AngloGold Ashanti Australia

TROPICANA GOLD PROJECT

TROGLOFAUNA SURVEY REPORT ADDENDUM PHASE 5

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TROPICANA GOLD PROJECT

Troglofauna Survey Report Addendum

PHASE 5 ADDITIONAL SURVEY RESULTS

Tropicana Joint Venture

ANGLOGOLD ASHANTI AUSTRALIA

INDEPENDENCE GROUP NL

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EXECUTIVE SUMMARY

The troglofauna survey carried out at the Tropicana Gold Project (TGP) Area for the Tropicana Joint Venture confirmed the presence of troglofauna within the TGP operational area both within and outside the mine and infrastructure footprint. Most species collected have been found inside the proposed mining area (troglobitic dipluran and centipede) where they would be directly impacted by mining activities, therefore the impact to the troglobitic community from the TGP development was considered potentially significant. Further surveying for troglofauna was therefore recommended and subsequently implemented in areas outside the mine and infrastructure footprint to account for the troglobitic dipluran and centipede.

In spite of the extensive sampling efforts, the additional surveying to date (Phase 5) has not identified further troglobitic specimens occurring outside the project area. Consequently, a review of the habitat in which the troglofauna specimens were found inside the TGP area was conducted instead. The results of the review showed that troglofauna occurred in regolith habitats which extend well outside the TGP area. The troglobitic communities are, therefore, also considered likely to extend outside the TGP area.

1.0 BACKGROUND

The troglofauna survey carried out at the Tropicana Gold Project (TGP) Area for the Tropicana Joint Venture confirmed the presence of troglofauna within the TGP operational area both within and outside the mine and infrastructure footprint. Most species collected to date have been found inside the proposed mining area where they will be directly impacted by mining activities, therefore the impact to the troglobitic community from the TGP development is potentially significant. Further surveying for troglofauna was therefore recommended in areas outside the mine and infrastructure footprint to account for the troglobitic dipluran and centipede.

2.0 RESULTS

Phase five additional sampling has yielded over 1,000 invertebrate specimens representing six orders, none of which were troglobitic. These include: Coleoptera (Rove and Carpet beetles); Diptera (biting midges); Acari (mites); Collembola (springtails); Hymenoptera (ants) and Isopoda (slaters). The isopods were found to be subterranean dwellers but not troglobitic (S. Judd, pers.comm., 2009). The rest of the specimens were classified as accidentals.

Table 1 Summary of Troglofauna Previously Recorded in Phases 1-4 (note. none recorded from Phase 5)

Organism	Total #	Code	Institution	Expert	Hole ID	Depth (m)	Location
Diplura (diplurans)	1	865_002	WAM	W. Humphreys	TPA 3981	20	Inside
Chilopoda (centipedes)	1	858_023	WAM	W. Humphreys	TPMB 099	stygo net*	Inside
Isopoda (slaters)	1	858_021	WAM	W. Humphreys	TPMB 100	stygo net*	Inside
Isopoda (slaters)	2	865_015	WAM	W. Humphreys	TPD 057	10	Inside
Isopoda (slaters)	1	865_017	WAM	W. Humphreys	TPD 057	20	Inside
Isopoda (slaters)	1	865_014	WAM	W. Humphreys	TPRC583	20	Inside
Isopoda (slaters)	1	08:0248	*ecologia*	G. Whyte	TPA3977	17	Inside
Isopoda (slaters)	1	08:0845	ECU	S. Judd	TPA 4270	13	Outside

* recorded during stygofauna survey during November 2007. Stygofauna sampling involves deploying a 50 µl and a 150 µl mesh net into a drill hole down to the water column. Each net is deployed 3x and the contents collected, sieved and placed in vials of 70% ethanol with the samples being examined in the laboratory.

2.1 Summary of Groups

2.1.1 Isopods (Phylum Arthropoda, Subphyllum Crustacea, Class Malacostraca)

Two specimens were found: however, both had small eyespots and a small amount of pigmentation. Further examination by the isopod expert Dr Simon Judd (ECU) determined these to be subterranean dwellers but not troglobitic.

