5 RISK ASSESSMENT

Risk management is a tool to facilitate informed decision making. The Australian Standard for Risk Management (AS/NZS ISO 31000:2009) identifies that "Organisations of any kind face internal and external factors and influences that make it uncertain whether, when and the extent to which they will achieve or exceed their objectives. The effect this uncertainty has on the organisation's objectives is "risk". All activities of an organisation involve risk. Organisations manage risk by anticipating, understanding and deciding whether to modify it. Throughout this process they communicate and consult with stakeholders and monitor and review the risk and the controls that are modifying the risk."

The first step in managing risk is to identify the risks. Once identified, the likelihood and consequences can be assessed, management controls identified and the "residual risk" assessed. In this way, the likely effectiveness of controls is evident, and the consequences of failure are also made clear.

Primary Gold has applied risk management to the design of the TGU Project and this approach is outlined in Section 5.1.

5.1 RISK ASSESSMENT PROCESS

Risk assessment requirements for the TGU Project were identified and documented in the ToR. The ToR identified risks to be addressed in the EIS. These are identified and addressed in each relevant Section.

Primary Gold completed two risk workshops and prepared a risk register which incorporates the ToR identified risks, and identified other relevant risks. The risk register covers environmental, community and health and safety risks. It has been subject to several reviews as additional risks were identified, modifications were made to Project design and mitigation measures were clarified.

The risk assessment workshops adopted a systematic approach, aligned with standard risk assessment and management methodologies including:

- AS/NZS ISO 31000:2009: Risk management - Principles and Guidelines (Standard);
- HB 203:2012: Environmental risk management - Principles and Process (Guide); and
- HB 158:2010: Delivering assurance based on ISO 31000:2009 - Risk management - Principles and Guidelines (Guide).

Risk is defined as the chance of something happening that will have an impact on objectives. The first step in the risk assessment process was to identify the Hazards (defined as anything that will cause harm and can affect meeting of outcomes and objectives).

Each Hazard was analysed for likelihood and consequence and a risk ranking was developed. The likelihood and consequences for the Hazard are initially considered in the absence of any particular risk mitigation measures to identify the inherent risk. Management controls were considered for each Hazard and a new likelihood, consequence and risk ranking (now the residual risk) was defined.

In determining management controls, the following hierarchy of control principles was adopted:

- Elimination of the Hazard;
- Substitution with a lower risk activity or product;
- Engineering solutions to reduce the impact of the Hazard;
- Implementation of administrative procedures to control the Hazard; and
- Clean up or remediation measures to mitigate impacts after an event.

In undertaking the risk analysis component of the overall assessment, the approach focussed on addressing the 'credible worst case consequence of the risk and the likelihood of the credible worst case consequence occurring'.

The approach taken in the TGU Project Risk Register (Appendix 7) was to quantify the risk using a combination of the likelihood (Table 25) and consequences (Table 26) to determine the risk rating (Table 27). The likelihood and consequences are rated for both the inherent risks (i.e. before the application of risk mitigation measures) and residual risks (i.e. after consideration of the change in likelihood and/or consequence that the risk mitigation measures).

The level of certainty surrounding the proposed risk rankings was also assessed in accordance with Table 28. Where proposed mitigation measures resulted in a reduction in risk ranking from inherent risk to residual risk, justifications for this were also provided.

A copy of the TGU Project Risk Register is provided in Appendix 7.

Table 25: Likelihood Definitions

Probability	Description	Rating
Almost Certain	More than once per month	A
Likely	Less than once per month, but more than once per year	B
Possible	Less than once per year, but more than once per five years	C
Unlikely	Less than once per five years	D
Rare	Unlikely to ever occur	E

Table 26: Consequence Definitions

Consequence Rating	Insignificant 1	Minor 2	Moderate 3	Major 4	Significant 5
People	No injuries or illness	First aid treatment	Medical treatment required	Extensive injuries or illness	Death
Environment	Minor localised spill	On-site release immediately contained	On-site release with detrimental effects	Off-site release with detrimental effects	Toxic release off-site with massive detrimental effects
Production delay/ loss	Low financial loss	Medium financial loss	High financial loss	Major financial loss	Huge financial loss
Damage	Less than $5k delay/loss	$5k to $500k delay/ loss	$500k to $1m delay/ loss	$1m to $5m delay/ loss	More than $5m

Table 27: Risk Rating Matrix

			Consequence				
			1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
Likelihood	A	Almost Certain	H	H	E	E	E
	B	Likely	M	H	H	E	E
	C	Possible	L	M	H	E	E
	D	Unlikely	L	L	M	H	E
	E	Rare	L	L	M	H	H

E – Extreme. H – High. M – Moderate. L - Low

Table 28: Level of Certainty

Control Rank	Description	Guidance
C1	Low	Risk ranking is based on subjective opinion or relevant past experiences.
C2	Moderate	Risk ranking is based on similar conditions being observed previously and/or qualitative analysis.
C3	High	Risk ranking is based on testing, high fidelity modelling or simulation, use of prototype or experiments. Analysis is based on verified models and/or data. Assessment is based on an historical basis.

5.2 Risk Identification

The NT EPA decision to require an EIS for the TGU Project was based on risks detailed in the *Statement of Reasons* for the decision. These included risks to:

- Ground and surface water quality;
- Downstream aquatic ecosystems in Mount Bundey Creek and Mary River National Park;
- Terrestrial biodiversity; and
- Human health and safety.

A risk assessment workshop was initially undertaken on 10 February 2015 to assist in identifying the key environmental, human health and social-cultural risks associated with the TGU Project and to develop appropriate management measures to be used in Management Plans and this EIS (GHD 2015e). The workshop was attended by a suitably diverse group of personnel including the Primary Gold Managing Director and suitably experienced environmental scientists and hydrogeologists. The risk assessment workshop focussed on the following key risk areas:

- Failure of existing / new infrastructure;
- Acid, Neutral and Saline Mine Drainage;
- Water management;
- Erosion and Sedimentation;
- Biodiversity;
- Human Health and Safety;
- Rehabilitation and Closure;
- Cultural Heritage; and
- Social and economic impacts.

A preliminary Risk Register was developed as a result of this risk assessment workshop.

Following development of the preliminary Risk Register, a number of background studies have since been completed as well as some changes made to proposed environmental management strategies. In light of this, the preliminary Risk Register has been updated to capture these recent changes. The Risk Register has also been expanded to include additional health and safety risks identified in the TGU Project Health and Safety Risk Management Plan (Bendan 2015b) and social and economic risks identified in the Economic and Social Impact Statement (ESIS) (Appendix 8).

The updated register was provided to key sub-consultants for review and has therefore been reviewed by a broad group of technically competent personnel including operations and corporate managers, mining engineers, hydrogeologist, hydrologist, geologist, geochemist, health and safety specialist and a number of environmental generalists. Comments from all key sub-consultants were addressed to form the current TGU Project Risk Register which is provided in Appendix 7.

The TGU Project Risk Register will remain an active document which will be modified and updated as additional information and/or management plans are created. The document will facilitate communication with key Project stakeholders, and provide transparency around the proposed development of the TGU Project.

5.3 Discussion of Key Outcomes

The risk assessment provides a good understanding of the TGU Project risk profile and enables priority risks to be highlighted, key controls to be identified and the risk reduction that is achievable with the application of risk mitigation measures. The key outcomes of the risk assessment are provided below and illustrated in Figure 30, Figure 31 and Figure 32. A copy of the TGU Project Risk Register is provided in Appendix 7.

- Environmental Risks:
  - 42 environmental risks identified;
  - Nine extreme, 19 high, 12 moderate and two low inherent risks. These are risk ratings without the implementation of control measures; and
  - No extreme, 12 high, 19 moderate and 11 low residual risks. These are risk ratings following the implementation of control measures.
- Health and Safety Risks:
  - 61 health and safety risks identified;
  - 45 extreme and 16 high inherent risks. These are risk ratings without the implementation of control measures; and
  - No extreme, 29 high, 23 moderate and nine low residual risks. These are risk ratings following the implementation of control measures.
- Social and economic risks:
  - 17 social and economic risks identified:
  - One extreme, six high, three moderate and seven low inherent risks. These are risk ratings without the implementation of control measures; and
  - No extreme, one high, seven moderate and nine low residual risks. These are risk ratings following the implementation of control measures.

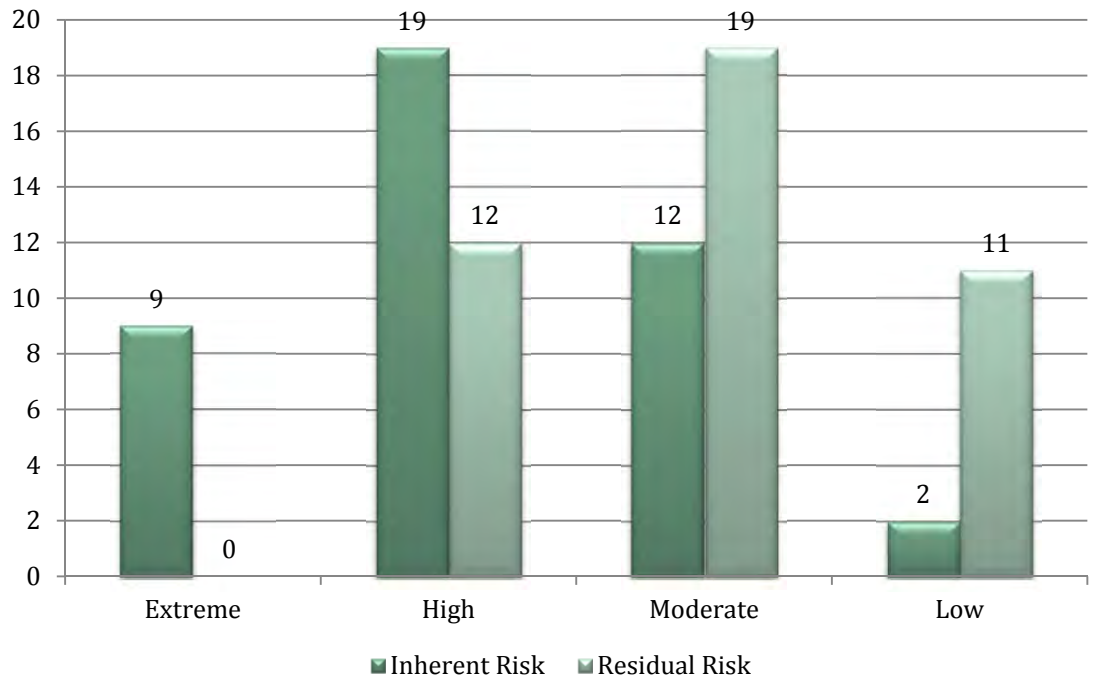

Figure 30: Primary Gold Environmental Risk Assessment and Reduction

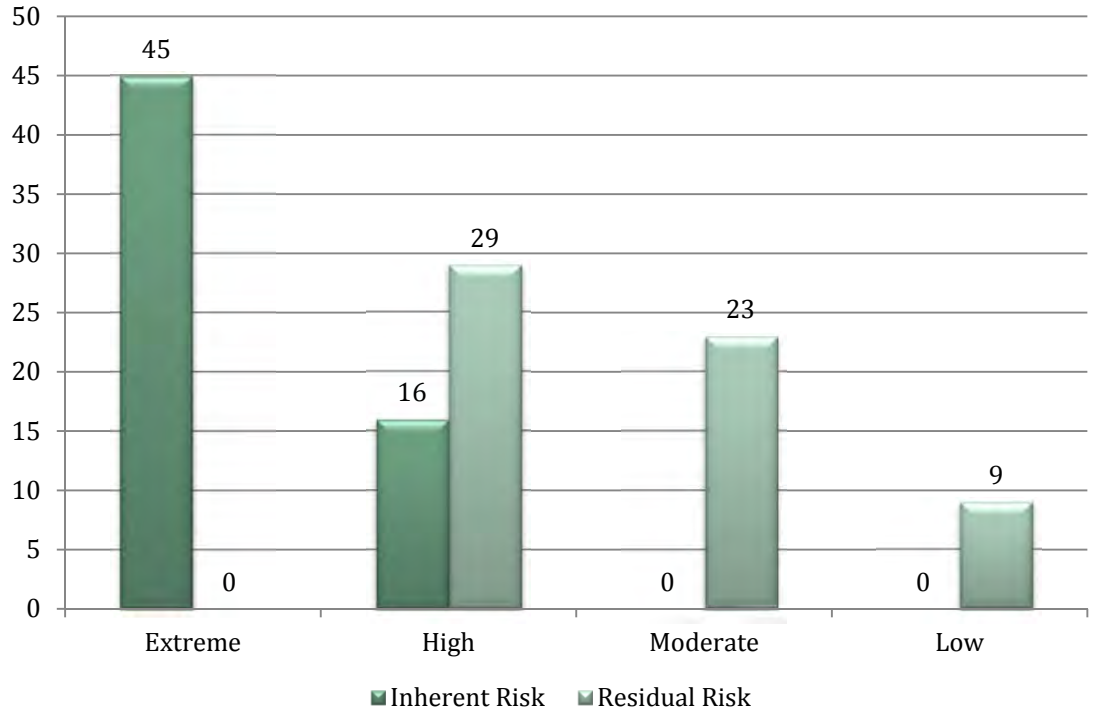

Figure 31: Primary Gold Health and Safety Risk Assessment and Reduction

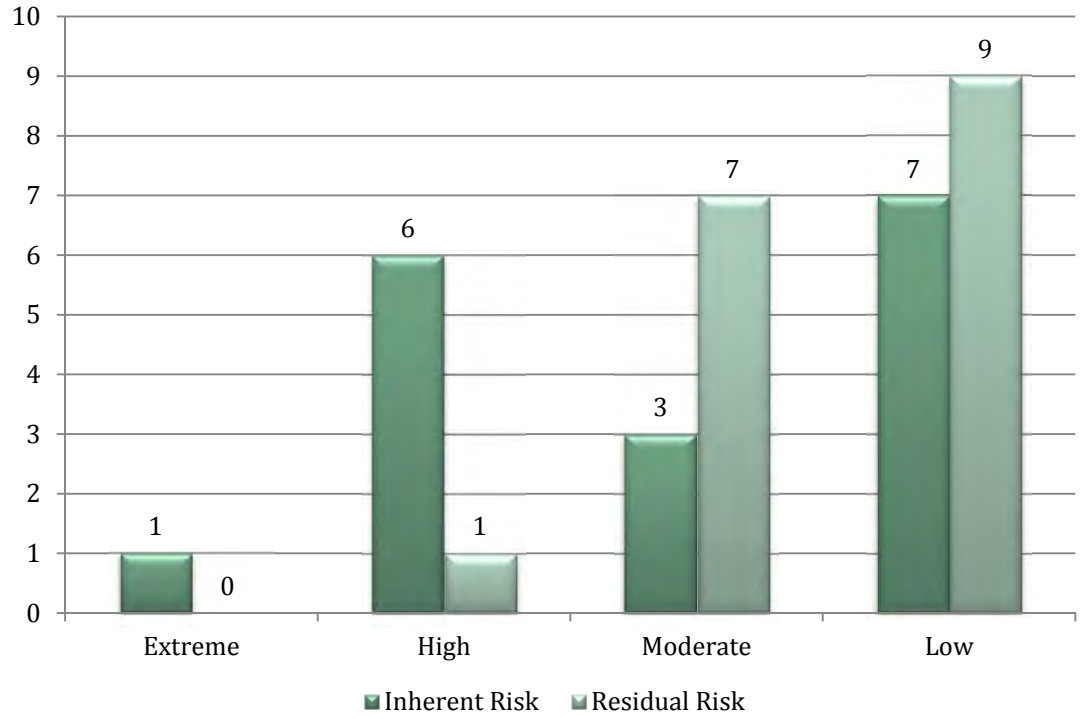

Figure 32: Primary Gold Community and Economic Risk Assessment and Reduction

Implementation of the control measures proposed in the TGU Project Risk Register will reduce the risks identified for the TGU Project with no extreme residual risks expected to occur (Figure 30, Figure 31 and Figure 32). Further discussions regarding proposed control measures, impact assessments and residual risks are provided throughout the remainder of this document.

The acceptance of residual risks by impacted stakeholders (such as pastoralists, community and regulators) is an ongoing process through stakeholder engagement and outlining the positive impacts resulting from the TGU Project. These positive impacts are outlined in Section 5.4.

Toms Gully is an existing mine with established infrastructure and features such as the pit, the WRDs, the tailings dams and evaporation ponds. The site has been in a phase of Care and Maintenance since 2010 and if the TGU Project does not proceed, the risk settings for the site are likely to stay as they currently are under the Care and Maintenance regime. The risks associated with key features such as the WRDs that are not disturbed by the TGU Project are not going to be significantly changed due to the TGU Project.

5.4 SUMMARY OF POSITIVE IMPACTS

The risk assessment process also highlighted a series of positive impacts and benefits that would flow from the approval and implementation of the TGU Project. These positive impacts are summarised in Table 29.

Table 29: Summary of Positive Impacts

Aspect	Positive Impact
Community	Training and skill development for local employees and contractors
	Social benefits associated with employment
	Supply of livestock quality water to pastoralist
Economic	Approximately AUD$6.3 M tax payable, AUD$11.6 M mineral royalties payable to the NT government. The estimated total operational expenditure in excess of AUD$100 M, capital expenditure for the TGU Project is AUD$24 - AUD$27 M.
	Opportunities for local employment
Environment	Increased levels of monitoring and management for site Opportunity to improve the environmental status and risk settings for the Toms Gully Mine
Closure and Rehabilitation	Tailings will be closed and rehabilitated according to current best practice for the long-term storage of acid producing tailings
	Investigations and planning completed for WRD long-term improvements
	Clean construction/capping materials won from WSD footprint
	Dewatering and treating water provides decreased risk of poor quality water escaping off-site by increasing water storage capacity on-site
Safety and Health	Training opportunities for local employees

6 WATER

This section reviews the identified risks of implementing the TGU Project in relation to water. The review includes both surface and groundwater and is closely linked to the following Section on AMD (which represents the key source of contaminants to water).

6.1 ENVIRONMENTAL OBJECTIVES

The environmental objective identified in the ToR (EPA 2014) for water is:

- To ensure that surface water and groundwater resources are protected both now and in the future, such that ecological health and land uses, and the health, welfare and amenity of people are maintained.

6.2 IDENTIFIED RISKS

Water is often the vector for impact, with sources being on-site, transfers occurring on-site, and potential impacts to receptors both off and on-site. Hence many risks of environmental impact are associated with water on mine sites. Water is required to operate processes and also presents a challenge to control, particularly in the climate of the top end where extreme events with high rates of rainfall create large quantities of runoff and infiltration into groundwater systems.

On a mine site, the risks associated with water will often be linked to AMD where there is potential for it to occur – as is the case at Toms Gully. This Section focuses on the water aspect – from the perspective that water is a critical contributor to the creation of AMD as well as a vector for transport of AMD products and the evaporation and concentration of those products. This Section therefore focuses on risks associated with water and the next Section on the generation and control of AMD products.

The ToR identified that risk exists of AMD/NMD/SD from mine infrastructure, impacting water quality and dependent ecosystems. The following risks were related to water:

- Passive discharge or seepage of AMD/NMD/SD from the mine into surface and/or groundwater resources;
- Mine-site erosion and sedimentation of waterways;
- Loss of control / containment of poor quality mine waters, such as associated with extreme weather events;
- Need for the TGU Project to dewater the flooded pit and underground mine;
- Need for the TGU Project to discharge surplus contaminated waters to local creeks (particularly at times of low creek flow);
- Increasing contaminant concentrations in evaporation ponds, reflecting in water quality in pond seepage and evaporation fan plumes;
- 'First flush' or early Wet season flushing of stored oxidation products (AMD/NMD/SD) generated over the Dry season in mine storage facilities;
- Effects of loading (lifts) to tailings and evaporation ponds on seepage rates;

- Potential hydraulic connections between the proposed process water dam site and fault zones (Crabb, Williams), preferential groundwater flow pathways, springs, creeks and/or the underground mine;
- Erosion and sedimentation; and
- Biodiversity, in particular, vegetation clearing and groundwater drawdown, with the latter potentially having knock on effects for hydraulically connected streams.

In addition the ToR requested that:

- The influence of seasonality should be discussed where relevant. The risk assessment should consider short (whilst operational), medium (post closure and under institutional control) and long-term (post-institutional control) timeframes of the TGU Project;
- Estimates be prepared of quality and quantities of seepage discharging to aquifers and creeks from existing and proposed mine components through all mine phases, including post closure (long-term);
- A summary of how water quality and flows in local creeks and aquifers will potentially be impacted by the TGU Project in the short and long-term; and
- Describe and assess the significance of residual risks to sensitive receptors from mine-induced water quality impacts. Include consideration of downstream ecosystems and stakeholders, in the short and long-term.

The ToR also stated that the EIS should describe proposed management of water for the TGU Project for all mine-life stages and seasons, according to its source, quality, volume, end use or other parameters, including:

- Proposed management to contain contaminants on-site;
- Water quality thresholds triggering management actions;
- Description of site surplus water volumes, and proposed management; and
- Management of stormwater, erosion and sediment loads during seasonal and extreme rainfall events.

A WMP has been prepared for the TGU Project (GHD 2015b) to provide more detailed background and management and is it provided in Appendix 4.

In addition, the risk assessment identified the following water related risks:

- Insufficient water to operate the process; and
- Flooding of pit and underground workings.

The risks associated with implementing the TGU Project are separated out from the risks associated with the existing Toms Gully site in its current Care and Maintenance status.

6.3 CONTEXT

This Section provides context for the design and operation of the TGU Project, the background for the identification and risks and development of mitigation measures and assesses the likely impacts in relation to water.

6.3.1 STUDIES COMPLETED

Due to the broad scope and area of influence that water may have, most of the studies completed in preparation for the TGU Project have some relationship with water. The key studies and plans completed to support the development of the water strategy are shown in Table 30 below and provided as Appendices.

Table 30: Water and Related Studies

Study/Plan	Addresses	Appendix
TGU Project WMP	Site water quality status. Overall site water management	Appendix 4
Aquatic Ecology Studies	Aquatic ecology of Mount Bundey and Coulter Creeks	Appendix F to the TGU Project WMP (Appendix 4)
Acid and Metalliferous Drainage Management Plan	Control of AMD source materials	Appendix 11
TGU Project Biodiversity Report	Listed flora and fauna species	Appendix 6
TGU Project Biodiversity Management Plan	Management and monitoring of flora and fauna	Appendix 12
Flood Risk Study	Modelling 1:100 year flood zone in Mount Bundey Creek	Appendix H to TGU Project WMP (Appendix 4)
Water Balance Model	Site water balance in support of proposed water strategy	Appendix C to the TGU Project WMP (Appendix 4)
Hydrogeological Assessment	Groundwater dewatering requirements and potential impacts. Requirements for contaminant transport modelling.	Appendix D to the TGU Project WMP (Appendix 4)
Assessment of Water Treatment Options	Lime and caustic based water treatment systems	Appendix L to the TGU Project WMP (Appendix 4)
TGU Project MCP	Incorporates consideration of water related issues into mine closure	Appendix 5

6.3.2 SURFACE WATER

In this Section surface water flows are discussed on-site, and in the context of the Mount Bundey Creek catchment and ultimately the Mary River catchment. As the existing site has drainage control features, these are taken as being part of the existing environment.

6.3.2.1 CATCHMENT CHARACTERISTICS

The key change to surface water flows arising from the TGU Project will be the construction of the WSD, which will effectively cut off flows from a small sub-catchment of Mount Bundey Creek. The WSD however, will have an emergency spillway to protect from embankment failure in the event of severe rainfall events.

Mount Bundey and Coulter Creek catchments both form part of the broader Mary River Catchment (Figure 33). Mount Bundey Creek catchment generally comprises a series of small

ridges and dissected hills that are drained by small, steep rivulets, which converge into Mount Bundey Creek. The majority of Mount Bundey Creek upstream of the TGU Project area consists of outcropping rock with thin soil cover and shallow alluvium within drainage lines.

Mount Bundey Creek flows west to east along the northern section of the TGU Project area. Coulter Creek is a tributary of Mount Bundey Creek and flows southwest to east (to the south of the TGU Project area). Coulter Creek flows into Mount Bundey Creek downstream of the TGU Project area and monitoring point SWTG2.

Surface water from the site ultimately flows from Mount Bundey Creek and Coulter Creek to Hardies Creek to the Mary River. A summary of distances from the two discharge points from site are provided in Table 31. Catchment definition (Figure 34) and flood modelling has been completed by GHD (2015f). The new WSD is to be constructed in sub-catchment 10 (West Creek).

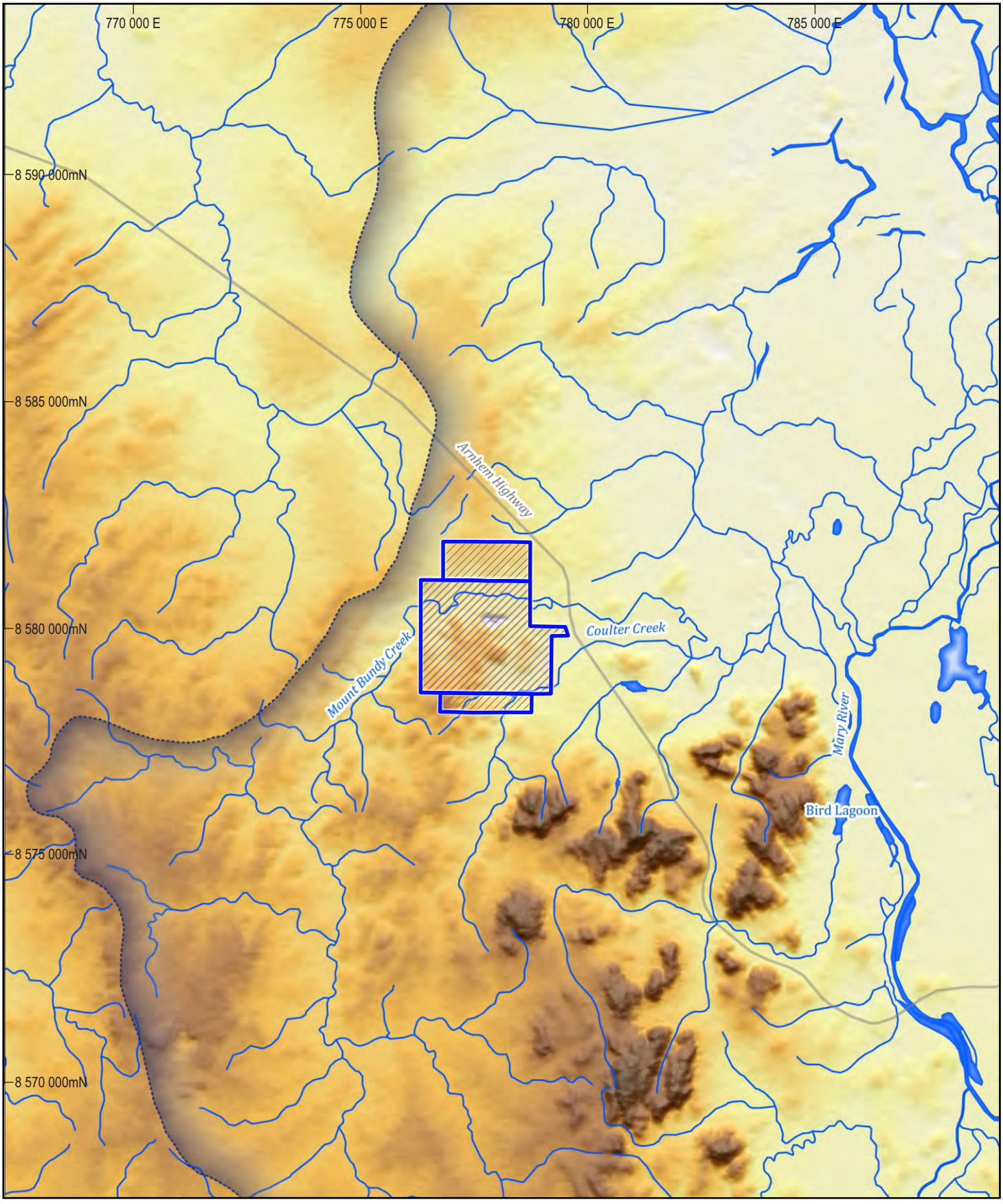

Figure 33: Mount Bundey Creek and Mary River Catchment

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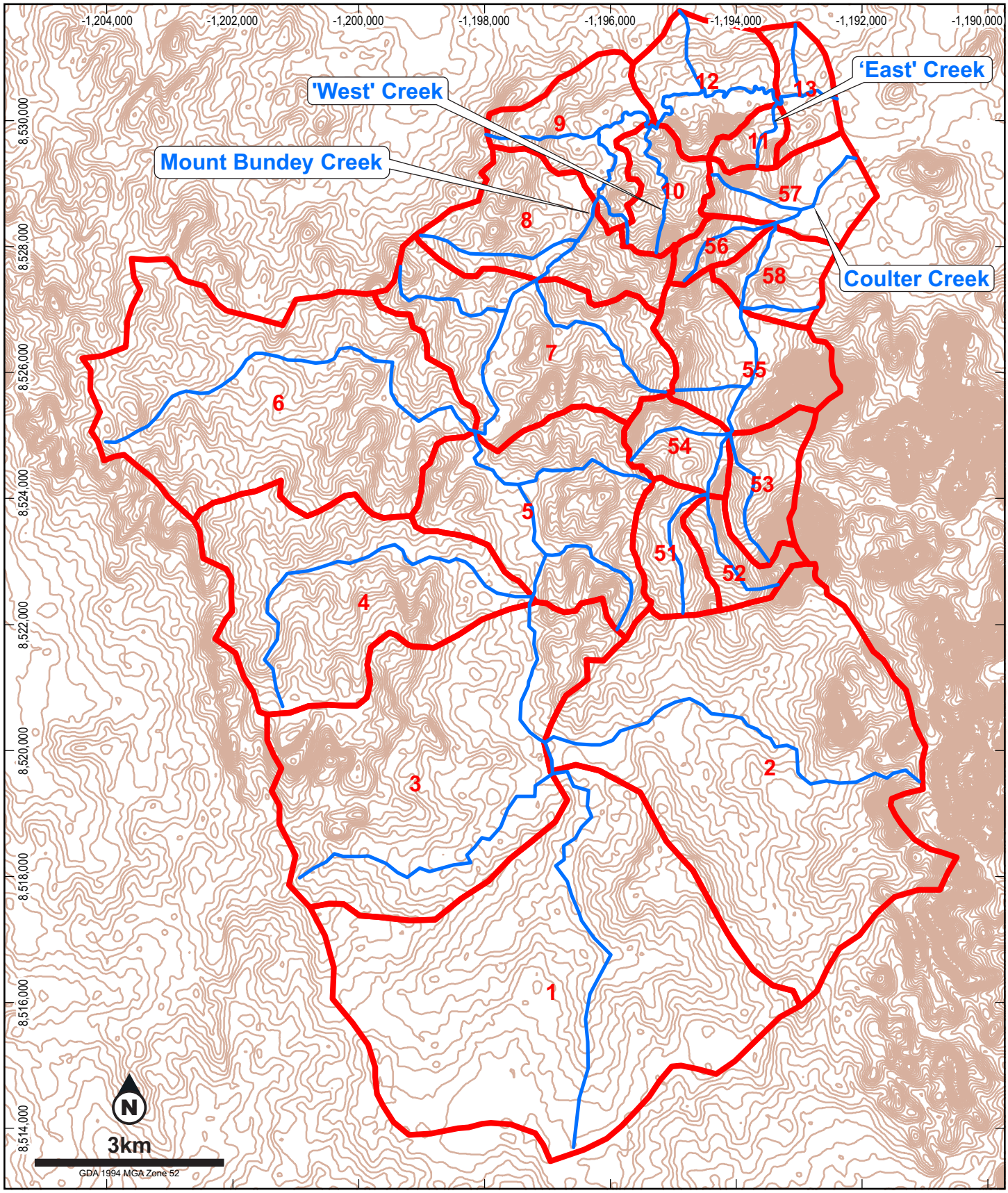
Table 31: Flow distances – Local water courses (GHD 2015b)

Location		Distance (m)	Details
Point A	Point B		
Mount Bundey Creek			
DP1	SWTG2	1,320	Lease boundary location for on-site flows transferred into Mount Bundey Creek (DP1) to sampling location SWTG2 at the Arnhem Highway crossing of Mount Bundey Creek.
SWTG2	SWTG3	6,186	Arnhem Highway crossing to the furthest downstream monitoring location on Mount Bundey Creek (SWTG3) receiving discharge from DP1 only.
SWTG3	Mount Bundey / Coulter Creek Confluence	1,410	Furthest monitoring point (SWTG3) to the confluence with Coulter Creek and DP2 discharged water.
Coulter Creek			
DP2	CK7	1,420	Lease boundary location for on-site flows transferred into Coulter Creek (DP2) to sampling location CK7 at the Arnhem Highway crossing of Coulter Creek.
CK7	Mount Bundey / Coulter Creek Confluence	3,127	Arnhem Highway crossing to confluence with Mount Bundey Creek.
Hardies Creek and Mary River			
Mount Bundey / Coulter Creek Confluence	Hardies Creek	2,861	Confluence of the Mount Bundey Creek and Coulter Creek to Hardies Creek.
Hardies Creek	Mary River Floodplain	15,800	Hardies Creek to where its flow levels out and discharges into the Mary River Floodplain.
Mary River Floodplain	Mary River Flow Channel	1,625	Mary River Floodplain to the main Mary River Flow Channel.



LEGEND

- 2m Contours
- Watercourses
- Hydrologic sub-catchments

Figure 34: Hydrological Sub-Catchments (GHD 2015b)

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6.3.2.2 WATER FLOWS

Mount Bundey Creek is approximately 30 km long with 13 km upstream of the mine site. The creek has several tributaries upstream of the TGU Project area. Downstream from the mine site it drains into Hardies Creek, and then the Mary River. Flows in Mount Bundey Creek have been recorded at Monitoring Station G8180031 on Mount Bundey Creek located directly downstream of mine site by the bridge over the Arnhem Highway.

Surface water flows for Mount Bundey Creek were reviewed in Section 4.3.2. The flows were only measured for two years, providing limited data for planning and management purposes. The peak month daily flows average in excess of 400 ML/day regularly occur in the wet season. Peak flow rates are recorded in excess of 5 cumecs.

The key potential impact on surface water flows is the new WSD. The area of the catchment within which the WSD is located 1.61 km^2 within a total catchment area for Mount Bundey Creek of 117 km^2. This represents a potential loss of 1.4% of the upstream catchment (see Figure 34). It also represents less than 0.02% of the total Mary River catchment (8,100 km^2). Given the dynamic nature of the environment, reductions in flow might be expected to have noticeable impacts on stream beds, riparian vegetation and fauna only at higher proportionate impact areas than the above.

The WSD will be used as temporary water storage for treated water from the mine pit, with some of this water being released to Mount Bundey Creek – however this addition is not expected to be significant as dilution ratios of the order of 1:10 up to 1:100 are expected to be required to meet the expected water quality. The WSD is also to be constructed with an overflow channel to enable any overtopping water to be safely released to Mount Bundey Creek.

GHD modelled the 1:100 year flood peaks from the "West Creek" and Mount Bundey Creek (GHD 2015f). The flood water from a design storm enters Mount Bundey Creek 17 hours before the arrival of the design flood peak from Mount Bundey catchment. According to the modelling completed by GHD (2015f), the design flood peak magnitude from Mount Bundey catchment is an order of magnitude greater than the design flood peak from the West Creek.

Considering the small proportion of the Mount Bundey Creek and Mary River catchments for which surface water flows will be captured by the WSD (Figure 17), the impacts of the WSD on flows in Mount Bundey Creek are expected to be very minor. Any impacts on the Mary River and other downstream wetland areas would be negligible.

During the operations phase, dewatering will be largely from bores located to the east of the pit located directly amongst the proposed underground workings. The water from bores will be released directly to Lake Bazzamundi (as has been done previously), adding to the flows in Coulter Creek on a more continuous basis for the life of the underground mining. A maximum dewatering rate of 32 L/s is predicted for the TGU Project. It is expected that once the pit is dewatered, the groundwater bores will be able to provide in excess of 80% of the required dewatering and the inflow rates will reduce substantially from the peak (AGEC 2015a).

6.3.2.3 Site Drainage and Sediment

Risks associated with mine site erosion have been identified. These risks may arise as a result of the existing site features, or the new site features associated with the TGU Project.

Erosion from existing site features can compromise site drainage. Significant erosion could occur on the WRDs, TSF and evaporation pond embankments, processing area and ROM pad, and existing roads and tracks. Douglas Partners (2015) completed a structural review of the WRDs and reported no signs of significant erosion or instability. The WRDs have had rehabilitation programmes completed and although there are signs of historic vegetation senescence, the vegetation on them currently appears to be stable.

An inspection of TSF2 by Douglas Partners (2015) indicated no visible signs of seepage at the toe of the outer face, nor any visible signs of excessive erosion or slope instability.

Existing site features and drainage patterns are shown in Figure 35. The existing site drainage provides protection against sediment export from the existing site features. The drainage design for the existing site features has been developed to retain and direct water primarily consistent with managing AMD risks and ensuring that potentially contaminated waters are controlled and directed to facilities where they can be stored and evaporated, or released to the environment. The key drainage features for the existing site include:

- Northern drain – gathers runoff and seepage water from the OWRD and directs it past TSF2 to the Oxbow Wetlands. Also would collect any runoff overflowing from the stormwater sump downslope of the processing area, and TSF2;
- EP1 and EP2 – gather seepage underflow and runoff from the SWRD;
- Stormwater sump and process water drain – collects runoff water from the ROM pad and processing area. The processing area has its own bunding; and
- TSF1 diversion drains – divert water away from the TSF1 embankment.

The above drainage features also play a role in capturing and directing any sediment-laden water to areas where the sediment can settle out and be retained. It is noted in GHD (2015b) that the median SSTV for turbidity is exceeded indicating potentially excessive levels of sediment in Mount Bundey Creek.

The risk of new sources of erosion from the TGU Project features is restricted to the new embankments for TSF2 and the WSD, disturbance associated with the borrow areas, precipitates from water treatment and erosion from new tracks, bores and stockpile areas. As the WSD will prevent flow to Mount Bundey Creek in all but extreme rainfall events, the risk of additional sediment transport to Mount Bundey Creek is limited to runoff causing erosion of the embankment wall. The conceptual design for the WSD embankment shows a slope angle of 1:3 for the outer embankment surface, and rip-rap for wave protection for the inner embankment. The downstream zone would be based on a method specification for construction based on the particle size distribution of the materials selected for construction. Ideally the materials selected for the relatively free draining downstream zone should comprise rock which is specifically excavated or blasted to suit the construction work so as to minimise the rehandling of materials.

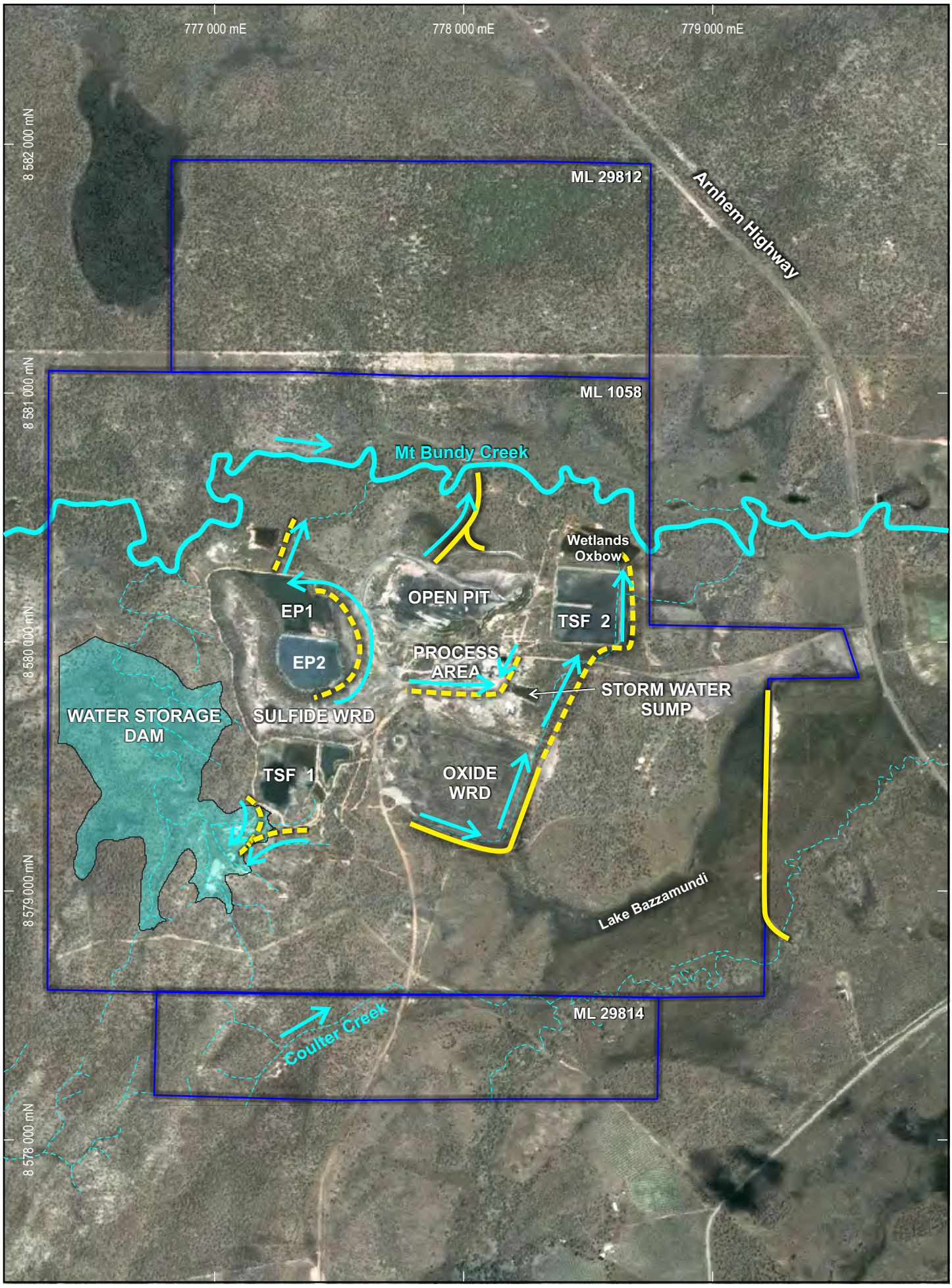

Figure 35: Site Drainage

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6.3.2.4 Surface Water Quality and Derivation of Site Specific Trigger Values

GHD (2015b) reviewed the on-site water quality data from approximately January 2007 to February 2015. The data available has been filtered by the analytes tested and a statistical analysis undertaken to establish minimum, median and maximum concentrations.

Default trigger values can be selected from the ANZECC & ARMCANZ (2000a) Guidelines, however, site derived trigger values are preferred to regionally derived trigger values (GHD 2015g). SSTVs have been derived from the upstream site SWTG1A on Mount Bundey Creek. The SSTVs have been designed to facilitate assessment of water quality at the downstream monitoring location SWTG2 and are to be updated following the collection of additional water quality data from SWTG1A. The SSTVs were derived following ANZECC & ARMCANZ (2000a) guidelines. A summary of the SSTVs is provided in Table 32.

Table 32: Site Specific Trigger Values

Analyte	Units	ANZECC & ARMCANZ (2000a) 80% TVs	SSTV
pH	pH	6.0-8.0	5.8-8.0
Dissolved Oxygen (DO)	%	85-120	85-120
EC	µS/cm	250	250
Turbidity	NTU	2-15	60
Total Suspended Solids	mg/L	-	32
Total Cyanide	mg/L	0.018	0.018
Sulphate	mg/L	-	129+
Ammonia	mg/L	2.3	2.3
Aluminium	µg/L	150	260
Arsenic (total)	µg/L	140*	140
Cadmium	µg/L	0.8*	0.8
Chromium	µg/L	40	40
Cobalt	µg/L	-	1.4**
Copper	µg/L	2.5*	2.5
Iron	µg/L	-	300***
Lead	µg/L	9.4*	9.4
Manganese	µg/L	3,600*	3,600
Molybdenum	µg/L	-	34**
Nickel	µg/L	17*	17
Uranium	µg/L	-	-
Zinc	µg/L	31*	31

Notes: + Elphick *et al* (2011);
* Low reliability trigger values (ANZECC & ARMCANZ 2000a. Chapter 8.3.7);
** ANZECC & ARMCANZ (2000a) low reliability protection level; and
*** ANZECC & ARMCANZ (2000a) recommended Canadian guideline value.

The SSTVs reference the ANZECC & ARMCANZ (2000a) trigger values for 80% aquatic ecosystem protection as the default SSTV (where either insufficient data is available or the upstream values fall below the ANZECC & ARMCANZ (2000a) 80% aquatic ecosystem protection value). Further details on the SSTVs are provided in GHD Site Specific Trigger Values Report, April 2015 (GHD 2015g – which is provided in the TGU Project WMP (Appendix 4)).

A summary of water quality on-site is provided in Table 33. The majority of elevated median values were at EP1, EP2, SWTG Tails 1, SWTG Tails 2 and Pit. These are all part of the mine water management system. Of the mine water management monitoring locations, ODP, SWTG6 and SWTG12 contained the lower median analyte concentrations.

Table 33: Summary of Surface Water Quality On-site (GHD 2015b)

Parameter	Summary of On-site Water Quality
pH	Median pH values range from 2.6 to 5.1 at SWTG Tails 1 (Old Tailings Dam) and SWTG6 respectively. All median values were below the minimum SSTV of 5.8 pH units.
EC	Median values ranged from 345 to 3,110 µS/cm at ODP and EP2 respectively. All median values were above the SSTV of 250 µS/cm.
Total Cyanide	The majority of cyanide values were below the SSTV of 0.018 mg/L. Only SWTG Tails 1 exceeded the SSTV with a median value of 0.009 mg/L.
Sulphate	Median values ranged from 100 to 2,900 mg/l at ODP and EP2 respectively. The majority of median values were below the SSTV of 129 mg/L with the exception of ODP with a median value of 100 mg/L.
Aluminium	Median values ranged from 1,200 to 300,000 µg/L at SWTG6 and EP2 respectively. All median values were above the SSTV of 260 µg/L.
Arsenic	The majority of arsenic values were below the SSTV of 140 µg/L. Only SWTG Tails 1 exceeded the SSTV with a median value of 1,200 µg/L.
Cadmium	Median values ranged from 7.05 to 205 µg/L at SWTG12 and EP1 respectively. All median values were above the SSTV of 0.8 µg/L
Chromium	The majority of chromium values were below the SSTV of 40 µg/L. The exceptions were EP2 and SWTG Tails 1 with median values of 49 and 55 µg/L respectively.
Cobalt	Median values ranged from 65.2 and 1,500 µg/L at SWTG6 and EP1 respectively. All median values were above the SSTV 1.4 µg/L.
Iron	Median values ranged from 130 to 56,000 µg/L at SWTG6 and SWTG Tails 1. The majority of median values were above the SSTV of 300 µg/L with the exception of ODP, SWTG6 and SWTG12 which ranged from 130 to 205 µg/L.
Lead	The majority of lead values were below the SSTV of 9.4 µg/L. Only OWRD and Pit exceeded the SSTV with median values of 30.9 and 14 µg/L respectively.
Manganese	Manganese values ranged from 799.5 to 18,000 µg/L. The median values at EP1, EP2, OWRD, SWTG Tails 2 and Pit were elevated above the SSTV of 3,600 µg/L.
Nickel	Median values for nickel ranged from 61 to 7,000 µg/L at ODP and EP1 respectively. All median values were above the SSTV of 17 µg/L.
Zinc	Median values of zinc ranged from 400 and 21,000 µg/L at ODP and EP1 respectively. All median values were above the SSTV of 31 µg/L.

6.3.2.5 Dewatering and Operations

The water management strategy for the TGU Project entails treating water in the pit to livestock water quality standard, then pumping it to the new WSD where a portion will be retained to ensure sufficient site water supply and a portion will be released to Mount Bundey Creek.

Treated water will be released from the WSD in the first wet season to create water storage for the operational phase. The water is expected to require dilution to meet the ANZECC & ARMCANZ (2000a) water quality for 80% aquatic ecosystem protection. Water discharge will be timed and planned to achieve the required levels of dilution through the water discharge licencing process.

A mixing zone is allowed for within the Mining Lease so the discharged water can mix with creek water and ensure that the ANZECC & ARMCANZ (2000a) 80% aquatic ecosystem protection requirements are met at the compliance point. The compliance point is proposed to be retained as site SWTG2 near where Mount Bundey Creek crosses the Arnhem Highway.

Dewatering of underground operations during mining is expected to provide good water quality representative of regional values. Water is not expected to be contaminated by AMD this far away from the pit and WRDs and hence able to be released to Lake Bazzamundi.

6.3.2.6 Water Discharge

The baseline surface water characterisation carried out by GHD (2015a) has been described in Section 4.3.3.1. In summary, the surface water conditions on-site are noted to be impacted by AMD with a range of analytes reflecting AMD influences from waste rock and tailings. The site has continued to be monitored over the Care and Maintenance period, adding to the understanding of site and stream water quality. It is clear that the pit water would require significant dilution to enable it to be released to Mount Bundey Creek, even if livestock water quality was the target at the monitoring location SWTG2 (Table 35). Primary Gold have assumed a water quality target of 80% ANZECC & ARMCANZ (2000a) and prepared SSTVs based on that assumption. A move to this new water quality standard would represent a significant improvement to the quality of water discharged to Mount Bundey Creek from the Toms Gully mine historically. Previous water discharges have been operated with dilution ratios of 100:1 to meet the water quality requirements.

Removing dissolved metals from low pH water can generally be achieved by raising the pH of the water. This treatment strategy is utilised at many locations around the world (ERIAS Group 2015). Previous studies completed by CGAO (2009) looked at the caustic water treatment process, and Primary Gold commissioned ERIAS Group (2015) to review the water treatment options for the TGU Project. This included consideration of recent experience in using lime to raise the pH and remove metals from a flooded pit at the Mount Todd gold mine in the NT.

The pit water quality shown in Table 34 is consistent with the sample taken in November 2012 and assessed for the caustic water treatment process by CGAO. The magnitude of reductions required to meet the SSTVs for site SWTG2 are identified in Table 34. Dilution ratios of up to approximately 250:1 would be required for untreated water. ERIAS Group (2015) identified reductions in metal concentrations of 49-98% using the in-pit lime dosing system at Mount

Todd. Metals concentrations were reduced by 33% to 99.9% using the caustic treatment process to raise the pH to 9 (CGAO 2013).

Table 34: Pit Water Quality

Parameter	Unit	Pit Water Quality November 2012	Pit Water Quality July 2015	SSTV (80% Aquatic Ecosystems)	Magnitude of reduction required (%)
Aluminium	µg/L	35,400	25,200	260	98.9
Arsenic	µg/L	6	6.9	140	0
Cadmium	µg/L	119	79.2	0.8	98.9
Cobalt	µg/L	384	343	1.4	99.6
Chromium	µg/L	3	2	40	0
Copper	µg/L	384	303	2.5	99.1
Iron	µg/L	3,900	3,690	430	91.8
Lead	µg/L	16	23	9.4	59.1
Manganese	µg/L	13,100	11,800	3,600	69.4
Nickel	µg/L	1,650	1,450	17	98.8
Zinc	µg/L	11,700	8,320	31	99.6
pH	pH units	3.04	4.43	6 to 8	1.4 to 3.6 increase

Primary Gold's strategy is to treat the pit water to achieve a target of livestock water quality as a minimum, then pump and store the water in the WSD, releasing excess water when necessary to meet the SSTVs at the monitoring site SWTG2. An assessment of the dilution ratios to meet the SSTVs assuming treated water meets livestock water quality shows that dilution ratios as high as 600-700:1 would be required for analytes such as cobalt and zinc. This is due to the livestock water quality trigger values being significantly higher than the SSTVs.

