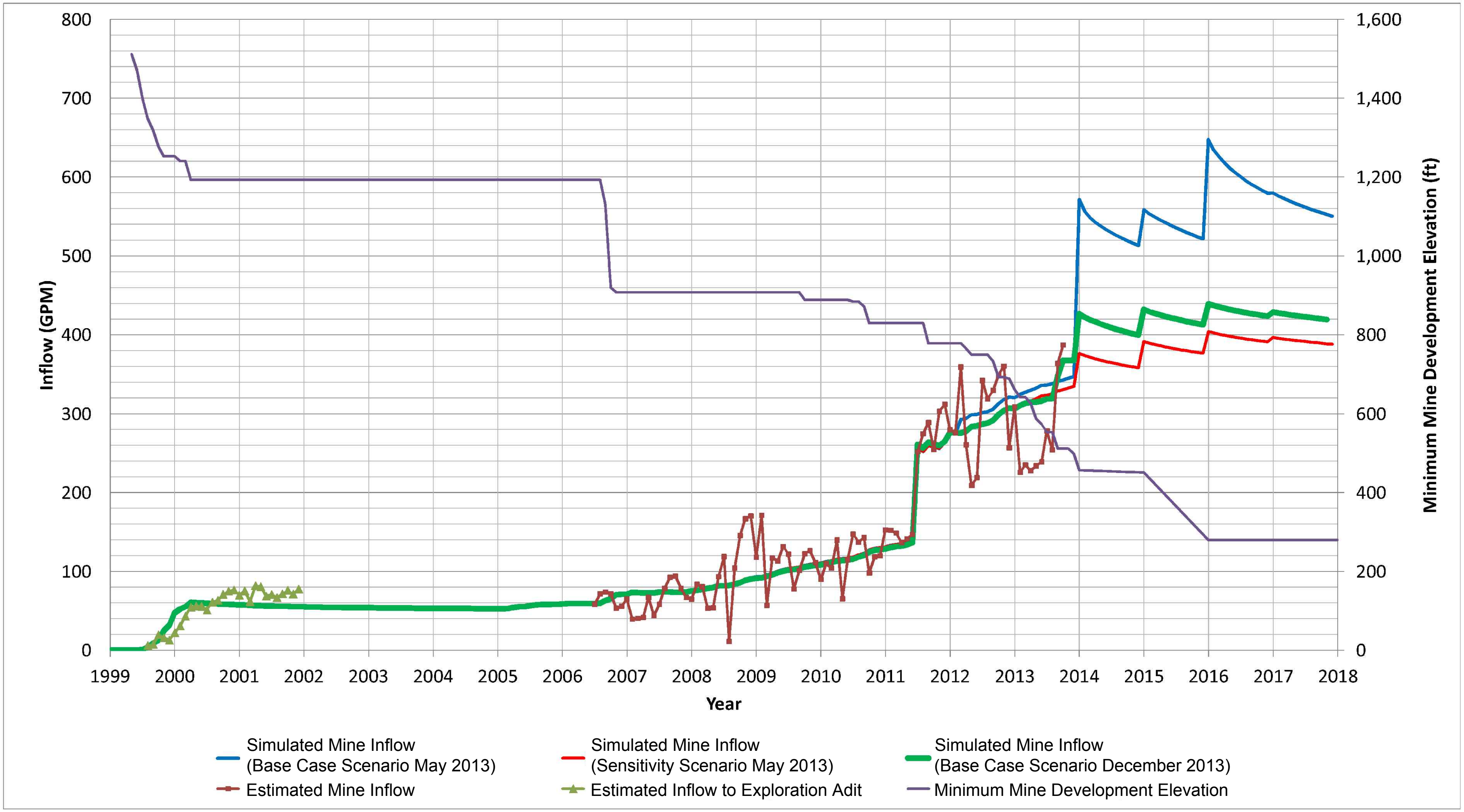

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		RESULTS OF SENSITIVITY ANALYSIS			
SRK JOB NO.: 147900.020	POGO UNDERGROUND GOLD MINE IN ALASKA	DATE: DEC 2013	APPROVED: VU	FIGURE: 24	REVISION NO. B
FILE NAME: 147900.020.Rev.B.Figure.24.Results.Of.Sensitivity.Analysis.2013-12-02.dwg					

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