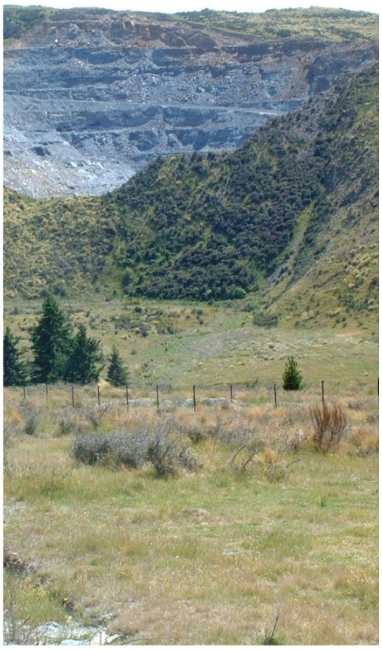
April 2011

MACRAES PHASE III PROJECT

Golden Point Pit Lake Seepage Loss Assessment

Submitted to:
Oceana Gold (New Zealand) Ltd

REPORT



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Golder Associates

Executive Summary

Oceana Gold (New Zealand) Limited (OceanaGold) is currently seeking consents to undertake the Macraes Phase III Project, which entails an expansion of existing opencast pits, the construction of the Top Tipperary Tailings Storage Facility and the construction of new waste rock stacks at the Macraes Gold Project (MGP) site.

A major component of the Macraes Phase III Project is planning for site closure, including closure scenarios for the opencast pits in their final layout. OceanaGold is proposing to allow a pit lake to develop in the combined Golden Point/Round Hill Pit following closure of operations in this area of the site during 2018. In order to assess the eventual water quality that can be expected to develop in the Golden Point Pit lake, water balance calculations for the lake are required. One factor in the water balance assessment is potential seepage losses from the Golden Point Pit lake during the water level recovery period and under long term steady state conditions.

Historical gold mine adits and underground workings are located beneath the schist ridge separating Golden Point Pit from Deepdell Creek. These workings have not been mapped in detail, however, their general layout, elevations and seepage discharge points are known. Three levels of mine workings have been identified from mapping undertaken by OceanaGold. These underground workings were exposed in the Golden Point Pit wall and have some connection to mine portals opening onto the valley slope above Deepdell Creek. The hydraulic connectivity of the upper levels of underground workings has not been tested. The lowest of these workings is however a demonstrated hydraulic connection between Golden Point Pit and Deepdell Creek valley. Underground workings that were exposed in the pit wall during mining operations have subsequently been buried with fill deposited in the pit.

Experience from past mine water discharges through the historic underground workings indicates the filling of a pit lake to the level of these workings would result in unacceptably large discharge flows to Deepdell Creek. At present these discharges have been minimised through pumping mine water from inside the pit to the process plant.

A water balance calculation for the combined Golden Point/Round Hill Pit (Golder 2011a) indicates the water level in the pit lake following closure would eventually rise above the level of the lowest underground workings, provided the workings have been sealed. A number of passive management options to reduce the projected seepage water discharges from the pit lake through the underground workings to Deepdell Creek have been considered by OceanaGold.

This report documents the assessment of potential seepage losses from the Golden Point Pit lake, taking into account flows through historical underground workings located in the northern pit wall. The overall water balance for the pit lake is reported in a separate report.

The 2D seepage simulations were undertaken using the SEEP/W software package. The following SEEP/W models were set up to evaluate these options:

- **Model 1:** The base case of the current pit layout without sealing the historical workings or lining the pit walls and base.
- **Model 2:** Construction of an A Zone liner against waste rock fill lining the northern wall of the pit and keyed directly into schist bedrock at the base of the pit wall.
- **Model 3:** Construction of an A Zone liner against the northern wall of the pit and across the floor of the pit. Instead of keying the liner directly into the underlying schist, the liner would lap onto in-situ schist exposed in the pit at closure.
- **Model 4:** Complete sealing of the underground workings to remove the preferred flow paths.

For the purposes of this analysis the design hydraulic conductivity and thickness of the A Zone liner are taken to be 1 x 10^{-7} m/s and 5 m, respectively. The layout of the northern end of Golden Point pit is based on site layouts provided by OceanaGold. The hydraulic parameters applied to the intact rock mass are the same as those applied to the schist and Hanging Wall Shear material in the site wide groundwater model.

The seepage models indicate that a groundwater level within the waste rock in Golden Point Pit of 347 mRL, which is approximately equivalent to elevations of water in the pit sump on occasion since 2007, would result in a discharge flow of approximately 400 m^3/day through the workings. This discharge rate is toward the upper limit of flows observed from the workings during the same period. The simulations also indicate that a further increase in water level within the pit would simply lead to increased discharges through the underground workings, as should be expected.

The models indicate that installing an A Zone liner keyed into the underlying schist, as simulated in Model 2, could reduce seepage flows through the underground workings by a factor of about 4. A liner keyed into the underlying schist performed better than a liner simulated as being installed on top of the backfill in the pit (Model 3). However, the calculated discharge flows still increased from approximately 600 m^3/day to between 1,000 m^3/day and 1,700 m^3/day as the simulated water level in the lake was increased. These calculations however assume that there would eventually be enough water coming into the pit from rainfall, run-off and groundwater seepage to enable this discharge rate.

The most effective scenario at limiting discharge flows from Golden Point Pit was to completely seal the underground workings, thereby limiting water losses from the pit to general groundwater seepage. If this could be achieved, the discharge flows could decrease to less than 100 m^3/day. The total discharge flows from Golden Point Pit are completely dominated by flows through the underground workings under each scenario where the workings have not been sealed.

If the underground workings are not sealed or potential flows through these workings not minimised by some means, the water level within Round Hill Pit is unlikely to rise much above the level of the lowest workings. Sealing the adits should result in the lake surface rising until the lake inflows are balanced by evaporation and seepage losses through the intact rock barrier.

ABBREVIATIONS

DC07	Deepdell Creek downstream water quality compliance point DC07.
HWS	Hanging Wall Shear
MGP	Macraes Gold Project
mRL	Metres above mean sea level
MTI	Mixed Tailings Impoundment
SPI	Southern Pit Tailings Impoundment
SP11	Southern Pit Tailings Impoundment SP11

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1.0 INTRODUCTION

1.1 Background

Oceana Gold (New Zealand) Limited (OceanaGold) operates the Macraes Gold Project (MGP) located in East Otago, approximately 25 km west of Palmerston. The MGP consists of a series of opencast pits and an underground mine supported by ore processing facilities, waste storage areas and water management systems. OceanaGold is currently seeking consents to undertake the Macraes Phase III Project, which entails an expansion of existing opencast pits, the construction of the Top Tipperary Tailings Storage Facility and the construction of new waste rock stacks at the site.

A major component of the Macraes Phase III Project is planning for site closure, including closure scenarios for the opencast pits in their final layout. OceanaGold is proposing to allow a pit lake (the Golden Point Pit lake) to develop in the combined Golden Point/Round Hill Pit following closure of operations in this area of the site during 2018. In order to assess the eventual water quality that can be expected to develop in the Golden Point Pit lake, water balance calculations for the lake have been undertaken (Golder 2011a).

Historical underground mine workings intersect the northern Golden Point Pit wall, with seepage water discharges through adits opening onto Deepdell Creek valley. The water balance indicates that the water level in the combined Golden Point/Round Hill Pit following closure would eventually rise above the level of the lowest underground workings, provided the workings have been sealed.

Golder Associates (NZ) Limited (Golder) has been retained by OceanaGold to undertake an evaluation of potential mine water losses between Golden Point Pit and Deepdell Creek resulting from the filling of Golden Point Pit lake. This report[1] documents the assessment of potential seepage losses from the Golden Point Pit lake, taking into account flows through historical underground workings located in the northern pit wall.

1.2 Scope of Work

The scope of work for this study is to:

1) Assess the potential rate of seepage loss from the Golden Point Pit lake to Deepdell Creek taking into account a range of possible lake water levels.

2) Assess the potential reduction in seepage losses that could occur if a liner is constructed inside the northern wall of Golden Point Pit.

An important factor to be taken into account is the presence of historical underground mine workings with open connections between the backfill in Golden Point Pit and the valley slope above Deepdell Creek.

2.0 PREVIOUS STUDIES AND RECORDED DISCHARGES

2.1 Previous Studies

As part of previous mine planning work undertaken by OceanaGold, an initial assessment of the potential for Golden Point Pit to be utilised as a tailings storage facility (TSF) was completed. Calculations of potential seepage losses from the TSF were documented in a report by Kingett Mitchell (2005).

A simulation of Golden Point Pit filled with tailings to an elevation of 424 mRL was produced using Visual MODFLOW. The simulation took into account the historical underground mine workings, a low permeability liner installed along the northern wall of the pit and the Hanging Wall Shear (HWS) of the Hyde Macraes Shear Zone.

[1] This report is provided subject to the limitations presented in Appendix A.

The outcome of the Visual MODFLOW simulation was a calculated seepage rate of approximately 67 m^3/day. Based on observed seepage losses from the Mixed Tailings Impoundment (MTI) to chimney drains incorporated in the embankment, this seepage rate was considered likely to be an underestimate. It was also expected that seepage through the intact rock barrier between Golden Point Pit and Deepdell Creek would probably be about two orders of magnitude less than the calculated seepage losses to the historical underground workings.

3.0 GOLDEN POINT PIT LAYOUT

3.1 Pit Layout

Golden Point Pit in its current form () incorporates the following features:

- A shell of in-situ schist that defines the maximum extent of ore and waste rock excavated from the pit. The original pit was excavated to a base elevation of between 327 mRL and 340 mRL. This elevation compares to the elevation of Deepdell Creek at its closest approach to Golden Point Pit of approximately 337.5 mRL.
- An intact schist barrier between the opencast pit and Deepdell Creek, which is approximately 200 m thick at the base. The lowest point of intact schist on the original crest line prior to partial backfilling of Golden Point Pit was at an elevation of approximately 392.5 mRL.
- Waste rock backfill covering much of the pit floor to an elevation of between 355 mRL and 362.5 mRL. In addition waste rock has been stored against the northern pit wall to an elevation of approximately 405 mRL, which has raised the crest of the barrier between the pit and Deepdell Creek to this elevation.
- A pit sump at the southern end of the pit, with the sump base having an elevation of approximately 342 mRL. The pump installed in the sump is controlled to switch on when the water level exceeds an elevation of approximately 344 mRL.

