Vista Gold Australia

Discharge Plan

Revision 5

October 2016

Executive Summary

This Discharge Plan has been developed for Vista Gold Australia Pty Ltd (Vista Gold) to address the requirements of Waste Discharge Licence (WDL) 178- (as amended). This Discharge Plan describes the investigations that have been, and are proposed to be conducted, in a weight of evidence approach (using multiple lines of evidence) to derive dilution factors for mine waste water discharge from site. The dilution factors have been calculated for ecosystem protection in the Edith River at the 80% species protection level near the point of discharge (SW4) and were derived from ecotoxicity testing using appropriate species following ANZECC (2000) guidelines. Investigations used to derive the dilution factors and to provide additional information on the health of the Edith River downstream from the discharge point include:

- Investigations into the toxicity of Retention Pond (RP) 7 mine water (*completed 2012*)
- Investigations into the toxicity of treated RP3 mine water (pilot trial and in-situ samples) (*completed 2012 - 2014*)
- Investigations into the toxicity of RP1 mine water (*completed 2012*)
- Investigations into the toxicity of surface water at SW4 (*ongoing*)
- Investigations into the toxicity of Newmarket Gold Mining Operations mine water (*completed*)
- Risk assessment for the discharge of treated RP3 mine water at SW4 (*completed 2014*)
- Macroinvertebrate and sediment studies to assess downstream impacts from the mine discharge (*ongoing*)
- Investigations into the speciation of metals due to water chemistry at the site (*completed 2014*)

This Discharge Plan provides results to date for the ongoing investigations listed above to address the requirements of the WDL.

This Discharge Plan provides information that will be used by Vista Gold for guidance on ecosystem protection within the Edith River including:

- An 80 % species protection dilution factor obtained from 21 suites of site specific bioassays using DTA methodology that can be applied to discharges of treated RP3, and, in emergency conditions and with approval from the Controller of Water Resources, untreated RP1.

Commitment 1

Vista Gold has committed to improve the quality of treated waste water leaving the site to meet the ANZECC (2000) 95% species protection trigger values at SW4 once mining operations commence

Commitment 2

Conduct screening cladoceran bioassays on SW13, SW2 and SW4 during discharge in 2017

Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
ARD	Acid rock drainage
DOC	Dissolved organic carbon
DTA	Direct toxicity assessment
ERISS	Environmental Research Institute of the Supervising Scientist
L	Litre
Kg	Kilogram
µg	Microgram
µS/cm	Microsiemens/centimetre
mg	Milligram
NATA	National Association of Testing Authorities
NT EPA	Northern Territory Environment Protection Authority
NT	Northern Territory
%ile	Percentile
mm	Millimetre
OECD	Organisation for Economic Co-operation and Development
RP	Retention pond
SSD	Species sensitivity distribution
SSTV	Site specific trigger value
TAT	Turn-around time
TOC	Total organic carbon
TV	Trigger value
USEPA	United States of America Environmental Protection Authority
WDL	Waste Discharge Licence
WTP	Water treatment plant

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1. Introduction

1.1 Project Background

Vista Gold Australia Pty Ltd (Vista Gold) discharges treated waste water under a Waste Discharge Licence (WDL) which is regulated by the Northern Territory Environment Protection Authority (NT EPA). The WDL outlines requirements for environmental protection of the Edith River from mine wastewater discharges from the Mt Todd mine site.

Additional studies and monitoring have been conducted at the Mt Todd site in relation to the RP3 discharge and the results of these studies have been used to update this Discharge Plan

This Discharge Plan has been developed to be used in conjunction with the relevant sections of the WDL in order to manage and minimise environmental impacts of the Mt Todd discharge.

Management of and responsibility for the various aspects of MT Todd is currently subject to an agreement between Vista Gold and the NT Department of Mines and Energy (DME). The agreement identifies Vista Gold as the onsite operator, responsible for maintaining the site assets of the Northern Territory Government, including daily management of the site and ensuring there is no further degradation of the environmental legacy issues at the site. The NT Government is responsible for the legacy environmental liability, which includes the onsite acid rock drainage (ARD) water inventory, until production at the site is resumed.

In 2014 and subsequent years, onsite wet season management of ARD waters will be undertaken by Vista Gold and funded by both organisations.

1.2 Water Treatment Objectives

The treatment and discharge of RP3 water will allow the DME and Vista Gold to meet their objectives at the Mt Todd site. These objectives are:

- Reduce the risk of significant environmental harm by using historical data to predict the impact of activities
- To reduce the on-site water inventory
- To reduce the risk of an uncontrolled discharge from RP1 and RP3
- To meet the WDL 80% species protection SSTVs at SW4 during dewatering

To meet the water inventory objectives, treated water from RP3 is proposed to be discharged to Batman Creek after which it will enter the Edith River via Stow Creek. The chemistry of the RP3 water, the flow in the Edith River and the capacity of the pumps will determine the amount of water able to be discharged to meet the site specific trigger values (SSTVs) based on ANZECC (2000[1]) 80 percent species protection trigger values at SW4 (WDL 178).

Commitment 1

Vista Gold has committed to improve the quality of treated waste water leaving the site to meet the ANZECC (2000) 95% species protection trigger values at SW4 once mining operations commence

[1] ANZECC (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.

1.2.1 Proposed Discharge Management

Vista Gold discharge only from RP3, if possible, with RP1 and RP7 water pumped to RP3 during the wet season if required as stated in the WDL. However, controlled discharge for the following scenarios in addition to the routine discharge from RP3 may be required in exceptional circumstances which override normal onsite water management actions.

The controlled release of water in the above scenarios would only be undertaken for the following reasons:

1. When there is a significant risk to the integrity of the retention pond structure, and lowering of the internal water level will contribute to a reduction in the risk of failure
2. When there is a significant risk of an uncontrolled discharge and lowering of the internal water levels will reduce the risk of uncontrolled discharge or minimise the quantity of uncontrolled discharge

If transfer pumping from RP7 and/or RP1 must be carried out, then this should be done early in the year to ensure that the changed water quality in RP3 can be treated to a suitable standard for discharge to meet the SSTVs at SW4.

1.2.2 Toxicity Assessment

Vista Gold has treated the water in RP3 to reduce the metal concentrations in the water to be discharged, and the DME conducted additional treatment on the RP3 water in late 2014 and 2015. In 2016 a much reduced water treatment program will target lowering the zinc concentration. Vista Gold intends to continue managing the environmental impacts from the mine discharge to the Edith River by meeting SSTVs at the downstream site SW4 as permitted in under the WDL.

Vista Gold now has sufficient ecotoxicology and chemistry data to calculate the predicted toxicity of discharge water based on the current water chemistry, and thus to determine the dilution factor required to meet SSTVs downstream at SW4.

Vista Gold will calculate the volumes to be discharged from RP3 using an algorithm for the dilution factor, based on the chemistry at the time of discharge and the previous DTA results from both Vista Gold and Newmarket Gold discharges. The dilution is managed by in-situ telemetry based on Edith River flows, which will determine the volume of treated RP3 water to be released.

During the 2014/15 wet season the abovementioned algorithm was validated with a direct toxicity assessment (DTA) and associated chemical analysis of RP3 treated water. The use of the algorithm was further validated during the 2015/16 wet season when water quality at SW4 met all the SSTVs during discharge. The dilution factor derived from the species sensitivity distribution (SSD) using the DTA results was compared to the results of the algorithm calculated for that water quality and confirmed the algorithm predictions, as discussed in (GHD 2015[2]).

The water quality at SW4 will be compared to the SSTVs and, if the SSTVs are exceeded, the dilution factor will be re-assessed and discharge stopped if necessary as the Investigation Process shown in Figure 3-1 indicates. Additional real-time data for pH and EC, will provide operational data and an early warning system of water quality discharged from RP3 using mid-stream water quality loggers.

[2] Mt Todd Waste Discharge Licence Algorithm Validation Report March 2015

1.3 Scope of Work

This Discharge Plan addresses the following aspects of the WDL:

- Proposed water management strategy for the Mt Todd mine site discharge
- Methodology for the application of the SSTVs following ANZECC (2000) guidelines for ecosystem protection applied at SW4 for mine discharges from RP3 and RP1
- Methodology for the application of an algorithm to calculate the dilution factor required for each RP based on the current water quality and up-to-date DTA data
- Investigation procedures triggered by an exceedance of the dilution factor at SW4
- Biological assessment methodology (i.e. macroinvertebrate population studies) and sediment studies to aid in the assessment of downstream impacts and validation of trigger values

1.4 Limitations

This Vista Gold Australia Discharge Plan 2016 ("Report"):

1. *has been prepared by GHD Australia Pty Ltd ("GHD") for Vista Gold Australia Pty Ltd (Vista Gold) and the NT EPA*
2. *may only be used and relied on by Vista Gold and the NT EPA*
3. *must not be, used by, or relied on by any person other than Vista Gold without the prior written consent of GHD*

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To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report:

- *were limited to those specifically detailed in section 1.3 of this Report*

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report ("Assumptions"), including (but not limited to):

- *Current accepted practices*

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until 6 months, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

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2. Discharge Management Strategy

2.1 Introduction

As discussed in Section 1, Vista Gold will to use this Discharge Plan in conjunction with the Mine Management Plan (MMP) and the WDL to enable the discharge of water from the Mt Todd mine site to meet NT EPA environmental requirements and DME objectives.

