# Thalanga Copper Mines Pty Ltd

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28 October 2015

Mr Wing Leung
Senior Environmental Officer
Mining - Townsville Environmental Services and Regulation
Northern Region
Department of Environmental and Heritage Protection
P O Box 5391
Townsville Qld. 4810

Dear Mr Leung

**Re: Transitional Environment Program (TEP) MAN17020**

In accordance with the commitments made in the above TEP please accept this report on the potential earthworks program for 2016 at the Highway Reward mine.

**INTRODUCTION**

The report was proposed as part of the TEP in the section " *Future Surface Water Flows*".

This section proposed:

- Determining which areas of the site provide a stable contaminant-free runoff
- Determining which areas of the site do not provide a stable contaminant-free runoff
- Developing measures to prevent off-site release of contaminants, such as diverting contaminated water into the pit, maximising evaporation on site, or using earthworks and revegetation to minimise waste rock dump seepage development.
- Providing a report to DEHP to evaluate prospective earthworks which can maximise clean water flows off site and contaminated water into the pit void, after monitoring flows for two wet seasons and assessing the interaction between surface water and groundwater.

**FLOW AND SURFACE WATER MONITORING**

The Thalanga Copper Mines Joint Venture (JV) provided a TEP report to DEHP on 12 June 2015 on flow and surface water monitoring.

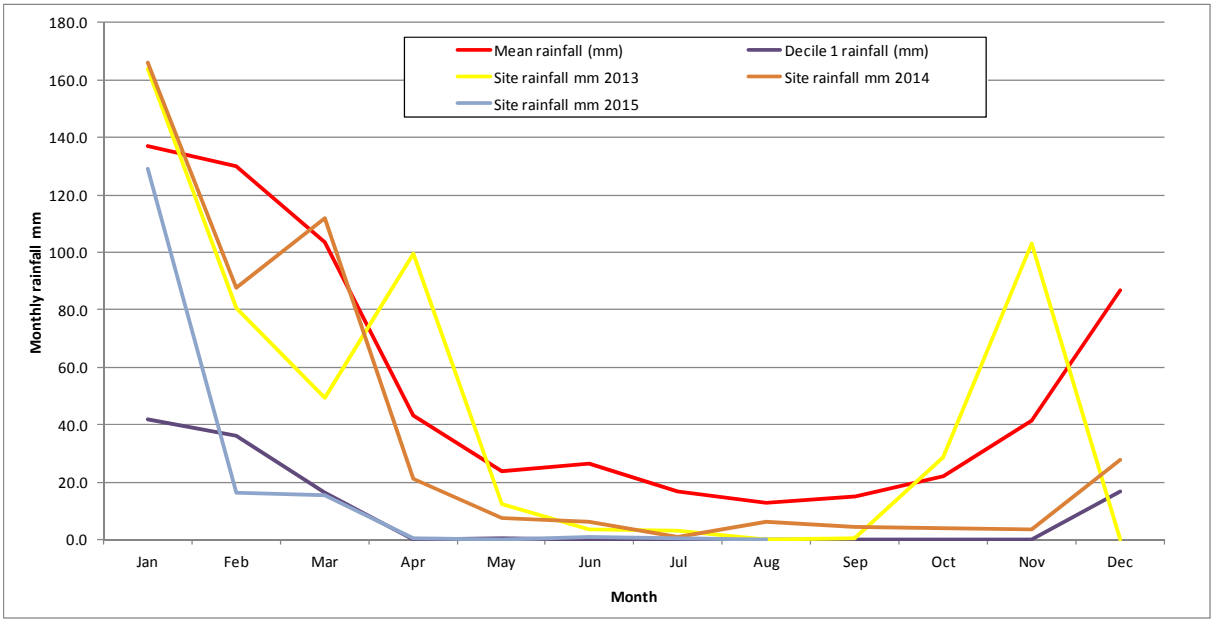
This report covered the period from 10 December 2014 until 11 June 2015. The TEP sites were sampled fortnightly during the notional wet season from 1 December until 30 March. The report noted that this period was characterised by extremely low rainfall on site with a few short duration flow events. The report also noted that drought conditions on site have prevented any runoff or seepage estimates being made during the monitoring period.