An analysis of current pit water quality against the SSTVs shows that cobalt and zinc would only require dilution ratios around 250:1 to meet the SSTVs (as the pit water quality for these analytes is better than the livestock quality trigger values). ERIAS Group (2015) report that the lime treatment used at Mount Todd reduced zinc concentrations by 84%. No data is available for cobalt.

Table 35: ANZECC & ARMCANZ (2000) Livestock Water Quality Trigger Values

Analyte	Units	ANZECC & ARMCANZ (2000) Livestock Trigger Value
Physiochemical Characteristics		
pH	pH	6.0-8.0
EC	µS/cm	3,000
Total Suspended Solids	mg/L	5,000
Environmental Indicators		
Sulphate	mg/L	1,000
Calcium	mg/L	1,000
Metals/Metalloids		
Aluminium	µg/L	5,000
Arsenic (total)	µg/L	500
Cadmium	µg/L	10
Chromium	µg/L	1,000
Cobalt	µg/L	1,000*
Copper	µg/L	1,000
Iron	µg/L	-
Lead	µg/L	100
Manganese	µg/L	-
Molybdenum	µg/L	150
Nickel	µg/L	1,000
Uranium	µg/L	200
Zinc	µg/L	20,000

*Notes: * Cobalt livestock value for cattle (ANZECC & ARMCANZ 2000. Chapter 4.3.4); and n/a indicates insufficient toxicity data.*

6.3.2.7 Mine Closure

As all waste rock material will be stored in the underground workings or in pit, waste rock will become fully submerged, precluding oxidation of the PAF material. The existing mining operations exposed PAF materials and used the pit as a storage location for contaminated water, leading to poor water quality with low pH, high sulphate and metals concentrations. The TGU Project is not expected to result in any deterioration in pit water quality at closure (AGEC 2015). A more rapid filling of the pit could to reduce the potential for AMD products to form, accumulate and concentrate in the pit water.

The water level in the pit is predicted to recover to within four metres of the pre-mining groundwater level (AGEC 2015). Previous studies suggest that the water table fluctuates 3.5 m between the wet and dry season (Dames & Moore 1993). Under steady-state conditions, during the wet season, the excess of rainfall is predicted to temporarily increase the pit water level above the long-term predicted level. The levels within the surrounding groundwater system are also expected to increase as a result of increased recharge to the groundwater system, leading to

a certain amount of "buffering capacity" in the event of very wet seasons. It is predicted that there may be a reversal of the hydraulic gradient between the pit and the surrounding groundwater as a result of the increased pit water level during the wet season. This could result in very localised migration of poor quality water away from the pit.

This process will be reversed during the dry season and the poor quality water would be expected to migrate back to the pit. This seasonal fluctuation could result in a localised halo of poor quality water in the immediate vicinity of the pit. There is not predicted to be any long-term or widespread contamination of groundwater resulting from the pit final void.

In conclusion, the post closure impact on groundwater quality from the TGU Project will be no different to that which would occur as a result of historical mining at the Toms Gully Pit, and may be expected to be improved by:

- Diverting surface runoff away from the pit;
- Not using the pit as a sump for contaminated site water; and
- Filling the pit rapidly upon cessation of mining.

6.3.2.8 Influence of Seasonality

The climate data presented in Section 4.1.2 identified the marked seasonal differences at the site. The significant excess of rainfall over evaporation during the wet season (daily average excess of between 4 and 7.3 mm in the months December to March) results in significant runoff and potential for erosion and flooding. Extreme rainfall events also create increased likelihood of infrastructure failure due to water damage.

The dry season presents a period where evaporation exceeds rainfall (daily average excess of between 3.3 to 4.6 mm from May to October) results in drying and potential shortage of water, as well as increased potential for dust.

6.3.3 Groundwater

The existing environment for groundwater was reviewed in Section 4.4.

6.3.3.1 Groundwater Aquifers

The three aquifer systems within the TGU Project site are:

- Upper weathered profile within the Wildman Siltstone;
- Fractured Wildman Siltstone; and
- Orebody and the Crabb Fault zone.

The weathered profile extends to a depth of 40 m below ground level with enhanced primary porosity and higher storage due to the weathering of the siltstone (Coffey & Partners 1988). Groundwater levels may be up to 50 m below ground level, but are generally less than 20 m (AGEC 2015).

Historical mining shows groundwater inflows to the pit are around 30 L/s to 40 L/s. As there will be no change to the size of the pit, these historical observations should be a reliable indicator of inflows when the pit is dewatered for the TGU Project. The groundwater inflow will reduce as dewatering continues and drainage of the rock mass reduces hydraulic gradients in the rock mass surrounding the pit. Drainage of groundwater into the underground mine to the south of the pit will also reduce groundwater inflows over time (AGEC 2015) (Figure 36). Unfortunately, bore level records from previous periods of dewatering that would show the impacts of dewatering are missing or unreliable.

The TGU Project dewatering will reduce water pressures in the rock mass surrounding the mine. The extent of the zone of depressurisation is determined by the hydraulic properties of these materials, and the nature of the mining. This zone is referred to as the zone of depressurisation or drawdown, and is greatest at the pit face and above the underground, reducing with distance away from the active mine area. As the ore zone is dewatered it will promote drainage of the fractures in the overlying siltstone. Once the flooded ore zone has been dewatered the hydraulic properties of the overlying siltstone will control the inflow rates and the growth of the zone of depressurisation as it drains into the underground (AGEC 2015).

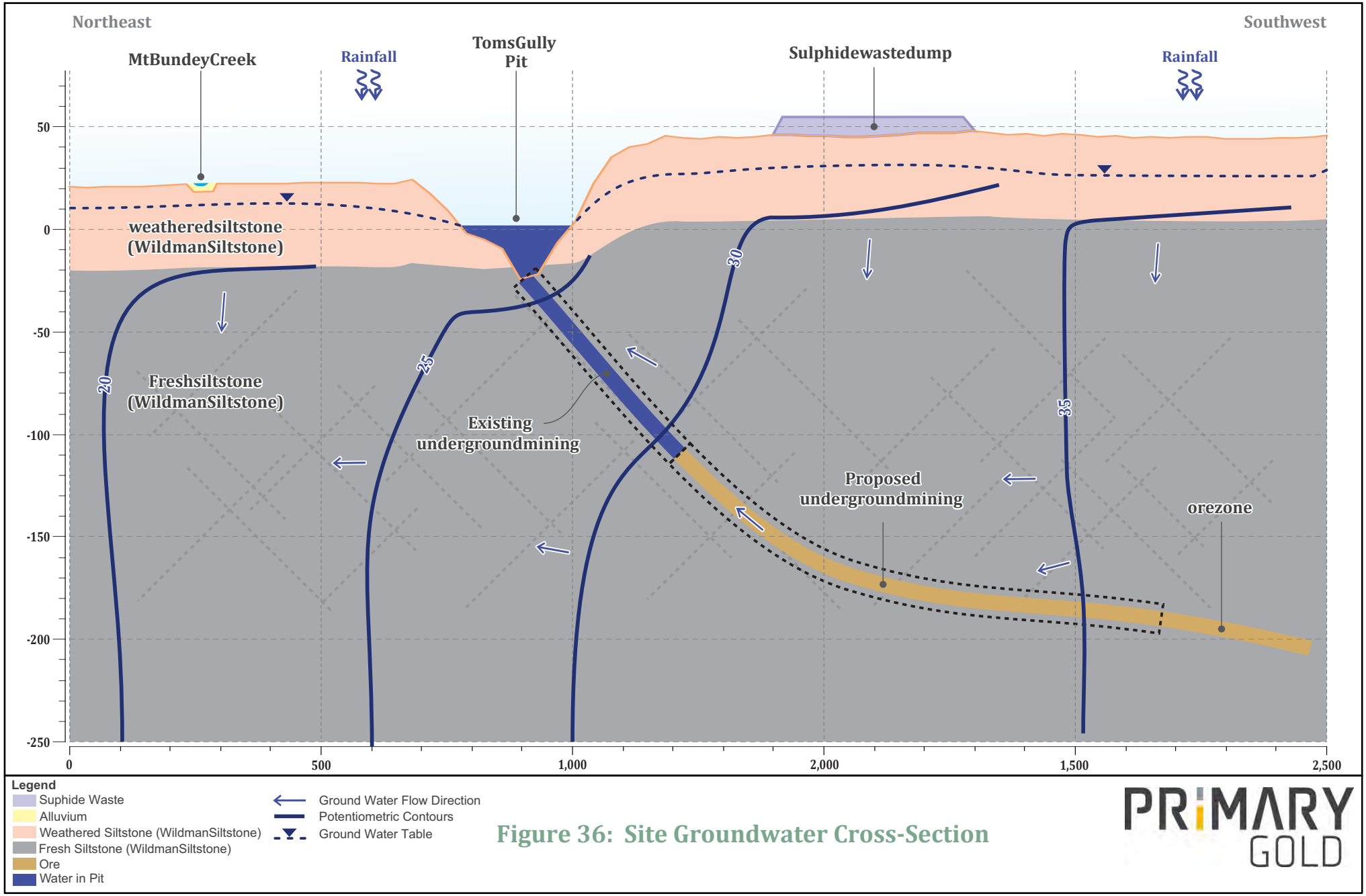


Figure 36: Site Groundwater Cross-Section

6.3.3.2 GROUNDWATER CONNECTIVITY

This Section reviews the potential consequences of groundwater connectivity and examines potential risks around the underground mining operations and water/TSF infrastructure, groundwater drawdown and potential impacts on surrounding groundwater users, Groundwater Dependent Ecosystems (GDEs) and additional seepage from TSF2.

Historical investigations indicate the Williams and Crabb Faults inhibit groundwater flow, and this means these features may promote preferential drawdown towards the south. Depressurisation to the north will be controlled by the groundwater level in Toms Gully Pit. As the pit is dewatered the zone of depressurisation will expand outwards, with the shape of the drawdown also influenced by the fault zones. The shape of the zone of depressurisation may fluctuate in response to seasonal rainfall. Drawdown is likely to expand over the dry season, and then contract during the wet season, if significant recharge occurs (AGEC 2015). AGEC also concluded that the highly conductive ore zone and the overlying fractured siltstone represent the main water bearing strata in the TGU Project area. The two units are hydraulically interconnected, although hydraulic properties vary significantly.

The potential groundwater connectivity has influenced the TGU Project design. Use of TSF 1 to retain the TGU Project tailings was considered, and was identified as being the option with lower construction material requirements and away from any potential flood risk from Mount Bundey Creek. Planning also identified that the Williams fault runs under the footprint of the existing TSF1. The risk of hydraulic connectivity between an active TSF and the underground workings was identified and led to this option being dismissed.

The Crabb Fault, which defines the eastern extent of the ore zone and consists primarily of quartz laminated with black shale and sulphides, is highly permeable near the pit (Rockwater 1995). Previous studies have suggested the Crabb Fault may restrict the hydraulic connectively to the east. During pumping tests, bore P90, which is located to the east of the Crabb Fault, responded significantly slower to pumping compared with a monitoring bore located to the west of the fault.

Excluding registered mine bores; there are a total of 19 registered groundwater bores located within 5 km of the mine lease, all of which are to the east or south of the TGU Project area (Figure 21). Registered bore RN034599 is approximately 3 km east of the proposed underground. As the Crabb Fault is expected to limit expansion of the zone of depressurisation to the east, the likelihood drawdown impacts will reach registered bores to the east is low (AGEC 2015).

Bore RN035786 is registered as an irrigation bore in the NT Water Portal, it is located approximately 2 km to the southeast of the proposed underground. The current usage of this bore is not known. Previous studies suggest most of the groundwater inflow into the underground is derived from storage in the ore zone and the overlying siltstone and historically drawdown from the underground was not noted to be laterally extensive. As the TGU Project is essentially a resumption of previous activity, the likelihood of the zone of depressurisation impacting bore RN035786 is considered low (AGEC 2015). Currently there are no mine groundwater bores to the southeast of the TGU Project. Thus the likelihood of groundwater drawdown impacting upon neighbouring bores is low.

Whilst the pit water balance modelling indicates there is minor potential for seepage of poorer quality from the pit during wet seasons, any contamination is highly likely to remain localised as the pit forms a groundwater sink during the dry season.

The dewatered pit represents a sink for contaminants. With the nearest down gradient registered bore being 1.7 km away, AGEC (2015) concluded that based on the current hydrogeological understanding it is highly unlikely that any seepage from the pit will migrate this far.

6.3.3.3 GROUNDWATER DEPENDENT ECOSYSTEMS

Figure 37 presents the mapped potential GDEs near the TGU Project area as presented in the publically available GDE atlas (BOM 2015b).

This preliminary mapping exercise is intended to identify areas that potentially access subsurface groundwater to meet all or some of their water requirements. The potential GDEs include terrestrial vegetation, subsurface fauna communities (e.g. burrowing crayfish), and vegetation associated with surface water bodies. The areas which show a moderate to high GDE potential are associated with existing creek channels, flood plain areas or shallow alluvium.

The map indicates that Mount Bundey Creek has potential for groundwater dependency. To date there has been no drilling to determine if there is any alluvium. Bores near Mount Bundey Creek (G9 and WB3) indicate the water table in the siltstone near Mount Bundey Creek is approximately 8 m below ground level suggesting Mount Bundey Creek is not likely to be directly connected to groundwater (AGEC 2015).

Further support for this is that the previous dewatering did not result in any significant changes in vegetation (vegetation death) in Mount Bundey Creek – no anecdotal or residual evidence exists for any such event. It is concluded that the TGU Project is very unlikely to result in any impact to GDEs.

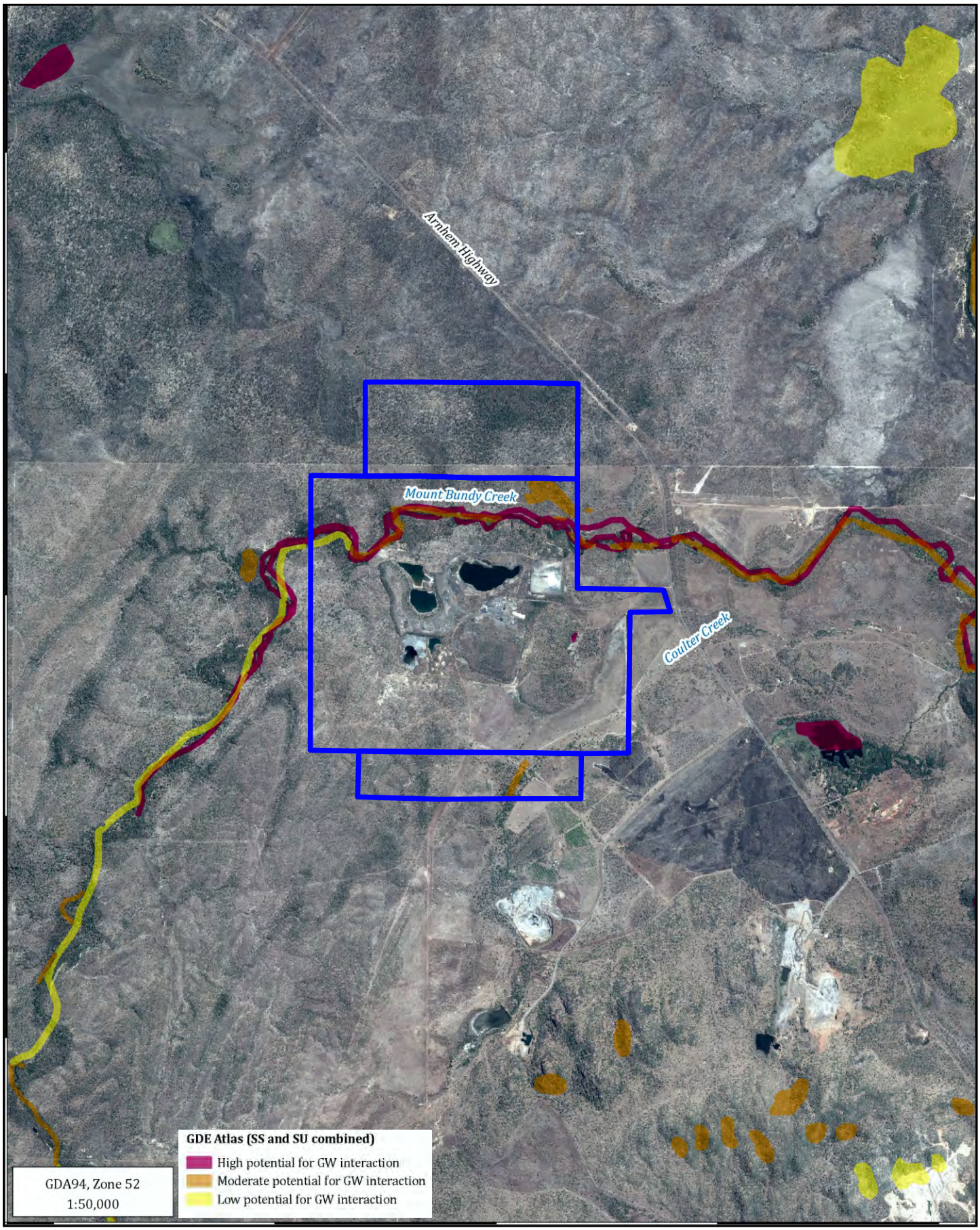
The historic mining infrastructure is a source of ongoing acid leachate within the mining leases. The water currently residing in the existing pit and underground mine is known to be low pH and elevated in a number of metals and sulphate. The TGU Project will dewater the existing pit and underground mine, treat this water and release it or store it in the new WSD.

Infiltration from the WSD will reflect the quality of the input water. The initial filling will be treated pit water and is expected to meet livestock water quality requirements (and better for many analytes). Further test work is being completed to confirm effectiveness at different dosage rates and with water from both the top and bottom of the pit.

The WSD water will be used as secure source of top-up for process water throughout the life of the mine. Water is expected to seep from the WSD into the underlying aquifer – water balance modelling has estimated this to be between 0.4 and 4 ML/day (Coffey 2015).

As dewatering continues, the bores or underground pumps will draw in groundwater from the surrounding fractures zones and overlying Wildman Siltstone and weathered zone. The quality of this water is expected be reflective of the groundwater in the area, and when the quality reaches the quality requirement for the WSD, water treatment will no longer be required.

The existing site features that are known to be sources of contaminants are the two WRDs and TSF1. Evidence of isolated groundwater impacts from the WRDs are seen in the water quality results from bores G5 and G9 (Section 4.4.4). Some of the contaminated water from under these structures may be drained through the dewatering process. Further intervention would be required to prevent these processes from resuming groundwater contamination post-Project.



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1km

Figure 37: Potential Groundwater Dependent Ecosystems

PRIMARY GOLD

10/8/2015

6.3.3.4 SEEPAGE FROM TSFS

Whilst the pit water balance modelling indicates there is minor potential for seepage of poorer quality water from the pit during wet seasons, any contamination is highly likely to remain localised as the pit forms a groundwater sink during the dry season. Furthermore, the nearest down gradient registered bore is 1.7 km away. Based on the current hydrogeological understanding it is highly unlikely that any pit seepage will migrate this far.

Preferential groundwater flow pathways from TSF2 to Mount Bundey Creek would be difficult to identify. The Crabb fault is noted to run approximately between TSF2 and the pit. Given the pit will be dewatered for the life of the TGU Project, the groundwater heads will direct any flow toward the pit and away from Mount Bundey Creek. The rate of new seepage, and additional heads created by the deposition of tails on any existing contaminated groundwater will be limited by the use of a GCL with permeability of the order of 10^{-11} m/s (based on Elcoseal GCL specification). The risk of seepage migrating during operations from TSF2 to Mount Bundey Creek is therefore considered to be very low.

6.3.3.5 SEEPAGE FROM EVAPORATION PONDS

Seepage from EP1 and EP2 is expected to be occurring currently (evidenced by water quality data from bore OB11). The TGU Project proposes to treat the existing water in the evaporation ponds so that new storage capacity is created and concentrated contaminants are precipitated out and removed from the system. The TGU Project will not create any additional load on the evaporation ponds. Dewatering the pit will ensure that groundwater heads around the pit direct local groundwater towards the pit, providing better potential capture of historic seepage from the ponds.

Once operational, EP1 and EP2, are expected to fill from runoff and seepage from their local SWRD catchment. Water quality will gradually deteriorate as contaminants concentrate through evaporation over time.

The pre-mining groundwater investigations and development of a regional scale three dimensional (3D) groundwater model will allow seepage from EP1 and EP2 to be better understood and managed.

6.3.3.6 SEEPAGE FROM WASTE ROCK DUMPS

Seepage from the WRDs is expected to be occurring currently (evidenced by water quality data from bore G8 (SWRD) and G5 (OWRD)). Runoff and seepage water from the SWRD is collected in the evaporation ponds where contaminants are concentrated. Historically, the evaporation ponds have been used as the storage vessel for mine water prior to release to Mount Bundey Creek. A system of syphons is installed to control this process.

Runoff and seepage water from the OWRD is collected in the northern drain and directed to the Oxbow Wetland which acts as a passive treatment system. The TGU Project will not create any additional load on the northern drain.

Dewatering the pit will ensure that groundwater heads around the pit direct local groundwater towards the pit, providing better potential capture of historic seepage from the ponds. The pre-

mining groundwater investigations and development of a regional scale 3D groundwater model will allow seepage from EP1 and EP2 to be better understood and managed.

6.3.3.7 Mine Closure

Current water levels in the pit are around 10 m below surrounding groundwater level, so the pit acts as a groundwater sink (no water flows out of the pit). The pit has a catchment area estimated at 35 ha from which surface water drains into the pit. The pit itself is only around 5 ha in area. There may be opportunity to identify surface flows of clean water that can be diverted to the environment rather than adding to pit water.

The pit will be dewatered, the water treated and discharged from site to enable underground mining to proceed. Upon mine closure, the pit will be allowed to fill, and given the reactivity of the AMD materials, the pit water quality is likely to return to these conditions. Based on the current water quality from the pit lake, Table 34 outlines the likely water quality in the pit following closure and refilling. It should be noted that the TGU Project is expected to delay the reaching of equilibrium levels between pit water and surrounding groundwater as the pit water will be treated and removed.

6.3.3.8 Influence of Seasonality

In the long-term, the combination of rainfall and evaporation will influence the level of water in the Toms Gully pit, which in turn will influence the role of the pit as a source or a sink for contaminants. AGEC (2015b) have modelled the pit water levels to show rises rapid over the first 10 years post-mining. This is followed by a period of slower recovery until approximately 50 years post-mining when the pit water level stabilises at approximately 12 mRL. Pre-mining water levels in the vicinity of Toms Gully Pit were approximately 16 mRL. The groundwater level in bore G9, located approximately 200 m north of Toms Gully Pit (between the pit and Mount Bundey Creek) is approximately 13 mRL. The implications of the pit water level are discussed in Section 6.3.2.7.

6.3.4 Contaminants of Concern

There is a history of mining at Toms Gully since 1988 with a series of water quality monitoring locations identified (Figure 16) and with historic records. The catchments of both Mount Bundey Creek and Coulter Creek can be seen to be cleared for agricultural grazing downstream of the Toms Gully site.

Contaminants of Concern (COC) were readily identified via a review of the existing water quality database and reviewed in the light of AMD assay work completed by GHD (2015c). In addition, baseline environmental work on aquatic ecosystems was completed on Mount Bundey and Coulter Creeks (GHD 2015a) and considered potential contaminants.

Table 36 shows surface water sampling sites which include sites that are part of the process water circuit (TSF1, TSF2, RO Pond and ODP). They also include areas with mine affected water, such as Pit, EP1 and EP2. Three sites are located on Mount Bundey Creek SWTG1A – upstream

of site, SWTG2 immediately downstream of site and SWTG3 near the confluence of Coulter and Mount Bundey Creeks.

Table 36: Water Infrastructure and Characteristics (GHD 2015b)

Structure	Sample Point ID	Max Volume (ML)	Surface Area (m^2)	Depth (m)	Catchment Area (m^2)
Pit	Pit	4,660	90,000	88.3	346,500
Underground Operations	-	140	n/a	n/a	n/a
Evaporation Pond 1	EP1	346	46,700	8	162,800
Evaporation Pond 2	EP2	354	47,900	8	98,000
New Tailings Dam	SWTG TAILS 2	75	75,300	1	91,400
Stormwater Pond	-	12.5	6,000	3	57,100
Drainage Bund	-	5	74,400	0.3	100,000
Oxbow Wetlands	SWTG11 – entrance SWTG6 – middle SWTG12 – discharge	30	29,900	1	550,100
Raw Water Pond / RO Pond / Mill Process Water Pond	RO Pond	1.4	400	8	0
Old Tailings Dam & decant pond	SWTG TAILS 1	133.1	70,900	-	270,800
Oxide Waste Rock Dump	OWRD	-	-	-	-
Lake Bazzamundi	SWTG5	50	167,500	1	1,712,500

Data from the Toms Gully site was reviewed for the period of approximately January 2007 to February 2015. Details of the characteristics of the water infrastructure storage volumes and catchment areas are provided in Table 36. The pit is noted to have a surface area of nearly 9 ha and a surface catchment area of 35 ha. Reduction in catchment area for site closure may be an option to ensure pit water levels are kept to a minimum. Table 33 presents a summary of water quality from the review.

As the Toms Gully site has previously discharged water to Mount Bundey Creek, there is a history of licence conditions that reflect the development of compliance requirements for water discharge. These previous requirements have been updated and upgraded to be suitable to current environmental standards and to minimise the risk of potential downstream impacts. GHD (2015g) prepared a revised set of SSTVs as a means of providing reference points for compliance that are consistent with the status and land use in Mount Bundey Creek. The SSTVs proposed acknowledge the downstream sensitivities associated with recreational fishing and aquatic ecology.

The evaporation ponds EP1 and EP2 combined represent the second largest containment structure on-site after the pit and underground (Approximately 2,647 ML). Currently both evaporation ponds have trends showing an increase for metals, sulphate and EC and decrease in pH (with the exception of lead which has a downward trend at EP2).

The discharge from the wetland (SWTG12) has a consistent downward trend for metals, sulphate and EC. However, no trend was observed for pH, chromium and nickel. The trends at SWTG12 could be indicative of reduced or no discharges from mine site water management infrastructure into the ecosystem allowing dilution.

6.3.5 CONTAMINANT TRANSPORT

Contaminant transport potential has been reviewed based on the historic site monitoring database, together with source, transport and receptor identification to provide a conceptual model for three phases of the mine life – dewatering, operations and closure. The ToR requested a 3D contaminant transport model be prepared for the site for all three phases of the mine. Following review and discussion with technical consultants, Primary Gold has proceeded to complete the EIS with a conceptual contaminant transport model due to the lack of data to support a robust 3D approach (Appendix 9). Primary Gold commits to implementing the additional monitoring bores and surface monitoring regime to support the 3D modelling approach. It is proposed to implement this program prior to mining, with data capture and modelling being completed when operations commence. The reasons for this approach are outlined below.

6.3.5.1 GROUNDWATER MODELLING

3D groundwater flow modelling for the purposes of Environmental Impact Assessment has not been carried out for the TGU Project on a scale appropriate to contaminant transport, and as a result, contaminant transport modelling has not been undertaken either. The reasons for not developing a 3D impact assessment groundwater flow model at this stage of development are as follows:

- Data with sufficient spatial coverage was not available;
- Successful development and undertaking of the TGU Project would hydrogeologically see no tangible change to the existing post closure conditions that would occur in a 'do nothing' scenario. Also, the dewatered heads in the vicinity of the pit and underground during operations reduce the likelihood and magnitude of contaminant migration from on-site sources;
- There is insufficient reliable data (temporally and spatially) to support or justify the requirement for a detailed impact assessment groundwater flow model;
- There is sufficient conceptual understanding of the groundwater system to justify not undertaking an impact assessment groundwater flow model;
- The TGU Project design has purposely limited the creation of new contaminant sources and will minimise the risk of tailings as a contaminant source during operations and at closure;
- The upfront time and cost involved to instrument and gather data in support of a 3D groundwater flow model;

- The improved technical accuracy of a 3D groundwater flow model to be developed from a purpose built data set;
- The reduced risk of off-site groundwater contaminant movement (from the WRDs and TSF) during operations due to the strong groundwater gradients created toward the dewatered pit;
- The adoption of best practice ARD management for tailings and waste rock; and
- The need to better understand the existing WRDs (which are not being further used in the TGU Project) as contaminants sources.

A bore census and further monitoring bore installation is planned to be implemented during the pre-mine phase of the TGU Project by Primary Gold. This will enable the site to generate data from specific locations and with the required spatial and temporal specifications to prepare a 3D impact assessment flow model. The regional model would use the latest geological data from site and be developed to simulate seepage from surface infrastructure such as WRD, TSF and the WSD.

The regional flow model would be calibrated against the initial dewatering period to ensure the stresses on the groundwater system (i.e. dewatering of the pit and existing underground) are accurately simulated and that observed groundwater levels closely match the model predictions. The regional flow model would then be used to predict the regional groundwater response to mining and in particular, post closure response. The post closure predictions would be compared against the feasibility dewatering model, spreadsheet water balance model and 2D SEEP/W model developed by AGE for the EIS.

Given that some contaminants are likely to bind and complex with other chemical agents prior to or during transport, the focus is on COC that are conservative in nature (that is – unlikely to react with other agents) such as salts for contaminant transport. It is these conservative agents that are likely to travel the furthest from source.

6.3.5.2 Contaminant Transport Modelling

One of the key benefits of contaminant transport modelling will be to examine in detail the potential long-term patterns and impacts of movement of contaminants via surface water and groundwater. These long-term issues are clearly more relevant to site closure as in the short-term surface water will be intensively managed and groundwater heads created that will create flow paths toward the dewatered pit.

As a pre-cursor to contaminant transport modelling, particle flow paths would be generated to assess the conservative behaviour of contaminants post-closure. Flow path assessment would determine whether contaminant transport modelling would be required and would depend upon the movement and capture of particles from the surface infrastructure. If the model predicts that the pit void post closure does not capture the contaminant particles, then it is recommended that contaminant transport modelling be carried out (AGEC 2015c).

The contaminant transport modelling would predict the behaviour, migration and potential contamination plume(s) that would occur over time from the TGU Project. The contaminant transport modelling would use the current conceptual understanding of site conditions, contaminant sources, pathways and receptors as a basis for development. It will require

detailed simulation of historic infrastructure to ensure the model predictions are as accurate as possible.

6.3.5.3 Conceptual Contaminant Transport – Dewatering Phase

During dewatering there is no movement of solid source materials such as ore, waste rock or tailings. The dewatering phase will treat the pit water (either in-pit or via the plant) to the target livestock water quality and pump the treated water to the WSD. The water in the evaporation ponds (EP1 and EP2) will also be treated either directly or via mixing with pit water. The WSD will discharge water to Mount Bundey Creek in accordance with a water discharge licence to meet the downstream water quality target.

The COC in the dewatering phase are therefore restricted to those apparent in the key existing water bodies on-site – pit, EP1 and EP2. Figure 38 shows the sources, pathways and receptors for the dewatering phase.

The dewatering phase involves significant scale internal (within the mining lease) water transfers and are dependent upon a water treatment process to ameliorate water quality and reduce the concentrations of COC. The proposed water treatment options are identified in Section 6.4.

The pit currently acts as a groundwater sink and has been used as a receiver for contaminated water from the evaporation ponds and TSFs. It is likely that the pit walls have exposed sulphides that will also have contributed to the low pH and elevated metals concentrations in the pit water. The pit water is not suitable for direct release to the environment. The development strategy for the TGU Project acknowledges this and proposes to treat the pit water to remove metals and elevate the pH to acceptable levels. They include two options for reagents (lime or caustic) to raise the pH, and may treat the water in-pit, in-pipe or via the processing plant. Test work is currently being completed to confirm the performance of the reagents and to allow for detailed planning of the water treatment process.

The treated water will still contain minor concentrations of metals and is likely to be elevated in sulphates. It is planned to target livestock water quality in the WSD. The water balance modelling shows that the WSD is unlikely to overflow in the dewatering phase (Section 6.3.6) and hence the risk of COC escaping from the WSD in significant concentrations is limited to scenarios where:

- Both the water treatment process has failed and high rainfall triggers an uncontrolled discharge; or
- The water discharge process is not managed to meet the required compliance level.

It is proposed that the Section of Mount Bundey Creek as it flows through the Mining Lease be used as a mixing zone.

The water treatment process will create a metal rich slurry from precipitation and residual undissolved solids (precipitates), representing a newly created material that contains COC in significant concentrations. Depending upon the water treatment process selected, the precipitates will either be deposited on the walls and floor of the pit as the water is pumped out, or will be gathered in the process plant for disposal in the TSF.

Sources of COC associated with existing infrastructure such as the WRDs, TSFs and EPs are shown in the Sections dealing with the operations and closure phases (Sections 6.3.5.4 and 6.3.5.5 respectively).

Potential receptors are identified outside of the operating area as:

- Livestock in grazing areas;
- Fauna living in or accessing Mount Bundey or Coulter Creek water; and
- Groundwater.

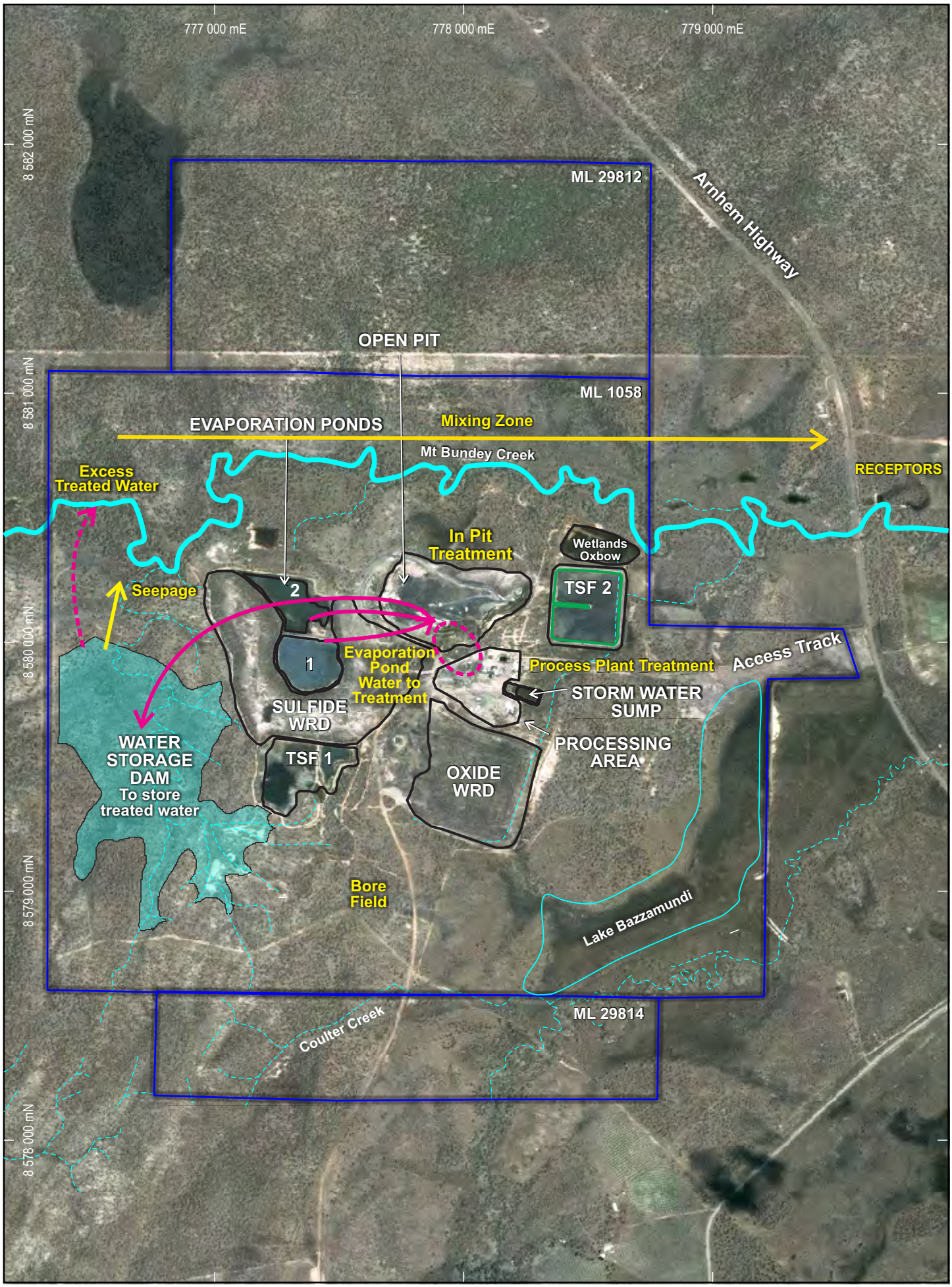

Figure 38: Contaminant Transport - Dewatering

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6.3.5.4 Conceptual Contaminant Transport – Operations Phase

During operations, the potential sources of COC include ore, waste rock and tailings. All of these are subject to disturbance and relocation. Ore will be mined and transported to surface, stockpiled on the ROM pad for a period and then run through the processing plant. Waste rock will be left underground or placed in the base of the pit. Tailings will be pumped to the TSF (Figure 39).

Whilst ore, waste rock and tailings are all sources of COCs, the pathway for transport to receptors is most likely to be water. Controls will be implemented to ensure that these materials are not transported to locations other than as planned. Minor quantities of COCs could be transported via air (as dust).

These movements of source materials create additional risk of movement of COCs from:

- TSF2 – additional tailings, decant water, seepage water with risk of transport via both surface water and groundwater; and
- ROM pad and processing area – stockpiled ore and ore in process (including additional reagents as COCs) with risk of transport via surface water to the Stormwater Sump (which would overflow into the cut-off drain), flow into the Oxbow Wetlands and eventually flow into Mount Bundey Creek. Seepage from the ROM and processing would most likely move towards the pit due to the groundwater head created by the dewatered pit.

In addition, the water quality in the WSD may still not meet the water quality requirements and hence seepage or unplanned discharge could create a pathway for COCs into Mount Bundey Creek.

Water from bores near the underground workings will be pumping water to the south of the existing sources of COC. This water is expected to be of suitable quality for direct release, and consistent with prior practise, will be released to Lake Bazzamundi, providing the pastoralist with additional feed in the dry season. AGEC (2015b) note the dominance of HCO_3 in natural groundwater samples, indicating the water is relatively young and reflective of recent recharge. Only three bores are noted to have groundwater characteristics with sulphate dominance reflecting sulphide oxidation. The oxidation process would be occurring at shallow depths, and is probably due to acid leachate contamination (low pH water) from the sulphide and oxide waste dumps. Bores G8 and G5 are along the edge of the sulphide and oxide waste rock dumps respectively (Figure 39), other proximal bores show little or no leachate contamination.

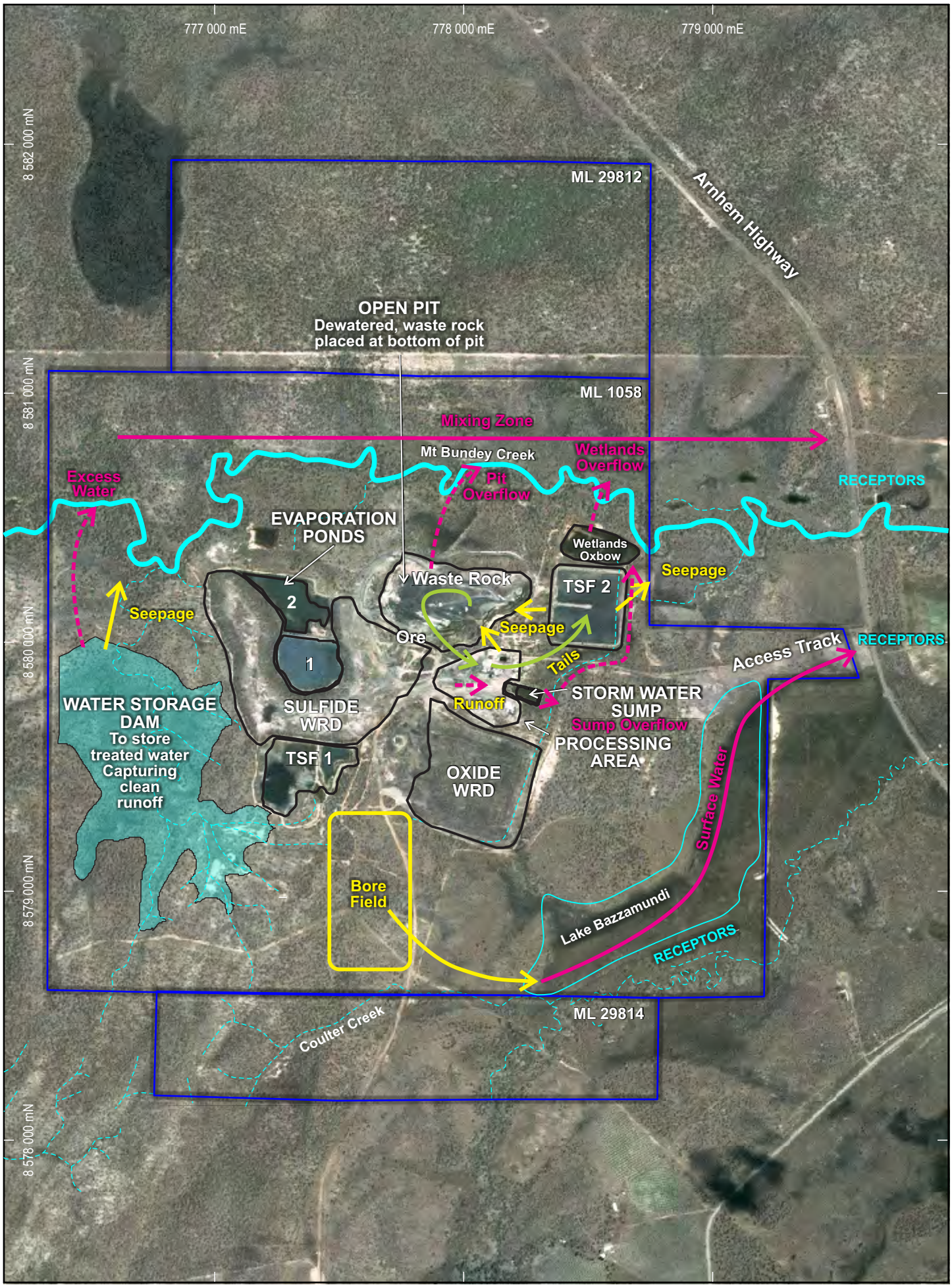

Figure 39: Contaminant Transport - Operations

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6.3.5.5 CONCEPTUAL CONTAMINANT TRANSPORT – CLOSURE PHASE

During the closure phase, the potential sources of COC are waste rock and tailings, as well as potential leachates and contaminants from PAF materials in the pit wall. The conceptual model for this phase also shows the potential pathways for COC to migrate from WRDs to receptors. It is acknowledged that these sources exist during previous phases, but for the sake of simplicity, they are only displayed in the closure phase.

Unless sufficient capping material can be accessed and a corresponding MCP approved which allows the tailings to be capped *in-situ*, they will be removed at the end of mining and placed in the base of the pit (Figure 40). This is the preferred strategy and represents the lowest risk for any future migration of COC from tailings off-site (as the materials will be inundated under many meters of water that will effectively prevent oxygen from accessing the sulphides and causing oxidation).

Whilst seepage from the pit is shown as a pathway, it occurs only after the pit water level reaches equilibrium with the surrounding groundwater. In a steady state (long-term) simulation (AGEC 2015c), the pit is predicted to behave as a localised sink in the groundwater environment. A long-term pit water level of 1,012 mRL is predicted which is 3 m below the level in Mount Bundey Creek (1,015 mRL assumed from monitoring data). Therefore, in the steady state, there is predicted to be minor groundwater flow back from Mount Bundey Creek toward the Toms Gully Pit void.

However, as the data used long-term net average data (rainfall minus evaporation) and doesn't take into account seasonal fluctuations, there will be a regular occurrence where during periods of increased rainfall, the water level in the pit will increase to greater than 1,015 mRL and groundwater flow toward Mount Bundey Creek will occur on a temporary basis. During the following dry season, evaporation will take over and the water level in the pit will reduce back to form a localised sink in the groundwater system. This may be a regular cycle depending on the short-term climatic regime.

The climatic data shows that December through to March (four months) will be the period where water level in the pit will be high and April through to November (eight months) the pit water level will be low. Hence, the groundwater head reversal would be expected to occur every dry season.

It is noted that the model employs a conservative assumption of a static environment outside of the pit - that is the levels are constant regardless of the climatic conditions. The groundwater levels surrounding the pit are all likely to increase during the wet season and hence the pit is less likely to behave as a source during this time.

Surface water exchange is also identified as a possibility. The pit crest is located close to the modelled 1:100 year flood level for Mount Bundey Creek. Events in excess of a 1:100 year magnitude would therefore be expected to flood the pit. Excess water may then flow back out of the pit and may lead to some transport of COCs to the wider environment, albeit under conditions of significant dilution.

The ROM pad and processing plant will have been rehabilitated and no COCs are expected to be exported post-closure. Figure 41 illustrates contaminant transport closure for tails capped *in-situ* should this option be approved.

The existing WRDs are both sources of COCs that will remain in their current location and status at the end of the TGU Project mine life. The site is configured to capture surface runoff from these features, either into the evaporation ponds (seepage and runoff from SWRD) or the Oxbow Wetlands (seepage and runoff from the OWRD) (Figure 35). A long-term plan that ameliorates the AMD problem from the WRDs and provides safe, resilient and reliable control of COC mobilisation required development.

At the end of mine life the WSD may be retained for use by the pastoralist, or emptied and the embankment used as capping material over tailings or waste rock. Neither of these scenarios are likely to lead to any new sources or relocation of sources of COCs, or pathways to receptors.

During closure the pathway for contaminant transport to receptors continues to be water.

The conceptual model detailed above shows that the site fundamentals and risks have been identified and have been used to assist in preparing the mitigation measures for water management. More detail regarding water management is provided in the WMP (GHD 2015b).

Primary Gold's commitments to international best practice in long-term tailings storage significantly reduces the risk associated with both the TGU Project tailings and the existing tailings.

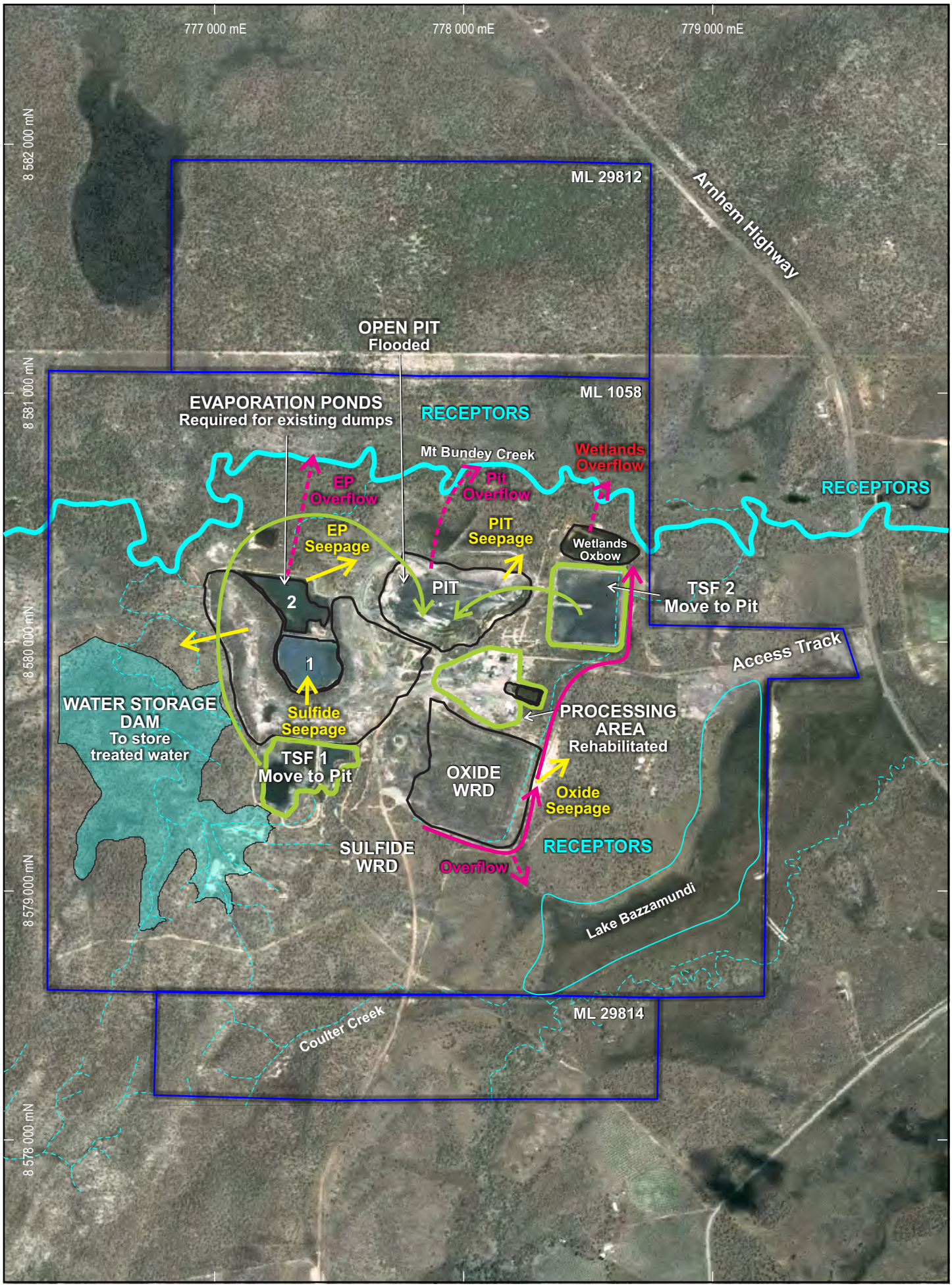

Figure 40: Contaminant Transport Closure Option 1 (Tails In-pit)

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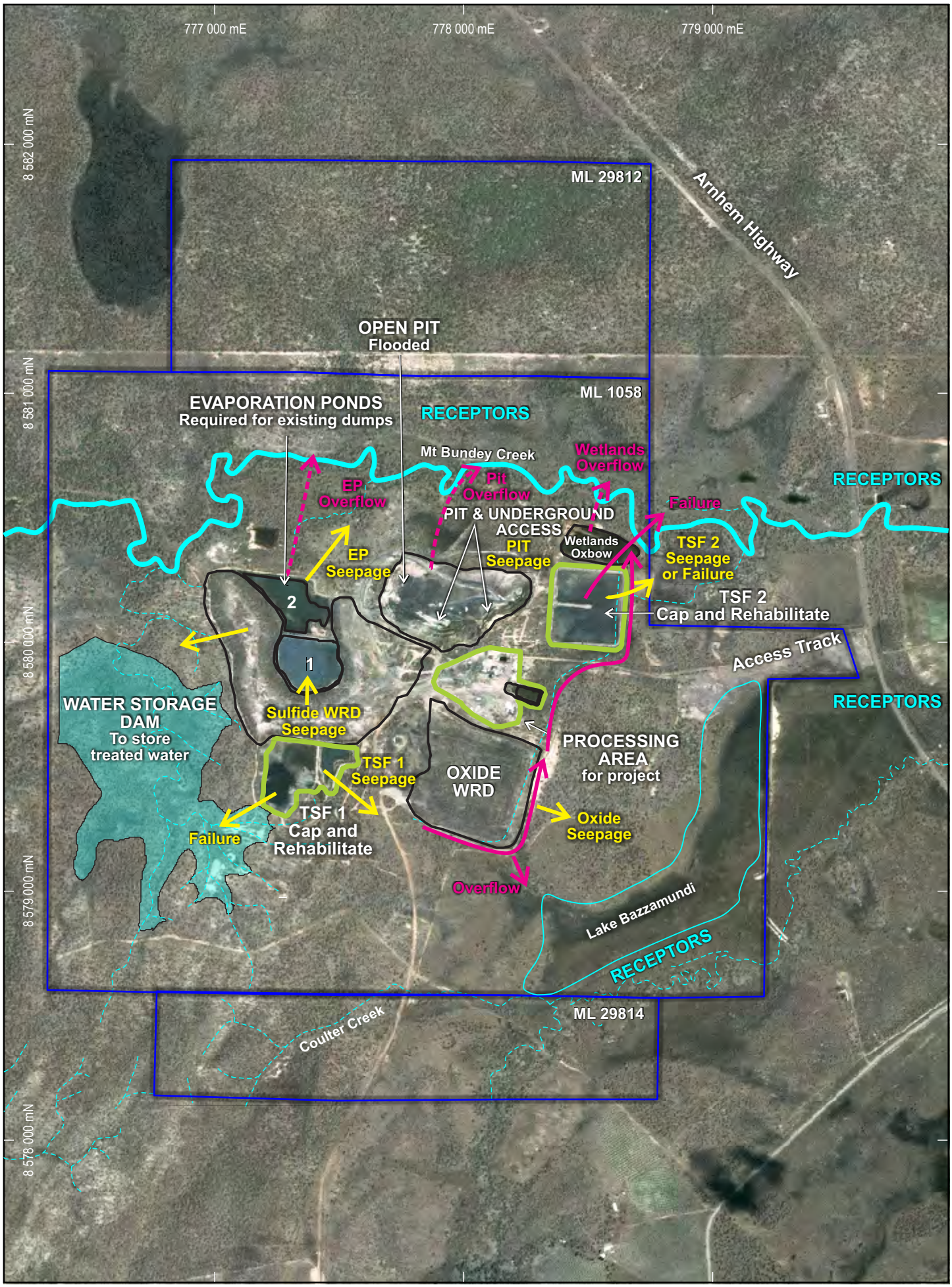

Figure 41: Contaminant Transport Closure Option 2 (Tails Capped *In-situ*)

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6.3.6 WATER BALANCE

Primary Gold has reviewed the existing environment (Section 4) and prepared an operations simulations model (OPSIM) water balance model (Coffey 2015) that has incorporated the latest changes to the site operational water management system. The water balance model has been based on a revised mine plan that incorporates the development of the new WSD and new TSF (Figure 42).