The Water Management Plan (Section 6) in the Mount Todd Gold Project MMP discusses all details in relation to onsite surface waters infrastructure and management. This Section of the Discharge Plan discusses the discharge management strategy only.

2.2 Water Pumping and Release Strategy

Vista Gold are intending to release water from RP3 only during wet seasons, however during unforeseen circumstances, discharges from RP1 may be required, either individually or as part of a multisource discharge. However, Vista Gold does not intend to discharge wastewater from RP1 offsite unless abnormal rainfall intensity or duration requires emergency action to prevent uncontrolled discharge as discussed in Section 1.2.

All measures will be implemented to minimise the requirement for an emergency discharge. Direct discharge offsite to the Edith River from RP1 and RP7 will only be permitted with the prior approval of the Controller of Water Resources.

In order to maintain sufficient freeboard, water in RP1 will be pumped to RP7, and if required, water in RP7 will be pumped to RP3.

Table 2-1 outlines the water management for the RPs involved in this Discharge Plan. Additional information on the water management of other RPs at Mt Todd is available in Vista Gold MMP (2013). Figure 2-1 shows the water movement and discharge locations for each RP at the Mt Todd site.

Table 2-1 Water Transfers and Monotoring Procedures (*MMP Vista Gold)*

Water Transfers	Monitoring
RP1	
Maintain freeboard by pumping untreated water to RP7 or treat water via WTP and redirect to RP3 or RP7. October to February – pump if freeboard is less than 2.5 metres. March to April – pump if freeboard is less than 1 metre. Dry season – pump if major rainfall is expected and freeboard is less than 0.5 metres. Discharge to Edith River through siphons when licence conditions can be met, and when no other discharges are occurring to the Edith River. April to November – maximise evaporation opportunities.	RP1 level daily (during wet). Flow to RP3 (cumulative and instantaneous. Daily recording of WTP flow meter and pump operating times). Discharge to Edith River through siphon (cumulative and instantaneous. Daily recording of flow meter and siphon operating times). Pump infrastructure (weekly). Water quality monitoring as per WDL.

Water Transfers	Monitoring
RP3	
Pump to Batman Creek when licence conditions and Edith River dilution rates can be met and authorisation is obtained from the General Manager to commit to the associated expenditure. RP3 can receive excess water from RP1, RP2 and the heap leach moat via the WTP as treated water.	RP3 level (daily during wet). Flow (cumulative and instantaneous. Daily flow meter recording and pump operating times). Pump infrastructure weekly. Water quality monitoring as per WDL.
RP7	
October to March – Pump untreated water to RP3 when water level is at base of spillway. Redirect all pumped inputs to RP3. April to November – maximise evaporation opportunities. Receives water from WTP, RP1, RP2, RP5 and HLP	RP7 level (weekly). Flow to RP3 (cumulative and based on pump operating times) Pump infrastructure (weekly). Water quality monitoring as per WDL

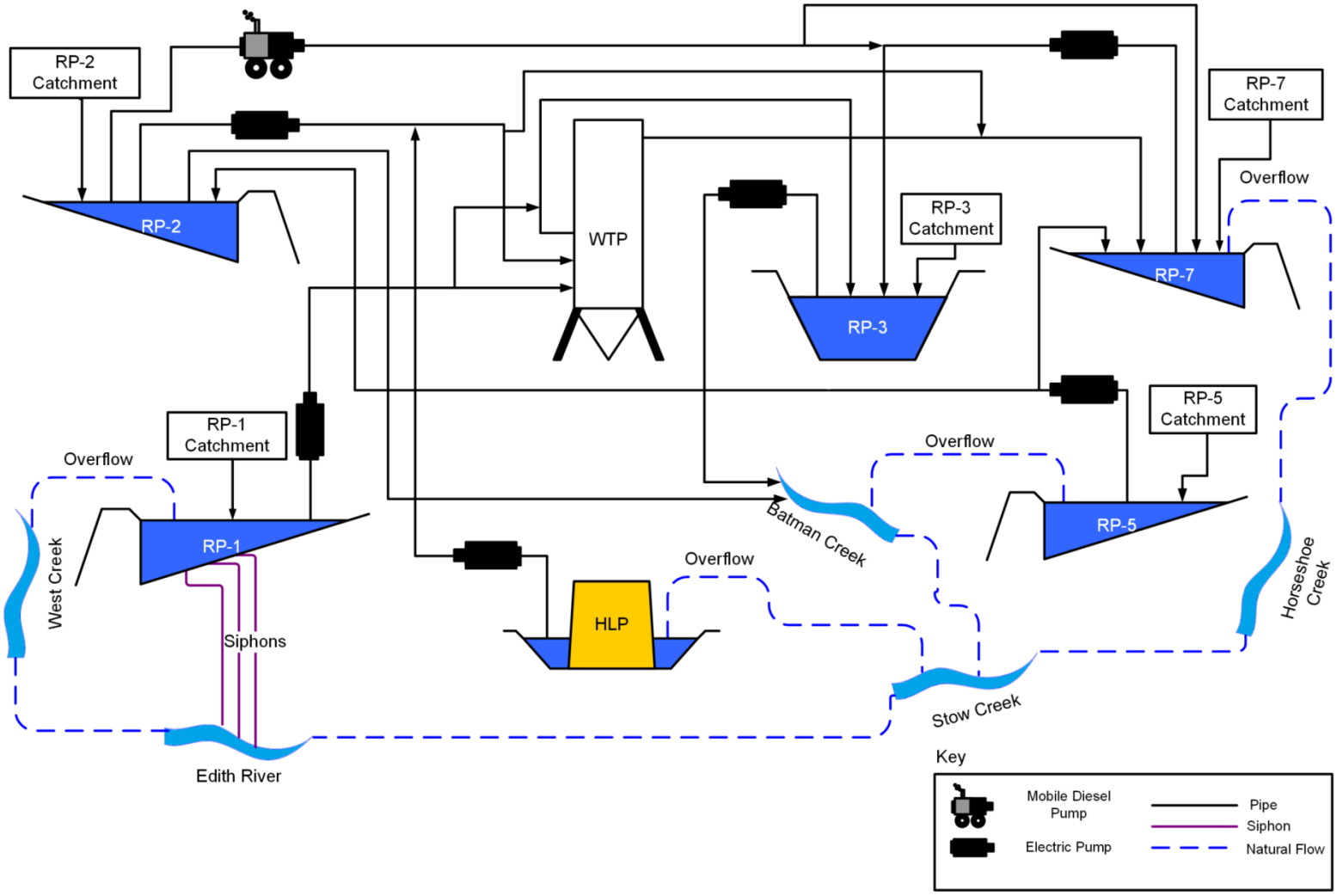

Figure 2-1Mt Todd Mine Water Management Conceptual Site Model

2.3 Monitoring of RP3

Vista Gold has installed an on-line water quality monitoring station that delivers continuous real-time pH, conductivity and temperature of the RP3 discharge water. RP3 water quality is monitored to meet the requirements of the current WDL.

The results of the RP3 water quality will be used by Vista Gold to determine if the water being released from RP3 is changing and therefore may require a change in the discharge ratio. The dilution factor will then be programmed into the telemetry system as described in Section 4. These results will be confirmed upon receipt of the SW4 and RP3 samples analysed.

Samples will be collected and analysed for the parameters following the procedure in Vista Gold's Surface Water Monitoring Standard Operating Procedure and Section 3.4. All quality assurance will be conducted as outlined in the SOP.

2.4 Monitoring of SW4 and SW2

Vista Gold has installed real-time pH, EC and temperature water quality monitoring loggers to monitor the water quality at SW4. In addition to the continuous monitoring, Vista Gold will sample SW4 and SW2 daily and will send the sample to a NATA accredited laboratory. Holding times and sample preservation will ensure that the results obtained are representative of the respective water quality.

