Vista Gold Australia Pty Ltd

Receiving Environment Monitoring Program Design 2017

March 2017

Table of contents

Table index

Figure index

Appendices

This report: has been prepared by GHD for Vista Gold Australia Pty Ltd and may only be used and relied on by Vista Gold Australia Pty Ltd for the purpose agreed between GHD and Vista Gold Australia Pty Ltd as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Vista Gold Australia Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (section 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Vista Gold Australia Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1. Introduction

1.1 Background

The Mt Todd Gold Mine site is located approximately 55 km north-west of Katherine and 250 km south of Darwin in the Northern Territory (NT). The Mt Todd Gold Mine site is a brownfield site that was previously mined for gold in the 1990's until the year 2000. Mining infrastructure such as tailing dams, waste rock dumps and the remanent processing facilities remain on site.

The current manager of the site is Vista Gold Australia Pty Ltd, a wholly owned subsidiary of Vista Gold Corporation. Vista Gold purchased the rights to the Mt Todd property on 1 March 2006. Under the terms of an agreement between Vista Gold and the NT Government (Agreement D92226).

Mt Todd mine is currently discharging treated waste water from RP3 to the Edith River according to WDL 178-05 requirements.

1.2 Scope of Works

Condition 38 of WDL 178-05 dictates that Vista Gold prepare a Receiving Environment Monitoring Plan (REMP) that is capable of measuring and reporting on the level of impact (if any) of wastewater discharges on the Beneficial Uses that have been declared for the Edith River.

As the focus of the REMP is on waterways downstream of discharge locations on Mt Todd Mine, this document does not discuss WDL monitoring requirements in relation to water storages, release points or groundwater. However, it is noted that the water quality results collected by Vista Gold as described in the Water Management Plan and for WDL requirements are an integral part of the interpretation of the biological monitoring and sediment monitoring results.

1.3 Objectives

This document has been developed to meet the following objectives:

Condition 38 of WDL 178-05 is to monitor, identify and describe any adverse impacts to surface water environment values, quality and flows due to the authorised mining activities.

Condition 39. The Licensee must ensure that the REMP is:

39.1 Reviewed by a suitably qualified professional who must produce a certified written report about their review with recommendations, where appropriate; and

39.2 Submitted to the administering agency by 31 March 2017 with a copy of the qualified professional's certified review.

1.4 Relevant documents

This REMP design has been developed with reference the following documents:

- Mt Todd Mine WDL 178-05
- 2016 Mt Todd Macroinvertebrate and Sediment Report (GHD 2016)
- Receiving Environment Monitoring Program guideline (EHP 2014);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1 (ANZECC & ARMCANZ 2000);
- Handbook for Sediment Quality Assessment (Simpson and Batley 2016); and

- NT Darwin Daly AUSRIVAS Sampling and Processing Manual (Lamche 2007).

1.5 Assumptions

This report cites WDL conditions for Mt Todd Mine, which may be subject to change. GHD is not responsible for updating this report based on any changes that occur subsequent to the submission of this report. This also applies with respect to any new guidelines that may come into effect at a later date.

2. Study Area

The Mt Todd Mine site lies within the Pine Creek bioregion. The Pine Creek bioregion comprises foothill environments below and to the west of the western Arnhem Land sandstone massif. Its main defining feature is the highly mineraliferous Pine Creek Geosyncline, comprising Archaean granite and gneiss overlain by Palaeoprotozoic sediments.

Land types of the Pine Creek bioregion are mainly hilly to rugged ridges with undulating plains. Vegetation communities include eucalypt woodlands, patches of monsoon forests, Melaleuca woodlands, riparian vegetation and tussock grasslands. The major vegetation types are eucalypt tall open forests typically dominated by Darwin Woollybutt (*Eucalyptus miniata*) and Darwin Stringybark (*E. tetradonta*), and woodlands (dominated by a range of Eucalyptus species); with smaller areas of monsoon rainforest.

2.1 Climate and flow conditions

The climate in the Katherine Region is characterised by hot, humid wet seasons lasting from November to March followed by a hot dry season from April to October. Transition periods occur between the wet and dry seasons.

The Katherine region has an average rainfall of approximately 1,100 mm, which is highly seasonal. Water courses in the study area are ephemeral and cease to flow during the late dry season, but have regular flows during the wet season. Some of the larger major watercourses remain inundated into the early dry season and seasonal and semi-permanent waterholes exist in the area. Remaining waterholes are likely to be ecologically important and serve as a refuge for fish and aquatic reptiles during the dry season.