Simulations have been conducted to predict the performance of the site based on future operations under the new configuration. The investigation has included:

- Review of mine expansion designs;
- Re-assessment of catchment size and storage stage relationships;
- Forecast assessment of the expected future stored water inventory for the Toms Gully gold mine;
- Forecast modelling under a high rainfall event (90th percentile); and
- Forecast modelling under a 1 in 100 year 72 hour rainfall event.

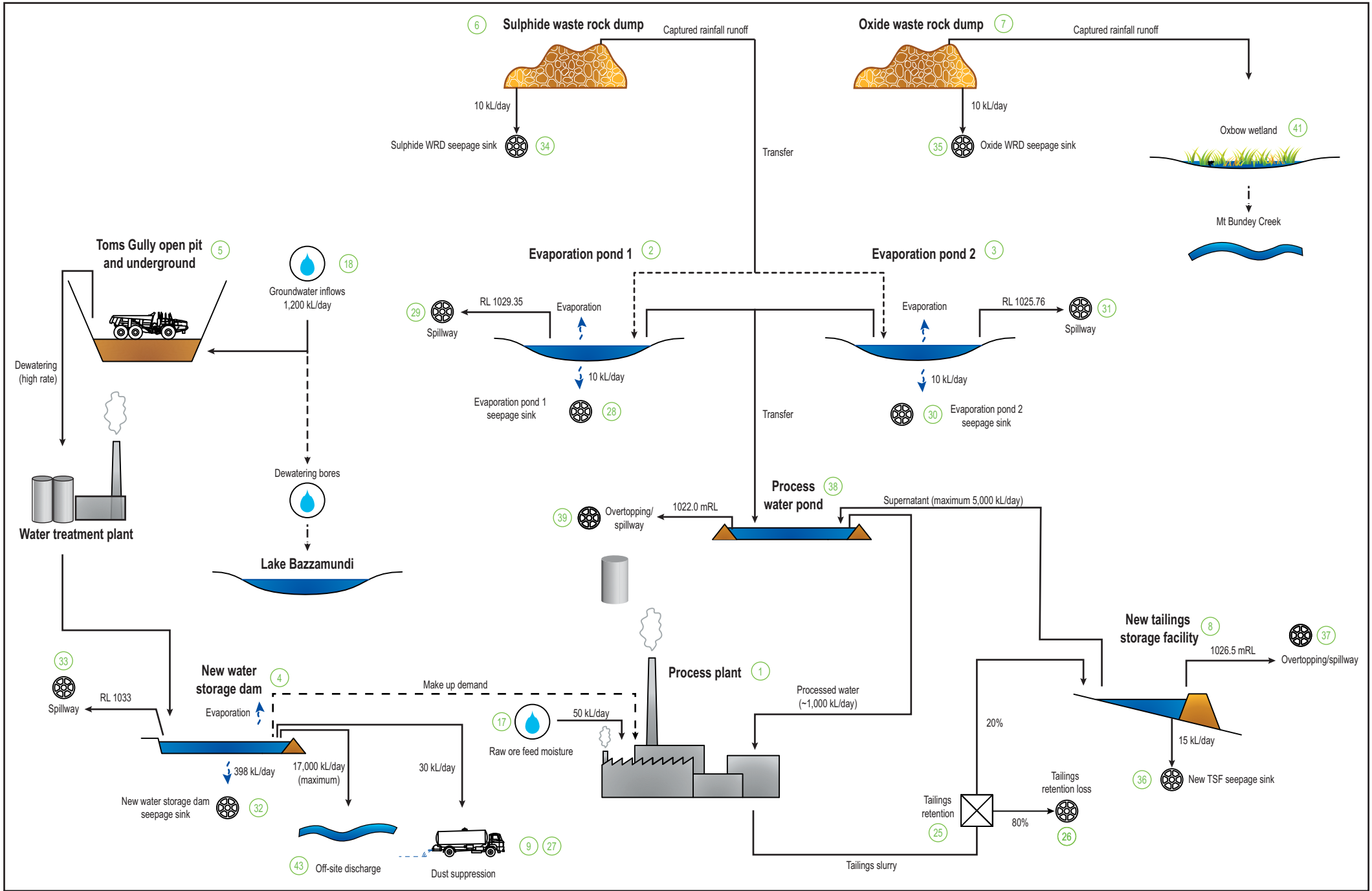
The OPSIM model was used to assess the expected performance of the water management system against the following key performance indicators:

- Reliability of water supply to the process plant;
- Excess water production and spillway frequency; and
- Forecast assessment of site water inventory.

Figure 43 shows the surface water catchments used in the water balance model.

The performance of the existing system was assessed by running the model for an extended 58 year simulation using historic climatic data to quantify expected future performance characteristics, based on the assumption that the historic climate data represents future conditions.

Based on long-term historical climate data, the modelled average daily catchment inflows (runoff) for the main surface water storages and waste rock dumps on the site are provided in Table 37. The new WSD is predicted to have average inflows of just below 1 GL/yr, with direct rainfall of approximately 0.35 GL/yr.



LEGEND

- Storage node
- Sink node
- Control/storage demand node
- Source node
- # Functional node number

Figure 42: Site Water Balance Model Schematic

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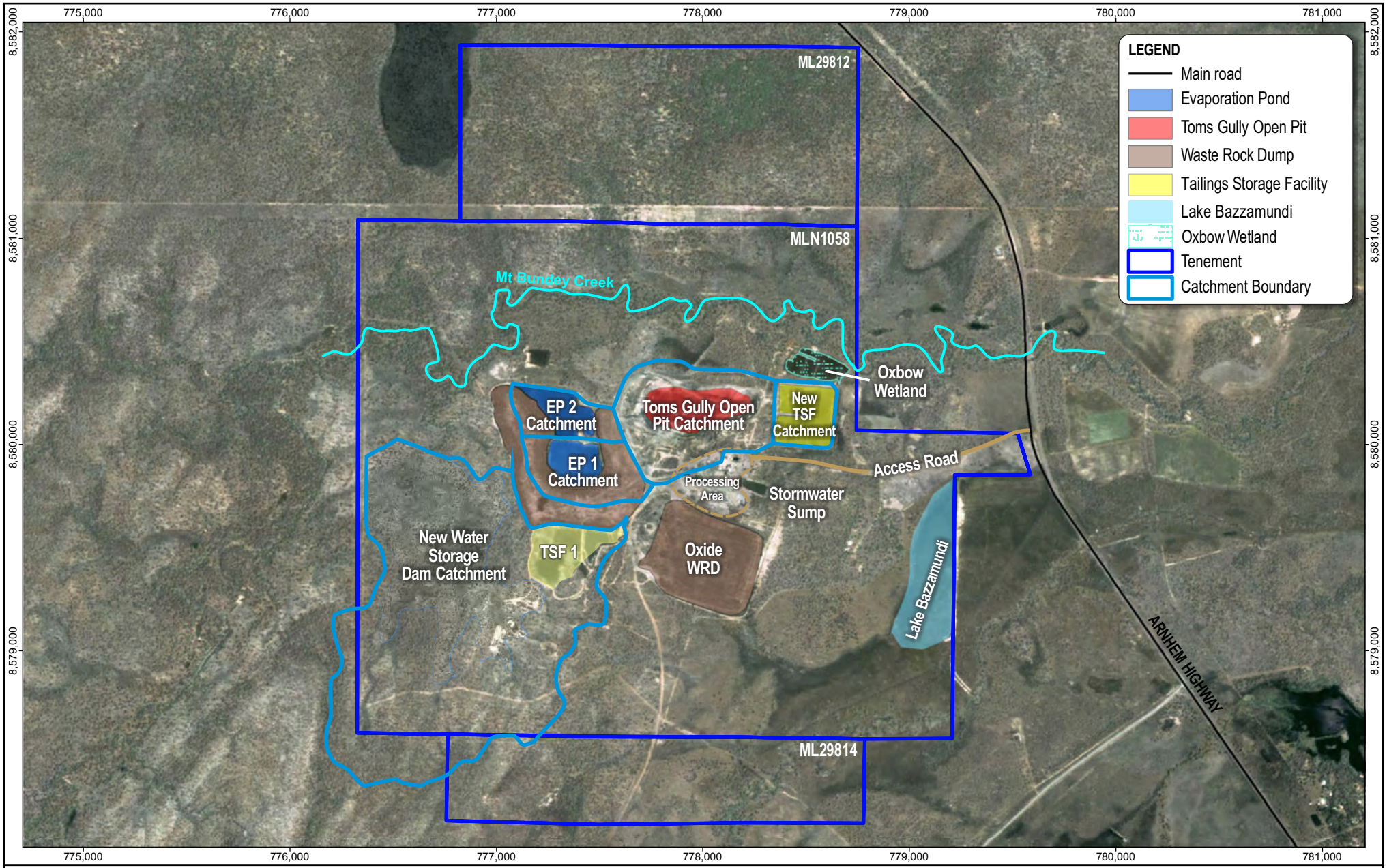

N

500m

Source:
Tenements from DME (July 2015)
Imagery from ALOS (2011)
Coffey 0911AC_01_F02.1_GIS
Projection: GCS GDA 1994
Scale: 1:25,000 @ A4
Date: 22.07.2015

Figure 43: Surface Water Catchments - Mining Area

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Table 37: Annual Catchment Inflows for Extended 58 Year Simulation

Storage	Catchment inflow (runoff) (kL/day)	Direct rain (kL/day)
EP1	274	141
EP2	132	151
New WSD	2,568	955
Toms Gully pit	-	765
New TSF	45	326
Process Water Pond	-	0.7
Sulphide WRD	538	-
Oxide WRD	359	-

The Toms Gully pit currently has a free water volume of 2.6 GL. Prior to the commencement of operational activities, the Toms Gully pit must be dewatered. During dewatering, all water will be directed to the new WSD via a water treatment plant or following in-pit lime dosing. The water balance model assumes a maximum treatment rate of 300 L/s. If the water treatment process can support higher throughput rates, the pumping rate could easily be increased to match.

The OPSIM model has been used to predict the expected future stored water inventory in the new WSD, once the Toms Gully pit has been fully dewatered. To model the dewatering scenario the average daily rainfall for each month was calculated based on 58 years of historical rainfall records. This new calculated rainfall dataset was then used to represent the dewatering period. Primary Gold proposes to commence dewatering in the month of May at the start of the dry season therefore the dewatering model was configured to start on the 1 May. The modelling predicts that it will take approximately 72 days to dewater the Toms Gully pit.

The long-term modelling has been undertaken for the six main storages during the static period simulation over the 58 year period of historical climate data, which includes two longer periods of higher than average rainfall. The OPSIM outputs for the WSD are shown in Figure 44.

The modelling also assessed the risk of overtopping of the existing evaporation ponds. Although Primary Gold has no need for the evaporation ponds for the TGU Project, they form part of the existing water management system and will be treated along with the pit water during the dewatering phase. The system will be operated to minimise the risk of overtopping EP2 with water being pumped from the evaporation pond to the WSD rather than allowing it to flow directly to Mount Bundey Creek. During the modelled period, uncontrolled releases from EP1 and EP2 could be avoided by maintaining a freeboard of 4 mRL and 3 mRL (Coffey 2015).

The WSD is expected to be maintained at less than half capacity to ensure sufficient wet season storage in the event of an emergency. The annual inflows into the dam together with its overall capacity provide the opportunity for substantial dilution in the event of an emergency.

Coffey (2015) also modelled a 72 hour period 1:100 year rainfall event for which the average rainfall intensity is 6.36 mm per hour. The volumes of water in the main water storages over the modelled period showed that EP1 overflowed, but EP2 and the WSD did not.

Assessing a drought scenario, the water balance model (Coffey 2015) shows that some water should be retained in the WSD to ensure that the site doesn't run out of water in a dry period. The model shows that water supply demand is met 99.9% of the time.

Water from the borefield will only be extracted once pit water levels have been reduced such that hydraulic gradients in the groundwater system are toward the pit. The quality of water in the bores will be tested daily upon start up, with the frequency of monitoring reduced only as the data shows no backflow of contaminated water from the pit to the bores.

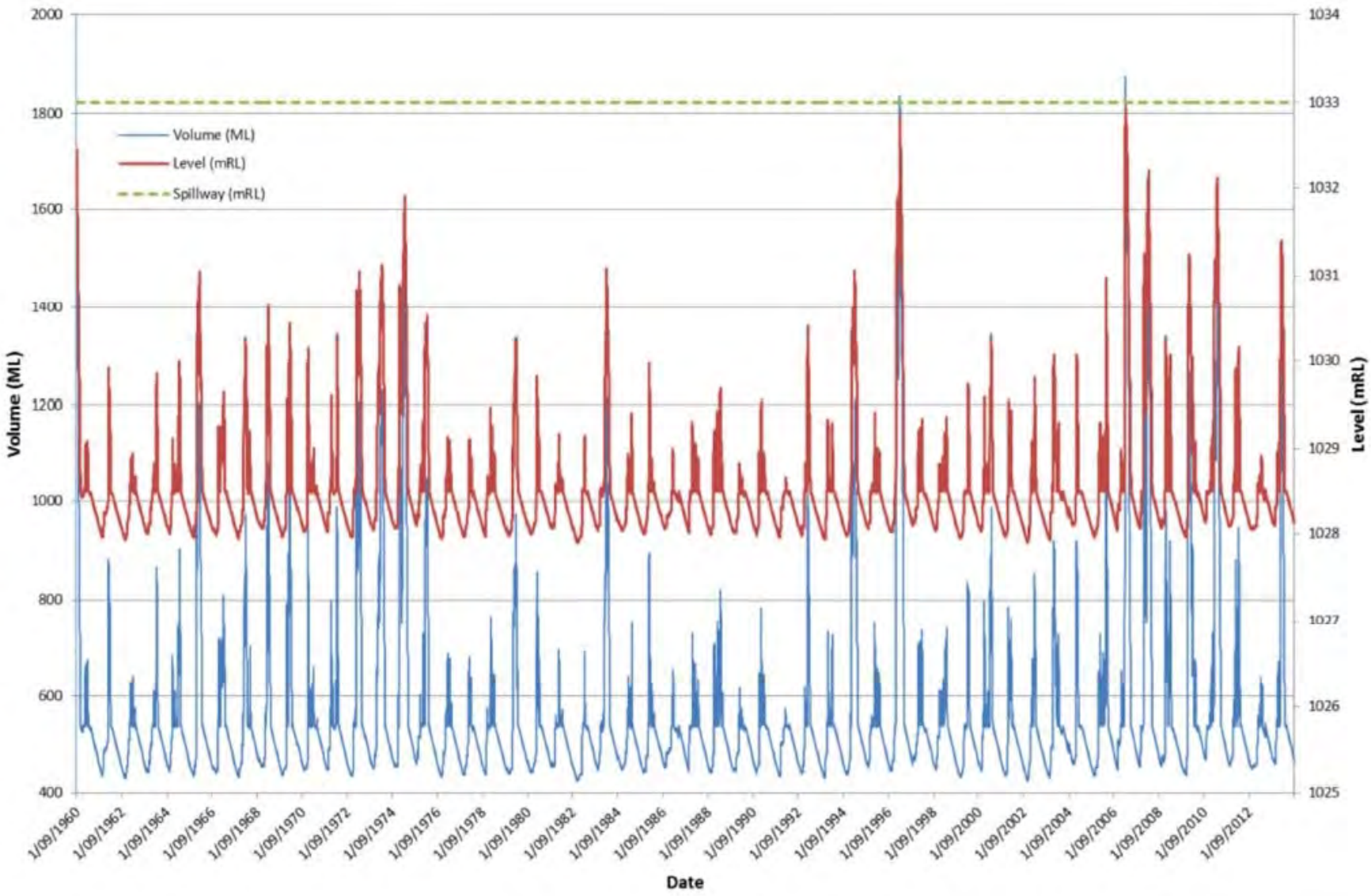


Figure 44: OPSIM Output – Levels and Volumes for WSD (Coffey 2015)

6.3.6.1 WATER DISCHARGE

Previous site management reports indicate that untreated water discharge to Mount Bundey Creek was conducted at a 1:100 dilution ratio with approximately 620 ML discharged in 2008-9 (1,342 mm rain) (CGAO 2009).

The water management system relies on the treatment and release to Coulter Creek of native bore water from around the underground operations. This water will never make its way into the mine water circuit as it is fresh, clean water. The priority usage of water on-site for running the process will see contaminated water used in the processing circuit in preference. AGEC (2015) have predicted flows as high as 70 L/s, with pumping rates reducing to 10-25 L/s for the majority of the mine life (Figure 45). The steady state release of water to Lake Bazzamundi would therefore be around 300 to 800 ML/yr. The capacity of Lake Bazzamundi is estimated at 50 ML, allowing for evaporation and seepage losses, it is likely that a significant portion of this water would flow through the Lake and into Coulter Creek.

The water balance modelling shows that for the 58 year climate record, the average daily discharge of treated water from the WSD is 3.7 ML/day. This equates to 1,350 ML/yr. The water would be discharged to Mount Bundey Creek during peak flow periods.

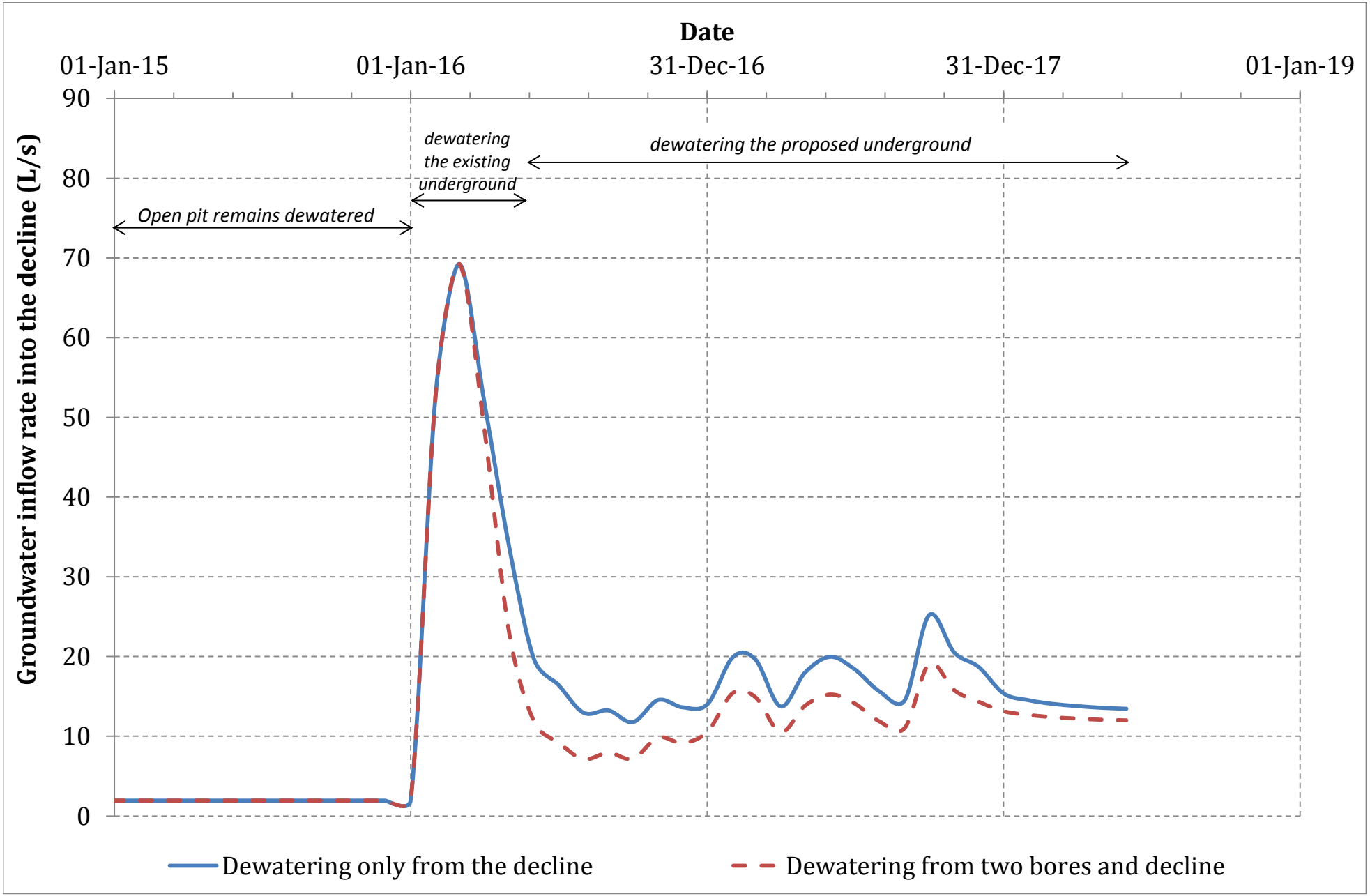


Figure 45: Bore Dewatering - Modelled Flows (AGEC 2015b)

6.3.7 POST-MINING

Post-mining the underground workings and mine pit will flood with rainfall runoff and groundwater. As previously experienced, the water levels in the pit are expected to recover rapidly. The existing pit will then largely control the groundwater levels surrounding the mine. The underground is expected to provide no significant impact to the groundwater levels in the long-term as there will be no permanent evaporative loss of groundwater. The presence of a permanent zone of depressurisation around the pit post-mining will depend on the volume of rainfall and runoff entering the pit. The water balance work shows the pit reaching equilibrium with the surrounding groundwater after approximately 50 years (AGEC 2015). After that, the pit may become a source for periods during the wet season, with heads reversing during the dry. The groundwater model does not allow for groundwater levels outside the pit to rise in response to the wet conditions, and hence is conservative in this prediction. It is also conceivable under those conditions that the pit water level could exceed the pit crest and lead to off-site surface water discharge of pit water.

The reaching of equilibrium between the pit and surrounding groundwater will occur whether the TGU Project proceeds or not. The TGU Project will enable the improvement of site drainage and ensure that any contaminated waters are directed to the pit, and hence deliver a better post-mine scenario in terms of risk of contamination of groundwater by AMD.

6.3.8 CUMULATIVE IMPACTS

6.3.8.1 SURFACE WATER CUMULATIVE IMPACTS

Cumulative impacts upon Mount Bundey Creek arising from the addition of the TGU Project to the existing site have been considered.

Historical impacts on off-site surface water quality have been reviewed by GHD (2015b). The review showed an improving trend at site SWTG2 from July 2002 to February 2015. Exceedances of the SSTVs generally occurred prior to 2011 and included pH (<5.8), EC, cobalt, copper and zinc. The trends are considered to be due to reductions in off-site disposal of waste water. The addition of treated water from the WSD will be cumulative upon any loads of metals, salts or pH from surface water runoff captured by the bund and drain capturing water from the OWRD and discharging via the Oxbow Wetland. Monitoring point SWTG2 is located downstream of both the Oxbow Wetland and will measure water quality that includes any water discharged from the Oxbow Wetland as well as from the WSD.

Biological data within Mount Bundey Creek indicates the highest abundance of macroinvertebrate populations in 2015 were recorded at SWTG1a (upstream). However, SWTG2 recorded the lowest abundance of macroinvertebrates. This could potentially be a function of uncontrolled discharges from the TGU Project or several additional factors. Additional surveys will be undertaken to establish a rationale.

6.3.8.2 GROUNDWATER CUMULATIVE IMPACTS

Cumulative impacts on groundwater have also been considered. The existing site is known to have mine affected water with low pH, elevated metals and salts from AMD. The evidence of AMD seepage is not seen in all monitoring bores, with evidence of AMD seen in Bore G9 (adjacent to the west of SWRD) and OB11 (adjacent to the north of EP2) (Figure 19). Bore G8 (on the west side of the SWRD) has low pH (~4.4) and also shows elevated metal loads against the adopted trigger values - including aluminium, cadmium, copper and nickel. Bore OB11 has had elevated EC (~3,600 µS/cm) and elevated sulphate (~2,350 mg/L) but the most recent results from February 2014 indicate a sulphate level of 61 mg/L. Insufficient down-gradient data is available to assess the extent of impact from the WRDs to groundwater (GHD 2015b).

The original site configuration contemplated AMD with the design of the SWRD to drain internally to the two evaporation ponds. Whilst the sizing of these ponds may have been adequate to manage seepage from the WRD, the use of them to store excess water from the TSFs has added to their retained water load. The TGU Project proposes to treat the mine affected water from EP1 and EP2 to maximise the on-site storage capacity.

Groundwater generally flows to the northwest across the TGU Project site. The closest downstream bore with available quality data is G9 which has one exceedance of pH and one for lead against the adopted trigger values. Through the sampling period it is likely groundwater was flowing to the pit and therefore G9 was not downstream of G8 or OB11. Dewatering of the pit will only increase the groundwater gradients toward the pit and hence the likelihood of contaminant capture. Whilst operating, the TGU Project lowers the potential for cumulative impacts by helping to manage and reduce the risk of groundwater contaminant migration from both existing features such as the WRDs and TSFs, and from the additional tailings and resumption of mining activities at the ROM and processing areas.

Groundwater flows post-closure will depend upon the eventual pit water level in relation to the surrounding groundwater. Two dimensional modelling by AGEC (2015) has shown that the pit water level is likely to mean the pit will continue to act as a groundwater sink, preventing contaminants from moving away from site by providing hydraulic heads to pull water into the pit. The development of a 3Dregional groundwater model will assist in determining appropriate closure strategies for the site. To avoid the potential for additional impacts from the TGU Project, Primary Gold commits to placing the tailings in the pit at the end of mine life, unless sufficient suitable capping material can be identified and a MCP for *in-situ* capping is approved. No previous impacts on vegetation in Mount Bundey Creek were noted from previous operations and whilst no regional groundwater model exists to verify this, the likelihood of GDEs being impacted in Mount Bundey Creek is considered low.

The operation of the TGU Project is likely to create a cone of groundwater depression and capture of impacted groundwater within the underground operation. In addition, water treatment on-site will treat water quality on transfer from the underground operation to stockwater levels reducing metal loads and pH.

6.4 MITIGATION

The ToR and risk assessment completed for the TGU Project indicate that many of the key risks are associated with water. The current site in its Care and Maintenance status exemplifies this with the key risks and management measures also often relating to water. The studies detailed in the previous Section have enabled Primary Gold to develop a series of mitigation measures to reduce the risks to the environment from water related issues.

The mitigation measures identified for the TGU Project have been prepared at different levels. At the highest level, the development strategy for the site, including the WSD and incorporating treatment of pit water, provide the basis for effectively managing water on-site. The development of the water strategy outlined below provides focus for the development of more detailed on-site water management and mitigation measures. At a more detailed level, individual administrative measures are identified, some of which apply to general water management, some to surface water management and some to groundwater management. Their application may be within the mining leases, through to monitoring activities which extend off the mining leases. Further details of water management can be found in the TGU Project WMP (Appendix 4).

6.4.1 WATER STRATEGY

The water management strategy for the TGU Project has been designed to protect water quality and to ensure that the TGU Project has reliable water supply. The water strategy has considerable benefits for site closure. The key strategy requirements are:

- A dewatering phase where in-pit or plant treatment of pit water and evaporation ponds to a minimum of livestock water quality, dewatering of pit and underground workings and storage of the treated water in the WSD Release of treated water to Mount Bundey Creek to meet 80% ANZECC & ARMCANZ (2000a) aquatic ecosystem protection criteria at the downstream compliance point;
- During operation, discharge of fresh groundwater from dewatering bores to Lake Bazzamundi;
- Separation of clean water and dirty water through the mine site;
- Best practice storage of tailings to minimise contamination risks; and
- Review and investigation of waste rock dumps to determine long-term remedial options.

6.4.2 ALTERNATIVES CONSIDERED

Primary Gold considered development alternatives that represent variations of the water management strategy, and some that would not have been consistent with the water management strategy. The alternatives identified (with reasons why not adopted) included:

- Not treating pit water, relying on dilution from Mount Bundey Creek for water release (not considered feasible as dilution ratios are too high and too much risk of downstream impact);
- WSD in different locations (not preferred by Pastoralist, located over underground workings);

- Lower water quality threshold for discharge to Mount Bundey Creek (potential for downstream impact);
- Use of TSF1 rather than TSF2 (located too close to underground workings and Williams Fault);
- Use of waste rock for construction materials (risk of spreading AMD problem); and
- Placement of underground waste rock above ground (risk of spreading AMD problem).

6.4.3 WATER MANAGEMENT MITIGATION MEASURES

Water management measures may be directed at managing risks to surface water, groundwater or both. This Section lists the water management measures identified to manage the risks to both surface water and groundwater. The management measures are also identified in the TGU Project WMP, and some in the AMD Management Plan to manage the source of potential contamination.

6.4.3.1 OVERARCHING ENGINEERING MEASURES

A series of engineering controls are designed to minimise the risk of catastrophic failure of engineered structures. The engineering controls include:

- Detailed ANCOLD compliant design for TSF2 raise and WSD;
- Develop manual detailing appropriate tailings and water management;
- Undertake regular routine and intermediate surveillance inspections;
- Instrumentation (i.e. piezometers, movement monitoring) to enable monitoring; and
- Establish sufficient freeboard to contain excess water and pump infrastructure to transfer excess water to alternative locations.

6.4.3.2 GENERAL MITIGATION MEASURES FOR WATER

At a high level, Primary Gold commits to implementation of the WMP which includes details of monitoring surface water, groundwater and biological impacts. The WMP includes a series of additional commitments and summarises knowledge gaps which require further work to establish additional mitigation methods are required. These include:

- Water Treatment Strategy;
- Discharge Management Plan;
- Groundwater Bore Census;
- Groundwater Modelling;
- Contaminant Transport Modelling; and
- Lake Bazzamundi Impacts.

General mitigation measures identified for water include:

- Treat the water from EP1 and EP2 as part of the pit dewatering procedure to maximise on-site water storage;
- Finalise the detailed design for the WSD and provide to the DME for review and approval prior to construction;

- Finalise the TSF2 detailed design and provide to the DME for review and approval prior to construction;
- Install flow meters and water storage gauges to validate the water balance model. Weekly readings will be collected on all transfers across site and storage levels;
- Gather sufficient relevant data and complete an annual update of Water Balance Model;
- Develop manual detailing appropriate tailings and water management;
- Instrumentation (i.e. piezometers, movement monitoring, tailings beach indicators) to enable tailings management monitoring;
- Undertake regular routine and intermediate surveillance inspections;
- Implementation of AMD Management Plan including ore and waste rock controls and tailings controls;
- Water captured within the pit/underground to be transferred to treatment and then storage on-site; and
- SWRD and OWRD investigation to establish required mitigation measures.

6.4.3.3 CONTAMINANT SOURCE CONTROL

Mitigation measures to control the source of potential contaminants to water identified are:

- Manage disposal of wastes in accordance with the *Waste Management and Pollution Control Act* 2009 and the TGU Project EMP;
- Chemical and hydrocarbon storage facilities bunded and managed in accordance with the Hazardous Materials Management Plan and the TGU Project EMP;
- Implementation of AMD Management Plan including ore and waste rock controls and tailings controls;
- Waste rock left in or returned to underground or stored within base of pit;
- All waste rock is assumed to be PAF and is to remain underground, or if not practicable, to be placed in the pit;
- All of the ore unit is considered to be PAF and shall only be stockpiled underground, in the base of the pit or on the ROM pad;
- No waste rock is to be moved beyond the pit base;
- No waste rock is to be used for construction purposes, other than the distal hanging wall unit;
- No waste rock from the existing sulphide or oxide waste rock dumps is to be used for construction purposes;
- The existing SWRD and OWRD are to be maintained to ensure their integrity;
- All metallurgical tailings to be treated as PAF and placed in TSF2;
- The existing TSF1 is to be maintained to ensure its integrity until removal and rehabilitation;
- Development of a TSF2 operating manual / procedure;
- Maintaining a minimum freeboard on TSF2 for water management purposes; and
- All tailings decant water is to be treated as contaminated and retained within the process circuit other than in an emergency situation.

6.4.3.4 Mitigation Measures for Surface Water

Mitigation measures specific to surface water include:

- Review existing site drainage, retain and renovate the existing site drainage features to ensure they are fit for purpose;
- Clean sumps and drains at least annually before each wet season;
- Prepare a water treatment plan including proposed water treatment methodology and target outcomes for review and approval as part of the Waste Discharge Licence and MMP;
- Design and install water retention ponds sized to capture an Average Recurrence Interval (ARI) rainfall event appropriate to their Hazard category plus an appropriate freeboard allowance for sedimentation;
- Monitor and manage water levels in the retention ponds to maximise available storage capacity prior to the Wet Season;
- Establish a Discharge Management Plan and apply for a Waste Discharge Licence to reduce volumes of water stored on-site;
- Rock armour protection on northern TSF2 embankment to protect against 1 in 100yr ARI flood level;
- Upgrade of embankment levels on existing infrastructure above 1 in 100 year ARI flood levels;
- Installation of clean water diversion channels;
- Installation of rip-rap protection on earthwork embankments adjacent to drainage channels;
- Regular inspections of bunds/embankments by a suitably qualified engineer and maintenance as necessary;
- Undertake regular routine and intermediate surveillance inspections;
- Establish sufficient freeboard to contain excess water and pump infrastructure to transfer excess water to alternative locations;
- Drainage to be designed to capture runoff from infrastructure and transfer to retention basins; and
- Establish sufficient freeboard to contain excess water and pump infrastructure to transfer excess water to alternative locations.

6.4.3.5 Mitigation Measures for Groundwater

Mitigation measures specific to groundwater include:

- Complete a monitoring well census to review the monitoring network and establish depth of screens, condition and potential rehabilitation plan. The census will inform locations of additional monitoring wells to provide effective coverage;
- Install and/or rehabilitate groundwater monitoring wells to provide upstream, mid and downstream coverage of infrastructure and underground operation. The installation will include MB1A, MB1B, MB2A, MB2B, MB3A, MB3B, MB4, MB5A, MB5B, MB6A and MB6B;
- Investigate the degree of interconnectivity between Mount Bundey Creek and associated alluvium. The investigation will assess life of mine and closure impacts in relation to the

potential for contaminated groundwater migration off lease boundary and potential impacts on GDEs;
- Groundwater bore census to confirm if bores meet minimum construction requirements for water bores in Australia and decommission or rehabilitate in accordance with the guidelines;
- Groundwater model and monitoring to establish cone of depression from dewatering and proposed LOM underground shells;
- Undertake investigation to establish quality of sediment and determine management requirements (i.e. removal, on-site landfill, cap); and
- Implement the Groundwater Monitoring Program.

6.5 RESIDUAL RISKS AND CONTINGENCY

The residual risks rated as high after the application of mitigation measures identified are:

- Extreme weather events that exceed design criteria or storage capacity in water management features leading to overflow or structure failure particularly the TSFs;
- Extreme weather event makes site inoperable for long period;
- Contaminated seepage and runoff from the WRDs;
- Re-exposure of PAF materials in the pit wall and underground leading to contaminated mine dewatering;
- Poor water quality released from site via storage overflow or failure of water dilution management;
- Poor water quality from the underground dewatering bores;
- Pit lake becomes a groundwater source upon reaching equilibrium; and
- Long-term positive site water balance exceeds site water containment capacity.

The TGU Project design provides significant contingency in the form of the WSD. It represents a buffer and control point between the pit and Mount Bundey Creek that provides storage for water so that it can be retained until sufficient dilution is available in the creek to enable water discharge. The WSD of itself, because of its size and catchment area would provide for significant dilution in the event of an emergency requirement to pump water from other parts of the water management system.

Should pump testing and monitoring determine that the water quality from the dewatering bores around the new underground workings is not suitable for livestock, the water may be used in the process or treated and stored in the WSD.

Primary Gold's commitment to continuous improvement also provides contingency in the event of water related environmental incidents. Any significant incidents will be investigated and reported, with improvements identified and implemented to prevent or lower the risk of that type of incident occurring again. Further details of contingency measures are provided in Table 38.

Table 38: Contingency Measures for Water Management

Risk Event	Contingency Measure
Evaporation ponds likely to overtop	Transfer water to process circuit, or if not possible, transfer to WSD
Tailings decant likely to overtop	Transfer water to evaporation ponds or WSD
Stormwater sump likely to overtop	Transfer water to process water circuit, evaporation ponds or WSD
Bore water dewatering does not meet water quality requirement for release to Lake Bazzamundi	Transfer water to WSD
Inrush of water into pit or underground workings	Transfer water to process water circuit, evaporation ponds or WSD
Excessive seepage noted in bores around TSF	Install pump back bores and return water to process water circuit
Water treatment does not meet quality requirements to enable discharge to Mount Bundey Creek	Alternative water treatment. Dewatering over longer time period
1:100 year flood event	• Evacuate underground workings and site as necessary • Implement emergency management plan
Pastoralist bore impacted by dewatering	Make good supply

6.6 MONITORING AND REPORTING

The TGU Project WMP (GHD 2015b) has identified a proposed monitoring program. The program has been designed to provide sufficient data to monitor potential impacts from the proposed operation. Table 39 outlines the monitoring frequency adopted for the monitoring programs. The sampling program has been developed based on analysis of historical data, focusing on parameters of concern likely to be encountered at the site.

Quality Assurance (QA) and QC will include laboratory QC with samples analysed at a National Association of Testing Authorities Australia (NATA) accredited laboratory. The laboratory QA processes are expected to include reagent blanks, matrix spikes, internal standards and surrogate spikes. Field QC will be consistent with the relevant requirements in the Australian Standard AS4482.1 (2005). QC samples provide information that discounts or potentially identifies any errors due to possible sources of cross contamination, inconsistencies in sampling and analytical techniques used. The QC program includes a split duplicate.

6.6.1 WATER MONITORING

Water monitoring includes monitoring of indicators other than surface water quality. Table 39 identifies the proposed monitoring program from the WMP. The monitoring approach provides additional levels of protection by identifying monitoring of biological components (fish and aquatic macroinvertebrates) as well as stream bed condition via photopoint monitoring and stream sediment sampling to identify potential sediment inputs from the mining operations.

Table 39: Proposed Water Monitoring Program

Monitoring	Number of Locations	Frequency
Surface Water	13	Fortnightly
Mine Affected Surface Water	8	Monthly
Groundwater	10*	Quarterly
Sediment	13	Annual
Photopoint Monitoring	13	Annual
Macroinvertebrate	13	Annual
Fish	13	Annual

*Note: * Groundwater sampling locations will increase to 21 following the bore census and installation of proposed monitoring*

6.6.1.1 SURFACE WATER QUALITY

Surface water and mine affected water quality will be monitored fortnightly and monthly respectively. Mine affected waters and the receiving environment (Mount Bundey Creek) will be sampled on a daily basis if sediment retention or other water storage basins overflow or are subject to a pumped discharge. The monitoring program (Table 39) is based on assessing the baseline (SWTG1A), on-site locations and downstream impact site (SWTG2). The monitoring locations are identified in Figure 46. The monitoring schedule will be confirmed via the approval of an MMP.

Monitoring of mine affected surface water will be completed on a monthly basis initially with field measurements of pH, EC, Total Dissolved Solids (TDS), Turbidity and Oxidation Reduction Potential, water level, freeboard and photopoint monitoring. Laboratory analysis will include total and 0.45µm dissolved metals (Al, As, Cd, Co, Cr, Cu, Fe, Pb, Mn, Mo, Ni, Zn and U), major cations and anions (Na, K, Ca, Mg, Cl, SO4, CO3, HCO3, NH3, NO3), Total Suspended Solids, Total Hardness, Total Acidity and Alkalinity.

The non-mine affected waters will be monitored fortnightly initially and are expected to include field measurements of temperature, pH, EC, TDS, Turbidity and Oxidation Reduction Potential as well as water level and photopoint monitoring. Laboratory measurements will include total and 0.45µm dissolved metals (Al, As, Cd, Co, Cr, Cu, Fe, Pb, Mn, Mo, Ni, Zn and U), major cations and anions (Na, K, Ca, Mg, Cl, SO4, CO3, HCO3, NH3, NO3), Total Suspended Solids, Total Hardness, Total Acidity and Alkalinity.

Monitoring data will be assessed against SSTVs as presented in Section 6.3.2.4. The SSTVs reference ANZECC & ARMCANZ (2000a) trigger values for 80% aquatic ecosystem protection as

the default SSTV where either insufficient data is available or the upstream values fall below the ANZECC & ARMCANZ (2000a) 80% aquatic ecosystem protection value.

Monitoring data will be reporting internally within Primary Gold and will be an agenda item at site management meetings. Data and interpretation will be reported according to the requirement of the Water Discharge Licence. Any water related incidents will be reported according to Primary Gold's incident reporting procedure, with includes notifications to key regulatory agencies.

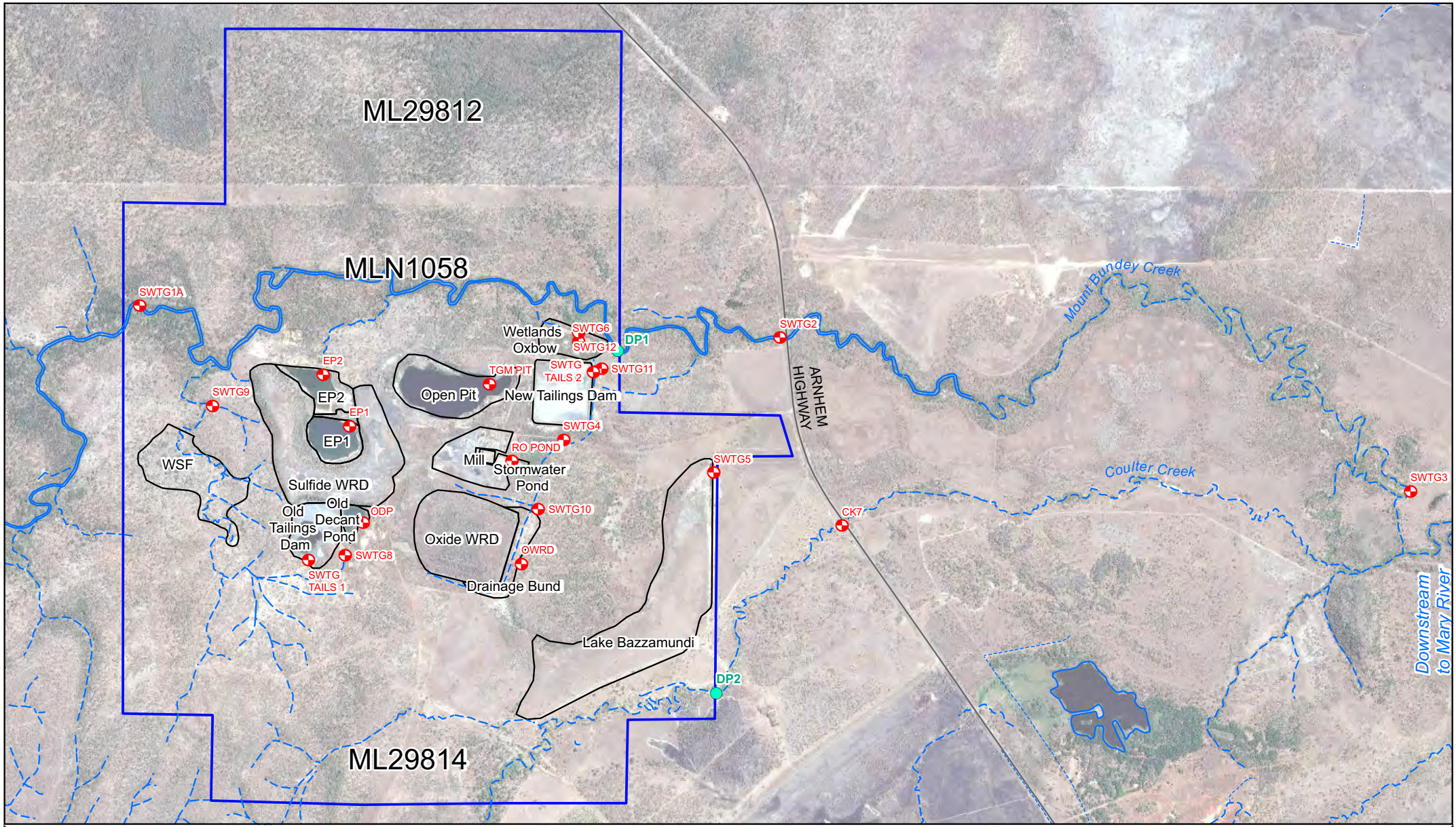
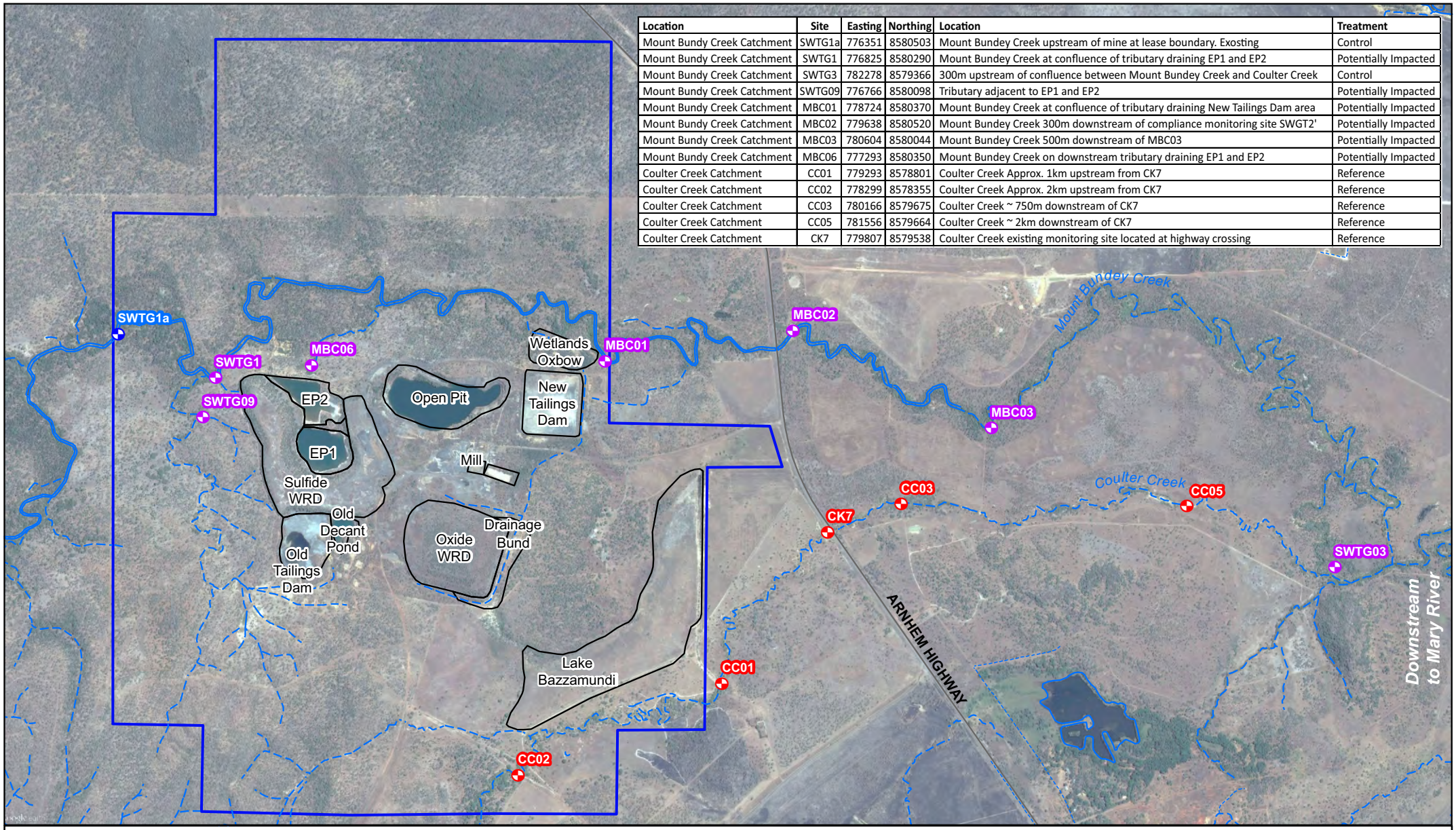


Figure 46: Proposed Surface Water Monitoring Sites

6.6.1.2 BIOLOGICAL MONITORING

Biological monitoring is planned to cover annual macroinvertebrate, fish, habitat assessment and *in-situ* water quality testing (GHD, 2015b). The biological monitoring will be undertaken annually during receding wet season flows at the locations indicated in Figure 47 and includes:

- Macroinvertebrate Survey (Northern Territory AUSRIVAS methodology);
- Fish Survey – Primarily using a mixture of backpack electrofishing and bait trapping;
- Habitat Assessment – Habitat assessments include the whole reach (100 m Section of the river), the habitats sampled, and the surrounding terrestrial environment. This includes information on:
    - Site description;
    - Water quality;
    - Characteristics of macroinvertebrate habitat;
    - In-stream physical characteristics (flow velocity and depth, in-stream habitat characteristics, bank height, riparian width);
    - Riparian vegetation characteristics (types, %cover, exotic species, erosion, land use);
    - Water quality observations (clarity, odour, oils, foam/scum, plume, sediment oils, sediment odours);
    - Sketch of the site and cross Section; and
- *In-situ* water quality – water quality measured using a YSI 650 MDS multi-parameter water quality meter, Hach 2100P turbidity meter and alkalinity field titration kit/or equivalent.