3. Site Specific Trigger Values for the Edith River

3.1 Trigger Values

This Discharge Plan (Revision 5) has been designed to enable calculation of the dilution factors from direct toxicity assessments (DTA) previously conducted on RP1, RP3, RP7 and various Newmarket Gold sites. These dilution factors, in combination with ANZECC (2000) 80 percent species protection trigger values are to be used in managing environmental impacts from Mt Todd mine site discharges. This approach using DTA is preferred for environmental management of a complex effluent (ANZECC 2000).

3.2 Site Specific Trigger Values

The SSTVs listed in WDL 178 are based on ANZECC (2000) 80 percent species protection trigger values to be applied at SW4. Those values listed in the WDL are appropriate for all analytes with the exception of iron (historical upstream 80 percentiles are above the ANZECC (2000) low reliability trigger value) and cobalt (Canadian guideline value now being accepted in Australia).

3.2.1 Iron

ANZECC (2000) does not have an 80 percent species protection trigger value for iron, and only has a low reliability trigger value at the 95 percent species protection level. This value is not appropriate for application at SW4 due to historical maximum concentrations of iron detected at SW2 at 390 µg/L and at SW13 at 700 µg/L. Table 3-1 shows the data for the iron concentrations from 2012 to 2016. The low rainfall during the 2015/16 wet season would account for reduced iron concentrations when compared to previous years.

Depending on the rainfall during the 2016/17 wet season the SSTV selected by the NT EPA may not be appropriate for application at SW4. All iron exceedances will need to be compared to the SW2 and SW13 water quality to show that the mine discharge is not contributing to any elevated concentrations exceeding the SSTV.. Based on the data shown in Table 3-1, an SSTV of 350 µg/L will take into account background concentrations of iron at SW2 and SW13.

Table 3-1 Edith River SW2 and SW13 Statistical Summary (July 2012 to May 2016)

Analyte (dissolved)	N	Min	Median	Max	80th Percentile
SW2					
Iron µg/L	34	110	175	390	310
SW13					
Iron µg/L	23	69	120	700	380

3.2.2 Cobalt

As discussed in the letter received from Peter Vassel (NT EPA) on 27 January 2015, a trigger value for 80% species protection for cobalt of 13 µg/L has been recommended by ERISS. This trigger value is based on the Canadian guidelines currently being adopted by Australian regulators and had been included in NT EPA WDLs for mine sites in the Northern Territory. It must be noted that a freshwater cobalt guideline has been derived using Australian tropical freshwater species, however, to date this guideline has not been made public. Until such time, the Canadian guideline as adopted by the Federal Department of the Environment and Energy would be appropriate as the cobalt SSTV for SW4.

3.2.3 Recommendations

- A value of 350 µg/L for dissolved iron is recommended to be applied as the SSTV to SW4.
- A value of 13 µg/L for dissolved cobalt is recommended to be applied as the SSTV to SW4.

3.3 Surface Water Monitoring

Vista Gold's current Surface Water Monitoring Procedure will be updated to meet the changes proposed to the water quality sampling at RP3, SW2 and SW4. The SOP provides details on sample locations and a full suite of analytes required to meet WDL requirements. The Discharge Plan provides a sampling procedure to meet water quality requirements for sampling during discharge, and monthly sampling at times of no discharge, for the suite of analytes shown in Table 3-2 from Appendix 3 of WDL 178 (as amended).

Table 3-2 Analytes for SW2, SW4 and RP3 Daily Sampling during Discharge

	Analytes
Field Data	Rainfall, evaporation, air temperature, pumping rate, cumulative discharge volume, River flow, water level
In-situ	DO, temperature[1], EC[3], pH[1]
Metals (dissolved i.e. 0.45 µm filtered)	Al ,B, Cd, Co, Cu, Cr, Fe, Li, Pb, Mn, Hg, Ni, Zn
Metals (total)	Al, Cd, Co, Cu, Fe, Hg
Others	TN, NO_3, NO_2, NH_3, TP, SO_4, bicarbonate, alkalinity, hardness, TDS, TSS, Na, chloride, Ca, K, WAD cyanide[4], total cyanide, TOC, fluoride, Mg

Water quality at SW4 sampled over the last 3 wet seasons where the dilution algorithm has been used has shown that daily monitoring of SW2, RP3 and SW4 provides sufficient information to assess background water quality. From the data collected to date[5] it is unlikely that daily monitoring of SW13 will provide additional information to assist in interpretation of SW4 water quality during discharge.

[3] Continuous at RP3 and SW4
[4] Required if total cyanide >0.004 mg/L
[5] Mt Todd WDL 178-4 Monitoring Report 2016

3.3.1 Recommendation

Water quality monitoring at SW13 remains as monthly as per WDL 178-4.

3.3.2 Surface Water Sampling

Vista Gold have installed on-line data loggers to continuously analyse pH, conductivity and temperature at RP3 and SW4. This system provides an early warning if water quality entering the Edith River is deteriorating. Figure 3-1 shows the location of the in-line continuous water quality monitor at RP3. The loggers are maintained on a routine basis by Envirotech Monitoring who also provide routine calibration of the probes.

Figure 3-1 RP3 in-line water quality monitor

Vista Gold will sample sites SW2, , SW4 and RP3 on a daily basis to meet WDL requirements, however, after the first three days of continuous discharge each daily sample will be combined to form a composite sample as shown below:

- Daily sample for the first three days of continuous discharge.
- Then a composite of daily samples every three days thereafter
- A daily sample on the last day of discharge
- A sample seven days after discharge has ceased
- Samples will be dispatched weekly to a NATA accredited laboratory for analysis.

A summary of the in-line RP3 water quality analysed during the 2015/16 wet season discharges in January and February 2016 is shown in Table 3-3 and represented in Figure 3-2 and Figure 3-3.

Table 3-3 Summary of in-line water quality at RP3

	pH	Electrical Conductivity µS/cm
Count	1,017	51,350
Median	7.54	2,717
Mean	7.52	2,737
Standard Deviation	0.19	45
Minimum	6.98	2,242
Maximum	8.54	2,849
Coefficient of variation[6]	2.5	1.6