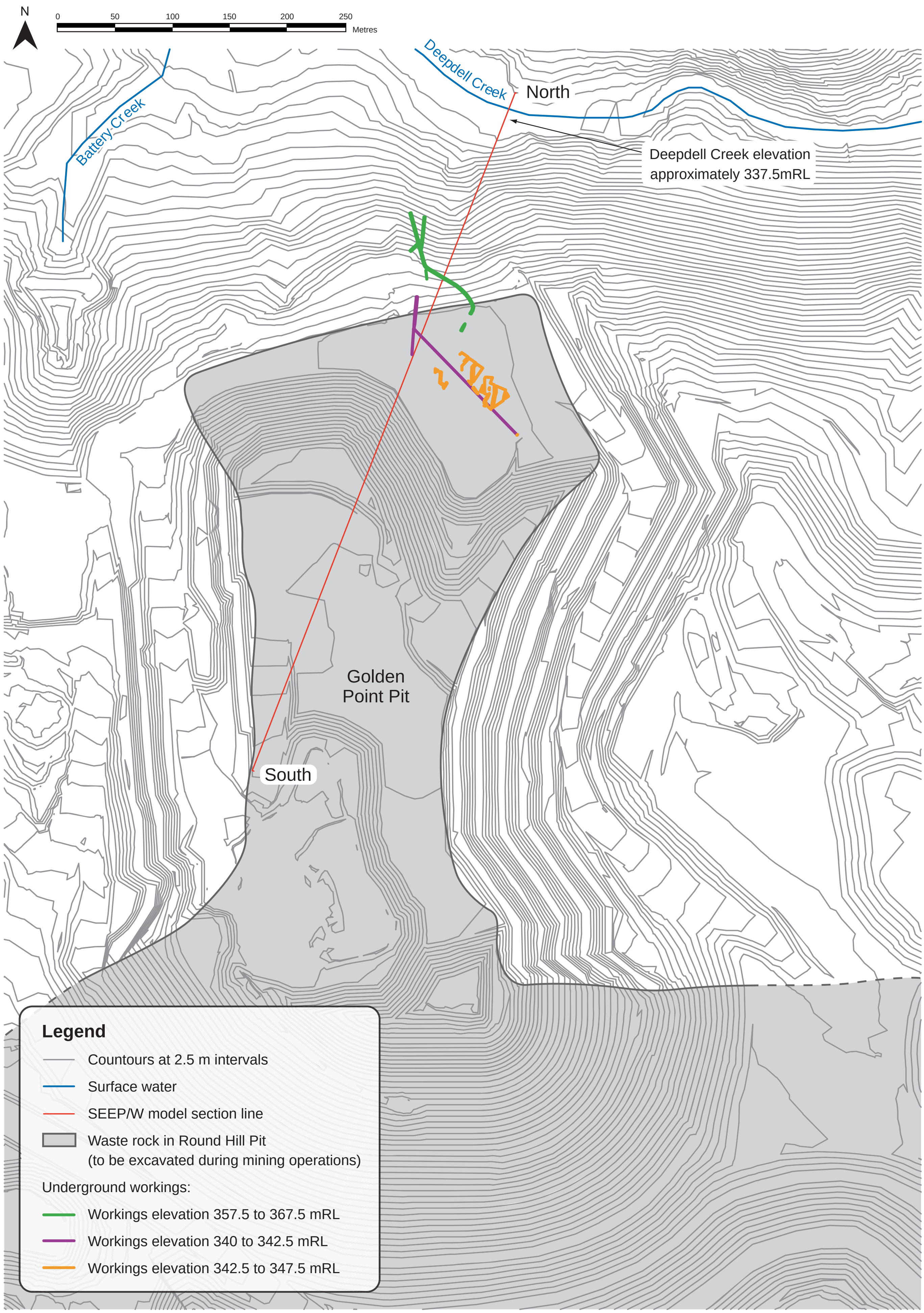
Historical underground mine workings within the schist barrier between the pit and Deepdell Creek are discussed in Section 3.3.

3.2 Geology

The schist, being a crystalline metamorphic rock, has effectively no primary or intergranular porosity or permeability, except where weathered. Secondary porosity and permeability in the form of fractures and faults provide the major groundwater seepage routes below the surficial, strongly weathered zone.

It is considered that hydraulic conductivity of the schist increases upward through the schist rock mass due to the increasing intensity of weathering and reducing overburden pressures (Table 1). Similar trends or decreasing rock mass permeability with depth have been recorded with respect to fractured crystalline rocks in other areas of the world (e.g., Masset & Loew 2010). This trend has been incorporated in several groundwater models of the MGP site (Kingett Mitchell 2002, 2005) and is based primarily on an assessment of hydraulic conductivity variation with depth for the Maori Tommy Gully area (GCNZ 1988).

The HWS of the Hyde Macraes Fault Zone forms a zone of crushed and deformed rock closely associated with the Macraes ore bodies. This shear zone dips at approximately 20° toward the east and has a strike parallel with the line of the MGP opencast pits. The HWS was exposed in the northern wall of Golden Point Pit, prior to backfilling, and the trace now passes along the western rim of the pit. In Deepdell Creek valley the fault trace is mostly obscured by colluvium, however it probably intersects the base of the valley approximately 100 m east of Golden Point Pit.



1. Schematic only, not to be interpreted as an engineering design or construction drawing

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Table 1: Comparison of hydraulic conductivity values applied to MGP models.

Depth interval (m)	Hydraulic conductivity applied to site wide MGP groundwater model (m/s) [1]	
	K_x [2]	K_y [3]
0 – 20 [4]	3.7×10^{-7}	1.0×10^{-6}
20 – 60 [5]	1.0×10^{-7}	2.5×10^{-7}
Hanging Wall Shear	8.0×10^{-8}	8.0×10^{-8}

Note:
1) Source: Kingett Mitchell (2005).
2) K_x = hydraulic conductivity in east-west direction.
3) K_y = hydraulic conductivity in north-south direction.
4) Not applied in SEEP/W model as the water level in the pit does not rise to this level in the simulations.
5) Applied for the full thickness of undisturbed schist simulated in the model.

The HWS has been defined as a relatively low permeability unit in this simulation, following the criteria for the various lithologies built into the site wide groundwater model (Golder 2011b). Although the HWS consists of crushed and sheared rock, which would normally imply a higher hydraulic conductivity than the surrounding rock mass. In the northern pit wall it may be expected that the rock mass is relaxed and generally somewhat weathered. This expectation is reflected in the hydraulic conductivity values applied to the intact schist in the model exceeding those for the HWS. In addition, the limited extent of the HWS material within the 2D model means the model outcomes are not sensitive to the hydraulic conductivity applied to this material unless the values are unrealistically high.

Alluvial and colluvial deposits form a narrow terrace along the base of the Deepdell Creek valley. The thickness and extent of these deposits are small. Golder considers these materials would have little influence on seepage rates from the proposed Golden Point Pit lake to Deepdell Creek. As a consequence, they have not been incorporated in the seepage model and are not discussed further in this report.

3.3 Historical Underground Workings

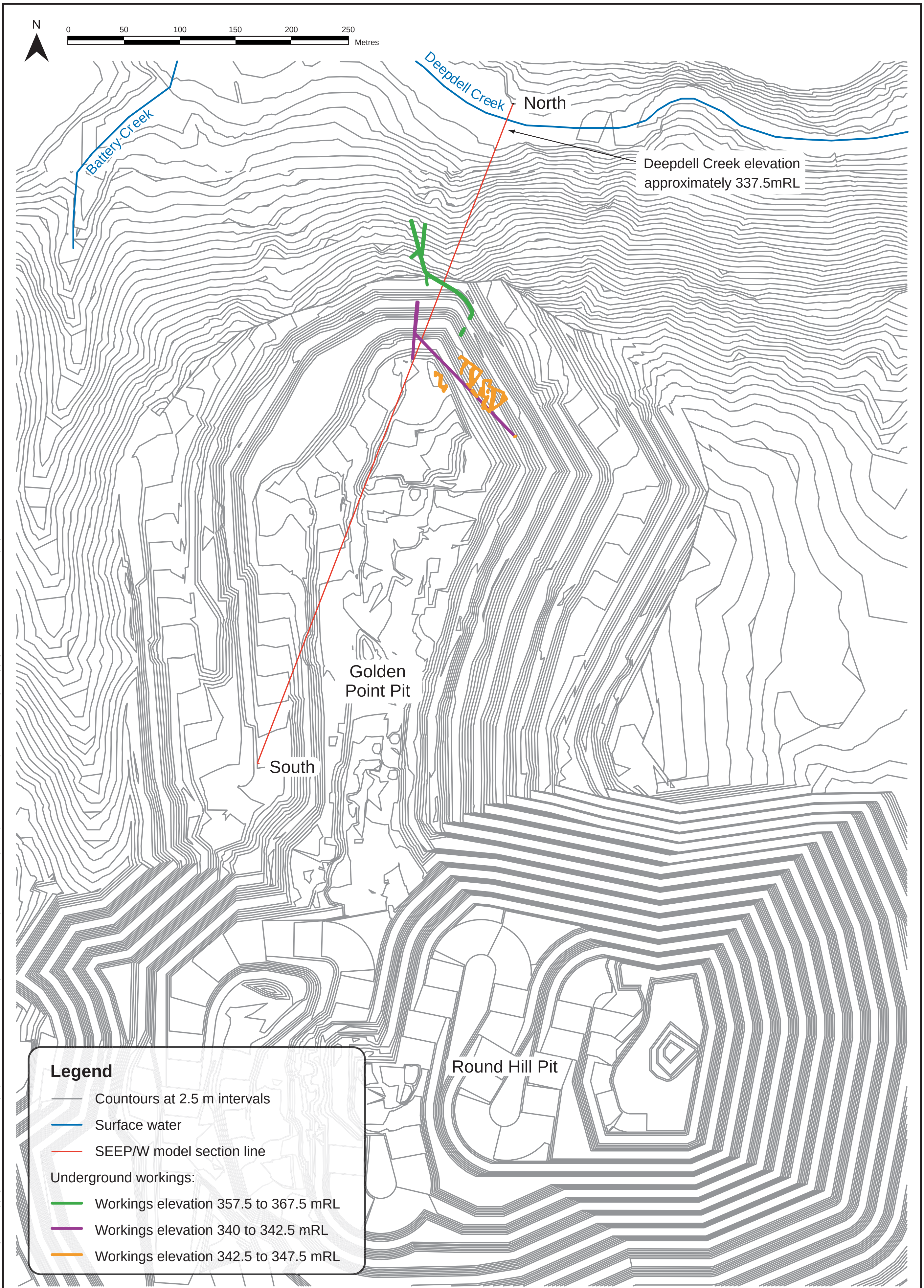
Historical gold mine adits and underground workings are located beneath the schist ridge separating Golden Point Pit from Deepdell Creek. These workings have not been mapped in detail, however, their general layout, elevations and seepage discharge points are known.

