Vista Gold Australia Pty Ltd

Mount Todd Ecotoxicological Plan 2017

March 2017

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Abbreviations

Acronym	Description
ANZECC	Australian and New Zealand Environment and Conservation Council
DO	Dissolved Oxygen
DPIR	Department of Primary Industries and Resources
DTA	Direct Toxicity Assessment
EC	Electrical Conductivity
EC10	Effective Concentration on 10% of the population
EC50	Effective Concentration on 50% of the population
EPA	Environmental Protection Authority
ESA	Ecotox Services Australasia Pty Ltd
NATA	National Association of Testing Authorities
NT	Northern Territory
SOP	Standard Operating Procedure
SSD	Species Sensitivity Distribution
SSTVs	Site Specific Trigger Values
TU	Toxic Units
WDL	Waste Discharge Licence

1. Introduction

1.1 Background

This Ecotoxicological Plan (the Plan) outlines the Ecotoxicity Monitoring Program for the Mount Todd mine discharge designed for application by Vista Gold Australia Pty Ltd (Vista Gold). This plan has been prepared to guide the assessment of the potential impacts of the active discharge of treated mine water and to meet the requirements of the:

- Northern Territory (NT) Environmental Protection Authority (EPA) in accordance with Condition 35, 36 and 37 of Waste Discharge Licence (WDL) 178-05.

ECOTOXICOLOGY PLAN

35. The licensee must prepare an Ecotoxicology Plan that describes the methods to:

35.1. verify level of species protection at SW4 during a discharge event when mixed with wastewater from RP3 (dilution verification) at least once per discharge season;

35.2 carry out whole effluent direct toxicity assessment of RP3 prior to the 2017/2018 discharge season;

35.3 ensure sampling and analyses are carried out with appropriate quality controls to ensure test water represents the quality of treated wastewater that will be discharged for the season;

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35.6. determine the dilution required to protect 80%, 90% and 95% species with 95% confidence using any new data and data produced from previous point estimate test results to populate the species sensitivity distribution, provided each data point can be justified; and to

35.7.ensure chemical analysis is concurrently carried out for the likely key contaminants, including sulfate, aluminium, cadmium, cobalt, copper, nickel, zinc and lead, for each of the toxicity assays.

36. The Ecotoxicology Plan must be:

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

36.2 submitted to the administering agency with a copy of the qualified professional's certified written report by 28 February 2017. 1.

37. The licensee must implement the Ecotoxicology Plan with all qualified professional's recommendations.

1.2 Objective and limitations

This Ecotoxicological Plan has been developed for Vista Gold Australia Pty Ltd (Vista Gold) to meet the requirements of WDL 178-05. The objectives of this plan are detailed in Condition 35 of the WDL.

1.2.1 Limitations

This report has been prepared by GHD for Vista Gold Australia Pty Ltd (Vista Gold). and may only be used and relied on by Vista Gold Australia Pty Ltd (Vista Gold)., NT EPA and DPIR for the purpose agreed between GHD and Vista Gold Australia Pty Ltd (Vista Gold) as set out in Section 1.3 of this report.

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1.3 Assumptions

In the development of this Plan GHD assumes the following:

All bioassays listed in this Plan are available and that testing will be conducted by the laboratory in a timely fashion.

The water discharged in the future would be of similar quality as a representative sample of water that is currently discharged.

2. Ecotoxicological plan

2.1 Introduction

WDL 178-05 requires the Mt Todd discharge to be assessed using site specific DTA following the methodology set out in Section 8.3.6 of ANZECC (2000).

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This ecotoxicological plan will conduct DTA of the treated discharge effluent (RP3) using two selected species and a screening toxicity assessment at the discharge point (SW4) using the same species.

2.2 Previous ecotoxicity studies

2.2.1 Discharge point - 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 of treated mine water. The cladoceran reproduction results showed increased reproduction when compared to the upstream sites, indicating no chronic toxicity. Table 2-1 shows the results for the screening bioassays.

Table 2-1 Results of the screening toxicity assessment in February 2015

Test	Control	SW2	SW13	SW4
Cladoceran 7-day reproduction (chronic)	100 %	50%	93%	102 %
Cladoceran 7-day survival (acute)	80 %	90 %	100 %	100 %

2.2.2 Treated Discharge Effluent (RP3)

A total of 19 DTA values were used to calculate a dilution algorithm, all of which were obtained between 2010 – 2015 using treated and untreated gold mine discharges. 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.