[6] Coefficient of Variation = Mean/Standard Deviation*100

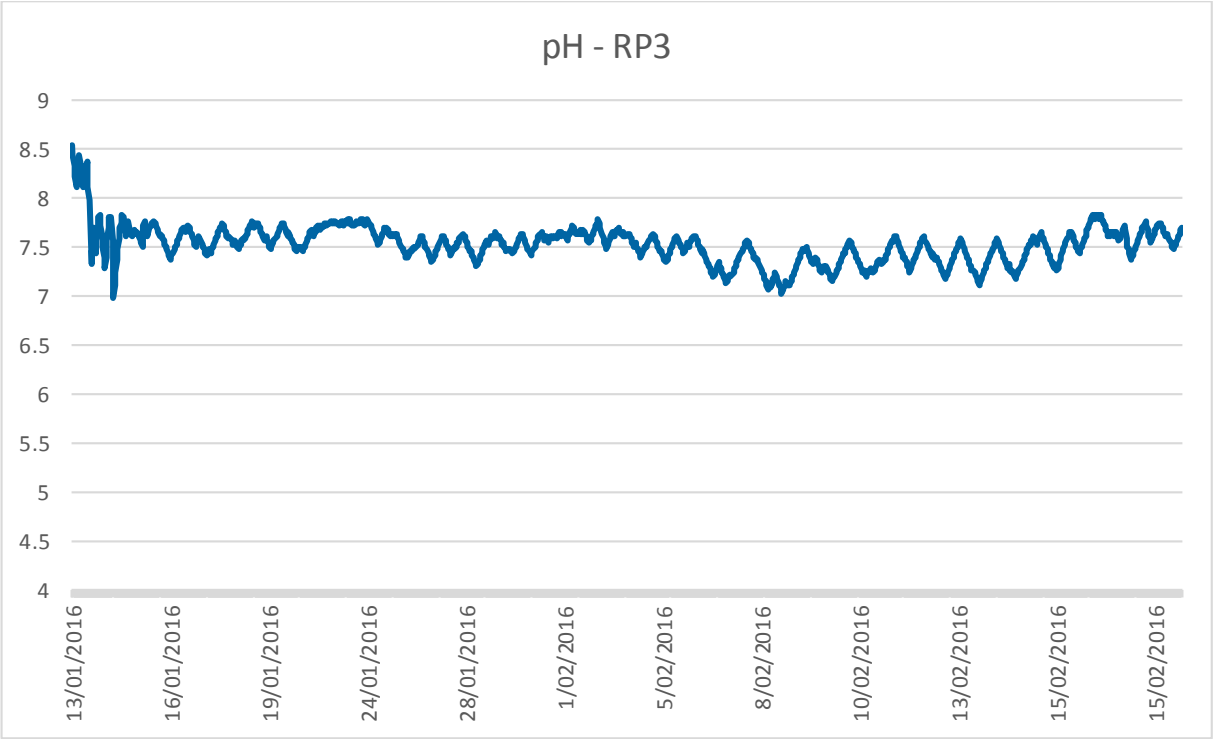

Figure 3-2pH at RP3 during discharge January - February 2016

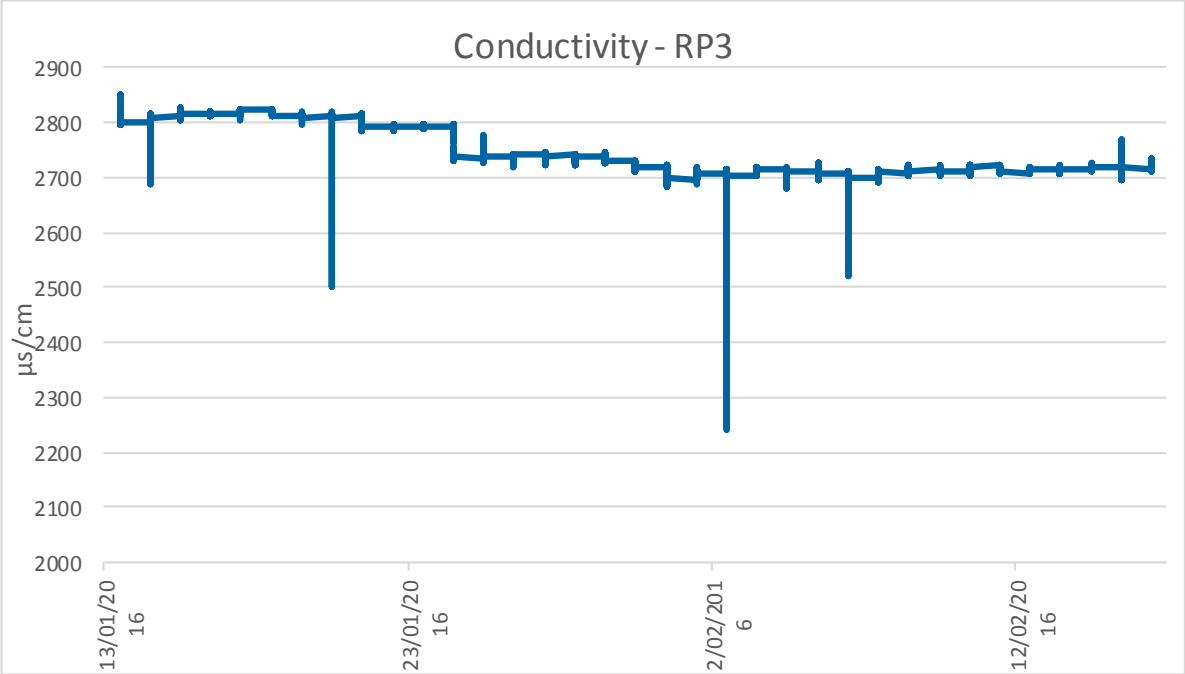

Figure 3-3Electrical Conductivity at RP3 during discharge January – February 2016

The data provided in Table 3-3 shows the variation in water quality as measured by pH and EC over the discharge period in January and February 2016. The coefficient of variation for the pH readings was 2.5 for the period and the EC coefficient of variation was 1.6. Both data sets show minimal variability during the discharge period as evidenced by the low coefficients of variation. The stability of the RP3 water is supported by the metals data shown in Table 3-4 for cobalt, nickel zinc and sulphate. The aluminium concentrations can be affected by surface runoff and

the copper results are skewed by the low concentrations and limits of reporting. Therefore, the copper coefficient of variation does not provide an accurate indication of the actual variability.

Table 3-4 Metals summary of RP3 discharge water

	Al µg/L	Co µg/L	Cu µg/L	Ni µg/L	Zn µg/L	SO_4 µg/L
Count	34	34	34	34	34	34
Median	55	72	1.0	190	465	1700
Mean	50	74	1.9	196	466	1665
Standard Deviation	23	5.9	1.2	13	30	98
Minimum	12	64	1.0	170	420	1500
Maximum	93	85	5.0	220	520	1900
Coefficient of Variation	46	7.9	63	6.6	6.4	5.9

Based on the data presented in Table 3-3, the stability of the water quality discharged from RP3 supports the proposed analysis of composite samples for treated RP3 mine water.

3.4 Monitoring Sites

Vista Gold proposes to meet the 80% species protection dilution factor at SW4 during wet seasons to meet the SSTV requirements of the WDL. Surface water monitoring locations are shown in Table 3-5.

Table 3-5 Surface Water Monitoring Sites

Site Name	Site Description	Latitude (degree, decimal) WGS84	Longitude WGS84
SW2	Edith River at bridge on Edith Falls Road	-14.17194471	132.1198981
SW4	Edith River downstream of RP1 siphon (Burrell Creek) and RP1 spillway (West Creek), near boundary of mine property	-14.17066860	132.0983470
SW10	Edith River at old Stuart Highway causeway (8.7 km downstream from SW4)	-14.18463718	132.0303688
SW13	Stow Creek above confluence of Horseshoe Creek	-14.15605200	132.0983470

Site Name	Site Description	Latitude (degree, decimal) WGS84	Longitude WGS84
RP1	Waste rock wastewater source	-14.16306406	132.1072276
RP3	Batman Pit	-14.14032773	132.1026623

3.4.1 Recommendation

SW10 be removed from the monitoring program as the train derailment and subsequent remaining copper concentrate in the Edith River at this site skew the water quality. Further, water quality at SW4 meets the WDL SSTVs during discharge and any poor water quality at SW10 is unlikely to be attributable to the Mt Todd discharge due to the distance from SW4 and the controlled discharge system.

3.5 SSTV Exceedance

For parameters that exceed the site specific trigger values at the downstream monitoring location (SW4), the actions described in the decision trees in ANZECC (2000) and in Figure 3-4 below are implemented for physico-chemical stressors and for toxicants.

For physico-chemical stressors and toxicants, the reporting requirements are triggered where the results of the composite sample exceed the SSTVs listed in Appendix 3 of the WDL at SW4.

The WDL reporting requirements are:

> *"Water quality parameters measured at SW4 do not exceed greater or equal to two times the SSTV for any single measurement; and*
>
> *The rolling 7 day 80th percentile of measurements for each water quality parameter does not exceed the SSTV"*

Additional investigations that will be required to manage and assess the exceedances include:

- Investigate the cause and duration of the exceedance;
- Implementation of remedial actions to improve discharge water quality by increasing the dilution factor (i.e. reducing the discharge volume); and/or
- Further site-specific investigations to determine the biological effects of the elevated parameters.

Further site specific investigations may include direct toxicity assessment (DTA) following ANZECC (2000) guidelines to determine biological effects in the downstream ecosystem. A single species representative of the receiving ecosystem may also be used in an ecotoxicological assessment to provide a timelier result. The aim of this investigation would be to identify the source of the contaminants, and to determine if the elevated concentrations are adversely impacting on the waters downstream of the discharge point.

3.6 Selection of SW4 as Monitoring Point

The monitoring location at SW4 has been selected as the site to meet the SSTVs calculated for the Edith River. Dilution factors calculated for the RP3 discharge will enable the SSTVs to be met at SW4.

3.7 Application of 80 Percent Species Protection Dilution Factor

The dilution algorithm derived in this Discharge Plan (Section 4) has been developed to protect 80 percent of resident species from a 10 percent decrease in growth or reproduction in the Edith River ecosystem during site dewatering.

Vista Gold proposes to meet the 80 percent species protection dilution factor at site SW4 for discharge of all mine waters. Water quality data for SW4 will be compared against the SSTVs listed in the WDL and upstream concentrations if the SSTVs are exceeded.

An exceedance which triggers the investigation process as listed in the WDL and described in Section 3.5.

If any of the SSTVs are exceeded, an investigation process as detailed in Figure 3-4 will be implemented upon receipt of analytical data from the laboratory. This investigation procedure follows ANZECC (2000).

3.8 Exceedance Investigation

Should a SSTV (listed in the WDL) be exceeded at SW4 during any discharge from the mine as defined in Section 3.5, and investigations reveal that follow up sampling of the mine discharge and ambient water are required, the follow up sampling will occur as soon as practicably possible with a rapid turn-around-time (TAT). Additional testing will be requested to be conducted on 0.1 µm filtered samples and Chelex extraction to assess metal bioavailability.

In the meantime, Vista Gold will implement the appropriate management actions for the exceedance, which may include additional sampling at key locations to assist with the isolation of any passive contaminant sources. The NT EPA will be advised of an exceedance.

The risk assessment process will commence upon receipt of the follow-up sample results if they confirm the previous results. Therefore, the time frame from the conclusion of the investigation process to the commencement of the risk assessment process is anticipated to be approximately 1-2 days. The risk assessment will take approximately one day. Another day is required to compile the report. A total of 4 to 5 working days is required to provide a completed report to NT EPA. If the exceedance was not caused by a laboratory or sampling error, the report may be completed in a minimum of 4 days from initial exceedance. The days for the investigation process listed on Figure 3-1 are for indicative purposes only and may change depending on information obtained during the investigation.

3.9 Cease Discharge

Vista Gold will cease discharging from a water source (RP3 or RP) if the SSTVs listed in the WDL are exceeded by a factor of 2 or more. The discharge will cease upon receipt of the laboratory results, i.e. the earliest known time of exceedance. The NATA accredited laboratory will then be sent additional samples immediately with a rapid TAT of the samples to confirm the exceedance.

A factor of 2 was selected to be applied to the SSTVs for ceasing discharge, based on concentrations that may have the potential to cause chronic toxicity to sensitive aquatic species within the mixing zone. Acute toxicity is unlikely in the mixing zone with a 1-2 day exposure at these concentrations.

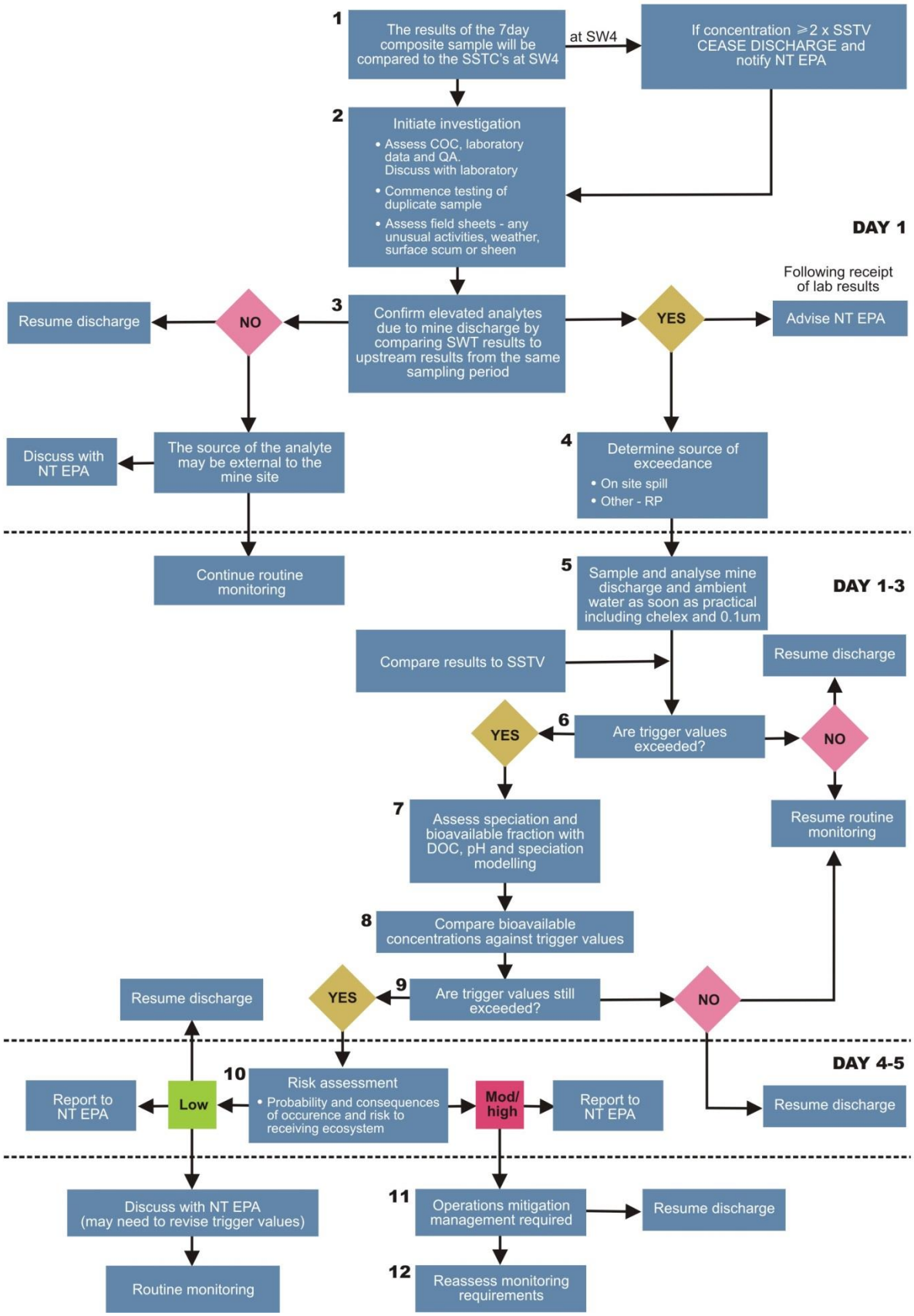

Figure 3-4Investigation Process for Exceedance of SSTVs at SW4

4. Dilutions to meet SSTVs

4.1 Introduction

Toxicity units from historical and recent ecotox testing by ERISS, NT EPA, Newmarket Gold and Vista Gold have been used to derive a dilution algorithm that can be used to calculate the dilution factor, based on the current chemistry of discharge water. This method takes into account analysed chemicals that are considered to be contributing the majority of the measured toxicity (calculated from DTAs) within the discharge.

The following is a discussion of the development of a dilution algorithm that uses the data available at the time of testing. The dilution algorithm does not intend to determine 100% of the contributors to toxicity, as it is recognised that the physico-chemistry of the RP and receiving waters may have ameliorating factors. This has partially been taken into account by using the upstream water as dilution water in all DTAs.

This method does not attempt to identify all contributors to the measured toxicity, but has been developed to provide a practical method for operators to modify the dilution of mine water with rapidly changing chemistry, due to operational procedures (e.g. treatment and/or input of poor quality water) for maximum discharge to meet operational objectives listed below.

Water Treatment Objectives

The treatment and discharge of RP3 water will allow the DME and Vista Gold to meet their objectives at the Mt Todd site. These objectives are:

- Reduce the risk of significant environmental harm by using historical data to predict the impact of activities
- To reduce the on-site water inventory
- To reduce the risk of an uncontrolled discharge from RP1 and RP3
- Meet the SSTVs at SW4

4.2 Method

Vista Gold will conduct water quality testing on RP3 during discharge, to monitor water quality discharged from the pit to meet WDL requirements. Samples for analysis by a NATA accredited laboratory will be collected mid-stream via a sample point at the discharge manifold. These results will be used to calculate a dilution factor (along with the receiving water chemistry) that will allow the maximum volume of water to be discharged to the Edith River to meet the SSTVs at SW4 and to comply with the WDL.

The chemistry and the dilution factors determined for an 80 percent species protection factor using the BurrliOZ species sensitivity distribution (Campbell *et. al.* 2000[7]) derived from DTA of gold mine discharges provided by ERISS, NT EPA, Vista Gold and Newmarket Gold Northern Territory Mining Operations (NTMO) have been used to determine the correlation of chemistry and toxicity. Additional ecotoxicity data was provided by NTMO from their Pine Creek, Cosmo Howley and Brocks Creek Project Areas. This combined data was used to calculate an algorithm derived from a large number of data points that can then be applied with a greater

[7] Campbell E., Palmer M.J., Shao Q., Warne M.StJ. and Wilson D. 2000. BurrliOZ: A computer program for calculating toxicant trigger values for the ANZECC and ARMCANZ water quality guidelines. Perth, Western Australia

level of confidence (GHD 2014[8], GHD 2014[9]) and validated in 2015 with RP3 treated waste water and in 2016 with treated and untreated mine water from Cosmo Howley. NTMO data were considered appropriate for use, given that the mine sites are in close proximity and the species and endpoints used in bioassays are similar in all DTAs.

A total of 21 water samples were used to calculate the dilution algorithm, all of which were obtained between 2010 - 2016. This number of data points provides an algorithm with a high level of confidence. These samples provide a wide variety of water qualities from untreated samples with poor water quality to treated samples of better quality. This data has previously been supplied to the NT EPA in various reports.

4.2.1 Trigger Values

Trigger values used to calculate the toxic units for the dilution algorithm are the ANZECC (2000) 80 percent species protection SSTVs to be applied to water quality at SW4 from the WDL. These SSTVs are listed in the WDL.