2.1.2 Collembola (Springtails) and Acarina (Mites)

Springtails and mites were recorded from a range of depths at several sites during the survey. Both groups inhabit the top layer of soil where they rely on decaying leaf matter for nutrition and are likely to be troglofiles or opportunistic feeders on the traps. Due to their typical near-surface habitat, they are not likely to be rare or restricted species and are therefore not unduly at threat from the mine and infrastructure footprint.

2.1.3 Accidental Fauna

A range of non-troglobitic invertebrate fauna were recorded, presumably accidentals which had fallen into the drill holes. These included beetles, biting midges, and various forms of larvae. These species were determined as not being troglobitic due to heavy pigmentation and/or well developed eyes and were thus excluded from further studies.

2.2 Habitat assessment

Previous examination of core samples from the vicinity of the original site (TPMB100) that yielded troglobitic species revealed no obvious habitat suitable for troglofauna colonisation. Only two zones showed some degree of porosity – a part of gneiss rock at 49 m bgl (Figure 1) and a layer of saprolitic clay with root mats of the surface vegetation, approximately 6-7 m bgl (Figure 2). Given that distance to ground water is 30-40 m bgl, the porous part of the gneiss rock is submerged and thus unsuitable for troglofauna colonisation. Thus the relatively shallow interface of the saprolitic clay with root mats is potentially the only zone suitable for troglofauna habitation.

Figure 1 Layer of Gneiss Rock 49 M bgl with Small Void Spaces. This Zone is Normally Submerged in Ground Water and thus Uninhabitable for Troglofauna.

Figure 2 Interface of Saprolitic Clay and Root Mats Approx. 6 M bgl. This Layer Contains Very Small Voids Created by Roots of Surface Vegetation and thus Could Potentially be Utilised as Habitat by Troglofauna.

3.0 DISCUSSION

To date, the additional sampling programme has not yielded any more troglobitic species (in particular the dipluran and the centipede) outside of the TGP impact area. The known distribution of both the centipede and the dipluran is currently restricted within the mine and infrastructure footprint and therefore fully impacted by the TGP. In particular, the centipede was located in the middle of the proposed pit outline whereas the dipluran was located in the proposed tailings dam area. The isopods are only partially impacted as they were located both inside and outside the proposed mining area (Table 2).

It remains difficult to determine which part of the geology the troglofauna in the TGP operational area occupy. The most prospective candidate for the suitable subterranean habitat is possibly the interface of saprolitic clay and root mats, which contains small voids created by decayed roots. Layers of gneiss rock, which contain fissures and are porous, may also be suitable provided they are not submerged in the water column.

The Tropicana area is at the juncture of three regionally extensive bio domains, the Great Victoria Desert, the Eucla Basin-Nullarbor Plain, and the Yilgarn Craton. Individually, these domains cover a vast area of many hundreds square kilometres with only slight variations in climate, biogeography, landform and regolith expression. With the exception of extensive sand dune cover within the Great Victorian Desert proper, 15 to 25 percent of the neighbouring bio domains cover is of similar regolith duricrust found at Tropicana, which are likely to support troglofauna. Figure 3 displays the location of troglofauna specimens within the TGP area and the different regolith units they were found in.

As can be seen in Figure 4 the same regolith units that occur inside the TGP area where troglofauna specimens were found continue to extend outside the TGP area on a regional level. It is known that geologically old and stable terrain provide the best possibility of supporting the continuous presence of troglofauna. The regolith of the Tropicana region is a product of a long weathering history, having evolved on a stable land mass over millions of years and therefore would be appropriate in providing the necessary habitat required for troglofauna.

The stability of the subterranean habitat at Tropicana is influenced by the duricrust. Duricrust are less prone to environmental disturbance and are geologically stable and resistant to further weathering and erosion under present weathering conditions. The indurated caprock found in the Tropicana region protects the subsurface profile from water and sediment inundation, flooding during episodes of high rainfall and from dehydration during extended dry periods. The caprock insulates the subsurface from large fluctuations in external temperatures and maintains an ambient environment. The caprock also acts as a barrier to capillarity rise and therefore creates an environment in the subsurface which is constantly moist and humid (Lawrance 2009).

Despite the duricrust caprock tending to be massive and largely impermeable, structural cracks and solution pipes between slabs allow local access to the surface. Interconnecting cavities and voids are common and are linked by fractures and root canals. These features allow the profile to be well ventilated and provide access of water and oxygen and an allochthonous food supply for the subterranean ecosystems. This suggests the extensive duricrust found in the Tropicana regional area provides a stable regolith environment and highly favourable conditions necessary to sustain troglofauna (Lawrance 2009).

In conclusion, the presence of troglofauna at Tropicana has been confirmed by the location

of three species within the TGP area. Although to date their actual habitat has not been clearly defined, the Tropicana area has regolith that is highly favourable to the formation of stable subterranean troglofauna habitat. Due to the broad range of similar climate, biogeography, landform and regolith settings found in surrounding bio domains, similar potential troglofauna habitat is present over an extensive range outside the TGP area. It is therefore probable that all three troglofauna species recorded within the TGP area are located in areas not affected by the proposed TGP.

Table 2 Summary of Troglobitic Specimens Impacted by the Mine and Infrastructure Footprint of TGP (Full Impact in Red, Partial Impact in Black)

Class	Order	inside	outside
Malacostraca	Isopoda (Slaters)	TPMB 100, TPD 057, TPRC 583, TPA 4270	TPA 3977
Chilopoda	Chilopoda (Centipedes)	TPMB 099	-
Entognatha	Diplura (Diplurans)	TPA 3981	-

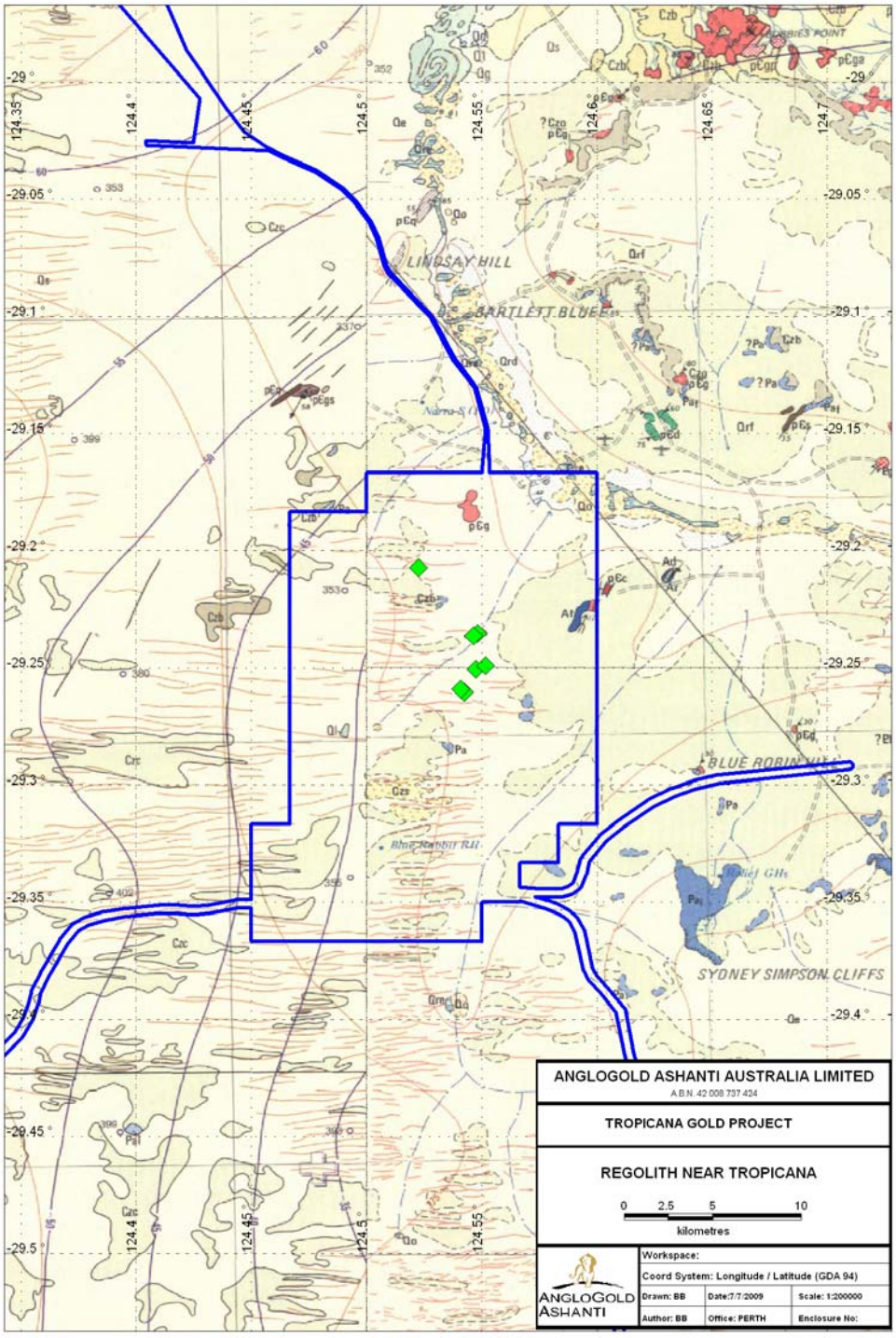

Figure 3 Map Showing Troglofauna Specimen Locations and Regolith Units at Tropicana (Blue lines represent the Tropicana impact area, green diamonds show sampled troglofauna locations, dotted lines and different colour backgrounds indicate different regolith units).

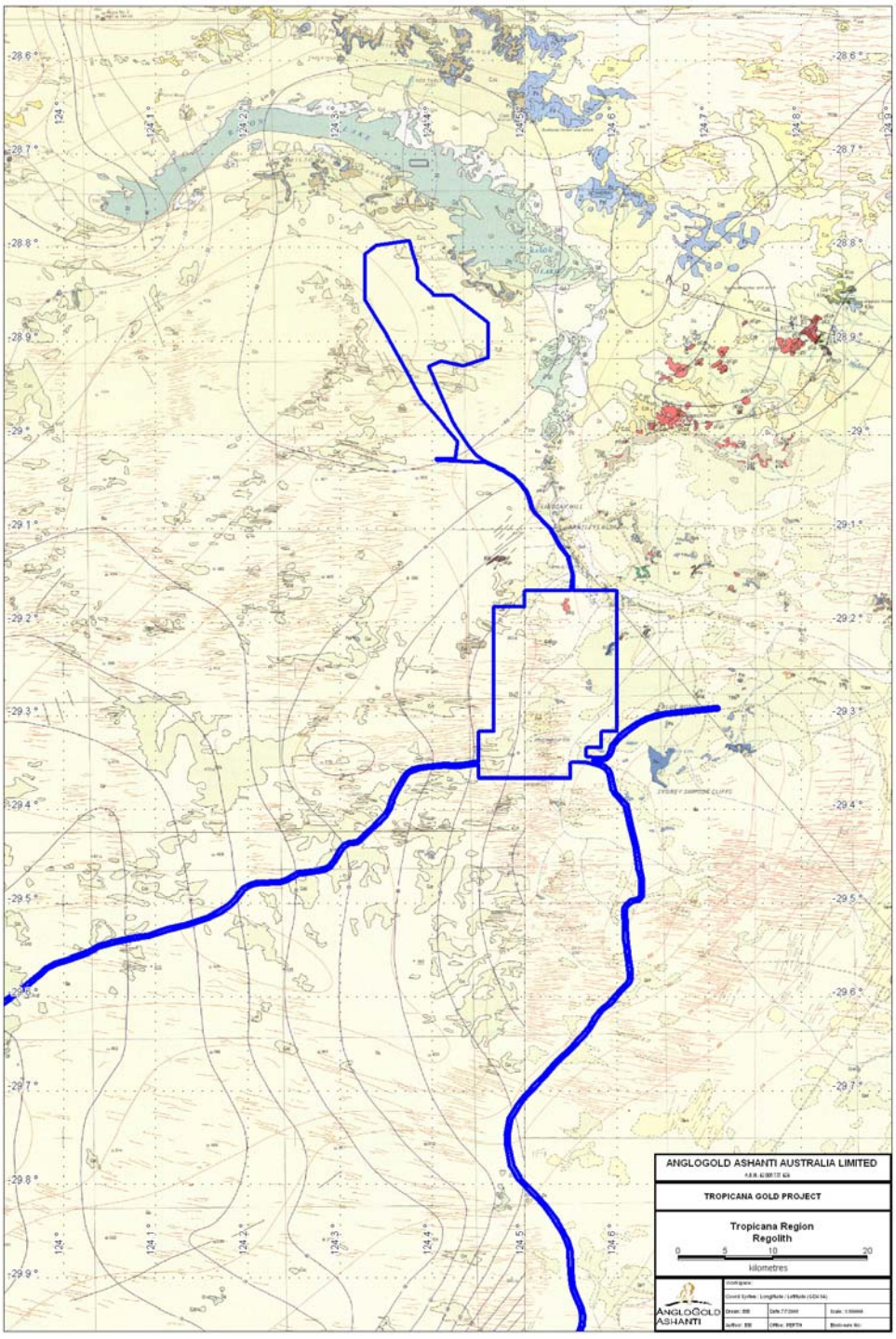

Figure 4 Map Showing Regional Regolith Units at Tropicana (Blue lines represent the Tropicana impact area, dotted lines and different colour backgrounds indicate different regolith units).

4.0 MANAGEMENT RECOMENDATIONS

Subterranean ecosystems and the fauna they support may face significant risks from a number of mining related processes, most significant of which is the ore extraction process itself, which directly removes the habitat and dependent species. Other risks to sub-surface dwelling species and communities may also occur as a result of surface operations, e.g. surface sealing or clearing and hydrocarbon and other contaminants (Humphreys 2001), which may impact upon the physical and chemical elements of the habitat. However, the lowering of the water table, associated with pit dewatering, may also impact upon troglofauna habitat by altering the humidity of those habitats. Troglofauna are very sensitive to subtle changes in their environment as they are generally adapted to an environment that sees only minor physical, chemical and biological change.

Mining, which is currently being proposed, could potentially have a significant impact on troglofauna habitat by:

- directly removing all or part of their habitat;
- changing the habitat temperature, humidity, elemental ratios, availability of organic matter and interrupting the food chain by exposing voids to atmospheric oxygen, water content and pollutants;
- lowering the water table sufficiently to effect the temperature and humidity of voids immediately above the water table; or
- contamination of habitats through hydrocarbon / chemical spills.

The following management recommendations may mitigate potential risks to troglobitic communities:

- Conducting further surveying using ‘smelly baited’ traps to increase likelihood of catching troglofauna.
- Confining impacts to the minimum area practical for the establishment of the mine and associated infrastructure.
- Preventing contamination of troglobitic habitats by hydrocarbon / chemical spills as per site procedures.
- Conducting further surveying prior to establishing new mining or infrastructure areas outside the proposed TGP footprint presented in the PER.

A risk assessment was undertaken to determine potential impacts arising from the TGP development on troglofauna and the residual impacts following the implementation of management strategies identified in this document. The ‘Significance’ of the risks is classified as either “High” (site/issue specific management programmes required, advice/approval from regulators required), “Medium” (specific management and procedures must be specified) or “Low” (managed by routine procedures). The impact risk assessment matrix is presented in Table 5.

5.0 REFERENCES

Humphreys, W. F. 2001. Groundwater calcrete aquifers in the Australian arid zone: the context to an unfolding plethora of stygal biodiversity. Records of the Western Australian Museum, Supplement No. 64: Subterranean Biology in Australia 2000:63-83.

Lawrance, L. 2009. Tropicana Gold Project: review of local and regional regolith types and distribution as potential troglofauna habitat. . Unpublished report for AngloGold Ashanti Australia Ltd.,

Appendix 1

Site Locations and GPS Co-ordinates for Phase Five Additional Sampling

Table 3 Sites Sampled During Phase Five, Round One (Trap Diameter 80 mm). All Holes Located Outside the Mine and Infrastructure Footprint. Stuck traps (samples not retrieved) in red.