Location	Site	Easting	Northing	Location	Treatment
Mount Bundy Creek Catchment	SWTG1a	776351	8580503	Mount Bundey Creek upstream of mine at lease boundary. Exosting	Control
Mount Bundy Creek Catchment	SWTG1	776825	8580290	Mount Bundey Creek at confluence of tributary draining EP1 and EP2	Potentially Impacted
Mount Bundy Creek Catchment	SWTG3	782278	8579366	300m upstream of confluence between Mount Bundey Creek and Coulter Creek	Control
Mount Bundy Creek Catchment	SWTG09	776766	8580098	Tributary adjacent to EP1 and EP2	Potentially Impacted
Mount Bundy Creek Catchment	MBC01	778724	8580370	Mount Bundey Creek at confluence of tributary draining New Tailings Dam area	Potentially Impacted
Mount Bundy Creek Catchment	MBC02	779638	8580520	Mount Bundey Creek 300m downstream of compliance monitoring site SWGT2'	Potentially Impacted
Mount Bundy Creek Catchment	MBC03	780604	8580044	Mount Bundey Creek 500m downstream of MBC03	Potentially Impacted
Mount Bundy Creek Catchment	MBC06	777293	8580350	Mount Bundey Creek on downstream tributary draining EP1 and EP2	Potentially Impacted
Coulter Creek Catchment	CC01	779293	8578801	Coulter Creek Approx. 1km upstream from CK7	Reference
Coulter Creek Catchment	CC02	778299	8578355	Coulter Creek Approx. 2km upstream from CK7	Reference
Coulter Creek Catchment	CC03	780166	8579675	Coulter Creek ~ 750m downstream of CK7	Reference
Coulter Creek Catchment	CC05	781556	8579664	Coulter Creek ~ 2km downstream of CK7	Reference
Coulter Creek Catchment	CK7	779807	8579538	Coulter Creek existing monitoring site located at highway crossing	Reference

LEGEND

Treatment

- Control
- Potentially Impacted
- Reference

- Mine Site Layout
- Site Boundary

1km

GDA 1994 MGA Zone 52

N

Figure 47: Proposed Biological Monitoring Sites

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6.6.1.3 STREAM SEDIMENT MONITORING

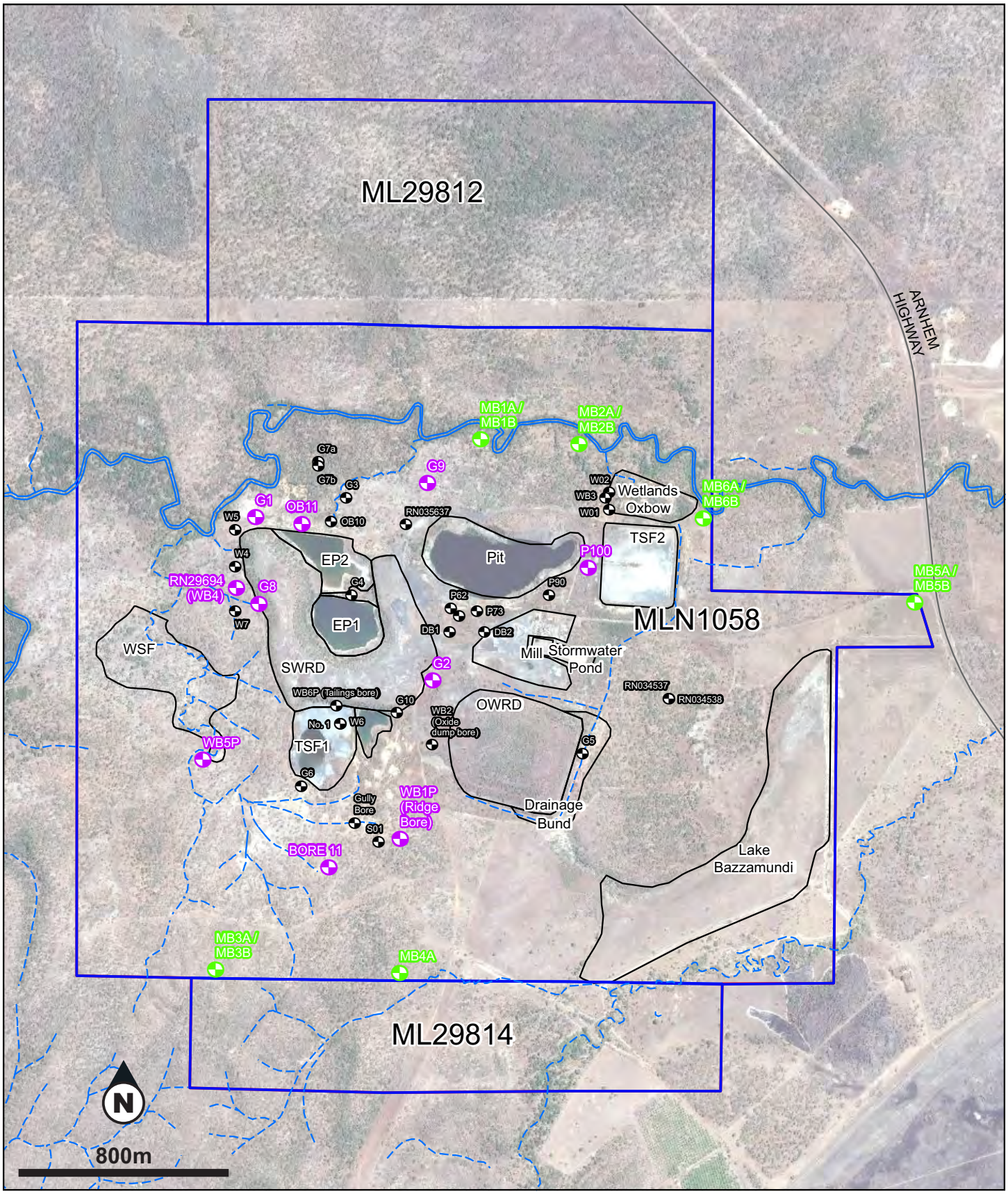
Sediment sampling is proposed to be completed annually to characterise the quality of sediments within the stream flow channels. This is expected to reduce the risk of long-term, low level deposition of sediments in local creeks impacting upon water quality and the biological substrate for aquatic organisms. Sediment sampling will be undertaken along both Mount Bundey Creek and Coulter Creek at the water monitoring locations identified above.

Assessment of the sediment samples will recognise that the systems adjacent to the TGU Project are highly disturbed systems. GHD (2015b) have recommended that a precautionary approach to applying Interim Sediment Quality Values should be adopted (i.e. utilising the upper and lower guideline values).

6.6.1.4 GROUNDWATER MONITORING

Groundwater levels and quality will be monitored at quarterly intervals at several production and monitoring bores located upstream, within and downstream of the site. Ten groundwater bores are already installed and additional monitoring bores will be installed and sampled as shown in Figure 48. The data and information gathered during these monitoring programs will be used to monitor for potential impacts on local groundwater levels and quality. The monitoring program will be conducted in accordance with the DME Advisory Note on the Methodology for the Sampling of Ground Waters (AA7-024):

- Gauging water levels relative to Top of Casing using an electronic interface meter to determine the relative elevation of the water table;
- Groundwater to be developed using low flow methodology prior to sampling. During development, field parameters including EC, pH, DO, redox potential (Eh) and temperature will be monitored. Wells will be developed until these parameters have stabilised for three consecutive readings, indicating that groundwater representative of the target aquifer has been obtained. The parameters will considered stable when three consecutive readings are within:
    - 0.05 for pH;
    - 3% for EC;
    - 10% for DO;
    - 0.2 C for temperature; and
    - 10 mV for Eh;
- Samples to be collected in pre-prepared laboratory supplied bottles containing appropriate preservatives for each proposed analyte. The integrity of groundwater samples to be analysed for heavy metals will be maintained through field filtration using a 0.45-micron filter followed by acidification; and
- All relevant sampling equipment will be decontaminated between samples and sample locations using a phosphate free detergent and final rinse with deionised water.



Legend

- 2015-16 Monitoring Well
- Historic Monitoring Well
- Proposed Monitoring Well
- Site Boundary
- Mine Site Layout

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Figure 48: Proposed Groundwater Monitoring Locations

10/8/2015

6.7 OUTCOMES

Whilst water management remains the biggest challenge for the implementation of the TGU Project, the action of dewatering and treating the pit water provides an opportunity to ensure that groundwater heads are such that any localised contaminant plumes will flow toward the pit and that site investigations are completed to ensure the sources of contamination are identified and understood and closure options for the WRDs are investigated and understood. The TGU Project provides the opportunity to ensure the existing and new tailings are managed according to best practice over the life of the mine. This will be achieved by placing the acid producing tailings in pit, or in an approved long-term stable structure, reducing the subsequent risks of leachate migrating into groundwater and off-site, runoff contamination, embankment failure and downstream contamination.

The dynamic nature of the climate and the complications provided by the existing infrastructure are significant contributors to the complexity of water management. The actions of dewatering and treating water, as well as mining and processing do present some new risks to the site, however, the TGU Project itself presents opportunities to reduce the overall risks associated with water management at the site. The on-site presence of personnel and equipment, the treatment of pit water and consequent reduction of inventory of contaminated water on-site significantly reduces risks.

The TGU Project presents risks to water quality by virtue of the need to transfer and discharge water. The majority of these are to be completed during the dewatering phase. This will coincide with the construction phase which also presents risks to water quality. Additional monitoring bores and surface water monitoring will be established during this early phase.

The TGU Project also provides the opportunity to gather data (hydrogeological, hydrological, geochemical, spatial and biological) to enable a 3D groundwater flow model and contaminant transport model to be prepared. The models can be used to assess closure options for the overall site.

Improvements to site drainage are expected to also enable better separation of clean and contaminated water, containment of contaminated water and potential for long-term closure of the site.

Finally, the pit dewatering and treatment effectively defers the equilibrium point being reached between the pit water and surrounding groundwater. As the contaminant transport outcomes beyond this point are not clear, the TGU Project represents an opportunity to understand them.

The surface water management strategy, including the treatment of pit water is designed to ensure that any water discharged to Mount Bundey Creek will meet the ANZECC and ARMCANZ (2000a) water quality requirements for 80% aquatic ecosystem protection at the downstream compliance monitoring station (site SWTG2). The adoption of this new and higher standard for water quality is expected to result in minimal risk of adverse impacts to water quality and the ecosystem health of Mount Bundey Creek, and consequently the Mary River system.

The risks to water associated with the TGU Project have been identified and minimised through Project design, implementation, mitigation strategies and management plans.

The environmental objective identified in the ToR for water is to ensure that surface water and groundwater resources are protected both now and in the future, such that ecological health and land uses, and the health, welfare and amenity of people are maintained.

The TGU Project design makes a very positive contribution to reducing long-term water risks for the Toms Gully site by:

- Avoiding the creation of significant new sources of contamination;
- Committing to best practice tailings disposal for both the existing and new tailings;
- Dewatering the pit and treating the water, creating a significant new WSD that enhances the ability to manage water discharge; and
- Committing to data acquisition and modelling of contaminant sources and transport mechanisms.

Based on the consideration of risks, impact assessment and implementation of the aforementioned mitigation strategies and management plans, the ToR environmental objective for water is able to be met.

7 ACIDIC AND METALLIFEROUS DRAINAGE

7.1 ENVIRONMENTAL OBJECTIVES

The environmental objective identified in the ToR (NT EPA 2015b) for AMD is:

- To prevent, mitigate or manage AMD/NMD/SD and sediment discharge to prevent on and off-site environmental impacts during mine operations and beyond mine closure.

7.2 IDENTIFIED RISKS

The EIS should provide the following information:

- Identify occurrence and risks of AMD/NMD/SD from existing and proposed infrastructure and the TGU Project, and demonstrate how future development of AMD/NMD/SD will be prevented by design;
- Describe proposed methods to characterise currently stored and future mine waste materials, including tailings, in terms of their potential to generate AMD/NMD/SD;
- Detail proposed management (and contingency management) that identifies, systematically addresses, remedies and monitors any occurrence of AMD/NMD/SD, to prevent environmental impacts during mine operations and beyond mine closure;
- Provide results of AMD/NMD/SD characterisation already undertaken on existing stored waste rock and tailings and for future waste rock and tailings (i.e. based on drill core samples);
- Site-wide AMD/NMD/SD management should be summarised in an AMD/NMD/SD Management Plan for the TGU Project;
- Demonstrate that sufficient quantities of suitable-standard clays, and Non-Acid Forming (NAF) rock without AMD/NMD/SD potential, are available to fulfil construction requirements for all proposed infrastructure builds and upgrades. Include:
    - Clay / NAF-rock sources;
    - Amounts of clay/NAF-rock needed, and available suitability (i.e. chemistry, permeability, etc.) of the available clays and NAF-rock;
    - Demonstration of appropriate identification and management of Arsenic levels, and other contaminants in NAF waste rock streams; and
- Provide a detailed conceptual site model[1] describing potential sources, pathways, receptors, and fate of any contaminated waters, and products, from the TGU Project, and

[1] See: NT EPA *Guidelines on Conceptual Site Models* at: http://www.ntepa.nt.gov.au/__data/assets/pdf_file/0005/349943/guideline_pollution_conceptual_site_models.pdf, and *Global Acid Rock Drainage (GARD) Guide. International Network for Acid Prevention (INAP).* at: http://www.gardguide.com Conceptual Site Models: http://www.gardguide.com/index.php?title=Chapter_4#4.2.3_Conceptual_Site_Model_Development

Including Figure 4-4:- *Sources and Pathways of ARD, NMD, and SD in Underground Workings during Operation and Closure*)

Project components. The model should be of sufficient detail for the general reader to understand the sources of potential contaminants, mechanisms of their release, pathways for transport, and potential for human and ecological exposure to these potential contaminants.

The ToR also highlighted potential impacts on aquatic ecosystems including:

- Failure of existing / new infrastructure resulting in AMD/NMD/SD materials escaping;
- Water management, particularly controlled and uncontrolled release off-site during low flow in the creek, uncontrolled release off-site during extreme weather events, first flush of stored oxidation products in WRDs and altered hydraulic connectivity to surrounding springs and creeks;
- Erosion and sedimentation; and
- Vegetation clearing and groundwater drawdown, with the latter potentially having knock on effects for hydraulically connected streams.

The risk assessment (Appendix 7) completed by Primary Gold highlighted the following additional risks:

- Spreading of AMD materials by using existing waste rock for construction materials;
- Bringing waste rock from underground and storing above ground;
- Flood risk on TSF2;
- Precipitates from water treatment as a source of contaminants;
- Bore water quality unsuitable for release to Lake Bazzamundi; and
- Long-term positive water balance.

7.3 CONTEXT

7.3.1 EXISTING SITE AND HISTORY OF ACID MINE DRAINAGE

The existing Toms Gully pit provides a real scale model of what is likely to occur in the mine closure phase of the TGU Project. Unlike a greenfields site where drilling, assay work and modelling is required to understand the geology of the pit walls in detail, predict the likely behaviour of the materials, calculate likely leaching rates into the water, and determine the outcome of water inputs, the existing surface and ground water quality data provides a predictive capacity based on real processes. The existing pit water quality is discussed in Section 6.3.2.6 (Table 34).

Under the current Care and Maintenance authorisation, the pit is the final receiving point for poor quality water around the mine site, having water pumped to it from the evaporation ponds and TSFs. This has no doubt contributed to its poor water quality. The pit surrounds are also configured so that some surface drainage reports to the pit.

The use of the pit as a sink for poor quality water has provided a location for long-term storage of poor quality water for the mine during Care and Maintenance. This approach remains viable as long as the pit water level remains below the level of surround groundwater such that there is no driving head to allow water to escape from the pit. This assumption has held true for the pit since dewatering ceased in 2010.

7.3.1.1 EXISTING GROUNDWATER

Groundwater quality is reviewed in Section 4.4.4. Groundwater on-site is generally fresh with isolated bores adjacent to WRDs showing signs of impact from AMD products.

7.3.1.2 EXISTING SURFACE WATER

Surface Water quality is reviewed in Section 4.3.3.

The water in the pit will be treated, using an industry standard technique of raising the pH to the point where dissolved metals precipitate. The treatment method options include both caustic or lime dosing (ERIAS 2015) and may be completed in-pit or via the processing plant.

7.3.2 CHARACTERISATION OF MATERIALS TO BE MINED

Current mine schedules show underground development over the 32 month mine life totalling 15,140 m, ramping up and down, for an average of 473 m advance per month. Average waste rock generation is around 52,000 t per month (tpm). Average tailings production over the 32 months is approximately 26,000 tpm. A summary of estimated ore and mineral waste (waste rock and tailings) is provided in Table 7.

All waste rock from mining development will be treated as Potentially Acid Forming (PAF) and managed by in pit and/or underground storage. All tailings will be treated as PAF and are reporting to a renovated TSF2. Although geochemical characterisation has been completed as part of the EIS, site performance has guided mineral waste handling and placement that may otherwise require segregation. The geochemical sampling will provide an inventory and historic record for closure management purposes.

The seven major mineral waste units at TGU Project identified by GHD (2015c) are:

- Tailings:
    - Metallurgical tailings;
    - Existing TSF1 tailings; and
    - Existing TSF2 tailings.
- Waste rock:
    - Hanging Wall (HW);
    - Footwall (FW); and
    - Distal Hanging Wall (DHW).
- Ore.

Geochemical assessment was completed by GHD (2015c) using the following input data and information:

- Assay data: Exploration assay data provided by Primary Gold formed the basis for a desktop AMD study completed by GHD (2015c);
- Static Acid Base Accounting (ABA) and net acid generation (NAG) testwork comprising 83 samples; comprising 75 waste rock and 8 tailings samples;
- Kinetic NAG testing was completed on 33 samples (25 waste rock and 8 tailings); and

- Metals data: Whole rock assay and assessment of the results using the Geochemical Abundance Index (GAI) was undertaken on all 83 samples. The metals data were compared against historic water chemistry samples to validate metals of concern to inform the monitoring program.

The seven waste rock and tailings mineral waste units were classified using a combination of Nett Acid Generation pH (NAGpH) values and net acid production potential (NAPP) results after Miller (1996). A summary of the classification is shown in Table 40 below.

Table 40: Waste Characterisation (GHD 2015c)

Measure	Samples (n)	NAG_{pH}/NAPP	Whole rock metals	Kinetic NAG
Reference		Miller (1996)	Mean ≥ GAI 3	Estimated time to pH 4 following oxidation
Met tails	2	UC	As (14), Sb (3), Cd (7), Pb (8), Mo (4), Se (6), Ag (15), Zn (6)	One sample inert, one indicating field oxidation within 4-6 months
TSF1	3	PAF	Sb (3), As (13), Pb (6), Se (5), Ag (5)	Inconsistent results with one sample inert, one indicating field oxidation within 1 month, the third showing a 6-12 month lag time
TSF2	3	PAF	As (12), Se (5), Pb (3)	One sample inert, one indicating field oxidation within 4-6 months, the third showing a 6-12 month lag time
DHW	15	NAF	Se (5), Ag (3)	N/A – test did not reach pH 4
FW	21	PAF	As (7), Se (5), Ag (3)	6-12 month oxidation lag time
HW	21	PAF	As (5), Mo (3), Se (5), Ag (3)	One sample indicating field oxidation within 1-2 months, the second showing a >2 year lag time
Ore	18	PAF	Sb (3), As (15), Cd (3), Pb (4), Se (5), Ag (6)	Two samples indicate a >2 year lag time while 2 showed increased temp excursion indicating reactions though maintained pH values around 6 suggesting self-neutralising capacity

Consistent with the design assumptions for the TGU Project, the geochemical assessment of all mineral waste material has shown that it will need to be managed as PAF. The volumes of PAF mineral waste estimated during Life of Mine (LOM) from mine development and minerals processing are:

- Approximately 1,665,849 tonnes of PAF waste rock;
- Approximately 832,925 tonnes of PAF tailings; and
- No NAF material.

7.3.3 Risk of Acid Mine Drainage from Proposed Infrastructure

The risk of AMD from proposed infrastructure arises largely from the recommencement of tailings deposition in TSF2 and the resumption of use of the ROM Pad and processing area. All other AMD sources are to remain in-pit or underground. Primary Gold has approached the TGU Project such that the risks of AMD arising from the TGU Project activities are avoided by being engineered out wherever possible. These risks are further reduced by the mitigation measures identified in Section 7.4 and supported by the implementation of the AMD Management Plan.

The key AMD risk associated with the TGU Project is the resumption of use of TSF2 for tailings storage. Adding further tailings to TSF2 (which will be acid-producing), will create additional driving heads to push AMD leaching products out of the base of the TSF.

Existing sources of AMD including the WRDs, evaporation ponds and TSF1 do not need to be disturbed or used by the TGU Project. This approach avoids the risks associated with re-using or renovating these structures. These are recognised sources of contaminants (see Section 6.3.4) and will require continued management of ARD risks.

Table 41: Water Storage Seepage (Coffey 2015)

Storage Name	Estimated Seepage Volume (kL/day)	Seepage Destination
EP1	10	EP1 Seepage Sink
EP2	10	EP2 Seepage Sink
New WSD	398	New WSD Seepage Sink
Toms Gully pit	-	-
New TSF	15	New TSF Seepage Sink
Process Water Pond	-	-

7.3.4 Post-mining

Post-mining, the underground workings and mine pit will flood with runoff and groundwater. As previously experienced, the water levels in the pit are expected to recover rapidly initially, being largely fed by groundwater inflows. The existing pit will then largely control the groundwater levels surrounding the mine. The presence of a permanent zone of depressurisation around the pit post-mining will depend on the volume of rainfall and runoff entering the pit.

AGEC (2015b) prepared a two-dimensional (2D) Sectional model of Toms Gully Pit using SEEP/W which is used extensively in the mining industry for assessing seepage through artificial embankments, tailings emplacement facilities, water impoundments and simulation of pits. It is an industry standard, 2D, finite element, numerical seepage modelling package. The 2D Sectional model has been generated for a northeast-southwest Section through Toms Gully Pit with the objective of predicting the final void water level. The SEEP/W model was run in a steady state condition, the main hydraulic parameters incorporated into the 2D model are hydraulic conductivity and volumetric water content of the geological materials.

Figure 47 shows the predicted pit water level rises relatively rapidly over the first 10 years post-mining followed by a period of slow recovery until approximately 50 years post-mining. The pit water level stabilises at approximately 12 mRL. Pre-mining water levels in the vicinity of Toms Gully Pit were approximately 16 mRL. The groundwater level in bore G9, located approximately 200 m north of Toms Gully Pit is approximately 13 mRL. The water balance modelling predicts the pit water level will stabilise close to the groundwater level in the surrounding siltstone within 50 years of the cessation of mining.

The model assumes that the entire existing void will be available to store water during closure. However, it is intended that the pit will be used to store waste rock which will mean the storage volume will be lower than modelled. This will affect the rate of water level recovery, however it will not have an impact on the final long-term water level which is dependent upon the rate of evaporation.

The scenario of pit water level reaching equilibrium is expected to occur whether the TGU Project proceeds or not. Dewatering the pit defers this equilibrium point being reached and provides a groundwater control mechanism whilst operating by creating driving heads toward the pit. The TGU Project affords the opportunity to get a better understanding of the existing sources and transport pathways for AMD contaminants by implementing the data gathering for a 3D regional groundwater model and contaminant transport assessment (Section 6.3.5).

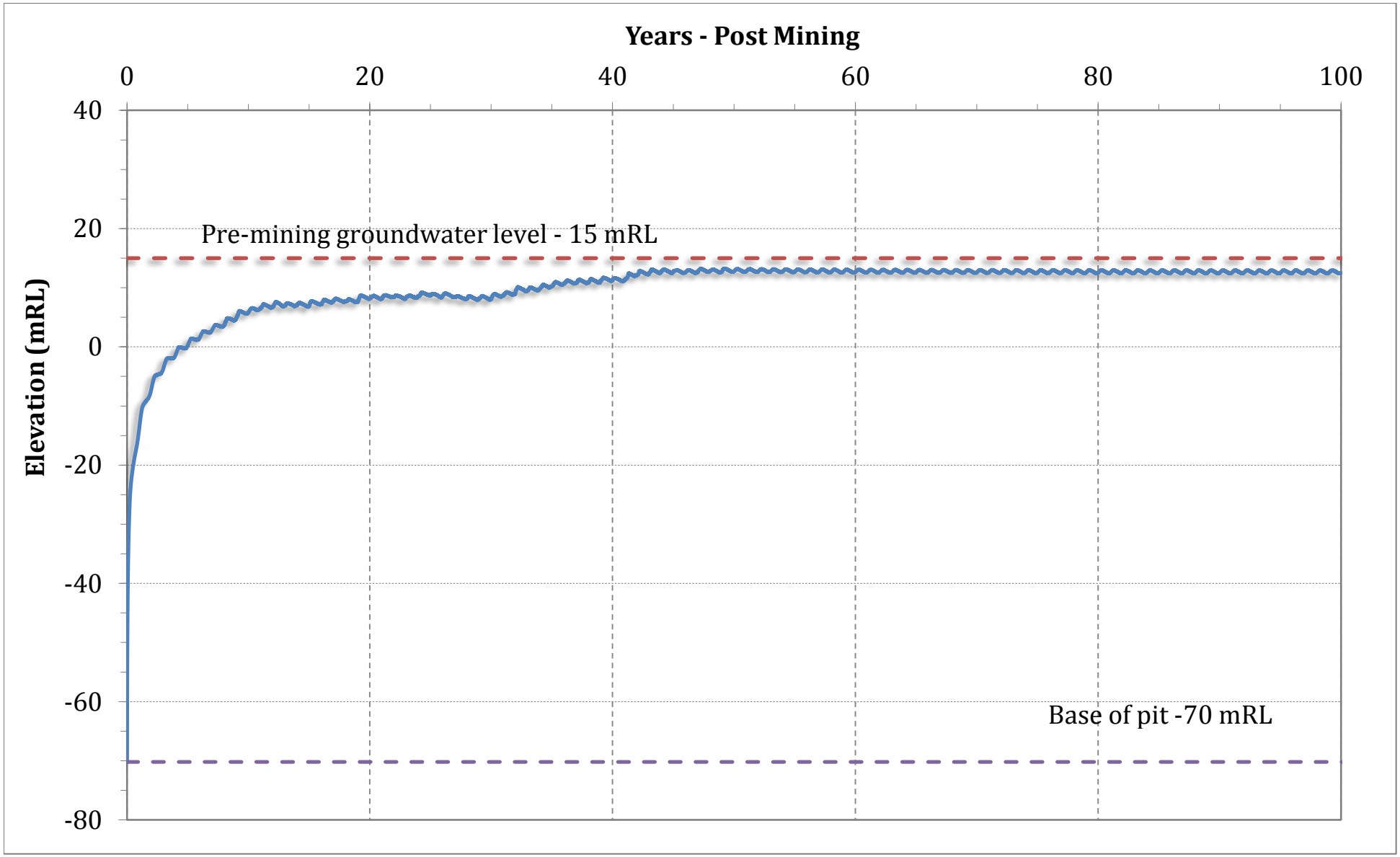


Figure 49: Pit Water Level Modelled Recovery

7.4 MITIGATION MEASURES

To reduce the potential for acid leachate conditions developing from exposure and movement of the TGU Project ore, waste rock and tailings, the TGU Project has committed that all PAF material will be compacted and encapsulated under water or within NAF material to minimise the risk of oxidation of the PAF during the life of the mine and in perpetuity into closure. Thus, the TGU Project design basis is that all waste rock material and tailings will be stored in the underground or in pit. Post-mining as the groundwater level recovers; these materials will become fully submerged precluding oxidation of the PAF material.

Primary Gold has developed a series of AMD design and operational mitigation measures designed to minimise the risks associated with dewatering the pit, mining the underground orebody, processing the ore and storing the tailings. The TGU Project design has been configured to deliver a nett reduction in AMD risk at the Toms Gully site.

The overall AMD strategy is consistent with leading practice as per the following references:

- Subaqueous tailings / waste rock deposition –Section 6.6.7 of INAP 2009; Section 7.1.6 of DITR 2007; Section 7 of DERM 1995; DITR 2006, Appendix 10 and various Minesite Environmental Neutral Drainage (MEND) reports at: http://mend-nedem.org/category/prevention-and-control/water-covers/;
- Store-release TSF cover design - Section 6.6.6 of INAP 2009, Section 7.1.4 of DITR 2007, Section 8 of NT EPA 2013; Section 7 of DERM 1995; DITR 2006, Appendix 10; various MEND reports at: http://mend-nedem.org/category/prevention-and-control/dry-covers/;
- Subterranean PAF waste rock storage – DITR 2006, Appendix 10;
- Drainage controls – Section 7.1.1 of DITR 2007, Department of Resources, Energy and Tourism 2008; and
- Ongoing monitoring – Chapter 8 of INAP 2009; Chapter 8 of DITR 2007; Section 9 of NT EPA 2013; Section 7.2 of DERM 1995 and various MEND reports at: http://mend-nedem.org/category/monitoring-category.

7.4.1 ACID MINE DRAINAGE MANAGEMENT STRATEGY

The AMD management strategy over the life of the TGU Project assumes that all waste rock and tailings generated is PAF. The management strategy is twofold:

- To minimise the risk of creating new AMD sources; and
- To ensure that the existing and new tailings, and new waste rock is managed and placed in safe and secure long-term storage using best available management practices.

7.4.2 ALTERNATIVES CONSIDERED

Primary Gold had initially considered re-commissioning the sulphide and oxide WRDs as both a source of construction materials and a location for storage of new waste rock, however, recognised that disturbing the existing covers would allow increased oxygen contact with potentially acid-forming mineral waste so this strategy was abandoned.

Primary Gold also considered a strategy that did not include a new WSD, rather, included direct release of treated water from the pit into Mount Bundey Creek. This strategy was also abandoned due to the potential risks from inadequately treated water reaching downstream receptors without the time in a contingency storage.

The use of evaporation fans was considered, but is not being pursued due to concerns about their effectiveness and the spread of contaminants via fine spray mist.

An option to utilise TSF1 as the location for the TGU Project tailings to be stored was considered and rejected on the basis that the location is too close to the Williams fault and underground workings.

An option to cap TSF1 *in-situ* is not favoured unless enough suitable capping material can be located to provide a long-term sustainable solution for the tailings in TSF1. The option of placing the tailings into the pit post operations for subsequent subaqueous deposition once the pit is allowed to re-flood is currently favoured, and subject to sampling and analysis, some or all of the tailings could be re-processed.

7.4.3 Ore and Waste Rock Mitigation Measures

The following measures have been identified to minimise risks associated with AMD. They are consistent with the AMD Management Plan and will be implemented on-site using that plan. The AMD Management Plan will be updated annually as part of the MMP process.

7.4.3.1 Design Measures

Design controls for ore and waste rock include:

- All waste rock is to be disposed of underground or in the base of the pit;
- Ore is only to be stored underground, in the pit or on the ROM Pad;
- The pit is to be flooded for mine closure to minimise oxygen availability to PAF waste rock; and
- Effective drainage keeping clean water out of the pit and directing dirty water from ROM Pad to the stormwater sump.

A design review is to be completed with each annual MMP that verifies the AMD standards are being implemented for the MMP term.

Design parameters for the in-pit storage of waste rock include identification and isolation of discrete areas with appropriate drainage management and placement protocols. Kinetic tests indicate that PAF waste rock is likely to oxidise within the proposed mine life, therefore, appropriate drainage management is required. Material will be placed using boggers in accordance with the mine development schedule under the supervision of the Mine Geologist. Water that has been in contact with the waste rock will be treated as contaminated and managed accordingly.

Suitable locations for the underground placement of waste rock are to be determined by the Mining Engineer in consultation with the Mine Manager. These would be communicated to the Mine Geologist for implementation.

Apart from augmented drainage, no changes to the current ROM pad layout are anticipated.

7.4.3.2 Operational Measures

Ore and waste rock operational controls include:

- Preparation and implementation of the AMD Management Plan and site AMD procedure;
- Preparation and implementation of the TGU Project WMP that includes the AMD water monitoring analytes;
- All waste rock is assumed to be PAF and is to remain underground, or if not practicable, to be placed in the pit;
- All of the Ore unit is considered to be PAF and shall only be stockpiled underground, in the base of the pit or on the ROM pad;
- No waste rock is to be moved beyond the pit base;
- No waste rock is to be used for construction purposes, other than the DHW unit;
- No waste rock from the existing SWRD or OWRDs is to be used for construction purposes; and
- The existing SWRD and OWRDs are to be maintained to ensure their integrity.

7.4.4 Tailings

7.4.4.1 Design Measures

Design controls for tailings include:

- TSF2 embankments will be raised using a downstream lift;
- TSF2 will have an engineered geomembrane installed over the historic tailings during the first lift to minimise the risk of leakage;
- All tailings from TSF1 and potentially TSF2 to be placed into the pit post closure for AMD management purposes;
- If not placed into the pit, all tailings in TSF2 to be capped *in-situ* in accordance with an approved closure design; and
- The pit is to be flooded for mine closure to minimise oxygen availability to PAF tailings.

7.4.4.2 Operational Measures

Operational controls for tailings include:

- All metallurgical tailings to be treated as PAF and placed in TSF2;
- Preparation and implementation of this AMD Management Plan and AMD site procedure;
- Preparation and implementation of the TGU Project WMP that includes the AMD water monitoring analytes;
- The existing TSF1 is to be maintained to ensure its integrity until removal and rehabilitation;
- Development of a TSF2 operating manual / procedure;
- Maintaining a minimum freeboard on TSF2 for water management purposes; and

- All tailings decant water is to be treated as contaminated and retained within the process circuit other than in an emergency situation.

7.4.5 CONSTRUCTION MATERIAL REQUIREMENTS

Primary Gold has completed conceptual design to determine the required quantities of materials required for construction of the WSD and the embankment raise on TSF2. As the waste rock that has previously been mined at Toms Gully is exhibiting acid producing behaviour, the materials in the WRDs has been excluded from construction plans. In addition, the underground mining operations will not produce any NAF waste rock and hence underground waste rock from the TGU Project shall not be used as construction materials. These requirements of the revised development strategy avoid the risk of AMD from TGU Project waste rock or via disturbance of the existing WRDS.

Investigations for construction materials have included the excavation of test pits to determine depth of profile and geotechnical characteristics of the soil. 101 test pits have been excavated and used to determine the extent of borrow pits required for construction (L&MGSPL 2015).

Table 42 shows the materials required for each of the WSD and TSF2 embankment and the quantities available from the WSD footprint and borrow areas.

Geotechnical investigation of the WSD footprint and surrounds indicated materials underlying the site are generally Clayey Gravel and Silty Clay with an average fines (materials finer than 75 microns) of 48%. The percentage of fines is above the minimum fines of 15% required to provide low permeability for an embankment core. The materials are therefore considered suitable for the embankment construction works for the WSD and TSF2.

A summary of the design (required) and site investigation (available) quantity of material for the WSD and TSF2 raise embankment construction is shown in Table 42.

Table 42: Construction Materials for TGU Project

Location	Estimated Design Quantity (m^3)	Estimated Quantity from Site Investigation (m^3)		Remarks
		Minimum	Maximum	
WSD	136,900	489,000	667,000	Adequate
TSF2	352,400			
Total	489,300	489,000	667,000	

The above table indicates that there is sufficient amount of material to construct the TSF2 and WSD.

Ideally the materials selected for the relatively free draining downstream zone of the WSD should comprise rock which is specifically excavated or blasted to suit the construction work so as to minimise the re-handling of materials. The downstream zone of the WSD would be based on a method specification for construction based on the particle size distribution of the materials selected for construction. The ridges forming the sides of the storage can be excavated to provide the materials for the relatively free draining downstream zone.

Other sources of relatively free draining materials within close proximity to the site include the following nearby quarries:

- H&R Quarry,
- Boral Quarry; and
- Ostojic Quarry.

7.5 SITE DRAINAGE AND CONTROLS

7.5.1 OVERVIEW

Mineral waste storages can generate contaminated water from runoff and seepage. Therefore, appropriately designed and operated water management structures are required. The TGU Project WMP details the design and operational level controls in place to manage water on-site; a summary of which is provided below.

A series of run on diversion bunds and run off drains manage water on-site to minimise the risk of clean water being cross-contaminated by contaminated water (Section 6.3.2.3). Mine affected water is diverted to stormwater ponds and non-mine affected water is transferred through the site via the bunds and run off drains. Water captured within stormwater ponds is assessed through the established network of surface water monitoring sites at TGU that would remain under the TGU Project WMP. Discharges from stormwater ponds and/or site will primarily exit the mineral lease boundary at locations DP1 and DP2.

The following operational mitigation measures apply:

- The TSF water circuit is designed to be closed during operations, with decant water being the priority water source for the processing operation;
- Drainage from the ROM pad shall be directed to the Stormwater Sump which shall be managed to prevent overflow;
- Water from the Stormwater Sump shall not be released directly to the environment. It shall be utilised in the process as first priority; and
- Details of routine operational and emergency water transfers are shown in the TGU Project WMP.

7.6 RESIDUAL RISKS AND CONTINGENCY

The key residual risks identified for AMD for the TGU Project are similar to those for water, as it would be the vector for any off-site transport. These key residual risks are listed below:

- Extreme weather events that exceed design criteria or storage capacity in water management features leading to overflow or structure failure particularly the TSFs;
- Extreme weather event makes site inoperable for long period;
- Contaminated seepage and runoff from the WRDs;
- Re-exposure of PAF materials in the pit wall and underground leading to contaminated mine dewatering;

- Poor water quality released from site via storage overflow or failure of water dilution management;
- Pit lake becomes a groundwater source upon reaching equilibrium; and
- Long-term positive site water balance exceeds site water containment capacity.

7.6.1 TAILINGS MANAGEMENT

Contingency measures for tailings management include Primary Gold identifying that up to approximately 250,000 tonnes of tailings could be safely placed in the underground workings whilst preserving access to any remaining ore. These tails would be the coarse fraction of the tailings stream and would be cycloned to reduce moisture content and remove fines.

7.6.2 WASTE ROCK

Controls for waste rock management include waste rock to be preferentially stored underground with in pit storage a contingency. The ROM Pad could also host waste rock in an emergency situation however this is not foreseen as the pit has sufficient capacity.

Primary Gold recognises that the existing WRDs are a source of AMD that require management. The previous closure strategy has not been effective and the lack of NAF available to the TGU Project means that a robust long-term closure solution has not yet been identified. The TGU Project provides the opportunity to investigate options for long-term remediation of the WRDs.

7.6.3 ROM PAD – ORE

Contingency measures for managing / stockpiling ore is for it to be placed in pit for AMD control if there is insufficient capacity on the ROM pad. This scenario is not anticipated.

7.6.4 WATER MANAGEMENT

In the event of an emergency situation where freeboard is not maintained in TSF2, water would be pumped from the TSF2 decant pond to the two evaporation ponds or WSD.

Should there be an emergency situation with the ROM pad stormwater sump with all contained water not being able to be reused in the process; the water would be pumped to the evaporation ponds, or failing that, to the overflow drain and into the passive oxbow wetland.

In the event of an emergency situation where the evaporation ponds exceeded their design capacity, water would be treated and pumped to the WSD, or would undergo controlled release to Mount Bundey Creek in accordance with the discharge licence. Emergency release would be directly to Mount Bundey Creek in an extreme situation in consultation with the NT EPA. Emergency spillway levels in EP1 and EP2 are 1,029.35 m and 1,025.76 m respectively.

7.7 MONITORING AND REPORTING

7.7.1 GEOCHEMICAL MONITORING

As the strategy adopted by Primary Gold assumes that all ore and waste rock is PAF, the geochemical monitoring program is for the purpose of maintaining an inventory of waste types to allow records to be maintained for development of the TGU Project components of the site. The data will help facilitate closure and management strategies, plans and monitoring.

7.7.1.1 VISUAL METHODS

The Environment, Health and Safety Manager (EH&S Manager) or delegate is to undertake weekly inspections of constructed landforms and water management structures to ensure their integrity and that hostile materials have not been used for construction. Records should be kept and photographic evidence of any structural integrity failing captured, with the Mine Manager notified for action. Examples include evidence of erosion and sediment transport downslope after a storm event, poorly maintained sediment traps, or a ruptured run on bund. This is applicable to historic and future mineral waste and water management structures.

On-site visual monitoring is to be undertaken down-catchment of the toe of the WRDs, TSFs and ROM Pad / Process area, in addition to downstream of the WRDs, ROM Pad and TSF runoff dams. Staff should be alert to the formation of secondary salts on waste rock surfaces and in drainage lines, particularly in dry season. An example is provided in Figure 50. The sources of the salts should be investigated to assist in determining future amelioration strategies for the WRDs and site remediation for the ROM pad and TSFs.

Figure 50: Secondary salt formation on a leaching waste rock dump[2]

Such salts are readily dissolved into solution during 'first flush' rain events and will compromise water quality. In the wet season, staff should note any discolouration of drainage water, particularly red (Fe), clear (Al), or blue-green (Cu) rich discharge. The results of the visual inspections should be documented and communicated to the EH&S Manager.

Excess sedimentation in flow channels or sumps may also be indicative of active erosion and material transport, and implies a lack of integrity of up-slope engineered management structures – which would be investigated with remedial actions undertaken as required for stabilisation. Material removed from drainage lines or sumps that are cleaned at the end of dry season shall be managed as PAF material and either placed in the TSF, or in-pit for management at closure.

The supervising geologist should undertake visual inspection of development material (ore/waste) and construction material collected for geochemical sampling and note the presence of any visual sulphidic material (particularly pyrite and/or arsenopyrite). This inspection should be documented with the laboratory results cross-referenced to the visual sample for data quality control and inventory, and appropriate emplacement of the mineral waste material.

[2] Site is not Toms Gully

7.7.1.2 Laboratory Analysis

Following visual inspection, a subset of the development waste and tailings samples would be forwarded to a NATA accredited laboratory to be analysed for:

- ABA; and
- Metals.

Recommended sampling and analysis frequency is provided below in Table 43.

Table 43: Geochemical Sampling Frequency

Mineral waste unit	LOM tonnes (Approximate)	Sample number required (Approximate)	Assumed mine life	Approximate sampling frequency
Waste rock	1,665,850	32	32 months	~1 per month
Tailings	850,000	23	32 months	~1 every 40 days

7.7.1.3 Surface Water Monitoring

The locations, sampling procedures and schedule and analytes for AMD surface water monitoring are entirely consistent with the TGU Project WMP and are therefore not reproduced herein. Analytes with specific reference to AMD monitoring include pH, EC, acidity and alkalinity, sulphate and metals. Baseline water quality data is also included in the TGU Project WMP.

Decreasing alkalinity is generally a good early indicator of deteriorating conditions in leachate from a WRD containing PAF material, and can therefore be tracked as an 'early warning' mechanism. Metals concentrations and declining pH values generally lag behind declining alkalinity; therefore, corrective actions can be implemented early should alkalinity decline.

Other trends that highlight the onset of AMD include increasing sulphate, increasing sulphate / alkalinity ratio, decreasing pH values and an increase in soluble metals as a result. Given that the TGU Project is a brownfields site with known on-site AMD water chemistry, the focus should be on improving trends as best as is practicable through operations, and ensuring off-site water chemistry compliance is maintained.

Given the development strategy adopted by Primary Gold, the risks of the TGU Project creating new AMD impacts on surface water quality are minimised. Any deterioration in surface water quality shall be investigated to determine the source.

7.7.1.4 Groundwater Monitoring

The locations, sampling procedures and schedule and analytes for groundwater monitoring are entirely consistent with the TGU Project WMP and are therefore not reproduced herein. Analytes with specific reference to AMD monitoring include pH, EC, acidity and alkalinity, sulphate and metals. Baseline groundwater quality data is also included in the TGU Project WMP.

Given the development strategy adopted by Primary Gold, the risks of the TGU Project creating new AMD impacts on groundwater quality are minimised. Any deterioration in surface water quality shall be investigated to determine the source.

7.8 OUTCOMES

AMD is the key source of contamination of water at the existing Toms Gully site. On-site water management systems have been configured and operated to minimise risks and impacts to downstream assets. A review of on-site water quality indicates that some contamination is occurring to on-site groundwater and surface water. The existing site behaviour provides a window into the potential for AMD from the TGU Project and has significantly influenced its development design.

There are two key aspects of AMD to consider relevant to the TGU Project:

- The risks associated with the existing site features – with AMD products leaching from the two WRDs and two TSFs and accumulating in the pit and evaporation ponds; and
- The risks associated with the TGU Project activities – dewatering the pit, the mining and processing of underground ore.

The TGU Project design identified the risks associated with a recommencement of mining an orebody with known AMD potential. The development strategy for AMD is:

- To minimise the risk of creating new AMD sources; and
- To ensure that the existing and new tailings, and new waste rock is managed and placed in safe and secure long-term storage using best available management practices.

The development strategy implemented in the design phase has resulted in a mine plan where no waste rock from the TGU Project will be placed in external WRDs, it will all be retained underground or in-pit. No waste rock in the existing WRDs will be used for construction purposes.

The ROM and ore handling will all occur on the existing ROM pad with drainage renovated to capture all surface water runoff to the stormwater sump.

Tailings from the TGU Project will be stored in TSF2, where a downstream raise technique will minimise risks and enable rock armouring of the external face of the embankment. A GCL will be used to separate the existing tailings in TSF2 from the new tailings to minimise the rate or seepage from the tailings. New monitoring bores will be installed between TSF2 and Mount Bundey Creek.

Dewatering and treating the pit water minimises the risk of AMD leachates in water being discharged to the environment. The commitment to ensure water in Mount Bundey Creek meets the ANZECC 80% aquatic ecosystem protection criteria at the downstream compliance point protects water resources, aquatic ecosystems, fisheries and land uses as it flows into the Mary River and associated wetlands. Primary Gold recognises that the Mary River is of high conservation significance and its protection is essential.

The TGU Project presents opportunities to reduce the overall risks associated with AMD management at the existing site. The on-site presence of personnel and equipment, the

treatment of pit water and consequent reduction of inventory of contaminated water on-site, significantly reduces risks of AMD related environmental impacts. The TGU Project has the potential to significantly reduce the long-term risk and liability associated with acid producing tailings and the subsequent risk of leachate migrating into the groundwater and off-site, runoff and downstream contamination and embankment failure.

The TGU Project has not identified the causes and spatial variability, or quantified the potential for off-site contaminant transport from the existing WRDs.

The risks associated with the TGU Project have been identified and minimised through Project design and whilst they represent some short-term risks in relation to AMD, a series of mitigation measures have been identified, and the expected outcome is that the long-term status of the site will clearly be improved by the TGU Project. By placing the tailings in-pit at end of mine life, the TGU Project will avoid the long-term risk of off-site migration of AMD products associated with tailings storage on-site. In the medium term, the investigations and development of a 3D regional groundwater model will enable site planning for management of contaminants to be targeted. In the short-term, dewatering the pit creates groundwater heads that will encourage contaminate capture.

The ToR Objective of preventing, mitigating or managing AMD/NMD/SD and sediment discharge to prevent on and off-site environmental impacts during mine operations and beyond mine closure is able to be met. The application of the AMD management controls, together with the surface water management strategy (including the treatment of pit water and management to ensure that Mount Bundey Creek water quality will meet the ANZECC and ARMCANZ (2000a) water quality requirements for 80% aquatic ecosystem protection) will result in minimal risks to water quality and the ecosystem health of Mount Bundey Creek and consequently the Mary River system.

8 BIODIVERSITY

8.1 ENVIRONMENTAL OBJECTIVES

The environmental objective identified in the ToR (NT EPA 2015b) for biodiversity from the ToR is to:

- Maintain the conservation status, diversity, geographic distribution and productivity of flora and fauna species and ecosystem levels.

8.2 IDENTIFIED RISKS

GHD (2015d) developed a Biodiversity Report that assessed the biodiversity status of the TGU Project area and identified the key risks the TGU Project may have on the biodiversity status. The key biodiversity risks identified are:

- Introduction of new weed species and spread of existing weed species;
- Increased risk of fire;
- Disruption in the lifecycle or populations of listed threatened species;
- Listed threatened species habitat modification/fragmentation;
- Decrease in fish populations and species richness;
- Impact to GDEs; and
- Impact to aquatic ecosystems.

An aquatic ecology assessment to characterise the existing aquatic health and condition of the TGU Project area (GHD, 2015a) was also undertaken. This included an assessment to identify Hazards with the potential to impact on the aquatic ecology of the local environment. The following risks were determined based on the Hazards identified in the assessment:

- Impacts on aquatic ecology as a result of potential failure of existing/new infrastructure, AMD and uncontrolled release of water;
- Increased erosion and sedimentation; and
- Impacts on GDEs as a result of vegetation clearing and groundwater drawdown.

The identified risks have been assessed in Section 8.3 and mitigations measures are proposed in Section 8.4.

8.3 CONTEXT

A summary of the existing biodiversity status of the TGU Project area was outlined in Section 4.5. The TGU Project has the potential to impact on the following biodiversity components of the area:

- Flora and vegetation;
- Fauna habitat;
- Downstream fisheries and aquatic ecosystems; and

- Introduced and invasive species.

8.3.1 FLORA AND VEGETATION

8.3.1.1 DIRECT IMPACTS

The TGU Project has minimised the amount of clearing required to implement the Proposal. Disturbance of a total of 93 ha is required to enable the construction of the WSD, raising TSF2, construction of water monitoring infrastructure, bores and pipes and accessing borrow materials for construction. The TGU Project ground disturbance works will result in the removal of:

- Approximately 79 ha of vegetation type 1a/l for the WSD and borrow pits;
- Approximately 11 ha of vegetation type 4 for the WSD and TSF2 expansion;
- Approximately one ha of vegetation type 3/l for the water management infrastructure; and
- Approximately two ha of vegetation type 2b/III for the TSF2 expansion.

Figure 51 shows the proposed ground disturbance areas and the underlying vegetation types. The impacted vegetation types listed above and the significance of impacts are further discussed below.

Vegetation type 1a/l primarily comprises of native Eucalypt woodlands; most prominently Darwin Stringybark (*Eucalyptus tetrodonta*), Darwin Woollybutt (*E. miniata*) and Ironwood (*Erythrophleum chlorostachys*) open woodland. The condition of this vegetation has been assessed to be residual and largely undisturbed. Vegetation type 1a/l is the most dominant vegetation type within the Mining lease occupying a total of 370 ha (Figure 51).

Removal of approximately 79 ha of vegetation type 1a/l will remove 21% of vegetation type 1a in good condition on the mining leases. A further 41 ha of this vegetation type is noted to occur on the mining leases, but is not in good condition.

The amount of this vegetation type occurring regionally is not accurately recorded but on a regional scale it is also a considered to be a dominant vegetation type (GHD 2015d). It is not expected that the removal of this vegetation will impact on the overall regional status of this vegetation type. It is noted that surround the mining leases, vegetation type 1a/1 is likely to be contiguous for significant areas, Therefore, at a local scale, the removal of 21% of this vegetation type from the mining leases is no expected to be significant.

Vegetation type 4 (cleared areas) comprises previously disturbed, cleared or constructed areas for mining and mining related activities within Toms Gully. Vegetation type 4 consists of bare ground or various degrees of regrowth ranging from grasslands, grasslands with isolated trees/shrubs, open to closed shrublands and open woodlands. Typical plant species encountered in this vegetation type include *Acacia holosericea* (Silver-leaved Wattle), *Acacia auriculiformis* (Black Wattle) and *Petalostigma pubescens* (Quinine Bush). In the understorey, colonising species include: *Andropogon gayanus* (Gamba Grass), *Sorghum intrans* (Annual Sorghum) and *Melinis repens* (Red Natal Grass) (GHD 2015d).