Three levels of mine workings have been identified from mapping undertaken by OceanaGold (Figure 2):

- The uppermost workings are located at an elevation of between 357.5 mRL to 367.5 mRL. The elevation of the workings decreases toward the east at a similar dip to that of the HWS of the Hyde Macraes Shear Zone.
- The mid level workings consist of a small area of drives located at an elevation of approximately 342.5 mRL to 347.5 mRL.
- The lowest workings are located at an elevation of approximately 340 mRL to 342 mRL.

In each case, the underground workings were exposed in the Golden Point Pit wall and have some connection to mine portals opening onto the valley slope above Deepdell Creek. The hydraulic connectivity of the underground workings has not been tested. The lowest of these workings is however a demonstrated hydraulic connection between Golden Point Pit and Deepdell Creek valley (refer Section 4.0).

For the purposes of this assessment, it is assumed that the lowest workings would have a discharge capacity exceeding the Golden Point Pit storm recharge rates, for practically any storm event if they were exposed in the pit. In effect, it is assumed the mine water discharge rate through the lowest adits is limited by the permeability and thickness of the waste rock fill in Golden Point Pit.



1. Schematic only, not to be interpreted as an engineering design or construction drawing

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TITLE GOLDEN POINT PIT IN-SITU SCHIST PIT SHELL AT END OF MINE LIFE

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3.4 Pit Liner

Mine water discharge flows from the historical underground mine workings at Golden Point have been monitored for the past four years (refer Section 4.0). Experience gained from managing these discharges indicates that establishment of a pit lake is unlikely to be achievable unless these workings are sealed off from the lake. Although the underground workings were at one time exposed in the northern wall of Golden Point Pit, these exposures have subsequently been buried by a substantial depth of waste rock fill.

There are three potential passive management options available to reduce the discharge of seepage water from the proposed pit lake through the underground workings to Deepdell Creek. These options are:

1) Fill the underground workings with a low permeability grout or equivalent, thereby removing the workings as a possible conduit for lake water discharges.

2) Construct a low permeability liner against the waste rock at the northern end of the pit, with the liner keyed down to the underlying in-situ schist bedrock.

3) Construct a low permeability liner to the current pit shell, keying this liner into in-situ areas of schist bedrock where this material is exposed (Figure B1 in Appendix B).

Where a liner is being considered, this would take the form of a layer similar to the A Zone constructed in the embankments of the MTI and the Southern Pit Tailings Impoundment (SPI). The A Zone in these embankments is constructed from compacted weathered schist and serves to reduce seepage losses from the impoundments. The design hydraulic conductivity stipulated by Engineering Geology Ltd for the MGP tailings storage facilities is 1×10^{-7} m/s. The A Zone would be approximately 5 m thick, which is considered to be a minimum thickness for constructability.

OceanaGold has reviewed the viability of each of the options listed above. The current preferred option for limiting seepage to the underground workings is to construct a low permeability liner against the face of the backfill and key this liner into the underlying schist at the base of the pit.

4.0 RECORDED MINE WATER DISCHARGES

Seepage losses from the Southern Pit 11 Tailings Impoundment (SP11) and leaching of waste rock stored in Round Hill and Golden Point pits affects the water quality in Golden Point Pit. The influence of seepage from and through these stored wastes is reflected in both the waste rock fill pore water quality and the quality of water in the pit sump. Water accumulating in Golden Point Pit discharges to Deepdell Creek through the intervening rock barrier. Seepage flows through the rock barrier are however minor compared to the potential discharge flows through the historical underground mine workings that characterise this area of the pit wall.

Under normal operational conditions, pumping from the Golden Point Pit sump minimises the discharges through the underground workings. During late 2006, problems with the water management system for Golden Point Pit allowed water levels within the pit backfill to rise, leading to increased discharge flows through the Golden Point historical mine workings.

On November 15, 2006 the water level in the Golden Point Pit sump reached an elevation of 353.39 mRL, after which the water level started to decrease as increased pumping rates brought the groundwater system in the pit under control. The discharge flows through the underground workings from the pit were not being accurately measured at this time. It is, however, expected that the discharge flows exceeded those recorded from subsequent monitoring.

Although the issues with the water management system were corrected as soon as they were identified, discharge flows from the mine workings continued to vary seasonally until early 2010 (Figure 3). Discharges during the 2010 winter period were, however, negligible, indicating the groundwater levels in the Golden Point Pit backfill have now decreased to 340 mRL or lower. This elevation corresponds to the elevation of the lowest of the historical adits. The potential capacity of the lowest workings to discharge water from Golden Point Pit to Deepdell Creek is not known.

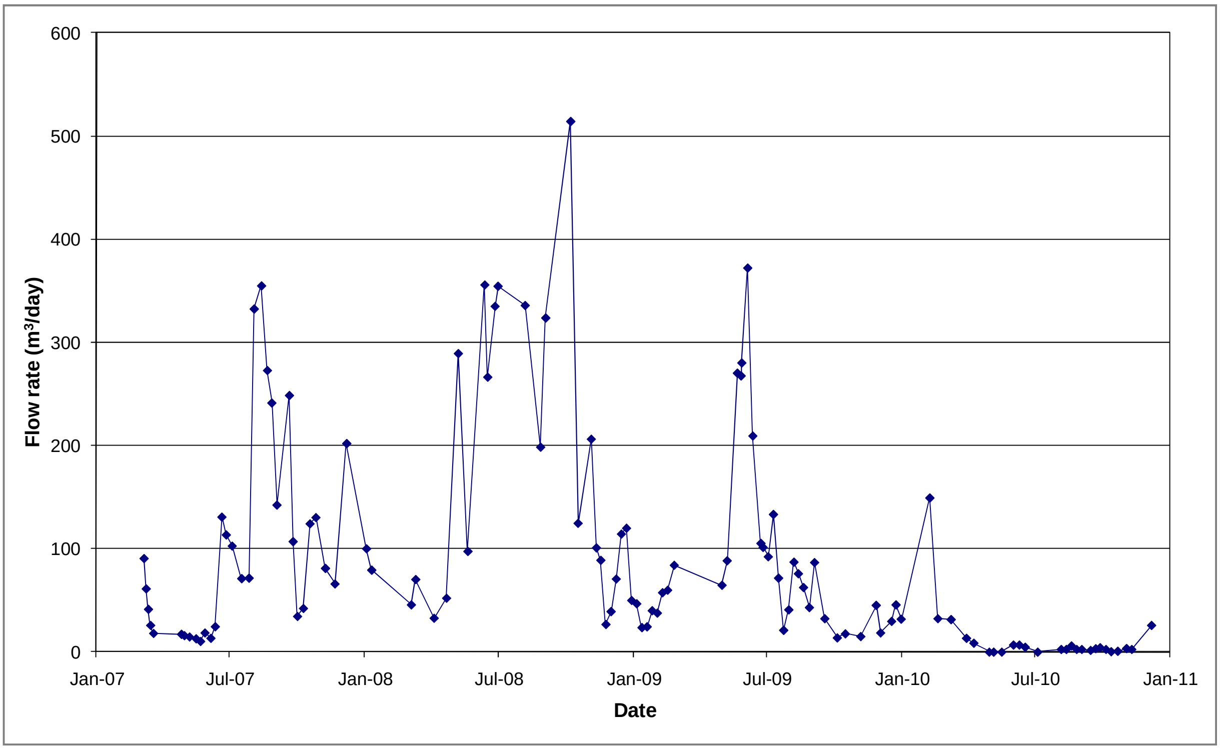

Figure 3: Discharge flows from historical Golden Point underground mine workings.

The sulphate mass loads from the Golden Point discharges have been monitored since 2007 and compared with those calculated for the MGP downstream compliance point (DC07) for part of that period (Figure 4). The comparison indicates that discharges through the underground workings are often the largest source of sulphate to Deepdell Creek upstream from DC07. Due to the negligible discharge flows since April 2010, this is no longer the case.

5.0 SEEPAGE MODEL

5.1 Conceptual Model

The previous assessment of potential seepage through the northern wall of Golden Point Pit (Golder 2006) was only partially successful. The simulated groundwater discharges through the pit wall were considered to underestimate the likely seepage losses from a tailings impoundment to be constructed in the pit by perhaps a factor of 10. This conclusion was reached through direct comparison with seepage losses to the drainage systems of the MTI at that time, and remains valid.

For the purposes of the current project a set of 2D steady state models has been produced in order to improve the simulation of a pit liner and the underground mine workings. A cross section through the narrowest section of the rock barrier has been chosen for the model ().