The drought conditions noted in June 2015 are the result of dry conditions experienced on site and in the region since the start of the TEP in August 2013. Table 1 compares recorded site rainfall to end August 2015 with BOM recorded rainfall at Charters Towers since Jan 2013. Site rainfall in 2013 was 62.6% of the mean annual rainfall at Charters Towers, 2014 was 61.7% of the mean annual rainfall at Charters Towers with 2015 dropping to 32.9% of the mean annual rainfall at Charters Towers to end August. This is also shown in Figure 1.

**Table 1 Site Rainfall**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall (mm) | 136.9 | 130.1 | 103.5 | 43.4 | 24.0 | 26.5 | 16.8 | 13.0 | 14.8 | 22.0 | 41.4 | 86.9 | 659.3 |
| Highest rainfall (mm) | 723.7 | 488.5 | 423.8 | 266.2 | 128.0 | 238.5 | 101.4 | 105.2 | 136.7 | 124.7 | 179.8 | 372.0 | 3288.5 |
| Decile 9 rainfall (mm) | 269.2 | 248.4 | 206.3 | 116.8 | 70.7 | 73.6 | 57.7 | 36.9 | 49.9 | 61.4 | 103.8 | 184.9 | 1479.6 |
| Decile 1 rainfall (mm) | 42.0 | 36.3 | 16.4 | 0.0 | 0.6 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.8 | 112.3 |
| Site rainfall mm 2013 | 163.9 | 80.6 | 49.5 | 99.6 | 12.5 | 3.4 | 3.3 | 0.1 | 0.4 | 28.8 | 103.0 | 0.2 | 545.3 |
| Site rainfall mm 2014 | 165.9 | 87.6 | 111.7 | 21.3 | 7.3 | 6.4 | 1.1 | 6.2 | 4.3 | 3.9 | 3.5 | 27.9 | 447.1 |
| Site rainfall mm 2015 | 129.2 | 16.4 | 15.3 | 0.7 | 0.0 | 1.0 | 0.3 | 0.1 | | | | | 163.0 |

**Figure 1 Rainfall comparison**




Given that when proposed this report was predicated on monitoring flows for two wet seasons to assess the interaction between surface water and groundwater and to evaluate prospective earthworks which can maximise clean water flows off site and contaminated water into the pit void, the JV submits that there has not been sufficient rainfall to facilitate this evaluation.

The JV will again review the available data in May 2016 after the impending wet season and the TEP sampling proposed. However, the Bureau of Meteorology (BOM) forecast outlook[1] is that October to December is likely to be drier than average across southeast

[1] http://www.bom.gov.au/climate/outlooks/#/rainfall/summary accessed 21 October 2015.

and northeast Australia. The BOM notes that current outlook reflects a combination of a mature El Niño in the Pacific, and an emerging positive Indian Ocean Dipole.

## POTENTIAL EARTHWORKS

Notwithstanding the above lack of data, the JV has been considering and evaluating options for eventual diversion works on site.

### *Groundwater and Pit Water Balance Models*

To evaluate the potential impact of groundwater quality on surrounding aquifers, a groundwater model and a pit water balance model was developed by EGC in April 2008. Mining One was commissioned to recalibrate and improve the models in 2012.

The groundwater model utilised rainfall data and ran scenarios (over 100 years) which indicated that the pit would be acting as a sink with a radius of influence ranging between 400 m and 1 km around the edge of the pit. This effectively means that any groundwater contaminants from the site will be drawn towards the pit and be captured within the mine drainage.

The height to which water in the pit can rise without adversely affecting the local or regional groundwater flows is the base of the Campaspe Beds, overlying the oxidized zone, at around 275 m AHD.