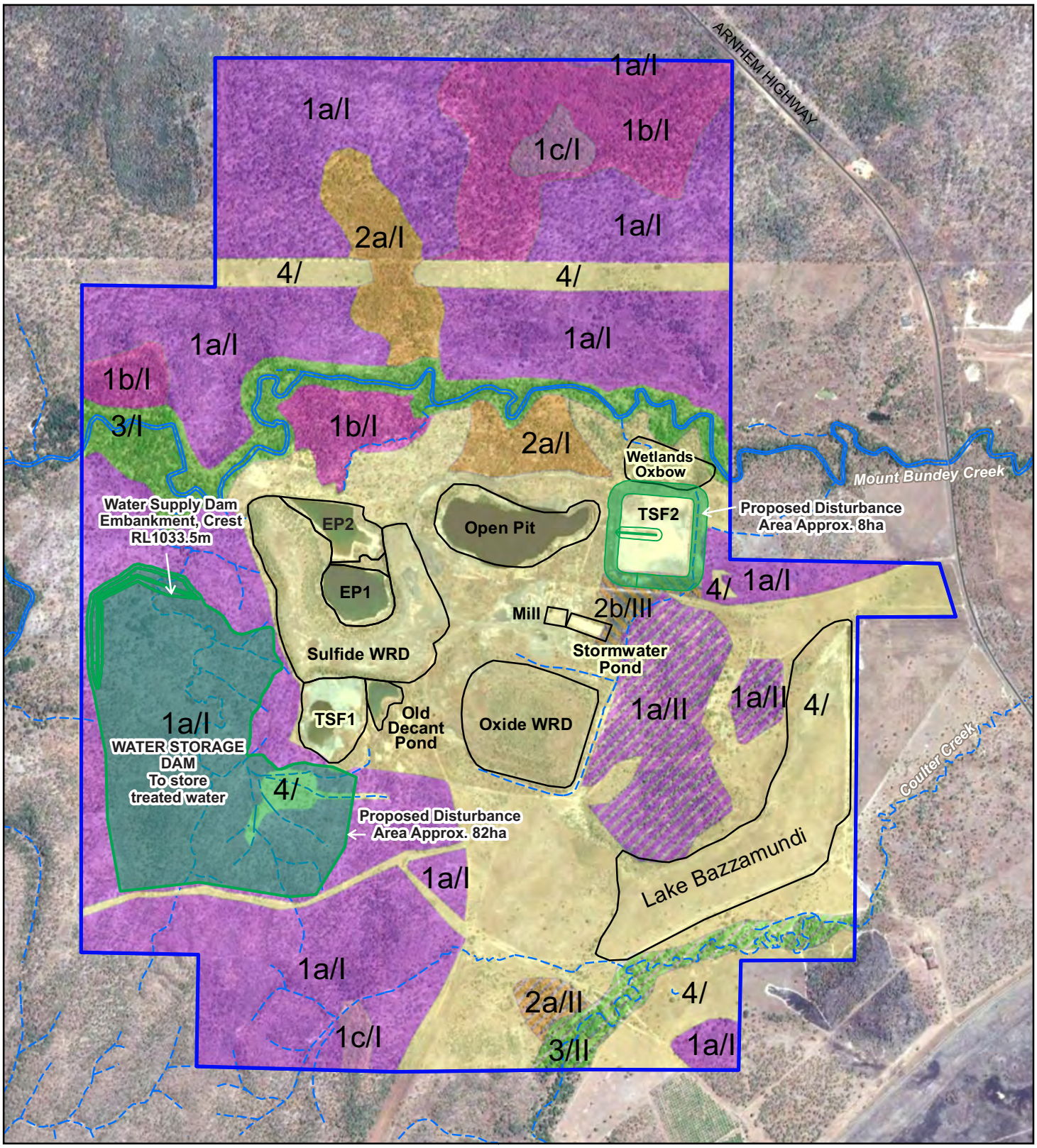
Vegetation type 4 is prominent throughout the south eastern area of the Mining Lease (Figure 51). This vegetation type is not considered to be of conservation significance. Removal of approximately 11 ha of vegetation type 4 is not considered significant.

Vegetation type 3/l occurs in the immediate vicinity of Mt Bundey Creek and Coulter Creek (Figure 51). Plant species composition varies along the creek, but generally includes species indicative of high soil moisture levels. *Bambusa arnhemica* (Bamboo) was the most common species. Other species included *Acacia auriculiformis* (Black Wattle), *Melaleuca leucadendra* (Weeping Paperbark), *Syzygium armstrongii* and *Barringtonia acutangula* (Freshwater Mangrove) (GHD 2015d). 41 ha of this vegetation type is recorded on the mining leases, with a further 16 ha recorded in disturbed condition.

Approximately one hectare of vegetation type 3/l is required to be disturbed for the installation of water compliance monitoring infrastructure in Mount Bundey Creek. Disturbance of riparian vegetation shall be kept to the minimum required and will not impact on the overall status of vegetation type 3/1. The removal of one hectare represents 2.4% of this vegetation type on the mining leases and is not considered significant.

An area of vegetation type 2b/III lies directly south of TSF2. This vegetation type comprises of open forest dominated by *Melaleuca* (Paperback) species, however most of the area proposed to be disturbed by the expansion of TSF2 has been mapped as transformed for grazed grassland with isolated trees (GHD 2015d). The extent of the TSF disturbance envelope into vegetation type 2b/lll will remove approximately two ha of this vegetation type. A total of 5.5 ha of this vegetation type is recorded on the mining leases. The disturbance represents approximately 35% of this mapped unit. The extent of this vegetation type regionally is not known. The removal of this vegetation is considered insignificant as it has previously been modified and is largely surrounded by previously cleared areas.

No threatened flora is expected to occur within the Mining Lease (GHD 2015d).



Mine Site Layout
Site Boundary
Disturbance Areas

Figure 51: Vegetation Clearing

PRIMARY GOLD

1a I	1b I
1a II	1c I
2a I	3 I
2a II	3 II
2b III	4

VEGETATION TYPE

- **1a** Darwin Stringybark *(Eucalyptus tetrodonta)*, Darwin Woollybutt *(E. miniata)* and Ironwood *(Erythrophleum chlorostachys)* open woodland
- **1b** Darwin Stringybark *(Eucalyptus tetrodonta)*, Darwin Woollybutt *(E. miniata)* and Ironwood *(Erythrophleum chlorostachys)* woodland
- **1c** Ironwood *(Erythrophleum chlorostachys)* open forest
- **2a** Paperbark *(Melaleuca spp.)* woodland
- **2b** Paperbark *(Melaleuca spp.)* open forest
- **3** Riparian Forest Corridor
- **4** Cleared Areas

VEGETATION CONDITION

- **I** Largely undisturbed native Eucalypt woodlands
- **II** Modified - native Eucalypt and Paperbark woodlands impacted by grazing
- **III** Transformed -Grazed grassland with isolated trees or native woody regrowth

N

800m

GDA 1994 MGA Zone 52

10/8/2015

8.3.1.2 INDIRECT IMPACTS

Indirect impacts on vegetation may be caused by:

- Changes to groundwater conditions (seepage causing elevated groundwater, dewatering causing lower groundwater levels);
- Discharge of very poor quality water (e.g. acid or saline water);
- Continual and repeated emissions of high levels of dust;
- Changes in burning regimes; and
- Competition from weeds.

The potential for indirect impacts to vegetation is identified as follows.

Seepage from TSF2 is to be limited by the placement of a GCL over the existing tailings prior to any deposition. As discussed in Section 6.3.3.4, with a permeability rating of 10^{-11} m/s the GCL is expected to reduce the risk of significant seepage and resulting elevation of groundwater. Pit dewatering will provide groundwater heads that will tend to capture any seepage from TSF2.

Reduced groundwater levels from dewatering the pit are not expected to have impacts on riparian vegetation in Mount Bundey Creek (see Section 6.3.3.3). Whilst the vegetation is mapped as GDE, previous operators have not caused vegetation death in the creek, and the short window of operations limits the risk of impact to GDEs. Primary Gold is proposing to install additional monitoring bores between TSF2 and Mount Bundey Creek to better understand any potential hydrological linkages and enable monitoring and modelling.

Water discharge to Mount Bundey Creek will be required to enable the pit to be dewatered. The construction of the new WSD enables this water to be stored ready for discharge to ensure suitable water quality. It is proposed that the discharge should meet the ANZECC and ARMCANZ (2000a) 80% aquatic ecosystem guideline at the compliance point which is expected to protect riparian vegetation from any impacts associated with water quality.

Specific mitigation measures for water management are discussed in Section 6.4.

The generation of dust from the TGU Project is not expected to be significant as most mining activities will be completed underground and the processing circuit will be fitted with dust control water sprays where required. Dust from vehicle traffic will be controlled by applying water to roads as required (Section 14.3.2). Dust emissions are not expected to occur at the intensity and frequency that would significantly impact on vegetation.

Management of fire and weeds is of significance to the management of the overall site. The mitigation measures detailed in Section 14.1.2 are expected to manage these potential impacts appropriately as detailed in Section 8.4.4. Management practices will be adapted to any changes in conditions.

8.3.2 TERRESTRIAL FAUNA

The removal of fauna habitat may have a direct or indirect impact upon conservation significant species. In this Section, direct and indirect impacts are considered together. The assessment firstly establishes the likelihood of occurrence of the species on the mining leases, and secondly considered the potential for impact arising from the TGU Project.

As outlined in Section 4.5.6 the likelihood of occurrence of threatened and migratory species within a 10 km buffer of the mine site was assessed based on desktop searches and a literature review. This information was then cross-referenced with habitat requirements and DLRM fauna species records to determine the likely presence or absence of threatened species' habitat within or adjacent to the mine site (Table 44 – Column 6).

The likelihood of direct and indirect impacts on the threatened species habitat was then assessed. Indirect impacts to threatened species are considered to range from unlikely to highly unlikely due to the low disturbance footprint of the TGU Project. The outcomes of the assessment are shown in Table 44.

The following threatened fauna species are found to be impacted by the TGU Project:

- Northern Quoll;
- Black-footed Tree-rat;
- Fawn Antechinus;
- Partridge Pigeon; and
- Floodplain Monitor.

Mitigation measures as proposed in Section 8.4 will minimise the potential for direct impacts on the above listed species.

Table 44: Likelihood of Occurrence and Impacts to Threatened Species

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
Mammals							
Brush-tailed Rabbit-rat (*Conilurus penicillatus*)	PMST	VU	EN	Restricted to mixed eucalypt open forest and woodland, or on dunes with Casuarina, seeming to prefer habitats that are not burnt annually, that have an understorey of predominantly perennial grasses and a sparse-to- moderate middle storey.	Unlikely Suitable habitat within the mine site but there are no records within 10 km of the mine site.	Unlikely No clearing of habitat associated with this species	Very unlikely
Northern Quoll (*Dasyurus hallucatus*)	PMST / DLRM			Habitat comprises rocky areas and tall open coastal eucalypt forests. Prime habitat in these northern regions is sandstone escarpment. Habitat includes open forest and woodlands on plains dominated by *Eucalyptus tetrodonta*, *E. miniata* and *E.tectifica* open woodland on low rocky hills dominated by *E. setosa* and *E.bleeseri* and riparian areas with flowing water dominated by *Melaleuca viridiflora* and *Pandanus spiralis*. Sometimes occurs around human dwellings and campgrounds.	Possible Suitable habitat within the mine site. There are numerous records within 10 km of the mine site with the most recent record being in 2009 (DLRM 2015a).	Possible Potential to clear habitat associated with this species Mitigation measures required	Unlikely
Northern Brush-tailed Phascogale (*Phascogale pirata*)	PMST	VU	EN	Most records from tall open forests dominated by *Eucalyptus miniata* (Darwin woollybutt) and *E. tetradonta* (Darwin stringybark).	Unlikely Suitable habitat within the mine site but there are no records within 10 km of the mine site	Unlikely No clearing of habitat associated with this species	Very unlikely
Bare-rumped Sheathtail Bat (*Saccolaimus*	PMST	CR	NT	Only anecdotal information is available based on habitat around roosts or from shot specimens.	Possible Possible roosting and foraging	Unlikely No clearing of	Unlikely

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
saccolaimus nudicluniatus)				Kakadu National Park specimens collected have been from open pandanus woodland fringing the sedgelands of the South Alligator River. May forage over habitat edges such as the edge of rainforest and in forest clearings.	habitat in Pandanus woodland present within the mine site but there are no records within 10 km of the mine site. Known only from Kakadu NP in NT.	habitat associated with this species	
Water Mouse (*Xeromys myoides*)	PMST	VU	DD	Habitat includes mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands. Utilises both intertidal and freshwater habitats.	Unlikely Suitable habitat within the mine site but there are no records within 10 km of the mine site.	Very unlikely No clearing of habitat associated with this species	Unlikely
Black-footed Tree-rat (*Mesembriomys gouldii*)	DLRM	-	VU	Found in the Top End of the Northern Territory in tropical woodlands and open forests in coastal areas.	Possible Habitat likely to be present within the mine site and there are two records within 10 km of the mine site from 1999 (DLRM 2015a).	Possible Potential to clear habitat associated with this species Mitigation measures required	Unlikely
Fawn Antechinus (*Antechinus bellus*)	DLRM	-	EN	Occurs in savannah woodland and tall open forest of the Top End of the Northern Territory.	Possible Suitable habitat within the mine site. There is one record within 5km of the mine site from 1989 (DLRM 2015a).	Possible Potential to clear habitat associated with this species Mitigation	Unlikely

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
						measures required	
Pale Field-rat (*Rattus tunneyi*)	DLRM	-	VU	Occurs in dense vegetation along creeks.	Possible Suitable habitat along dense vegetation along creeks may be present within mine site. There are numerous records within 10 km of the mine site (DLRM 2015a).	Unlikely Minimal (approximately 1 ha) clearing of creekline vegetation Mitigation measures proposed	Unlikely
Birds							
Yellow Chat (Alligator Rivers) (*Epthianura crocea tunneyi*)	PMST	EN	EN	Occurs around channels and depressions on seasonally inundated floodplains. In the dry season, it has been observed in areas of exposed mud or clay with or without a sparse (up to 50 %) cover of grasses, sedges and forbs, such as *Hymenachne acutigluma*, *Ludwigia adscendens*, *Ipomoea aquatica*, *Sesbania sesban* and species of Cyperus and Eleocharis. Habitat preferences in the wet season are less well known, but all of the few records of nesting from Kakadu National Park have been in low mangroves on the margins of tidal channels.	Unlikely Suitable habitat within the mine site but there are no records within 10 km of the mine site.	Very unlikely No clearing of habitat associated with this species	Very unlikely
Red Goshawk	PMST	VU	VU	Prefers tall open forest and woodland, or	Unlikely	Unlikely	Very unlikely

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
(*Erythrotriorchis radiatus*)				tall fringing woodlands along rivers in grasslands, shrub-lands, and low open woodlands. Also occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia or riverine forests. Nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one kilometre of permanent water.	Possible roosting and foraging habitat in Pandanus woodland may be present within the mine site but there are no records within 10 km of the mine site.		
Gouldian Finch (*Erythrura gouldiae*)	PMST / DLRM	EN / Mi	VU	Inhabits open woodlands that are dominated by Eucalyptus trees and support a ground cover of Sorghum and other grasses. Critical components of suitable core habitat appear to be the presence of favoured annual and perennial grasses (especially Sorghum), a nearby source of surface water and in the breeding season, unburnt hollow-bearing Eucalyptus trees (especially *E. tintinnans*, *E. brevifolia* and *E. leucophloia*). Breeding habitat confined to ridges and rocky foothills.	Possible Suitable foraging habitat present within study area. There are numerous records within 10 km study area, as recent as 2010 (DLRM 2015a).	Unlikely No clearing of habitat associated with this species	Very unlikely No clearing of nesting habitat
Partridge Pigeon (eastern) (*Geophaps smithii smithii*)	PMST / DLRM	VU	VU	Occurs in open forest and woodland dominated by Darwin Stringybark *Eucalyptus tetrodonta* and Darwin Woollybutt *E. miniata* that has a structurally diverse understorey.	Possible Suitable habitat within the mine site.	Possible Potential to clear habitat associated with	Unlikely

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
				Nests on the ground, usually where there is plenty of vegetation cover. Forage where the ground layer is open, or on bare ground in recently burnt areas.	There are records within 10 km of mine site, but not since 1990 (DLRM 2015a).	this species Mitigation measures required	
Australian Painted Snipe (*Rostratula australis*)	PMST	EN / Mi	VU	Inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains.	Highly unlikely Suitable habitat not present within mine site and there are no records of the species within 10 km of the mine site.	Very unlikely No clearing of habitat associated with this species	Very unlikely
Masked Owl (northern) (*Tyto novaehollandiae kimberli*)	PMST	VU	VU	Inhabits riparian forest, rainforest, open forest, Melaleuca swamps and the edges of mangroves.	Unlikely Suitable habitat within the mine site but there are no records within 10 km of the mine site.	Very Unlikely Minimal (approximately 1 ha) clearing of creekline vegetation Mitigation measures proposed	Very unlikely
Reptiles							
Floodplain Monitor (*Varanus panoptes*)	DLRM	-	VU	Occupies a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands.	Possible Suitable habitat within the mine site. There are records within 10 km of the mine site, though not since	Possible Potential to clear habitat associated with this species	Unlikely Wide habitat preference

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
					2002 (DLRM 2015a).	Mitigation measures required	
Mertens' Water Monitor (*Varanus mertensi*)	DLRM	-	VU	Inhabits margins of watercourses, swamps and lagoons in Northern Australia. Has a broad geographic range, occupying coastal and inland waters across the far north of Australia.	Possible Suitable habitat within the mine site. There are records within 10 km of the mine site, as recent as 2011 (DLRM 2015a).	Unlikely Minimal (approximately 1 ha) clearing of creekline vegetation Mitigation measures proposed	Unlikely Indirect on Mount Bundey Creek.
Mitchell's Water Monitor (*Varanus mitchelli*)	DLRM	-	VU	Inhabits margins of watercourses, swamps and lagoons in Northern Australia. Has a broad geographic range, occupying coastal and inland waters across the far north of Australia.	Possible Suitable habitat within the mine site. There is one record within 10 km of the mine site, though not since 1989 (DLRM 2015a).	Unlikely Minimal (approximately 1 ha) clearing of creekline vegetation Mitigation measures proposed	Unlikely Indirect on Mount Bundey Creek. Broad range.
Fish							
Freshwater Sawfish (*Pristis pristis*)	PMST	VU	VU	Occur in rivers and estuaries, while large mature animals tend to occur more often in coastal and offshore waters up to 25m depth.	Unlikely Suitable habitat within the mine site but there are no records within 10 km of the mine site.	Negligible	Very unlikely Indirect on Mount Bundey Creek.

Species / Community	Source	Conservation Status		Habitat and Resource Preference	Likelihood of Occurrence in Mining Lease	Likelihood of Impact	
		EPBC Act	TPWC Act			Direct	Indirect
Plants							
Goodenia quadrifida	PMST / DLRM	VU	DD	Occurs on the upper parts of estuarine floodplains, on poorly drained grey clays or silty soils. There is one record from 1967 approximately 5 km from the mine site.	Unlikely There is one record from 1967 within 10 km of the mine site (DLRM 2015a).	Very unlikely Clearing mainly well drained areas.	Very unlikely
Helicteres macrothrix	PMST / DLRM	EN	EN	Recorded from three populations: near Mount Bundey, Batchelor/Glenluckie Creek and Lake Bennett. There is a high degree of confidence that the species is restricted to its current general area. This species was recorded in 2011 south-west of the mine site, this is the Mount Bundey population. It is highly unlikely that this species occurs within the mine site.	Highly unlikely There are records within 10km of the mine site but there is a high degree of confidence that the species is restricted to its current known populations.	Very unlikely Highly unlikely for species to occur in TGU Project area	Very unlikely
Schoutenia ovata	DLRM	-	EN	This species occurs in Thailand, Indochina and Java. In Australia, it is known only from the NT. In the NT, it occurs in three disjunct subpopulations, two in the Mount Bundey-Mount Goyder area and near Tipperary Station. This species has been collected from monsoon vine thicket on granite and limestone outcrops. The Mount Bundey subpopulation mostly occurs on south facing slopes.	Highly unlikely There are records within 10km of the mine site as recent as 2011 (DLRM 2015a). There is a high degree of confidence that the species is restricted to its current known populations.	Very unlikely Highly unlikely for species to occur in TGU Project area	Very unlikely

8.3.3 FISHERIES AND AQUATIC ECOSYSTEMS

The potential for impact upon fisheries and aquatic ecosystems of Mount Bundey Creek, neighbouring Mary River National Park and wetlands of the Mary River system have been identified in the ToR and in ongoing consultation completed by Primary Gold. Potential impacts on fisheries and aquatic ecosystems could occur by:

- Release of water into Mount Bundey Creek thereby potentially impacting on the water quality;
- Changes to water flows in Mount Bundey Creek as a result of the WSD; and
- Lowering groundwater levels around the pit during the dewatering period thereby potentially impacting groundwater dependent vegetation.

To address these impacts Primary Gold has completed a number of baseline and characterisation assessments to understand the current environment, and has developed designs and management strategies aimed at minimising the potential for the TGU Project to impact on downstream fisheries and aquatic ecosystems. Primary Gold has also had valuable discussions with stakeholders with an interest in these risks. Management strategies developed are documented in a series of management plans, including a WMP, BMP, AMD Management Plan, MCP and an overarching TGU Project EMP including erosion and sedimentation controls.

8.3.3.1 WATER QUALITY

Water within the existing pit will need to be removed to enable further underground mining. The water management strategy for the TGU Project is to treat the existing pit water to meet water quality standards, then pump the treated water to the new WSD where a portion will be retained to ensure sufficient site water supply and a portion released to Mount Bundey Creek.

This water management strategy is designed to ensure water quality within Mount Bundey Creek meets the 80% ANZECC & ARMCANZ (2000a) aquatic ecosystem protection levels at the downstream compliance monitoring point. This is a higher quality standard than was set for previous discharge licences which operated to the lower, livestock water quality level at the downstream compliance point in Mount Bundey Creek. The higher standard of treatment is achieved via a two-fold strategy involving treatment of mine-affected waters targeting stock quality levels (or better), prior to dilution on discharge. The management of water quality is described in detail in Section 6, whilst the management of the key sources of contaminants (ore, waste rock and tailings) is described in Section 6.4.3.3.

By ensuring discharged water meets the 80% ANZECC & ARMCANZ (2000a) protection levels at the downstream monitoring site, risk of impacts to downstream fisheries and the aquatic ecosystems of Mount Bundey Creek is expected to manageable via the implementation of the relevant controls. Given the small proportion of catchment and flow contribution made by Mount Bundey Creek, any impacts on Mount Bundey Creek are not expected to impact upon the wetlands of the Mary River system.

8.3.3.2 WATER FLOWS

The key mechanisms for changes to water flows in Mount Bundey Creek are the clearing of land, the construction of the WSD, and the release of water from the site.

The clearing of land will be largely completed within the footprint of the WSD which will effectively buffer the system from any mobilisation of sediments and changes to catchment runoff characteristics associated with clearing.

The potential impacts on surface water flows within Mount Bundey Creek are considered in terms of the relative size and location of the WSD. These are:

- Connectivity of catchments will not be impacted as the WSD affects a single, small tributary;
- The WSD is designed not to stop the contribution of tributary flow to Mount Bundey Creek under peak flow conditions, but to utilise the flow to control fresh and diluted treated water discharge into the system; and
- The total size of the WSD catchment (1.61 km^2) is only 1.2% of the total catchment of Mount Bundey Creek (131 km^2), and less than 0.02% of the total Mary River catchment (8,100 km^2).

Based on the above, flows in Mount Bundey Creek are not expected to be significantly impacted. Under these circumstances, no associated impacts to downstream fisheries and aquatic ecosystems as a result of a change in flows are envisaged.

In relation to the potential for lowering of the groundwater table due to pit dewatering, bores in proximity to Mount Bundey Creek (G9 and WB3) suggest that the water table in the siltstone near the creek is approximately 8 m below ground level. This indicates that Mount Bundey Creek is not likely to be directly connected to groundwater (AGEC 2015). Further support for this disconnect is that the previous dewatering operations at the mine did not result in any significant changes in vegetation (vegetation death) in Mount Bundey Creek. It is therefore concluded that the TGU Project is very unlikely to result in any impact to GDEs.

8.3.4 INTRODUCED AND INVASIVE SPECIES

8.3.4.1 WEEDS

Mining activities have the potential to introduce and/or spread weeds within an area. Weeds can be introduced to an area on machinery and equipment that may have come from other weed infected sites. In addition to introducing new weed species, mining activities may also spread the occurrence of existing weed populations on site.

Past annual weed mapping has identified seven weed species within and adjacent to the mine site. Gamba Grass is the only grass species from the Threat Abatement Plan to reduce the impacts on Northern Australia's biodiversity by the five listed grasses (Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) 2012) that has been documented to occur within/adjacent to the mine site. Under the NT's Weed Management Plan for Gamba Grass (DLRM 2014) there are defined 'eradication' and 'management' zones for

Gamba Grass. The TGU Project site is located within a "management zone". DLRM (2014) requires that the growth and spread of Gamba Grass be controlled in "management" zones.

The TGU Project has minimal disturbance to land required. The retention of waste rock underground and in-pit limits the disturbance footprint to that required for the WSD, some ancillary water management infrastructure and to raise TSF2.

Standard industry practice weed mitigation measures can minimise the potential for the introduction and spread of weeds. Management of Gamba Grass can include burn-offs in the early season and cattle grazing. The proposed weed mitigation measures for the TGU Project are outlined in Section 8.4 and the Biodiversity MP. The rehabilitation program outlined in the MCP also considers weed management.

These mitigation measures will minimise the potential for weed impacts in the region as a result of the TGU Project.

8.3.4.2 Feral Animals

Historically feral animals such as cattle, buffalo and pig were recorded on the Mining lease in the lowland habitats. Numbers of these animals were relatively low, and apart from some pig rootings, the area had sustained very little environmental damage from these species (Kinhill Engineers 1988).

The 2013/2014 MMP also made reference to animal species such as Feral Pigs (*Sus scrofa*), Water Buffalo (*Bubalus bubalus*) and Cane Toads (*Rhinella marina*) having been observed around the Mount Bundey Creek system and associated wetlands. It is likely that Feral Cats (*Felis cattus*), common across the NT, are also present in the TGU Project area (Primary Gold 2013)

With the implementation of the management measures outlined in Section 8.4 and the Biodiversity MP, the proposed mining activities are not envisaged to cause a notable increase in feral animal populations in the area. Where annual monitoring identifies an increase in feral animal numbers (in particular feral cats, feral pigs and cane toads) mitigation measures as outlined in the following Threat Abatement Plans shall be implemented where required and practicable:

- Threat Abatement Plan for Predation by Feral Cats (DotE 2015);
- Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs (Department of the Environment and Heritage (DEH), 2005); and
- Threat Abatement Plan for the Biological Effects, including Lethal Toxic Ingestion, caused by Cane Toads (DSEWPC 2011).

8.4 Mitigation

Impacts to biodiversity shall be minimised by appropriate design and avoidance where possible. Proposed mitigation measures are outlined below and within the TGU Project Biodiversity Management Plan (Appendix 12).

8.4.1 FLORA, VEGETATION AND FAUNA HABITAT

To minimise the direct loss of flora, vegetation and fauna habitat and the potential for habitat modification/fragmentation due to land clearing, the following mitigation measures shall be implemented:

- A Ground Disturbance Permit (GDP) System shall be implemented to restrict the number and extent of cleared areas to the minimum needed for safe and efficient implementation of the TGU Project. The system shall include:
    - Checks that clearing requirements are consistent with approvals;
    - Geographical Information System (GIS) information identifying significant flora and fauna features for use when planning Project activities;
    - A communication and approval system that requires management signoff; and
    - Specifications for clearing.
- Vegetation clearing shall occur within approved boundaries;
- Disturbance of riparian vegetation shall be avoided wherever practicable;
- Required clearing shall be minimised, for example:
    - Material from excavations will be used for construction where practicable;
    - Pre-disturbed areas shall be used wherever possible; and
- Rehabilitate cleared areas in accordance with the MCP.

To minimise the potential for the introduction or spread of weeds, the following mitigation measures shall be implemented;

- Machinery hygiene procedures shall be implemented to manage the risks of weed introduction and export to and from the site;
- Movement of topsoil between sites where weeds could be spread to new locations shall be restricted;
- All ground engaging equipment shall be required to arrive on site clean of plant and soil material from other sites or hygiene work areas; and
- Weed surveys shall be conducted as soon as practicable after construction to determine whether construction of the TGU Project has increased the population or distribution of weeds. If determined that the TGU Project has caused an increase in the population or distribution of weeds corrective actions (spraying, removal etc.) shall occur after consultation with relevant government authorities and weed experts as to the preferred course of action.

To minimise the potential for direct loss of flora, vegetation and fauna habitat due to fire, the mitigation measures outlined in the fire Section (Section 14.1) of the EIS and TGU Project EMP shall be implemented.

8.4.2 TERRESTRIAL FAUNA

To minimise the potential for fauna injury or death, the following mitigation measures shall be implemented:

- Fencing shall be installed around the TGU Project site;
- Speed limits shall be applied and enforced within the TGU Project site; and

- Selected personnel shall be trained in wildlife rescue protocols. All other staff shall notify trained staff of any incidences of fauna injury or death. Incidents shall be investigated with follow up measures implemented.

8.4.3 FISHERIES AND AQUATIC ECOSYSTEMS

To minimise the potential for contamination of waterways, the following mitigation measures shall be implemented;

- Pit water shall be treated to livestock water quality standards;
- Treated water shall be released to Mt Bundey Creek to meet 80% ANZECC & ARMCANZ (2000a) criteria at the downstream compliance point;
- Clean water shall not to be mixed with dirty water;
- A bio-monitoring programme shall be implemented downstream of the mine site in Mount Bundey Creek; and
- Water quality and water release shall be monitored in accordance with the WMP.

To minimise impacts to the biodiversity status of Mount Bundey Creek, the following mitigation measures shall be implemented:

- Stockpiled vegetation and topsoil shall be stored away from water courses to prevent sedimentation;
- Impact on active creek beds shall be minimised through the use of culverts, to help protect riparian vegetation;
- Monitoring of riparian vegetation health shall be undertaken to ensure that surface hydrology management measures are suitable.

To minimise the potential for contamination of groundwater and GDEs, the following mitigation measures shall be implemented:

- All waste rock shall be assumed to be PAF and shall remain underground, or if not practicable, placed in the pit;
- No waste rock from the existing sulphide or oxide waste rock dumps shall be used for construction purposes;
- All metallurgical tailings shall be treated as PAF and placed in TSF2;
- A minimum freeboard shall be maintained on TSF2 for water management purposes; and
- All tailings decant water shall be treated as contaminated and retained within the process circuit other than in an emergency situation.

To minimise the potential impacts on water quality as a result of erosion and sedimentation, the mitigation measures as outlined within the TGU Project EMP shall be implemented.

8.4.4 INTRODUCED AND INVASIVE SPECIES

Where feral animal numbers are increasing as a result of TGU Project activities, mitigation measures as outlined in the relevant Threat Abatement Plans shall be implemented where required and practicable.

Existing stock proof fencing shall be upgraded and extended where required to restrict access to the site by stock.

8.5 RESIDUAL RISKS AND CONTINGENCY

There is the potential for the following residual risks to occur.

- Over clearing or clearing outside of approved areas;
- Impacts to riparian vegetation and GDEs;
- Introduction and/or spread of weeds;
- Fauna injury or death;
- Unsuccessful rehabilitation; and
- Contamination of surface water.

Implementation of the monitoring and mitigation measures described below and in Section 8.6 will minimise the potential for these residual risks.

Primary Gold will implement a system of GDPs to minimise the risk of over clearing and to ensure adequate data capture to enable reporting. Monthly ground disturbance reports shall be prepared to calculate areas cleared during the reporting period and overall clearing. Any incidents of over-clearing or clearing outside of approved boundaries, incidences of vegetation health decline or death, weeds, fauna injury or death, unsuccessful rehabilitation or non-compliant surface water release shall be reported in accordance with the TGU Project Incident Reporting and Management System and where required to the relevant authorities in the Annual Environmental Report.

8.6 MONITORING AND REPORTING

Monitoring of site conditions and mitigation measures shall be undertaken to determine the impact of the TGU Project on the biodiversity status of the site. This monitoring shall be continuous throughout the construction and operation phase of the TGU Project, with the registers and systems developed and implemented prior to the start of construction. Proposed monitoring requirements are summarised in Table 45 below.

Water monitoring is also relevant to the protection of downstream biodiversity. The proposed water monitoring actions are outlined in Section 6.6 and are also described in the TGU Project WMP (Appendix 4).

Table 45: Biodiversity monitoring actions

Category	Monitoring Action
Clearing of native vegetation	Maintain and monitor the GDP System to assess and record proposed clearing to ensure compliance with Project vegetation and flora constraints. Specific information collected will include: • Shape files or coordinates of cleared areas • Party responsible for the clearing • Confirmation of compliance with clearing methods requirements • Calculations of the amount of native vegetation clearing conducted • Calculations of the amount of vegetation clearing remaining from approved allocation
Weeds	Maintain and monitor the Hygiene Program such that the following information is recorded: • Inspection reports for random weed inspections • Records of weed hygiene certificates for all earthmoving equipment arriving on site • Data recorded during weed surveys
Aquatic and riparian ecosystems	Monitoring of riparian vegetation health shall be undertaken to ensure that surface hydrology management measures are suitable
	Implement a bio-monitoring program to include the monitoring of fish species. Results from these future programs shall be compared against the baseline fish survey results recorded by GHD (2015a) to determine if the TGU Project is having any adverse impacts on fish species and downstream fisheries.
	Monitor surface water and groundwater impacts in accordance with the WMP
GDEs	Monitor the health of groundwater dependant vegetation during dewatering activities to assess whether there are any impacts as a result of groundwater drawdown
Rehabilitation	Maintain and monitor the Rehabilitation Register and record the following information: • Area rehabilitated • Identification of new areas available for rehabilitation to commence • Location and size of topsoil storage areas • Inspections of rehabilitation success at completed rehabilitation areas

In the case of a significant biodiversity related incident, the EH&S Manager shall contact the DME or other appropriate agency within 24 hours and information about the incident shall be provided.

8.7 OUTCOMES

The TGU Project will require clearing of up to 93 ha of vegetation. Mitigation and monitoring measures have been proposed to ensure ground disturbance works stay within approved limits and boundaries.

Assessment of the amount and types of vegetation to be removed has been completed and demonstrates that the clearing is unlikely to have a significant impact on the affected vegetation types at either local or regional scales. An assessment of the likely occurrence and potential

impacts on species of conservation significance has been completed and demonstrates that significant impacts are unlikely to highly unlikely depending upon the species. The assessment concludes that the TGU Project may directly impact on habitat for the following threatened fauna species:

- Northern Quoll;
- Black-footed Tree-rat;
- Fawn Antechinus;
- Partridge Pigeon; and
- Floodplain Monitor.

The surface water management strategy shall treat pit water to ensure that any water discharged to Mount Bundey Creek will meet the ANZECC and ARMCANZ (2000a) water quality requirements for 80% aquatic ecosystem protection at the downstream compliance monitoring station. This will result in minimal adverse impacts to water quality and the ecosystem health of Mount Bundey Creek and represents an increase in the standard required for water quality for Mount Bundey Creek. It is also consistent with the likely impacts associated with surrounding land uses. The geographic positioning, scale and contribution of Mount Bundey Creek to the Mary River system, means that if Mount Bundey Creek is protected, the Mary River system will also be protected.

The environmental objective for biodiversity from the ToR is to maintain the conservation status, diversity, geographic distribution and productivity of flora and fauna species and ecosystem levels.

Based on the consideration of risks, impact assessment and implementation of the aforementioned mitigation strategies and management plans, the ToR environmental objective for biodiversity is able to be met.

9 HISTORIC AND CULTURAL HERITAGE

9.1 ENVIRONMENTAL OBJECTIVES

The environmental objective identified in the ToR (NT EPA 2015b) for the management of historic and cultural heritage values is:

- Places and items with historic and/or cultural heritage values protected under the Heritage Act and/or NTASS Act will be identified and those values protected.

9.2 IDENTIFIED RISKS

The ToR identified the following historic cultural and heritage risk for the TGU Project:

- Potential to impact on-sites/objects of sacred, heritage cultural or indigenous cultural significance.

This risk has been assessed, with proposed mitigation measures outlined in Section 9.4.

9.3 CONTEXT

An assessment of the historic and cultural heritage status of the TGU Project site was undertaken and described in Section 4.6. The key findings of this assessment are as follows:

- A search of the NT Heritage Register identified no nominated, provisional or declared heritage places within the TGU Project site;
- A search of the NT Archaeological Sites Database identified no previously recorded Aboriginal archaeological sites within the existing and the proposed TGU Project site;
- Correspondence from the Commonwealth Department responsible for the ATSIHP Act advised that there are no declarations under the ATSIHP Act applicable to the TGU Project site; and
- A search of the NT Aboriginal Sacred Sites register retrieved an Authority certificate from the AAPA for mining operations at the TGU Project site within ML1058 and 29814.

As there are no known historic or cultural heritage sites within the TGU Project site, there is no risk of the TGU Project directly impacting on known heritage sites.

Although only 93 ha of ground disturbance is proposed as part of the TGU Project, there is still a minor risk that direct ground disturbance may impact on unknown historic and/or cultural heritage sites. Mitigation measures to minimise such impacts are discussed in Section 9.4.

9.4 MITIGATION

The following mitigation measures are proposed to minimise the potential risk of impacts on unknown historic or cultural heritage sites. Should a site be identified within the disturbance footprint, details of requirements to disturb a site are also provided.

- All personnel shall undertake an induction that outlines their requirements in relation to historic and cultural heritage management;
- All personnel shall be informed of the need to identify and protect historic and cultural heritage sites;
- All clearing shall be undertaken in areas approved to be cleared in accordance with an approved GDP;
- In the event of a discovery of objects suspected to have historic and/or cultural heritage significance, work at that location shall stop immediately until the object/s can be assessed and authorisation given to continue activities;
- Should the objects discovered be human remains, the NT Police shall be immediately notified;
- If a historical or cultural heritage site is determined, the area shall be flagged on the ground and demarcated on drawings. No works shall be undertaken within this flagged area until approval to disturb is granted; and
- Should a historical or cultural heritage site be identified and require disturbance, approval shall be sought for its disturbance. Works shall then be undertaken in accordance with the Heritage Act, the conditions of the Works Approval and in consultation with TOs.

9.5 RESIDUAL RISKS AND CONTINGENCY

The primary residual risk following implementation of the mitigation measures will be accidental damage to unknown historic and/or cultural heritage site. Implementation of the monitoring measures described in Section 9.6 will minimise this residual risk.

9.6 MONITORING AND REPORTING

Although there are currently no known historic or cultural heritage sites within the TGU Project site, any newly discovered sites shall be flagged as described in Section 9.4 and the condition of the flagging shall be regularly monitored. The site shall also be inspected and any impacts or disturbance shall be recorded and reported to the EH& Manager. Sites and flagging shall be inspected weekly during the construction phase of the TGU Project and monthly thereafter.

9.7 OUTCOMES

The potential historic and cultural heritage risks associated with the TGU Project have been identified and mitigation measures considered and assessed. The identified risks outlined in Section 9.2 have a low probability of occurrence due to there being no known historic or cultural

heritage sites within the TGU Project site and consequently a low potential for future sites to be discovered.

In the unlikely event that a historic and/or cultural heritage site is discovered within the TGU Project site, implementation of the proposed mitigation measures outlined in Section 9.4 will minimise the potential for adverse impacts occurring.

The following environmental objective was identified in the ToR (NT EPA 2015b) for the management of historic and cultural heritage values is that "places and items with historic and/or cultural heritage values protected under the Heritage Act and/or NTASS Act will be identified and those values protected". Based on the information above, the ToR environmental objective for historic and cultural heritage is able to be met.

10 INFRASTRUCTURE INTEGRITY AND SUITABILITY

10.1 ENVIRONMENTAL OBJECTIVES

The following environmental objective was identified in the ToR (NT EPA 2015b) for infrastructure integrity and suitability:

- Designs, construction methods and available materials for proposed and existing infrastructure will be sufficient to ensure infrastructure integrity, and protection of the environment for the short and very long-term.

10.2 IDENTIFIED RISKS

The key risks identified in the ToR for the TGU Project infrastructure are:

- Inadequate engineering or construction methods or having insufficient suitable construction materials available;
- Dam wall leakage or failure;
- Extreme rainfall events and overtopping; and
- Presence of underlying high permeability geological faults and/or strata.

Other key risks associated with the TGU Project infrastructure include:

- Seepage to groundwater of contaminated water from TSF2;
- Flooding risk to TSF2; and
- Flooding risk to the pit.

Some features of the existing Toms Gully site infrastructure are not required to be used by the TGU Project. The key risks identified for non-required Toms Gully infrastructure are:

- Poor quality water seeping from or running off the WRDs and evaporation ponds;
- Overtopping of evaporation ponds in an extreme weather event; and
- Flooding risk to the evaporation pond embankments.

The Sections on closure and rehabilitation, water and AMD also specifically identify risks associated with these features. The risks identified above have been assessed and are presented together with mitigations in the Sections below.

10.3 CONTEXT

The existing Toms Gully site includes infrastructure features that are able to be renovated and reused for the TGU Project, and other features that will not be utilised. As the site has been in Care and Maintenance for an extended period, most of the infrastructure requires inspection and renovation prior to use.

Primary Gold arranged for a preliminary inspection of the site and facilities in 2015. The subsequent report reviews the condition of the WRDs and embankments of the existing tailings and water storage facilities and is provided in Appendix 10 (Douglas Partners 2015). The scope of the review included:

- Determine if existing Tailings Dams No. 2 is 'fit for purpose' and provide advice on management requirements for this structure, primarily from a stability and seepage point of view;
- Determine if the existing tailings solids in Dams No. 2 are suitable for re-use as filling to raise the tailings dam walls, which are simple earth embankments;
- Assess existing oxide and waste dump erosion and overall stability, and provide advice on management requirements to minimise the risks of instability and degradation of slopes by erosion;
- Assess current stormwater management methods at the base of the oxide and waste dump and provide advice for improving these methods, if required; and
- Undertake a preliminary assessment of the site of a new WSD.

Inspection of WSD site and TSFs was also undertaken to input to the tails strategy and as part of the design process for re-use and construction. Further engineering inspections of plant site and ancillary infrastructure are planned prior to re-commencement of mining.

10.3.1 PROPOSED AND RENOVATED INFRASTRUCTURE

Primary Gold has approached the TGU Project as an incremental operation on the existing Toms Gully site.

The key new item of infrastructure to be constructed by Primary Gold is the new WSD. Investigations for the WSD have included considerations about location (in relation to the proposed underground workings and fault structures, and in relation to its potential suitability as a long term asset for the pastoralist), the availability of construction materials, "footprint" impacts of the structure, its potential impacts on stream flow and the conceptual design of the structure. The conceptual design process for the WSD included these considerations. The conceptual design has been completed for the WSD located as proposed in this EIS (on the small tributary to Mount Bundey Creek, known as West Creek). The design is for an embankment height that would provide for 2.1 GL of water storage (L&MGSPL 2015) with a spillway to enable overflow in peak flood events.

The other most significant construction required for the TGU Project is the embankment raise for TSF2. Whilst TSF1 and the evaporation ponds were both considered as potential locations for tailings storage, TSF2 has been selected as the most suitable location.

The detailed design of both the WSD and the embankment raise of TSF2 will be according to the following Guidelines, Codes of Practice and Standards:

- Australian National Committee on Large Dams document: 'Guidelines on Tailings Dams - Planning, Design, Construction, Operation and Closure' (ANCOLD 2012);
- Department of Mines and Petroleum Western Australia, 'Code of Practice, Tailings Storage Facilities in Western Australia' (2013); and
- AS 1726-1993 SAA Geotechnical Site Investigations.

The conceptual design for the TSF2 is as shown in Figure 8 and Figure 9 for the WSD embankment raise.

Geotechnical investigation of the WSD has been conducted, including test pitting, logging, sampling of representative materials and laboratory testing of some selected samples. The investigation and testing regime included routine materials classification and strength testing to ascertain the engineering parameters for detailed design and included:

- Particle size distribution and hydrometer;
- Plasticity index tests - Atterberg Limits tests;
- Emerson Class Number Tests, or alternatively Pinhole Dispersion Test;
- Standard or modified compaction tests; and
- Consolidated undrained and unconsolidated undrained triaxial tests.

The results from the geotechnical investigations and testing are essential for the detailed design consideration of seepage and stability analyses for embankment design. The materials have been seen to be suitable for the embankment construction works for both the WSD and TSF2 (L&MGSPL 2015).

10.3.2 EXISTING INFRASTRUCTURE

The EIS considers the risks of the TGU Project in the light of the existing site infrastructure and environmental issues.

The existing site infrastructure that has no need to be modified or used by the TGU Project includes:

- Two WRDs (WRD1 and WRD2) (also known as the OWRD and SWRD respectively);
- Two evaporation ponds known as EP1 and EP2;
- TSF1;
- Wetland area (used as passive treatment for runoff from the OWRD) known as Oxbow Wetlands; and
- The existing pit.

Components of the existing infrastructure that will be renovated and/or reused:

- Roads and tracks including the pit ramp and underground portal (renovated as required);
- Underground workings (renovated as required and expanded);
- Ancillary infrastructure including power lines, pipes, bores, piezometers and drains;
- Plant processing area (renovated);
- TSF2 (renovated); and
- Lake Bazzamundi (used for re-directed clean water).

A geotechnical assessment of the existing tailings structures and waste dumps at Toms Gully has been completed (Douglas Partners 2015 & Appendix 10). The assessment focused on TSF1, TSF2, OWRD and SWRD. The assessment determined the following:

- TSF1 was constructed in 1988 and was used until 1991. The southern (main) embankment was noted to be stable;
- TSF2 was constructed in 1994 for placement of re-treated tailings and was used for a total of 12 months over 1995 and then 1999-2000. The embankments were reported to be stable;
- The OWRD did not have any indicators of potential slope stability issues but had some minor erosion and drainage problems. OWRD is vegetated and showed signs of salt staining around the base in one location;
- SWRD showed more resilient materials at the surface and had established patchy vegetation, including some large trees. SWRD was reported to be very stable; and
- The processing area had minor erosion but remedial works to improve surface drainage were reported to have been carried out.

Primary Gold completed flood risk modelling that has indicated that the existing TSF2 embankments are within the predicted 1:100 year flood zone for Mount Bundey Creek (GHD 2015f). The flood modelling indicated that the existing TSF2 embankment would overtop in a 1:100 year flood event.

10.4 MITIGATION MEASURES

Mitigation for the risks associated with the integrity and stability of infrastructure consists of a series of measures that are routinely utilised by the mining and construction industries.

10.4.1 PROPOSED AND RENOVATED INFRASTRUCTURE

Roads and tracks will be renovated to be fit for purpose, with safety bunds, drainage, signage all reviewed and upgraded as required. On-site road and traffic risks will be managed as a safety issue and have been considered in the risk assessment (Appendix 7). Additional controls will include education and training (including records of same), qualifications and competency assessment, vehicle inspections and maintenance, radio and communications requirements and regular reporting.

Renovations to the processing plant area will be completed to ensure it is fit for purpose with all infrastructure being subject to engineering inspection prior to and post-renovation.

The existing evaporation ponds are fit for continued storage of water and will continue to be regularly inspected. The water currently residing within the ponds will be treated along with the pit water to provide additional water storage in the ponds.

To provide protection against engineering design risks, Primary Gold commits to completing the TSF2 and WSD detailed design and construction to be consistent with the:

- Guidelines on Tailings Dams - Planning, Design, Construction, Operation and Closure (ANCOLD 2012);

- Code of Practice, Tailings Storage Facilities in Western Australia (Department of Mines and Petroleum 2013); and
- AS 1726-1993 SAA Geotechnical Site Investigations.

Additional mitigation measures will be defined by the detailed design and the accompanying operating manual for TSF2. This will include industry standard measures including:

- Identification of freeboard requirements to enable retention of a 1:100 year 72 hour rainfall event at all times;
- Monitoring of pond size;
- Spill prevention and containment measures including bunding, inspections and reporting;
- Embankment integrity monitoring including inspections, annual audits;
- Use of a GCL to limit seepage of tailings slurry water;
- Additional groundwater monitoring around TSF2;
- Continued surface water monitoring around TSF2; and
- Commitment to a detailed closure plan including cover specifications for TSF2 should sufficient suitable cover materials be identified.

10.4.2 EXISTING INFRASTRUCTURE

10.4.2.1 TSF2

As the TSF2 embankments are located within the 1:100 year flood zone for Mount Bundey Creek, the proposed raising of the embankment will provide additional protection against inundation of the tailings by floodwater. At completion, the embankment height will ensure that a 1:100 year flood event would not inundate the tailings.

The location also necessitates the inclusion of flood protection in the design and this has been incorporated at the conceptual design in the form of rip-rap rock armouring of the exposed embankments (Figure 8).

10.4.2.2 WRDs

The OWRD and SWRD are seen to contain PAF waste rock that represents an ongoing risk to surface and groundwater. The TGU Project will not result in any changes to the construction, structural integrity or rehabilitation status of the OWRD or SWRD. Both are reported to be geotechnically stable and largely free of erosion. The TGU Project will result in temporary dewatering of any water retained within and beneath the dumps and thus assist in preventing the wider migration of contaminated groundwater.

As part of the ongoing investigations to plan for the remediation of both the SWRD and OWRD, the risk of ongoing contamination will be mitigated by:

- Conduct an investigation into water management for the WRDs that assesses the potential for water to enter the structure, the quality of runoff and seepage water, the locations for seepage exit and options for capture; and

- Review the options for long term remediation of the WRDs.

10.4.2.3 EVAPORATION PONDS

Water from TSF1 and EP1 and EP2 has been pumped to the pit due to the poor water quality seen in these storages. Water in EP1 and EP2 includes runoff contributions from SWRD and historically, pumped contributions from TSF1. The quality of the runoff water from SWRD is not known, but inspection has not revealed any significant salt staining at the toe that would suggest ARD. However, bore G8, located midway along the west facing outer slope of TSF2, is noted to be displaying low pH (AGE, 2015) and the quality of water in EP1 and EP2 suggests that mine affected seepage and runoff water is being collected by the ponds.

10.4.2.4 TSF1

TSF1 tailings represent an ongoing risk to both surface and groundwater quality. Primary Gold plans to ensure the risks associated with the tailings stored in TSF1 are minimised by.

- Capping or removal of the tails from TSF1 such that they are placed in the bottom of the pit (potentially via re-processing), or capped and rehabilitated *in-situ* should sufficient suitable materials be located and a detailed closure plan for TSF1 approved; and
- Rehabilitation of the TSF1 footprint with materials suitable to ensure revegetation and the capacity to resume pastoral land use on the site.

The above steps significantly reduce the risks associated with TSF1 tailings.

10.4.2.5 OXBOW WETLAND

The Oxbow Wetland area (used as passive treatment for runoff from OWRD) is seen as an asset and will be retained for ongoing use. The existing monitoring sites for surface water will be retained and continue to be monitored.

10.4.2.6 PIT

The existing pit will be retained and used as a low oxygen storage location for any PAF waste rock unable to be retained underground and potentially for PAF tailings from TSF1. The existing pit is seen as an asset as a location to retain any potential contaminants. In order for this to be effective, the water level in the pit must be maintained at levels below the surrounding aquifers such that the pit is a groundwater sink. This approach is consistent with industry best environmental practice for the long term storage of acid production tailings.

10.5 RESIDUAL RISKS AND CONTINGENCY

Infrastructure of the scale or WSDs and TSFs generally has significant consequences of failure. Failure of engineered structures such as dam walls may lead to incidents with consequences of fatality to people, as well as environmental impacts. Because of these significant consequences,

industry has developed routine approaches to design, construction, management and monitoring of these structures to minimise the risks of failure. The residual risks for these structures can sometimes continue to be high even with the application of controls.

The risk register (Appendix 7) shows that the risks associated with the infrastructure failure have severe consequences and without the application of controls are considered Extreme. With the application of the planned mitigation measures, the residual risks for these features are reduced to High or less. Many of these mitigation measures use monitoring to ensure that the inherent risks are being adequately controlled and are summarised in Table 46 below.