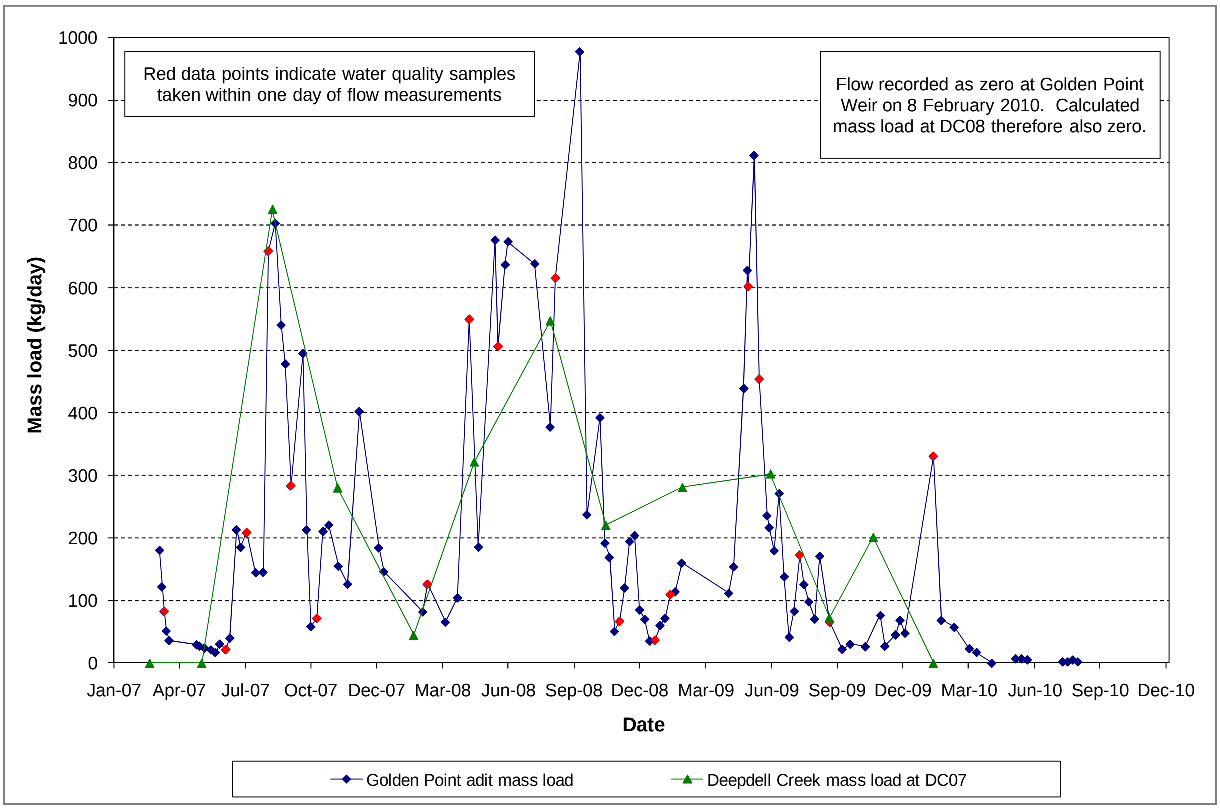

Figure 4: Sulphate mass loads in Golden Point underground mine workings discharge.

The model consists of a 635 m long section with the ends of the section being defined to correspond to the northern side of Deepdell Creek and the southern edge of Golden Point Pit, where the ground level starts to rise above the base of the pit. These boundaries have been applied because Deepdell Creek is a regional groundwater discharge zone and groundwater pressures on the far side of the creek increase as the distance away from the creek increases. It is not expected that there would be any groundwater flow toward the north past Deepdell Creek.

As the hydraulic pressures within the pit are to be fixed to correspond to specific lake water levels, the actual length of the model section toward the south is not considered to be a significant factor in the model. The southern boundary position was defined to ensure the base of the pit, including the waste rock fill was effectively simulated. An area of exposed schist at the opposite end of the pit from Deepdell Creek was also simulated to allow a liner positioned on top of the waste rock to be keyed into the bedrock.

Both ends and the base of the model are simulated as no-flow boundaries. Groundwater inflows to the model are via defined water levels in or above the Golden Point backfill, to simulate partial saturation of the fill or development of a pit lake to different elevations.

The hydraulic conductivity parameters applied to the model are based on those from the site wide groundwater model (Table 1). As the SEEP/W models are in 2D, the appropriate values for hydraulic conductivity have been applied (Table 2). The shallowest zone of weathered schist has not been incorporated in the SEEP/W model as seepage flows through this zone are not considered crucial for the purposes of this modelling exercise.

Groundwater discharge zones incorporated in the model consist of:

- Deepdell Creek.
- The lowest of the historical mine workings at an elevation of approximately 340 mRL.

- A single tunnel at an elevation of approximately 368 mRL to simulate the uppermost mine workings.
- A potential discharge zone from the base of the Deepdell Valley slope to the top of the slope above the pit.

Table 2: Hydraulic parameters applied to SEEP/W models.

Material simulated	Hydraulic conductivity (m/s)
Schist	1×10^{-7}
Hanging Wall Shear	8×10^{-8}
Backfill	3×10^{-5}
Liner	1×10^{-7}

Four models have been produced for comparison purposes, simulating the following scenarios:

1) The base case of the current pit layout without a liner.
2) Construction of an A Zone liner against the northern wall of the pit and keyed directly into schist bedrock at the base of the pit wall.
3) Construction of an A Zone liner against the northern wall of the pit and across the floor of the pit. Instead of keying the liner directly into the underlying schist it would lap onto in-situ schist exposed in the pit at closure.
4) Complete sealing of the underground workings to remove the preferred flow paths.

Model 1 has been used to calculate mine water losses through the underground workings based on water levels observed in Golden Point Pit during the past four years. The permeability of the backfill has been broadly calibrated against these observations. As the water level in the pit has not been monitored accurately, the calibration is not reliable enough to provide more than an approximation of the seepage losses to be expected should a pit lake form following closure of the pit.

5.2 Assumptions

The primary assumptions built into the SEEP/W model of the northern wall of Golden Point Pit are:

- The zone of relaxed schist expected to be present beneath the valley slope of Deepdell Creek has not been modelled and is assumed to not be crucial in the outcomes of the simulations.
- The hydraulic conductivity of the schist rock mass in the intact rock barrier has not been seriously influenced by blasting or other mining activity associated with the MGP.
- The historical workings, although constructed at several elevations, are of relatively limited extent and can effectively be simulated by a drainage system at the toe of the original pit wall.

5.3 Numerical Model

Seepage through and beneath the embankment was analysed by assuming 2 dimensional seepage flow conditions. The finite element program SEEP/W in the GeoStudio 2007 computer package was used for the seepage analysis.

The layout and mesh structure of the SEEP/W models are presented in Appendix B. Key information relating to the modelling in Appendix B includes the following:

- The structure of Model 1 simulating the base case is presented in Figure B1. The liner shown in this figure is not active in the base case simulation.
- The structure of Model 2 simulating the addition of an A Zone liner keyed into the schist at the base of the northern pit wall is presented in Figure B2.
- The structure of Model 3 simulating the addition of an A Zone liner across the base of the pit is presented in Figure B1.
- The structure of Model 4 simulating the sealed underground workings is presented in Figure B1. The liner shown in this figure is not active in the sealed workings simulation base case simulation. In addition, the region used to simulate the lowest workings has been filled with material replicating the seepage properties of the HWS. The boundary conditions applied to simulate groundwater flows into the workings have been inactivated.

The SEEP/W models by default simulate seepage flows through a 1 m thick section of the pit. The calculated seepage flows subsequently need to be multiplied by the width of the northern pit wall to produce an approximation of the total flows than can be expected to discharge to Deepdell Creek under the different modelled scenarios.

5.4 Model Results

The base case simulation used for the initial model calibration applied a groundwater head of 347 mRL to the waste rock fill in the pit. This pressure is approximately equivalent to elevations of water in the pit sump since 2007, although seasonal variations have not been taken into account. The calculated water discharge through the underground workings under this scenario is approximately 400 m^3/day. This rate is close to the upper end of the range of flows recorded (Figure 3). However, the pumping system in Golden Point Pit is expected to be keeping the sump water level down below the 347 mRL elevation applied to this simulation. As such, the simulated flow is in the correct range for model calibration purposes.

Simulated discharge flows through the underground mine workings to Deepdell Creek under a range of water levels in Golden Point Pit are summarised in Figure 5. The results from the scenario simulating sealed underground workings are not presented in this figure as the workings are assumed to no longer form a conduit for mine water discharges. The simulated direct seepage flows discharging to Deepdell Creek are presented in Figure 6 and the total simulated flows are presented in Figure 7.

It is clear that mine water discharges through the underground workings would increase rapidly as the pit lake level rises. The simulated flows of several thousand m^3/day generated from the base case model confirm this expectation (Figure 5).

The models indicate that installing an A Zone liner keyed into the underlying schist, as simulated in Model 2, could reduce seepage flows through the underground workings by a factor of about 4. A liner keyed into the schist at the toe of the liner performed better than a liner simulated as being installed on top of the backfill in the pit (Model 3). However, the calculated discharge flows still increased from approximately 600 m^3/day to between 1,000 m^3/day and 1,700 m^3/day as the simulated water level in the lake was increased.

The most effective scenario at limiting discharge flows from Golden Point Pit was to completely seal the underground workings, thereby limiting water losses from the pit to general groundwater seepage. If this could be achieved, the discharge flows could decrease to less than 100 m^3/day (Figure 6). The total discharge flows from Golden Point Pit are completely dominated by flows to the underground workings under each scenario where the workings have not been sealed (Refer Appendix C).