Mining One's 2012 pit water balance model suggested that up to 100 ML per annum of runoff could be diverted into the pit without compromising the ability of the pit void to handle the increasing water level (through evaporation) without impacting on surface or groundwater. This equates to run off from 36% of the site's catchments assuming a run off co-efficient of 40%. The runoff co-efficient is yet to be confirmed from rainfall and runoff measurements and calibration of the groundwater model.

Table 2 Shows the catchment estimates used by Mining One in 2012 and the current catchment and consequent runoff estimates (See Figure 2). In Figure 2 the purple area is the runoff from the ROM which drains into the pit. The Mining One model allowed for waste rock dump areas of 59 ha for Highway waste rock dump and 21 ha for the Reward waste rock dump with no allowance for the ROM runoff for a total pit catchment of 80 ha. The current pit catchment is 29 ha. These are shown in Table 3. These runoff estimates have been based on the mean annual rainfall for Charters Towers.

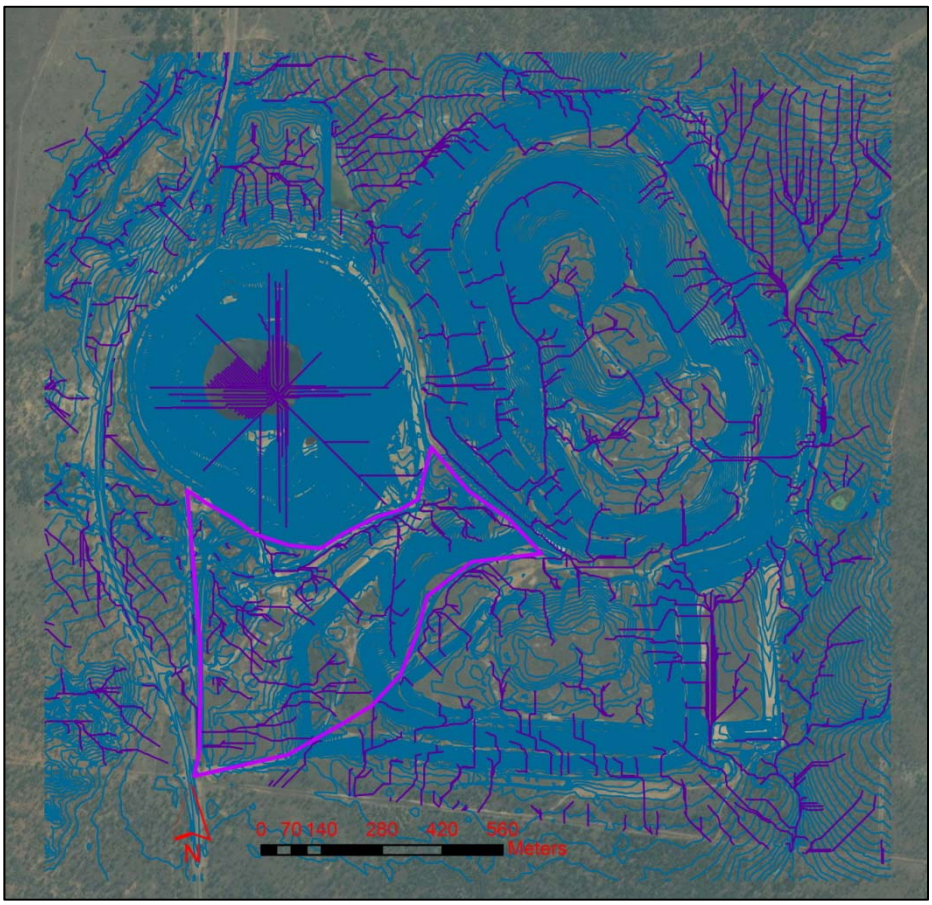
**Table 2 Estimated runoff into pit**

| | From M1 Report 2012 | Current Runoff 2015 |
|---|---|---|
| Catchment area $M^2$ | 800,000 | 293,682 |
| Runoff coefficient | 0.4 | 0.4 |
| Mean annual rainfall mm | 659.3 | 659.3 |
| Annual Volume ML | 210 | 77 |

**Table 3** **Pit Catchments**

| | From M1 Report 2012 | Current Runoff 2015 |
|---|---|---|
| Highway WRD $m^2$ | 590000 | 0 |
| Reward WRD $m^2$ | 210000 | 0 |
| ROM $m^2$ | | 293,682 |
| **Total area $m^2$** | **800,000** | **293,682** |

**Figure 2** **Current Runoff into the Pit Void.**




The pit catchment needs to receive runoff of less than 100 ML per. Run off from catchments which do not drain into the pit, needs to be demonstrably clean water which meets EA quality limits. The lack of site rainfall and runoff over the life of the TEP has meant that the JV has not been able to verify this.

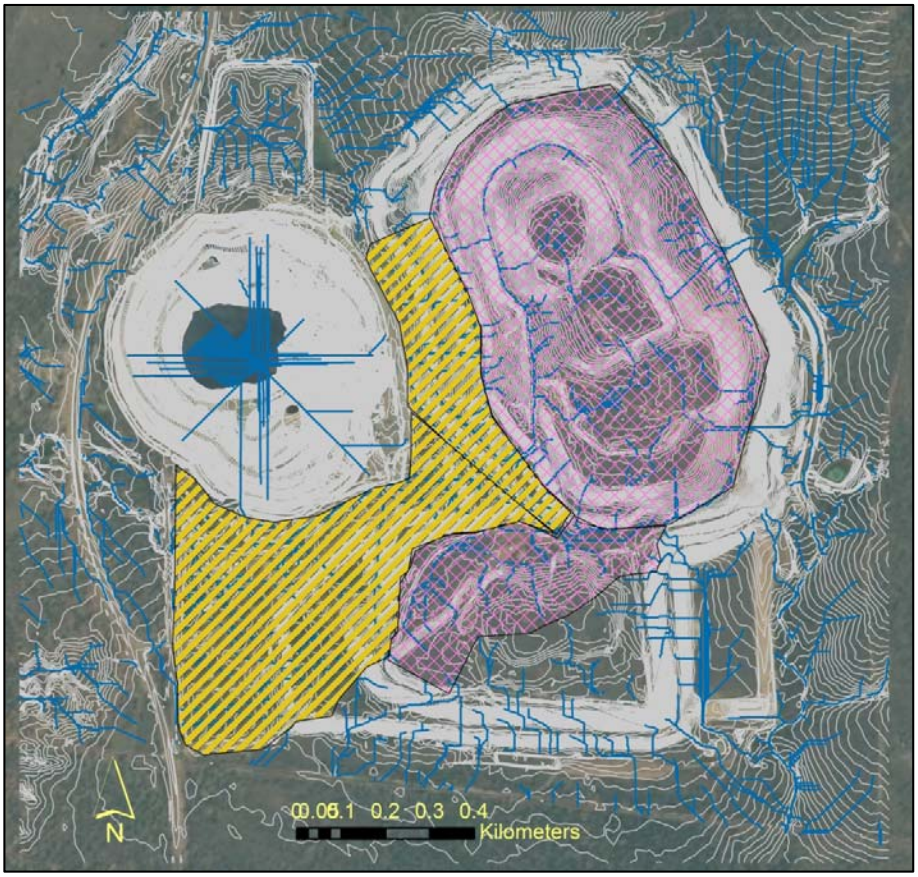
Scoping level calculations have been undertaken to estimate the potential catchments which could be safely diverted into the pit void. This is shown in Table 4 and Figure 3.

**Table 4** **Reduced Pit Catchment Estimates**

| | From M1 Report 2012 | Current Runoff 2015 | Reduced Catchment |
|---|---|---|---|
| Highway WRD $m^2$ | 590000 | 316,872 | 104,506 |
| Reward WRD $m^2$ | 210000 | 99,856 | 0 |
| ROM $m^2$ | | 293,682 | 294,907 |
| **Total area $m^2$** | **800,000** | **710,410** | **399,413** |

The reduced catchment above equates to an mean annual pit inflow of approximately 105 ML using the assumed run off co-efficient of 40%. Depending on the results of the pit water balance calibration work currently underway, the area being diverted into the pit may need to decrease or be able to increase as required.

**Figure 3 Reduced Pit Catchment Depiction**




The yellow cross hatch depicts the runoff which would be diverted into the pit and the red cross hatch depicts the catchment where the water quality needs validation through good wet season sampling. The blue drainage lines show existing flows to the southeast continuing. To date, downstream surface water monitoring has not shown any EA exceedances to the south east.

**Figure 4 Potential Drainage and Diversion Lines**


Figure 4 shows potential drainage and cut off channels to divert contaminated and clean runoff. The marked drainage lines direct flows into the pit and from upper benches of the Highway waste rock dump to the decommissioned water dam to the east. They have lengths of 221 metres and 917 metres respectively. Figure 4 also shows the potential location of a cut through the current site road which would facilitate the diversion of contaminated runoff from the Highway waste rock dump into the pit.

**TEP SAMPLING 2015-2016**

The TEP sampling for the impending wet season involves sampling and analyzing surface runoff and ponds along the western base of the Highway WRD and along the second top western bench to characterise the potential runoff.

The objectives of the surface water sampling proposed for the third year of the TEP are to:

- Investigate and confirm some sources of acidity and copper which have been are reporting to the sample site SW6.
- Evaluate the quality of water pooling along the high benches of the Highway waste rock dump.

- Evaluate the quality of water which may be seeping to the south from the Reward Waste rock dump.

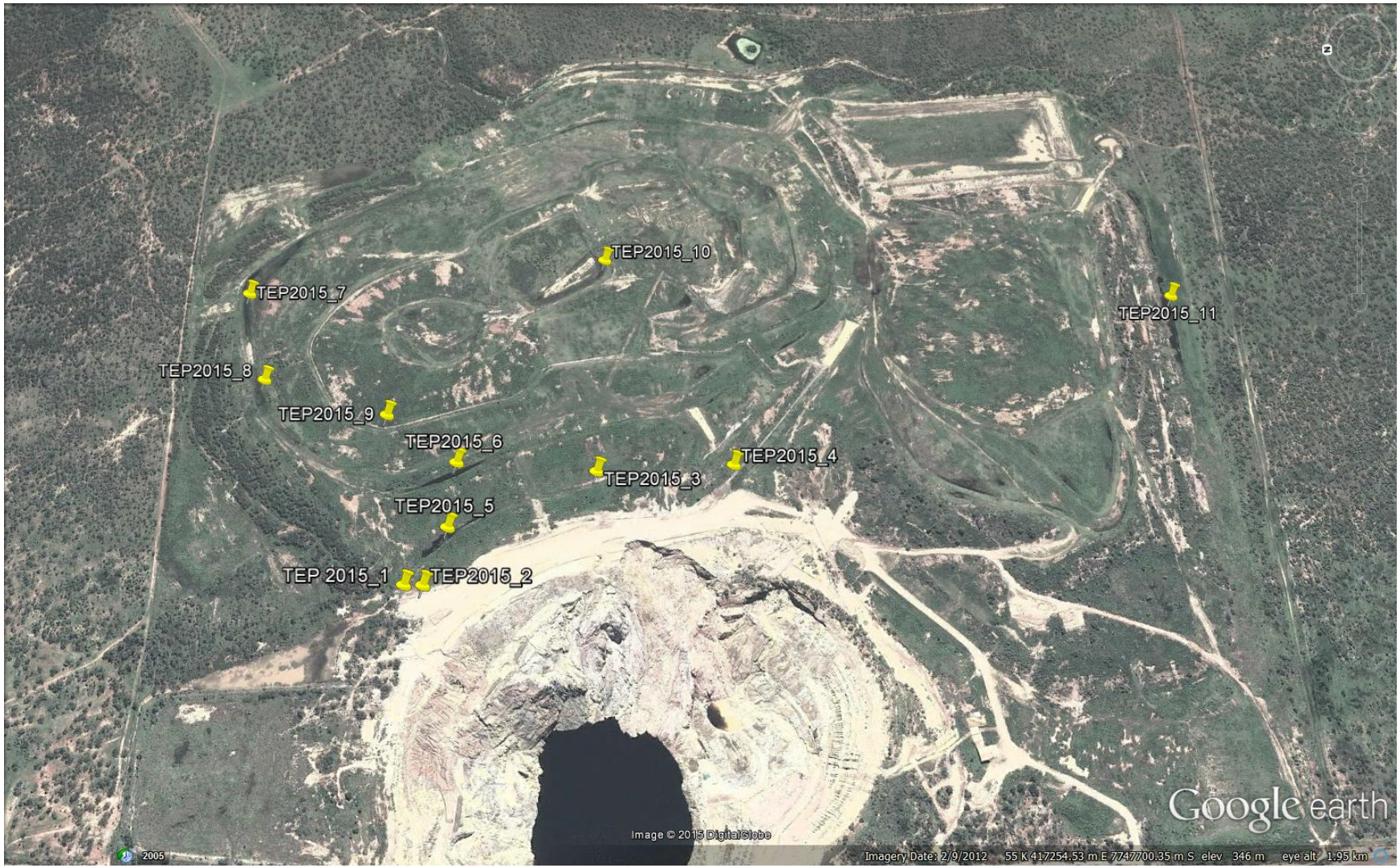
The location of each proposed sample site is shown in Figure 5 below. Sampling is proposed in conjunction with SW sampling i.e. when there has been enough rain to get water flowing around the site and again one week later.

All samples collected will be sent to ALS for the following analysis:
Lab pH, Acidity, Total & Dissolved metals (Cd, Cu, Pb, Se, Mo, Zn).
Approximate coordinates for TEP samples are provided in Table 5.

**Table 5 TEP 2015 co-ordinates**

| ID | UTME | UTMN | Location |
|---|---|---|---|
| TEP2015-1 | 0417018 | 7748144 | North of NW cnr highway WRD |
| TEP 2015-2 | 0417016 | 77479118 | S of NW cnr highway WRD |
| TEP 2015-3 | 0417181 | 7747866 | First bench Highway WRD pooling water immediately south of drop structure |
| TEP2015-4 | 0417183 | 7747661 | SF2 weir sample point |
| TEP2015-5 | 0417102 | 7747084 | First bench Highway WRD northern pool western side of dump |
| TEP2015-6 | 0417203 | 7748073 | Second bench Highway WRD northern pool western side of dump |
| TEP2015-7 | 0417533 | 7748418 | Second bench Highway WRD north eastern pool |
| TEP2015-8 | 0417365 | 7748374 | Second bench Highway WRD northern pool |
| TEP2015-9 | 0417285 | 7748179 | Third bench Highway WRD north western corner pool |
| TEP2015-10 | 0417554 | 7747845 | Highest bench Highway WRD south western corner pool |
| TEP2015-11 | 0417455 | 7746928 | Pooling water immediately south of the Reward WRD |

**Figure 5 Sample Locations**



The JV will review data again after the completion of TEP sampling at the end of the 2015/2016 wet season and if insufficient rain falls, the JV may apply for an extension to the current TEP.

**MAINTENANCE EARTHWORKS**

The JV will also undertake maintenance earthworks to repair erosion lines and scours which could expose sulphidic material and lead to AMD formation. Areas currently marked for capping and repair are shown in Figure Figure 6 below. The site will be inspected in May 2016 to determine whether any further maintenance earthworks are required.

**Figure 6 Currently Proposed Maintenance Earthworks**

Please feel free to call me if you have any questions.

Yours sincerely

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