10.6 MONITORING AND REPORTING

Monitoring systems for infrastructure integrity are well established for the key types of infrastructure that represent risks to the environment. The monitoring approach proposed by Primary Gold are summarised in Table 46 below.

Table 46: Proposed Infrastructure Monitoring and Reporting Programme

Infrastructure	Risk	Monitoring
New/Renovated/Used		
TSF2	Wall failure	Piezometers in embankments. Annual geotechnical audit reported to DME.
	Overtopping	Operating manual defines monitoring of freeboard and identifies embankment raise triggers. Water balance model updated and reported annually via WMP. Decant pond monitoring and reporting.
Tailings pipelines	Pipe failure	Daily inspections. Telemetry based pipe flow monitoring.
Process plant	Tank failure (including process, cyanide, caustic)	Annual inspection. Wall thickness monitoring. Auditing (bunding condition and sump capacity).
Power lines	Faults Pole collapse	Initial inspection.
Pit	Wall failure	Geotechnical monitoring and reporting.
Underground	Structural failure	Geotechnical monitoring and reporting.
	Flooding	Water balance model updated and reported annually via WMP.
	Ventilation	Audit and inspection regime with internal reporting.
WSD	Wall failure	Piezometers in embankments. Annual geotechnical audit reported to DME.
	Overtopping	Water balance model updated and reported annually via WMP. Evaporation pond monitoring and reporting.
Existing/Unused		
WRDs	Slope failure	Annual geotechnical Audit reported to DME.
	Erosion	Annual geotechnical Audit reported to DME.
	Drainage control	Annual geotechnical Audit reported to DME. Annual submission of WMP.
TSF1	Wall failure	Piezometers in embankments. Annual geotechnical audit reported to DME.
	Overtopping	Operating manual defines monitoring of freeboard and identifies embankment raise triggers. Water balance model updated and reported annually via WMP. Decant pond monitoring and reporting.
Evaporation ponds	Wall failure	Annual geotechnical audit reported to DME.

10.7 OUTCOMES

The TGU Project has been designed to minimise the need for additional infrastructure and the risks associated with re-using existing infrastructure. The development strategy for the TGU Project sees only new underground workings, a new WSD, TSF2 being utilised, and renovation and re-use of the process plant and ancillary equipment. The designs, construction methods and available materials for proposed and renovated infrastructure have been investigated and will be sufficient to ensure infrastructure integrity and protection of the environment.

The existing WRDs will not be disturbed by the TGU Project, eliminating the risk of increasing the spread of any existing environmental impacts. Dewatering the pit will reduce the risk of spread of contaminated water from existing seepage. The geotechnical stability of the WRDs has been examined and found to be acceptable, with some minor erosion to be addressed, and upgraded toe drains to capture runoff and seepage water (Douglas Partners 2015). A review of the WRDs will be completed during the operation of TGU and be used to determine the feasibility of improvement options for these features.

The above actions address the environmental risks for both the short and very long-term.

The environmental objective identified in the ToR (NT EPA 2015b) for infrastructure integrity and suitability is that designs, construction methods and available materials for proposed and existing infrastructure will be sufficient to ensure infrastructure integrity, and protection of the environment for the short and very long-term. Based on the information reviewed above, the ToR objective is able to be met.

11 HUMAN HEALTH AND SAFETY

11.1 OBJECTIVES

The following environmental objective was identified in the ToR (EPA 2015) for human health and safety risk:

- Ensure protection of human health and safety from Project-generated impacts, now and in the future.

11.2 IDENTIFIED RISKS

The ToR identified the following health and safety risks:

- Materials storage, and transport of materials and personnel on public roads, including interaction of TGU Project traffic with tourist traffic and other road users on the Arnhem Highway;
- Fire, including combustible materials;
- TGU Project impacts on downstream ecosystems including fish caught for human consumption;
- TGU Project impacts on downstream potable water supplies;
- Underground mine collapse or flooding;
- Hazardous materials exposure and proposed management of hazardous process inputs and outputs such as cyanide; and
- Other direct and indirect health and safety risks for the workforce and the general public.

The ToR also required an assessment of worker or public inhalation of mists from evaporative fans. The use of fans to evaporate excess water will only be considered as a contingency measure and after a full health and safety risk assessment is completed, and the activity approved by DME. The revised site configuration and water balance work indicates that the site water management will not require the use of fans to evaporate excess water, but they may be retained as a contingency measure.

The following additional key health and safety risks were identified from the health and safety risk assessment. These risks have been assessed and are presented together with proposed mitigation measures in Section 11.4.

- Injury/mortality via vehicle accidents;
- Injury/mortality via plant and equipment;
- Injury/mortality as a result of fire;
- Impacts on human health via downstream ecosystems and water supply;
- Accidents from storage, transport and use of hazardous materials on-site;
- Injury/mortality as a result of a fall from height;
- Injury as a result of manual handling;
- Health issues from excessive dust and noise levels;

- Injury/mortality from explosive incidents;
- Injury/mortality from extreme weather events;
- Injury/mortality from electrical incidents; and
- Incidents/mortality from structural failure of embankments.

11.3 CONTEXT

Management of health and safety risks remains a priority for the Mining Industry (Minerals Council of Australia (MCA) 2014). Primary Gold subscribes to the philosophy:

- All fatalities, injuries and diseases are preventable;
- No task is so important it cannot be done safely;
- All Hazards can be identified and their risks managed; and
- Everyone has a personal responsibility for the safety and health of themselves and their workmates.

Primary Gold has developed a Health and Safety Management System (H&S MS) to provide management with clear direction on health and safety management, to ensure compliance and provide the basis for driving improvements (Bendan Australia Pty Ltd 2015a). All Primary Gold mine employees and contractors are expected to comply with all requirements of the H&S MS.

Primary Gold has also developed a Health and Safety Risk Management Plan (Bendan Australia Pty Ltd 2015b) for the TGU Project with the objective to demonstrate statutory compliance, demonstrate a risk based approach to all stakeholders, and to assist with ensuring the health and safety of employees, contractors, and other parties impacted by Primary Gold Operations.

A health and safety risk assessment was undertaken as part of the Health and Safety Risk Management Plan (Bendan Australia Pty Ltd 2015b) using a group of suitably qualified and experienced individuals to systematically identify all Hazards/ risks/ threats to the safety and health of employees, contractors and visitors in the workplace, rank those risks to determine the priority for any mitigation actions and then determine suitable mitigation and monitoring control measures. The risk assessment process generally followed the principles outlined within ISO 31000 and recommendations of the Australian Standard on Risk Management AS/NZS 4360 using a qualitative model.

In addition to the requirements of the NT EPA to address human health and safety in this EIS, NT Worksafe and DME have responsibility for safety in the workplace and will have their own requirements for risk assessment, approvals and reporting. Certified copies of the H&S MS (Bendan Australia Pty Ltd 2015a) and the Health and Safety Risk Management Plan (Bendan Australia Pty Ltd 2015b) have been submitted to NT Worksafe. Receipts of these have been acknowledged by Worksafe.

11.4 MITIGATION

The following Sections identify the mitigation measures to be implemented to ensure that the EPA objective outlined in Section 11.1 can be met.

11.4.1 VEHICLE ACCIDENTS

To minimise the potential for vehicle collisions on the Arnhem Highway, Primary Gold proposes to provide a bus service for the transfer of employees to and from work. Provision of this bus service will reduce the number of vehicles on the road thereby reducing the potential for vehicle collisions.

Primary Gold will ensure that the dedicated bus driver is a competent driver with the necessary driving permits in place. The use of a dedicated competent driver will reduce such issues as driver fatigue, speeding and other related road safety concerns. Primary Gold will ensure that the bus is kept in good condition and serviced on a regular basis.

There is also the potential for vehicle collisions to occur within the TGU Project site during the day to day running of the mine. Management measures to minimise such vehicle accidents include:

- Drivers shall have the required permits/licences in place;
- Drivers shall be aware of and comply with the TGU Project Traffic Management Plan;
- Speed limits shall be applied and enforced within the TGU Project site;
- Vehicles shall have communication radios installed; and
- Pedestrian areas shall be demarcated.

No additional transport infrastructure is required. Road signage shall be installed on the northern and southern approaches of Arnhem Highway warning of the mine entrance and the potential for entering and exiting vehicles. This signage shall be in accordance with Austroad requirements and to the satisfaction of the Department of Transport (NT). Signage shall be installed along the site entrance road warning of the upcoming intersection with the Arnhem Highway. A stop sign shall also be installed on the entrance road at the intersection point. Vehicle speed limits shall be set and signposted within the TGU Project site.

11.4.2 PLANT AND EQUIPMENT

Use of plant and equipment on-site has the potential to result in injury or death. The following mitigation measures shall be implemented to manage risks associated with plant and equipment:

- Use of plant and equipment shall require competency based training delivered and assessed by a trained and certified person;
- The induction process shall include specific Hazard awareness training regarding plant and equipment both on and off-site;
- Plant and equipment shall be maintained through a robust maintenance regime by competent and appropriately experienced personnel;
- An equipment specification for each type of equipment shall define the risk controls necessary to ensure the safe operation of equipment; and
- Personnel shall wear high visibility clothing and maintain direct radio contact when working alongside or within heavy plant.

11.4.3 FIRE

Fires within the TGU Project site have the potential to cause loss of lives. Fires can be generated externally from bush fires, or internally from mining activities (e.g. mobile equipment fire, fixed infrastructure fire, chemical fire, and tyre fire). The following (typical) fire mitigation measures will be implemented for the TGU Project:

- All underground mobile mining equipment shall be fitted with fire suppression;
- An equipment specification for each type of equipment shall define the risk controls necessary to ensure the safe operation of equipment;
- Equipment shall be maintained through a robust maintenance regime by competent and appropriately experienced personnel;
- Fire extinguishers shall be placed on all mobile equipment and at strategic locations in and around all fixed infrastructure;
- Fire detection systems shall be used in all offices and on underground mobile equipment;
- Refuge chambers shall be installed underground;
- All personnel who are underground shall be inducted, appropriately trained and use a self-rescuer; and
- Equipment fire risk, mitigation and contingency actions shall be included in all operator training.

Further information on fire management and mitigation is provided in Section 14.1 and the TGU Project EMP (Appendix 2).

11.4.4 DOWNSTREAM ECOSYSTEMS

The risk of impacts on human health via downstream ecosystems (including potential use for third party water supply) could occur in the event that water quality in Mount Bundey or Coulter Creek is impacted by mining operations from the TGU Project. The risk of adverse changes to water quality from mining operations is already evident from the existing water quality on-site at Toms Gully. Without risk mitigation measures, uncontrolled drainage water has the potential to significantly impact on downstream water quality.

GHD (2015a) completed a downstream survey of aquatic ecosystems. Fauna in aquatic ecosystems, and particular filter feeding aquatic fauna such as mussels, are likely to be most sensitive to changes in water quality. Biomonitoring of selected downstream aquatic fauna is an accepted means of monitoring for potential impacts. The key findings of the GHD (2015a) review of water quality in the Mount Bundey and Coulter Creeks included:

- Some sites featured low pH. The location of those sites in relation to existing mine infrastructure suggests a possible impact of those on pH in receiving waters, though local factors (including groundwater influence) cannot be ruled out.;
- There was widespread instances of low DO content;
- Turbidity levels were low and generally within or only slightly exceeding the SSTV for turbidity;
- The level of freshwater fish diversity recorded aligned with that expected;

- The majority of macroinvertebrate taxa recorded were high to moderately pollution-tolerant taxa; and
- A number of aquatic fauna species that are likely to be more sensitive to the potential impacts of activities associated with the TGU Project were identified. It is recommended that these species be monitored to determine any potential TGU Project impacts.

Based on the observations above, the TGU Project needs to particularly avoid impacts on water quality associated with low pH, i.e. leachates from WRDs and pits seeping into creek and/or low pH releases and turbid water. It also needs to consider managing releases such that the operation does not contribute to reduced DO levels (i.e. impacting on environmental flows and release of hypoxic water) (GHD 2015a).

The development strategy for the TGU Project incorporates the new WSD as a key means of ensuring that water discharge is able to be carefully managed to meet water quality objectives. Quality in the WSD will be well understood and will form the basis of the water discharge strategy and water discharge licence application.

Additional mitigation measures proposed to achieve protection of downstream ecosystems and potential third party use of water include:

- Engineering standards for infrastructure construction;
- Implementing water treatment and discharge strategies as outlined in the WMP;
- Water quality and biomonitoring of Mount Bundey and Coulter Creeks as specified in WMP and BMP;
- Mitigation measures for controlling the potential sources of AMD as proposed in the AMD Management Plan;
- Reporting; and
- Communication with downstream stakeholders.

These strategies are expected to ensure adequate management of any outputs from the operating phase of the TGU Project such that downstream water quality is protected.

The TGU Project provides the opportunity to minimise the risk of downstream impacts from tailings by placing them in the pit at the end of mine life, or rehabilitating them *in-situ* with an approved mine closure design that includes a specified engineered cap to prevent AMD. The TGU Project will also provide the opportunity to gather data and model in detail the potential contaminant sources and transport pathways for the site. This will include consideration of long-term closure options to minimise the risk of offsite impacts from the WRDs.

Further information on mitigation is provided in Section 8.4.3.

11.4.5 MINE COLLAPSE AND FLOODING

The TGU Project involves underground mining. The collapse of mine infrastructure has the potential to result in the loss of human lives. To minimise the potential for mine collapse, the following measures will be implemented:

- All designs for underground openings and dam walls shall include geotechnical input and sign off;

- When working underground, no person shall be permitted to work under unsupported ground;
- Slope management plans shall be developed for any active surface mining activity where wall failure is identified as a high or extreme risk;
- The ground control management plan shall include the necessary requirements to mitigate ground failure risks; and
- Mine pumping capacity shall include contingency volume and also include backup diesel pumps to mitigate power loss.

11.4.6 HAZARDOUS MATERIALS EXPOSURE

Mitigation measures to minimise the risk of exposure to hazardous materials are presented below. A key strategy for minimising risks of exposure to hazardous materials is controlling what is allowed on-site and the means of storage on-site as well as appropriate training and inductions for site personnel. The TGU Project induction shall include an outline of the risks and mitigation measures associated with hazardous material storage and exposure. Selected personnel shall be trained in the clean-up of hazardous material spills.

11.4.6.1 INTRODUCTION OF A NEW CHEMICAL ON-SITE

As identified in the Hazardous Materials Management Plan, a series of questions are to be asked before bringing any new products on-site, including:

1. Is the new product necessary?
2. Can the task be achieved without the use of a chemical?
3. Can we use an existing chemical that is already approved for use on site?

If the new product is to replace an existing one:

- Will the existing product be used up or disposed of?
- If to be disposed of, disposal should be in accordance with regulatory requirements and site procedures.

H&S and Environmental management will support line management with assistance to identify and evaluate alternate products. Should the new chemical be required (at TGU Project commencement all hazardous materials will be treated as new products), a request form is to be completed for approval by the relevant Coordinator. If the product is classified as hazardous, Dangerous, or is one of its ingredients or is suspected of being carcinogenic, teratogenic / mutagenic (reproductive toxicants), a Hazardous Substance Risk Assessment (see Senior H&S Adviser) must accompany this application.

The coordinator and the environmental professional will assess the product(s) by, but not limited to, the following criteria:

1. Can we safely dispose of the product?
2. Do we have the means to control a spill?
3. Do we have the means to control a fire involving the product?
4. Do we have the necessary Personal Protective Equipment (PPE) to safely use the product?

5. If the product affects a person, do we have the medical facilities to manage the situation?
6. Can we safely store the product?
7. Can we safely transport the product?
8. Does the product contain any known and suspected carcinogens (cancer causing agents), reproductive toxicants, or other ingredients hazardous to health (e.g. lead)?
9. What will its effect on the environment be?

Further details can be found in the Hazardous Materials Management Plan (Appendix 3).

11.4.6.2 HAZARDOUS MATERIALS STORAGE

Storage of hazardous materials shall also be in accordance with the following requirements:

- Stored in a secure, limited access area until disposal;
- Storage as per MSDS recommendations;
- Storage areas and bunding constructed as per Australian Standard AS1940;
- Incompatible hazardous materials not stored together;
- Appropriate first aid equipment made available; and
- Storage practices and physical arrangements shall be regularly audited.

The use, handling and transport of these hazardous materials shall meet the following requirements:

- Transport and use of hazardous materials in accordance with relevant regulations, and directions given on the MSDS for the substance;
- Suitable signage used during transport;
- Decanting and labelling carried out in accordance with the National Code of Practice for the Labelling of Workplace Substances NOHSC (1994); and
- Containers used for decanting hazardous materials as per the MSDS requirements of the substance and all containers labelled appropriately.

Hazardous materials that are no longer required on-site shall be stored in the salvage yard until disposal. The substance shall be suitably packaged, include a sealed copy of the MSDS with each container and returned/disposed of at an appropriately licensed facility.

11.4.6.3 HAZARDOUS MATERIALS SPILLAGE

In the event of a Hazardous materials spillage, the MSDS shall be consulted for spill procedures. Where the MSDS indicates requirement for containment and clean, the following steps shall be undertaken:

1. Stop the source and spread of the spill if safe to do so:
    a. Check for danger;
    b. Prevent the spill from getting larger (turn off valves, block damaged tanks or pipes); and
    c. Use any suitable material or equipment to confine the spill by “damming it off” (e.g. use available spill response equipment such as booms or absorbent or if unavailable then use soil or other suitable material).

2. Clean up the spill:
    a. Once the spill has been contained, retrieve as much of the spilled liquid as possible and place in an appropriate container (e.g. 20L drum or 1000L pod). The liquid should then be either reused or disposed of;
    b. Absorb remaining spill with absorbent material and place used absorbent in the appropriate waste bin;
    c. Treat areas of contaminated soil; and
    d. Where applicable, replenish equipment used from Spill Response Kit.
3. Report the spill:
    a. Report and investigate all spills in accordance with the TGU Project Incident Management System.

If the spill threatens the safety or health of people or creates a fire Hazard then the site emergency procedure for hazardous substance release as described in the TGU Project Emergency and Crisis Management Plan (ECMP) (Appendix 13) shall be implemented. The TGU Project ECMP contains site emergency procedures for the following:

- Bulk LPG Storage Incident;
- Reagent Truck Accident;
- Explosives Truck Accident; and
- Surface Magazine Fire/Explosion.

All employees and contractors shall be made aware of the hazardous materials stored on site, including details of their location, quantities and procedures in the event of an incident.

11.4.7 FALLS FROM HEIGHT

TGU Project operations will occasionally involve working from heights. Mitigation measures to manage falls from height include:

- All works to be undertaken at height shall require either a documented work procedure or a Job Hazard Analysis prior to commencement;
- A "Take 5" shall be used immediately prior to the task;
- Risk assessments shall apply the hierarchy of avoiding working at heights where other safer options can be implemented;
- Fall prevention shall be used to prevent personnel from falling from height if reasonably practicable;
- Where fall prevention cannot be used then fall arrest shall be used through PPE;
- Any person using fall prevention or fall arrest harness shall be trained in the use of the equipment.

11.5 RESIDUAL RISKS AND CONTINGENCY

The risk assessment process, together with the EIS ToR identified risks to health and safety and enabled the development of a series of mitigation measures to manage those risks. Figure 31 illustrates the reduction in risk ratings from inherent risk to residual risk following implementation of the proposed mitigation measures. Of the 61 identified health and safety risks in the TGU Project Risk Register (Appendix 7), 45 were found to be of extreme inherent

risk with 16 identified as high level risks. The application of the proposed mitigation measures sees the risk ratings reduced to zero extreme risks and 29 high level risks, with 23 rated as moderate and 9 as low. This highlights the importance of the mitigation measures to manage risks adequately.

Contingency for management of health and safety risks is identified in the following section.

11.5.1 EMERGENCY MANAGEMENT

Notwithstanding the measures in place to manage Risk, should an emergency situation occur, Primary Gold has prepared an ECMP (Primary Gold 2015g – Appendix 13) that applies to all operations including exploration, mining, processing and administration. All TGU Project team members and contractor team members are required to comply with the requirements of the ECMP (Appendix 13). Selected personnel will be trained in emergency response procedures. On-site capability to respond to emergencies will include housing an ambulance and ensuring access to paramedic capability.

Emergency incidents that require a response from the TGU Project management could occur on or off-site and may involve TGU Project team members, contractor team members or even members of the public. The ECMP:

- Identifies the Hazards that might cause an emergency;
- Assesses the risk of an emergency occurring; and
- Includes means for dealing with such emergencies.

An analysis to determine the types of probable on and off-site incidents that could occur at the TGU Project site was undertaken as part of the Emergency and Crisis Management Plan. This included:

- A review of TGU Project risk assessments to identify potential emergency response requirements; and
- A qualitative risk assessment to identify and assess probable “high risk” incidents that might require formal emergency response.

The ECMP covers:

- The main “threats” associated with the incident;
- How the incident may be notified (aside from emergency telephone/ radio call);
- Alarms or methods to alert persons of an emergency;
- The management response required (i.e. who should be notified, what action should be taken);
- Any special instructions; and
- Possible contacts for specialist advice.

Measures are identified in the ECMP to manage a broad range of potential emergency and crisis situations that include on-site and off-site, natural disasters and underground accidents.

11.6 MONITORING AND REPORTING

Consistent with the principles of continuous improvement, the identified health and safety risks are part of the TGU Project Risk Register. The Risk Register will be initially reviewed by the on-site operations team (when appointed) and then regularly reviewed during operations. Commensurate updates of management plans will be required depending upon the outcome of the reviews. The overall responsibility for risk management will reside with the General Manager Operations and be incorporated into day to day management of the operation.

All health and safety incidents and near misses (that have a serious potential consequence) shall be investigated. Actions shall be developed from the incident investigation and the incident report shall include a clear description of the specific action, have a person assigned to implement the action and have a specific completion date. Incident investigations shall also look to identify opportunities to prevent a reoccurrence, and incidents recorded will be monitored to identify any potential trends.

In the case of emergency management, regular drills shall be conducted to measure the effectiveness of Primary Gold emergency preparedness and the Emergency and Crisis Management Plan. Evacuation drills shall be conducted in each areas on an annual basis. Emergency Management and Recovery drills shall also be conducted on an annual basis and involve all key personnel.

Internal reporting of safety and health management shall occur at a range of levels, from shift change meetings, though weekly management meetings, monthly and annual reporting. Reporting to regulatory agencies will be completed according regulatory requirements.

11.7 OUTCOMES

Management of health and safety in mining is administered by NT DME and NT Worksafe. Primary Gold will liaise with both of these agencies regarding the management of safety on-site.

The TGU Project has completed planning and development of a H&S MS and a Health and Safety Management Plan for management of health and safety risks both on and off-site. The risk register and management plans will require revision following detailed design of the TGU Project infrastructure, inspection of the existing infrastructure to determine specific upgrade requirements, and again following completion of construction. The implementation of the management plans and mitigation measures is expected to significantly reduce risks to health and safety and enable the EPA objective of protecting human health and safety from project generated impacts to be met.

12 SOCIAL AND ECONOMIC ENVIRONMENT

The ToR requires an ESIS to be undertaken for the TGU Project in accordance with the NT EPA G*uidelines for the Preparation of an Economic and Social Impact Assessment* (NT EPA 2014a). To meet this requirement, an ESIS was undertaken by Mr Trevor Bradley (Bradley 2015) to provide an independent assessment of the potential positive and negative economic and social impacts that may occur within the regional and local area in response to the TGU Project.

The ESIS has been used to compile this Section of the EIS. A copy of the ESIS is provided in Appendix 8.

12.1 ENVIRONMENTAL OBJECTIVES

The following environmental objective is identified in the ToR (EPA 2015) for socio-economic risk:

- To analyse, monitor and manage the TGU Project's intended and unintended social and economic consequences, both positive and negative, such that outcomes are optimised.

The objectives of the NT EPA Guidelines for the Preparation of an Economic and Social Impact Assessment (NT EPA 2014a) are:

- To document the economic and social impacts of a proposed development on the locality and region;
- To mitigate negative economic and social impacts on the locality and region;
- To encourage development of new and/or expansion of existing businesses in the locality; and
- To foster sustainable development and community wellbeing.

12.2 IDENTIFIED OPPORTUNITIES AND RISKS

The identified opportunities and risks have been assessed and are presented together with mitigations (where appropriate) in Section 12.4. They have been separated into economic and social. Necessarily, the risks identified include safety and health risks relevant to the general public.

12.2.1 ECONOMIC OPPORTUNITIES

The economic opportunities presented by the TGU Project are generally local in nature and are consistent with the sound business management of the TGU Project. These comprise of:

- Opportunities for local employment with Primary Gold or local contractors (particularly relevant with other projects in the region completing construction and in the current economic climate);

- The opportunity to use the revenue stream from the TGU Project to extinguish existing environmental liability associated with tailings and to complete investigations and planning for contaminant management associated with the existing waste rock dumps;
- Support for local initiatives and businesses; and
- Provision of tax and royalties to the government.

12.2.2 ECONOMIC RISKS

Economic risks identified include a normal array of financial, technical and safety risks attributable to most mining projects that can impact upon economic viability. The following potential economic risks (some having economic consequences associated with technical causes) have been identified for the TGU Project:

- Decrease in commodity price;
- Changes to exchange rates;
- Increase in fuel price;
- Errors in ore reserve estimation;
- Errors in metallurgical recovery characteristics;
- Adverse ground conditions;
- Adverse climatic conditions;
- Major mechanical failure; and
- Insufficient financial capacity to:
    - Implement the TGU Project, mitigation measures and contingency management measures;
    - Maintain environmental obligations should the TGU Project be temporarily closed or suspended; and
    - Meet all stabilisation, rehabilitation and closure requirements should operations cease.

12.2.3 SOCIAL OPPORTUNITIES

The social opportunities presented by the TGU Project are also generally local in nature and will contribute to the stability of the region and encourage a strengthening of community within the region by:

- Training and skill development for local employees and contractors associated with the TGU Project;
- Social benefits associated with employment; and
- Opportunities for contractors to develop their businesses, skills and workforce requirements through the provision of services to the TGU Project.

12.2.4 SOCIAL RISKS

Social risks associated with the TGU Project include:

- Road safety due to increased traffic and haulage of dangerous goods;
- Reduction in housing availability and increase in house prices;
- Increased demand on existing services;
- Negative impact on community cohesion and inclusion;
- Negative impact on other land users; and
- Negative impact on tourism.

12.3 CONTEXT

Bradley (2015) has reviewed the social and economic aspects of the TGU Project. The following information represents a summary of findings. The ESIS is provided as appendix 8.

The nearest regional population centre to the TGU Project is Humpty Doo (population 8,395) which falls within the Litchfield Statistical Area (SA3) and makes up part of the greater Darwin Statistical Area (SA). The nearest community to the TGU Project is the rural subdivision of Marrakai 17.5 km northwest of the TGU Project area. Marrakai is predominantly comprised of small dwellings occupied mostly by recreational fishers and holiday makers on weekends and during holiday periods. Any direct or indirect economic and social impacts resulting from the development of the proposed TGU Project are likely to be most observable within their statistical areas.

12.3.1 LAND USE

Land use in the region includes agriculture (orchards and pastoral operations) and mining, with historic iron ore mining at Mount Bundey and gold mining at Toms Gully, Quest 29 and Rustlers Roost mines. Granite quarrying is currently conducted by three companies approximately 5 km east of the TGU Project site. It is noted that with the completion of the port facilities for the Inpex Ichthys Gas Field Development, the demand for rock from these quarries is expected to be significantly reduced with commensurate reductions in local jobs and training opportunities.

Conservation reserves exist to the east and northwest of the TGU Project and support the basis for some local tourist attractions. The principle tourist attractions in the region are the Litchfield, Kakadu, Djukbinj and Mary River National Parks with the, Adelaide River and Mary River systems being popular locations for recreational fishing.

The closest tourist destination to the TGU Project site is the Mary River National Park which is popular with recreational fisherman, campers and hikers (Figure 52). The TGU Project site is set well away from the areas predominantly visited by tourists and will not materially impact the holiday and tourist traffic visiting for cultural and aesthetic reasons. It is likely that groups with interests in recreational fishing and other riparian activities will have an interest in the TGU Project. Primary Gold has held discussions with the Amateur Fishers Association of NT and relevant regulatory agencies regarding the TGU Project. These discussions have resulted in concerns being raised about water management and water quality.

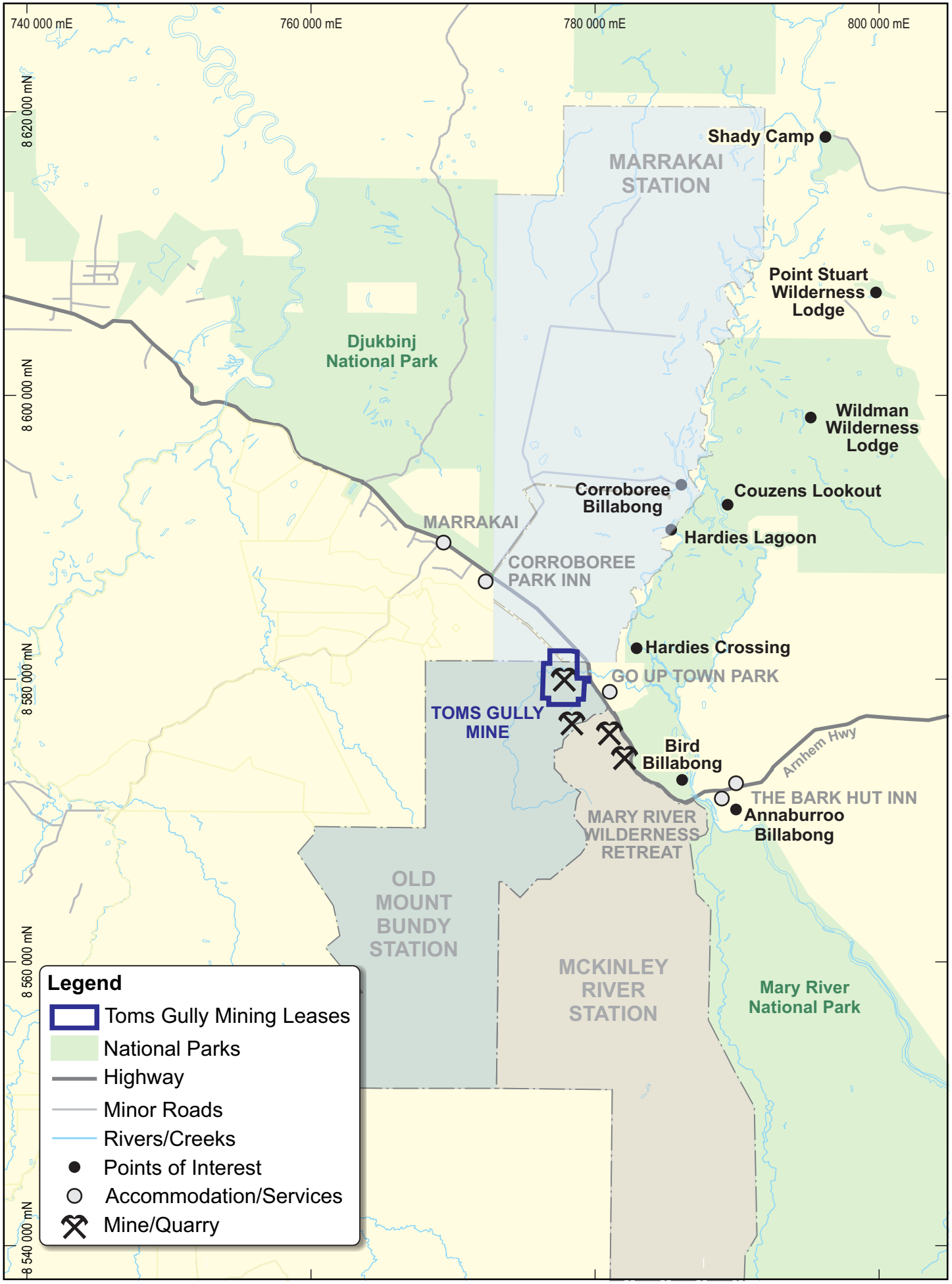


Figure 52: Local National Parks and Sites of Interest

PRIMARY GOLD

10/8/2015

12.3.2 ECONOMICS

The total revenue directly attributable to the TGU Project is estimated to be within a range of AUD$220 M to AUD$225 M. This estimate is based on extracting the currently defined Ore Reserve to produce approximately 144,000 troy ounces of gold.

Current financial modelling indicates that the tax payable over the TGU Project life will be approximately AUD$6.3 M and mineral royalties payable to the NT government will be approximately AUS$11.6 M.

The estimated total capital expenditure for the TGU Project is AUD$24 - AUD$27 M. The expected annual Operational Expenditure (Opex) for the Toms Gully project is presented in Table 47.

Table 47: Project Forecast Opex Costs

LOM Plan	Units	2016	2017	2018	Total
Gold produced (Au)	Ounces (Oz)	52,745	63,726	26,471	144,809*
Cost	AUD$/Au Oz	669.50	884.70	570.40	737.40
Opex	AUD$ Millions	35.3	56.4	15.1	106.8

** Note production schedule 2016 – 2018 equals 142,942 Au Oz an additional 1,867 Au Oz produced during the 4 months of project life not included in this table brings total production to 144,809 Au Oz.*

Primary Gold proposes to use Australian contract service companies and suppliers wherever possible. Assuming 80% of service providers and suppliers will be Australian based, the estimated forecast of the TGU Project contribution to Gross Domestic Product is in the range of $195 M to $207 M. Of this contribution to Gross Domestic Product it is assumed that approximately 80% of the expenditure will contribute to GSP resulting in a forecast contribution to NT GSP of $156 - $162 M over the next three years. This equates to approximately 0.86% of the NT's GSP in 2011-12 which was $18.5 B (NT Government 2013).

12.3.3 EMPLOYMENT

Mining is reported to be the second largest employer in the NT (after the public service) and represents 16% of the Territory's Gross Domestic Product (MCA 2015a). Further details on regional employment are detailed in Bradley (2015).

12.4 MITIGATION

The following mitigation measures have been identified to be implemented to ensure that the EPA's environmental objective can be met.

12.4.1 ECONOMIC RISK MITIGATION

Reduction in commodity prices, exchange rate fluctuations and increase in fuel prices tend to be global and systemic risks for which there are a limited number of diversification strategies which can implemented. The primary risk diversification strategy for these types of risks involves hedging strategies as detailed in Table 48.

Risks such as ore reserve estimation error, changes in the metallurgical recovery characteristics, adverse ground conditions, adverse climatic risks (high rainfall events) and major mechanical failure tend to be partially diversifiable and mitigation strategies have been included in Table 48 to minimise the likelihood or potential consequences of such risks.

To minimise the risk associated with insufficient funds being available to fully implement the TGU Project (including closure and rehabilitation costs) all costs associated with the TGU Project have been analysed via a financial model. This model accounts for all costs associated with the TGU Project including implementation, mitigation and contingencies and is kept up-to-date to reflect any changes to the TGU Project (for example Resources/Reserves or implementation strategy as determined in the assessment process) or to reflect changes to the operating environment (such as gold price, interest rates or wages). The TGU Project provides an opportunity to reduce the already existing risk of insufficient financial resources to cover the environmental liabilities of the existing Toms Gully site by enabling a revenue stream to fund the rehabilitation of TSF1 and renovation and closure of TSF2.

In the event of temporary closure, Primary Gold has operated the Toms Gully mine site under a Care and Maintenance plan since 2012 and hence fully understands the activities and associated costs of its environmental obligations.

The costs associated with closure including stabilisation and rehabilitation will be addressed as part of ongoing submissions of the Toms Gully MMP. The MMP is required to contain such items as a summary of the closure activities and costs and the progressive rehabilitation that is planned completed.

These closure costs provide the basis for the security bond, which covers 100% of calculated costs plus a 5% contingency and is payable once authorisation is attained and before the commencement of planned mining activities. Primary Gold states that it currently has cash-backed bank guarantees for all security bonds for its NT mine sites, including Toms Gully.

A summary of the mitigation measures proposed to manage the economic risks is provided in Table 48.

Table 48: Economic Risks and Mitigation

Risk	Mitigation Measures
Adverse Change in Au price	Target Opex costs in lower quartile of Australian production costs combined with a forward gold price hedging strategy.
Adverse change in US$ foreign exchange rate	Target Opex costs in lower quartile of Australian production costs consider foreign exchange hedge.
Adverse change in fuel prices	Target Opex costs in lower quartile of Australian production costs consider and review any potential advantages of a diesel fuel price hedging strategy.
Adverse ground stability conditions	Implement a ground monitoring programme that effectively captures changes in ground conditions and stress.
Adverse rainfall event	• Ensure adequate pumping capacity available at all times. • Ensure availability of effective drainage which can be used during high rainfall events. • Install and maintain effective water drainage control bunds around potential water ingress channels.
Adverse change in metallurgical recoveries of ore	Metallurgical recovery testing of exploration samples on an appropriate density to undertake recovery modelling, monitor in production reconciliation studies.
Major mechanical failure (plant)	Ensure appropriate warranties in place and maintain appropriate critical mechanical spares inventory.
Ore Reserve modelling estimation error	Grade control and mapping programmes combined with effective production reconciliation studies both present and historical.
Serious contractual dispute	• Use of Australian Standards for preparation of applicable and appropriate contract conditions. • Conduct appropriate legal and commercial due diligence. • Use only reputable established contract companies with record of successful completion.
Skilled labour shortages	Preferred employer status, slowdown in Australian Mining industry relieving potential labour shortages, and operating in regions where mining is the major industry of employment.

12.5 SOCIAL RISK MITIGATION

12.5.1 WORKFORCE

The TGU Project has the potential to provide a 1.7% boost to employment growth within the region providing employment for up to 104 personnel with peak employment expected to coincide with peak production in year two of the TGU Project.

The influx of employees to an area as a result of a new development has the potential to change the demographics and social status of the area. Given the compatible employment demographics documented by Bradley (2015), Primary Gold will seek to employ locally and provide bus services to transport employees to and from work. As potential employees will be already resident within established communities it is expected that their employment at the TGU Project site will not distort the current prevalent social fabric of the communities in which they currently live and economically interact. The decision to recruit locally from within the area and transport employees to site from residential hubs contributes greatly to minimising the risk for

negative social impact by minimising the chances of pressures on accommodation and services and risks of road accidents arising from the TGU Project.

Additionally, as the TGU Project is consistent with the major industry of employment within the surrounding Alligator River and Humpty Doo areas, any wages that flow from the TGU Project into the area will be consistent with the current income profile of the areas.

The greater Darwin area has a diverse and comparatively large economy. Wages inflow from the proposed small resources project into the large and diversified economy of greater Darwin is unlikely to create any negative distortion to the economic fabric of Darwin or the NT.

12.5.2 ACCOMMODATION AND HOUSING

As there is no plan to establish a residential camp facility at the TGU Project site, there will not be any new demand for housing or services. This approach will assist in minimising the impact on house prices, availability and residential rents attributable to the development of the TGU Project.

If it does prove necessary to recruit from outside the area, then the individuals concerned will be accommodated at currently operating accommodation service premises in the local area. Similarly, if there are occasional overnight visitors to the TGU Project, they will be accommodated in the same manner. The low level of additional demand for food and accommodation services is considered to be well within the region's current capacity. This approach provides a responsible level of positive economic stimulus to the local economy as it creates an opportunity for food and accommodation service providers to increase the utilization of existing services without distorting the current supply and demand balance.

12.5.3 TRAFFIC AND TRANSPORT

The Economic and Social Impact Assessment indicates negligible increase (0.2%-0.3%) to current traffic volumes along the Arnhem Highway. Traffic associated with the TGU Project is characterised according to the stage in mine life:

- Construction phase (6 months): Three trucks and ten light vehicles per day during daylight with peak times 5 am to 10 am and 3 pm to 7 pm;
- Operations: TGU Project traffic flow on and off-site is estimated at an average of five delivery trucks per week, up to six bus trips daily and ten light vehicles daily. Operating during daylight hours with peak times 5 am to 10 am and 3 pm to 7 pm;
- Closure: Daily traffic negligible.

Primary Gold proposes to provide a bus service for the transfer of employees to and from work. Provision of a bus service for employees offers a number of advantages including:

- Provides a mild stimulus for local bus transport service providers;
- Minimises traffic volumes on the road;
- Integrates with current road usage patterns; and
- Directly addresses matters of road safety for employees as it circumvents issues such as driver fatigue, speeding and affiliated road safety concerns.

The TGU Project will cause a small increase in general freight haulage. The Arnhem highway is the major service corridor for the mining projects in the region. The general freight logistics needs of the TGU Project will be similar to and at the smaller end of any other mine projects in the NT. It is envisaged that local general freight logistics companies will compete for contracts to provide services to the TGU Project. Demand for general freight transport arising from the TGU Project will be accommodated by increased utilisation of current services by operators on the Arnhem Highway freight routes. This will minimise the need for additional trucks along the delivery route. Licenced carriers will be used and shall ensure that freight loads are restrained as per current industry best practice.

The safety risk associated with the transport of hazardous goods to site (diesel fuel, cyanide, caustic) will be minimised by ensuring transport of such goods is in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission Australia 2014) and the following mitigation measures:

- Ensure supply of hazardous goods is by recognised and approved suppliers; and
- Ensure transport of Hazards goods is as per directions of the MSDS.

12.5.4 SERVICES

The business development potential arising from the proposed TGU Project is consistent with services that are already available in the region and as such will provide positive stimulus for positive business growth over the next three to four years. It is expected that NT domiciled business will gain more than 80% of the available opportunities. No specific mitigation measures are considered to be required.

12.5.5 TOURISM

The closest tourist destination to the TGU Project site is the Mary River National Park and its environs and nearby facilities which are popular with recreational fisherman, campers and hikers. Given the modest increases in traffic associated with the TGU Project, holiday and tourist traffic visiting the Mary River National Park are not expected to be impacted by the TGU Project. The TGU Project site is located adjacent to the Arnhem Highway. Potential visual impacts are reviewed in Section 14.4. The TGU Project is not expected to have any impact on current cultural, recreational or aesthetic use of the area.

12.5.6 INDIGENOUS

The TGU Project is located within perpetual Pastoral Lease 1163 (Old Mount Bundey Station) and its surface infrastructure is wholly contained within mining lease MLN 1058. The mining tenement was granted prior to January 1, 1994 and as such the tenement is regarded as a “past Act” under the NT Act and subsequently there is no requirement for a Native Title Agreement under the NT Act.

There are no local indigenous communities in the TGU Project area and no aboriginal heritage sites are registered within the TGU Project site. Primary Gold has been in communication with

the NLC and where possible, will continue to seek opportunities for local indigenous employment agencies and work programmes.

12.5.7 SUMMARY

A summary of the mitigation measures proposed to manage the social risks discussed above is provided in Table 49.

Table 49: Social Risks and Mitigation Measures

Risk	Mitigation Measures
Additional highway commuter traffic and associated road safety concerns	Implement bus/coach transport on shift by shift basis to transport employees to work and home
Additional general freight haulage traffic impacts and associated road safety concerns	Engage with general freight haulage companies with established routes on Arnhem Highway and utilise any excess capacity
Negative impact on housing availability and affordability	Recruit locally from within existing labour pool
Negative impact on tourism	As required, lower visual impact of Project site from highway using vegetation placement and good design
Negative impact on NT provided services	Seek commercial terms from NT based providers
Negative impact on community cohesion and inclusion	Where possible, recruit locally from a demographic where mining is already significant proportion of industry of employment
Negative impact on other land users	Operate within existing access agreement.

12.6 RESIDUAL RISKS AND CONTINGENCY

The social and economic risks identified for the TGU Project are presented in Table 48, Table 49 and the TGU Project Risk Register. The inherent risks are characterised as being generally in the Moderate to High categories, with only one being rated as Extreme. The application of mitigation measures reduces the risk profile such that the only High residual risk is that associated with an extreme weather event. For that event there are a number of measures that can reduce the likelihood of the event leading to the consequence of causing such economically significant damage that the TGU Project is no longer viable. All other risks are reduced to Moderate or Low (Figure 32).

Risks associated with rehabilitation and closure are also considered in an economic and social sense. The prevalence of historic mine sites with legacy issues in the NT demonstrates the implications of proponents either not being able to meet commitments, of projects not being soundly planned and of the absence of a regulatory system to prevent and rectify abandoned sites with ongoing environmental legacies (NT EPA 2014c). For the TGU Project, the resumption of underground mining and resultant dewatering, water treatment and tailings upgrades enable the Toms Gully site existing environmental risks to be significantly reduced. The TGU Project is unable to provide certainty as to a long-term improvement to the acid leaching currently

occurring in the WRDs. It will however, provide critical resources and focus to enable investigations to occur and options to be identified and assessed.

The acceptance of that residual risk is essentially a matter for key stakeholders that include the pastoralist, the community and regulators. It should be noted that the realisation of the risk of an extreme event occurring and the resultant impacts can apply to the existing site equally as to the TGU Project. In fact, the limited time period of the TGU Project and the resultant improvements to long-term tailings storage mean that the consequences are likely to be more significant whilst the site is not in production.

Primary Gold will continue to consult with key stakeholders to determine what the preferred method of communication with the community may be. Once the preferred method(s) of communication are established, Primary Gold will then implement an integrated communications strategy based on the preferences. In the interim, communication with the community will be managed through public announcements, press releases and one-on-one meetings where face to face discussions will be held. A web page including an email address will be specifically provided for the purpose of community engagement. A site telephone number will be made available to the public and communications will be managed through these media.

The economic and social impact risks associated with the TGU Project are generally able to be managed through mitigation measures that make good business sense and hence are considered unlikely to require any statutory process to mandate implementation. They are also sometimes of a nature that is not the usual province of regulation (such as gold price and currency hedging).

Primary Gold considers that there is no further requirement to prepare a management plan to deal with economic or social risks as the mitigation measures identified herein are consistent with sound business practices and existing legislation.

12.7 MONITORING

The identified economic and social risks are part of the TGU Project Risk Register. The Risk Register and risk assessment will be initially reviewed by the on-site operations team (when appointed) and then regularly reviewed. The overall responsibility for risk management will reside with the General Manager Operations and be incorporated into day to day management of the operation.

Primary Gold will be required to produce annual reports as part of its obligations as a corporate entity. The annual report will cover many of the mitigation measures identified for the social and economic risks.

Primary Gold will be required to report annually to DME on the implementation of the TGU Project. These annual reports will also enable reporting of any significant changes in social or economic circumstances, or TGU Project implementation that may result in altered risk settings.

12.8 OUTCOMES

The potential economic and social risks associated with the TGU Project have been identified, mitigations considered and impacts assessed. The identified social and economic risks

associated with the TGU Project generally have a low probability of occurrence and furthermore in the unlikely event that they do occur, are likely to have negligible impact on the social and economic fabric of the NT, Alligator SA2 or broader NT (Bradley 2015).

The TGU Project presents economic and social opportunities at a scale that is not problematic for services, existing infrastructure or social fabric. The opportunities present at a time when other local economic activity is slowing. In addition, the TGU Project represents an opportunity to address some of the existing liability associated with the existing Toms Gully site.

The environmental objective identified in the ToR (EPA 2015) for socio-economic risk was to analyse, monitor and manage the TGU Project's intended and unintended social and economic consequences, both positive and negative, such that outcomes are optimised. The TGU Project provides an opportunity to enable a further mining increment to generate local economic opportunities with minimal environmental risk, and creates the opportunity to manage historic and new tailings streams according to international best practice for mine closure such that the ToR objective for this factor is able to be met.

13 REHABILITATION AND CLOSURE

13.1 ENVIRONMENTAL OBJECTIVES

The following environmental objective was identified in the ToR (EPA 2015) for rehabilitation and closure:

- Rehabilitation and closure planning will ensure that:
  - Rehabilitation will achieve a stable and functioning landform, consistent with the surrounding landscape and other environmental values, and will remove potential for long term or post closure impacts on downstream water quality, beneficial uses or environmental values; and
  - Closure and care and maintenance planning will effectively achieve containment of all mine–related environmental contaminants on-site, for the very long term, without need for ongoing management, intervention or expenditure, and allow for post-closure return to agreed land uses on the site.

13.2 IDENTIFIED RISKS

The ToR requires that rehabilitation and closure planning, and contingency planning for periods of care and maintenance, should be completed. Planning is to take into account results of materials characterisation, data on the local environmental and climatic conditions, and consideration of potential impacts through contaminant pathways and environmental receptors. In addition, the ToR requires the EIS should include assessment of risks to successful rehabilitation and closure including:

- The TGU Project not realising its projected outcomes (i.e. delays, unexpected or forced closure, falling gold and prices etc.);
- Inadequate identification and management of materials with AMD/NMD/SD potential;
- Changes in the assumptions used as a basis for the post-closure risk assessment; and
- Natural extreme events, including earthquakes, cyclones, rain depressions, fire and flood.

The ToR also states that the EIS should identify and assess environmental risks associated with a potential short and long term period of care and maintenance of the TGU Project and site. Assessment and planning should consider all potential TGU Project development stages, and plan to fulfil all relevant environmental objectives and obligations.

In addition to the above, the risk assessment completed by Primary Gold identified:

- Pit lake becomes a groundwater source;
- Long term positive water balance and AMD issue for WRDs; and
- Lack of rehabilitation material leads to inadequate tailings closure and poor quality site rehabilitation.

The above risks generally apply to the Toms Gully site in its current status. A number of steps have been taken by Primary Gold in developing the Proposal to avoid and minimise the risks associated with the TGU Project. In some cases, these steps create opportunities for

improvement of rehabilitation and likely closure outcomes for the existing site. The Section below describes in more detail both the risks and opportunities in relation to the TGU Project.

A copy of the TGU Project MCP is provided in Appendix 5.

13.2.1 TGU PROJECT

Toms Gully has existing infrastructure that has been subject to closure and rehabilitation planning and has resulted in a partially rehabilitated site, with residual AMD from WRDs and TSFs, and a pit flooded with poor quality water. The TGU Project is a small underground mining increment designed to:

- Avoid disturbance to existing sources of AMD;
- Avoid spreading contaminated water;
- Provide an opportunity to close and rehabilitate the tailings at the site; and
- Provide an opportunity to improve site drainage and understand the sources of AMD in the WRDs.

The steps taken in Project planning that reduce risks or provide opportunities to improve likely outcomes for rehabilitation and closure of the site include:

- Embankments for the expanded TSF and the new WSD will be constructed from newly won, clean oxidised material from the top of the soil profile, minimising the risk of spreading AMD materials sourced from WRDs around the site;
- The construction of the new WSD will enable the salvage and use of clean topsoil for site rehabilitation (currently none is available);
- Waste rock from the Underground operations is to be retained underground or stored at the base of the pit where insufficient oxygen will be available to support oxidation and acid generation following the completion of mining and filling of the pit with water. This strategy significantly reduces the risk of AMD leaching into ground and surface water and offsite;
- Tailings from the operation will be stored in TSF2 in a facility that employs a GCL to reduce the risk of seepage to groundwater. TSF2 will be designed to accommodate closure with provision for a cover designed to limit the ingress of oxygen and water to prevent AMD seepage from the structure should sufficient suitable cover materials be found and approval be given to rehabilitate *in-situ*. The use of GCLs is expected to significantly reduce seepage;
- The embankment of TSF2 will be rock armoured to provide protection from any flood waters;
- The opportunity for tailings to be transferred to the pit at the completion of mining to provide an industry best practice solution to long-term tailings storage has been reviewed by Primary Gold;
- Water from the pit will be treated prior to storage in the new WSD prior to release to Mount Bundey Creek in the wet season. This will avoid the risk of groundwater contamination from seepage under the WSD and the creation of a new source of contamination; and

- The opportunity to gather data to enable the development of a regional 3D groundwater model and complete contaminant transport modelling to support more detailed assessment of closure outcomes for the existing Toms Gully site and TGU Project.