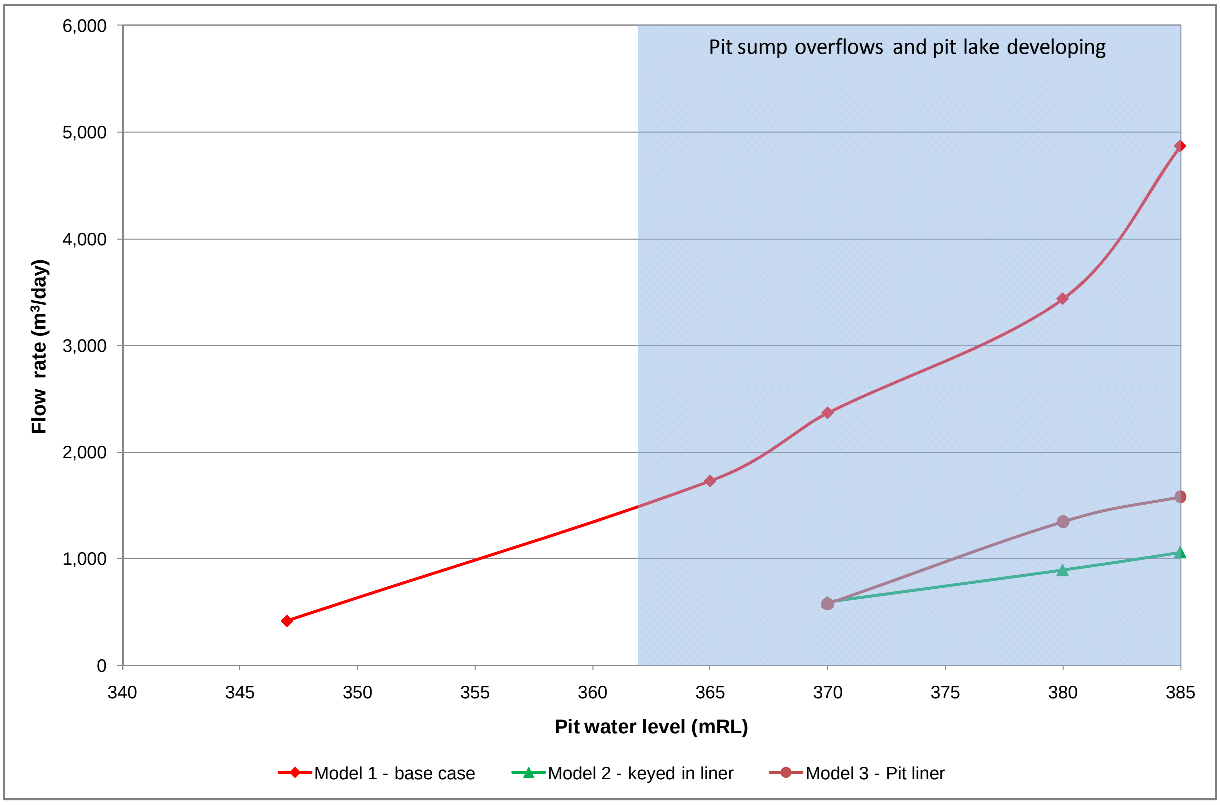

Figure 5: Simulated seepage losses to Deepdell Creek through the underground workings.

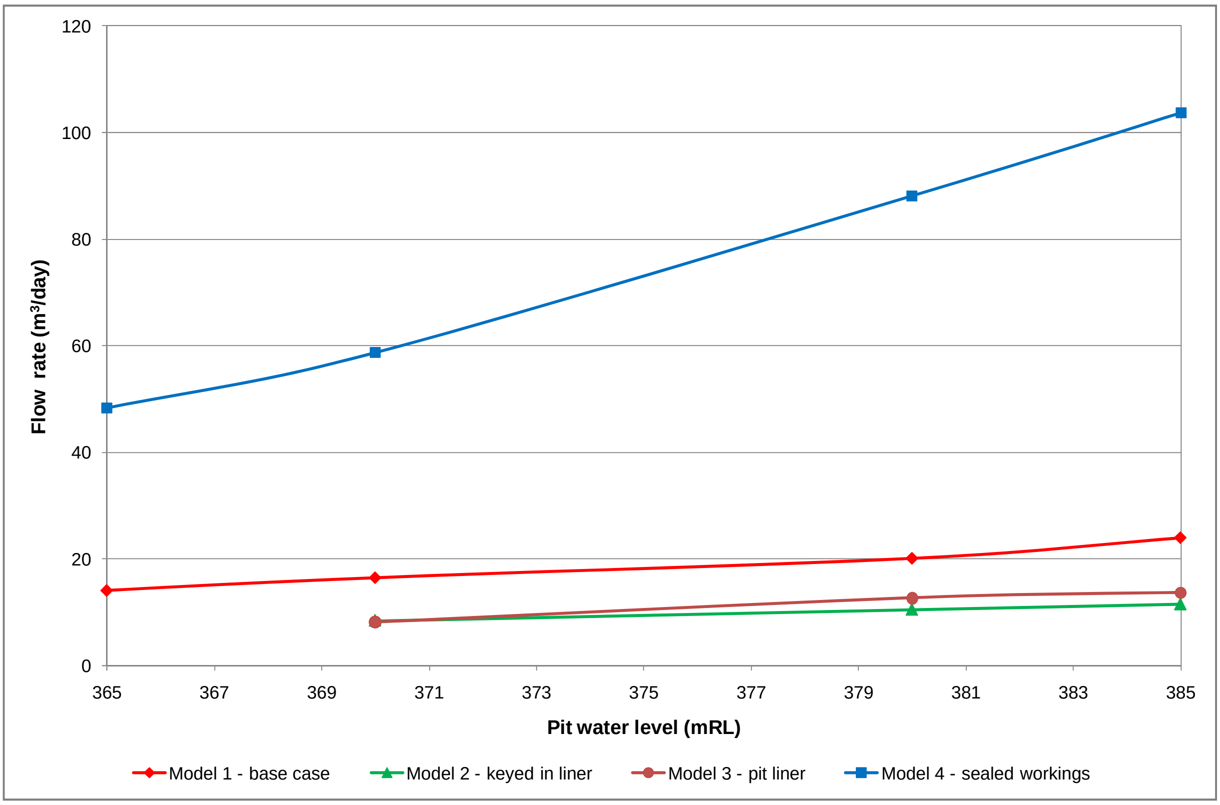

Figure 6: Simulated seepage losses directly to Deepdell Creek.

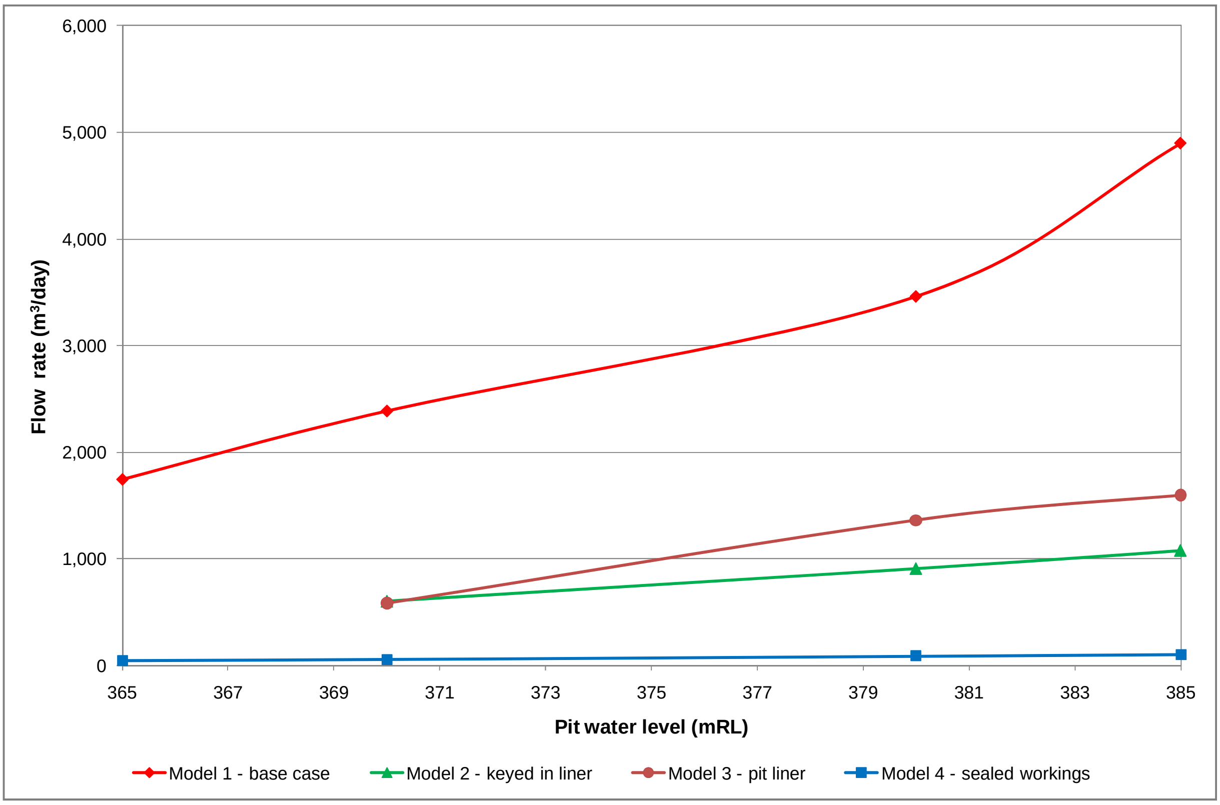

Figure 7: Simulated total seepage losses to Deepdell Creek.

6.0 DISCUSSION AND CONCLUSIONS

The modelling undertaken for this project indicates discharge flows from the proposed Golden Point Pit lake could exceed 1,000 m^3/day even if the northern end of the pit could be lined with an A Zone similar to that installed in the tailings storage facilities. The most effective modelled scenario to limit discharge flows is to completely seal the underground workings.

The seepage flow rates derived from the SEEP/W models are on a similar scale to current discharge flows from drainage systems installed in the tailings storage facilities at the MGP. This provides further confidence in the outcomes being in the correct range. These calculations however assume that there would eventually be enough water coming into the pit from run-off and groundwater seepage to form a pit lake that exceeds the invert level for the lowest of the underground workings.

The long term water balance modelling for the combined Golden Point and Round Hill Pits (Golder 2011a) indicates that the water level in these pits would eventually rise above the level of the lowest historical workings. The water balance modelling incorporated an assumption that the underground workings were sealed and the water level is therefore free to rise further. The results of the SEEP/W simulations indicates that discharges through the underground workings would eventually limit the height to which the lake level could rise due to the large potential discharge flows through these workings. Although not specifically investigated in this modelling, it may be assumed that seepage losses through the underground workings would eventually balance rainfall and run-off inflows to the pit.

If the underground workings are not sealed or potential flows through these workings not minimised by some means, the water level within Round Hill Pit is unlikely to rise much above the level of the lowest workings. Sealing the adits should result in the lake surface rising until the lake inflows are balanced by evaporation and seepage losses through the intact rock barrier. The potential final water level in the lake was not investigated during this study.

7.0 REFERENCES

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Golder 2011b. Macraes Phase III Project. Groundwater Contaminant Transport Assessment - Deepdell Creek, North Branch Waikouiti River and Murphys Creek Catchments. Report prepared for OceanaGold (New Zealand) Limited by Golder Associates (NZ) Limited, April 2011. Report No. 0978110-562 R006.

Kingett Mitchell 2002. Macraes Gold Project tailings capacity expansion – groundwater assessment. Report prepared for OceanaGold (New Zealand) Limited by Kingett Mitchell Limited, September 2002.

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Masset O, Loew S 2010. Hydraulic conductivity distribution in crystalline rocks, derived from inflows to tunnels and galleries in the Central Alps, Switzerland. Hydrogeology Journal 18: 863–891.

APPENDIX A

Statement of Limitations

REPORT LIMITATIONS

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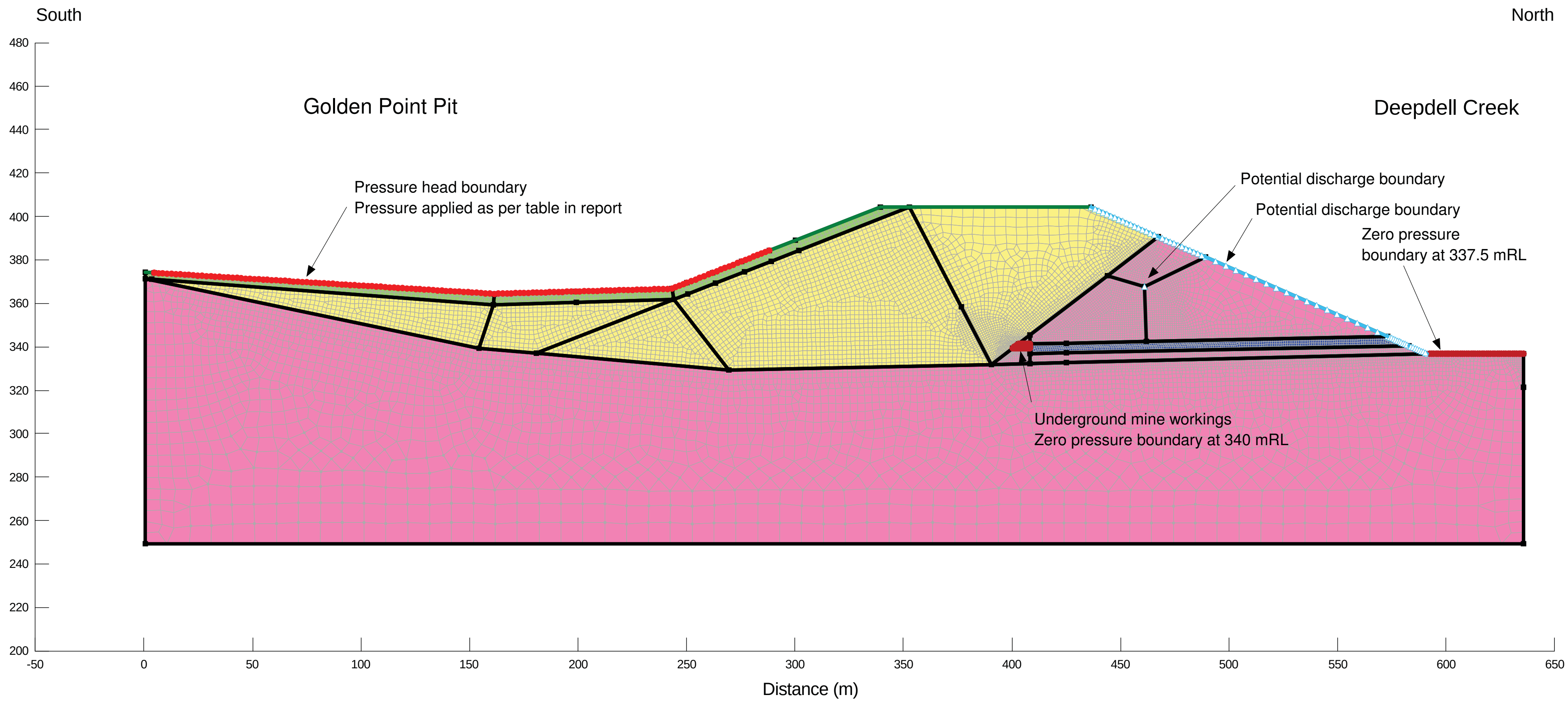
APPENDIX B

SEEP/W Model Layouts



Legend

- Schist: Hydraulic conductivity 1 x 10e-7 m/s
- Waste rock backfill: Hydraulic conductivity 3 x 10e-5 m/s
- Hanging Wall Shear: Hydraulic conductivity 8 x 10e-8 m/s
- Constructed liner: Hydraulic conductivity 1 x 10e-7 m/s

1. Schematic only, not to be interpreted as an engineering design or construction drawing

Golder Associates

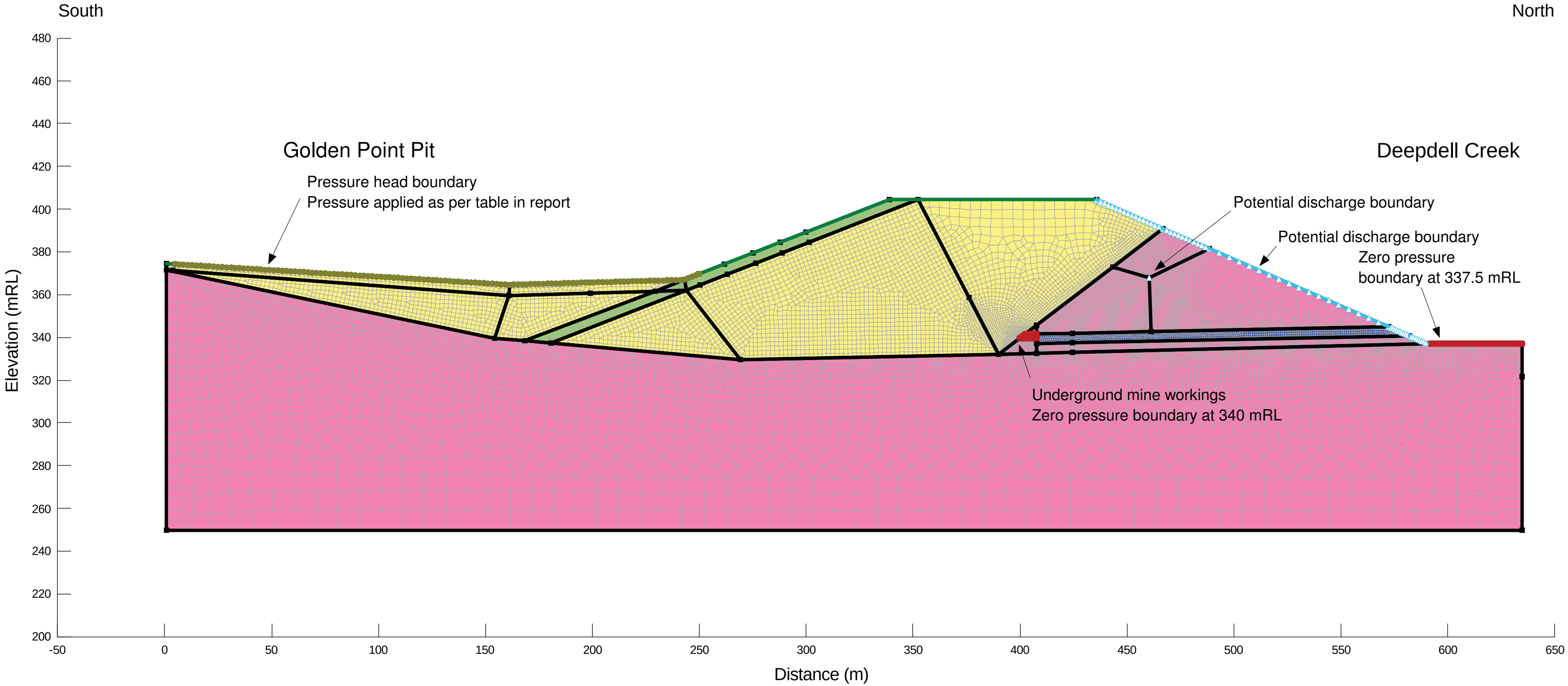
TITLE GOLDEN POINT PIT SECTION WITH INTERNAL LINER: MODEL STRUCTURE

MARCH 2011

PROJECT 0978110562

B1

H:\Technology & Desgin\Graphics\Projects-numbered\2009\09781x\10xxx\0978110_562_OceanaGold_MacraesFlatExpansion\Mar11\Phase III_R014 Golden Point seepage



Legend

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- Waste rock backfill: Hydraulic conductivity 3 x 10e-5 m/s
- Hanging Wall Shear: Hydraulic conductivity 8 x 10e-8 m/s
- Constructed liner: Hydraulic conductivity 1 x 10e-7 m/s

1. Schematic only, not to be interpreted as an engineering design or construction drawing

Golder Associates

TITLE GOLDEN POINT PIT SECTION WITH EXCAVATED LINER: MODEL STRUCTURE

MARCH 2011

PROJECT 0978110562

B2

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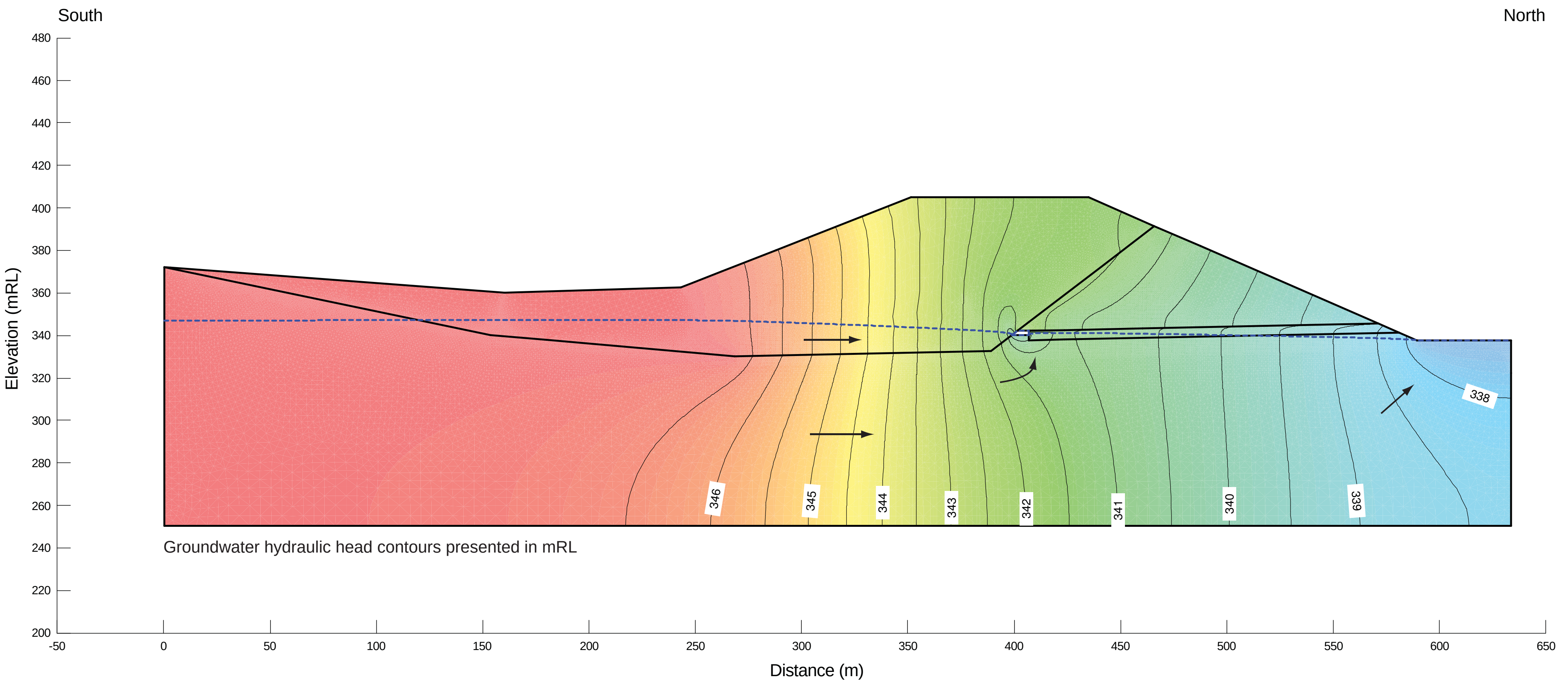
APPENDIX C

Selected SEEP/W Model Simulation Results



Legend

- Groundwater table
- Groundwater flow direction

NOTES:
1. Flooded area of Round Hill Pit located to one side of the line of the modelled cross section
2. Schematic only, not to be interpreted as an engineering design or construction drawing

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TITLE BASE CASE MODEL OUTCOME: WATER LEVEL IN PIT 347 MRL

MARCH 2011

PROJECT 0978110562

C1

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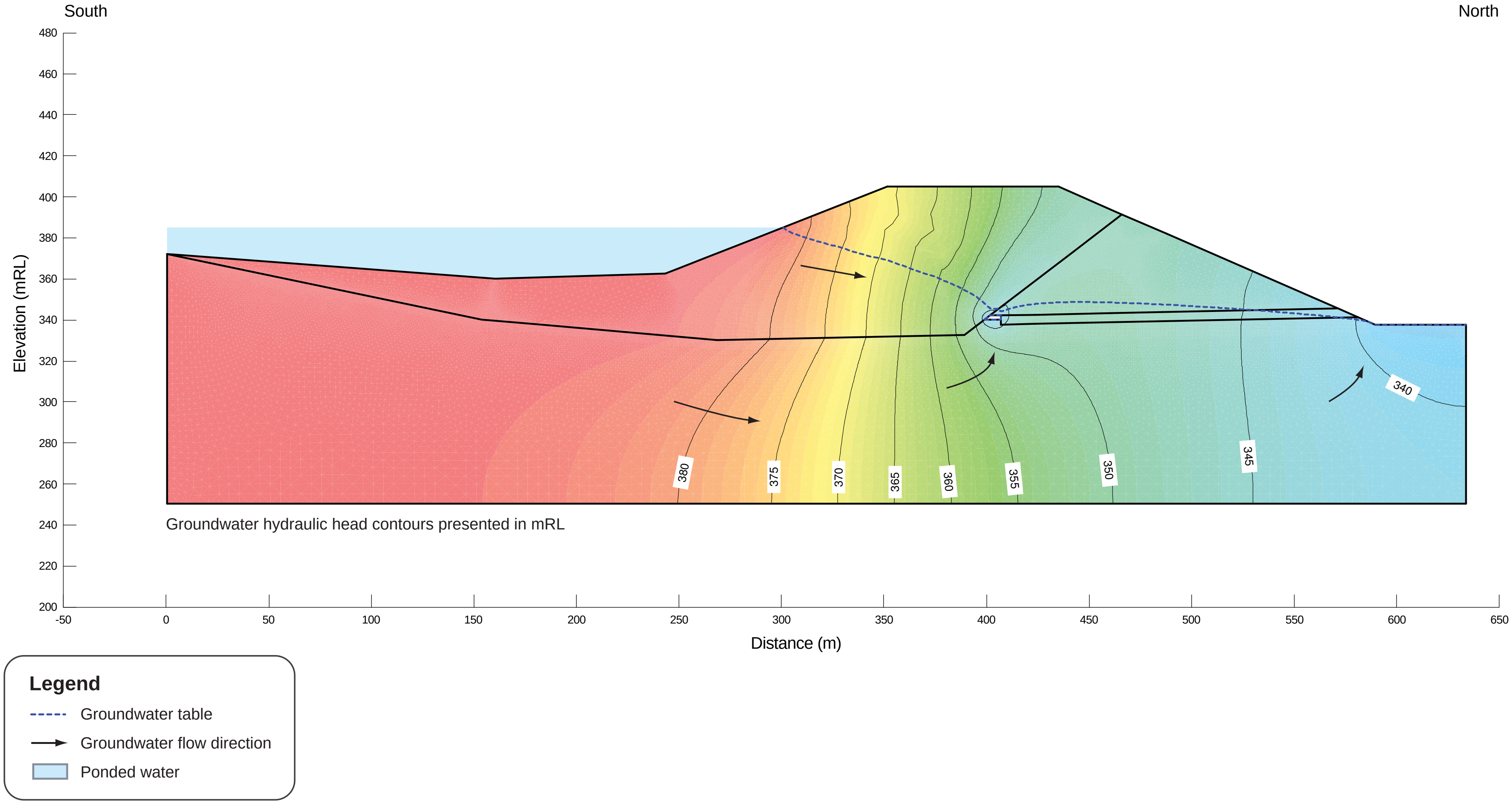