Waterways found within the spatial boundaries of this study can be characterised as ephemeral in nature, with many of them and their tributaries drying up with intermittent refuge pools during the dry season. The two main creeks are Stow Creek and Batman Creek, which lead into the Edith River.

2.1.1 Edith River Catchment

The study area is located on the Edith River, which is part of the Daly River catchment. The Daly River is one of the Northern Territory's largest rivers with a catchment area of 52,577 square kilometres, and is one of the few catchments in the Northern Territory that flows perennially. The Edith River is an important tributary of the Daly River, with a catchment of 1,057 square kilometres. The Edith River flows to the Fergusson River before joining the Daly River downstream. The greater region that the Edith River is located in is classified under the Australian River Assessment System (AUSRIVAS) as the Darwin-Daly Region.

The Edith River rises at an elevation of 257 m and ends at an elevation of 81.8 m where it merges with the Fergusson River, dropping around 175 m over its 69.1 km length. The Edith River is the largest waterway in the immediate vicinity of the mine and has been the recipient of mine overflow waters via Stow Creek and West Creek. In the past, it has received licensed discharge from Mt Todd mine's RP1 waste rock retention pond. Currently, the Edith River receives treated mine water from RP3 through Batman Creek and Stow Creek. The Edith River has been intensively sampled because it is the end receiving environment of the Mt Todd Mine Site catchment.

LEGEND

Sampling Locations

1:23,000 @ A3

0 0.25 0.5 0.75 1

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

N

Vista Gold Australia Pty Ltd
Mt Todd Gold Project

Project Site & Sampling Locations

Job Number 43-22187
Revision 1
Date 31 May 2016

Figure 2-1

G:\43\22187\GIS\Maps\Working\4322187_Project_Site_RevA.mxd

66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com.au

Data source: Tetra Tech - Existing Mine Layout (2011). Vista Gold - Imagery (2011). GHD - Access Roads (2011). Created by: CM

3. Monitoring Methodology

3.1 Introduction

As water quality monitoring is conducted under the Mine Management Plan and the WDL requirements, it has not been included as part of this Methodology. However, the water quality data is used to assist in interpreting the results of the REMP. To assess the long-term impacts on the receiving ecosystem in the Edith River, a macroinvertebrate monitoring program and a sediment monitoring program have been selected. Both these programs have been developed following current Australian guidelines and standard methods. Sediments have been collected for approximately five years and the 2017 sampling will provide sufficient results that a trend analysis can be conducted to assess trends in deposition of metals downstream of the mine site.

3.2 Site selection

The primary aim of the study is to detect impacts on the aquatic environment in the Edith River from mine water released from discharge point RP3, in accordance with the discharge licence. Sites for sediment and macroinvertebrate sampling have been chosen to provide an assessment of the state of the aquatic environment in the footprint of the mineral leases and adjacent waterways. The study design has been simplified from previous years, as the use of the Ferguson River as a reference system in previous studies was found to be unsuitable as discussed in GHD (2015); this was confirmed by the NT EPA and the DME in 2015. Consequently, the current study focusses on the comparison of the aquatic environments between the sites upstream and downstream of discharge locations.

As a secondary objective of the study design, sites will be assessed on Stow Creek which receives the treated mine water through Horseshoe Creek. Sites have been located upstream and downstream of the confluence of Horseshoe Creek (SCTOP) and Stow Creek (SCDS) to provide an indication of any potential impacts that the discharge may be having on the receiving environment.

Consistency of sampling locations is important to enable the creation of a long-term data set with which to assess any temporal changes that might indicate adverse impacts on the receiving environment. A comprehensive historic data set is also important towards establishing background water levels and natural variation in the receiving environment. Table 3-1 outlines the sites that will meet the objectives of the REMP, and be in line with the current licence conditions set out in WDL 178-05.

Table 3-1 REMP locations for Mt Todd Mine.

Site	GPS Coordinate UTM (GDA 94 Zone 53L)		Altitude (m)	Location	Treatment
	Easting	Northing			
Edith River					
ERTOP	191545	8431259	121.0	Edith River farthest upstream site	Control
ERUS	188476	8431460	117.2	Edith River upstream of Stow Creek confluence.	Control
ERDS	187685	8431369	116.7	Edith River downstream of Stow Creek confluence.	Potentially Impacted
ERSW4	186750	8431478	114.0	Edith River downstream of site ERSW4	Potentially Impacted

Site	GPS Coordinate UTM (GDA 94 Zone 53L)		Altitude (m)	Location	Treatment
	Easting	Northing			
ERBTM	180080	8430235	101.1	Edith River farthest downstream site	Potentially Impacted
Stow Creek					
SCTOP	53019005	8433207	-	Stow Creek upstream site	Control
SCDS	53018895	8432524	-	Stow Creek downstream site	Potentially Impacted
SCBTM	53018836	8431616	-	Stow Creek farthest downstream site	Potentially Impacted

3.3 Survey Timing

Sampling of macroinvertebrates under stable conditions allows for a robust characterisation of the macroinvertebrate community of the receiving waters and is consistent with the methodology stated in the NT Darwin Daly AUSRIVAS Sampling and Processing Manual (Lamche 2007). For consistency between years and to meet the guidelines set out by Lamche (2007), REMP sampling will take place during the early dry season period, when the Edith River and Stow Creek have stabilised in flow.

3.4 Physical Habitat Assessment

Descriptions of habitat conditions are to be recorded at each site following the criteria listed in the Northern Territory AUSRIVAS “Darwin-Daly Region Model” field sheets (Lamche, 2007). Habitat assessments will be undertaken in consideration of the whole reach sampled (100 m longitudinal section of the river) and include:

- Site description
- Water quality
- Characteristics of macroinvertebrate habitat
- Instream physical characteristics (flow velocity and depth, instream habitat characteristics, bank height, riparian width)
- Riparian vegetation characteristics (types, %cover, exotic species, erosion, land use)
- Water quality observations (clarity, odour, oils, foam/scum, plumes etc.)
- Sketches of the site, including a cross-section of the reach

The information recorded is used to help interpret biological data and to provide input data for the Northern Territory AUSRIVAS model. Data recorded is also used in conjunction with the biological community information as the basis of the overall health assessment.

Photos are to be taken of upstream and downstream portions of the reach sampled, as well as bank habitat and other key habitat features. This will further characterise the habitat conditions at each site, serving as a pictorial record of site conditions that can be tracked over time using photos taken from the same photo points.

3.5 Water and Sediment Quality

3.5.1 Collection

The physico-chemical parameters of the water at each site is to be measured *in-situ* using a calibrated multi-parameter water quality meter. *In situ* parameters to be recorded on the AUSRIVAS proforma are:

- pH
- Electrical conductivity (EC) (µS/cm)
- Water temperature (°C)
- Dissolved oxygen (DO) concentrations (mg/L and % saturation)
- Turbidity

As per the WDL, field environmental data and sample collection must be undertaken in accordance with recognised Australian Standards and guidelines. Hence sediment sampling will be undertaken at each site in accordance with methods described by Simpson and Batley (2016).

Under WDL 178-05 Condition 42 the following information for each sample collected is retained:

- The date on which the sample was collected
- The time at which the sample was collected
- The location at which the sample was collected
- The name of the person who collected the sample
- The chain of custody forms relating to the same
- The field measurements (if any) and analytical results (if any) relating to the sample
- Laboratory quality assurance and quality control documentation

3.5.2 Analysis

Sediment samples will be analysed at a laboratory with current NATA accreditation for the parameters to be measured.

Water quality grab samples are to be collected at the same time as macroinvertebrate samples during the annual monitoring event. The details of analysis and methods are discussed further in the Water Management Plan (Vista Gold 2016).

3.5.3 Assessment of impacts

The determination of compliance with WDL specifications for water quality is outlined in condition 20 of WDL 178-05, and is to be covered in the WDL Report.

The results of sediment and water quality testing are to be included in REMP reporting to assist in the interpretation of biological monitoring results.

3.6 Biological monitoring

The following methodology relate to macroinvertebrate samples collected using AUSRIVAS protocols. Macroinvertebrate monitoring has been previously selected as the bioindicator for biological monitoring in relation to the Mt Todd Mine, and for consistency, it will be used in future REMPs to assess the impacts of the treated mine water discharge on the receiving ecosystem in the Edith River.

The macroinvertebrate monitoring techniques are based on AUSRIVAS Manual for the Darwin-Daly Region protocols (Lamche 2007). The following elements are discussed in the sampling manual document and will be considered in relation to biological monitoring:

- Habitat sampled
- Collection procedure and equipment
- Sample replication
- Field processing method (e.g. live-pick or bulk)
- Lab processing method (e.g. sub-sorting)
- Level of identification
- Quality assurance

3.6.1 Sample Collection

Macroinvertebrate sample collection and analysis will follow procedures outlined in the AUSRIVAS Manual for the Darwin-Daly Region (Lamche, 2007). Three replicate samples are to be collected at each site to increase the statistical power of any analyses required. All samples will be collected by trained environmental scientists.

Sampling will involve one field team member scraping submerged root matter associated with the lower bank to agitate and remove macroinvertebrates into the water column, while the other field team member sweeps a dip net through the water column downstream of the edge habitat, to collect the dislodged animals. Areas of riffle or fast flowing habitat, Pandanus roots and severe bank undercuts are to be avoided when collecting edge habitat samples.

Once collected, the samples are washed through 10 mm and 250 µm mesh sieves. The course mesh sieve is examined for large, conspicuous taxa, and these placed in a labelled sample container. The sample collected in the fine mesh sieve is also placed in the labelled sample container and filled with 70% ethanol. All samples are to be sent to a macroinvertebrate laboratory for further processing and identification.

3.6.2 Laboratory processing

Each sample receiver by the nominated macroinvertebrate laboratory will follow standard procedures for processing as set out by Lamche (2007).

Samples are to be washed through a series of sieves (10 mm, 500 µm and 250 µm mesh sizes). Any large, conspicuous taxa identified in the 10 mm mesh sieve are separated to be identified separately. The contents of the 500 µm mesh sieve are retained for macroinvertebrate identification and enumeration, while the 250 µm fraction is retained as sample residue for quality assurance purposes. The contents of the 500 µm mesh fraction is poured into a Marchant sub-sampler (Marchant, 1989) and extractions made randomly from cells (aliquots) in this apparatus. These extractions are placed under a microscope and the taxa identified and counted.

This process continues until either all aliquots are examined, or a total of 200 individuals have been counted and identified (excluding those from the 10 mm fraction). The number of aliquots required to be processed to obtain a minimum 200 individual sub-sample is recorded in order to calculate abundance.

Taxa are identified to family level where possible, with the exception of key taxa identified in Lamche (2007) as either requiring identification to sub-family level (e.g. Chironomidae) or only to order level (e.g. Acarina). All taxa are identified using the keys specified in Hawking (2000).

Following identification, taxa counts are to be recorded in a database and samples preserved and archived.

Quality assurance is to be maintained by ensuring that identifiers are adequately trained and qualified. As specified in AUSRIVAS (Lamche 2007), 5% of samples identified in the laboratory are verified by a secondary check undertaken by a senior taxonomist.

3.6.3 Data analysis

The macroinvertebrate data collected will be analysed using univariate and multivariate statistical techniques. Univariate metrics provide an indication of waterway 'health', whilst multivariate analysis focusses on variability in community composition between sites.

Univariate techniques

Univariate measures (biotic indices) are used to assess the 'health' status of the macroinvertebrate community at each site. For each analysis, replicate samples are combined to provide an overall site community. The macroinvertebrate community biotic indices used for this study will include:

- Abundance
- Taxonomic Richness
- PET Richness
- SIGNAL-2
- Northern Territory AUSRIVAS Observed over Expected (O/E) scores and bandings

Abundance is the count of macroinvertebrates per sample, this is an applicable index in this study as sampling methods were quantitative. To derive whole of sample abundance counts, the percentage of the total sample counted is used with the count in the subsample to calculate the number of macroinvertebrates in the entire sample. This index can be useful in detecting impacts on pollution-affected sites if counts are significantly different between control and impact sites. It can also indicate declines in habitat availability and therefore will be interpreted with a degree of caution, in conjunction with other indices.

Taxonomic Richness refers to the number of different taxa contained in a sample. In theory, the higher the taxa richness value, the healthier a community is, but there are some instances where anthropogenic activities promote taxa richness through increased supply of nutrients or habitat (e.g. riffles through additional flows). Therefore, taxa richness data needs to be interpreted on a case by case basis.

EPT Richness refers to the proportional representation of key macroinvertebrate taxa belonging to the sensitive macroinvertebrate orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). High EPT richness is indicative of a healthy macroinvertebrate community, though it must be noted that some EPT taxa have more tolerance to pollution than others, so generally EPT richness data is interpreted together with other data such as community composition and SIGNAL score information (discussed further below). It should be noted that in the Northern Territory there are no known Plecoptera species, so in this study, the number of EPT taxa is limited to the number of ephemeropteran and trichopteran families.

SIGNAL 2 Scores (Stream Invertebrate Grade Number – Average Level) are based on the sensitivity of each macroinvertebrate family to environmental conditions, including forms of water pollution (Chessman 2003). Macroinvertebrate families are assigned a pollution sensitivity grade between 1 (most tolerant) and 10 (most sensitive). Families in a sample that have not been assigned a grade are excluded from the analysis. This assessment allows an additional

line of evidence for assessing the potential impacts of water quality. Lamche (2007) cautions against the use of the SIGNAL 2 index for assessing the status of Northern Territory macroinvertebrate communities, however, GHD still view the assessment of pollution-sensitive versus pollution-tolerant species as a useful indicator to provide some insight as to the level of stress the macroinvertebrate community is currently subjected to from the environment.

Northern Territory AUSRIVAS O/E 50 is a predictive system that uses macroinvertebrates to assess the biological health of rivers in the Darwin-Daly Region (Lamche, 2007). AUSRIVAS uses site-specific predictions of the macroinvertebrate fauna expected to be present in the absence of environmental stress. The expected (E) fauna from reference sites with similar sets of predictor variables (natural physical and chemical characteristics) are compared to the observed (O) fauna and the ratio derived is used to indicate the extent of any impact. The ratio can range from zero, when none of the expected taxa are found at a site, to one, when all the expected taxa are found. Values greater than one are achieved when more families are found at the site than predicted by the model. The scores derived from the model can be placed in bands delineated by the Monitoring River Health Initiative (Table 3-2), which allows assessment of the level of environmental health at a site.

For this study, macroinvertebrate data will be assessed using the NT AUSRIVAS Darwin-Daly Early (dry season) Family level Edge habitat model.

Table 3-2 AUSRIVAS bands for the Darwin-Daly Model

Band Label	Upper Limit	Band Name	Band Description
Band X	O/E greater than 90th percentile of reference sites used to create the model.	More biologically diverse than reference sites	More families found than expected. Potential biodiversity "hot-spot" or mild organic enrichment. Continuous irrigation flow in a normally intermittent stream.
Band A	O/E within range of central 80% of reference sites used to create the model.	Reference condition	Expected number of families within the range found at 80% of the reference sites.
Band B	O/E below 10th percentile of reference sites used to create the model. Same width as band A.	Significantly impaired	Potential impact either on water and/or habitat quality resulting in a loss of families.
Band C	O/E below band B. Same width as band A.	Severely impaired	Many fewer families than expected. Loss of families from substantial impairment of expected biota caused by water and/or habitat quality.
Band D	O/E below band C down to zero.	Extremely impaired	Few of the expected families and only the hardy, pollution tolerant families remain. Severe impairment.

An analysis of similarity (ANOSIM) should be undertaken to identify any statistically significant differences between sites upstream and downstream of mine inputs for the abundance, taxonomic richness, EPT richness, and SIGNAL 2 indices. Statistical significant will

be set at a P-value of <0.05, therefore the null hypothesis of no difference between upstream and downstream sites is accepted for any P-value >0.05.

Multivariate techniques

Multivariate data analysis is used to assess variation in community composition between samples. Site based replicate samples are kept separate for this analysis.

The multivariate analysis methods used to assess macroinvertebrate data will include:

- Non-metric Multi-Dimensional Scaling (NMDS) Ordination
- Analysis of Similarity (ANOSIM)
- Similarity Percentage (SIMPER) Analysis

NMDS Ordination provides a representation of the relative similarity of entities (i.e. site samples) based on their attributes (i.e. macroinvertebrate community composition) within a reduced dimensional space. The more similar sites are to each other, the closer they are located in the NMDS ordination space. The initial step in this process is to square root transform the data to reduce the biasing influence of highly abundant taxa on results.

Following data transformation**,** a similarity matrix for all pairs of samples based on the Bray-Curtis similarity coefficient is calculated. The number of dimensions (axes) used in the NMDS procedure is based on the resultant Stress levels. The stress level is a measure of the distortion produced by compressing multi-dimensional data into a reduced set of dimensions and would increase as the number of axes (i.e. dimensions) is reduced. Stress levels above 0.20 indicate a poor representation of inter-sample similarity and, as such, the NMDS results with stress values of this order require interpretation with caution.

The NMDS is used to display the similarity between treatments ('potentially impacted' and ‘control' site groups). This is done in order to establish whether or not there is any evidence of treated mine water discharge impacts on macroinvertebrate community composition.

In order to assess whether between-treatment differences in macroinvertebrate community composition observed are significant, a one-way ANOSIM will also be undertaken.

3.6.4 Assessment of impacts

Assessment of impacts from mine affected water release will consider the following:

- Qualitative assessment of community composition and sensitivity metrics
- Comparison of macroinvertebrate metrics and community composition between sites upstream and downstream of the release points
- Comparison of community composition and sensitivity metrics to historic data collected prior to commencement of releases
- Comparison of macroinvertebrate metrics to water quality and sediment quality collected at the time of sampling

The use of statistical analysis techniques such as Analysis of Variance (ANOVA) will be considered when determining impacts to macroinvertebrate metrics between sites upstream or downstream of release points as part of a hypothesis testing framework. Multivariate techniques such as ordination and cluster analysis may assist in identifying complex patterns in biological data between sites, while community composition can be compared statistically between sites using techniques such as Analysis of Similarities (ANOSIM) or PERMANOVA. The use of these statistical methods will only be employed where sufficient and appropriate data are available. All statistical methodology used will be explained and justified.

4. Reporting

Condition 51 in WDL 187-05 requires Vista Gold Australia Pty Ltd to provide to the administering agency an Annual Monitoring Report. The REMP report will be a component of the Annual Return. The REMP report must include as a minimum:

- Clearly stated objectives of the study and predicted outcomes
- The date, time and location of sample collection
- A clear description of sampling and analysis methods, detailing quality assurance and controls
- Flow and hydrological information and environmental conditions in the interpretation of water quality and biological data
- Results of all monitoring conducted and samples analysed including the use of visual aids such as graphs and tables
- Application of guidelines from ANZECC & ARMCANZ (2000) and other relevant guideline documents, including comparisons to long-term water quality objectives and SSTVs
- A comparison of macroinvertebrate based metrics and community composition between sites upstream and downstream of release points and at the mining lease boundary
- Evaluation of the current study design and its ability to meet the objectives of the monitoring program
- Recommendations of improvements (if any) to be made for future monitoring

5. Review

To meet the requirements of Condition 39 of WDL 178-05, this document has been reviewed by Professor Jenny Davis. Professor Davis' contact detail are listed below. The signed report on the review is located in Appendix A.

Professor Jenny Davis
Head, School of Environment

ENGINEERING HEALTH SCIENCE & ENVIRONMENT
T: +61 8 8946 6094
M: 0404 448 042
E: jenny.davis@cdu.edu.au
W: cdu.edu.au

CHARLES DARWIN UNIVERSITY
Darwin, Northern Territory 0909 Australia

6. References

ANZECC and ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australia and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

ANZECC (2016). Sediment Quality Assessment. Simpson and Batley. CSIRO

Bureau of Meteorology (2011). Climate Statistics for Australia Locations, Wildman NT 97-203. Retrieved 12 May 2015 from: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2015&p_c=-40782775&p_stn_num=014275

Chessman (2003). SIGNAL 2 - A scoring system for macroinvertebrates ('water bugs') in Australian rivers: User manual, September 2003. National River Health Initiative Technical Report Number 3.

EHP (2014) Receiving Environment Monitoring Program guideline - For use with Environmentally Relevant Activities under the *Environmental Protection Act (1994)*. Brisbane: Department of Environment and Heritage Protection, Queensland Government.

Envirotech (2014). 2013-14 Mt Todd Mine Wet Season Macroinvertebrate and Sediment Report.

GHD (2015). Vista Gold WDL 178-4, 2014-2015 Aquatic Monitoring. GHD, July 2015.

Hawking, J.H. (2000). Key to Keys. A guide to keys and zoological information to identify invertebrates from Australian inland waters.

Lamche, G. (2007). The Darwin-Daly Regional AUSRIVAS Models –Northern Territory: User Manual. Aquatic Health Unit –Department of Natural Resources, Environment and the Arts. Report 06/2007D.

Marchant, R (1989). A sub-sampler for samples of benthic invertebrates. Bull. *Australian Society of Limnology*. Vol 2. 49-52.

Northern Territory Government (2017), Waste Discharge License WDL 178-05, Vista Gold Australia.

Simpson, S., Batley, G.E., (2016). Sediment Quality Assessment, a practical guide. Second Edition. CSIRO Publishing. Clayton South, Australia.

Appendix A – Letter of Review

CHARLES DARWIN UNIVERSITY
Ellengowan Drive, Darwin, Northern Territory 0909
CRICOS Provider No. 00300K (NT) | 03286A (NSW) | RTO Provider No. 0373
ABN 54 093 513 649
cdu.edu.au

Dr Jill Woodworth
Service Group Manager – Environment and Water
Principal Environmental Scientist – Ecotoxicology
GHD

Dear Jill,

RE: Vista Gold Australia Pty Ltd - Receiving Environment Monitoring Program Design 2017

I have reviewed the Receiving Environment Monitoring Program Design 2017 in association with the report of the Mt Todd Aquatic Monitoring Program undertaken by GHD on behalf of Vista Gold, as required under WDL 178-4; and the Waste Discharge License 178-05.

The scope of work is described as follows:

Condition 38 of WDL 178-05 dictates that Vista Gold prepare a Receiving Environment Monitoring Plan (REMP) that is capable of measuring and reporting on the level of impact (if any) of wastewater discharges on the Beneficial Uses that have been declared for the Edith River. The Plan does not discuss WDL monitoring requirements in relation to water storages, release points or groundwater. The water quality results collected by Vista Gold as described in the Water Management Plan and for WDL requirements are an integral part of the interpretation of the biological monitoring and sediment monitoring results.

The 2017 plan includes physical habitat assessment, water and sediment quality analyses, and biological monitoring. The monitoring methodology, as described in Section 3, is based on the application of nationally recognised scientific methods, analyses and interpretation. The macroinvertebrate sampling methods and protocols, including reporting of abundance, taxonomic richness, PET richness, SIGNAL 2 scores, the AUSRIVAS Darwin-Daly predictive model scores and bands, and multivariate analyses (NMDS and ANOSIM) are nationally recognised approaches that provide diverse lines of evidence regarding biological impacts.

The application of these methods and approaches is demonstrated in the Mt

CHARLES DARWIN UNIVERSITY
Ellengowan Drive, Darwin, Northern Territory 0909
CRICOS Provider No. 00300K (NT) | 03286A (NSW) | RTO Provider No. 0373
ABN 54 093 513 649
cdu.edu.au

Todd Aquatic Monitoring Program Report 2015-2016. The report describes the assessment of aquatic health in the Edith River to determine if treated mine water discharged through the discharge point RP3 has an adverse impact on the downstream receiving environment. The assessment included sampling of water and sediment quality, and macroinvertebrate community composition. Stow Creek, which flows through the Mt Todd mine site into the Edith River, was also assessed for aquatic health to provide Vista Gold with a further understanding of any potential impacts of mine run-off in other areas on the Mt Todd site.

The findings of the 2016 report include the following:

- the results from the 2016 monitoring round are consistent with the previous year's monitoring event, showing no discernible impact from treated mine water discharged from RP3 on the Edith River aquatic ecosystem;
- water quality in the Edith River is relatively benign in terms of toxicity potential; iron is the only parameter elevated above the site-specific trigger value;
- sediment quality along the Edith River showed no elevation of parameters above ANZECC guideline levels;
- macroinvertebrate results were similar to the previous year's monitoring event, with samples from the Edith River showing no significant community change as a result of the RP3 discharge;

These results are comprehensive and indicate that the approaches described in the Receiving Environment Monitoring Program Design 2017 are scientifically-based, informative and appropriate.

Sincerely,

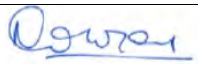
Professor Jenny Davis
Head of School
March 29, 2017

GHD

Level 7, 24 Mitchell Street Darwin NT 0800
GPO Box 351 Darwin NT 0800
T: (08) 8982 0100 F: (08) 8981 1075 E: drwmail@ghd.com.au

G:\43\22187\WP\REMP\Final REMP Mt Todd.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	T. Steele	J Woodworth		N. Conroy		20/03/2017
0	T. Steele	J.Woodworth		N. Conroy		30/03/2017

www.ghd.com