Information on species used in the DTAs conducted for previous ecotox programs and that are suitable for use to assess tropical freshwater systems are shown in Table 2-2.

Table 2-2 Species Suitable for Use in Ecotoxicological Assessment at RP3

Test Organism	Test Duration Temperature	Test Endpoint	Key Reference
Selenastrum capricornutum (green alga)	72 hour (chronic) 25 ± 1°C	Growth inhibition	USEPA Method 1003.0 (2002)
Chlorella vulgaris (green alga)	72 hour (chronic) 25 ± 1°C	Growth inhibition	USEPA Method 1003.0 (2002)
Lemna aequinoctialis (duckweed)	96 hour (chronic) 29 ± 2°C	Growth (frond number)	OECD Method 221 (2006)
Ceriodaphnia dubia (cladoceran)	7 day (chronic) 25 ± 1°C	Reproduction	USEPA (2002)
Hydra viridissima Pallas (green hydra)	96 hour (chronic) 27± 1°C	Population growth	Riethmuller *et al.* (2003)
Chironomus tepperi (chironomid)	48 hour (acute 25 ± 1°C)	Survival	USEPA (2002), OECD (2011)
Paratya australiensis (shrimp)	96 hour (acute) 20 ± 1°C	Survival	ESA SOP 123 (ESA 2012)
Macrobrachium rosenbergii (freshwater prawn)	96 hour (acute) 25 ± 1°C	Survival	ESA SOP 123 (ESA 2012)
Melanotaenia splendida (rainbowfish)	10 - 12 day (chronic) 25 ± 1°C	Embryonic development and post hatch survival	USEPA (2002)

NOTE: The duration of the cladoceran bioassay is determined by the time it takes for the control cladocerans to produce three broods of offspring. This may take between six and eight days.

2.2.3 Dilution algorithm last revision (2016)

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. In total 19 DTA data sets, including the Vista Gold ecotoxicity data (October 2011 to February 2015) and the NTMO data, with data from the NT EPA report (GHD 2016), has been used to calculate the dilution algorithm. Total TUs were calculated for sulphate, aluminium, cobalt, copper, nickel and zinc. The data used in the algorithm is shown in Table 2-3.

Table 2-3 Total 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

A linear regression was conducted on the data in Table 2-3 and shown in Figure 1. The R^2 value is 0.969, 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 (GHD 2014), 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 1.

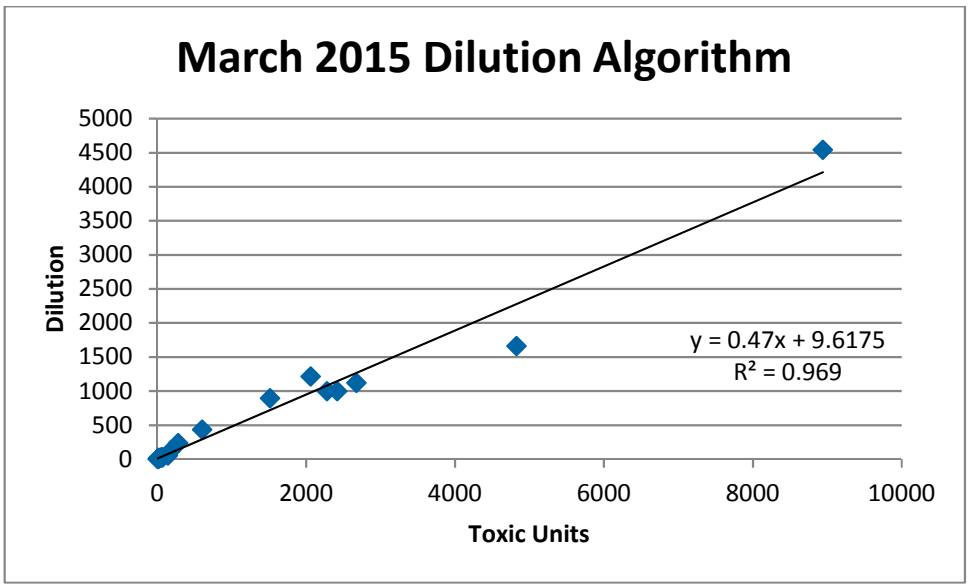

Figure 2-1 Linear regression for dilution algorithm

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 (GHD 2015) and in 2016 with Cosmo Howley mine water (GHD 2016). The dilutions algorithm to meet the 80 percent species protection is:

Total Toxicity Units (SO_4, Al, Cu, Ni and Zn): $y = 0.47x + 9.6175$

This algorithm will provide a conservative estimation of dilution at low TUs which are expected to be found in RP3 after the 2014 treatment process as the minimum dilution factor that will be calculated will be >1:10.

2.3 Program

The toxicity assessment program presented in this Ecotoxicological Plan includes a screening toxicity assessment at the waste water discharge point at Edith River (SW4) and a serial diluted toxicity assessment of the treated waste effluent (RP3) (Table 2-4) to meet WDL 178-05. A detailed description of how this plan meets the requirements in the WDL is presented in Table 2-4.

2.3.1 Screening Bioassays at discharge point

Screening bioassays are used to assess the toxicity of natural waterways where the water quality is not expected to show toxicity. The screening bioassays use an undiluted water sample from each site for the assessment. The results of the screening bioassay will be compared to a natural water upstream sample and a laboratory control water sample. A result of >80% when compared to controls indicates that the water quality shows no significant toxicity. The screening results can also be used to compare water chemistry and toxicity spatially across a site and temporally if historical results are available.

This Plan proposes using the 7 day *Ceriodaphnia dubia* reproduction bioassay (this is the most sensitive species as determined by previous studies) and the duckweed *Lemna aequinoctialis* (Growth). The organisms within both bioassays will be exposed to 100% of the sample (SW4) only (sampled during RP3 discharge). The screening bioassays will be run concurrently with a laboratory control sample. Toxicity is observed if the difference between the test and the controls is >20%.

Table 2-4 2017 Ecotox program

Condition	Requirements	Justification
35.1	Screening bioassays at SW4 and SW2 using: 7 day *Ceriodaphnia dubia* reproduction bioassay; and *Lemna aequinoctialis* (Growth). SW4 must be sampled during discharge	Meets 34.1 and 34.4
35.2	RP3 – whole effluent serial dilution using: • 7 day *Ceriodaphnia dubia* reproduction bioassay; and • *Lemna aequinoctialis* (Growth). Both tests will be conducted with two diluents: • SW2 (upstream water) • Laboratory diluent	Previous monitoring has shown that SW2 (upstream water) can adversely impact on cladoceran reproduction at low RP3 concentrations when used as a diluent.
35.3	Water quality will be tested to ensure that water tested at RP3 is representative of the quality of water discharged. Water quality will be assessed against historical data to date to ensure compliant.	Ensure that RP3 water tested is representative of the quality of water discharged.
35.4	Cladoceran *Ceriodaphnia dubia* and duckweed *Lemna aequinoctialis* will be used is this Plan	Both have shown to be sensitive to the discharge
35.5	Concentrations to be tested for condition 34.2: 100, 50, 25, 12.5, 6.6, 3.1 and 0% This will apply to both Cladoceran and duckweed DTA	To provide an EC_{10} and EC_{50} data point for comparison to downstream toxicity and to update the dilution factor, if required
35.6	Data from the Cladoceran and duckweed bioassays will be compared against previous data GHD (2016) to find significance differences in toxicity in samples with similar water chemistry. The algorithm will be updated if new data is significantly different.	To provide an updated algorithm with the latest validated data, if required
35.7	Chemical analysis as per WDL requirements as detailed in Table 2-6	To ensure chemical analyses include the most likely key contaminants in the discharge

With the addition of a chronic bioassays when compared to the 2015 screening results (see Table 2-1), this plan will meet requirement specified in points 35.1, i.e. to verify the ecosystem protection in the Edith River at the 80% species protection level near the point of discharge (SW4).

2.3.2 RP3 whole effluent toxicity

Two chronic bioassay are proposed to undertake a whole effluent DTA of RP3, the 7 day *Ceriodaphnia dubia* reproduction bioassay (this is the most sensitive species as determined by previous studies) and the duckweed *Lemna aequinoctialis* growth bioassay. Both species has showed to be sensitive to RP3 samples in previous studies. This will meet requirements of the WDL (point 35.2 and 35.4).

Dilution series

Where a dilution series is identified, a geometric progression series is recommended:

100% sample, 50%, 25%, 12.5%, 6.25%, 3.13%, site control and laboratory control. An additional low concentration has been included to provide sufficient data to improve the EC10 95% confidence limits to ensure compliance if the point 35.5 of the WDL. An additional dilution series with the same concentrations will be conducted with laboratory diluent as detailed below.

Dilution water

ANZECC (2000) recommends the use of water upstream of the pollutant source as the diluent in DTAs (section 8.3.6.7). However, previous monitoring has shown that upstream water (SW2) may adversely impact on cladoceran reproduction at low RP3 concentrations when SW2 is used as a diluent. This Plan proposes the use of SW2 water as a diluent together with an additional dilution water provided by the laboratory. This will assist in identifying false positive toxicity results that could be caused by the diluent.

2.4 Quality assurance

All bioassays are NATA accredited and, as such, are regulated as to quality assurance. Each bioassay is conducted with a laboratory control (the water in which the organisms are grown), diluent control and a reference toxicant.

Sampling in 2017 wet season will occur during discharge events following the Australian Standard method for water sampling with all sample containers filled to the top (i.e. no air spaces). Samples will be immediately chilled on ice prior to transport to the ESA laboratory in Sydney. Volumes required for each site will be confirmed by ESA. ESA uses the following quality assurance parameters for each test as shown in Table 2-5.

Table 2-5 Quality assurance criteria

Bioassay	QA/QC Parameter	Criteria
Duckweed	Control specific growth rate	>0.231
	Reference toxicant (within Cusum chart limits)	Currently 6.2 – 62.8 mg/L Mg
Cladoceran	Control mean % unaffected	≥80%
	Control mean number of young /adult	≥15.0
	Reference toxicant (within Cusum chart limits)	Currently 171 – 262 mg/L KCl

2.5 Water quality

Water quality will be tested to ensure that water tested at RP3 is representative of the quality of water discharged to the Edith River. Water quality will be assessed against historical data to date to ensure that the quality is representative of water historically discharged from the site to meet Condition 35.3 of the WDL. An assumption is made that water discharged in the future would be of similar quality (if not, improved) as a representative sample of water that is currently discharged.

All water samples for ecotox testing will be concurrently analysed for the suite of analytes shown in Table 5-3, meeting the analyses required in Condition 35.7 of WDL. Analysis will be conducted by a NATA accredited laboratory and sampled according to Australian Standards.

Table 2-6 Chemical analyses

	Analytes
In-Situ	EC (µS/cm), pH, DO (%),Temperature (°C)
Metals (Total and Filtered 0.45 µm)	Aluminium, Cadmium, Cobalt, Copper, Nickel, Zinc, Iron Manganese and Lead
Others	Sulfate, Bicarbonate, Chloride, Magnesium, total cyanide

2.6 Dilution algorithm update with new data

The current algorithm last revised in 2016 (See section 2.2.3) will be updated with new data if comparison of new data against previous data is significantly different, in order to meet point 35.6 in the WDL. 2017 results will be compared to previous duckweed and cladoceran data where water quality is of a similar type.

2.7 Review

To meet Condition 36.1, the Plan has been reviewed by Dr Tristan Stringer. Any comments by the Reviewer have been addressed in this version of the Plan and the reviewer's commenbts are found in Appendix A. The Review letter is provided in Appendix B to this Plan.

2.8 Submission to the NT EPA

To meet Condition 36.2, the Plan will be submitted to the NT EPA by COB 24 March 2017.

2.9 Reporting

All chemistry and ecotox results will be provided in an interpretive report. All NATA certified results will be attached.

Vista Gold will provide a report to the EPA, by 30 May 2017, ensuring that includes a summary of the outcomes of the Ecotoxicology Assessment Plan.

3. References

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.

GHD (2014) Vista Gold Australia. Discharge Plan Revision 3. December 2014.

GHD (2015). Vista Gold Australia Pty Ltd Mt Todd Waste Discharge Licence Algorithm Validation Report: 43/22187/10. 36pp

GHD (2016). Newmarket Gold Inc Cosmo Howley Project Area Algorithm Validation. Ref:. 43/22434/00.

Warne, M, Batley, G, van Dam R, Fox, DR, Hickey, C, and Stauber,J, 2014. Revised method for deriving Australian and New Zealand water quality guideline values for toxicants. Prepared for the Council of Australian Government's Standing Council on Environment and Water (SCEW).

Appendix A – Reviewer's Comments

Vista Gold Australia Pty Ltd

Mount Todd Ecotoxicological Plan

February 2017

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19	Feb-15	RP3	31	15.8

A linear regression was conducted on the data in Table 2-3 and shown in Figure 1. The R^2 value is 0.969, 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 1.

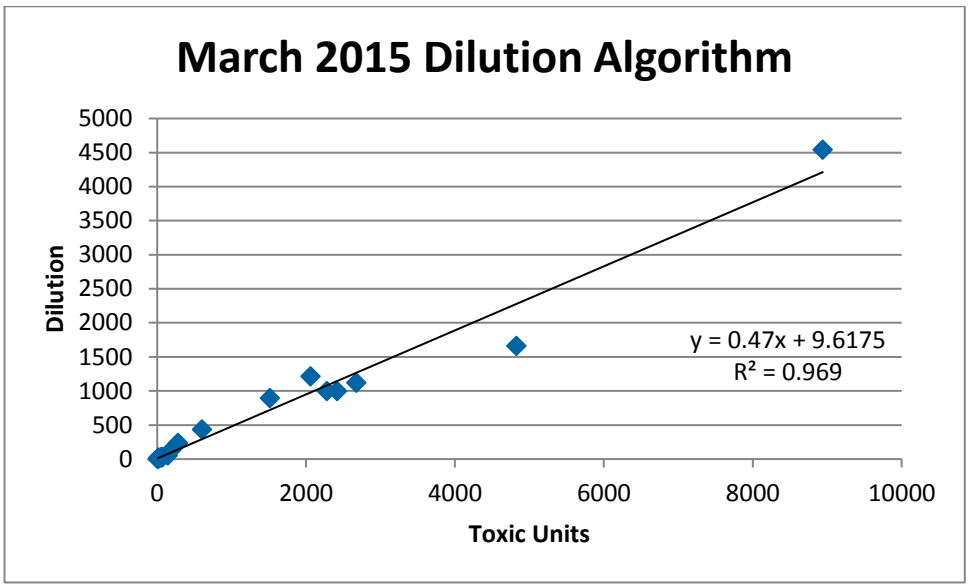

Figure 2-1 Linear regression for dilution algorithm

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 (GHD 2015) and in 2016 with Cosmo Howley mine water (GHD 2016). The dilutions algorithm to meet the 80 percent species protection is:

Total Toxicity Units (SO_4, Al, Cu, Ni and Zn): $y = 0.47x + 9.6175$

This algorithm will provide a conservative estimation of dilution at low TUs which are expected to be found in RP3 after the 2014 treatment process as the minimum dilution factor that will be calculated will be >1:10.

2.3 Program

The toxicity assessment program presented in this Ecotoxicological Plan includes a screening toxicity assessment at the waste water discharge point at Edith River (SW4) and a serial diluted toxicity assessment of the treated waste effluent (RP3) (Table 2-4) to meet WDL 178-05. A detailed description of how this plan meets the requirements in the WDL is presented in Table 2-4.

2.3.1 Screening Bioassays at discharge point

Screening bioassays are used to assess the toxicity of natural waterways where the water quality is not expected to show toxicity. The screening bioassays use an undiluted water sample from each site for the assessment. The results of the screening bioassay will be compared to a natural water upstream sample and a laboratory ~~water control~~ sample. A result of >80% when compared to controls indicates that the water quality shows no significant toxicity. The screening results can also be used to compare water chemistry and toxicity spatially across a site and temporally if historical results are available.

This Plan proposes using the 7 day *Ceriodaphnia dubia* reproduction bioassay (this is the most sensitive species as determined by previous studies) and the duckweed *Lemna aequinoctialis* (Growth). The organisms within both bioassays will be exposed to 100% of the sample (SW4) only (sampled during RP3 discharge). The screening bioassays will be run concurrently with a laboratory control sample. Toxicity is observed if the difference between the test and the controls is >20%.

Table 2-4 2017 Ecotox program

Condition	Requirements	Justification
34.1	Screening bioassays at SW4 and SW2 using: 7 day *Ceriodaphnia dubia* reproduction bioassay *Lemna aequinoctialis* (Growth). 100% SW4 must be sampled during discharge	Meets 34.1 and 34.
34.2	RP3 – whole effluent DTA using: • 7 day *Ceriodaphnia dubia* reproduction bioassay • *Lemna aequinoctialis* (Growth). 100% Both test will be conducted with two diluents: • SW2 (upstream water) • Laboratory diluent	Previous monitoring has shown that SW2 (upstream water) adversely impacts on cladoceran reproduction at low RP3 concentrations when used as a diluent.
34.3	Water quality will be tested to ensure that water tested at RP3 is representative of the quality of water discharged. Water quality will be assessed against historical data to date to ensure compliant.	Ensure that RP3 water tested is representative of the quality of water discharged.
34.4	Cladoceran *Ceriodaphnia dubia* and duckweed *Lemna aequinoctialis*. will be used is this plan	Both has shown to be sensitive to the discharge
34.5	Concentrations to be tested for condition 34.2: 100, 50, 25, 12.5, 6.6, 3.1 and 0% This will aply for both Cladoceran and duckweed DTA	To provide an EC_{10} and EC_{50} data point for comparison to downstream toxicity and to update the dilution factor
34.6	Data will be compared against previous data GHD (2016) to find significance differences. The algorithm will be updated if new data is significantly different	To provide an updated algorithm with the latest valid data
34.7	Chemical analysis as per WDL requirements as detailed in Table 2-6	To ensure chemical analyses include the most likely key contaminants in the discharge

With an additional chronic bioassay compare to the 2015 Ecotoxicity) Plan(see Table 2-1, this plan will meet requirement specified in points 34.1, i.e. to verify the ecosystem protection in the Edith River at the 80% species protection level near the point of discharge (SW4).

2.3.2 RP3 whole effluent toxicity

Two chronic bioassay are proposed to undertake a whole effluent DTA of RP3 the 7 day *Ceriodaphnia dubia* reproduction bioassay (this is the most sensitive species as determined by previous studies) and the duckweed *Lemna aequinoctialis*. Both species has showed to be sensitive to RP3 samples in previous studies. This will meet requirements of the WDL (point 34.2 and 34.4).

Dilution series

Where a dilution series is identified, the geometric progression series is recommended:

100% sample, 50%, 25%, 12.5%, 6.25%, 3.13%, site control and laboratory control. An additional low concentration has been included to provide sufficient data to improve the EC10 95% confidence limits to ensure compliance if the point 34.5 of the WDL. An additional dilution series with the same concentrations will be conducted with laboratory diluent as detailed below.

Dilution water

ANZECC (2000) recommends the use of water upstream of the pollutant source as the diluent in DTAs (section 8.3.6.7). However, previous monitoring has shown that upstream water (SW2) adversely impacts on cladoceran reproduction at low RP3 concentrations when used as a diluent. This Plan proposes the use of SW2 water as a diluent together with an additional dilution water provided by the laboratory. This will assist in identifying false positive toxicity results that could be caused by the diluent.

2.4 Quality assurance

All bioassays are NATA accredited and, as such, are regulated as to quality assurance. Each bioassay is conducted with a laboratory control (the water in which the organisms are grown), diluent control and a reference toxicant.

Sampling in 2017 wet season will occur during discharge events following the Australian Standard method for water sampling with all sample containers filled to the top (i.e. no air spaces). Samples will be immediately chilled on ice prior to transport to the ESA laboratory in Sydney. Volumes required for each site will be confirmed by ESA. ESA uses the following quality assurance parameters for each test as shown in Table 2-5.

Table 2-5 Quality assurance criteria

Bioassay	QA/QC Parameter	Criteria
Duckweed	Control specific growth rate	>0.231
	Reference toxicant (within Cusum chart limits)	Currently 6.2 – 62.8 mg/L Mg
Cladoceran	Control mean % unaffected	≥80%
	Control mean number of young /adult	≥15.0
	Reference toxicant (within Cusum chart limits)	Currently 171 – 262 mg/L KCl

2.5 Water quality

Water quality will be tested to ensure that water tested at RP3 is representative of the quality of water discharged. Water quality will be assessed against historical data to date to ensure compliant of point 34.3 of the WDL. An assumption is made that water discharged in the future would be of similar quality as a representative sample of water that is currently discharged.

All water samples for ecotox testing will be concurrently analysed for the suite of analytes shown in Table 5-3, meeting the analyses required in the point 34.7 of WDL. Analysis will be conducted by a NATA accredited laboratory and sampled according to Australian Standards.

Table 2-6 Chemical analyses

	Analytes
In-Situ	EC (µS/cm), pH, DO (%),Temperature (°C)
Metals (Total and Filtered 0.45 µm)	Aluminium, Cadmium, Cobalt, Copper, Nickel, Zinc, Iron Manganese and Lead
Others	Sulfate, Bicarbonate, Chloride, Magnesium, , total cyanide

2.6 Dilution algorithm update with new data

The current algorithm last revised in 2016 (See section 2.2.3) will be updated with new data if comparison of new data against previous data is significantly different, in order to meet point 34.6 in the WDL

2.7 Review

To meet Condition 35.1, the Plan will be reviewed by Dr Ross Jeffree. The written Review will be provided as an appendix to this Plan. Any comments by the Reviewer will be addressed prior to submission to the EPA.

2.8 Submission to the NT EPA

To meet Condition 35.2, the Plan will be submitted to the NT EPA by COB 28 February 2017.

2.9 Reporting

All chemistry and ecotox results will be provided in an interpretive report. All NATA certified results will be attached.

Vista Gold will provide a report to the EPA, by 30 April 2017, ensuring that includes a summary of the outcomes of the Ecotoxicology Assessment Plan.

3. References

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.

GHD (2015). Vista Gold Australia Pty Ltd Mt Todd Waste Discharge Licence Algorithm Validation Report: 43/22187/10. 36pp

GHD (2016). Newmarket Gold Inc Cosmo Howley Project Area Algorithm Validation. Ref:. 43/22434/00.

Warne, M, Batley, G, van Dam R, Fox, DR, Hickey, C, and Stauber,J, 2014. Revised method for deriving Australian and New Zealand water quality guideline values for toxicants. Prepared for the Council of Australian Government's Standing Council on Environment and Water (SCEW).

GHD

Level 5, 66 Smith Street Darwin NT 0800
GPO Box 351 Darwin NT 0801
T: (08) 8982 0100 F: (08) 8981 1075 E: drwmail@ghd.com.au

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	V Perez-Landa	J Woodworth		J Woodworth		27/02/2017

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Appendix B – Letter of Review

intertek
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Intertek
41-45 Furnace Road
Welshpool
Western Australia 6106
Australia

Tel +61 8 9263 0263
intertek.com

17 March 2017

Dr Jill Woodworth
GHD
Level 7, 24 Mitchell St
Darwin, Northern Territory, 0800
Australia

Dear Dr Woodworth,

Mount Todd Ecotoxicological Plan Professional Review

An Ecotoxicological Plan has been developed by GHD for Vista Gold Australia Pty Ltd in regards to the planned discharge at the Mount Todd mine site. The Ecotoxicological Plan describes the methodologies necessary for meeting the requirements stipulated in section 35 of the Waste Discharge Licence WDL 178-05.

After careful review of the Ecotoxicological Plan and Section 35 of the Waste Discharge Licence it is my professional opinion that methodologies described meet the requirements stipulated in the Waste Discharge Licence.

Yours sincerely,

Dr Tristan Stringer
Principal Ecotoxicologist

GHD

Level 7, 24 Mitchell Street Darwin NT 0800
GPO Box 351 Darwin NT 0801
T: (08) 8982 0100 F: (08) 8981 1075 E: drwmail@ghd.com.au

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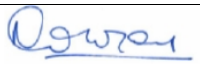
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	V Perez-Landa	J Woodworth		J Woodworth		27/02/2017
0	V Perez-Landa	J.Woodworth		N.Conroy		23/03/2017

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