HOLE ID	Depth (m)	Zone	Eastings	Northings	Samples Collected
TCA011	22	51J	628797	6749631	1
TCA060	59	51J	629997	6751230	1
TCA062	42	51J	630397	6751231	1
TPA2312	31	51J	625709	6744616	1
TPA2695	25	51J	628870	6741950	1
TPA2698	44	51J	627770	6742750	1
TPA3272	19	51J	636868	6744436	1
TPA1967	22	51J	645700	6744544	0
TPA1961	23	51J	644500	6744367	1
TPA1953	24	51J	642874	6744402	1
TPA3280	30	51J	640054	6744400	1
TPA3275	32	51J	638075	6744372	0
TPA3268	24	51J	635257	6744523	0
TPA3258	25	51J	631260	6745052	1
TPA2678	20	51J	627269	6741145	1
TPA2703	18	51J	628754	6742758	1
TPA2709	25	51J	628270	6743550	1
TPA3308	40	51J	628058	6736004	1
TPA3316	25	51J	631261	6735999	1
TPA3320	16	51J	632854	6736000	1
TPA3324	15	51J	634456	6736006	1
TPA3329	20	51J	636454	6736000	1
TCA026	30	51J	631841	6749630	0
TCA020	13	51J	630597	6749631	1
TCA051	30	51J	631997	6750431	1
TCA040	33	51J	629797	6750431	1
TCA097	18	51J	632597	6752831	1
TCA495	19	51J	631800	6752830	1
TCA497	19	51J	631400	6752830	1
TCA500	12	51J	630800	6752830	1
TCA120	31	51J	632607	6753630	1
TCA164	21	51J	635197	6755231	1
TPA2874	19	51J	635991	6755117	1
TPA1502	19	51J	641977	6756410	1
TPA887	14 & 20	51J	637823	6756046	2
TPA2882	21	51J	636403	6756186	1
TPA1501	21	51J	641782	6756463	1
TPA371	21	51J	642600	6756000	1
TPA368	23	51J	643194	6755997	1
TPA4466	12	51J	644201	6756003	1
TPA4412	10	51J	644998	6756922	1
TPA4409	11	51J	644699	6756921	1
TPA4493	10	51J	644300	6755600	1

HOLE ID	Depth (m)	Zone	Eastings	Northings	Samples Collected
TPA4492	15	51J	644200	6755600	1
TPA911	29	51J	639624	6756853	1
TPA901	20	51J	637636	6756841	1
TPA698	10	51J	637027	6756848	1
TPA2884	19	51J	635603	6756699	1
TPA1943	19	51J	647511	6748115	1
TPA1940	21	51J	646898	6747997	1
TPA1932	32	51J	645300	6747770	1
TPA1928	18	51J	643910	6747813	1
TPA1922	38	51J	643300	6747799	1
SLA600	21	51J	650100	6749800	1
SLA567	21	51J	650300	6750400	1
TPA4431	10	51J	644100	6756500	1
TPA4436	22	51J	644600	6756500	1
TPA4427	30	51J	643400	6756510	0
TPA4491	25	51J	644100	6755600	0
KMA032	53	51J	642700	6755200	0
KMA029	15	51J	642100	6755200	0
KMA065	11	51J	642700	6754400	0
KMA151	33	51J	643100	6752800	1
KMA147	14	51J	642305	6752817	1
SLA575	22	51J	651200	6750200	1
SLA574	14	51J	650300	6750200	1
SLA578	22	51J	651500	6750200	1
SLA098	20	51J	650000	6750200	1
SLA095	13	51J	649700	6750200	1
SLA583	14	51J	649900	6750000	1
SLA580	7	51J	649600	6750000	1
SLA587	6	51J	650300	6750000	1
SLA585	15	51J	650100	6750000	1
SLA601	20	51J	650200	6749800	1
SLA595	10 & 20	51J	649300	6749800	2
SLA599	13	51J	650000	6749800	1

Table 4 Sites Sampled During Phase Five, Round Two (Trap Diameter 80 mm). All Holes Located Outside the Mine and Infrastructure Footprint. Stuck Traps (samples not retrieved) in red.

Hole ID	Depth (m)	Eastings	Northings	No of samples
TUA045	15	648650	6774200	1
TTA309	13	645000	6773750	1
TTA307	13	644000	6773500	1
TTA306	5	643500	6773500	1
TTA300	15 & 36	640515	6773500	2
TTA298	10	639500	6773500	1
TTA297	27	639000	6773500	0
TTA338	22	640476	6772033	1
TTA336	19	640137	6771092	1
TTA335	10	639968	6770621	1
TTA325	21	639000	6769200	1
TTA322	51	637500	6769200	1
TTA321	20	637000	6769200	1
TTA317	11	635000	6769200	1
TTA316	7 & 23	634500	6769200	2
TTA328	16	640500	6769200	1
TTA322	11	642500	6769200	1
SEA068	20	655800	6755400	1
SEA071	12	656100	6755400	1
SEA080	7	656500	6755800	1
SEA085	10	656300	6756200	1
SEA083	12	655900	6756200	1
SEA082	8	655700	6756200	1
SEA038	7	655500	6755000	1
SEA041	12	655900	6755000	1
SEA047	10	656500	6755000	1
SEA001	12	654900	6753800	0
SEA099	5	655519	6753813	1
TPA209	31	644990	6763242	1
TTA362	11	641157	6763300	1
TTA360	15	640180	6763439	1
TTA359	15	639727	6763510	1
TTA358	10	639214	6763573	1
TTA354	7	637214	6763712	1
TTA349	5	635754	6763483	1
TTA348	25	635148	6763383	0
TTA347	21	634661	6763300	1
TTA345	8	633683	6763135	1

Hole ID	Depth (m)	Eastings	Northings	No of samples
TTA344	45	633200	6763054	1
TPA3227	31	655265	6754280	1
TPA3229	6	656075	6754303	1
TPA3230	10	656481	6754300	1
TPA3231	15	656851	6754315	1
TPA3232	15	657263	6754330	1
TPA3237	22	659270	6754400	1

Appendix 2

Biological Environmental Impact Risk Assessment for Troglofauna at Tropicana Gold Project

Table 5 Risk Assessment to Determine Potential Impacts Arising From the TGP Development on Troglofauna and the Residual Impacts Following the Implementation of Management Strategies.

Biological Environmental Impact Risk Assessment											
AGAA Tropicana Gold Project		*Location: Great Victoria Desert*					*Date: 01/03/09*				
			Inherent Risk					Residual Risk			
Risk Issue	Aspect (Event)	Impact	Likelihood	Consequence	Risk Level	Significance	Controls	Likelihood	Consequence	Risk Level	Significance
Mine Site: AGAA TGP											
Mining Operations	Construction of Tropicana / Havana pits	Removal of troglofauna species and habitat	5	3	15	High	No controls are available for pit construction; however further sampling outside the mining and infrastructure footprint should be conducted to locate species in areas not impacted by TGP and thus confirm that the impact on troglofauna species located within the TGP is only partial.	5	2	10	Med
Mining Operations	Expansion of Tropicana / Havana pits	Removal of troglofauna habitat	3	3	9	Med	Ground disturbance should be restricted to that which is necessary and outlined within this report. Boundaries should be clearly defined in the field.	1	3	3	Low
Changes to groundwater recharge regimes	Water use for general mine activities.	Changes to humidity of troglofauna habitat	3	3	9	Med	Ensure water consumption does not exceed aquifer recharge rates.	1	3	3	Low
Contamination of Tropicana/ Havana aquifers	Nutrients, heavy metals or other contaminants adversely impacting troglofauna habitats	Contamination of troglofauna habitat	3	3	9	Med	Spills to be cleaned immediately and reported to supervisors.	1	3	3	Low
Mining Operations	Subterranean disturbance from blasts and vibrations	Disturbance to animals and habitat	3	3	9	Med	Equipment maintenance and correct storage controls in place. Disturbance should be restricted to that which is necessary and outlined within this report. Boundaries should be clearly defined in the field	2	2	4	low

Risk Matrix:

		LIKELIHOOD				
	Risk Assessment Rating	5 ALMOST CERTAIN Is expected to occur in most circumstance	4 LIKELY Will probably occur in most circumstance	3 POSSIBLE Could occur	2 UNLIKELY Could occur but not expected	1 RARE Occurs in exceptional circumstances
CONSEQUENCES	5 - CATASTROPHIC Significant impact to fauna species of conservation significance or regional biodiversity	25	20	15	10	5
	4 - MAJOR Impact to fauna species of conservation significance in project area.	20	16	12	8	4
	3 - MODERATE Loss of fauna biodiversity in project area.	15	12	9	6	3
	2 - MINOR Short term or localised impact to fauna biodiversity.	10	8	6	4	2
	1 - INSIGNIFICANT No impact to fauna of conservation significance or biodiversity.	5	4	3	2	1

25-12	High risk, site/issue specific management programmes required, advice/approval from regulators required.
6 – 10	Medium risk, specific management and procedures must be specified.
1 – 5	Low risk, managed by routine procedures.