13.2.2 TGU PROJECT EXISTING INFRASTRUCTURE

The existing site infrastructure risks and opportunities relating to closure and rehabilitation relevant to the EIS are:

- The opportunity to either store in-pit or encapsulate *in-situ* tailings from TSF1. This will effectively reduce the availability of a significant contaminant source from leaching and adding to the load of contaminated water;
- The initial plan to utilise materials from the WRDs for construction materials has been abandoned to avoid the risk of re-disturbance or use for construction of any PAF materials from within the WRDs. The Proposal will not disturb the WRDs and hence does not represent any additional risk from existing in relation to the WRDs;
- The TGU Project provides the opportunity to improve drainage, gather data and study the long-term options for the existing WRDs; and
- The process plant area will be removed or demolished on completion of the TGU Project, (assuming no further resources and mine life are identified and approved). Other infrastructure that the Pastoralist does not want retained will be removed from site at the completion of the TGU Project.

13.3 CONTEXT

To reduce the risks associated with the closure and rehabilitation phase of the TGU Project and avoid creating further rehabilitation liabilities, Primary Gold has conducted several studies that have contributed to the understanding of risks and impacts and the development of mitigation measures. Through these and other studies, the key risks to closure and rehabilitation, and their potential impacts are addressed below.

Design of the TGU Project has considered the pre-existing issues with an objective to reduce the long term environmental risks posed by the site.

As an incremental project to the historic operations of the Toms Gully site, the scope of closure for the TGU Project relates specifically to:

- Underground mine and open pit;
- Process plant;
- ROM Pad;
- TSF1 and TSF2;
- EP1 and EP2;
- Offices, workshops and sheds;
- Arterial infrastructure; and
- WSD.

The following Sections focus on closure and rehabilitation for the above scope, whilst considering opportunities to address existing Toms Gully infrastructure and historic issues.

13.3.1 UNFINISHED OR UNSUCCESSFUL REHABILITATION DUE TO INADEQUATE FUNDS

All mining ventures are sensitive to a number of factors including the commodity price, exchange rates, cost of capital, energy prices and labour. Severe, unfavourable movements in these could result in inadequate funds being available to start the TGU Project, continue to operate the TGU Project or close the TGU Project. In addition to the above financial risk factors, timing, cost and availability of project funding in all markets is subject to sovereign risk factors which can undermine confidence in project start up schedules. Changes in legislation or policy in relation to closure and rehabilitation can result in previously unidentified obligations applying that have not been planned for. This can also apply pressure to budgeting and funding for an operation.

These circumstances could crystallise the risk that rehabilitation of the TGU Project could be unfinished or not started at any point from commencement through to closure.

13.3.1.1 PRE-MINING

The impact of inadequate funds being available before the TGU Project commences will mean continuation of Care and Maintenance in its current form.

13.3.1.2 OPERATIONS

If adequate funds are not available during operations, and the mine enters premature closure/care and maintenance, or if inadequate funds are available at the end of mine life, there is potential for rehabilitation to be incomplete or not commenced. Depending upon the status of operations at the time, exacerbation of issues associated with AMD, water management, weeds, erosion and sedimentation could occur. Extinguishment of the tailings issues which are planned to be mitigated by the TGU Project may not be completed, and levels of understanding of options for improving the WRDs may not have had time to develop.

Mitigating this risk is able to be achieved by the design and sequencing of the TGU Project. Dewatering the pit without a further water storage feature and/or without treating the water would place site water storage under strain should the TGU Project be forced to close at the dewatering phase. Constructing the new WSD will commence prior to dewatering commencing and provide additional buffering and protection for Mount Bundey Creek and the Pastoralist. Pit water will be treated to ensure discharge to Mount Bundey Creek is able to meet water quality requirements prior to release into the WSD. Thus if the TGU Project was to close due to inadequate funding, the treated pit dewatering water is expected to be suitable for use by livestock and would be safely stored in the WSD.

A secondary benefit associated with the WSD is that stripping its footprint will result in the ability to salvage and stockpile rehabilitation materials at the start of the TGU Project. There are currently no topsoil stockpiles and limited construction materials available. Even if no rehabilitation was commenced before inadequate funds became an issue, the site would be better off by having the materials ready for use and a WSD with livestock quality water.

In addition, Primary Gold has committed to not hauling waste rock to surface or using waste rock for construction materials – eliminating the risk of spreading existing or creating new liabilities. Even if the TGU Project was to stop early in its life, the pit would have no water in it, and no PAF materials will have been spread around the site. The water balance for the site will have substantially more storage, as the pit dewatering would have provided additional water storage capacity on site.

The risk of release of poor quality water from overtopping of TSF2 will be mitigated by raising the TSF in the first year of operations to provide additional freeboard to retain water and will rock armour the base of the lift to provide flood protection. These actions will reduce the risk of TSF failure or overtopping. The risk of TSF2 being flooded by Mount Bundey Creek will be reduced as soon as the TSF2 embankments are raised.

The TGU Project will utilise TSF2 for the storage of all new tailings. Should the TGU Project close after treating all of the underground ore, but not have the funds to process or relocate the tailings in TSF2 to the pit, the fresh tailings would remain *in-situ* without capping. Adherences to freeboard requirements in the TSF will mitigate risks of decant water stored on the dam overtopping.

Primary Gold plans to either treat the tailings in TSF1 at the end of mine life as a batch and place the tails in-pit, underground or in TSF2. Should this not be completed, the tailings in TSF1 will remain *in-situ* and Primary Gold has the option to utilise the materials used for construction of the WSD as capping. This option is currently not preferred and will be further assessed in consultation with Regulators and the Pastoralist.

13.3.1.3 POST CLOSURE

The risk of inadequate funds post-closure of the TGU Project would be limited to the current WRDs and long-term seepage and water balance issues.

13.3.2 UNFINISHED OR UNSUCCESSFUL REHABILITATION DUE TO NATURAL DISASTER

In the event of a natural disaster there is potential for either severe disruption to site operations resulting in cessation of mining, and prevention of rehabilitation, or in the post closure environment, damage to rehabilitated infrastructure e.g. wall failure on TSF2 or significant erosion and seepage from the WRDs. A natural disaster during operations is likely to result in similar funding issues, as the natural disaster would potentially trigger suspension of operations, and potential costs of damage. An example would be the impact a severe storm event causing flooding. Mitigation measures include improved drainage, increased pumping capacity, raising TSF2 and having the WSD as additional water storage.

The impact of a natural disaster on the success of rehabilitation will depend on the type of disaster encountered. Perturbations inflicted by fire or insect plague could delay the progress of rehabilitation or bias the species present to those able to pioneer after the event. An earthquake could affect the stability of the TSF walls or disrupt capping layers, allowing oxygen and water ingress. Consequent impacts include loss of containment of water, renewed AMD generation or excessive erosion as runoff adjusts to the changed landscape and alteration to site drainage. A

cyclonic event may have the effect of causing severe erosion by overwhelming freeboard tolerances on ponds or structures like TSFs, or disrupting the site drainage network. In each case remedial works would be required to repair the damage made, however, the storm event noted above had little impact on the soundness of existing infrastructure, a testament to its structural integrity.

The key mitigation measure that would limit the risk of extreme events is to place the tailings in-pit at end of mine life. This measure avoids impacts under earthquake and significantly reduces risks during extreme weather events. It also mitigates against the inevitable weathering process that acts upon cover systems.

To further mitigate this impact, designs of the new WSD and the raised TSF2 will incorporate design principles from leading best practice guidelines such as the Australian National Committee on Large Dams 2012. Design of these impoundments considers the level of Hazard and incorporates consideration of the underlying ground conditions, loading against the impoundment and maximum credible earthquake. The design also incorporates safe freeboard for the targeted storm event plus spillways to manage major rainfall events.

Levels in ponds will be managed in closure/Care and Maintenance to maintain freeboard levels and minimise the risk of uncontrolled release from storage ponds and TSF2.

One of the benefits of the TGU Project will be improvement of site drainage. With changes to the TGU Project, the existing site drainage will be reviewed to ensure it is fit for purpose.

13.3.3 PIT LAKE BECOMES A GROUNDWATER SOURCE

Recovery of groundwater levels following the TGU Project is expected to result in the void becoming a groundwater sink (AGEC 2015b). This has been the situation to date. However, in certain scenarios there is a risk that the pit void (when it has reached equilibrium with surrounding groundwater) would become a groundwater source, enabling water to migrate away from the pit. This scenario is only likely to be temporary due to the excess of average annual evaporative rates/demand over rainfall (see Section 4.1.2). If additional runoff water is routed into the pit, or in a series of very wet seasons, it is conceivable that the hydraulic gradients would reverse. This is made less likely by the expected general increase in groundwater levels surrounding the pit in wet conditions.

The potential for the pit to become a groundwater source exists now, but is deferred by the TGU Project as it treats and places water in to the newly constructed WSD prior to being released from site (see Section 3.9.1). The TGU Project will review the routing of clean runoff water to minimise inputs into the pit.

13.3.4 LONG TERM POSITIVE WATER BALANCE AND ACID MINE DRAINAGE ISSUES FROM WASTE ROCK DUMPS

WRDs are not part of the TGU Project. At closure, Primary Gold will not have completed any substantial capping or relocation of materials that will prevent or improve their current behaviour as a source of AMD. This means a continuation of the current long term risk of the WRDs producing water with low pH and elevated metals. However, to assist with long term

management of AMD from the WRDs, Primary Gold has committed to undertaking studies into AMD from the WRDs and review options to provide sustainable long term closure solutions of these existing liabilities. Existence of the TGU Project will not increase this risk over the current care and maintenance regime. The TGU Project will establish improved site drainage (Figure 35), and identify potential remedial actions to reduce impacts.

The site drainage configuration and water management strategy during care and maintenance will aim at controlling any contaminated water on-site. The TGU Project does not alter the AMD risks from the WRDs, other than to provide an on-site presence and capability to reduce the level of salts and metals in first flush runoff, observe dump and water behaviour, investigate, control drainage and monitor water balance.

There is not expected to be any substantial reduction of this legacy risk from the TGU Project, thus the residual risk is still high.

13.3.5 LACK OF REHABILITATION MATERIALS LEADS TO INADEQUATE TAILINGS CLOSURE AND POOR QUALITY SITE REHABILITATION

A pre-existing issue for the site is the absence of rehabilitation materials for capping and rehabilitating the TSFs, process plant/ROM area or WRDs. The volume of clean construction materials identified within the main mining leases to date is sufficient to meet the construction needs for the WSD and raise of the TSF2 embankments. Whilst there is some potential for additional material to be available from the identified areas, it is likely to be insufficient to support suitable encapsulation of the tailings. In consideration of this, together with the significant reduction in long-term risk associated with in-pit placement of tailings, the TGU Project proposes to transport the tailings to the pit prior to filling with water. This results in the tailings being in a geotechnically stable and isolated environment with no risk of future failure of embankments or covers. Once flooded, the water will prevent oxygen from interacting with the tailings to minimise the risk of AMD. This method is consistent with best practice mine closure and rehabilitation.

Should sufficient clean construction materials be identified in new areas within the mining leases, detailed design will be required to determine the optimal cover thicknesses and design, long term flood protection and rehabilitation of the structures. Approval will be sought for this as an alternative closure option, via the MMP process.

Should excess rehabilitation materials become available, they may be applied to other infrastructure in need of rehabilitation such as the process plant footprint or utilised on other rehabilitation areas.

13.3.5.1 REHABILITATION MATERIALS

Clearing the WSD will allow the salvage of topsoil. Other potentially valuable rehabilitation materials will be identified and salvaged where possible. Consideration will be given to:

- Timber salvage;
- Retention of cleared bush and scrub material;
- Collection of seed; and

- Retention of boulders and logs for fauna habitat.

Establishment of vegetation on TGU Project rehabilitation areas will use native species collected from the general area, or if not locally available, as close as possible to Toms Gully. Rehabilitation will generally target mapping unit 1 (Figure 24) as the predominant vegetation community being disturbed across site. In some areas which are prone to inundation, species from mapping units 2 and 3 may be added to provide tolerant vegetation for a range of conditions.

As the TGU Project is located on the Old Mount Bundey Pastoral Station, the rehabilitation prescription will be developed in consultation with the Pastoralist prior to presentation in the MMP.

Broadcasting seed will form the main strategy for revegetation. However, there are expected to be instances where tube stock may be required to supplement revegetation or acquire target species including:

- Advancing overstorey species in the rehabilitation landscape such as Darwin Stringybark, Darwin Woollybutt and Ironwood;
- Advancing species in rehabilitation susceptible to grazing;
- Stabilise or prevent erosion occurring on certain landscape features such as drainage lines and slopes;
- Species difficult to grow from seed and are reliant on cuttings for reproduction (many riparian species); and
- Species difficult to grow from seed due to physical limitations of their preferred habitat (e.g. Melaleuca spp. in areas prone to inundation).

Given the small size of the TGU Project, it is Primary Gold's preference to contract out raising of tube stock to external nurseries that have expertise in this area.

13.3.6 FUTURE LAND USE

Past land use at the site includes gold mining and pastoral grazing. The most recent previous operator, CGAO (now Newmarket Gold Inc.), noted it had an obligation to "return the land to a condition that enables the landholder to economically use the land and also significantly reduce the environmental impact for the future" (CGAO 2011). Consultation records from CGAO notes that the landowner expects to be able to use the mine area for grazing and also utilise some infrastructure such as sheds and workshops.

Considering the landowner's expectations and the presence of legacy infrastructure, Primary Gold proposes to segregate the site into pastoral grazing and livestock exclusion precincts for the scope of the TGU Project (Figure 53). The pastoral grazing precinct will be able to support grazing in the short term. The livestock exclusion precinct will be regarded as temporary livestock exclusion zone and have restricted access whilst the landscape stabilises, is revegetated and investigations conducted to ensure rehabilitation is safe and sustainable to support pastoral grazing.

The livestock exclusion precinct forms the core of the site, including TSFs, the sulphide and oxide WRDs, process plant, evaporation ponds, Oxbow wetlands and the pit footprint. Within

the livestock exclusion precinct, the land use will continue to be restricted access until rehabilitation has stabilised. Initial targets will be to stabilise and revegetate the landscape with the available materials. Access by people and livestock will be restricted via maintenance of the existing fence that separates this area from the remainder of the pastoral lease.

The remainder of MLN1058 forms the pastoral grazing precinct which includes the new WSD and existing Lake Bazzamundi and other areas unaffected by mining. Both these features will be retained as water storage assets for the Pastoralist should this be agreed. The initial targeted land use for the pastoral grazing precinct will be pastoral grazing and water capture in support of grazing.

By splitting the site into two precincts, part of MLN1058 can return to its desired land use shortly after completion of the TGU Project. Restricted access to the livestock exclusion precinct recognises that rehabilitation will take time to establish and become stable and sustainable. The OWRD and SWRD as well as EP1 and EP2 and the pit will not be rehabilitated by Primary Gold in the timeframe of the TGU Project. Those features are expected to require long term exclusion of livestock until safe and sustainable. Primary Gold will complete studies to advance development of a long term closure solution for these legacy features.

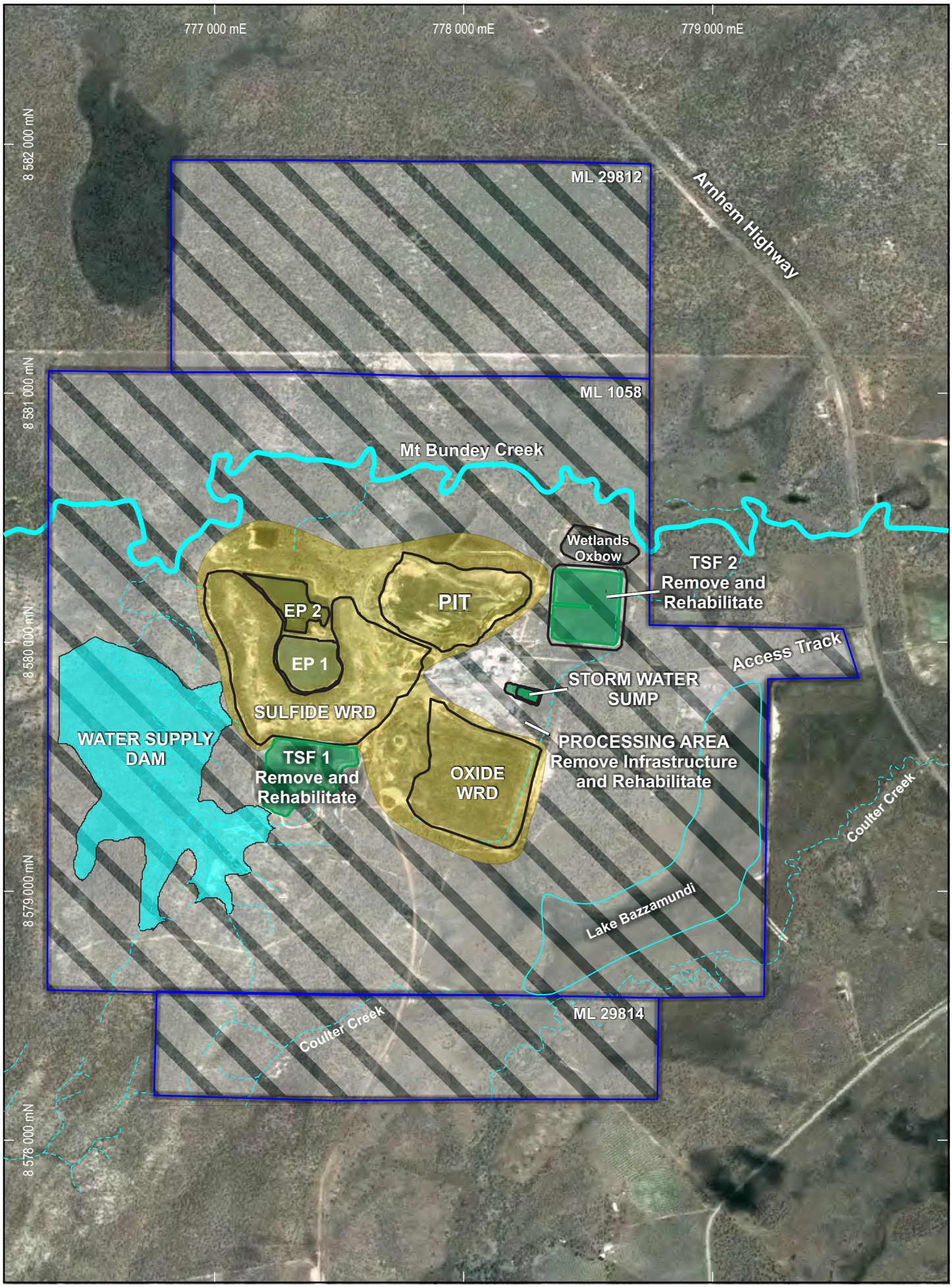


Figure 53: Post-Project Land Use

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13.3.7 FINAL REHABILITATION, REVEGETATION AND MINE CLOSURE PLANS

Within the livestock exclusion and pastoral grazing domains, the site has been split into several sub-domains. The sub-domains will undergo closure/rehabilitation as part of the TGU Project and are discussed below. For complete account of all domains (e.g. WRDs, Evaporation Ponds etc.) please see the TGU Project MCP in Appendix 5.

13.3.7.1 OPEN PIT AND UNDERGROUND

The open pit and underground domain covers a total area of 9 ha. It is planned to leave the open pit without rehabilitation, and it is planned to have tailings deposited at the base of it as part of closure for TSF1 and/or TSF2. The base of the pit (-70 mRL) is well beneath the predicted long term pit water level of 12 mRL and will fill when dewatering activities cease at conclusion of the TGU Project (AGEC 2015). The following closure actions are planned for this domain:

- Undertake detailed surveys of the underground workings and open pit. These will be forwarded to the DME for their records. The survey data provides accurate information should future exploration or mining companies consider any future development of the site;
- Underground workings will have hydrocarbons or other contaminating materials removed to the surface and infrastructure of value removed;
- Infrastructure not containing contaminating materials and not of any commercial value will be left *in-situ*;
- Some tailings (up to 250,000 t) are able to be placed underground whilst preserving access to the deeper orebody. Should this option be adopted, their location will be recorded and forwarded to DME for their records;
- Ventilation shafts and alternative egress points will be sealed and to prevent access. Any infrastructure associated with these features (e.g. vent fans) will be removed;
- If not already fenced, ventilation shafts outside of the pit boundary will be fenced to preclude access;
- An abandonment bund already exists around the pit. However the bund will be reviewed to ensure it has been built to an acceptable standard, with suitable materials and is located outside of the theoretical zone of potential pit instability (as per the Western Australian guideline *Safety Bund Walls around Abandoned Open Pit Mines* [Department of Industry and Resources 1997]). If circumstances dictate the abandonment bund must be within this zone, a geotechnical study will be conducted to confirm ground conditions where the abandonment bund has been placed is stable;
- The pit will be left to refill with a combination of groundwater inflow and rainfall/runoff with a monitoring programme implemented to monitor the water level and characterise changes to water in the pit against the void model. The water quality in the pit can be expected to be comparable to its current quality. The data from current pit water is a more reliable predictor than modelling (which therefore has not been completed); and
- A gate will be installed at the pit entry for the initial stage of closure to allow access for monitoring and placement of tailings or selected materials (either inert concrete or footings contaminated with acid or metals). This will be eventually replaced by competent rock at the completion of monitoring of the pit.

The preferred option for long term management of TSF1 and/or TSF2 is to rehandle tailings for long term disposal at the base of the pit. Tailings placement should avoid blocking access to the underground workings to avoid sterilising any remaining mineralisation. Further investigations will determine the best means of achieving placement (e.g. mechanically through conventional truck and shovel mining or hydraulic mining).

At this stage no post-mining land use is identified other than restricted access.

13.3.7.2 TAILINGS STORAGE FACILITY 1

TSF1 is a valley fill impoundment occupying 7.4 ha. Whilst Primary Gold has eliminated TSF1 as a location for any future tailings deposition, it has identified that the TGU Project can have a positive impact on reducing its legacy liability. Primary Gold intends to undertake studies to determine if it should either:

- Re-process the remaining 190,000 t of tailings in the TSF. After re-processing, the tailings will be placed in TSF2, in the base of the pit or underground;
- Rehandle the tailings directly to permanent disposal at the base of the open pit; or
- Design and install a cap/cover system over the top of the TSF and engineer drainage to prevent seasonal build-up of water and ingress of oxygen.

Should re-processing or rehandling to the pit be found to be the best option, TSF1 will effectively become an empty dam. Subject to the further studies noted above, rehabilitation of the dam is likely to include the following steps:

- Seal and decommission any monitoring piezometers on the wall;
- Treat or remove any surface water in the TSF, and transfer to the WSD or use directly into the process plant during operations;
- Remove tailings to process plant or pit;
- Remove contaminated materials under the tailings (potentially for use as lower level capping on TSF2);
- The embankment is seen as a potential capping resource and will be removed or partially removed for pushing upstream over the TSF footprint to achieve external drainage. Alternatively, embankment material can be made available for other site rehabilitation requirements;
- Place material won from stripping the WSD over the surface of the TSF footprint. This may be a combination of capping and growth medium; and
- Rip/scarify the floor of the TSF and seed with native species.

In the event the tailings are not re-processed or rehandled, the TSF will need to be capped and rehabilitated. This will require the following actions:

- Undertake studies to determine the thickness of cover required to ensure a sustainable structure that does not allow ongoing AMD;
- Consider the optimum design in relation to the materials available;
- Secure approvals for capping the tailings *in-situ*;
- Treat and/or transfer surface water in the TSF to the WSD or use within the process plant during operations;

- Establish causeways over the TSF if the tailings matrix has not sufficiently settled to be fully trafficable for mining equipment. Preliminary shear strength studies may be required to assist gauging the strength of the tailings matrix and potentially rehabilitation earthmoving equipment selection (i.e. selecting D6 Swampy bulldozers);
- Construct the capping layer over the TSF;
- Place a soil cover (stripped from the WSD) over the top of the capping. This will provide a germination bed for seed/seedlings to establish before growing into the capping;
- Install drainage where necessary on the surface of the TSF cap to allow for controlled release of water when high rainfall events exceed the storage capacity of the rehabilitated TSF landscape;
- Rip or scarify the rehabilitation surface to provide a suitable surface for vegetation establishment. On the embankment, ripping should be completed on contour; and
- Once surfaces have been ripped, seed/plant the area with native species.

Successful rehabilitation of TSF1 would target pastoral grazing as a post-mining land use.

13.3.7.3 TAILINGS STORAGE FACILITY 2

TSF2 is a paddock style TSF currently occupying 7.5 ha. Primary Gold plans to raise the embankments of TSF2 to accept tailings as part of the TGU Project. The preferred option is rehandling the tailings to the base of the open pit. The option to construct an engineered cap/cover over the top of the TSF for rehabilitation will require the location of sufficient suitable capping materials and approval of rehabilitation *in-situ*. Assuming the tailings from TSF2 are removed, rehabilitation of the TSF2 footprint would require the following activities:

- Seal and decommission any monitoring piezometers on the walls;
- Treat and/or transfer any surface water in the TSF to the WSD;
- Remove the tailings to the base of the structure;
- The embankment is a potential capping resource and will be removed or partially removed for pushing upstream over the TSF footprint to achieve external drainage. Alternatively embankment material can be made available for other site rehabilitation requirements;
- Spread any available topsoil; and
- Rip/scarify the floor of the TSF and seed with native species.

In the event the tailings are not rehandled, the likely solution for TSF2 will be to cap and rehabilitate. The following actions would then be undertaken:

- Undertake studies to determine the thickness of cover required to ensure a sustainable structure that does not allow ongoing AMD;
- Consider the optimum design in relation to the materials available;
- Seek approval for capping and rehabilitation *in-situ*;
- TSF risk assessment and pre-decommissioning audit conducted prior to closure;
- Adjust deposition strategy (if required) to create a tailings surface most compatible with the post closure landform design;
- Assess consolidation and trafficability of the TSF. Given it has been active, the TSF may need to be left for a period to allow consolidation and trafficability to improve;
- Treat and/or transfer any surface water in the TSF to the WSD;

- Establish causeways over the TSF if the tailings matrix has not sufficiently settled to be fully trafficable for mining equipment. Shear strength studies may be required to assist gauging the strength of the tailings matrix and potentially rehabilitation earthmoving equipment selection (i.e. selecting D6 Swampy bulldozers);
- Construct the capping layer over the TSF;
- Place a soil cover (stripped from the WSD) over the top of the capping. This will provide a germination bed for seed/seedlings to establish before growing into the capping;
- Install drainage where necessary on the surface of the TSF cap to allow for controlled release of water when high rainfall events exceed the storage capacity of the rehabilitated TSF landscape;
- Rip or scarify the rehabilitation surface to provide a suitable surface for vegetation establishment. On the embankment, ripping should be completed on contour;
- Once surfaces have been ripped, seed/plant the area with native species; and
- Ensure suitable rock armour and flood protection is installed to provide long term stable storage and containment of tailings.

Successful rehabilitation of TSF2 will enable pastoral grazing as a post-mining land use.

13.3.7.4 Run-of-Mine Pad

The following steps are envisaged for rehabilitation of the ROM pad:

- The ROM pad will undergo a clean-up at the end of operations to process all economically feasible ore and any sub-optimal materials which are cheaper to process and receive marginal revenue compared to the cost of rehandle to the bottom of the pit;
- Once all ore has been processed and the crusher removed as part of deconstruction of the process plant, the ROM pad will be reshaped to form a surface which can be rehabilitated as a landform. If AMD material is present, it will be excavated and returned to the base of the pit;
- If available, topsoil shall be placed over the ROM footprint; and
- The surface of the ROM will then be ripped to a depth of at least 1 m and seeded with native species.

Successful rehabilitation of the ROM Pad will enable pastoral grazing as a post-mining land use.

13.3.7.5 Process Plant

The process plant will continue to operate after cessation of mining to process remaining ore stockpiles on the ROM and to conduct campaign milling during mill clean up. It may also process the tailings from TSF1.

The following steps are envisaged to rehabilitate the process plant (including use of the process plant in the lead up to closure to minimise post closure liabilities):

- Continued processing and salvage of ore on the ROM pad to the maximum possible extent. On the presumption sub-economic ore will be PAF, it may be cost effective to process sub-economic ore in place of load and haul to the base of the pit;

- An initial clean-up of the plant will be conducted in the last weeks of processing, which will include removal of built up material (ore) on tanks, launders, pipes, sumps, crusher floor, bins and hoppers. This material can then be returned to the process via sump pumps;
- Draw processing water using the worst quality water source possible. This is done on the basis it will be easier to manage better quality water than poor quality water post closure;
- Review procedures to focus on plant shutdown and undertake cyanide decontamination safety training;
- Hazard Operability and Workplace Risk Assessment and Control assessments to be conducted;
- Implement planned rundown of reagent and other spares to minimal inventories;
- In the last two weeks of cyanide consumption, tanks should be drained to process any organo-cyanide sludges at the bottom of the storage tanks;
- Clean up and decontamination of plant facilities; and
- Water treatment or disposal of contaminated water.

13.3.7.6 CLOSURE

Once processing of ROM ore has been completed, full clean-up of the plant will begin in conjunction with two other processes, gold scavenging and cyanide decommissioning. The main activities likely at this stage are described below:

- A gold scavenging crew will scour through low energy gravity traps to remove gold or gold concentrates for either smelting, or further processing/refining through a third party;
- Small batches of material collected from clean-up activities will require milling at times during the first few weeks of closure;
- Once tanks have been emptied, they can be accessed via trap doors. Tanks will be washed out with high pressure water, followed by a specialist contractor to scour the tanks using twin plane nozzles. The last stage of tank cleaning will be a rinse with sodium hypochlorite solution to destroy any residual cyanide. Due to Hazards associated with tanks containing cyanide, Hazard assessments, having continuous atmospheric monitoring, spotters and use of Confined Space Entry Permits are required;
- Other reagent tanks will be emptied and cleaned of sludge, hosed out and left to drain by leaving trap doors open;
- Process tanks will be emptied in a manner that maximises economic recovery of loaded carbon and the logistics of being able to pump carbon to elution;
- As tanks are emptied, mud on walls will be dislodged by hoses (or high pressure water where required). It is possible a heavy, iron rich sediment may exist at the base of tanks which will need physical removal to either TSF2 (if it is to be rehabilitated as a landform) or to the base of the open pit. Once tanks have been cleaned, they will be left to drain by leaving trap doors open;
- Bins, chutes and hoppers will be hosed out and left to drain or have drainage holes cut in them;

- Any cyanide pipelines will be flushed with five volumes of potable water, followed by flushing with a sodium hypochlorite solution. Non-cyanide pipelines will only be flushed with water;
- Once flushed, pipelines will be drained by breaking flanges at low points;
- Pumps and mechanical equipment will be washed down externally with raw water to remove process slurry and cyanide;
- The elution circuit and gold room will continue to be used to complete electrowinning and smelting from the plant carbon inventory and from gravity trap gold recovery. Once completed, electrowinning cells will be washed out with fresh water;
- Once loaded carbon has been stripped, it will be bagged and sold;
- Electrical reticulation will be progressively isolated as areas no longer require electricity;
- Excess compressed air systems will be shut down and statutory pressure vessel inspections conducted at the time of shut down;
- Once clean-up is complete, the stormwater storage pond and process water pond will be drained, have sediment cleaned out and liners removed. These dams will be used as plant catchment sumps with the aim of reducing sediment release during storm events; and
- Radiation devices will be removed and sent offsite for secure storage and or sale.

13.3.7.7 DEMOLITION

Once the plant has been cleaned up and decontaminated of reagents, gold and process slurry, removal can begin. Depending on the economic cycle at the time, Primary Gold may elect to sell the plant or parts of the plant, relocate the plant to another project or demolish the plant as scrap. Demolishing the plant as scrap is the base case for this plan as it is also relevant to relocation and sale of the plant as there will always be some remnants of infrastructure which requires demolition/scrapping such as concrete. The following steps are envisaged:

- A specialist contractor will be appointed to deconstruct the plant. This will typically involve unbolting, cutting and in limited circumstances demolishing infrastructure. Equipment will be separated as specific assets (e.g. mill) or cut to lengths (e.g. steel pipe) in order to be suitable for transport from site;
- Most of the steel work and infrastructure will be removed from site as it will have scrap value. A portion of the plant will not have scrap value such as concrete pillars, slabs and scrap timber. These will be broken up and excavated onto trucks before haulage to the base of the pit;
- An assessment of contamination will be conducted to determine if there are areas which require remediation prior to rehabilitation. Areas to be targeted will include under cyanide, leach and elution tanks and hydrocarbon tanks, and any areas which have substantial staining suggestive of contamination;
- Any hydrocarbon contaminated soil will be excavated and taken to a bioremediation pad to be remediated;
- Any chemically contaminated soil will be excavated and taken to the base of the pit;
- Buried services will be excavated to 0.5 m depth;
- Any residual slurry/ore in the plant footprint will be graded into windrows, then excavated and taken to the base of the pit;

- The surface of the process plant will then be levelled off/re-contoured to match the surrounding landscape;
- Soil may be placed over the plant footprint, if sufficient soil is available; and
- The plant footprint will then be ripped to a depth of 0.5 m and seeded with native species.

Successful rehabilitation of the Process plant will enable pastoral grazing as a post-mining land use.

13.3.7.8 OFFICES, WORKSHOPS AND SHEDS

At closure, there will initially be ongoing use of offices and workshops to manage rehabilitation and closure activities and maintain earthmoving equipment conducting earthworks. Based on the current Access Agreement between Primary Gold and the Pastoralist, retention of these assets for the beneficial use of the Pastoralist is an option.

The likely steps required for these assets:

- As part of consultation prior to closure, Primary Gold will obtain agreement with the Pastoralist which structures are to be retained;
- Archiving of electronic and hard copy records will be completed. Hard copy records will be placed in safe storage for minimum statutory periods. Electronic records will be stored by Primary Gold at their corporate office;
- Offices identified for retention will be swept out and cleaned for handover to the landowner. If any offices are not required, they will either be taken offsite (as part of sale or relocation by Primary Gold) or demolished. The demolished offices will be placed at the base of the open pit or in a landfill. Any concrete slabs such as walkways will be broken up and placed at the base of the open pit;
- Sheds identified for retention will be cleaned out for handover to the owner. If any sheds are not required, they will be dismantled and taken offsite as scrap. Underlying concrete slabs will be removed and taken to the base of the open pit;
- The workshop will also be cleaned out for handover to the landowner if identified for retention. If not required, the workshop will be dismantled and taken offsite as scrap. Concrete will be broken up, excavated and placed at the base of the pit;
- A contamination assessment will be conducted around the workshop footprint to determine if any contamination needs to be excavated for bioremediation;
- Buried services across the offices shed and workshops areas which have not been retained will be removed to a depth of 0.5 m. If the landowner requires buried services to be retained, they will be retained. This may necessitate leaving some non-essential buried services to avoid impacting on retained infrastructure; and
- The ground surface of removed buildings will then be ripped to a depth of 0.5 m and seeded with native species.

Successful rehabilitation of the Offices, Workshops and Sheds will enable pastoral grazing or support of pastoral grazing as a post-mining land use.

13.3.7.9 ARTERIAL INFRASTRUCTURE

Arterial infrastructure includes pipelines, roads, bores and power reticulation. These transcend the livestock exclusion and pastoral grazing precincts.

Power lines will be retained across the site, but will be isolated at the process plant or offices/workshops once no longer required, to prevent fire risks.

Pipelines will be retained for the length of their useful life on the TGU Project. Some pipelines will be removed shortly after closure whereas as others used for site water management will be retained for a substantial period after closure.

Pipelines will be cut to lengths suitable to be placed on trucks and transported offsite for recycling.

Across the site are haul roads and access roads, of which some will have little to no use after closure. Others will be an integral part of post closure site management or handed back to the Pastoralist by agreement with Primary Gold. This includes roads for ongoing monitoring, access to retained infrastructure or accessing other parts of the Old Mount Bundey station.

Rehabilitation protocol for roads is provided below:

- At or before closure, Primary Gold intends to meet with the Pastoralist to identify which roads should be retained for future use by the Pastoralist;
- Roads superfluous to needs, will have their shoulders pushed in then ripped as deep as possible (to the limitations of the bulldozer used) but will target 1 m;
- The roads will then be seeded with native species; and
- Road blocks may also be installed on rehabilitated roads and public access points to prevent access across rehabilitation.

13.3.7.10 BORES

Once their useful life has concluded, monitoring bores will be sealed by grouting and have their collars cut. The Pastoralist may elect (by agreement with Primary Gold) to retain production bores for future use. If bores are to be retained, they will have a fenced enclosure installed around them.

13.3.7.11 WATER SUPPLY DAM

The WSD may be retained in some form at closure as an available water store for pastoral grazing. Where the Pastoralist does not wish to retain the WSD, anticipated closure activities include:

- In the dry season, transfer remaining water to the open pit;
- The embankment is seen as a potential capping resource and will be removed or partially removed for pushing upstream over the WSD footprint to achieve external drainage. Alternatively embankment material can be made available for other site rehabilitation requirements;
- If stockpiled topsoil is still available, place topsoil over the WSD footprint; and

- Scarify the floor of the TSF and seed with native species.

Successful rehabilitation of the WSD will enable pastoral grazing or support of pastoral grazing as a post-mining land use.

13.3.8 STAGING AND TIMING OF REHABILITATION

An indicative closure schedule is provided in Table 50. The schedule incorporates a number of assumptions. The most significant assumptions (which are not implied to be decisions) are:

- There is no active care and maintenance phase, therefore underground dewatering pumps will not continue to operate after closure and the process plant will not be maintained after completion of cyanide decontamination and cleaning;
- TSF1 is reprocessed, or rehandled to the pit;
- TSF2 is rehabilitated as a TSF (*in-situ* encapsulation), thus rehabilitation is unlikely to start until at least the end of the first year of closure; and
- The TGU Project achieves completion criteria during the 10th year of closure resulting in the Minster for Mines and Energy issuing Primary Gold a Certificate of Closure and relinquishment of bonds.

Not included in the schedule is a breakdown of wet and dry seasons. As guidance, earthworks will be conducted during the dry season wherever possible which will influence the schedule. In addition, the gold resource at Toms Gully will be subject to further evaluation, exploration or mining studies or authorisation processes which may also influence the schedule.

Table 50: Indicative Closure Schedule for the TGU Project

Major or Significant Aspect/Task to Closure	Planning and Development Phase	Operations Year 1	Operations Year 2	Operations Year 3	Closure Year 1	Closure Year 3	Closure Year 5	Closure Year 10
Stakeholder engagement								
Prepare MMP								
Stripping of capping and growth medium from WSD footprint								
Treatment and transfer of pit water to WSD								
Upgrade site drainage								
Complete raise of TSF2								
Decide on TSF2 (cap or rehandle)								
TSF rehabilitation study								
Reprocess/rehandle TSF1, then rehabilitate footprint								
WRD investigations								
Notifications of closure								
Establish abandonment bund								
Survey pit and underground								

Major or Significant Aspect/Task to Closure	Planning and Development Phase	Operations Year 1	Operations Year 2	Operations Year 3	Closure Year 1	Closure Year 3	Closure Year 5	Closure Year 10
Stop dewatering pumps								
Seal underground access points								
Establish site fencing								
Agreement for retention of assets with Pastoralist								
Process plant rundown and preparation for closure								
Gold scavenging								
Final cleaning of plant								
Office archiving and ensure all electronic data is being stored on Primary Gold's server in corporate office								
Remove residual ore and AMD material from ROM pad								
Monitoring, rehabilitation and maintenance inspections								
Rehabilitate ROM pad								
Plant demolition								
Contamination assessment								

Major or Significant Aspect/Task to Closure	Planning and Development Phase	Operations Year 1	Operations Year 2	Operations Year 3	Closure Year 1	Closure Year 3	Closure Year 5	Closure Year 10
Rehabilitate process plant footprint								
Rehabilitate TSF2								
Rehabilitate WSD (if required)								
Handover retention assets to Pastoralist								
Certificate of completion issued								
Relinquishment of bonds								

13.3.9 CLOSURE CRITERIA

Preliminary completion criteria have been prepared for the TGU Project and are presented in Table 51.

Table 51: Indicative Completion Criteria for the TGU Project

Closure Strategy	Indicative Completion Criteria	Measurement Tool
Implement safe and secure tailings strategies that will either cap and rehabilitate *in-situ* or place in-pit the existing tailings and all new tailings to be created by the TGU Project	TSFs will be either reprocessed, rehandled to the pit or rehabilitated.	Physical removal of tailings to mine pit or submission and approval of closure and rehabilitation design report if one or both TSFs are to be rehabilitated.
Improve site drainage to minimise the generation of contaminated runoff and ensure that any contaminated runoff is directed to an appropriate storage or treatment facility	TSFs rehabilitated or removed and site drainage improved to direct and contain poor quality water.	Water quality monitoring meets the approved water quality guidelines in Mount Bundey Creek compliance point.
Utilise the development activities for the TGU Project as an opportunity to win growth medium and other resources to allow rehabilitation of disturbed areas	Growth medium and capping stripped from WSD footprint and stockpiled for rehabilitation.	Growth medium and capping inventory prepared once stripping of the WSD footprint has been completed. Report quantities annually to ensure they are not used for other purposes.
Provide opportunity for Pastoralist to assume responsibility for existing infrastructure and rehabilitate remaining areas	Documented agreement with Pastoralist specifying which assets are to be retained for the Pastoralist's benefit and responsibility.	Executed agreement with Pastoralist. Physical inspection following infrastructure removal.
Secure site access to ensure that risks to public safety and livestock will be minimised	Livestock exclusion precinct to be fenced to restrict access. Pit abandonment bund or fence. Underground portals will have a locked gate installed to prevent unauthorised access.	Presence and condition of fence Presence of abandonment bund or fence. Presence of locked gates on portals.
Remove, remediate or demonstrate acceptability of contamination present in areas to be rehabilitated	Contamination assessed ahead of rehabilitation and solution identified before final rehabilitation earthworks conducted.	Report prepared on contamination assessment and remediation.

13.4 MITIGATION

Specific mitigation measures to address the identified closure and rehabilitation risks are presented by aspect in Table 52.

Table 52: Aspects and Mitigation Measures

Aspect	Mitigation Measure	Timing	Performance Indicators
Planning	Sufficient resources shall be made available to enable detailed closure planning to be completed ensuring mine closure standards are implemented.	Planning and Operations	Detailed plans for closure and rehabilitation
	Planning shall include consultation with key stakeholders.	Closure	Consultation records Closure plans consider key stakeholders
Post-mining Land Use	The mine closure process shall enable the TGU Project to be closed and rehabilitated so that pastoral grazing land use may be fully resumed over the majority of the land.	Post-closure	Pastoral grazing resumed over rehabilitated and closed areas
	The mine pit, WRDs and associated drainage controls shall be retained post closure.	Post-closure	Mine drainage retained during closure
Tailings	All tailings shall be stored in safe, stable long term facilities that may include *in-situ* encapsulation within, or placement in the base of the pit (or underground workings) prior to flooding the pit.	Closure	Approved capping design or in-pit disposal
	The tailings stored in the TSF1 site shall be either re-processed or placed directly in the pit (including underground workings) or have *in-situ* encapsulation.	Closure	TSF1 tails removed
Waste Rock	Existing WRDs are to be retained with management focusing on investigating causes of AMD and potential solutions, maintenance of drainage controls and monitoring.	Closure	Investigation and Options report
Pit and Underground Workings	The pit and underground workings shall be used for long term storage of AMD materials then allowed to flood.	Closure	AMD materials records AMD audit at mine closure
	The abandonment bund shall be reviewed at closure to prevent inadvertent vehicle access.	Closure	Bund in place
Water	Closure of TGU Project shall be designed and completed to ensure that water quality of Mount Bundey Creek and the post-mining pastoral land use areas is protected.	Closure	Water quality monitoring records
	Site drainage shall be configured to minimise risks associated with the existing WRDs.	Closure	MMP approved site drainage plan
Processing Area and Ancillary Infrastructure	At closure, the processing area shall be cleaned, equipment sold and relocated or removed from the area and disposed of at a suitable location (in-pit or landfill).	Closure	Equipment removed Disposal records

Aspect	Mitigation Measure	Timing	Performance Indicators
	At closure, surface material from the processing area that is contaminated with ore, waste rock or tailings shall be removed and placed in-pit or TSF. Suitable growth medium shall then be spread over the processing area and it shall be revegetated with native species.	Closure	Post-closure inspection
Rehabilitation	Areas to be cleared of vegetation shall have any useful materials (seed, timber) salvaged, before vegetation is pushed aside, topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use.	Closure	GDPs for clearing Audits of GDP conditions
	Topsoil that is likely to be infested with weed seed shall be stockpiled separately from clean topsoil.	Closure	GDP records GDP audit records
	Areas designated for rehabilitation (TSF footprints) shall be prepared with topsoil spread to specified thicknesses, ripped and seeded with native species.	Closure	Post-closure inspection
	Weed infested topsoil shall only be used in areas designated as appropriate by the site EH&S Manager. A weed control programme shall be used to control weeds if necessary.	Closure	GDP records Weed map
Post-Closure Monitoring and Reporting	Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season.	Closure	Rehabilitation monitoring reports
	Annual reporting on rehabilitation and closure progress and plans shall be provided to DME for a minimum of five years post-closure.	Closure	Rehabilitation monitoring reports
Record Keeping	Records of rehabilitation and closure activities shall be retained by Primary Gold and submitted to DME annually.	Closure	Rehabilitation monitoring reports

13.5 RESIDUAL RISKS

The residual risks associated with closure of the TGU Project are:

- Failure of a tailings cover;
- Economic failure of the TGU Project leaving un-capped tailings; and
- Migration of groundwater from the pit.

13.5.1 FAILURE OF A TAILINGS COVER

Before adopting a strategy to place a cover or capping over tailings, Primary Gold will be undertaking studies to determine:

- If there will be sufficient material available to establish capping on TSF1 and/or TSF2;

- The required depth to establish a sustainable long term cover; and
- The economic feasibility of capping TSFs versus other options such as rehandling to the pit.

Should the outcome suggest a capping solution is materially possible, scientifically sound and economically feasible, Primary Gold will forward plans to the DME for approval in the MMP. Placement of a capping layer would therefore occur only after approval by the DME.

In the event the capping layer failed, impacts experienced could include oxidation of the tailings resulting in generation of AMD affecting water quality, failure of vegetation to establish or loss of sediment.

The capping layer could fail due to either natural events such as weather, insect plague, fire, poor construction or incorrect science (e.g. cover thickness not thick enough).

Construction inspections and records can be used to minimise the residual risk of poor construction. Monitoring of key indicators such as runoff quality and vegetation will help determine if the capping strategy is trending towards a sustainable cover.

13.5.2 ECONOMIC FAILURE OF THE TGU PROJECT LEAVING TAILINGS *IN-SITU*

Economic failure resulting in uncapped tailings could either occur before the TGU Project commenced or during operations and before rehabilitation. In the case of economic failure before the operation commenced, the presence of uncapped tailings would be no different to continuation of the current care and maintenance authorisation.

If economic failure occurred during operations, the situation would also be similar to continuation of current care and maintenance. However one key difference is the topsoil and any available capping after constructing the WSD will be stockpiled and available for rehabilitation (i.e. there will be a supply of rehabilitation material available as opposed to the current situation of no materials).

13.5.3 MIGRATION OF GROUNDWATER FROM THE PIT

Modelling suggests the pit will be a sink for groundwater under most circumstances. However it is possible following periods of extreme rainfall for the hydraulic gradients of the pit to temporarily reverse enabling the pit to become a groundwater source. This would allow migration of groundwater from the pit to the environment. This risk already exists at Toms Gully with groundwater levels currently near their projected long term equilibrium.

The TGU Project defers the likelihood of this risk occurring by dewatering the pit as one of the first activities to re-establish operations. The pit is only a risk to become a groundwater source (increasing the likelihood of water migrating to the environment) once the pit void has recovered.

13.5.4 MONITORING

Monitoring for the rehabilitation and closure phase of the TGU Project will focus on the areas that have been potentially impacted by the TGU Project. Specifically, the monitoring, inspection and maintenance programme will aim to:

- Ensure surface and groundwater quality leaving the site satisfies discharge requirements and is not having an incremental impact on the downstream environment;
- Calibrate actual pit filling rate against modelled rates;
- Check the stability of landforms and determine if any minor remedial works are required;
- Assess the evolution of landforms towards being a stable revegetated system;
- Inspect site drainage to ensure drains are maintained as fit for purpose;
- Inspect gates and fencing around site to ensure unauthorised access is not occurring or fences are damaged allowing livestock to enter the livestock exclusion precinct;
- Prevent uncontrolled spread of fire;
- Control the spread of weeds; and
- Manage water levels around site to minimise risks of unplanned release.

13.5.5 WATER MONITORING

13.5.5.1 SURFACE WATER MONITORING

Surface water monitoring is expected to comprise:

- Pit water levels and quality;
- WSD water quality;
- Discharge water volumes and quality;
- Background water quality on Mount Bundey Creek and Coulter Creek;
- Compliance sites on Mount Bundey Creek and Coulter Creek;
- TSF2 decant pond water quality and levels until rehabilitation is conducted; and
- Evaporation pond levels and quality.

13.5.5.2 GROUNDWATER MONITORING

Groundwater monitoring is expected to comprise:

- TSF2 wall piezometers until rehabilitation is conducted, to monitor the phreatic surface;
- TSF groundwater monitoring bores (levels and quality);
- Regional bores (levels); and
- Specific impact bores around site (quality).

13.5.6 REHABILITATION MONITORING

A rehabilitation monitoring programme will be prepared for the TGU Project rehabilitation areas. The programme will be consistent with the Leading Practice Sustainable Development

Program for the Mining Industry – Mine Rehabilitation (DITR 2006). The monitoring programme will be conducted on all major areas of rehabilitation of the TGU Project including TSF1, TSF2, the process plant/ROM pad and the WSD (if rehabilitated). Comparison from transects on these landforms will be compared to natural analogue sites.

Erosion monitoring will be conducted on landforms rehabilitated as part of the TGU Project. Transects approximately 50 m long will be established across slopes to quantify erosion. This will be supplemented by a walkover inspection to determine if any gullies are becoming hazardous. This could be a substantial trip/fall Hazard for people or livestock, or deep erosion that has penetrated through the capping layer. Such gullies will be identified for repair works.

13.5.6.1 INSPECTIONS AND MAINTENANCE

The care and maintenance and closure inspection programme for the TGU Project will be similar to that currently used for the care and maintenance programme. The proposed inspection programme is outlined below.

13.5.6.2 DRAINAGE

Inspections will be undertaken to ensure drainage structures have not been compromised by storm activity. It is anticipated inspections and maintenance of drainage will be conducted on both a pre-emptive and reactive basis. In the dry season, a thorough annual inspection will identify drains requiring remedial works or sediment removed to be completed before the next wet season. During the wet season, inspections will check overall drain integrity after trigger storm events (once safe) to identify any structures in urgent need of repair or other management action.

Maintenance of drainage is expected to occur for the first three years after rehabilitation whereby the likelihood of excess sediment build up or erosion of drains is reduced.

13.5.6.3 FENCING

At closure, fences will isolate the livestock exclusion precinct from the pastoral grazing precinct and to secure the site from unauthorised access. Fencing will allow the Pastoralist to graze the pastoral grazing precinct but prevent livestock accessing areas which could pose risks to livestock. Gates will be installed on the pit ramp, access to the livestock exclusion precinct and site access points for monitoring and/or maintenance access whilst excluding unauthorised personnel. In addition to fencing, abandonment bunding will be reviewed around the pit to ensure it is adequate to prevent inadvertent vehicle incursion to the pit.

Fences, gates and abandonment bunds will be inspected routinely to ensure they have not been compromised by either natural events (e.g. trees falling) or vandalism/damage. Signs of unauthorised entry or damage to locks will also be checked.

13.5.6.4 FIRE

Fire will be managed consistent with TGU Project EMP (Appendix 2). Fire breaks have been installed around the site and key infrastructure for protection against bushfires. The firebreak network has historically been implemented in conjunction with the Pastoralist and volunteer bushfire brigade to ensure that fire breaks are optimised (Primary Gold 2013c).

Fuel reduction burns are carried out on site post wet season. This is to reduce the ferocity of bushfires on site when they occur. Back burns are also used to provide fire breaks. With new areas of rehabilitation, fire breaks may need to be adjusted prior to controlled burns to minimise adverse impacts to new rehabilitation.

Burns are also used to control some of the pest weed species as a broad acre management strategy.

13.5.6.5 PESTS AND WEEDS

Pests and Weeds will be managed consistent with TGU Project EMP and Biodiversity Management Plan (Appendix 12).

Management options employed for weeds is dependent on the species present but includes grazing, spot spraying, cut and touch, broad acre spraying and controlled burn offs.

Weed inspections will still occur during the post closure period, with specific attention given to high traffic areas such as roads, ROM pad surrounds and workshops.

Earthmoving equipment mobilised to site will need to be washed at the wash-down bay to prevent new weeds being introduced to site. The wash-down bay will continue to require maintenance during the rehabilitation phase of closure.

13.5.6.6 REHABILITATION COMPLIANCE INSPECTIONS

Once the bulk of a rehabilitation domain has been completed, an inspection of the area will be completed to check rehabilitation earthworks were conducted to design, and other features of the rehabilitated landscape have been incorporated.

13.5.6.7 WATER MANAGEMENT INFRASTRUCTURE INSPECTIONS

Whilst undertaking water monitoring, inspections will be undertaken of essential water management infrastructure during closure to ensure it is not damaged and operating to expectations. Items inspected will include:

- Operational pipelines for leaks;
- Operational pumps for serviceability;
- Fauna trapped in water storage bodies; and
- New seepage, cracks or damage to embankments of water storage bodies.

13.6 CONTINGENCIES AND ASSESSMENT CRITERIA

Table 53 identifies the contingencies identified in the event of deviations from planned activities affecting closure.

Table 53: Outcome and Assessment Criteria and Contingencies

Outcome	Assessment Criteria	Contingency
Insufficient material for capping TSF	Mass balance is less than determined requirements.	The preferred option is to rehandle tailings to the base of the pit. Further exploration for capping materials, or access via commercial arrangements, are contingency measures to provide more capping materials.
Insufficient space to store waste rock underground	Stope sequence issue, development issue	Waste rock to be stored at bottom of the pit if necessary.
Poor water quality discharged from site	Monitoring records of discharge, compliance limit exceeded	Suspend discharge (if possible). Advise DME and NT EPA. Conduct investigation.
Contaminated groundwater extends from pit or TSF	Monitoring bore water quality exceeds internal triggers	Resample bore/s. Undertake investigation of cause. Advise DME and NT EPA of outcome and proposed response, pump back bores.
Fire jumps firebreaks	Bushfire on site	Protect personnel as first priority and critical infrastructure if possible.
New weed outbreak	Weed identified in inspection	Determine best control strategy and implement.
Seepage from TSF	Inspection identifies new seepage	Arrange for professional geotechnical inspection. Response to be provided by geotechnical engineer.
Excessive erosion on TSF rehabilitation	Erosion monitoring shows erosion is continuing or gullies become hazardous	Identify cause of erosion. Ameliorate cause then repair erosion.
Rehabilitation does not meet completion criteria	Rehabilitation monitoring, Rehabilitation Completion Inspection	Investigate cause of failure. Address cause of failure and monitor subsequent performance.
Unauthorised access to site or pit is occurring	Vehicle tracks, cut locks, broken fences, livestock in mine	Repair fence, replace locks, and remove livestock.

13.7 OUTCOMES

Establishment of the TGU Project will reduce the existing rehabilitation issues present across the site by:

- Excluding access to the Underground portals and pit post closure;
- Reprocessing, rehandling to the pit or placing a long term rehabilitation cover over TSF1;
- Rehandling to the pit or placing a long term rehabilitation cover over TSF2;
- Ensuring waste rock generated by the TGU Project does not leave the pit (it is either stored underground or placed at the base of the pit to be inundated with water post closure;
- Reviewing and upgrading where necessary the drainage network across the Toms Gully site;
- Removing the processing plant and other infrastructure not retained for the benefit of the Pastoralist;
- Stripping topsoil and available capping materials from below the WSD footprint which can be used for rehabilitation across site; and
- Rehabilitating the WSD if not retained for the benefit of the Pastoralist.

The development strategies adopted for the TGU Project have directly targeted minimising the potential to generate AMD. Providing a long-term sustainable solution of the TSFs provides a tangible improvement over the current status of the mine.

The TGU Project effectively defers the attainment of an equilibrium water level in the pit for many years. This long term level and the quality of the water within is not expected to be significantly different from the current pit. Hence, the TGU Project is not expected to significantly change the risks or likely outcomes associated with the pit. It will continue to be used to store contaminated water, but changes will be made to site drainage to minimise clean water inputs. Rehabilitation of tailings removes a source of contaminated water that has historically been pumped to the pit or evaporation ponds.

From a rehabilitation management perspective, the site has been divided into a pastoral grazing precinct (available for grazing in the short term) and a livestock exclusion zone which will require restricted access until such time that landforms and rehabilitation stabilises. This will enable the majority of MLN1058 to return to pastoral grazing shortly after closure, whilst protecting people and livestock from higher risk features. The monitoring, inspection and maintenance programme will provide feedback on the success of the closure strategies adopted.

The ToR objective for rehabilitation and closure planning is to ensure that:

- Rehabilitation will achieve a stable and functioning landform, consistent with the surrounding landscape and other environmental values, and will remove potential for long term or post closure impacts on downstream water quality, beneficial uses or environmental values; and
- Closure and care and maintenance planning will effectively achieve containment of all mine–related environmental contaminants on-site, for the very long term, without need for ongoing management, intervention or expenditure, and allow for post-closure return to agreed land uses on the site.

The TGU Project is consistent with the ToR objective, enabling a substantial improvement to the environmental status of the Toms Gully mine site – ensuring tailings from the TGU Project are managed in a stable and safe location. This approach significantly reduces the risks of potential off-site impacts from tailings (both old and new).

A plan for remediating the WRDs to prevent continued AMD impacts requires detailed investigations and planning. The TGU Project will gather the data and complete contaminant transport modelling and options analysis to identify the options for such a plan. In the meantime, the TGU Project will continue with management options aimed at containment of any AMD products. The development strategy and mitigation measures enable the TGU Project to meet the ToR rehabilitation and closure objectives for the proposed increment of mining at Toms Gully.

14 OTHER FACTORS

This Section briefly reviews the other factors identified in the ToR:

- Fires and bushfires;
- Noise and vibration;
- Air emissions;
- Visual amenity; and
- Mosquito breeding.

Primary Gold has prepared an EMP (Appendix 2) that provides more details on the mitigation measures and management of these factors. The EMP details measures to manage the risk of erosion and sedimentation.

14.1 FIRES AND BUSHFIRES

14.1.1 RISKS

Bushfires are a natural component of the area and can be generated through natural causes (e.g. lightning strike) or through human activities. There is significant fire activity in the bioregion (particularly in the late dry season) due to large tracts of grazing land that have nil to low levels of pastoral development and consequent minimal firebreaks and control measures. Burning is frequently used as a management tool on pastoral land, freehold and conservation reserves. TGU Project activities have the potential to generate fires through human, construction and operating activities. The TGU Project site is also susceptible to being impacted by fire activity from the surrounding area.

The following risks associated with fire have been identified:

- TGU Project generated fires impacting on Project infrastructure and personnel;
- TGU Project generated fires extending beyond the TGU Project site and impacting on surrounding properties, their stock, grazing resources, flora and local fauna populations; and
- TGU External bushfires encroaching within the TGU Project site and impacting on Project infrastructure and personnel.

14.1.2 MITIGATION

The following mitigation measures shall be implemented to minimise the potential impacts associated with fires and bushfires:

- Prior to hot works commencing on-site, the surrounding area shall be cleared of all combustible material and a fire extinguisher and some other means of fire suppression shall be provided and available;
- Cigarette smoking shall be restricted to approved areas only, with appropriate cigarette butt disposal facilities available;

- No burning of rubbish or open fires shall be permitted on-site;
- Vehicles shall be restricted to existing roads and tracks where practicable;
- Vehicle undersides shall be checked and any material stuck around exhaust manifolds shall be removed as part of normal vehicle pre-start check routines;
- Firebreaks shall be established around key facilities and shall be maintained on a seasonal basis (as required);
- All buildings on-site should comply with Australian Standards and Fire Safety regulations;
- Firefighting equipment including fire extinguishers or other control equipment shall be made available in all vehicles and at designated work area points;
- Firefighting equipment shall be maintained to comply with relevant fire safety standards;
- A fire management works/action programme shall be implemented which will detail spatial and temporal aspects of wildfires and Hazard reduction burns, mapping of fire extents and documentation of fire effects and control outcomes;
- Fire breaks shall be slashed or graded at the end of the wet season (or when access is permissible);
- A 5 m buffer zone shall be installed and maintained either side of the site boundaries and the constructed stock fence; and
- Controlled mosaic burning shall be undertaken within the TGU Project area to reduce fuel loads. Burns shall be coordinated with the assistance of the pastoralist, Bushfires NT or local volunteer brigade.

14.1.3 MONITORING

The following monitoring works shall be undertaken to ensure the proposed mitigation measures are being implemented and risks associated with fires and bushfires are minimised:

- A fire incident register shall be developed and maintained that will log uncontrolled fires incidences and controlled burning events including details of location, approximate area burnt and severity;
- The condition of firebreaks shall be monitored to ensure they are sufficiently free of vegetation; and
- Regular consultation shall be undertaken with NT Bushfires regarding regional fire break scheduling and implementation.

14.1.4 OUTCOMES

Project assets and infrastructure have the potential to be damaged or destroyed by TGU Project generated fires or encroaching bushfires. Fires also have the potential to cause environmental damage, damage to surrounding properties, their stock and pastoral infrastructure.

Implementation of the above mitigation and monitoring measures will reduce the likelihood of TGU Project activities generating fires, the spread of TGU Project generated fires outside the TGU Project site and the potential for external bushfires to impact on TGU Project activities, infrastructure and personnel. Fire extinguishers and a small firefighting unit will be retained on site to limit the consequences of any fire.

Through implementation of the proposed mitigation and monitoring measures, impacts associated with Project fires and bushfires are expected to be environmentally acceptable.

14.2 NOISE AND VIBRATION

14.2.1 RISKS

Aside from the risk of noise affecting the workforce (which is discussed in Section 11), the main potential risk associated with noise and vibration as a result of TGU Project activities is the impact it may have on local residents and communities.

The primary noise sources include:

- Noise generated from mobile plant and equipment during construction and operation;
- Noise generated from fixed processing plant including crushers and mills; and
- Noise generated from blasting of the underground mine voids.

These noise sources are similar to those at the operating quarries near Mount Bundey and it is noted that the site has been operated previously, with open cut mining techniques that are likely to have created more noise than the TGU Project due to increased surface activity and blasting.

The closest dwelling to the TGU Project site is a cottage owned by the pastoralist which is approximately 1.3 km southeast from the top of the pit ramp. The station manager's house is approximately 2.8 km south-southeast of the top of the pit ramp. The nearest community to the TGU Project is the rural subdivision of Marrakai, which is located 17.5 km northwest of the TGU Project. The risk of significant noise impacts to local residents and communities is therefore considered low due to:

- The significant separation distances between the TGU Project site and these receptors;
- All blasting and waste rock movements being underground or in-pit;
- Only ore being transported to surface;
- The principal uphill haulage being in-pit; and
- The nearby Arnhem Highway presenting an influencing factor.

Noise and vibration may interfere with local fauna, which can be of particular significance if it interrupts breeding in critical populations of conservation significant species. No such populations have been identified on the Toms Gully Mining Leases.

The risks to workers, local fauna populations and local residents as a result of Project noise and vibration emissions will be minimised through the implementation of the mitigation measures outlined in Section 14.2.2 below. Note that all blasting will be underground and is expected to be completed (on average) once daily.

14.2.2 MITIGATION

The following mitigation measures shall be implemented to minimise noise and vibration impacts to workers, local fauna populations and nearby residents as a result of Project activities:

- All plant and equipment shall be maintained in good working order and fitted with appropriate noise abatement devices where required;
- During the construction phase, works which have the potential to result in excessive noise or vibration shall be undertaken as per regulatory requirements. Where excessive noise and vibration works are required to be undertaken outside these hours, the pastoralist and station manager shall be notified;
- A complaints register shall be maintained to record any community and/or worker complaints received concerning excessive noise and vibration levels;
- Workers shall wear hearing protection when undertaking tasks that exceed occupational health and safety limits for noise (above LAeq, 8h of 85 dBA). Hearing protection shall meet Australia Safety Standards in accordance with AS/NZS 1269.3;
- Areas where people may be exposed to excessive noise levels should be sign-posted as hearing protector areas;
- A blast management plan shall be prepared prior to the commencement of blasting. This shall include details of nearest receptors, potential impacts and appropriate mitigation measures; and
- All workers and visitors shall be made aware of the blast schedule.

14.2.3 MONITORING

Due to the remoteness of the TGU Project site, noise and vibration emission levels are not proposed to be monitored. Instead the following monitoring and inspections are proposed:

- The complaints register shall be regularly reviewed to identify if there are potential trends in the number, frequency and type of noise and vibration complaints being recorded; and
- Plant and equipment shall be regularly inspected to ensure they are adequately maintained, not generating excessive noise levels and fitted with appropriate noise abatement devices where required.

14.2.4 OUTCOMES

Noise and vibration emissions are expected to be minor. The risks to workers, local fauna populations and local residents as a result of TGU Project noise and vibration emissions will be minimised through the implementation of mitigation measures. The mitigation measures to minimise these impacts have been proposed in Section 14.2.2 and also in the TGU Project EMP.

Through implementation of the proposed mitigation and monitoring measures, impacts associated with TGU Project noise and vibration levels are expected to be environmentally acceptable.

14.3 AIR EMISSIONS

14.3.1 RISKS

The primary risk associated with air emissions as a result of TGU Project activities is the impact it may have on workers and surrounding vegetation.

The main sources of air emissions as a result of TGU Project activities include:

- Dust generated from mobile plant and equipment during construction and operation;
- Dust generated from fixed processing plant including crushers, conveyors and mills; and
- Exhaust emissions from TGU Project plant and equipment.

These dust sources are similar to those at the operating quarries near Mount Bundey and it is noted that the site has been operated previously, with open cut mining techniques that are likely to have created more dust than the TGU Project due to increased surface activity and blasting. Dust complaints have not been noted to have been a key issue in previous operations.

Increased dust levels have the potential to:

- Increase the risk of workers suffering respiratory problems following prolonged exposure to elevated dust levels;
- Reduce visibility on roads thereby increasing the risk of vehicle accidents occurring; and
- Increase deposition of dust on vegetation, potentially killing the vegetation.

Increased exhaust emissions also have the potential to cause respiratory issues in workers following prolonged exposure.

The closest dwelling to the TGU Project site is a cottage owned by the pastoralist which is approximately 1.3 km southeast from the top of the pit ramp. The station manager's house is approximately 2.8 km south-southeast of the top of the pit ramp. The nearest community to the TGU Project is the rural subdivision of Marrakai, which is located 17.5 km northwest of the TGU Project.

As dust is a health and safety risk for the work force, appropriate mitigation measures for managing risks to the workforce include operating procedures, enclosed dust collection systems, health monitoring, dust suppression, PPE where required, personal risk assessment, water monitoring procedures, minimum equipment specifications.

Air emission risks to the environment will be further minimised through the implementation of the mitigation measures outlined in Section 14.3.2 below. Due to the remoteness of the TGU Project site, air emissions from project activities are not envisaged to impact on local residents.

14.3.2 MITIGATION

The following mitigation measures shall be implemented to minimise dust and exhaust emission impacts to workers, local fauna populations and nearby residents as a result of TGU Project activities:

- Construction works that have the potential to generate high dust levels shall be restricted during times of high wind in the direction of station dwellings;
- Water shall be applied to unsealed tracks and open areas during times of increased dust levels;
- Ore shall be wetted prior to crushing;
- Dust shall be controlled using sprays over the conveyors at crusher and mill feed during processing;
- Vehicle speed limits shall be set within the TGU Project site;
- Clearing shall be restricted to the minimum required;
- Vehicles shall keep to designated tracks as far as practicable;
- All plant and equipment shall be regularly inspected and maintained to minimise exhaust emissions; and
- No burning of waste shall be permitted on-site.

14.3.3 MONITORING

Due to the remoteness of the TGU Project site and the minor levels of dust and exhaust emissions envisaged to be generated, dust and exhaust emission levels are not proposed to be monitored. Instead the following inspection and reporting measures are proposed:

- The complaints register shall be regularly reviewed to identify if there are potential trends in the number, frequency and type of air quality complaints being recorded;
- Plant and equipment shall be regularly inspected to ensure they are adequately maintained, and not generating excessive exhaust emissions; and
- The condition of surrounding vegetation shall be visually monitored for evidence of excessive dust deposition causing vegetation damage.

14.3.4 OUTCOMES

Dust and exhaust emissions from the TGU Project have the potential to impact on workers and surrounding vegetation. These emissions are envisaged to be small due to the scale of the TGU Project, the short life of the TGU Project (four years) and the restriction of clearing to 93 ha (of which the majority will be inundated by water within the WSD). Mitigation measures to minimise any adverse impacts have been proposed in Section 14.3.2 and also in the TGU Project EMP.

Through implementation of the proposed mitigation and monitoring measures, impacts associated with TGU Project air emissions levels are expected to be environmentally acceptable.

14.4 VISUAL AMENITY

14.4.1 RISKS

The Arnhem Highway is the major road artery into Kakadu National Park and other local attractions. Tourist and local traffic will pass by the TGU Project site which is located on mining leases adjacent to the Arnhem Highway. The TGU Project area is not currently visible from the highway. Changes to the viewscape of the area have the potential to:

- Impact on any local tourism in the area; and
- Impact on local residents and community.

The following TGU Project works have the potential to impact on the visual amenity of the area:

- Construction of the WSD;
- Raising of the existing TSF2; and
- Increasing dust levels beyond ambient levels.

No new WRDs or other infrastructure of significant scale is planned.

The Arnhem Highway is the key visual receptor and the nearest significant structure to be constructed is the TSF2 embankment raise which is located approximately 1 km from the Highway. The raise will see the final crest level at 1028.8 mRL (L&MGSPL 2015). The view of TSF2 from the eastern approach along the Arnhem Highway is sheltered by a small hill that is just over 1032 mRL (Figure 12). On the western approach, the natural vegetation around the Mount Bundey creek crossing provides visual screening (Figure 54). The raised TSF2 embankments may be visible as vehicles pass the Toms Gully mine turnoff. The WSD is located behind existing topography and not expected to be visible from the Highway.

The lack of significant ground disturbance or creation of new roads together with the implementation of industry standard dust mitigation measures is expected to control dust such that visible levels of dust from the site will be an occasional occurrence.

Based on the above, impact on the visual amenity of passing tourist traffic is unlikely to be significantly impacted by the TGU Project.

14.4.2 MITIGATION

The following mitigation measures shall be implemented to minimise the potential for impacts on visual amenity:

- Mining will be restricted to underground and there shall be no surface expansion of the pit;
- Waste rock material shall be disposed of underground or in the bottom of the existing pit to avoid the need to create additional WRDs;
- Options to rehabilitate the existing sulphide and oxide WRDs shall be investigated;
- Areas required to be cleared shall be restricted to the minimum required;

- Existing cleared areas and tracks should be used for laydown and temporary construction areas in preference to undertaking new clearing; and
- Water shall be applied to unsealed tracks and open areas during times of increased dust levels.

14.4.3 OUTCOMES

The TGU Project has been designed to use existing infrastructure where suitable, thereby minimising the potential for visual impacts. The processing infrastructure will be reused, waste rock material shall be disposed of in the pit and underground mining activity will be restricted to underground. The existing TSF2 will be raised as opposed to constructing a new TSF, with the raised TSF2 still 28 m lower than the existing OWRD and 22 m lower than the SWRD.

The closest residence to the TGU Project site is located approximately 1.3 km from the TGU Project and on the opposite side of a small hill. The nearest community (rural subdivision of Marrakai) is located 17.5 km northwest of the TGU Project.

The main publicly accessible area is the stretch of Arnhem Highway that passes by the site. As illustrated in Figure 54 and Figure 55, the TGU Project site is not currently visible from Arnhem Highway. The raised embankment of TSF2 is largely sheltered from view by a small hill and the riparian vegetation of Mount Bundey Creek.

Figure 56 shows the view of the TGU Project site from a local highpoint (10-15 m above the surrounding landscape) located approximately 5 km south east of the TGU Project site. Access to this vantage point is difficult and was only made possible due to the recent burning of vegetation. The low flat topped hill in the centre of the image is the OWRD, however other features of the site are not visible from this vantage point.

Based on the existing visual amenity status of the site, the limited amount of additional works proposed and the remote location of the site, the TGU Project will not significantly alter the visual amenity of the area.

Figure 54: Arnhem Highway - Southern side of Mount Bundey Creek looking southwest towards the TGU Project

Figure 55: Arnhem Highway – Looking west along the TGU Project access road

Figure 56: View from local vantage highpoint looking Northwest over the TGU Project

14.5 MOSQUITO BREEDING

14.5.1 RISKS

A baseline mosquito monitoring assessment was undertaken for the TGU Project site between February 2000 and February 2001. The assessment involved trapping on a monthly basis at four sites. A total of 31 species of mosquito were collected during the monitoring program. The species recorded are those expected from the general northern sub-coastal region of the NT. The domestic pest species *Culex quinquefasciatus* that is often associated with polluted water was not recorded (Department of Health and Community Services (DoHCS) 2002).

The most important potential endemic mosquito borne diseases in the area are Murray Valley Encephalitis, Ross River Virus and Barmah Forest Virus. *Ochlerotatus vigilax,* an important vector of Ross River Virus and Barmah Forest virus, was not recorded in high numbers. *Ochlerotatus normanensis,* another potential vector of Ross River Virus, Barmah Forest Virus and Murray Valley encephalitis was recorded in very low numbers at only one site. An exotic mosquito (*Culex gelidus*) that has recently been introduced into Australia was found in low numbers during the baseline monitoring (DoHCS, 2002).

TGU Project activities have the potential to create mosquito breeding sites and/or exacerbate any mosquito breeding that may already occur on-site. Potential breeding sites that may be created as a result of TGU Project activities include water dams, wetland filters, borrow pits, sediment traps, general site disturbance and waste water disposal. Many of these are current features that will continue to be utilised by the TGU Project.

The creation of mosquito breeding sites increases the potential for mosquitos to occur on-site, thereby increasing the risk of mosquito borne disease transmission to staff.

14.5.2 MITIGATION

Mitigation measures to reduce the potential for the creation of mosquito breeding site as a result of TGU Project activities are provided below. In circumstances where mosquitos are found on-site, measures have also been provided to protect the health of workers from mosquito borne diseases.

- Where practical, dam walls should be constructed with steep sides (45 degree slope) to prevent the establishment of semi-aquatic vegetation that will provide suitable breeding habitat;
- Surface water drainage shall be designed to minimise potential for ponding;
- Areas of frequent surface water ponding shall be filled in or drained where practicable;
- Stockpiles shall not be placed in areas that may impede drainage and shall be contoured to prevent ponding of water;
- Sedimentation ponds shall be designed to drain and empty following rainfall events;
- Unless in use, all rainwater tank access points, (excluding inlet and outlets), shall be kept shut to prevent mosquito access. Inlets and outlets shall be covered with closely fitting removable insect-proof screens;
- Wastewater treatment and storage systems shall be designed and constructed as per DoHCS guidelines;
- Dead and lodged reeds shall be removed from Bazzamundi lake on an annual basis where practicable;
- Where TGU Project activities have created active breeding sites, these sites shall be modified where practicable to prevent further breeding;
- Where active breeding sites are unable to be modified, options for chemical control shall be investigated in consultation with the Medical Entomology Branch of the DoHCS;
- Workers shall wear long sleeved shirts, long trousers and mosquito repellent during times of high mosquito activity;
- Site offices and cribs shall be screened and air conditioned to discourage the presence of mosquitos; and
- Workers shall be educated in the prevention and early identification of mosquito and biting insect borne diseases.

14.5.3 MONITORING

The following monitoring shall be undertaken to minimise the potential for the establishment of mosquito breeding grounds and the spread of mosquito borne diseases:

- Natural and man-made water storage features within the TGU Project site shall be monitored for the presence of biting insect larvae during the wet season;
- The extent of surface water ponding within the TGU Project site shall be monitored for the potential to act as biting insect breeding sites; and
- The condition of biting insect screens and other access prevention measures shall be monitored for effectiveness.

14.5.4 OUTCOMES

Recent on-site observations support a low mosquito population, however may increase closer to the natural water courses of Mount Bundey and Coulter Creeks. The proposed WSD and associated borrow pits also have the potential to act as a mosquito breeding ground.

Through implementation of the mitigation measures outlined in Section 14.5.2 and the borrow management measures provided in the EMP (Appendix 2), the potential for mosquito larvae to become established is minimised along with the transmission of any mosquito borne diseases.

15 ENVIRONMENTAL MANAGEMENT

15.1 ENVIRONMENTAL MANAGEMENT SYSTEM

Primary Gold has a strong commitment to responsible environmental management. Primary Gold has commenced preparation of an EMS for the TGU Project and plans to continue to develop the EMS to enable systematic assessment and review of environmental impacts, continuous improvement and obligations to be identified and addressed. An illustration depicting the TGU Project EMS is provided in Figure 57. The cyclical process of referring to policy, planning, implementing, checking and reviewing is central to the EMS. Details of the following key components of the EMS are described throughout the remainder of this Section:

- Environmental Policy;
- Environmental Requirements;
- Management Structure;
- Incident Reporting and Management;
- Education and Training;
- Audits and Inspections; and
- Continuous Improvement.

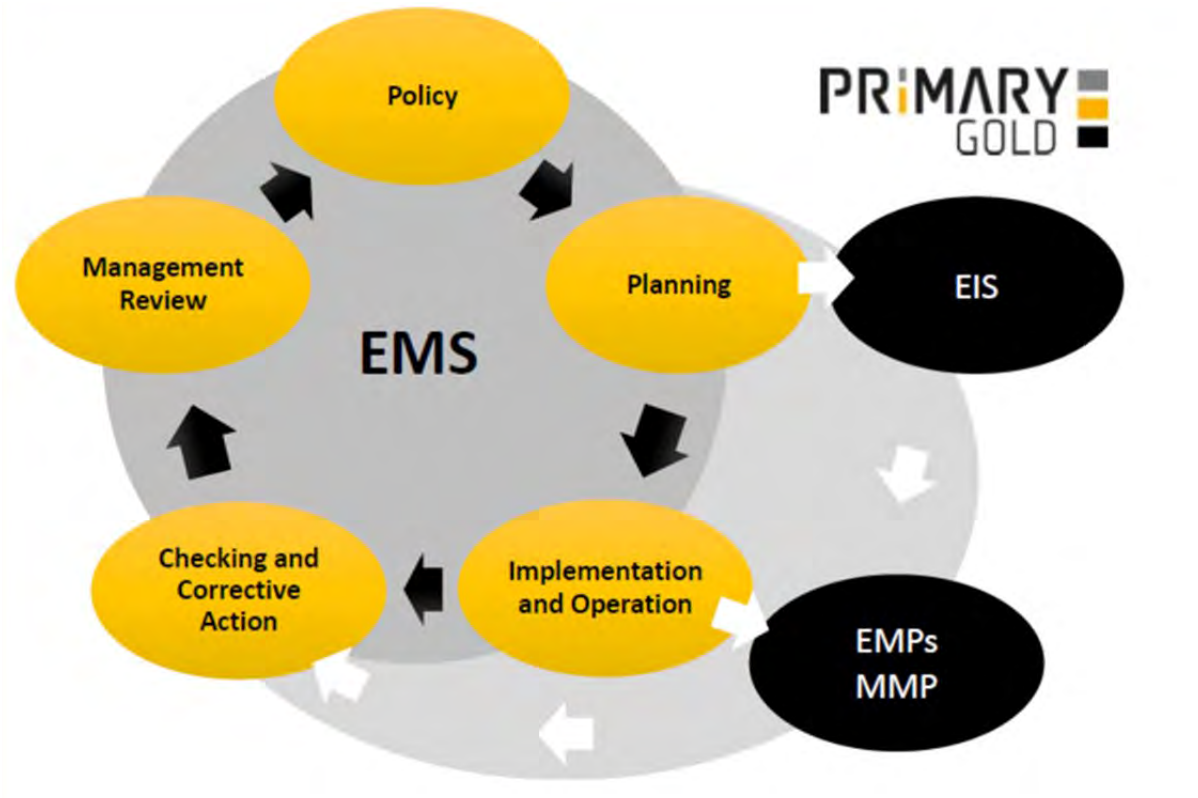

Figure 57: Primary Gold's Environmental Management System for the TGU Project

An outline of the proposed EMS documentation structure is provided in Figure 58 below. The Primary Gold Environmental Policy is the overarching environmental document for the TGU Project. Beneath the Policy in the structure are the EIS commitments and the TGU Project Risk

Register (Appendix 7). The Risk Register has been developed with input from subject matter experts and forms the basis for identifying environmental risks and appropriate controls to ensure they are managed to acceptable levels. A Project EMP and various Topic EMPs (AMD, Water, Biodiversity, Hazardous Materials, Emergency Response, Traffic, Mine Closure and Health and Safety) have been developed to manage the impacts associated with the risks identified in the Risk Register (Appendix 7). These are incorporated as appendices to this EIS.

The Risk Register shall be reviewed and updated on an annual basis, with changes to other system elements made accordingly. The annual review provides a cornerstone for continual improvement of environmental performance.

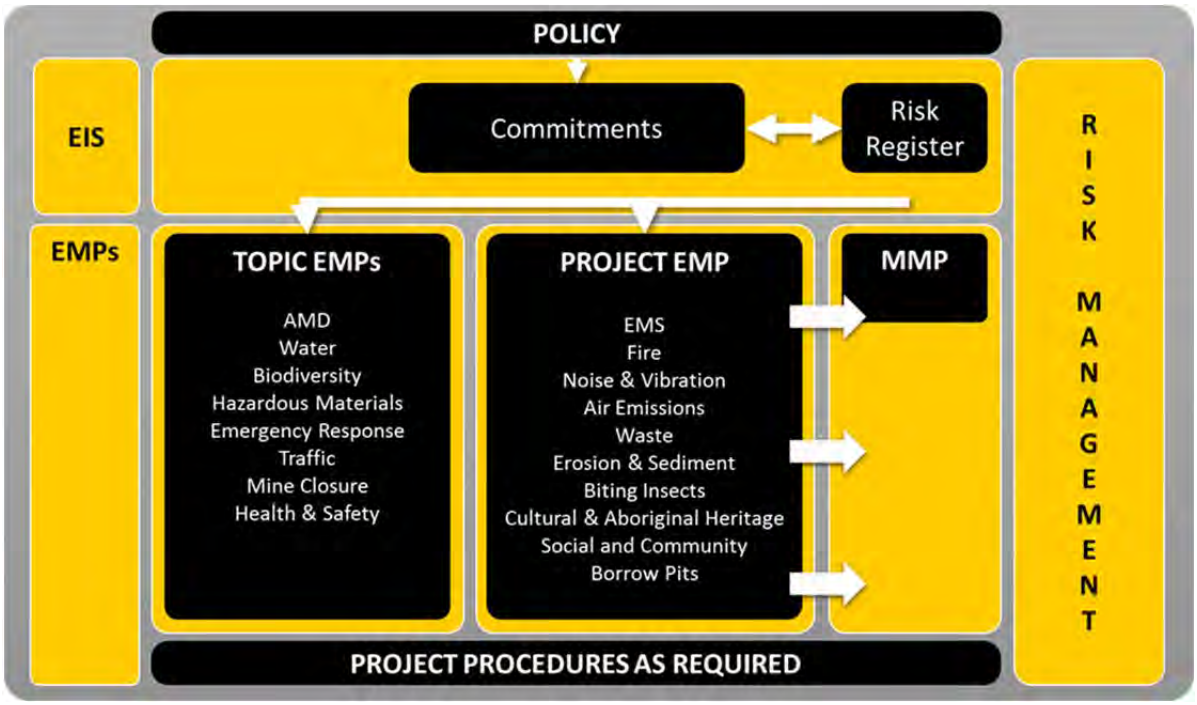

Figure 58: Primary Gold's Environmental Management System Documentation Structure for the TGU Project

15.1.1 Environmental Policy

Primary Gold's Environmental Policy for the TGU Project (Environmental Policy) outlines the commitment to promote sound environmental and community engagement practices, and to undertake all works in accordance with the relevant environmental regulatory requirements. The Environmental Policy shall be reviewed and updated if required on an annual basis. Copies of the Environmental Policy shall be displayed in prominent locations throughout the TGU Project site.

15.1.2 Environmental Requirements

The Primary Gold management team will identify and track the legal and other requirements applicable to its activities. A legislation register is to be maintained, providing a complete listing of applicable Acts, Regulations, Codes of Practice, Standards, Approvals, Licenses and Permits.

As detailed in Section 2.7.2, the TGU Project EMP (Appendix 2), Primary Gold has assembled a consolidated list of commitments made in this Draft EIS. This list of commitments will form the basis of a commitments register, with other commitments and obligations added from sources such as MMPs, licences, laws and agreements.

15.1.3 PROJECT MANAGEMENT STRUCTURE

The proposed management structure for the TGU Project is illustrated in Figure 59.

The Managing Director will hold overall responsibility for the TGU Project. A General Manager Operations will be responsible for the day to day running of the TGU Project and will report to the Managing Director. A number of EH&S Area Managers, Administration, Geology, Mining and Processing) will be responsible for the management of personnel and activities associated with their area. All Area Managers will report to the General Manager Operations.

All EH&S personnel will report to the EH&S Area Manager. Details of the roles and responsibilities of the EH&S Manager, EH&S personnel and all other personnel with environmental responsibilities are provided in the TGU Project EMP (Appendix 2).

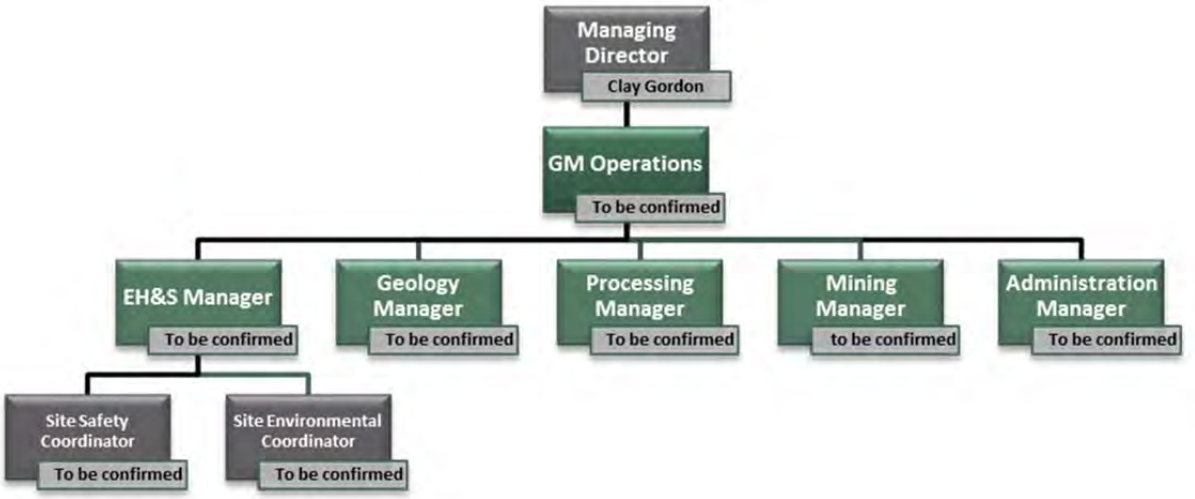

Figure 59: Primary Gold's Proposed Management Structure for the TGU Project

15.1.4 INCIDENT REPORTING AND MANAGEMENT

An Incident Management Procedure has been developed for the TGU Project. All events (e.g. near misses, audit non-compliances), incidents and injuries shall be reported, assessed and recorded as per the Incident Reporting process illustrated in Figure 60 and described below:

- All Hazards and incidents are reported to the appropriate Supervisor as soon as the Hazard or incident is identified;
- All significant safety incidents are recorded and reported to NT WorkSafe under the *Work Health and Safety (National Uniform Legislation) Act* 2011 (NT);
- All significant environmental incidents are recorded and reported to DME as required under Section 29 of the *Mining Management Act* 2001 (NT);

- Where required, copies of the environmental incident report are submitted to the DLPE and a copy submitted to the AAPA where the incident involves damage or destruction of Aboriginal heritage sites; and
- All significant incidents are investigated, with follow up actions allocated to improve systems and prevent recurrence.

Reportable incidents may include environmental events (such as spillages, unplanned discharges, non-compliance with approval or licence conditions, over clearing and fauna deaths), minor illnesses, minor injuries, medically treated injuries, or serious and potentially serious injuries.

Involvement by the management team in routine inspections by EH&S personnel will ensure that Corporate level of commitment to the management of EH&S is apparent to all personnel and contractors. Regular and routine site management meetings and communication protocols will ensure prompt reporting of incidents and follow ups.

In the event of a major environmental or safety incident, the matter will be reported to the General Manager Operations and Managing Director who will coordinate any necessary response according to the Emergency and Crisis Management Plan. It is the responsibility of the General Manager Operations to report the occurrence of a serious accident or critical incident to the CEO of the DME in accordance with Section 29 of the *Mining Management Act* 2001 and conduct a full investigation. Investigations will aim to identify system improvements and will allocate actions to appropriate positions in the organisation to provide for continuous improvement.

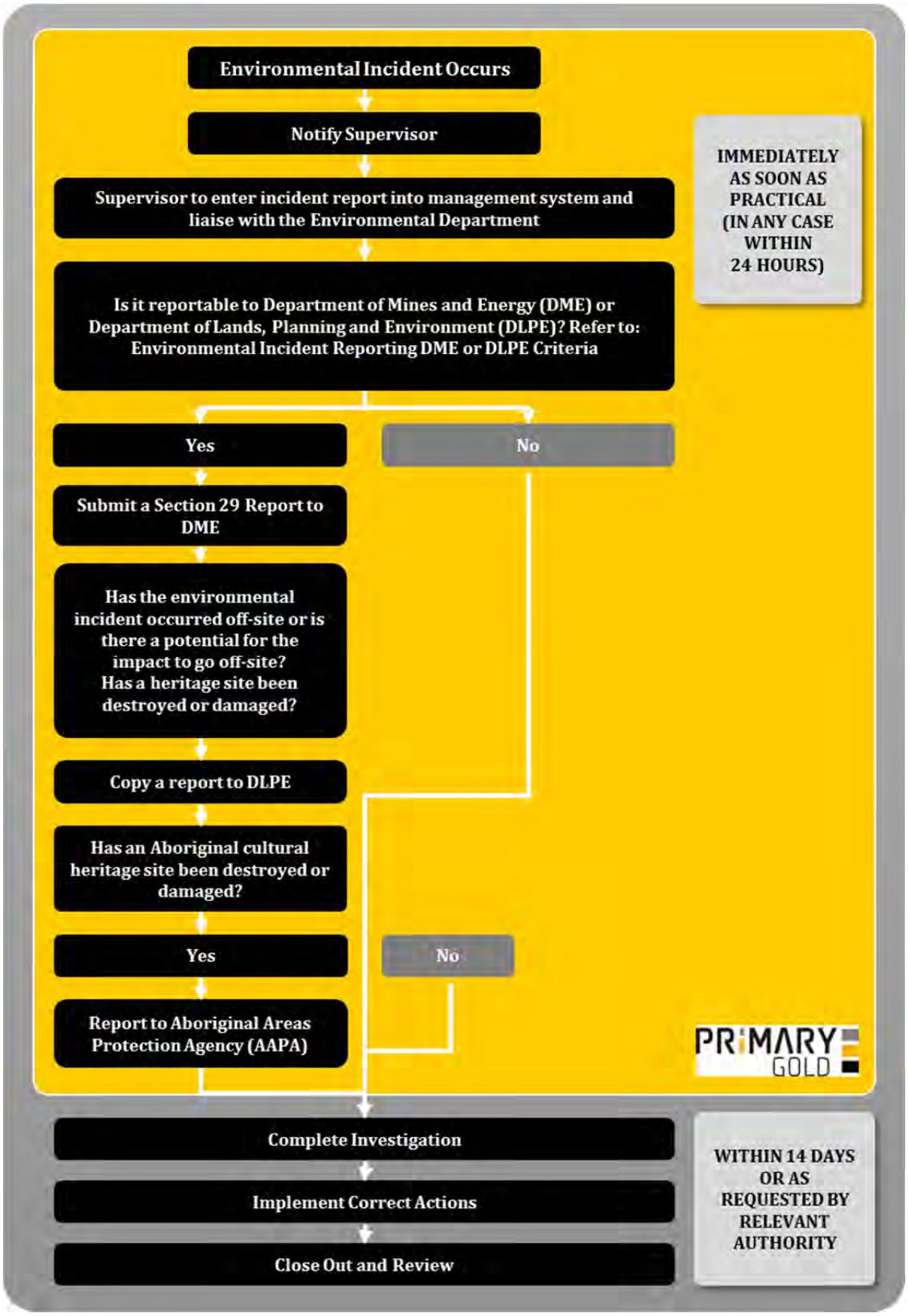

Figure 60: Primary Gold's Environmental Incident Management Process for the TGU Project

15.1.5 EDUCATION AND TRAINING

Primary Gold will develop and provide all employees and contractors working on the site with an induction. The induction will include an introduction to the site and establish the minimum standards required of all persons to the site. An overview of environmental management will be included along with employees' responsibilities with regard to the environment and their own health and safety. All Contractors will be required to ensure their employees have the required level of competence and training, and provide evidence to Primary Gold.

All health, safety and environmental policies will be communicated to employees and contractors. All employees/contractors will be responsible for adherence to corporate and site policies as part of their duty of care and employment contract conditions. Implementation of the policies is achieved by:

- Employment strategies;
- Copies of policies included in tender documents and contracts;
- Induction of employees, contractors, contractor's employees and visitors;
- Displaying of policies in work areas;
- Training programmes; and
- Policies available on the internal server.

Ongoing awareness and communication of environmental issues will be reinforced through email notification, bulletin boards, daily site meetings, tool box talks, training and awareness programmes. Communication meetings will be regularly held and environmental issues raised and discussed as needed.

All staff will be required to follow department guidelines on off-road driving, safety, ground clearing, staged rehabilitation, weed reporting and spread minimisation, and report native and feral animal sightings to the environmental department. They are also expected to report any environmental incidents to their supervisor or manager and take appropriate action.

15.1.6 ENVIRONMENTAL AUDITS AND INSPECTIONS

Regular environmental site inspections shall be conducted throughout the life of the TGU Project. These inspections shall be undertaken by the EH&S Manager (or nominated personnel), utilising an Environmental Inspection Checklist that shall be developed for the TGU Project.

Project performance against Primary Gold and regulatory requirements shall be audited to demonstrate compliance and ensure any non-compliances identified are appropriately managed. Environmental audits shall be regularly conducted during the construction, operationl and closure phases of the TGU Project.

15.1.7 CONTINUOUS IMPROVEMENT

The TGU Project EMS has incorporated various measures that promote continuous improvement throughout the life of the TGU Project. These include:

- Regular audits and inspections to determine environmental concerns and areas for improvement;

- Incident investigations to look at identifying system improvements as part of the investigation process; and
- Annual review of the Risk Register with changes to other system elements made accordingly.

16 CONSULTATION STRATEGY

Primary Gold has developed a register and network of contacts to record the details of key stakeholders. A consultation strategy has been developed and implemented to identify key stakeholders, make direct contact and build relationships and communication. The EIS process itself is expected to enhance the consultation completed to date.

16.1 CONSULTATION UNDERTAKEN TO DATE

In preparing and developing plans for the TGU Project, Primary Gold has consulted with a large number of key stakeholders. Details regarding the stakeholders consulted, nature and topic of consultation, and the outcomes of consultation are provided in Table 54 below.

No negative responses have been received by Primary Gold. Several stakeholders did not respond to direct Primary Gold communication efforts.

Table 54: Consultation Completed

Stakeholder	Nature of Consultation	Topic	Outcome of Consultation
NT EPA	Meetings, exchange phone calls, letters & emails	• EIS approach & process • Clarifications with respect to EIS requirements	• Establish lines of communication • Process guidance • Strategy agreement • Progress updates
DME	Meetings, exchange phone calls, letters & emails	• MMP process with respect to EIS assessment • MMP requirements • Water treatment • Access to Department archives	• Establish lines of communication • Process guidance • Progress updates
DLPE	Exchange phone calls, letters & emails	• Primary Gold introduction and offer of Project information • NT Heritage register search • NT Archaeological Sites database search	• Search results
Power & Water Corp	Exchange phone calls & emails	• Primary Gold introduction and offer of TGU Project information • Potential for provision of power	• Provision of services
DotE	Meetings, exchange emails	• EIS process • Primary Gold introduction and offer of Project information	• Establish lines of communication • Progress updates
Local Government Association of the NT	Primary Gold Email	• Primary Gold introduction and offer of Project information	• No response (no local government overseeing Project area)
NT Worksafe	Exchange	• Covering letter and Risk Management	• Process

Stakeholder	Nature of Consultation	Topic	Outcome of Consultation
	phone calls, letters & emails	Plan submission explanation • Primary Gold Health and Safety Policy certified March 2015 • Primary Gold Risk Management Plan certified 1'5'15 • Primary Gold Health and Safety Management System certified March 15 • Primary Gold Whole of Project Risk Assessment Report certified 1'5'15	requirements and guidance • Receipt of documents acknowledged
Department of Business	Exchange phone calls, letters & emails	• As above	• As above
National Parks and Wildlife Commission NT	Primary Gold phone calls	• Primary Gold introduction and offer of Project information	• No response
Traditional Owners (via local management committees of Mary River and Djukbinj National Parks)	Primary Gold letters	• Primary Gold introduction and offer of Project information	• No response
Northern Land Council	Exchange phone calls & emails	• Primary Gold and TGU Project information • Meeting request • Seek introduction to TOs, establish cooperation arrangement (including employment opportunities)	• NLC unable to assist without a commercial agreement
Government Ministers and Advisors	Meeting & exchange emails	• Chief Minister and various Ministers responsible for Environment, Mines and Energy, Treasury, and Lands and Planning • Primary Gold and TGU Project information • Authorisation process	• Establish lines of communication • Progress updates
Old Mount Bundey Station	Multiple meetings, exchange multiple phone calls & emails	• Access Agreement • Authorisation process • EIS progress updates • Community consultation • Location of new infrastructure • Annual fire management strategy • Annual water sampling strategy • General pastoral operations	• Executed Access Agreement • Positive input & assistance in all aspects to advance Project • Execute annual fire management strategy • Execute annual

Stakeholder	Nature of Consultation	Topic	Outcome of Consultation
		• Activities in the field	water sampling strategy
Neighbouring Pastoralists	Meetings, exchange phone calls & emails	• Marrakai Station, NT Portions 1832, 3698, 6407, 6408, 7230, and 7231 • Primary Gold and TGU Project information • EIS process	• Response, albeit from only a few neighbours, has been positive in all aspects to advance Project
Aboriginal Areas Protection Authority	Meetings, exchange letter, phone calls & emails	• Sacred site survey and certificate	• Certificate received
Amateur Fishers Association of NT Inc.	Meetings, exchange phone calls & emails	• Primary Gold and TGU Project information • EIS process	• Open lines of communication • Progress updates
NT Guided Fishing Industry Association	Exchange emails	• Primary Gold introduction and TGU Project information • EIS process	• Referred Primary Gold to AAFANT for future correspondence
Bushfire NT (Arafura region) & Point Stuart Volunteer Bushfire Brigade	Exchange emails & letter	• Primary Gold introduction & TGU Project information	• Open lines of communication • Assist with annual fire management strategy • Donations, fundraising
Local businesses	Exchange emails & letters	• H&R Quarry, Boral Quarry and Ostojic Quarry • Bark Hut Inn, Corroboree Park and Mary River Retreat • Primary Gold introduction and offer of Project information • Potential for supply of accommodation services • Potential for supply of quarry products	• Open lines of communication • Provision of services

16.1.1 CONSULTATION WITH TRADITIONAL OWNERS

Primary Gold contacted NLC to commence engagement with the TOs and to explore the possibility of entering into a cooperation engagement to enable employment opportunities for local TOs. NLC was not able to assist without a commercial arrangement being concluded between the parties. As a result, Primary Gold will advertise opportunities in the local community as they become available.

Direct contact has also been attempted via mail letters to the Local Management Committees of the Mary River and Djukbinj National Parks, in their capacity as TOs and managers of the land. Primary Gold has not received a response.

16.2 FUTURE CONSULTATION

Open communication will be maintained with the NT EPA, DME and DLPE and all other relevant government departments over the life of the TGU Project. Consultation will be promoted through formal channels such as reports and written communications as well as informal contact as required. Consultation with external stakeholders and in particular landholders, is seen as an important part of all operations from the exploration stage through to mine closure. On-going contact with landowners, specifically the underlying pastoral lease holder, National Park Management Committees, fishers, and other interested community members, will be maintained by Primary Gold throughout the life of the TGU Project.

Primary Gold values the input of stakeholders who have expressed an interest in the potential impacts on fisheries and aquatic ecosystems of Mount Bundey Creek, neighbouring Mary River National Park and wetlands of the Mary River system.

Primary Gold acknowledges the local and regional significance of these features and plans to continue to consult and communicate with key stakeholders on these issues. Primary Gold is aware of the recent Mary River National Park Joint Management Plan (March 2015), and believes the TGU Project is consistent with the key natural, cultural, recreational and historical values of the Park. Primary Gold looks forward to the opportunity for specific consultation with the Management Committee in the future. In addition to undertaking consultation on the construction and operational components of the TGU Project, consultation on the closure and proposed future land use of the TGU Project is also considered to be very important. With this in mind Primary Gold has developed a closure consultation program with the following key objectives:

- Informing the local stakeholders of the closure planning process and allowing opportunities for stakeholder input into planning decisions;
- Informing the local stakeholders of the proposed timeframe for closure, including key closure planning milestones (such as the preparation of a final decommissioning plan) and decision points (such as the designation of end land uses for rehabilitated sites);
- Identifying, and providing a forum for discussing, stakeholder aspirations and concerns regarding closure; and
- Identifying any closure issues not covered in the TGU Project MCP.

The TGU Project provides the opportunity to reduce the overall environmental risks associated with the closure of the Toms Gully site by ensuring tailings are managed in closure consistent with international best practice. The risks associated with the operational phase have been identified, with many avoided via TGU Project design. Risk assessment has identified a series of applicable management measures to further reduce risks. Primary Gold will continue to consult regarding the identification and management of risks for the TGU Project. The consultation plan for mine closure is included in the MCP (Appendix 5).

17 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

In addition to the information provided within the individual Sections of this document, an assessment of the TGU Project against relevant objectives and principles of the *National Strategy for Ecologically Sustainable Development*[3] has been undertaken. Table 55 lists the Core Objectives, Guiding Principles and Mining Objectives that apply to the TGU Project. Details of the key management actions proposed, or already applied in TGU Project design, so the TGU Project meets these objectives and principles are provided. An assessment is also provided that outlines whether the objectives and principles will be met following implementation of the proposed management actions.

[3] Ecologically Sustainable Development Steering Committee, 1992. *National Strategy for Ecologically Sustainable Development*. Department of the Environment and Water Resources, Canberra, Australia. Available at: http://www.environment.gov.au/resource/national-strategy-ecologically-sustainable-development

Table 55: Principles and Objectives of ESD

Principle/Objective	Key Management Actions	Predicted Outcome (Meets Principle/Objective)
Core Objectives		
To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.	• