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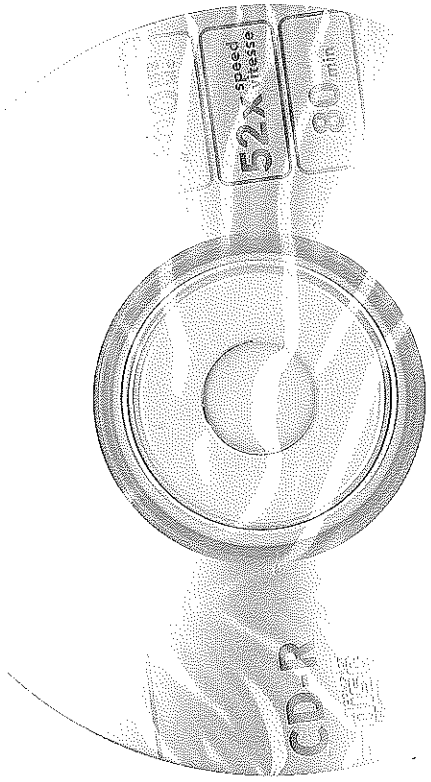
SM - Kadletz



QUEENSLAND FLOODS COMMISSION OF INQUIRY

STATEMENT

OSKAR KADLETZ of C/- Level 16, 61 Mary Street, Brisbane in the State of Queensland, Abandoned Mines Coordinator**, states on oath:**

1. I am the Abandoned Mines Coordinator and manage the Abandoned Mine Lands Program, implemented by the Mines and Energy Division of the Department of Employment, Economic Development and Innovation (the Department).

2. This statement is provided in response to the requirements of the Commissioner of the Queensland Floods Commission of Inquiry, the Honourable Justice Holmes, made 8 and 9 September 2011, seeking statements in relation to certain points outlined below.

Provide a brief description of the main flood related concerns at the Mt Oxide Mine (abandoned) ("the Mine") (for example – hazards and contaminants at the Mine, effect of flood on the downstream environment)

3. The abandoned Mt Oxide mine site is located on a cattle grazing tenement known as Chidna Station. The historic mining leases expired or were surrendered by August 1999 and there has been no mining on the site since the early 1990s. There is a company currently carrying out exploration activities to assess whether there are sufficient mineral reserves to develop another mine in the future. DEEDI is addressing the ongoing impact from the historic mine which includes rehabilitation works to minimise contaminated discharges. These works are not mining and are not carried out under a mining tenement. The landholder has primary control of the site.

4. The site is located approximately 25 kilometres by road from the Birla-Mount Gordon Mine, and is approximately two hours travel by road from the nearest township which is Mt Isa.

5. Flooding at Mount Oxide is in the context that the water courses are dry for most of the year and only flow during the wet season. The term flooding is generally used in the local context to describe the fact the watercourses are carrying water which impedes access to and around the site. The current understanding of DEEDI officers is, the yearly water flows stay within the current defined bed and banks of the natural water

course. Current understanding is during the wet season water does not go over the top of the natural formed banks of the watercourse.

6. The abandoned mine site contains two areas of possible concern:
    a. a mine pit that is partially filled with water; and
    b. waste rock dumps/stockpiles that contain mineralised material.

7. In relation to the mine pit, the water within the pit is contaminated from contact with naturally occurring mineralisation associated with the ore body that was mined. That is, the naturally occurring rock that forms the lining or walls of the pit is mineralised, and the result is that the minerals leach into the water held in the pit.

8. Potential flood related concerns with respect to the mine pit are overtopping, which would release contaminated water into surrounding streams. In my opinion, this is unlikely, because of the local relationship between rainfall, evaporation, and the size of the mine pit catchment. Annual rainfall varies from several hundred millimetres per year to around 800mm per year in a very wet year, but evaporation for the year is of the order of several metres. With respect to the mine pit catchment, the catchment area is approximately four the size of the mine pit, which is about 240 metres long by 90 metres wide. The average unused containment capacity within the mine pit is 5 – 6 meters, which allows sufficient room to accommodate rainfall from a number of years. Due to the limited size of the catchment, the ratio of the evaporation to rainfall, and the average depth of water in the pit, it is highly unlikely that the pit would overflow from rainfall.

9. To my knowledge, the mine pit has never overflowed.

10. Hydrological advice is that the water in the pit most likely leaks into the ground, and that some of this leakage impacts on the local streams. It is likely that there are other groundwater aquifers surrounding the mine pit and the local streams, and that these are to some extent connected. I **attach** a copy of this hydrological advice, marked **"OK-01"**. Over the coming year, DEEDI is preparing to undertake a number of investigations (referred to in Paragraph 21 of this statement) to better understand the relationship between the mine pit, streams and groundwater aquifers under the site. These investigations incorporate the recommendations of the hydrological report.

11. In relation to the waste rock dumps/stockpiles, metals leach from the mineralised rock within the dumps through contact with rainfall which has infiltrated. Seepage then flows off the dumps into the local creeks. The leaching process within the dumps generates acid, and hence the discharges contain elevated metals and are acidic. By "leaching", I am referring to the process where low pH or acidic water dissolves minerals into the water and is able to carry them away from the source with seepage.

12. Within the mineralised stockpiles, chemical reactions associated with the breakdown of sulphide-containing minerals upon contact with water which has infiltrated from rainfall, produces sulphuric acid. The sulphuric acid makes the water acidic, and it then has a much greater capacity to dissolve minerals (eg copper) than water at a neutral pH. Therefore seepage coming out of the bottom of the stockpiles is acidic and contains dissolved minerals.

13. The main metal of interest at this site is copper, and it is copper that appears to have the most impact downstream.

14. Potential flood related concerns (due to above average rainfall) are increased release of contaminants into streams through seepage from mineralised stockpiles. In addition, due to the location of stockpiles adjacent to a creek, there is the potential that in a flood event large stream flows may erode some of the stockpile material into the creek flow. The result of such erosion is difficult to assess, as the creek already flows across naturally exposed mineralised seams, resulting in natural mineralisation of the water flow.

Provide details of any ongoing concerns regarding controlled or uncontrolled discharges from Mt Oxide mine (abandoned), including the quality of discharges

15. The concerns described above in paragraphs 5 to 14 are the ongoing concerns that relate to discharge from the Mine.

Provide details of flood preparedness activities undertaken by the Department in advance of the 2010/2011 wet season at the mine, including whether any particular activities were undertaken as a response to the forecast of an above-average rainfall

wet season, or any government communications to the Department regarding that forecast.

16. In July to December 2010, DEEDI undertook a major project to place plastic covers over the stockpile areas that had been identified as the most mineralised. This work was undertaken so that the amount of rainfall infiltration into the most mineralised parts of the stockpiles could be minimised, hence reducing the discharge of contaminants to the local streams. This concept was developed during the 2010 Mount Oxide Expert Panel meeting held on 25 June, and was further refined by DEEDI using stockpile analysis information obtained from Perilya Limited, the holder of the current exploration permit over the area. A number of other site actions including some diversion works were also carried out at the same time. I **attach** a copy of the short term actions arising out of the Mount Oxide Expert Panel meeting of 25 June 2010, attached and marked **"OK-02"**.

17. Based on the recommendations of the Mount Oxide Expert Panel, DEEDI samples stream flows downstream of the mine site to assess the extent of impact that the abandoned mine is having. This is carried out at the tail end of the wet season, when the mine site becomes accessible and before all stream flows cease during the dry season (May – November). The sampling has been carried out by both a contractor and rehabilitation scientists to standard water quality sampling guidelines. The sampling involves travel to site and physical sample collection. Samples are analysed in a nationally accredited laboratory.

18. Rainfall events in this semi-arid area generally last from half an hour to several hours and are of high intensity, producing localised flooding. In some years, monsoonal rainfall occurs as weather patterns move down from the Gulf and extended periods of intermittent rainfall can occur for several days. During the wet season, the site becomes isolated because of stream flows and bogginess. The Department's operating method for this site is to carry out works and investigations during the dry season. Because of the potential for personnel to become stranded, and the dangers related to flooding, no activities are carried out at the site during the wet season.

19. Given the mine's location in the north-west, the upcoming 2010/11 wet season was not expected to be any different from normal. Forecasts from the Bureau of Meteorology were used to determine the likelihood of local rainfall and decide when the site was

safe to access. Due to the site's remote location and uncertain accessibility during the entire wet season, no measures could be taken after the start of the wet season. In any event, the standard design for site works incorporates an allowance for high intensity rainfall events and flooding.

20. There was potential for high rainfall at the site due to the remnants of Cyclone Yasi but this potential only became known as the cyclone developed in February 2011 towards the end of the wet season, and hence no special preparations were initiated.

Provide details of any remediation works planned and the intended outcome of those works

21. During the 2011-12 year, the remediation works that DEEDI intends to progress are outlined below. Some of these works will be commenced prior to the onset of the 2011-12 Wet Season:
    a. Hire of a large capacity water evaporator and its installation at the mine pit, with view to reducing pit water volume prior to this wet season. This may also provide some information on the interconnectedness of groundwater aquifers.
    b. Carry out maintenance works on the plastic covers
    c. Carry out a hydrological assessment of the value of reshaping of creek and removing material to allow for better stream flow.
    d. Carry out an assessment of geophysical survey methods to determine their suitability for local groundwater investigations. Dependent on results carry out a further detailed survey to assess the status and location of groundwater.
    e. Continue to conduct, review, and revise site monitoring to address the priorities confirmed by the Mount Oxide Expert Panel
    f. Begin the development of a hydrological model to help assess surface and groundwater interrelationships.
    g. Clean out site catch dams, and investigate opportunities for installing automatic pump back systems to the Mine Pit (to handle post rainfall seepage).
    h. Begin defining the scope for tender documents to seek offers for the final removal or remediation of the mineralised stockpiles.

Provide details of flood preparedness activities to precede the 2011/12 wet season.

22. The flood preparedness activities for the 2011/12 Wet Season are the items described in Paragraph 21.

Provide details of any regulation of discharge from the Mine by any environmental authority, transitional environmental program, emergency direction or any other government regulatory document during the period 1 October 2010 to 30 July 2011.

23. The discharges from the abandoned mine site are not regulated, and there are no structures in place which would normally be regulated i.e dams. The local creek system flows are unregulated by either legislation or infrastructure. There are no site activities related to DEEDI's rehabilitation works that require an environmental authority. DEEDI does not carry out any mining operations on the site. To DEEDI's knowledge, there are no relevant environmental programs that regulate discharge from the site.

Provide, to the knowledge of the Department, details of any adverse effects to drinking water quality, any plant or animal species, any industry or agriculture, the environment or public health that occurred as a result of discharge during the period 1 October 2010 to 30 July 2011.

24. There was no out of the ordinary flooding at Mount Oxide during the period from 1 October 2010 to 30 July 2011. The wet season rainfall for 2010-11 at the Mine was average.

25. As discussed in paragraphs 16, 17 and 21above, DEEDI is actively taking steps to reduce the adverse effects from the abandoned Mount Oxide mine site. Site remediation is being undertaken with review and recommendations by the Mount Oxide Expert Panel. I **attach** a copy of the draft minutes and action items from the latest expert panel meeting held on 26 July 2011, attached and marked **"OK-03"** and **"OK-04"** respectively.

26. Notwithstanding this, blue discolouration occurred in the creeks downstream of the mine for several hundred metres beyond the confluence of the local streams at the mine site; ie, to 1 and 2 kilometres downstream. This tributary feeds into a larger creek approximately 5.2 km downstream from the mine site. DEEDI, in consultation with DERM and the Mount Oxide Expert Panel, will be undertaking further monitoring to assess downstream impacts to water quality and to stream sediment. I attach four Excel files containing monitoring compilations for the Mount Oxide site and downstream, attached and marked **"OK-05"**, **"OK-06"**, **"OK-07"** and **"OK-08"**. To help mitigate the likelihood of copper contamination in cattle, DEEDI is continuing to

provide supplementary lick blocks for the cattle to help reduce their attraction to impacted areas.

27. Potential adverse impacts downstream could arise from the uptake of copper and possibly other metals as cattle and wildlife drink the water or lick mineralised salts in the first few kilometres of the stream downstream of the mine site. The water from this zone is not used for potable purposes. The stream metal levels could be toxic to fish and other aquatic fauna. DEEDI is investigating these impacts through its monitoring program as discussed in paragraph 25 above, and is also consulting with Biosecurity Queensland to assess and address potential livestock impacts.

28. This area is within a heavy mineralised landscape. The further downstream one goes, the more difficult it is to identify and quantify the amount of the local impact that is due to Mount Oxide alone.

Sworn by Oskar Kadletz on 20th Sept 2011

at Brisbane in the presence of:

[redacted]

Witness

[redacted]

Solicitor/~~Barrister~~/~~Justice of the Peace~~/
~~Commissioner for Declarations~~

RPS

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Date: June 28, 2011

Attn: [redacted]
Senior Rehabilitation Scientist
Mines Safety and Health
Department of Employment, Economic Development and Innovation
[redacted]
TOWNSVILLE QLD 4810

Dear [redacted]

RE: Mt Oxide Inspection and preliminary advice

Site inspection

As previously discussed we undertook the inspection of the Mt Oxide site on 19 May 2011. We note that the Perilya staff members were both cooperative with and helpful to the RPS field staff.

During the inspection we located a series of bores (both production and observation) and the data we obtained from these bores is summarised in Table 1 below. Figure 1 attached indicates the locations of the bores in Table 1. It is noted that unfortunately at least two of the groundwater observation bores were impacted by active or recent pumping (i.e. bores MOXMB04 and Caravan Park bore 1), accordingly these data points cannot be used for the purposes of assessment of static depth to groundwater.

Discussion of observations and data reviewed

The key reference that documents groundwater conditions at the site is:

- Klohn Cripper Berger (KCBL) (2008) Mt Oxide Groundwater Monitoring and Production Bore Installation and Testing, Final Report, report to Perilya Limited, November 27, 2008

From the data supplied by KCBL (2008), of the monitoring bores at the site only bore MOXMB01 has a relatively shallow depth of screening (i.e. 12 – 15 m bGL for the upper slotted section) whilst the remaining monitoring bores all have much deeper slotted sections. These bores were not constructed to assess or define groundwater contamination, but rather for more general assessment of mine site hydrogeology.
Table 2 provides a comparison of the groundwater levels we observed (somewhat after end of wet season) with those observed by KCBL in October 2008 (end of dry season). From Table 2 it

is easy to see than in most of the bores there had been a marked rise in groundwater levels, reflecting seasonal recharge (with the exception of bore MOX MB01 where there was a net 0.69 m fall). The maximum net rise observed was 4.37 m in bore MOXMB03.

This data bears out our initial view that there would be very significant seasonal fluctuations in groundwater levels at the site. However we note that it would be likely that higher groundwater levels prevailed during and immediately after the cessation of the wet season rains in early 2011.

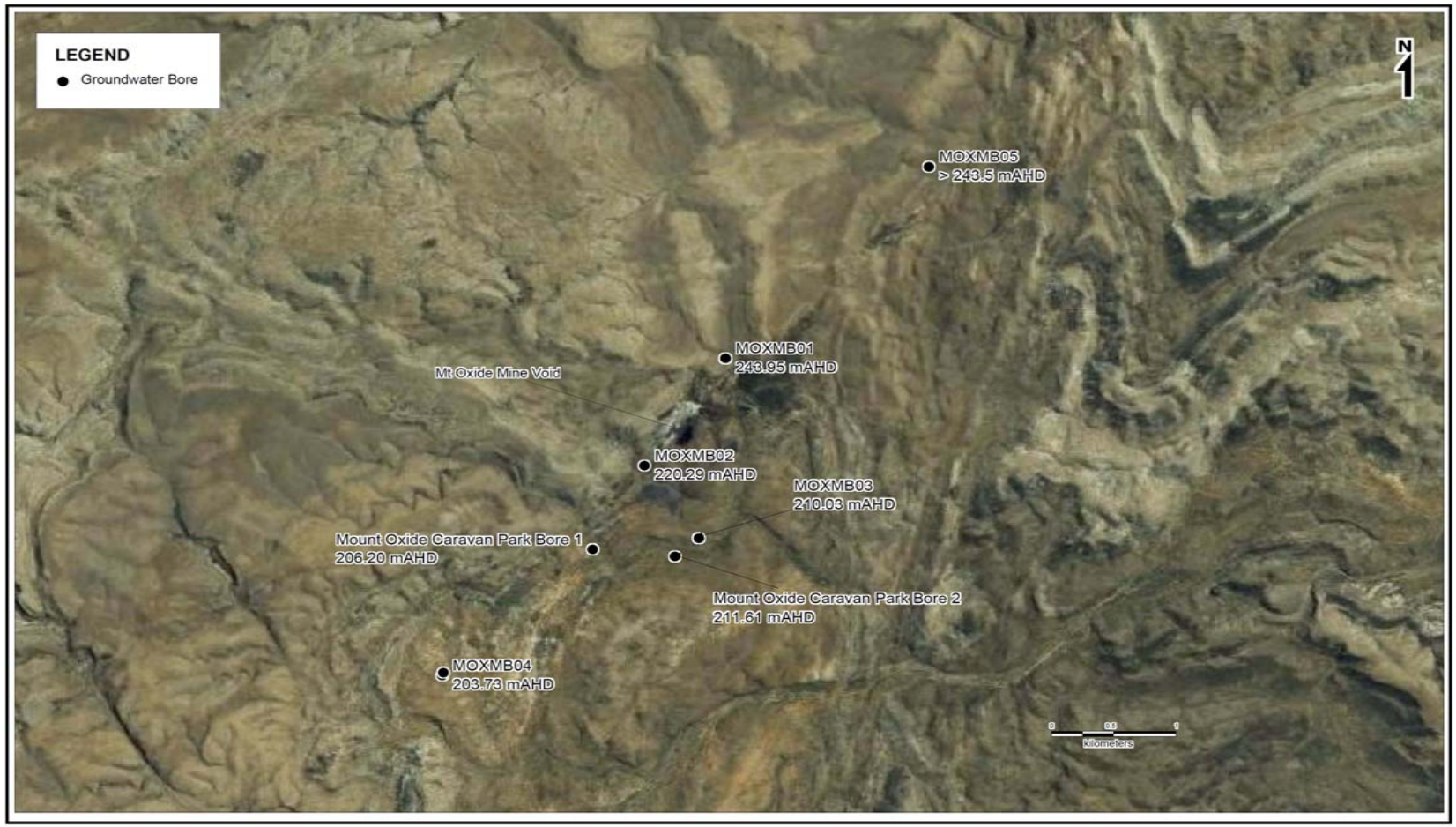

Figure 1 Location of bores and calculated approximate groundwater elevations 19 May 2011

Table 1 – Summary of groundwater observations 19 May 2011

Bore identifier	Reference point description	Height of reference point above ground level (m aGL)	Observed depth to groundwater (m b Ref Pt)	Observed depth to groundwater (m b GL)	Observed depth to groundwater (m b top of uPVC casing)	Comment
MOXMB01	Top of aluminium bore shield	0.30	3.35 3.05 3.30			
MOXMB02	Top of aluminium bore shield	0.32	2.03 1.71 1.99			Water filled drilling sumps immediately adjacent to bore
MOXMB03	Top of aluminium bore shield	0.37	2.34 1.97 2.13			
MOXMB04	Top of aluminium bore shield	0.48	14.75 14.27 NO			Production bore MOXPB04 was operating at time of observation 5.28 m away
MOXMB05	Top of aluminium bore shield	0.50	< 0	> 0.5	NA	Bore is artesian with head > 0.5 m aGL but only flows at a slight dribble
Caravan Park bore 1	Lip of steel casing	0.11	13.91 13.80 NA			Bore equipped with submersible pump. Bore not operating at time of observation but likely to have been recently operating
Caravan Park bore 2	Lip of uPVC casing	0.66	5.05 4.39 0.66			Bore not equipped

The data for the currently artesian bore MOXMB05 markedly bears out that there is confined / semi-confined aquifer conditions present in the area (i.e. there are no obvious natural springs in the vicinity of bore MOXMB05, despite there being artesian conditions in this bore).

It is also of some note that the depth to groundwater observed in bore MOXMB02 of 1.71 m bGL was relatively shallow and that this bore site is relatively close to the origin of one of the impacted springs as indicated by strong blue coloured staining in the waterway nearby.

In Table 2 we have included data drawn from KCBL (2008) regarding the manner in which the bores were constructed, the yields from the bores and the depth at which permeable zones were intersected.

It is noted that although bore MOXMB02 (located 240 m south east of the mine void lake) recorded a recent depth to groundwater of only 1.71 m, when drilled this bore did not encounter seepage until 14.5 m bGL. This bore was ultimately screened from 37 – 64 m bGL and 79 – 90 m bGL and accordingly the groundwater level observed in it is a semi-confined piezometric head rather than a true watertable. It is noted that the available water chemistry for this bore as documented by KCBL (2008) represents an appreciable outlier compared to most of the other bores with sulphate of 432 mg/L as SO_4 compared to background sulphate levels in the order of 8 – 20 mg/L.

However, notwithstanding that the groundwater levels observed in bore MOXMB02 are semi-confined piezometric heads rather than watertable observations, it appears to be more likely than not that the springs emanate from groundwater that has been impacted from seepage from the mine void lake up gradient.

Table 2 – Summary of groundwater observations 15 October 2008 to 19 May 2011

Bore identifier	Lithology / Structure	Total Depth / Response Zones	Airlift Yield / Inflow Zone	Observed depth to groundwater (m bGL)		Observed change in groundwater levels (m)	Comment
				15/10/2008	19/5/2011		
MOXMB01	Paradise Creek Fm; Mapped fault intersection & brecciation	Total depth - 80 m, 50 mm cased to 54 m, key seal 10 m - 11m, Slotted 12 m - 15 m & 45 m - 51 m	Sandstone at 13 m - seepage; Quartzite at 45 m - seepage	2.36 3.05		-0.69	
MOXMB02	Paradise Creek Fm, Inferred mine fault	Total depth - 100m, 50mm cased to 92 m, key seal 33 m - 35 m, Slotted 37 m - 64 m & 79 m - 90 m	Weathered siltstone at 14.5 m - seepage, Shale at 42 m - 51 m - 0.2 - 0.25 L/s	4.61 1.71		2.90	Water filled drilling sumps immediately adjacent to bore
MOXMB03	Paradise Creek Fm, Inferred fault intersection	Total depth - 100 m, 50 mm cased to 65 m, key seal 34 m - 36 m, Slotted 39 m - 62 m	Siltstone at 8m - seepage, Shale at 43 - 50 m - 0.1 - 0.21 L/s, Shale at 64 - 70 m - 0.25 - 0.44 L/s	6.34 1.97		4.37	
MOXMB05	Whitworth Quartzite, Inferred fault intersection	Total depth - 100 m, 50 mm cased to 66 m, key seal 33 - 35 m, Slotted 37 m - 64 m	Quartzite at 22 m - seepage, Quartzite at 49- 60 m - 0.15-0.21L/s	1.20 >	0.5	>1.7	Bore is artesian with head > 0.5 m aGL but only flows at a slight dribble
MOXMB04	Lochness or Quilalar Fm potentially overlain by Qt alluvium Inferred fault intersection	Total depth - 100 m, 50 mm cased to 55.5 m, key seal 21 - 22 m, Slotted 23.5 m - 53.5 m	Siltstone at 31m - 0.4 L/s, Fractured siltstone / chert at 40m - 5.4 L/s (initial) increasing to 9.7 L/s with development	16.44 14.27		2.17	Production bore MOXPB04 was operating at time of observation 5.28 m away
Caravan Park bore 1	NA NA		NA	NA	13.80	NA	Bore equipped with submersible pump. Bore not operating at time of observation but likely to have been recently operating
Caravan Park bore 2	NA	NA	NA	NA	4.39	NA	Bore not equipped

While the source of the sulphate contamination impact in bore MOXMB02 would clearly be the mine, it is noted also that KCBL recorded appreciable sulphate levels in the groundwater of bore MOXMB03 (i.e. 92 mg/L).
KCBL (2008) did not document spot natural surface elevation values for the bores. In order to obtain some impression of the overall groundwater flow directions at the site, natural surface elevations were obtained using the SRTM DEM. Table 3 summarises the spot reduced groundwater elevation values obtained using the May 2011 groundwater level observations and the interpolated natural surface elevation values. Figure 1 indicates these spot groundwater elevations.

Table 3 – Summary of groundwater elevations 19 May 2011

Bore identifier	Date	Observed depth to groundwater (m bGL) 19/5/2011	SRTM elevation (m AHD)	Calculated approximate groundwater elevation (m AHD) 19/5/2011	Comment
MOXMB05	19/05/2011	> 0.5	243.00	> 243.5	Bore is artesian with head > 0.5 m aGL but only flows at a slight dribble
MOXMB01	19/05/2011	3.05	247.00	243.95	
MOXMB02	19/05/2011	1.71	222.00	220.29	Water filled drilling sumps immediately adjacent to bore
MOXMB03	19/05/2011	1.97	212.00	210.03	
Caravan Park bore 1	19/05/2011	13.80	220.00	206.20	Bore equipped with submersible pump. Bore not operating at time of observation but likely to have been recently operating
Caravan Park bore 2	19/05/2011	4.39	216.00	211.61	Bore not equipped
MOXMB04	19/05/2011	14.27	218.00	203.73	Production bore MOXPB04 was operating at time of observation 5.28 m away

From the data in Table 3 and Figure 1 it can be noted that from the mine void, there appears to be a general flow direction to the south east and east in sympathy with the overall fall in topographic surface in the valley of Caves Creek.
It is of some note that two monitoring bores are recorded as having elevated groundwater sulphate values, being bore MOXMB02 (432 mg/L) and MOXMB03 (92 mg/L). As previously indicated bore MOXMB02 is located relatively close to the mine void lake, however bore MOXMB03 is approximately

820 m south, albeit down grou ndwater flow gra dient. It seems pl ausible that the elevated groundwater sulphate in bore MOXMB03 is related to the movement of impacted groundwater from the mine site to the east and south east.

Figure 2 indi cates trilinear plots of major ion water chemi stry for the bores and mine void lake prepared drawing on chemical analysis data documented by KCBL (2008).

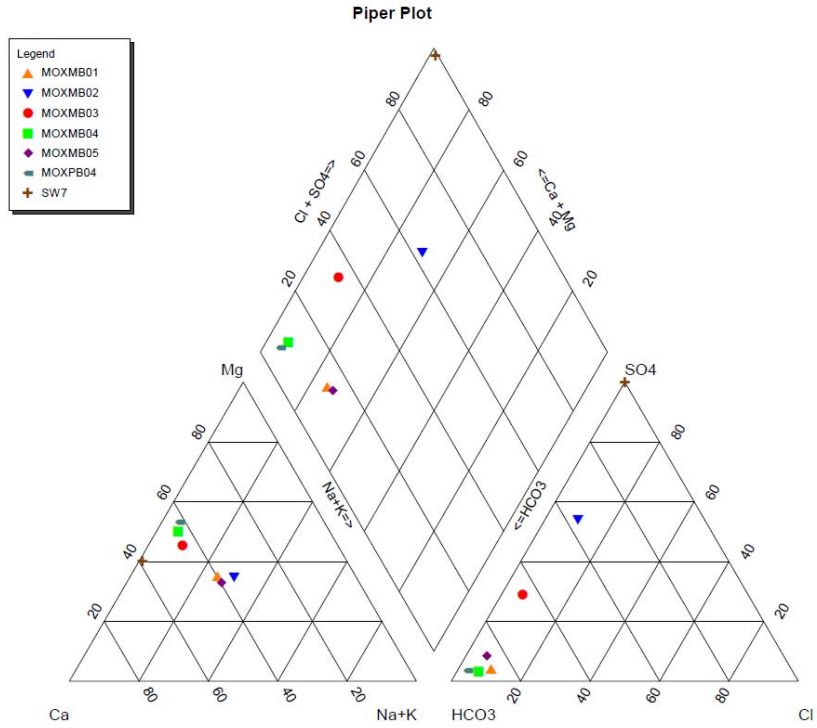

Figure 3 Trilinear plot of groundwater chemistry for groundwater and mine void lake samples

From Figure 3 and notwithstanding likely local differences in groundwater chemistry between the different host formations tapped, it is clear that the samples drawn from bores MOXMB02 and MOXMB03 lie on a mixing line b etween the surface sampl e from the m ine void la ke and ba ckground water chemistry a s indicated by the analyses for bores MOXMB01, MOXMB04 and MOXMB05.

Given that the available data suggests that there are relatively discrete zones of fracture permeability that provide pote ntial migratio n path ways for imp acted groundwater, con sideration of meth ods to delin eate such zones is appropriate.

The water quality data fo r the mine void lake in dicates very significant salinity wi th electrical conductivity values well in excess of 8,000 µS/cm, extremely elevated sulphate levels in th e order of 13,500 mg/L as SO_4, very elevated fluoride of 55 mg/L and a ra nge of elevated metal con centrations (e.g. inclu ding but

not limited to copper of 2,440 mg/L, manganese of 59.7 mg/L, cobalt of 37.8 mg/L, and arsenic of 0.344 mg/L). It is noted however that there is a paucity of depth profile quality data for the mine void lake and it is likely that the lake will be strongly stratified. Accordingly there is scope for worse water quality at depth in the void lake.

The available groundwater quality data documented by KCBL (2008) indicates that there is a strong contrast in salinity between background groundwater quality and the void water. It is of some note that the groundwater in the general region is of a quality suitable for potable usage (e.g. the former caravan park used bores as a primary supply and the current exploration camp draws groundwater from bore MOXPB04). Accordingly ground electromagnetic geophysical methods (EM) offer a potentially viable route to delineate zones of subsurface transmission of impacted groundwater.

Delineation of the relevant fracture zones that host the impacted groundwater should be able to be achieved using electromagnetic techniques that indirectly measure the ability of the ground to pass current. The more saline the groundwater, the more electrically conductive it is compared to background conditions of lower salinity groundwater.

A Geonics EM-31 unit could be used in the first instance in an attempt to delineate very shallow saline groundwater (i.e. depth penetration in the order of 5 to 6 m), however it is more likely than not that an electromagnetic unit with a greater depth capacity such as Geonics EM-34 will be required. Depending on the coil spacing used, an EM-34 can potentially be used to delineate targets down to 50 – 60 m below ground. Some literature regarding these units is appended for your reference.

The best approach would be to undertake a scoping exercise to undertake some EM traverses across the sites of some existing bores where we have records of depth to groundwater, groundwater salinity and depth of intersections of groundwater inflows to establish “baseline” conditions and then undertake a series of EM traverses in the areas where the coloured springs have emanated.

Following on from this scoping geophysical investigation work a program of investigation drilling could be then undertaken at identified target zones of high apparent conductivity at depth near the site of the springs to confirm intersection of permeable zones hosting saline impacted groundwater.

If this work demonstrates that the EM survey work can delineate permeable zones hosting saline impacted groundwater then a subsequent program could be undertaken to construct and test production bores that could ultimately form part of an intercept-pump-and-treat remediation / stabilisation strategy.

Possible strategy for management of impacted groundwater

A groundwater management strategy would require the following elements:

- Reduction in the input of source contaminants from the mine void lake via routine chemical dosing and floc removal;
- Identification of key aquifer zones through which the groundwater is migrating from the pit and ultimately into the environment;

- The institution of interception pumping to tap the aforementioned zones with the recovered groundwater ideally being transferred to a small holding dam for chemical treatment prior to decant back to the mine pit void lake; and
- Routine monitoring of groundwater and surface water to confirm the efficacy of the strategy.

It is noted that even after chemical dosing to achieve upward adjustment in pH and reduction in the trace metals load, the lake water will remain saline and the movement of this water from the pit will result in ongoing contamination of the groundwater system which is characterised by largely low salinity groundwater. However reduction in the metals content of void lake groundwater would ultimately reduce the visual impact of groundwater discharge, notwithstanding that there will likely be ongoing adverse impact attributable to the discharge of saline (and sulphate rich) groundwater to local waterways.

Data gaps

The following key data gaps remain for the site:

- A lack of bathymetry data for the lake (i.e. no data available to confirm the volume of water impounded);
- A lack of observation of time series water level elevations for the mine void lake;
- A lack of continuous temporal observation of groundwater levels;
- A lack of reliable and precise survey elevations for the monitoring bores and production bores;
- A lack of monitoring bores screened to assess the movement of groundwater at shallow depth and hence of watertable levels and shallow groundwater quality data;
- A lack of depth profile water quality data for the mine void lake; and
- A lack of a water balance for the mine void lake.

Preliminary advice regarding way forward

Our preliminary advice regarding a way forward would be:

For the mine void

- Procure and install a logging device to allow continuous monitoring of water level in mine void lake and have the elevation of the reference point for the observations surveyed ideally to Australian Height Datum;
- Procure and install a weather station to allow continuous logging of meteorological data at site;
- Undertake a survey program to confirm the bathymetry of the void using a small boat and sounder;

- Undertake a program to collect depth profiled water quality samples to more fully characterise the water quality in the void;
- Obtain advice regarding the feasibility of periodic chemical dosing to the void to neutralise acidity and reduce trace metals in solution; and
- Using the water level records, weather station records and bathymetry, develop a water balance model for the void.

For the groundwater system

- Have the elevation of the reference points for observation bores and production bore surveyed ideally to Australian Height Datum;
- Procure and install 15 x groundwater level data loggers for the site (i.e. 2 x to be installed in each well to provide redundancy and surety of data acquisition with 5 x back ups in the event of unit failure);
- Install a "gripper" type cap for bore MOXMB05 to allow artesian conditions to be controlled;
- Undertake a scoping geophysical EM survey using an EM-31 and an EM-34 unit to confirm "background" conditions over the existing bores and in areas where groundwater movement from the mine void lake appears possible;
- Based on the scoping geophysical survey, target sites for the installation of a series of new shallow (i.e. 15 – 20 m deep) and deep bores (i.e. 30 – 60 m deep) to allow groundwater level and quality monitoring and ideally also provide a sufficient spatial array of groundwater monitoring points to support the development of depth to groundwater surface plans;
- Undertake a program of additional data logger installation and groundwater sampling for the existing and new observation bores;
- Based on the geophysical survey work and the additional monitoring well drilling program, undertake a program to construct production bores that can then be test pumped to confirm aquifer hydraulics and also water quality response to pumping stress;
- Evaluate the feasibility of developing a pump-treat-and-recirculate system for the interception of impacted groundwater.

If you agree with the aforementioned actions we could prepare a proposal to implement the required additional investigations and works.

We trust this information is sufficient for your purposes, however should you require any further details or clarification, please do not hesitate to contact me on telephone [redacted] or mobile [redacted] or [redacted]@rpsgroup.com.au

Yours sincerely

Australia East Pty Ltd

[redacted]

[redacted]

Principal Groundwater & Environmental Scientist

GEONICS LIMITED

LEADERS IN ELECTROMAGNETICS

GEOPHYSICAL INSTRUMENTATION
FOR EXPLORATION & THE ENVIRONMENT

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EM39 CONDUCTIVITY

The EM39 provides measurement of the electrical conductivity of the soil and rock surrounding a borehole or monitoring well using the inductive electromagnetic technique. The unit employs coaxial coil geometry with an intercoil spacing of 50 cm to provide a substantial radius of exploration into the formation while maintaining excellent vertical resolution. Measurement is unaffected by conductive borehole fluid or the presence of plastic casing. The instrument operates to a depth of 500 metres.

The combination of a large conductivity range, high sensitivity and very low noise and drift, allows accurate measurement of subsurface conditions. Typical applications include groundwater contamination monitoring, groundwater and mineral exploration, and general geotechnical investigations.

The 4-conductor EM39 probe can be used with many commercially available borehole logging systems, or with a dedicated winch and console system from Geonics.

Measurements can either be recorded with a digital data logger, or viewed in real-time using the EM39RT program with field computer.

Specifications

MEASURED QUANTITIES	Apparent conductivity in millisiemens per metre (mS/m)
PRIMARY FIELD SOURCE	Self-contained dipole transmitter
SENSOR	Self-contained dipole receiver
INTERCOIL SPACING	50 cm
OPERATING FREQUENCY	39.2 kHz
MEASURING RANGES	100, 1000, 10,000 mS/m
DEPTH	200 m (500 m cable optional)
MEASUREMENT RESOLUTION	0.1 % of full scale
MEASUREMENT ACCURACY	± 5 % at 30 mS/m
NOISE LEVELS	<0.5 mS/m
POWER SUPPLY	10 disposable "D" cells, or 12 VDC external power source
DIMENSIONS	Probe: 3.6 cm diameter, 163 cm length
WEIGHTS	Probe: 2.2 kg, Console: 7 kg Shipping: 90 kg (2 boxes)

GAMMA39 NATURAL GAMMA

The EM39 Borehole Conductivity Probe has been designed for rapid, accurate measurements of groundwater contamination in the earth and rock surrounding monitoring wells. Since clays also increase the electrical conductivity, Geonics introduced the GAMMA39 Natural Gamma Ray Probe to resolve this ambiguity. Whereas conductivity highs with coincident gamma ray highs often indicate enhanced clay content, conductivity highs not associated with a gamma ray high can be expected to be due to enhanced TDS in the groundwater.

Like the conductivity probe, the gamma ray probe is unaffected by plastic casing in the well. It requires no special licences, can be used anywhere, is relatively fast to operate and can, of course, also be employed to detect radioactive wastes in the ground.

Specifications

MEASURED QUANTITY	Naturally occurring gamma-radiation, in counts/second
SENSOR	Thallium-activated sodium iodide crystal
COUNTS RANGE	100, 300, 1000 counts/second
DEPTH	200 m (500 m cable optional)
MEASUREMENT PRECISION	one count/second
POWER SUPPLY	10 disposable "D" cells, or 12 VDC external power source
DIMENSIONS	Probe: 3.6 cm diameter, 100 cm length
WEIGHTS	Probe: 1.6 kg Console: uses EM39 console

EM39S MAGNETIC SUSCEPTIBILITY

The EM39S probe provides measurement of the magnetic susceptibility of the formation in the vicinity of a borehole or monitoring well. The EM39S, with intercoil spacing of 50 cm, provides good vertical resolution while still achieving a reasonable range of investigation into the surrounding medium. High sensitivity and low noise performance characteristics ensure an excellent range of measurement for most geological applications.

The susceptibility response is unaffected by plastic casing, and unlike conventional magnetometers, is unaffected by either variations in remanent magnetization of the surrounding soil or rock, or in the strength of the earth's magnetic field.

Specifications

MEASURED QUANTITY	Magnetic susceptibility in parts per thousand (ppt)
PRIMARY FIELD SOURCE	Self-contained dipole transmitter
SENSOR	Self-contained dipole receiver
INTERCOIL SPACING	50 cm
OPERATING FREQUENCY	39.2 kHz
MEASURING RANGES	30, 300 ppt
DEPTH	200 m (500 m cable optional)
MEASUREMENT RESOLUTION	0.1 % of full scale
MEASUREMENT ACCURACY	± 5 % at 30 ppt
NOISE LEVELS	0.02 ppt
POWER SUPPLY	10 disposable "D" cells, or 12 VDC external power source
DIMENSIONS	Probe: 3.6 cm diameter, 163 cm length
WEIGHTS	Probe: 2.2 kg Shipping: 90 kg (2 boxes)

GROUND CONDUCTIVITY METERS

EM31-MK2

The EM31-MK2 maps geologic variations, groundwater contaminants or any subsurface feature associated with changes in ground conductivity, using a patented electromagnetic inductive technique that allows measurement without electrodes or ground contact. With this inductive method, surveys can be carried out under most geologic conditions including those of high surface resistivity such as sand, gravel and asphalt.

Ground conductivity (quad-phase) and magnetic susceptibility (in-phase) measurements are read directly from an integrated data logger (which can easily be removed from the console for data transfer). Real-time (RT) graphical presentation of data is possible by connecting a computer directly to the RS232 output port on the front panel with an optional RS232 interconnect cable.

The effective depth of exploration is about six metres, making it ideal for geotechnical and environmental site characterization. Important advantages of the EM31-MK2 over conventional resistivity methods are the speed with which surveys can be performed, the precision with which small changes in conductivity can be measured and the continuous readout and data collection while traversing the survey area. Additionally, the in-phase component is particularly useful for the detection of buried metallic structure and waste material.

EM31-SH

The EM31-SH is a "short" version of the EM31-MK2 providing an effective depth of exploration of about four metres. With a smaller coil separation (2 m) and lighter weight, the EM31-SH offers improvements in sensitivity to smaller near-surface targets, lateral resolution and portability, while maintaining the high levels of accuracy and stability provided by the standard EM31-MK2. A "trailer-mount" (inset) is available for either instrument, offering greater convenience in field operation.

Specifications

MEASURED QUANTITIES	1: Apparent conductivity in millisiemens per metre (mS/m) 2: In-phase ratio of the secondary to primary magnetic field in parts per thousand (ppt)
INTERCOIL SPACING	3.66 metres
OPERATING FREQUENCY	9.8 kHz
POWER SUPPLY	8 disposable alkaline "C" cells (approx. 20 h continuous)
MEASURING RANGES	Conductivity: 10, 100, 1000 mS/m; In-phase: ± 20 ppt
MEASUREMENT RESOLUTION	± 0.1 % of full scale
MEASUREMENT ACCURACY	± 5 % at 20 mS/m
NOISE LEVELS	Conductivity: 0.1 mS/m; In-phase: 0.03 ppt
DATA STORAGE	10,000 records (2 components); 16,500 records (1 component); ext. memory available
DIMENSIONS	Boom: 4.0 m extended, 1.4 m stored Shipping Case: 145 x 38 x 23 cm
WEIGHTS	Instrument: 12.4 kg; Shipping: 28 kg

EM34-3

The EM34-3 is a simple-to-operate, cost-effective instrument for the geologist and hydrogeologist alike; applications have been particularly successful for the mapping of deeper groundwater contaminant plumes and for the exploration of potable groundwater resources.

Using the same inductive method as the EM31-MK2, the EM34-3 uses three intercoil spacings - 10, 20 and 40 m - to provide variable depths of exploration down to 60 metres. With three spacings and two dipole modes (horizontal as shown, and vertical) at each spacing, vertical electrical soundings can be obtained. In the vertical dipole (horizontal coplanar) mode, the EM34-3 is very sensitive to vertical geologic anomalies, and is widely used for groundwater exploration in fractured and faulted bedrock.

The EM34-3 includes connectors for an analog signal output, as well as an input which can be used with a rechargeable battery option. Digital signal output, required for data collection with the DAS70 system, is available as an option for all models of the EM34-3.

In regions of particularly high cultural and/or atmospheric noise, the EM34-3XL - including increased transmitter power and a larger transmitter coil - improves the signal-to-noise ratio by a factor of 10 at the 40 m spacing, and by a factor of 4 at the 10 m and 20 m spacings.

Specifications

MEASURED QUANTITIES	Apparent conductivity in millisiemens per metre (mS/m)
PRIMARY FIELD SOURCE	Self-contained dipole transmitter
SENSOR	Self-contained dipole receiver
REFERENCE CABLE	Lightweight, 2 wire shielded cable
INTERCOIL SPACINGS & OPERATING FREQUENCY	10 m at 6.4 kHz 20 m at 1.6 kHz 40 m at 0.4 kHz
POWER SUPPLY	Transmitter: 8 disposable or rechargeable "D" cells Receiver: 8 disposable or rechargeable "C" cells
CONDUCTIVITY RANGES	10, 100, 1000 mS/m
MEASUREMENT RESOLUTION	± 0.1 % of full scale
MEASUREMENT ACCURACY	± 5 % at 20 mS/m
NOISE LEVELS	0.2 mS/m (can be greater in regions of high power line interference)
DIMENSIONS	Receiver Console: 19 x 13.5 x 26 cm Transmitter Console: 155 x 8 x 26 cm Receiver & Transmitter Coil: 63 cm diameter EM34-3XL Transmitter Coil: 100 cm Shipping Case: 27.5 x 75 x 75 cm
WEIGHTS	Instrument: 20.5 kg; XL: 26.5 kg Shipping: 43 kg; XL: 51 kg

EM38

Designed for relatively shallow applications - specifically within the agricultural root zone - the EM38 provides measurement of ground conductivity (quad-phase) and magnetic susceptibility (in-phase) within two effective depth ranges: 1.5 m in the vertical dipole mode (shown above); and 0.75 m in the horizontal dipole mode. Based on the same induction principle as the EM31-MK2, the EM38 can survey large areas quickly without any requirement for ground-to-instrument contact.

For agricultural applications, measurement of ground conductivity is particularly useful in the mapping of variations in important soil properties such as salt and soil moisture content.

The EM38 has proven to be useful for many near-surface applications, including archaeology, wherein use can also be made of the information available in the measurement of soil magnetic susceptibility.

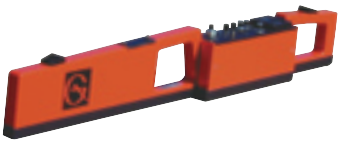
Very lightweight and only one metre long, the EM38 provides rapid surveys with excellent lateral resolution. Measurement is generally made by placing the instrument on the ground and recording the indicated reading. Either stationary or continuous measurements can be obtained from a standing position using the optional extender arm (shown above) with cable connection to a data acquisition system. In this mode of operation, several thousand data points can easily be obtained in one hour.

For large-area surveys, the EM38 can be easily mounted on a platform and towed behind a vehicle. Real-time (RT) data acquisition, with direct connection to computer-based acquisition systems, is available with an optional modification.

Specifications

MEASURED QUANTITIES	1: Apparent conductivity in millisiemens per metre (mS/m) 2: In-phase ratio of the secondary to primary magnetic field in parts per thousand (ppt)
PRIMARY FIELD SOURCE	Self-contained dipole transmitter
SENSOR	Self-contained dipole receiver
INTERCOIL SPACING	1 metre
OPERATING FREQUENCY	14.6 kHz
POWER SUPPLY	9 V battery
MEASURING RANGE	Conductivity: 1000 mS/m In-phase: ± 29 ppt
MEASUREMENT RESOLUTION	± 0.1 % of full scale
MEASUREMENT ACCURACY	± 5 % at 30 mS/m
NOISE LEVELS	Conductivity: 0.5 mS/m; In-phase: 0.02 ppt
BATTERY LIFE	30 hours continuous
DIMENSIONS	Instrument: 106 x 15 x 3.6 cm Shipping Case: 117 x 19 x 13 cm
WEIGHTS	Instrument: 3 kg Shipping: 10 kg

EM38B



For any one measurement, the standard EM38 provides measurement of either quad-phase (conductivity) or in-phase (magnetic susceptibility) component data, as selected by the operator. Comparatively, the EM38B provides simultaneous measurement of both phase components at all times. For surveys which include measurement of both components - common for archaeological investigations - the EM38B significantly reduces the amount of time required.

EM38-DD

The standard EM38 is operated in either the vertical or horizontal dipole mode at any given time. The EM38-DD provides simultaneous measurement of both dipoles at all times. The time required to complete any survey which includes the measurement of both dipole modes, therefore, is significantly reduced.

DAS70-CX DATA ACQUISITION SYSTEM

The DAS70-CX Data Acquisition System is available as an option for any Ground Conductivity Meter with the real-time (RT) modification for digital signal output, and all models of the EM61 and EM61-HH Metal Detectors. A complete DAS70-CX system includes a rugged, waterproof Allegro CX field computer; interface cables; and utility software, with programming for data transfer and management.

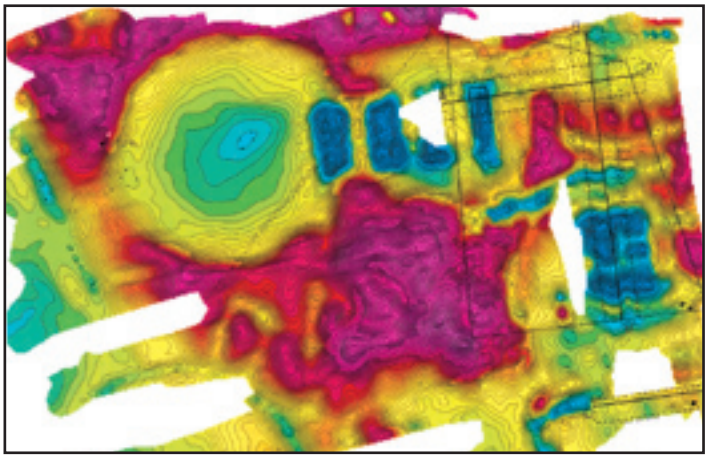
The Allegro CX field computer provides several benefits for field operations including a real-time graphic display of collected data for quality control; high capacity (256M) internal data storage, PC card compatibility and rechargeable NiMH batteries for extended survey time; and additional input connections to support the simultaneous collection of EM and GPS data.

Important specifications of the Allegro CX include an Intel XScale 400 MHz processor; 128M RAM; the intuitive Windows CE operating system; and an active matrix TFT colour display that is highly visible in direct sunlight. Included Bluetooth is available for custom applications.

For survey applications that include the use of multiple (e.g. EM61) units as a single sensor array, the **DAS70ML-CX** Data Acquisition System, including the Allegro CX field computer, supports simultaneous EM and GPS data collection through six available input connections.

Specifications

PROCESSOR	Intel XScale 400 MHz
OPERATING SYSTEM	Windows CE.NET 4.2
DATA STORAGE	256M internal disk storage; PC card compatible
COMMUNICATIONS	Two 9-pin RS-232
DISPLAY	High visibility active matrix TFT colour display (320 x 240 pixels)
KEYBOARD	Large keys for use with gloved hands; Touchscreen enabled
OPERATING TEMPERATURE	-30° to +54° C
POWER SUPPLY	Rechargeable NiMH high capacity battery pack
DIMENSIONS	25 x 15 x 3.8 cm
WEIGHT	<1 kg



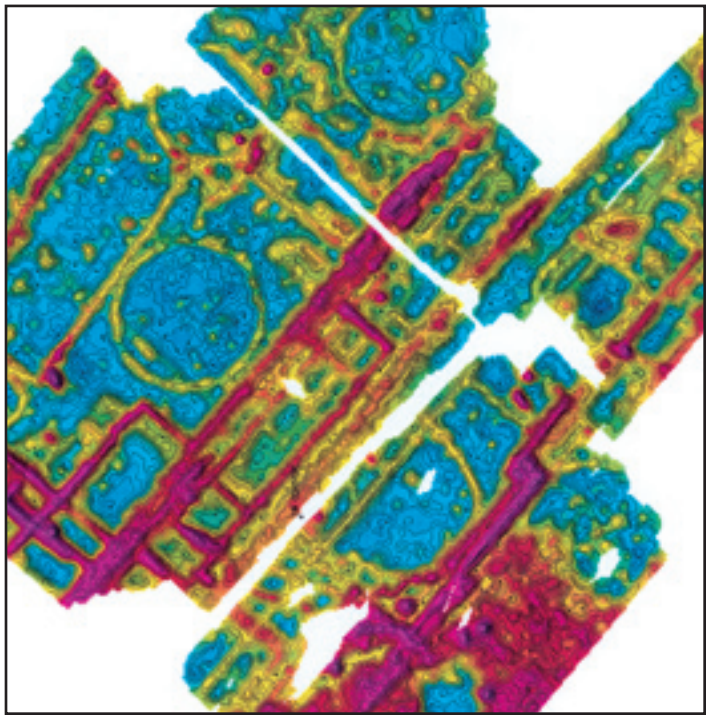
Geonics recommends any contour program which can generate both colour image and shaded relief maps in addition to the standard isoline contour maps. The gridding algorithms should be best suited to line-based data of high density and high dynamic range. The following are two programs recommended by Geonics.

Surfer

Surfer is a grid-based contouring and three dimensional surface plotting graphics program produced by Golden Software, Inc. Surfer interpolates your irregularly or regularly spaced XYZ data onto a regularly spaced grid, and places this data in a grid file. Surfer combines sophisticated gridding and data interpretation with a variety of presentation capabilities that allow the user to produce quick and customized maps.

OASIS montaj

OASIS montaj is a comprehensive PC-based earth science data processing software package produced by Geosoft Inc. This program is ideally suited for line-based data of high density and dynamic range. Presentation formats include standard contour maps, colour image maps and shaded relief maps. Any combination of formats can be merged into a single plot file for customized presentation. Plot files can be easily converted to AutoCad.DXF format for transfer to AutoCad facilities.



EM61-MK2

The EM61-MK2, an enhanced version of the patented EM61, is a time domain metal detector which detects both ferrous and non-ferrous objects with excellent spatial resolution. Target response is a single, sharply defined peak, facilitating quick and accurate target location. A single 200 litre (55 gal.) drum can be detected at depths greater than three metres; modification for increased power, to increase both the sensitivity to smaller targets and depth of detection, for all targets, is available.

Data from multiple time gates - three or four, user-selectable - are recorded to provide a more complete measurement of the response decay rate for improved target characterization (and discrimination). Early time gates increase the maximum depth of detection for all targets; a mid-range time gate, at the same position as the original EM61, offers comparison with, and continuation of original EM61 data sets.

Data acquisition is supported by the Allegro CX field computer. Important features include real-time graphic display of data for review and quality control; high capacity (256M) data storage for extended survey time; increased rate of data collection; and additional input connections for simultaneous collection of EM and GPS data.

The system is immediately GPS compatible; a fully integrated Trimble AG114 - with no requirement for a separate GPS receiver console - is available as an option.

The system can be pulled as a trailer, in single or multiple unit configurations, or carried by an operator with a belt harness.

For applications in marine environments, the **EM61S** (Submersible), available as either an attachment to a standard EM61-MK2 (or EM61) or a complete stand-alone unit, is a submersible coil and cable system capable of operation to depths of more than 60 metres.

Specifications

MEASURED QUANTITIES	Four time gates of secondary response in mV
EM SOURCE	Air-cored coil, 1 x 0.5 m size
CURRENT WAVEFORM	Unipolar rectangular current with 25 % duty cycle
EM SENSORS	a) Main: Air-cored coil, 1 x 0.5 m in size, coincident with EM source b) Focusing: Air-cored coil, 1 x 0.5 m in size 30 cm above main coil
MEASURING RANGES	10,000 mV
DYNAMIC RANGE	18 bits
OUTPUT MONITORS	Colour TFT active matrix LCD (320 x 240 pixels), and audio tone
DATA STORAGE	256M internal disk storage; PC card compatible
POWER SUPPLY	12 V rechargeable battery for 4 h continuous operation
OPERATING WEIGHT & DIMENSIONS	Backpack: 60 x 30 x 20 cm; 8 kg Coil Assembly: 100 x 50 x 5 (bottom), 100 x 50 x 2 (top); 14 kg (23 kg in trailer mode)
SHIPPING WEIGHTS & DIMENSIONS	112 x 61 x 26 cm (box 1) 54 x 59 x 63 cm (box 2) with trailer option only 48 kg (74 kg with trailer)

EM61HH-MK2

The EM61HH-MK2 is a "hand-held" complement to the EM61-MK2, providing greater sensitivity to smaller targets at shallow depths. A single 20 mm projectile can be detected to a depth greater than half a metre. Comparatively, a single 200 litre (55 gal.) drum can be detected to depths of greater than 2 metres.

Data is collected from a single receiver at four time gates after transmitter turn-off. Information from four gates provides for the discrimination of targets based on the response decay rate; the early-time data will detect both small and large targets with short and long decay rates respectively, while the late-time data will detect only larger targets with relatively long response decay.

Calculation of the decay apparent time constant, proportional to the ratio between early- and late-time signal response, allows for the identification of targets with similar physical characteristics such as material, size and shape; inherently, information is provided for improved target discrimination.

With a narrower spatial focus than the standard EM61-MK2, the EM61HH-MK2 is relatively less sensitive to sources of potential interference. As a result, data can be collected in closer proximity to structural features such as fences and buildings. Additionally, the narrower focus provides enhanced target resolution, and consequently improves discrimination of multiple targets.

The EM61HH-MK2 can be operated either with or without wheels. In either configuration, the smaller, more portable design offers improved access to areas of difficult terrain and dense vegetation.

Specifications

MEASURED QUANTITIES	Four time gates of secondary response in mV
EM SOURCE	Air-cored coil, 17 cm diameter
CURRENT WAVEFORM	Unipolar rectangular current with 25 % duty cycle
EM SENSOR	Air-cored coil, 17 cm diameter
MEASURING RANGES	10,000 mV
DYNAMIC RANGE	18 bits
OUTPUT MONITORS	Colour TFT active matrix LCD (320 x 240 pixels), and audio tone
DATA STORAGE	256M internal disk storage; PC card compatible
DATA OUTPUT	RS232 serial port
POWER SUPPLY	12 V rechargeable battery for 4 h continuous operation
OPERATING WEIGHTS & DIMENSIONS	Backpack: 60 x 30 x 20 cm; 8 kg Sensor Assembly: 33 x 20 cm; 2.8 kg (7.5 kg with wheels)
SHIPPING WEIGHTS & DIMENSIONS	50 kg 117 x 50 x 54 cm

EM63

The EM63 Metal Detector advances the application of time domain electromagnetics (TDEM) methods to the detection of unexploded ordnance. Measurement of the full transient electromagnetic response offers improved detection capability and information on target characteristics.

Comparable to the EM61-MK2, the EM63 generates a pulsed primary magnetic field which induces eddy currents in nearby metallic objects. The decay of these eddy currents with time generates a secondary magnetic field with a specific rate of decay that is determined uniquely by the character - the size, shape, orientation and metal composition - of the object itself.

Measurement of the secondary magnetic field decay (the transient response), therefore, will provide important information toward: a more complete characterization and classification of the target; identification and rejection of the characteristic response from certain geologic materials (e.g. magnetite); and, consequently, a reduction in target selection error (the "false positive rate").

The EM63 accurately measures the complete transient response over a wide dynamic range of time: measurements are recorded at 26 geometrically spaced gates, covering a time range from 180µs to 25ms. Data acquisition is supported by the Allegro (DOS) field computer (32M data storage capacity) which is able to simultaneously receive GPS data for location control.

Software is available and provided to facilitate the collection and basic processing of data; data inversion software for target characterization/classification is expected to become available sometime in 2006.

Specifications

MEASURED QUANTITIES	26 time gates of secondary response in mV covering range from 180 µs to 25 ms
EM SOURCE	Air-cored coil, 1 x 1 m size
CURRENT WAVEFORM	Bipolar rectangular current
EM SENSORS	a) Main: Air-cored coil, 0.5 x 0.5 m in size, coincident with EM source b) Focusing: Air-cored coil, 0.5 x 0.5 m in size 60 cm above main coil c) Compensation coil, 0.5 x 0.5 m in size
MEASURING RANGES	10,000 mV
DYNAMIC RANGE	18 bits
OUTPUT MONITORS	Colour TFT active matrix LCD (320 x 240 pixels), and audio tone
DATA STORAGE	>100,000 data sets
DATA OUTPUT	RS232 serial port
POWER SUPPLY	12 V rechargeable battery for 4 h continuous operation
OPERATING WEIGHT & DIMENSIONS	Sensor: 100 x 100 x 60 cm; 32 kg Console: 38 x 19 x 6 cm; 4.5 kg Battery: 23 x 21 x 14 cm; 10 kg
SHIPPING WEIGHTS & DIMENSIONS	104 x 104 x 22 cm (box 1); 60 kg 58 x 48 x 47 cm (box 2); 46 kg

PROTEM TIME DOMAIN EM SYSTEMS

PROTEM RECEIVER

It is well known that there is a trade-off between depth of exploration and target definition in terms of conductivity, extent and orientation. Greatest depth is obtained with large fixed loop Turam-type systems which generate large half-space responses that, along with current gathering, make target detection difficult. Better spatial resolution is obtained with a moving transmitter configuration with a short intercoil spacing, but is limited to a shallower depth of exploration. These variations in survey requirements make system flexibility an important design consideration.

Time domain systems are also routinely employed for general geological exploration, such as for freshwater aquifers in bedrock fractures, and mapping groundwater contaminant plumes. Exploration to shallow depths, as necessary in these applications, requires a very wide bandwidth and many narrow sampling gates.

Recognition of such diverse requirements led to development of the extremely flexible PROTEM time domain system. The digital, three-component receiver is used with any of the three TEM transmitters and choice of receiver coils to cover all applications. With true 24-bit resolution (at a single gain), system bandwidth of 270 kHz, microsecond sampling gates and simultaneous three-component (XYZ) component measurements, the PROTEM receiver provides the ultimate in time domain capability.

The PROTEM Receiver enables the selection of either 20 gates per base frequency covering two decades of time, or 30 gates for a three decade range. If three decades of time are required to cover the decay, then this selection saves switching frequencies and repeating the measurement; if only two decades are required, using the 20-gate range reduces the measurement time by a factor of 10.

Automated measurements during the on-time, in addition to off-time measurements, is a standard feature of every receiver.

Specifications

MEASURED QUANTITY	Rate of decay of induced magnetic field along 3 axes, in nV/m^2
EM SENSOR	Air-cored coils
CHANNELS	1 channel used sequentially for 3 components or optionally, 3 channels for 3 components simultaneously
TIME GATES	20 gates covering 2 time decades, or 30 gates covering 3 time decades
DYNAMIC RANGE	24 bits (138 dB)
BASE FREQUENCY	0.3, 0.75, 3, 7.5, 30, 75 and 285 Hz or 0.25, 0.625, 2.5, 6.25, 25, 62.5 and 237.5 Hz
INTEGRATION TIME	0.5, 2, 4, 8, 15, 30, 60 or 120 s
DISPLAY	240 x 64 dot graphic LCD
DATA HANDLING	Solid-state memory for 3300 data-sets, RS232 output
SYNCHRONIZATION	Reference cable or, optionally, highly stable quartz crystal
POWER SUPPLY	12 V rechargeable battery for 8 h continuous operation
WEIGHT	15 kg
DIMENSIONS	34 x 38 x 27 cm

TEM47 TRANSMITTER

Three interchangeable transmitters - TEM47, TEM57-MK2 and TEM67 - are used with the PROTEM receiver and the appropriate receiver coil to make up different PROTEM systems for various applications such as mineral exploration, structural mapping, resistivity sounding and contaminant plume mapping.

The TEM47 is the smallest and lightest transmitter, battery powered, with a very fast turn-off time to enable measurement of the near-surface response. The PROTEM 47 (including PROTEM receiver, TEM47 transmitter) is most often used for shallow resistivity sounding of groundwater contamination, saline intrusion and geologic units. In this configuration, single turn transmitter loops from 5 m up to 100 m on a side, with turn-off times as short as half a microsecond, can be used to give maximum near-surface resolution.

The transmitter output current of 3 A into a 100 m x 100 m loop gives good response and resolution to depths of 150 m, making this the ideal instrument for resistivity sounding over a large area. The 30 gate, three time-decade measurement is usually enough to cover the full decay curve including the early time gates, without changing base frequency.

The TEM47 uses a reference cable to achieve the high synchronization accuracy required for shallow sounding. Regardless of application, a high-frequency receiver coil is used in PROTEM 47 systems - the high-frequency receiver coils have the bandwidth necessary to capture the earliest portion of the transient decay.

For greater consideration of structural response within complex geologic environments, the three-component high-frequency receiver coil is recommended.

When used in a PROTEM 47 system for profiling, the TEM47 supplies 2.5 A to an 8-turn, 5 m x 5 m moving transmitter loop to provide a dipole moment of 500 Am^2. With base frequency of 75 Hz, and 20 gates from 49 µs to 2.9 ms, this configuration is optimal for Slingram (horizontal loop) surveys for mineral exploration to shallow depths, and for groundwater exploration in bedrock fractures. Electrical sounding is performed simultaneously with the search for fault or dike-like targets.

Specifications

CURRENT WAVEFORM	Bipolar rectangular current with 50 % duty cycle
BASE FREQUENCY	30, 75, or 285 Hz where powerline frequency is 60 Hz 25, 62.5 or 237.5 Hz where powerline frequency is 50 Hz
TURN-OFF TIME	2.5 µs at 3 A into 40 x 40 m loop; faster into smaller loop
TRANSMITTER LOOP	5 x 5 to 100 x 100 m single turn loop, or 5 x 5 m 8-turn loop
OUTPUT VOLTAGE	0 to 9 V, continuously variable
POWER SUPPLY	Internal 12 V rechargeable battery
BATTERY LIFE	5 h continuous operation at 2 A output
WEIGHT	5.3 kg
DIMENSIONS	10.5 x 24 x 32 cm

TEM57-MK2 TRANSMITTER

The TEM57-MK2 Transmitter is the upgraded version of the TEM57, and combined with the PROTEM digital receiver are the principal components of the PROTEM 57-MK2 system. The design and performance of the TEM57-MK2, with increased power of 1,500 W, makes it a highly portable, powerful, mid-range time domain transmitter. The internal power supply has variable voltage range from 18 to 60 V so that it can be precisely matched to the transmitter loop for optimum performance. An external battery source increases performance to 3,800 W and 160 V.

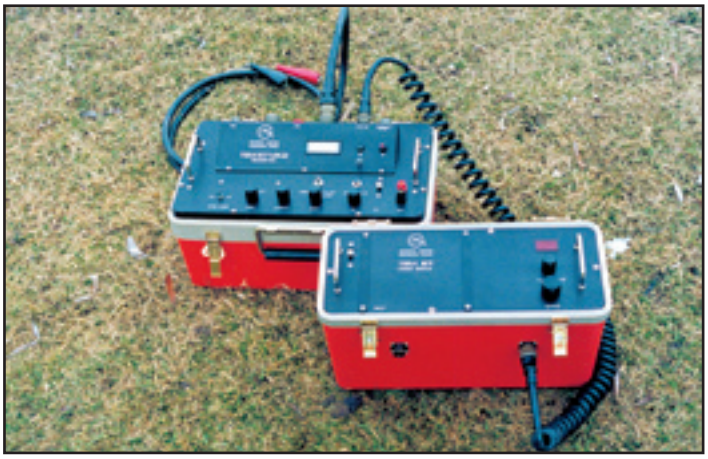
The TEM57-MK2 is the perfect mid-range power transmitter for sounding depth, thickness and conductivity of geologic layers down to 500 m for a wide variety of applications such as mapping of aquifers and aquitards, water quality and stratigraphy. In coastal areas, the PROTEM 57-MK2 system has defined depth to saline intrusion as accurately as chemical well samples.

The PROTEM 57-MK2, with a short reference cable, portable transmitter and 3D receiver coil, can delineate complex ore bodies within 200 m of surface. Deeper conductors can be characterized by profiling with a crystal-synchronized receiver and a large, fixed transmitter loop. Modelling provides conductivity, thickness, dip and extent of the ore body.

For measurements during the turn-off (T/O) ramp, an optional T/O controller, connected externally to the transmitter, can variably increase the turn-off time, typically within the range of 200-1000 microseconds.

Specifications

CURRENT WAVEFORM	Bipolar rectangular current with 50 % duty cycle
BASE FREQUENCY	3, 7.5, or 30 Hz (powerline frequency 60 Hz) 2.5, 6.25, or 25 Hz (powerline frequency 50 Hz) Rates below 1 Hz available from PROTEM receiver through reference cable
TURN-OFF TIME	20 to 115 µs, depending on size, current and number of turns in transmitter loop
TRANSMITTER LOOP	Single turn: any dimension (minimum resistance 0.7 ohms) up to 300 x 600 m 8-turn: 5 x 5 or 10 x 10 m
OUTPUT CURRENT	25 A maximum
OUTPUT VOLTAGE	18 V to 60 V continuous control with motor generator; up to 160 V (3,800 W) with external power supply
SYNCHRONIZATION	Reference cable or, optionally, quartz crystal
POWER SUPPLY	1,800 W, 110/220 V, 50/60 Hz single-phase motor-generator or, optionally multiple 12 V batteries
TRANSMITTER PROTECTION	Electronic and electromechanical protection
TRANSMITTER SIZE	43 x 25 x 25 cm
TRANSMITTER WEIGHT	15 kg
MOTOR GENERATOR SIZE	51 x 29 x 42 cm
MOTOR GENERATOR WEIGHT	21 kg



TEM67 TRANSMITTER

The TEM67 Transmitter is the most powerful of the current PROTEM transmitters, replacing the TEM37 of the previous generation. Not only is the TEM67 (3,800 W) more powerful than the TEM37 (2,800 W), but it also offers a degree of flexibility not previously available with time domain transmitters.

The TEM67 is comprised of two principal components: a complete TEM57-MK2 transmitter; and an integral, but separate, power module with a larger (4,500 W) power generator. Such modular design allows for easy upgrade from the TEM57-MK2, by the addition of the power module and larger generator. Alternatively, when applications do not require the full capabilities of the TEM67, the more portable, mid-range TEM57-MK2 can be operated independently.

The PROTEM 67 is appropriate for deep soundings in ground water exploration, saline intrusion mapping, geothermal exploration, and regional geological research where structures and layer information is required to depths of 1,000 m or more.

The PROTEM 67 system with the 3D receiver coil is the ideal time domain system for profiling deeply buried conductive ore bodies, such as massive sulphides, to depths in excess of 500 metres, and with the three-axis BH43-3 borehole probe for time domain logging to 2 kilometres.

For increased depth of exploration, the addition of a second, optional power module, increasing the output voltage from 150 V to 240 V, can extend the range of measurement for any application.

For measurements during the turn-off (T/O) ramp, an optional T/O controller, connected externally to the transmitter, can variably increase the turn-off time, typically within the range of 200-1000 microseconds.

Specifications

CURRENT WAVEFORM	Bipolar rectangular current with 50 % duty cycle
BASE FREQUENCY	0.3, 0.75, 3, 7.5 or 30 Hz (powerline frequency 60 Hz) 0.25, 0.625, 2.5 or 25 Hz (powerline frequency 50 Hz) Rates below 1 Hz available from PROTEM receiver through reference cable
TURN-OFF TIME	20 to 750 µs, depending on transmitter loop size, current and number of turns
TRANSMITTER LOOP	Up to 2,000 x 2,000 m maximum
OUTPUT CURRENT	25 A maximum
OUTPUT VOLTAGE	18 to 150 V continuously adjustable
SYNCHRONIZATION	Quartz crystal and reference cable
POWER SUPPLY	4,500 W, 110/220 V, 50/60 Hz, single phase with 8h continuous operation motor generator
TRANSMITTER PROTECTION	Electronic and electromechanical protection
TRANSMITTER SIZE	43 x 25 x 25 cm (TEM57-MK2); 42 x 20 x 31 cm (TEM67 Power Module)
TRANSMITTER WEIGHT	15 kg (TEM57-MK2); 12 kg (TEM67 Power Module)
MOTOR GENERATOR SIZE	60 x 50 x 49 cm
MOTOR GENERATOR WEIGHT	62 kg

BOREHOLE TDEM PROBE

BH43-3

The BH43-3 provides three-dimensional time domain EM exploration from boreholes, in conjunction with a PROTEM system. Boreholes as deep as 2 km can be surveyed using a PROTEM system with a 500 x 500 m transmitter loop. (At developed mines, the transmitter loop can be laid out in underground workings.)

The probe has three sensors which measure orthogonal components of decay. Along the hole, spatial resolution as fine as 1 m can be obtained - the actual measurement interval depends on the desired resolution of the response.

The wide bandwidth of the probe, coupled with the excellent temporal resolution and large dynamic range of the PROTEM system, provides maximum diagnostic information with a high degree of rejection of powerline and other noise sources.

Computer programs for editing, displaying and interpreting BH43-3 responses are supplied with the probe, including a program for calculating all field components in a conductive earth. Third party software is available to successfully transform data collected with the BH43-3 to a step response.

The BH43-3 probe is available separately, or as a complete borehole system with cable, main winch, dummy probe, test cable and winch, and retrieval tools.

Specifications

SENSOR	Three orthogonal coils (one axial and two radial)
SENSOR AREA-TURNS PRODUCT	10,000 m^2 for axial and 2,500 m^2 for radial sensors (with amplification)
SENSOR-PREAMPLIFIER RESONANT FREQUENCY	10 kHz for all sensors
PROBE ROTATION CORRECTION	Two orthogonal tilt meters with range from ± 1° to ± 80° (from vertical)
OPERATING TEMPERATURE	-30° C to +80° C
POWER SUPPLY	Rechargeable nickel cadmium battery sealed pack for 20 h continuous operation
CONTROL BOX	Channel selection, impedance and gain matching network between probe and PROTEM receiver (normalizes sensor effective area to 100 m^2 for all three sensors); comes with VLF filter
CABLE	Two-conductor shielded; polyurethane jacket; Kevlar strength membrane, 5.6 mm diameter with weight 40 kg/km and breaking strength 500 kg
WEIGHT	Probe: 9.5 kg Control Box: 1.5 kg
DIMENSIONS	Probe: 3.8 cm diameter, 234 cm length Control Box: 22 x 13.5 x 8 cm

VLF RECEIVER / TRANSMITTER

EM16 / EM16R / TX27

The EM16 VLF Receiver is the most widely used EM geophysical instrument of all time. Local tilt and ellipticity of VLF broadcasts are measured and resolved into in-phase and quadrature components of VLF response The EM16 has discovered several base and precious-metal orebodies and many water-bearing fractures and faults.

The EM16R Resistivity Attachment uses a pair of electrodes to measure the apparent resistivity of the earth. The combined EM16/16R instrument can detect a second earth-layer if the layer occurs within the VLF skin-depth. In addition, the EM16/16R can map resistive alteration for gold exploration.

The TX27 is a portable VLF transmitter supplying a VLF field for surveying with either the EM16 or the EM16/16R if remote broadcasts are weak, intermittent or poorly coupled with the target. For EM16 surveys, the TX27 antenna consists of a long (typically 1 km) grounded wire.

Specifications (EM16 / EM16R)

MEASURED QUANTITY	EM16: In-phase and Quadrature components of the secondary VLF field, as percentages of the primary field EM16R: Apparent resistivity in ohm-metres, and phase angle between E_x and H_y
PRIMARY FIELD SOURCE	VLF broadcast stations
SENSOR	EM16: Ferrite-core coil EM16R: Stainless-steel electrodes, separated by 10 m: impedence of sensor is 100 MΩ in parallel with 0.5 pf
OPERATING FREQUENCY	15 to 25 kHz (optionally to 30 kHz) depending on VLF broadcasting station
MEASUREMENT RANGES	EM16: In-phase: ±150 %: Quadrature: ±40 % EM16R: 300, 3000, 30000 Ω-m, Phase: 0-90°
POWER SUPPLY	EM16/EM16R: 6 alkaline "AA" cells
DIMENSIONS	EM16/EM16R: 53 x 30 x 22 cm
WEIGHTS	EM16: Operational: 1.8 kg; Shipping: 6.2 kg EM16R: Operational: 1.5 kg; Shipping: 6 kg

Specifications (TX27)

PRIMARY FIELD SOURCE	Grounded wire or 500 x 500 m loop, current adjustable, 0 to 2 A
OPERATING FREQUENCY	18.6 kHz
POWER SUPPLY	120/220 V, 350 W motor generator
DIMENSIONS	Transmitter and loop; Shipping: 89 x 29 x 39 cm Generator; Shipping: 50 x 27 x 36 cm
WEIGHTS	Transmitter and loop; Shipping: 32.5 kg Generator; Shipping: 17 kg

GEONICS LIMITED

[redacted] Meyerside Drive, Unit 8, Mississauga, Ontario, Canada L5T 1C6

Tel: +[redacted] • Fax: [redacted] • E-mail: [redacted]@geonics.com • Website: http://www.geonics.com

Meeting Item Number	Panel Group	Issue description	Panel discussions	FOR REVIEW - Proposed short term actions arising from Expert Panel discussions	Onsite Activity	How to Implement	Estimated cost	Comment
11	All	Digital Terrian Model (DTM)	Commissioned by DEEDI. Use to review and improve understanding of the site	DTM has now been received and is available for use in any assessments. Incorporates high detail photography and contouring	n			To assist in assessments
5	All	Risk assessments	Finalise draft risk assessment spreadsheet for distribution and review	Complete and distribute for review	n			
1	Engineering	Getting runoff from upstream of the site through the site without it becoming contaminated. Prevent contact with mineralised material	Would this strategy cause copper contamination to progress further downstream as buffering and neutralising effect of the current dilution from the additional runoff is removed?	Initial focus on the reduction of the volume of contamination generated. Diverting upstream runoff directly to below the site should not impact significantly on downstream regimes	y	Contractor	??? (diversion costs)	Need to define what specifically is required
2	Engineering	Minimise Runoff Infiltration into waste rock dumps	Discussion of methodologies that can be achieved this year	Install HDPE membranes over leach pad and Low Grade Ore Dumps. Welded, anchored and trenched. Create non-erodable flow paths into creek line. Breach catch dams, line with dolomite/limestone (ideally screened to 15-50mm)	y	Contractor	$350,000	Advice from [redacted] required Requires review of cost estimate and design info suitable for works tendering
10	Engineering	Western Waste Rock Dump - Clean water diversion needed to stop runoff ponding on the upstream side	Methodologies to achieve this Potential opportunity to build a fresh water supply dam Methodologies to seal off upstream side of WRD where water ponds, ways to divert upstream runoff around the WRD	Investigate diversion trench above western WRD to reduce clean water inflow.	y	Contractor	$10,000	
12	Engineering	Identify needs for fresh water at the site	Discussion of clean water capture options	Assess potential for the western WRD in Twibble Creek to be used as a foundation for a fresh water dam. This to be achieved by placement of impermiable barrier on top wall. Use of local material plus HDPE liner to create barrier and stop infiltration through WRD. Short term construction, removal at completion of site works.	y	Contractor	$250,000	Advice from [redacted] required Requires review of cost estimate and design info suitable for works tendering
	Engineering	North East Waste Rock Dump - Improve runoff discharge from top	Methodologies to improve water discharge from the top of the WRD and over the eastern face Reduce water flows to the western (ponded) side of the WRD	Construct surge dam and stable discharge structure/piping for water flows off NE WRD. Cease use of current drop structure off WRD. Requires sheeting with dolomite and energy dissipation at creek end of new structure			$50,000	Advice from [redacted] required Requires review of cost estimate and design info suitable for works tendering
13	Engineering	North-east Waste Rock Dump - stop surface runoff from ponding on the high (mine pit) side of the WRD	Optons to prevent water from ponding	No short term activity identified To be addressed in long term site management	n			
17	Engineering	Use of local dolomite to act as a filter / buffer in the catch ponds and top of the north east waste dump water shedding structure.	Investigation into volumes required and source location. Determine availability in Mount Isa	Assess if local dolomite is appropriate or similar material is available in Mount Isa.	y	Contractor	$25,000	
3	Cattle	Managing cattle impacts. Indludes contamination potential, saleability and cattle health standards	Options are to retain existing electric fence, install a more permanent fence, agist (landholder proposal), do nothing. Test data to date does not indicate any significant health impact on cattle, so adistment cannot be justified on health grounds. Fencing will minimise risk to cattle to the same extent as would adjistment Fencing off the area of contamination is not warrented on cattle health grounds. Management of percepotion of risk to cattle is a greater issue. Currently the contaminated areas have an electric fence around them. Landholder is constantly releasing cattle trapped in the electric fencing Permanent fencing of caves creek contamination would address this concern through a pyhsical barrier. Would any additional watering points provide additional incentive to stay away from contaminated areas?	Install a permanent barbed wire fence around the whole mine site and downstream contaminated areas to isolate cattle from areas of elevated copper levels. Fence location to be decided in collaboration with the landowner. Design to include consideration of cattle movement to watering points and mustering activities.	y	Contractor		
	Cattle	Reducing the attactiveness of contaminated salts to cattle	Provision of lick blocks reduces the incentive for cattle to go there	Reinstate the supply of licks to the landholder to encourage cattle to stay away from the site (done) Installation of permanent fencing around the mine site providesn a physical barrier to access to contamination to address the potential risk	n	Internal	$30,000	
	Cattle	Attraction of cattle to contaminated water	Cattle won't drink high salinity water if they are not used to it. Better quality water is within reach	DEEDI Biosecurity to provide advice on options for additional watering points to minimise the attraction Installation of permanent fencing around the mine site provides a physical barrier to access to contamination to address the potential risk				
	Cattle	Monitoring of Cattle	Data seems to suggest there is no evidence of copper poisening of cattle There may be a need to provide data, guidelines and communication of data on adult cattle, juvinile and cronic illness.	DEEDI Biosecurity to prepare an information package on cattle health, copper contamination guidelines, interpretation of data and management options DEEDI Biosecurity to develop an appropriate cattle health monitoring program	y	Internal / External	$20,000	
	Cattle	Possible cattle rejection by meatworks who are aware of the issue on the site	What is the reason justifying the rejection?	DEEDI Biosecurity to investigate Action as based on findings	n			
20	Wildlife	Managing wildlife impacts from contamination	Fencing provides no protection of wildlife No benefit in the cleaning of the creek in the short term - wallabies not very sensitive. Collect mortality samples if available (provide info to landowner on procedure.	Are there other actions or investigatons that should be undertaken? Provide information to landowner on collection of dead animal samples. Generate map locations of wallaby colonies and provide advice on the extent of contamination removal that is required near those colonies.				
Intro	Wildlife	Impacts on birds at the Mine Pit and the Creek	Landholder has expressed a concern about water birds at the Mine Pit Difficult to assess bird impact along the creek because of probable scavenging of carcasses	Mine Pit - advice on methods to make the pit area less attractive to birtds, and appropriate bird scaring methods	y	External	$20,000	
6	Monitoring - Wildlife	Wildlife status and baseline monitoring	Programs are required for stream sediment and biota monitoring Need to determine site specific improvement criteria Long term f/up is - remediation to address issues found Include photographic record for all monitoring Also descptive terminology of visual appearances should be undertaken eg green water/ blue water	Develop monitoring programs for aspects identified and implement. Monitoring program for metal levels in fish and aquatic biota, also freshwater mussles Include visual descriptors with photo database	n	External	$5,000	

Meeting Item Number	Panel Group	Issue description	Panel discussions	FOR REVIEW - Proposed short term actions arising from Expert Panel discussions	Onsite Activity	How to Implement	Estimated cost	Comment
23	Monitoring - Wildlife, Mine Rehab	MR - Baseline studies	See if there is ability to use Perilya Flora/Fauna study as environmental baseline criteria.	Contact Perilya to determine access to data.	n			
4	Mine Rehabilitation	Monitoring program (site and downstream, sensitive water hole downstream, cultural water values).	Review existing data (water and sediment) and identify what is missing (parameters, methodology, locations). Develop monitoring locations in consultation with stakeholders. Current sites and additional ones for further downstream to the confluence with Gunpowder Creek. Also further downstream to waterholes and cultural/tourism sites. Sampling and analysis of pre-wet season water (where available) and sediments at these locations. The monitoring program needs to capture requirements for water, sediment, environmental values, cultural values and success criteria. Also the domainal requirements of site, immediate downstream and larger catchment scale assessment.	Advice on various aspects of the monitoring program	y		Costs accounted for in No3 ($20000)	
	Monitoring - Mine Rehab Groundwater	Groundwater movement in the streams, waste rock dumps, and potentially from the Mine Pit are important in understanding site contamination mechanisms	Groundwater monitoring	Advice on various aspects of the monitoring program	y	Internal	$10,000	
7	Mine Rehabilitation	Review of existing geo-chemical data, modelling, copper precipitation modelling	Develop framework of review requirements, collate and review data. Review and gap analysis of water and waste geochemical data from the site. NAPP and NAG type testss on waste samples from selected stockpiles as an initial assessment. Results will contribute to the prioritisation for which stockpiles/heaps will be covered using HDPE sheeting	Identify cohesive waste/mineralised zones requiring management Collection and anlaysis of representitive samples for characterisation testwork. Identification of priority stockpiles to cover with HDPE	n	Internal	$5,000	
19, 21	Mine Rehabilitation	Develop a conceptual contamination pathway model based on catchments.	Tracer studies would help to identify contamination pathways (initialisation).	Utilise DTM for generation of catchment model. Identify data gaps and monitoring requirements. Initiate desktop study to determine scope of works to undertake tracer studies. Panel advice to plan sample collection and define analytical requirements for oncoming wet season.	n			
16	Mine Rehabilitation	Potential water loss from the mine pit to the eastern tributary of Caves Creek.	Analysis of mine pit water and any other seepages and or precipitates in the drainage pathways on the mine site will provide a preliminary test of the initial site contamination pathway model (Refer Item 7). It will also demonstrate to stakeholders that government is addressing the potential contribution of mine pit water to the creek	Analyse existing water chemistry. Collect water samples from the mine pit and from identified background sites for charactorisation as determined by advice from the Panel. Install water level indicator boards in the mine pit to allow precise measurement of water levels.	n	External	$5,000	
14	Mine Rehabilitation	Deal with scrap iron that is on site	Low priority; minimal impact Long term remediation will address this matter.	Low priority for site management - await long term options assessment	n			
8	Social and Stakeholder	Soc - Communication strategy for stakeholders using a participant model,	Appoint an 'Expert Panel Stakeholder Review Group'? Stakeholder participation in works and monitoring - solutions for involving given procurement limitations Possible solution is to use the Southern Gulf NRM to group to assist with monitoring activities; access Caring For Country funding? Develop a communication strategy for the Mount Oxide Project, explore areas such as Traditional Owner involvement and partnership programs	Develop a Stakeholder Communication Plan including advice from the Panel. Incorporate stakeholder education, site facts, evidence, expectation management Allow stakeholders to become observers. Open public info provision/consultation and presentation – with question time at the end. Develop discharge notification procedures for stakeholders. Assess potential partners for the project - Southern Gulf NRM Group, DEEDI, DERM, catchment programs, BIRDS AUSTRALIA	n			
9	Social and Stakeholder	Traditional Owner involvement in any works; job opportunities.	Opportunities for participation in works and monitoring - solutions for involving given procurement limitations	Ensure TO's are aware of every opportunity for works tendering	n			
18	Social and Stakeholder	Managing Stakeholder Issues	Communicatons methodology Involvement in the solutions through the development of partnerships Actions that will address issues and improve relations	Collate stakeholder issues and demands Review stakeholder submissions Potentially solve pastoral lease renewal early - don't excise the mine area from the pastoral lease. Reduce creek contamination Maintain action to separate cattle from contaminated areas eg fencing Monitoring of downstream impacts; investigate whether there is water loss from the mine pit Media communication of prior activities and preparation for wet season incidents Define a timeframe for the release of data (eg monitoring results) If possible provide more notification for stakeholders meetings.	n	External	$10,000	
22	Social and Stakeholder	Review stakeholder submissions for other actions	Tabulate and review for items for inclusion in actions Incident notification protocol (prep stakeholders before event)	Provide Stakeholder submissions to the Panel and seek its advice on matters presented Incorporate actions in the Stakeholder Communications Plan to expand on framework of interaction and involvement.	n			
	All	Third Party Review	Potential benefit from 3rd party review of strategy - to provide validation and transparency of actions taken	Determine options for review.	n	External	$5,000	

MT OXIDE EXPERT PANEL MEETING

Level 16 Conference Room, 61 Mary Street Brisbane

Date: Tuesday 26th July 2011

Meeting commenced: 11:40 am

Attendees: Oskar Kadletz (OK), [redacted] DG), [redacted] (VH), [redacted] (DL), [redacted] (RMc), [redacted] (ME), [redacted] (BN), [redacted] (NT), [redacted] I (BH), [redacted] (DS), [redacted] (BD), [redacted] (DF), [redacted] (BS), [redacted] (JW), [redacted] (CA), [redacted] (DM), [redacted] (TB)

Teleconference invitees: [redacted], AECOM, [redacted] Southern Gulf Catchments

Apologies: [redacted] Kalkadoon Community

Meeting Purpose:
Session 1: Update over last 12 months since previous Expert Panel meeting.
Discuss progress to date on previous Expert Panel recommendations.
To enable contact with Stakeholders, including landholders of Chidna Station; Kalkadoon Community and Southern Gulf Catchment (SGC).
Expert Panel to hear from Brussie Spreadborough (Landholder), regarding an update into considerations of the Expert Panel.
Session 2: Technical discussions on site knowledge to date and further actions/recommendations required.

Proposed Stakeholder Session to be held at Mt Isa on 18th August 2011 with emphasis to follow through/discuss outcomes from Expert Panel Meeting.

ITEM NO	ISSUE	ACTION
1 A	**pologies and Introductions:** Oskar Kadletz commenced the meeting and addressed the Expert Panel (EP). Expert Panel members individually introduced themselves and their relevant expertise.	
2	**Update on activities at Mount Oxide abandoned mine site since last panel meeting** Oskar introduced Daniel Gillinder, Manager, Abandoned Mines Unit, North to present to Expert Panel members. Broad outcomes from last Expert Panel Meeting:- • Sources of Contamination; • Monitoring Regime; • Cattle & Wildlife; • Mine Rehabilitation; • Engineering ; • Social and Stakeholder.	

	Items addressed:- • RPS undertook study since last year indentified sources of contamination. AECOM provided preliminary data (not ideal), data still being compiled for final report. • RPS study has indicated pit as a potential source of contamination in creek east of pit. • Waste Dump Characterisation study – DEEDI Rehabilitation Scientists have identified main source of contamination is from stockpiles (based on EC connectivity). • Partly relying on further information from Perilya, (subject to confidentiality).	
3 Discus sion of Hydrological Assessment	RPS Hydrogeological report indicates little water quality information available on site • Water flows show semi-confined and confined aquifers below. • Recommended BM surveys (electromagnetic surveys) undertaken. DEEDI installed data loggers into pit. AECOM engaged to undertake monitoring via tender process. • Further advice/discussion with [redacted] re advice on activities undertaken to date via teleconference. • AECOM provided information on surface water quality; sediment and wildlife. AECOM raised concerns re: wildlife require further advice/direction from Expert Panel. DEEDI have been providing lick blocks to leaseholders to minimise cattle accessing pit over last 12 months. • Permanent (electric) fencing provided has been removed. • HDPE covers were installed to stockpiles in attempt to reduce infiltration (medium to holding option) • Decision needed on further management including design if left on site (DERM approved). • Investigate Mine Pit movement • Study indicates traces not available for site. EM survey only further option. • DEEDI still looking at Characterisation Study with views to move things, develop Conceptual Halfway model Options available from last EP meeting: 1. Keeping clean water away from mine area - placed HDPE covers over stockpiles; 2. Installed pipe drop structure north east of dump; 3. Extreme run- off diversions for waste rock dumps, partially from stockpile re-shaping. 4. Catch dam on Tweebles creek has been removed. BS stated stockpiles were still contaminating creek. • Previous strategies did not appear to be working. Caps installed on heaps and catchment dams, have not entirely stopped some pollution from rainfall running under heaps and into creeks due to fractured terrain. • RMc explained to BS – that the intended use of caps was to cover known source of pollution, to determine what other pollutants could be captured. Unlikely to be infiltration from dumps. OK advised panel another idea for lime treatment would be introduced during the EP meeting for discussion.	Undertake BM Surveys (electromagnetic) Expert Panel to provide advice/direction re wildlife Undertake Characterisation study to determine what is in stockpiles. Options for relocation or removal of stockpiles

	• Discussion amongst (DS/OK/ – discussed RPS preliminary data and anticlines.
	• DS posed questions:-
	  o Has RPS study has penetrated the fault zone north and south of pit in preliminary data?
	  o Is there any transverse dislocation, fracture-set, fault-set that is potentially a conduit of contaminants towards the creek line?
	• BS advised once pit gets to certain level it leaks. Post-rain, levels rise in pit and leaks down river.
	• DS – Have Perilya done detailed structural geology mapping of the pit and its immediate environment?
	• OK advised DEEDI had not seen data, but drilling by Perilya would have included this, very complex.
	  o OK advised Perilya had discussions that drilling may have pin cushioned the area, creating connections over time, aiding water flow through area. EM survey will provide further information on this issue. i.e. define straight lines, narrow or broad pathways for flow?
	Social and Stakeholder engagement – ongoing communication protocol, partnership; monitoring slightly superseded due to contracts put out.
	  o OK explained tendering process and criteria set by DEEDI.
	  o Had several tendering runs to optimise opportunity, AECOM successful. SGC were unsuccessful in tender process.
	• Expert Panel requested feedback on selection in tender process.
	  o OK advised successful tenderer selected due to technical ability and ability to adhere to DERM sampling guidelines. Price not DEEDI's sole criteria.
	• BS gave feedback on the sampling techniques utilised, expressed concern that ground water sampling methods were questionable and did not believe they were of same quality/standard as Perilya samples. BS advised samples were taken with use of bailer.
	  o OK stated there were DERM guidelines for taking samples.
	  o DS explained background on ground water sampling, use of bailer is recognised method.
	  o DEEDI have installed automated weather station (AWS), EP can log in to view live data, capability to expand that, automated information from pit and stream flowing vents.
	• In regards to managing mine pit leakage, benefits of AWS are –
	a. able to gauge level fluctuation in mine pits,
	b. conditi on monitoring (with evaporators), to ensure pumping system keeps running and;
	c. live data with remote sensor for downstream monitoring.
	• Ground water Report –
	  • Pre-works – Ground water filtered copper – elevated copper levels south to pit, concern it may be contamination source (DG reiterated only preliminary data).
	  • Surface water tested prior to HDPE Covers:-
	  • Clarification requested by RMc –
	  o Is this data taken pre or post-works?
	  o Any water qualities taken when site was flushing or post-flush?
		AMU Northern to review Groundwater monitoring

4	**12:10 pm – 12:25 pm Teleconference:**
	DG commenced teleconference. Introduction of [redacted], Technical Officer – AECOM to Expert Panel.
	OK requested wildlife update:
	• Macropod Survey - Originally proposed ANZECCs not suitable –
	  • Discussed Macropod study - observations of purple neck rock wallabies, scats, home range.
	  • Permissions/limited access to certain areas of site impeded studies.
	  • In summary – Macropod study did not identify suitable background population.
	  • Known population – trip cameras to capture wallabies drinking up to 12 (anecdotal evidence landowners up to 30 observed at site)
	  • Further west - Identified sole purple-neck wallaby, drinking.
	  • Consultant with Perilya, scats found up to 150m from home range.
	  • Observed joeys at MOWS09; drinking observed
	  • Another macropod observed, not determined if euro or red kangaroo.
	  • Another group of wallabies observed 1½ hrs north of site, would require site access.	

	• Hair analysis performed on cattle – heavy metals samples no results, beast killed, samples taken from liver of one cattle (LM) Value of macropod survey is questionable). • Collecting hair samples from scats is impractical methods of hair sampling due to minimal hair available in scats. • Collected bones from main wallaby site, possibly from purple-necked wallaby. • May be worth taking skin samples from another species. • May not pick up scats after rain.	

	• Second population at MOWS16, permission would be required to access that area.
	• LM - Achievable to find background population, not sure if meaningful.
	OK stated an expert review of methodology needed to identify risks to population, movement of population, how contact with stream water/contamination and how it would impact on them.
	Discussion about value of Macropod Survey. LM stated study was initially considered most achievable as macropods were main users of water.
	BH suggested whether better value for input through monitoring aquatic species, rather than macropods.
	  • Expressed belief that monitoring aquatic life may be more valuable due to higher turnover of species.
	  • Cyclical activity, measurement of rise & fall of intoxicants in surface water.
	Discussion between BH/BS re aquatic life in surface water/indication of how elevated levels of copper could vary during year, according to weather events would be advantageous.
	  • Marrying study with automated weather station data would be more fruitful.
	  Ok stated that this was planned for in second level of work planned.
	  • LM – Requested further advice from EP:-
	  o What type of analysis do they require and what is achievable?
		Expert review of methodology – access to background population if possible – risks to population from adjacent stream; contact with stream water/contamination and how it would impact on them.
		
		Talk to Govt Veterinary Science experts; other experts in Wildlife Network DERM to evaluate and perform risk assessment.

	OK questioned BS – Is access to background population possible? • BS stated his belief that access is possible. LM – In relation to ground water well, AECOM given bore logs. • samples for ground water zones may not be reliable as screened across multiple water-bearing zones, at 40-60 metres and 10-20 metres. • Needs to be taken into consideration when reviewing data. Data results could easily be diluted. Expert Panel posed questions to LM. • Clarified sample taken was from one well with two lots of screening. SW – first round – noticed two of background sites had no water (MOWS22/MOWS23). May be issue going forward and needs to be considered. • ME posed question to LM:- o Was sampling of pit water quality sampled at depth or one location at surface? o LM advised taken from top 30 cms o BD – Multiple wells screened at different levels	[redacted] to liaise with [redacted] regarding outcomes and further work to be done. Discuss further sampling required.
5	**12:35 pm – 12:50 pm Teleconference:** DG commenced teleconference with [redacted] A/CEO, SCG. Don introduced to Expert Panel. • Expressed disadvantage in not being privy to previous briefing. • DP apologised on [redacted] (board member for SGC) behalf. • [redacted] no longer at SCG. • [redacted] transitioning to role with State Govt. DP stated SCG's position is willing to do whatever facilitation required to property in question. • SCG keen to work with DEEDI; to represent interests of region and property holders. • Once framework has been established, SGC play regional, community role. To communicate where practical/feasible to region. • SGC have not formed their position on this issue yet.	[redacted] to meet with [redacted] in Townsville to discuss SGC interests. Make available briefings previously supplied by SGC.
6	**Stakeholder's (Landholder) Input:** **Outlines of issues and concerns presented by Brussie Spreadborough.** BS expressed SCG have been a great help to date with sampling etc. Would like to continue ongoing partnership with SCG. Don apologised re unable to make contact with BS prior to meeting.	
	Main issues: 1. Proposed smaller, paid Action group (10 people) is formed to get things done. • OK responded DEEDI-AMU is the "action group". The purpose of this meeting is to discuss the work has been done over last year – a culmination of 12 months work. 2. BS expressed lack of communication regarding assessing work progress; updates on what's happening, plan to deal with contamination. Discussion amongst EP members OK/DP/BS) regarding lack of financial assurance from previous mine operators for Mt Oxide site.	Formal update to Stakeholders to be given on progress, plans for Mt Oxide.

	• OK advised there is no link between previous mine operators and initiators. Issue now in hands of landholder with no resources and little control. • No financial assurance left behind for this particular mine site which represents challenge for all. Comes back to Govt to address with public money. • Big, complex problem with no simple solution. Issue requires time and effort. • DP - Are you likely to set a precedent in this case that will be a useful policy used for State? DP to BS Has there been a serious commercial offence? Have you got biosecurity issues? • BS replied not that he can prove, believes his cattle have elevated levels of copper; consulted with experts in Canada, yet to be determined level of effect on immune levels. Unsure of level of copper required before it affects their immune systems, does not affect meat. OK indicated a difference of opinion exists between BS & Biosecurity Qld discussions. • BH explained information to date did not indicate any untoward difficulties with cattle, difficulties in monitoring productivity, morbidity and mortality with cattle on Chidna Station. • Not much evidence to support downside at present. DP queried renewed prospect interests at Mt Oxide? • OK advised Perilya currently evaluating residual mineralisation. In preliminary process. Environmental impact study underway. • DEEDI having discussions with Perilya about their interests in stockpiles in relation to our need to control contamination. • Realistically Board will make decision by early 2012. If applicable, at least 4 yrs before mine takes shape on ground. We can't wait for Perilya to make its decision, basis of DEEDI's work and management we require. • DEEDI having discussion with Perilya re control of contamination. • DP conveyed Pieter Swart's feedback more forward notice for meetings should be given for technical meetings. • SGC relying on Pieter's input into the Director's considerations of the matter.	More forward notice for meetings to be given.
	3. BS asked - What funding has been allocated for Mt Oxide? OK explained difficulty in discussing funding at this stage of meeting as funding will be established based on the work plan proposed to EP during meeting. • Discussing funding is premature as EP's opinion needed. A better estimate will be given in August. • Explained tendering required including earthworks, contractors. • Significant allocation of funding for next 4 yrs ($6M) in association with work at Mt Morgan, Horn Island & additional work at Croydon and Southern Region to carry out works. • OK assured BS funding will be enough to do work agreed on at this meeting at Mt Oxide. • BS stated that $26M funding not enough to fix Abandoned Mines in Qld. • BS stated his belief that funding was a result of the proactive efforts of himself and sister, [redacted] • OK advised whatever works are done in next year won't be enough to fix problem, but	Agreed outcomes will be given to stakeholders

	DEEDI is working towards sustainable solutions (best outcome and solutions) step by step, do work once and properly. • BS raised question re: Where does EPA stand on making DEEDI comply? OK – any works need to be run past DERM/other appropriate government agencies for best outcomes and solutions. • DG assured there is regular interdepartmental communication between DERM and DEEDI. • BS asked "Can they (DERM) force DEEDI to do more"? • DS stated there are currently:- o enforcement guidelines, expectations relayed to DEEDI at Senior Level. o BS – DERM have clearly stated expectations and outcomes required by DEEDI. • Confirmed by OK - ADG's very interested in progress. 4. BS asked why a closed session (excluding stakeholders) was being held after this session? • OK explained due to confidential nature of information from Perilya discussed, ideas passed around may/may not occur, technical information discussed. • Assured BS agreed outcomes will be given at Stakeholder's Meeting, just taking away the interim discussion. OK does not want non-technical assessment colouring our outcomes. BS emphasised the need for a paid Action Group required to speed the rehabilitation process. • Reiterated that action has been stalled. OK thanked BS for attending meeting, advised of the opportunity to discuss any issues with EP members during lunch break.	
	LUNCH BREAK	
7	**Discussion of monitoring results and outcomes from monitoring programs** Discussion of monitoring results and outcomes continued. Power Point presentation presented by [redacted]/Oskar Kadletz outlining:- • Overview of last 12 months. • Proposed strategies for next 12 months. • Additional suggestions by Oskar Kadletz for discussion by Expert Panel.	
	Discussion amongst EP regarding efficacy of HDPE covers and infiltration of contaminants in Ground water, geological factors involved. • OK stated that covering needs to be moved; complex • DS – engineering required; open cut proposed General discussion on Perilya. • Verbal comments only from Perilya given unlikely to have board decision in next year. General discussion - (DS/RMc/OK/BH) on ways to overcome high pH levels AECOM queried what standards should be used for ground water? • DS stated DERM's preferred choice is ANZECC(2000) Further work reqd with DERM regarding water quality assessment and appropriate reference values.	Sediment monitoring should focus on -63 micron fraction ANZECC(2000) **Ecosystems need to be applied in consultation with DERM.**

Deleted: Stock Watering standard needs to be used (DS) **NO**

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	DF wanted clarification whether concentration same as last wet season, but volume of contaminants less? General discussion – Tracers are not viable (BN/ME) OK - Is Electromagnetic survey worth conducting? – DS believes viable. RMc queried can Perilya information be accessed? May be more comprehensive data as only sparse information supplied by RPS data. • OK - More drill holes may be required. Discussion on strategies to reduce attractiveness of pit to birds. • DG raised question to panel:- Are there any practical measures to do reduce attractiveness of pit to birds? • Difficult to eradicate small birds. To deter large birds need to remove roof sites and trees. • Scare cannons not effective. Discussion about AECOM investigation. • What is the effect on wallaby's drinking water? • What can be done to improve conditions for wildlife? BN stated that studies on hair is heterogeneous. • Evidence show that kangaroos/wallabies are less sensitive to contaminants than cattle. • Aquatic life has highest intolerance. EP suggested we perform risk assessment on more intolerant species such as cattle/aquatic life	Need to focus in on next wet season - pit & contamination, strategies used (caps) DERM Birla weather date required ICPMS scan for trace elements/ratios of trace elements Electromagnetic survey – investigate options and have reviewed by DERM and the Expert Panel Comprehensive review on previous studies done – AECOM not given clear indication of studies to be undertaken. Need to organise library search on impacts to wallabies and managing birds to determine if impact is significant. More field studies to determine problem/impact Determine/identify species that are dying on site. Perform risk assessment on more intolerant species ie. cattle/aquatic life If possible, send data from drilling of the dumps to be sent to DERM Expert Panel) for interpretation of data. check confidentiality agreement
Reduc e flood level.		Investigate groundwater flow measurement in bore hole using down the water technology. Develop a list of sample specifications. Cut wide shallow channel in southern stream Investigate lime treatment

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	EP discussed lime dosing of pit water and factors to consider: • Discussed feasibility to use pit water for pre armouring. • Lime dosing results in high 1500tds; more lime required • Sludge plug up waste dump impeding preferential flows	Work up strategy and pass onto DERM and Expert Panel for comment.
	DS suggested focus on ground water ingress. • Establish ground water inflow into pit • How do we reduce or prevent?	Focus on ground water ingress. Establish ground water inflow into pit. Automatic monitoring of # 4 contaminated borehole
8	**Discussion of Perilya waste dump characterisation study, update on Perilya's plans and activities on site**	
	Need to seek release of data to Expert Panel for discussion in context of future works	
9a Commun ication strategy	Discussed a revised process for future. • What can be done for Stakeholders Meeting in August? • Currently managing stakeholder requirements through discussion at Stakeholder Meetings.	Develop communication strategy. Maintain communication with Stakeholders every 3 weeks to advise update on status/developments. Ask BS Stakeholders what communication strategy they would be satisfied with.
	Suggestions by Expert Panel Meeting:– Suggestion made that budget considerations/constraints are not discussed during Expert Panel Meetings.	Develop Working Group Panel. Develop clear terms of reference on agendas for Mt Oxide meetings – i.e. Charter or Agreement
	General discussion on proposed suggestion to form "Rehab" or Working Group Panel with view to holding quarterly meetings allowing more regular updates; and gives Stakeholders more opportunity to participate. Suggested proposed Working Group Panel involves DEEDI - AMU; DERM; other Government Stakeholders; [redacted] Kalkadoon Community, Southern Gulf Catchments.	Hold Working Group Panel meetings in Mount Isa on quarterly basis.
	Review of long term site remediation and management • Develop options/tenders discussed. (long term)	
9b	**Confirmation of updated recommendations and management**	
	Suggestions for proposed work program over next 12 months	Review options for solar system to pump back.

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	Short term:- • Pumping with solar – with constraints of limited flow rates • Continuation of monitoring program • Install remote telemetry option to pit, creek lines and monitoring bores • Develop conceptual model of contamination • Develop water balance model for site • Develop communication plan with conjunction with EP • Earthw orks	

	• Mo nitoring program
	• Lime dosing ([redacted] as previously commented above
	• Suggested GRS alternative option for monitoring.
	  • Site access problematic.
	  • Needs to occur once finish of rain (suggested March 2012)
	• DG raised clarification of whether EP agreed on water past the Waste Rock Dump or wide shallow channel re manipulating creek bed.
		Obtain data from Perilya and pit water data from Borers
		Liaise with Perilya for updated geology with view to moving to east.
		Inconclusive – consider DEEDI's options

	• Suggestion raised regarding the feasibility to train landholders in taking samples. OK explained DEEDI departmental tendering processes would need to be followed.	
		Look at AECOM Aquatic fauna sampling
	NT raised review of quality and sediment quality • How is measurement done? • Is data providing sediment fractions? Bore monitoring – down the hole monitoring.	Pass on data to DERM for review – tender document, site info, check if any other relevant data available. – Send through parameters of sampling requested to be made available to DERM. for review
	Water Balance Model Catchment/Sub catchment data – use of spreadsheet or ?? program AMU have collated contour data gives rough estimate of data. RMc suggested EP looks into data from Horn Island DL raised issue of potentially shotcreting/grouting to increase draw down	Follow up with DERM regarding stream gauging & rainfall monitoring at Birla, Mt Gordon [redacted] Cross sections to estimate flows. Expert Panel members can contact [redacted] regarding information available. Refer to data from Horn Island ICP-MS full range analysis of groundwater & surface water samples to be done at tail end of wet season. AMU to send DERM points to be considered for water balance model (for review)

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	Liming works	Develop draft process for lime works – look at small scale trial to happen.
10	**Discuss Expert Panel representation at upcoming Stakeholder's Meeting**	
	Discussed requirement for representation of EP at Stakeholder's Meeting in Mt Isa – DG called for nomination of all interested panel members in attending including Stakeholders:- • SCG – [redacted] • [redacted] - N/A late August due to annual Mining S&H Conference • [redacted] advised he was not available 18th August.	Process together draft for comment to be submitted to EP members. Process for Working Group meeting. 6 or 12 month annual technical panel meeting held off working group panel. Require EP members' input re structure. Aim for bi-monthly updates for EP.
BN	offered to look up toxicology reports	Toxicology reports to be obtained.
11 Ma	**tters Arising/Other Business**	
	Proposal – independant validate outcomes of groups findings	

Meeting ceased: 5:10 pm

Responsible Officer – See Action Item Summary (for meeting)

MOUNT OXIDE EXPERT PANEL
ACTION ITEM SUMMARY

Tuesday 26 July 2011
Level 16 Conference Room, 61 Mary Street, Brisbane
Chair – Oskar Kadletz

In attendance: Oskar Kadletz [redacted]

Apologies: [redacted]

Agenda Item Number (from minutes)	Action Item	Responsible Officer
3 & 7	Undertake BM (electromagnetic) surveys.	AM Unit & DERM
3	Expert Panel to provide advice/direction regarding wildlife.	[redacted] DERM, AM Unit
3	Undertake Characterisation Study to determine what is in stockpiles. – Discuss with Perilya	AM Unit
3	Explore options for relocation or removal of stockpiles	AM Unit & Perilya
3	AMU North to review ground water monitoring.	DERM & AM unit
4	Expert review of Methodology. – Wallaby sampling techniques by talking to other Government Veterinary Science experts to evaluate and perform Risk Assessment. – AECOM regarding outcomes and further work to be done. – Discuss further sampling required.	[redacted] AM Unit AM Unit
5 & 6	Meet with [redacted] Southern Gulf Catchments (SGC) to further discuss SGC interests. Make previous submissions from SGC available to [redacted] - Formal update to Stakeholders to be given on progress/plans for Mt Oxide. - More forward notice to be given for Expert Panel Meetings - Agreed outcomes to be given to Stakeholders	[redacted]
7	Sediment monitoring should focus on -63 micron fraction ANZECC (2000) Stock Watering standard needs to be used Need to focus in on pit & contamination and strategies (caps) used during upcoming wet season. DERM Birla data. ICPMS scan for trace elements/ratios of trace elements. Comprehensive review on previous studies done – AECOM not given clear indication of studies to be undertaken. Need to organise library search on impacts to wallabies and managing birds to determine if impact is significant More field studies to determine problem/impact. Determine/identify species that are dying on site with [redacted] Send data from drilling of the dumps to be sent to DERM DS (and/or Expert Panel) for interpretation of data. Perform risk assessment on more intolerant species ie. cattle/aquatic life	AM Unit
7& 14	Investigate lime treatment Cut wide shallow channel in southern stream Work up strategy and pass onto DERM for comment. Develop draft process for Lime Works – look at small scale trial to happen.	AM Unit
9a	Maintain communication with Stakeholders every three weeks to advise update on status/developments at Mt Oxide. Develop communication strategy - DG to liaise with BS/Stakeholders re: what communication strategy they would be satisfied with. Develop Working Group Panel.	AM Unit

	Develop clear terms of reference on agendas for Mt Oxide meetings – i.e. Charter or Agreement Hold Working Group Panel meetings in Mount Isa on quarterly basis Review options for solar system to pump back – lot of energy reqd Seek access to Perilya Pit water data Pass on data to DERM – tender document , site stuff, check if any other relevant data	
9b	Send through parameters of sampling requested to be made available to DERM. Liaise with Perilya for updated geology with view to moving to east. Investigate groundwater flow measurement in bore hole using down the water technology Follow up with DERM regarding stream gauging & rainfall monitoring at Birla, Mt Gordon [redacted] Cross sections to estimate flows Expert Panel members can contact [redacted] regarding information available. Refer to data from Horn Island ICP-MS full range analysis of groundwater & surface water samples to be done at tail end of wet season. AMU to send DERM points to be considered for comment – including height confirmation, Clarification of whether Expert Panel agreed collectively on manipulation creek bed.	AM Unit
9b	AMU to send out list of Action Items for Expert Panel's review and consideration.	AM Unit
10	Inconclusive – email to be sent out to Expert Panel for Expressions of Interest. Process together draft for comment to be submitted to EP members. Process for Working Group meeting. 6 or 12 month annual technical panel meeting held off working group panel – EP members input required how it should be structured. Aim for bi-monthly updates to Expert Panel.	[redacted]
10	Toxicology reports to be obtained.	[redacted]

Note - AM Unit = Abandoned Mines Unit – Northern Region (DEEDI)

On site weather station link

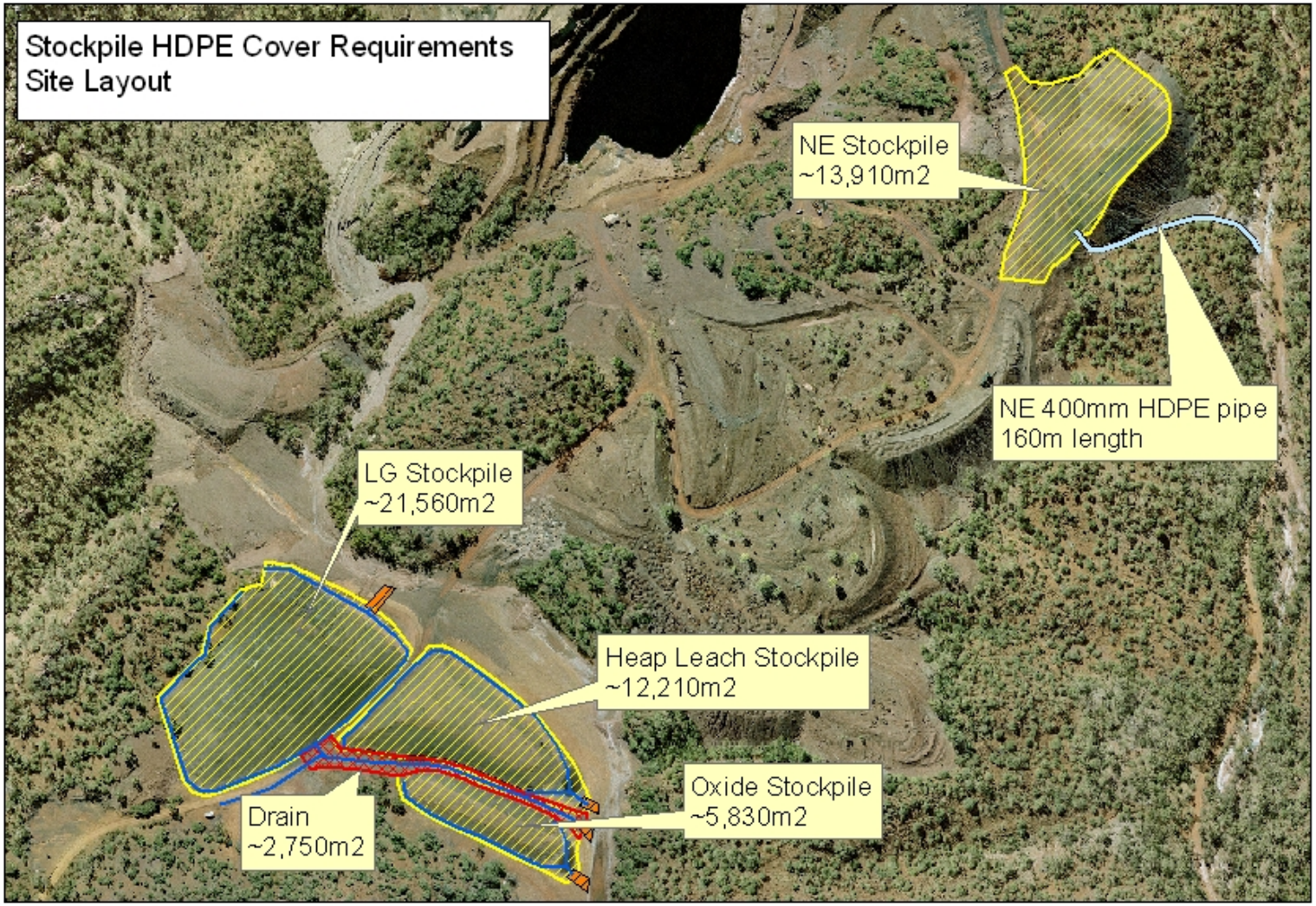
– http://www.weatherdata.com.au/mtoxide/

MOUNT OXIDE EXPERT PANEL

Panel Member	Email Address	Relevant Experience of Expertise
[redacted] General Manager - Mining and Petroleum Operations, DEEDI	[redacted]@deedi.qld.gov.au	
[redacted] Regional Director - Mining and Petroleum Operations, DEEDI	[redacted]@deedi.qld.gov.au	
[redacted] Manager AMU, North Region, DEEDI	[redacted]@deedi.qld.gov.au	
Oskar Kadletz, Queensland Coordinator Abandoned Mines, DEEDI	oskar.kadletz@deedi.qld.gov.au	
[redacted] Safety and Health Representative, Mines Inspectorate, DEEDI	[redacted]@deedi.qld.gov.au	Chemical Engineering and Metallurgical processes expertise Mines Safety and Health inspectorate
[redacted] Principal Veterinary Officer, Biosecurity Services for Biosecurity Queensland, DEEDI	[redacted]@deedi.qld.gov.au	Educational Qualifications: • Bachelor of Science (Major: Pathology), University of Queensland. • Bachelor of Veterinary Science (Honours, Division A), University of Queensland. • Doctor of Philosophy Degree, University of Edinburgh, Faculty of Veterinary Medicine (1989) • Graduate Certificate Public Sector Management, Flinders University (2003) Professional Memberships: • Member (by examination) of the Australian College of Veterinary Scientists (Pathobiology Chapter) • Member of the Australian Veterinary Association (Member No: 2913) • Member of the Australian Society for Veterinary Pathology Specialist Areas of Expertise: • Diagnostic Anatomic Pathology (gross and histopathology) • Immunopathology of gastroenteric diseases • Neuropathology • Reproductive failure in cattle • 15 years experience in multidisciplinary project leadership and coordination across university, public sector and industry organisations. • Management and sustainability of veterinary diagnostic laboratories based in extensive grazing environments
[redacted] PSM, BVSc (Hons), PhD MACVSc, GCertAppSC(RurExt), GCertPSectMgt, PGDAppSc, MRurSysMan Director, Product Integrity - Biosecurity Queensland, DEEDI	[redacted]@deedi.qld.gov.au	
[redacted] Biosecurity Officer, Biosecurity Queensland, DEEDI	[redacted]@derm.qld.gov.au	
Bernie Givney, Biosecurity Inspector, Animal Biosecurity and Welfare, DEEDI	[redacted]@deedi.qld.gov.au	I was based in Mt Isa during the 2009 flooding event in the Gulf region in my current position as a Biosecurity Inspector with Biosecurity Queensland. This included the Mt Oxide mine response where I developed a good working relationship with [redacted] I sampled animals, soil and pasture to determine if contaminants could affect animal health and product integrity on his property. My input to the meeting would provide animal biosecurity and welfare advice including practical aspects of animal husbandry in the area.
[redacted] Director, Program Coordination, DEEDI	[redacted]@deedi.qld.gov.au	

[redacted] Manager Dam Safety, Environmental Operations Division, DERM	[redacted]derm.qld.gov.au	[redacted] has been involved in the engineering of dams since 1970 when he joined the then Queensland Irrigation and Water Supply Commission. In 1987 he took over implementation and management of the Queensland dam safety program. As well as regulating large water supply dams, the program also included surveillance of dams containing wastes from various industries including mining. In 2002, the regulation of dam safety was split between government departments according to the types of dams. The regulation of dams containing waste moved to the Environmental Protection Agency (EPA) as did [redacted] and his group of engineers. Within the EPA, the focus of the dam safety program has evolved from purely technical issues to containment of contaminants and environmental sustainability both now and into the foreseeable future. [redacted] has been involved with the development of many of the ANCOLD guidelines including the Tailings Management Guideline, the Dam Safety Management Guideline and the Dam Failure Consequences Guideline.
[redacted] Professor and Director, Centre for Mined Land Rehabilitation	[redacted]@cmlr.uq.edu.au	
[redacted] Principle Research Fellow, Centre for Mined Land Rehabilitation, University of Queensland	[redacted]@uq.edu.au	Associate Professor [redacted] from CMLR, the University of Queensland, has studied processes and fates of trace substances, particularly metals, in the environment, including in tropical environmental systems with special reference to risk management associated with the study of the bioavailability of toxic elements in mine wastes, including waters. He was appointed in 2007 as Lead Author of the Australian Government Sustainable Leading Practice Development Program for the Mining Industry Handbook on Cyanide Management.
[redacted] Research Fellow, Centre for Social Responsibility in Mining, University of Queensland	[redacted]@smi.uq.edu.au	[redacted] is a Research Fellow at the Centre for Social Responsibility in Mining, Sustainable Minerals Institute, University of Queensland. [redacted] experience traverses the policy, social and earth sciences, with a particular interest in community and stakeholder relations, community engagement, social impact assessment and environmental geology. [redacted] previously held positions as a social scientist within the Queensland Department of Natural Resources and Water, and as a geoscientist.
[redacted] Centre for Mined Land Rehabilitation, The University of Queensland	[redacted] @cmlr.uq.edu.au	[redacted] has a background in soil physics (soil hydrology and soil mechanics). His expertise in mine site rehabilitation is the assessment of the performance and the design of covers for waste material. This includes understanding the parameters which control the integrity of a cover (hydrologically and geochemically) and covers as a medium for plant growth.
[redacted] Centre for Mined Land Rehabilitation, University of Queensland	[redacted]@cmlr.uq.edu.au	[redacted] has a PhD from the University of New England and more than 12 years of experience in collaborative research with the minerals industry. His expertise is in the understanding and monitoring of geochemical processes which are applicable to mining environmental management, particularly in the area of mine water geochemistry.
[redacted] Environmental Consultant specialising in Sustainable Mine Rehabilitation, University of Queensland	[redacted]@bigpond.com	
[redacted] Discipline of Civil and Environmental Engineering School and Physical Sciences, James Cook University, Townsville	[redacted]@jcu.edu.au	Surface water and Groundwater Quality and Quantity modelling, hydro geologic modelling and simulation, development of optimal strategies for remediation of contaminated aquifers, simulation of pollutant transport in surface and groundwater, identification of unknown contaminant source location magnitude and duration, optimal monitoring network design for groundwater contamination detection, management of groundwater aquifers for contamination control and remediation, design of strategies for bioremediation of aquifers, detection of aquifer contamination based on background concentration data, real time operation of surface water reservoirs for multiple objectives of operation including water quality control.
[redacted] Industry Mine Site Rehabilitation, Environment Manager, Xstrata Copper NQ Operations	[redacted]@xstratacopper.com.au	[redacted] has 18 years experience in the mining industry, split in the areas of Mineral Resource- and Environmental Management. Pieter has worked in the South African and Australian mining industries, with some project experience in Ghana. My relevant expertise is in the mine rehabilitation and closure arena, remediation of legacy contaminated sites, landform design and erosion modelling. [redacted] has been involved in projects related to Asbestos, Coal, Copper, Diamonds, Gold, Lime and Zinc/Lead minerals and operations.
[redacted] Operations Manager, Wet Tropics, DERM	[redacted]@derm.qld.gov.au	

[redacted] Threatened Species Officer, DERM	[redacted]@derm.qld.gov.au	I am a herpetologist with 20 years experience in Wildlife management and conservation biology in university and government agencies. In particular I have expertise in the conservation management of freshwater turtles, snakes and lizards. Other areas of interest include bird ecology and frog conservation.
[redacted] Principal Scientist, DERM	[redacted]@derm.qld.gov.au	I have worked closely with DME [redacted] managing water quality related issues at the Mt Morgan mine and have performed assessments and provided advice relating to Mt Cutherbert (Matrix Metals), Mt Leyshon, Mt Gordon (Birla), Ben Lomond Uranium Mine, McFarlane Box Cut Pit (QERL), Cannington (BHP), Ernest Henry Mine, Roseby Copper, Lady Annie and the Tinaroo Tin Mine including dozens of Fitroy Basin coal mines.
[redacted] Manager, Mining & Industry, North Region, DERM	[redacted]@derm.qld.gov.au	
Rob Lawrence, Director, DERM	rob.lawrence@derm.qld.gov.au	
[redacted] Principal Environmental Officer, Mining and Heavy Industry, DERM	[redacted]@derm.qld.gov.au	I hold post graduate qualifications in Geology and Environmental Science and have worked in the environmental sector for the last 15 years, mainly in the areas of waste management and mining. Over the last 5 years I have led the mining team in Cairns, which regulates the environmental performance of the mining industry across North Queensland. I have dealt with a wide range of AMD issues at a variety of mine sites and have extensive experience in dealing with the environmental challenges that these sites present for both stakeholders and regulators alike.
[redacted] Chief Scientific Advisor, DERM	[redacted]@derm.qld.gov.au	


Stockpile HDPE Cover Requirements
Site Layout
NE Stockpile
~13,910m2
NE 400mm HDPE pipe
160m length
LG Stockpile
~21,560m2
Heap Leach Stockpile
~12,210m2
Oxide Stockpile
~5,830m2
Drain
~2,750m2