4.3 Toxic Units

To derive a formula for determining dilution factors for Mt Todd discharge, previous ecotoxicity dilution data (calculated following ANZECC (2000) guidelines for 80 percent species sensitivity distributions (SSD)) from ERISS, NT EPA, Vista Gold and NTMO were correlated with sulfate and dissolved metals: aluminium, copper, cobalt, nickel and zinc chemical concentrations. The toxicity units for each chemical were calculated using SSTVs from the WDL as shown below:

TU = concentration in sample of individual analyte / SSTV for that analyte

The toxicity units for each chemical were then added to obtain the total toxicity units for each sample. A linear correlation was then conducted to assess the relationship between total toxicity units and dilution. The formula for the correlation can then be used to calculate the appropriate dilution based on toxic units derived from the chemistry of the RP3 sample.

4.4 Selection of Chemicals

From the ecotox data to date, and the toxicity units at low metal concentrations, sulphate and other ions contribute the majority of the toxicity. Once zinc and copper concentrations increase, these contribute the most to toxicity; with copper contributing >60 percent of the toxicity at high concentrations.

The metals contributing to the majority of toxicity in the sample were selected for inclusion in the calculation of the algorithm. Aluminium was selected as untreated water contains high concentrations of aluminium. The SSTV was selected as the TV for aluminium as the pH at SW4 is above pH 6. As discussed previously, sulfate contributes to toxicity at low metal concentrations; therefore, sulfate was selected for inclusion in the algorithm calculation. Copper, nickel and zinc contribute the majority of the toxicity in poor water quality; therefore, these metals were selected to be used to calculate the algorithm. DME requested that cobalt be included in the algorithm in 2015. Cobalt has now been included in the algorithm with a SSTV of 13 µg/L as per the WDL and 180-03 for NTMO.

[8] GHD 2014. Crocodile Gold Pine Creek Project Area. Environmental Monitoring and WDL 166-02 Report 2013-2014. August 2014. Draft

[9] GHD 2014. Crocodile Gold Cosmo Howley Brocks Creek Project Area. Environmental Monitoring and WDL 180-01 Report 2013-2014. August 2014. Draft.

It must be noted that the analytes selected are not intended to be a complete representation of the total contributors to toxicity.

4.5 Results

The Vista Gold ecotoxicity data (October 2011 to February 2015) was combined with the CGAO data, with data from the NT EPA report (NT DLPE 2012) and data from Cosmo-Howley was added in 2016. Total TUs were calculated for sulfate, aluminium, copper, cobalt, nickel and zinc. The data used in the algorithm is shown in Table 4-1. Figure 4-1 shows the linear regression for the Toxicity Units against dilution for using data from Table 4-1.

Table 4-1 Toxicity Units (SO_4, Al, Co, Cu, Ni and Zn) and Dilution Data

Test No	Date	Site	Total TUs	Dilution
1	Jan-12	RP1	2074	1219
2	Oct-11	RP3	178	58
3	Apr-12	RP1	2468	1000
4	Oct-12	RP7	9087	4545
5	Jan-13	RP3	2776	1123
6	Mar-13	RP3	15	20
7	Dec-13	RP3	226	132
8	Jan-14	RP1	4914	1666
9	Apr-13	CHCK03	76	29.4
10	Apr-13	CHCK05	675	435
11	Apr-13	BCSW16	24	15.3
12	Apr-13	BCSW12	5	2.5
13	Apr-13	PCPWD	291	238
14	Apr-13	PCCK04	22	25
15	Mar-10	PCPWD	2374	1000
16	Mar-10	TGEP	1559	900
17	Mar-10	CHCK05	68	30
18	Jun-14	CGAO Treated	70	31
19	Feb-15	RP3	31	15.8
20	Mar-16	CHCK02	26	9.1
21	Mar-16	HWPit	32	4.2

A linear regression was conducted on the data in Table 4-1 and shown in Figure 4-1. The R^2 value is 0.9694, which shows high correlation between toxicity and toxic units. Additional data points can be added to the data set following future DTAs. Even though the high data points do skew the frequency distribution as discussed in Dr Jeffree's Technical Review, they have been maintained in the algorithm to ensure that the minimum dilution that can be calculated will not be negative. By removing the higher values dilution factors will reduce to <1:2 and remove any safety margins that are inherent in the algorithm as shown in Figure 4-1.

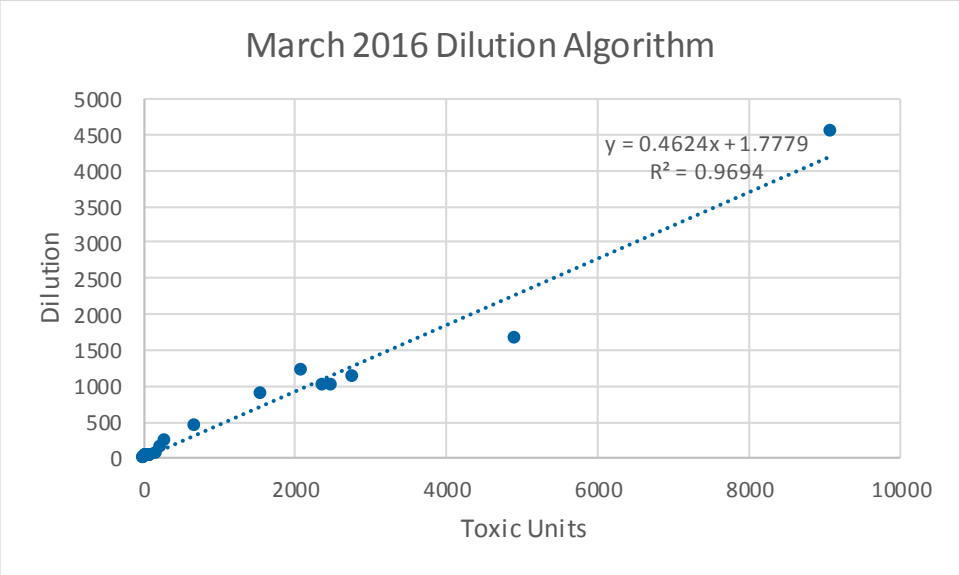

Figure 4-1 Linear Regression for Dilution Algorithm

4.6 Application Method

The algorithm shown in Figure 4-1 has been derived to apply to pumping rates based on the flow in the Edith River and the water chemistry in each pit, so that the SSTVs will be met at SW4.

This algorithm can be applied to future chemistry analysis of sulfate, aluminium, copper, nickel and zinc to derive the dilution required to meet WDL requirements for environmental protection of the Edith River:

- Total Toxicity Units (SO_4, Al, Cu, Ni and Zn): $y = 0.4624x + 1.7779$

This algorithm will provide a conservative estimation of dilution at low TUs which are expected to be found in RP3 after the 2015 treatment process as the minimum dilution factor that will be calculated will be >1:1.8.

4.7 Validation of Method

The algorithm has been validated using a DTA conducted in February 2015 on the treated RP3 water and in March 2016 with treated mine water from NTMO's Cosmo Howley site.

Daily sampling will be conducted at SW4 to meet WDL requirements to ensure SSTVs are met.

4.8 Peer Review of Method

A copy of the dilution algorithm methodology was provided to Dr Ross Jeffree for an independent peer review. The algorithm dilution methodology is currently undergoing further review by Dr Graeme Batley. This review is expected to be completed by October 30 2016.

4.9 2015 Screening Bioassay at SW4

Vista Gold conducted a screening bioassay using the cladoceran reproduction test on a sample from SW2, SW13 and SW4 during discharge in February 2015. The SW4 results were compared to the upstream SW2 and SW13 samples to determine if any significant toxicity was exhibited at SW4 that could be attributed to the discharge. The cladoceran reproduction results showed increased reproduction when compared to the upstream sites. Table 4-2 shows the results for the screening bioassays.

Table 4-2 Summary of Screening Ecotox Results for SW2, SW13 and SW4

Test	Control	SW2	SW13	SW4
Cladoceran 7-day reproduction (chronic)	100 %	50.3 %	92.5 %	102 %
Cladoceran 7-day survival (acute)	80 %	90 %	100 %	100 %

4.10 Discussion

The method used for the development of the algorithm has been derived from Schmidt *et al.* (2010) and is a conservative version of the cumulative criterion unit (CCU) model. The CCU is a toxic unit approach that predicts additive toxicity of trace metal mixtures to aquatic organisms in freshwater streams. The CCU model takes into account ameliorating factors such as hardness, pH, dissolved organic carbon, Ca^{2+} and Mg^{2+} concentrations.

The method used in the development of the dilution algorithm has not taken the effect of ameliorating factors into account. The method used here assumes that the dilution rate calculated from the species sensitivity distribution (SSD) has already accounted for any ameliorating factors. This method is also based on the assumption that bioavailable metals are the primary cause of toxicity in these samples, and that ions contribute to toxicity at low metal concentrations. This assumption is validated by the significantly high R^2 value.

This method provides the simplest way of calculating the dilution factor based on ecotoxicology and capturing chemistry data and the contribution of each selected chemical to toxicity and has been developed for use by operations personnel.

The screening results from SW4 show that no toxicity was evident at that site, in fact the water was less toxic than that at SW2. The DTAs conducted on RP3 and Cosmo Howley validated the dilution algorithm and was used to update the algorithm.

Commitment 2

Conduct screening cladoceran bioassays on SW13, SW2 and SW4 during discharge in 2016/17

5. Flow Control Mechanisms for Discharge to Meet the Dilution Factors

This section describes the mechanisms, including infrastructure and telemetry, installed at Mt Todd that will control discharges to meet the dilution factors at SW4.

5.1 RP3 Discharge

The discharge of treated RP3 water will occur via the following mechanism:

- Release of treated RP3 water via variable speed pumping system from 100 L/s to 1200 L/s capacity
- Pump flow rate controlled by automated pumping system
- Pumping rates determined from volume of water available in Edith River for discharge and applicable dilution rates
- Flow and water quality in Edith River measured by gauging station at monitoring location SW4
- Real time flow at SW4 reported via radio telemetry to pump controller
- User adjustable dilution rates are set in pump control system
- Pump control system uses river flow rates and dilution ratio to regulate the pump flow rate
- Pump flow rate from RP3, Edith River flow rates and quality from SW3 and SW4 reported live to site office via radio telemetry connection
- Live telemetry data available to Vista Gold mine site and Darwin offices via internet link

5.2 RP1 Discharge

The release of untreated mine water from RP1 will only be permitted under emergency conditions as outlined in the WDL, and with approval from the Controller of Water Resources. If permitted the discharge of untreated RP1 water will occur via the following mechanism:

- Release of water via existing siphon system
- Flow rate manually controlled by valves
- Flow rate reported by inline flow meter
- Discharge enters Burrell Creek
- River height, flow and water quality continuously monitored by gauging station SW4 downstream of Burrell creek confluence with Edith River
- Siphon flow rate reported live in site office by radio telemetry
- Height, flow and water quality at SW4 reported live at site office via radio telemetry
- Live telemetry data available to Vista Gold mine site and Darwin offices via internet link

6. Sediment Monitoring Summary

6.1 Introduction

The information provided in this section is a summary of the "Vista Gold WDL 178-4 2015/2016 Aquatic Monitoring Report" prepared by GHD (June 2016).

Sampling was undertaken between 6th and 8th April 2016. At the time, there was low flow at most sites. Sites featuring water were characterised by deep pools connected by very shallow runs or hyporheic flow.

6.2 Methodology

Sites for water, sediment, habitat and macroinvertebrate sampling were chosen to provide an assessment of the state of the aquatic environment in the footprint of the mineral leases and adjacent waterways. Sites were positioned to efficiently quantify existing conditions and allow for detection of impacts from future potential pollutant sources.

6.2.1 Study Design

The primary aim of the study design 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. The study design for the 2016 sampling round has been simplified from previous years, as the use of the Ferguson River as a reference system in previous studies (GHD 2015a[10]) was found to be unsuitable; this was confirmed by the NT EPA and the DME in 2015. Therefore, the current study focusses solely on the comparison of the aquatic environments between the sites upstream and downstream of the discharge location.

As a secondary objective of the study design, sites were 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 and Stow Creek to provide an indication of any potential impacts that the discharge may be having on the receiving environment.

The 2016 survey was timed to align with previous aquatic assessments (~April) undertaken for the Project to maintain consistency of results.

6.2.2 Survey Sites

Sites for water, sediment, and macroinvertebrate sampling were chosen to provide an assessment of the state of the aquatic environment in the footprint of the mineral leases and adjacent waterways. Sites were positioned to efficiently quantify existing conditions and allow for detection of impacts from potential pollutant sources.

A total of eight sites were sampled in April 2016. These sites were located on the Edith River and in Stow Creek. Both waterways are ephemeral and had low flow at the time of sampling. There was no direct discharge from RP3 into the Edith River at the time of the survey, nor during the immediate period leading up to the survey.

The range of sites nominated for sampling included historic monitoring sites used by Vista Gold since 2008. The sample sites are detailed in Table 6-1.

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

Table 6-1 Site location details, April 2015 aquatic ecology baseline survey

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
ERBTM	180080	8430235	101.1	Edith River farthest downstream site	Potentially Impacted
Stow Creek (New Sites)					
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

** = downstream compliance monitoring site, not sampled because water levels were too low to provide safe access via steep banks for sampling in April 2015. Nearest site downstream sampled instead.*

6.3 Results and Discussion

The sediment quality results were compared against the ANZECC Guideline (2016) Sediment Quality Guideline (SQG) low values. No values exceeded the SQG-Low values, with most metals undetectable. The highest metal concentration at all sites was iron, followed by manganese. Metal concentrations did not show spatial patterns relative to the position of the release point for any analytes. This may have been due partly to the observed broad similarity in sediment particle size distribution across study sites.

Sediment particle size was broadly similar at the two furthest sites upstream on Stow Creek, though there was slightly coarser sediment at site SCDS. The site at the bottom of the creek had significantly coarser sediment, with a higher proportion in the range >2.36 mm.

On the Edith River, the four most upstream sites had generally similar sediment particle size distribution, though the two impact sites closest to the release point featured a slightly higher proportion of finer sediment particles compared to the upstream control sites. Further downstream at site ERBTM, the sediment makeup changed significantly, with close to 70% of sediment particles being >600 µm (i.e. course), with limited fines.

7. Macroinvertebrate Data

7.1 Introduction

The information provided in this section is a summary of the "Vista Gold WDL 178-4 2015/2016 Aquatic Monitoring Report" prepared by GHD (June 2016).

Treated mine water enters the Edith River from RP3 via Batman Creek and Stow Creek under controlled discharge. Historically, the majority of mine water that entered the Edith River under controlled discharge previously occurred at the RP1 discharge point into Burrell Creek prior to entering the Edith River. Other potential sources of mine water include discharge from Batman Creek and Horseshoe Creek, which pass water to Stow Creek prior to the Edith River, and discharge from West Creek. Stow Creek receives seepage and pond overflow from RP7, RP2, RP5 and the Heap Leach. West Creek receives potential overflow from RP1. Anthropogenic discharge can occur from RP7, RP1 and since 2013, from RP3.

At the Mt Todd mine site, pelagic macroinvertebrates have been monitored since 2003. From 2003 to 2010 five sites were monitored annually by the then Northern Territory Department of Resources (DoR), with a single macroinvertebrate sample collected at each site. The number of sites included in the macroinvertebrate monitoring program has been increased to eight sites with three replicates collected.

7.2 Method

7.2.1 Sampling

Macroinvertebrate sampling and processing followed procedures outlined in the Northern Territory AUSRIVAS Manual for the Darwin-Daly Region (Lamche, 2007[11]). Sampling involved 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 swept 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 were avoided when collecting edge habitat samples.

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

7.2.2 Data Analysis

The macroinvertebrate data collected as part of this project was analysed using univariate and multivariate statistical techniques. Univariate metrics provided an indication of 'health', while multivariate analysis focussed on variability in community composition.

[11] 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.

Univariate Techniques

Univariate measures (biotic indices) were used to assess the 'health' status of the macroinvertebrate community at each site. The macroinvertebrate community biotic indices used for this study included:

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

Multivariate Techniques

Multivariate data analysis was used to assess variation in community composition between samples. The multivariate analysis methods used to assess macroinvertebrate data included:

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

7.3 Results and Discussion

Edith River

Water quality along the Edith River at the time of sampling showed the water chemistry to be benign in terms of toxic potential. There were some noticeable trends from upstream to downstream with magnesium and manganese content, but all were below SSTVs, with manganese significantly below the SSTV. Total iron concentrations were above SSTVs at all sites, with no spatial trend between upstream and downstream sites, suggesting a natural source. Further, dissolved iron concentrations (the bioavailable fraction) were all below the SSTV.

Sediment quality analysis along the waterway showed that no parameter concentrations exceeded the SQG-low trigger values stipulated in the ANZECC Guidelines (2016). Iron and manganese were the only metals detectable in bioavailable forms within the sediment sampled. Sediments along the Edith River are considered to be benign in terms of potential toxicity.

The abundance of macroinvertebrates was highly variable between sites on the Edith River, with no spatial trends noted. Therefore, the differences in abundances seen along the river are most likely a result of changes in habitat availability between sites rather than any impacts of treated mine water discharge. The ANOVA showed no significant difference between upstream and downstream sites for this index.

Taxonomic richness results do not suggest an impact from exposure to treated mine water. The site immediately downstream of the discharge area (ERDS) showed the highest diversity and equal highest number of EPT families for the Edith River sites. There was a decline in taxa richness from this site towards the site at the bottom of the waterway, however this is likely explained by habitat changes rather than treated mine water impacts as the influence of the discharge would be expected to decline through dilution with distance from the release point. Also, no significant difference was detected in the ANOVA.

The EPT results do not point to any obvious impacts from treated mine water on the Edith River, with no significant difference in EPT counts between the sites immediately upstream and downstream of the discharge area. There was a change in EPT family percentage abundance

between the sites, but this is more likely a result of habitat availability rather than water chemistry, as pollution sensitive EPT taxa (e.g. Leptophlebiidae) still occur at both these sites.

AUSRIVAS results showed that the macroinvertebrate communities all sites (regardless of their orientation to the discharge) returned the expected number of families within the range found at 80% of the reference sites of the Darwin Daley model. This consistent AUSRIVAS result indicates that there was no deleterious impact on invertebrate communities during the time of, or the weeks leading up to the survey.

Multivariate community analysis confirms all of the above observations, showing no significant statistical difference between sites upstream and downstream of the discharge location.

Temporally, there are no notable or consistent trends for any of the macroinvertebrate indices between the sample events in 2015 and 2016.

In conclusion, the results show that treated mine water discharge is not resulting in any significant detrimental impacts to the aquatic ecology of the Edith River.

Stow Creek

The Stow Creek sites showed some changes in water chemistry between upstream and downstream sites. Sulphur content, TDS and water hardness increased and pH became slightly more acidic downstream of Horseshoe Creek, as RP3 was not discharging at the time of sampling these observed changes are naturally occurring. Total and dissolved magnesium concentrations were found to increase downstream also, to concentrations above the SSTVs. Total iron concentrations were above the SSTVs at all sites, but as was the case in the Edith River, the dissolved bioavailable fractions were all within the SSTV. Nutrient levels increased slightly downstream of Horseshoe Creek. Most parameters that showed an increase at the first downstream site began to recover towards ambient levels at the next downstream site.

Sediment chemistry was similar to the Edith River, with no parameters exceeding the adopted SQG-low trigger values. Manganese showed an increasing pattern from upstream to downstream. Iron concentrations were similar at all sites. Zinc was detected only at the furthest downstream site, but at a low concentration slightly above detection limits. Overall sediment is considered to have a low potential toxicity.

Macroinvertebrate abundance increased dramatically at the first downstream site (SCDS), then showed a corresponding drop in abundance at the next downstream site. The large abundance change is related to numbers of chironomids and cladocerans in the samples. This is unlikely to be related to the noted changes to water chemistry, as the same taxa are seen upstream. It is more likely a result of increased habitat for the abovementioned macroinvertebrates. No significant difference was noted in the ANOVA between the total of the upstream site and the sites downstream of Horseshoe Creek.

The diversity at the Stow Creek monitoring sites show a non-significant drop between the site upstream of Horseshoe Creek and the site immediately downstream. The results then show a recovery in the next downstream site. The same pattern is also observed in the EPT results. However, overall between the upstream and downstream sites, the ANOVA did not detect a significant difference in either index. The SIGNAL 2 results also show no significant difference between upstream and downstream sites. The most pollution sensitive family found during the study, Leptophlebiidae (SIGNAL 2 = 8), was found at all three sites, suggesting water quality may not be having an adverse effect.

Multivariate community analysis confirms no significant statistical difference between sites upstream and downstream of the horseshoe creek confluence.

In conclusion, the macroinvertebrate communities of Stow Creek do appear to be slightly influenced by discharges into Horseshoe Creek however ANOVA tests indicate that this is not

significant, and habitat availability may be attributable to the differences. There are still some significantly pollution sensitive taxa present at the first downstream site, including three families from the Ephemeroptera, therefore any impact is considered slight. The macroinvertebrate community appears to recover in the next downstream site, therefore any influences are highly localised.

8. Conclusions

This Discharge Plan provides information for the management of the Mt Todd discharge to Edith Creek. This report provides 80 percent species protection trigger values to be met at SW4 to ensure that the dilution ratios calculated from ecotoxicology and chemistry results for gold mine discharges are providing the appropriate environmental protection. A risk assessment conducted for SW4 in 2014 shows that the risk to the site from RP3 discharge was low. This risk assessment was not repeated as no evidence of adverse environmental harm has been detected with sediment and macroinvertebrate monitoring.

This Discharge Plan (Revision 5) has been developed to meet the requirements of the WDL.

The dilution factors will be applied to the water discharging from the Mt Todd mine site. These dilution factors will be met at the Edith River at monitoring location SW4.

SSTVs have been calculated to confirm that the dilution factors are being met at SW4. Several lines of investigation will be/have been used to assess and validate the dilution factors including:

- Daily monitoring at SW4 during discharge. *On-going*
- Additional screening bioassays to confirm low risk of RP3 discharge to Edith River. *Completed for 2015*. *To be repeated in 2017*
- Macroinvertebrate and sediment studies to assess downstream impacts from the mine discharge. *On-going*
- Investigations into the speciation of metals due to water chemistry at the site. *Completed*

8.1 Dilution Factors for Discharge

Ecotoxicological investigations into the toxicity of treated and untreated mine water from several sources were used to calculate a dilution algorithm for use at Mt Todd. The dilution algorithm has been developed to meet 80 percent species protection at SW4 using ecotoxicological testing. This algorithm has been validated using a DTA conducted in February 2015 on RP3 mine water and in 2016 with Cosmo Howley mine water. The dilutions algorithm to meet the 80 percent species protection is:

- Total Toxicity Units (SO_4, Al, Cu, Ni and Zn): $y = 0.4624x + 1.7779$

8.2 Cease Discharge

Discharge will cease upon receipt of laboratory data that shows that the water chemistry at SW4 is greater than or equal to double the SSTVs in the WDL.

8.3 Multiple Discharge Points

Vista Gold does not propose to discharge from multiple discharge points except in the case of unforeseen circumstances when this strategy would be used to reduce the chance of uncontrolled discharges. Vista Gold's preferred option for managing water volumes on site is by moving water from RP1 and RP7 to RP3 and discharge from RP3 only.

8.4 Macroinvertebrate and Sediment Study

Overall the results from the 2016 survey do not indicate that the discharge from the Mt Todd mine is having an impact on macroinvertebrate fauna of the Edith River.

The Edith River was assessed for aquatic ecological health to determine if treated mine water discharged through the licenced discharge point RP3 is having an adverse impact on the downstream ecology of the river. This assessment was undertaken through 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 results from the 2016 monitoring round were 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 was found to be relatively benign in terms of toxicity potential; iron was the only parameter elevated above the site specific trigger values. Sediment quality along the Edith River showed no elevation of parameters above 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.

The results from the survey show that Vista Gold remain compliant with licence requirements under the WDL.

9. Recommendations

9.1 Management of Discharge

- Apply the SSTVs to SW4 for management of the Mt Todd discharge from RP1 and RP3. The metal speciation bioavailability will be included in the case of an exceedance of a metal SSTV.
- Apply the algorithms for calculating the dilution factor for each RP depending on water chemistry and total toxic units.

9.2 Surface Water Monitoring

- SW10 should be removed from the monitoring program as the train derailment and subsequent remaining copper concentrate in the Edith River at this site skew the water quality. Further, water quality at SW4 meets the WDL SSTVs during discharge and any poor water quality at SW10 is unlikely to be attributable to the Mt Todd discharge due to the distance from SW4 and the controlled discharge system.
- A value of 350 µg/L for dissolved iron is recommended to be applied as the SSTV to SW4.
- A value of 13 µg/L for dissolved cobalt is recommended to be applied as the SSTV to SW4.
- Water quality monitoring at SW13 remains as monthly as per WDL 178-4.

9.3 Macroinvertebrate and Sediment Monitoring Program

- Continue using the sites from the 2016 monitoring program.

10. Commitments

Commitment 1

To meet the 95% species protection SSTVs at SW4 after mining commences

Commitment 2

Conduct screening cladoceran bioassays on SW13, SW2 and SW4 during discharge in 2016/17

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
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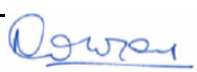
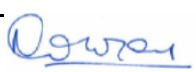
0	J.Woodw orth	N.Conroy		N.Conroy		3/10/2016

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