1. Schematic only, not to be interpreted as an engineering design or construction drawing

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TITLE BASE CASE MODEL OUTCOME: WATER LEVEL IN PIT 385 MRL

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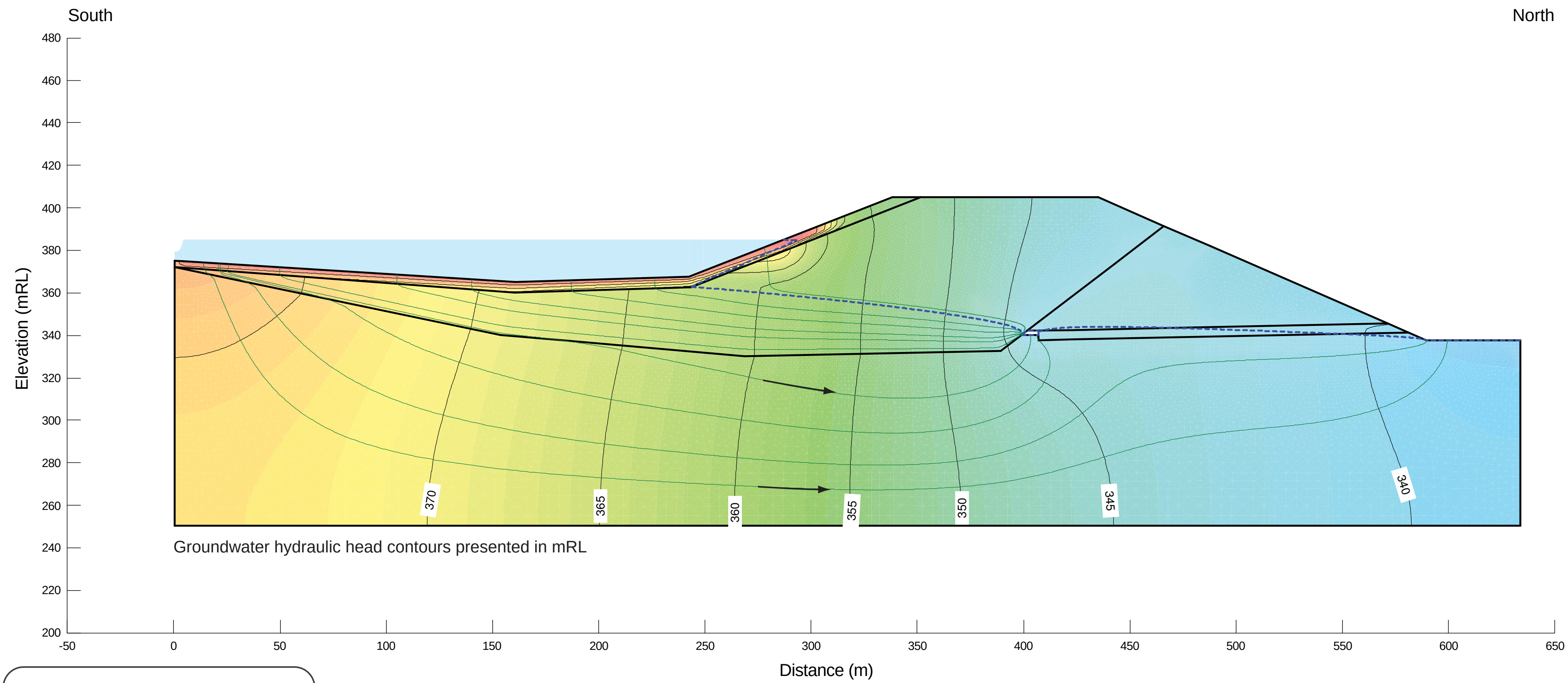
C2



Legend

- Seepage flow paths
- Groundwater table
- Groundwater flow direction
- Ponded water

1. Schematic only, not to be interpreted as an engineering design or construction drawing

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TITLE INTERNAL LINER MODEL OUTCOME: WATER LEVEL IN PIT 385 MRL

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PROJECT 0978110562

C3

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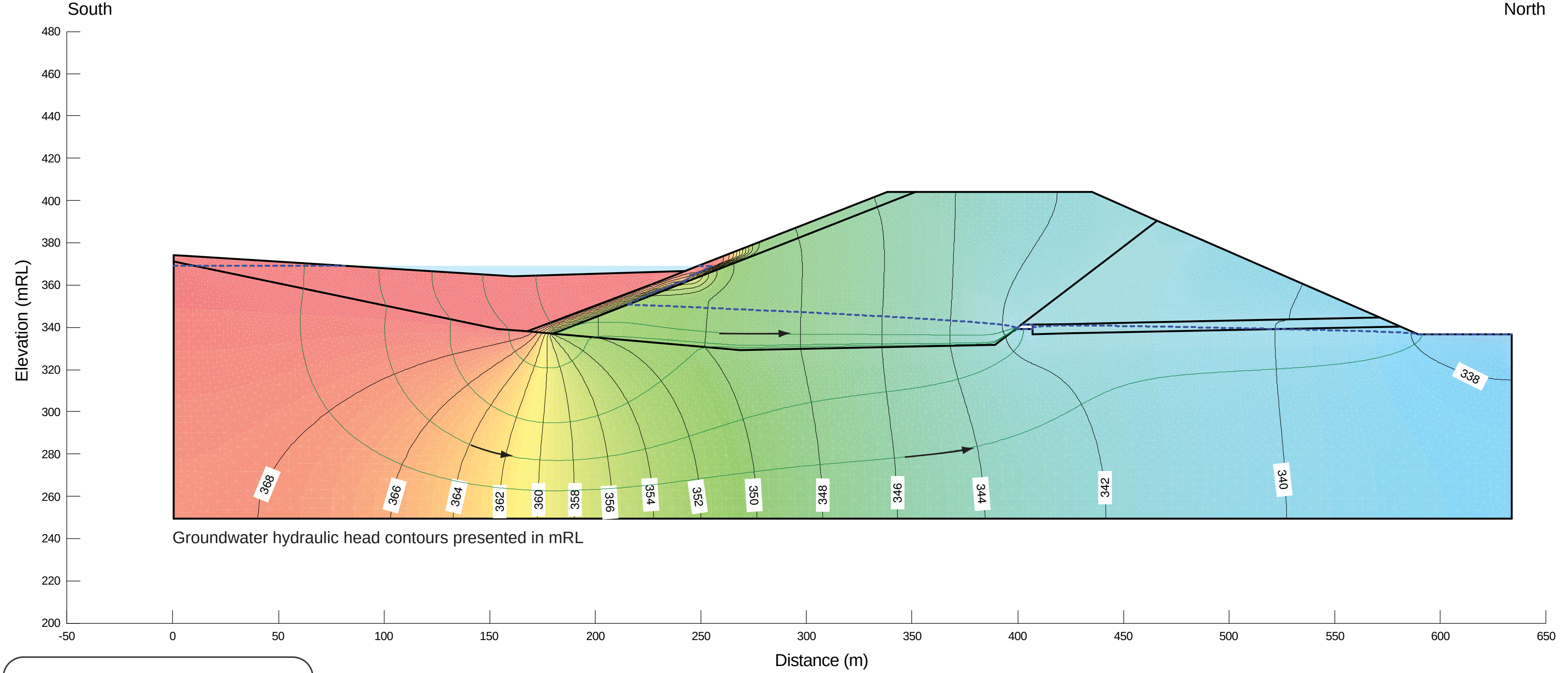

Legend

- Seepage flow paths
- Groundwater table
- Groundwater flow direction
- Ponded water

1. Schematic only, not to be interpreted as an engineering design or construction drawing

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TITLE EXCAVATED LINER MODEL OUTCOME: WATER LEVEL IN PIT 370 MRL

MARCH 2011

PROJECT 0978110562

C4

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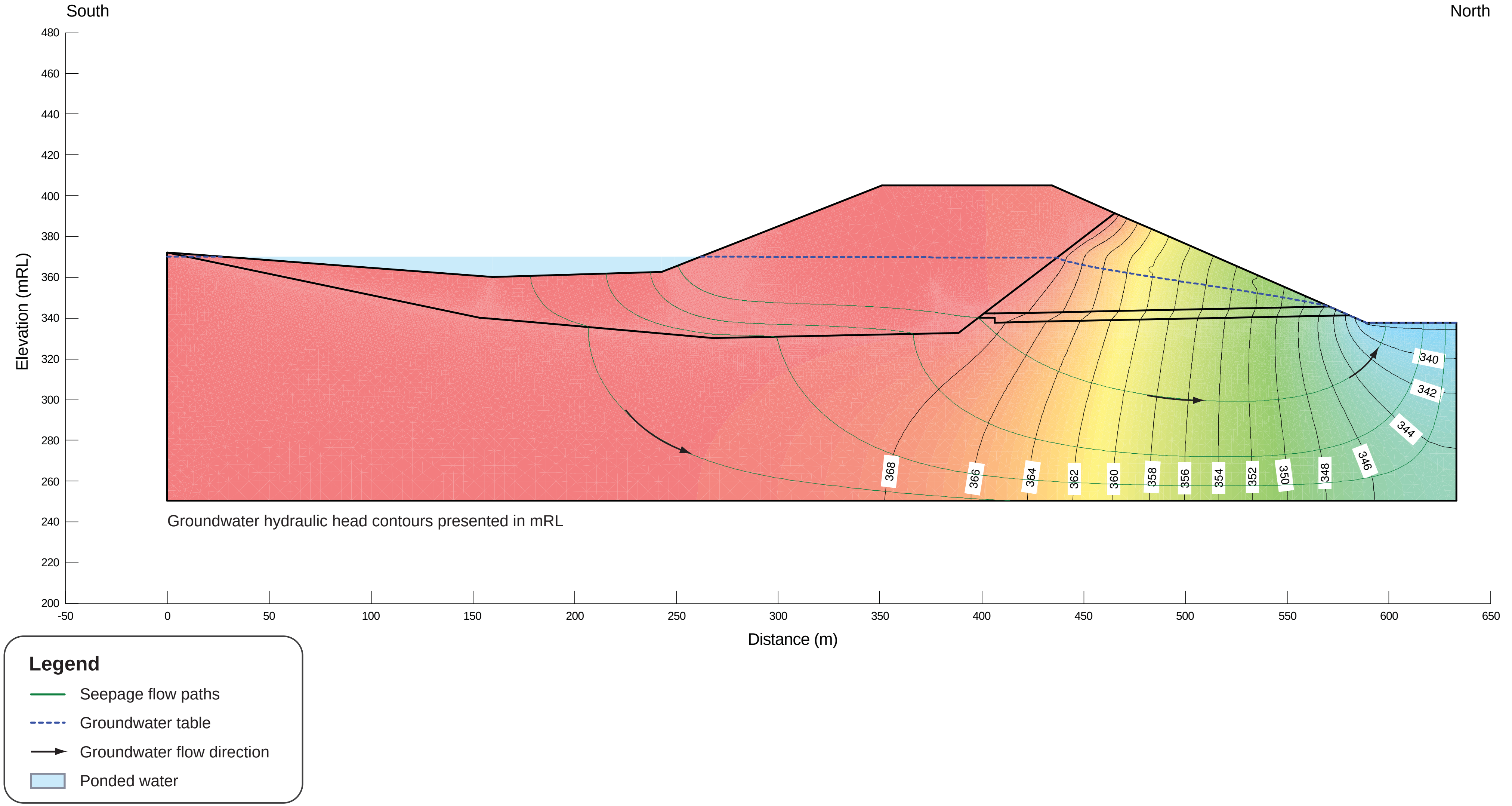

1. Schematic only, not to be interpreted as an engineering design or construction drawing

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TITLE SEALED ADITS MODEL OUTCOME: WATER LEVEL IN PIT 370 MRL

MARCH 2011

PROJECT 0978110562

C5

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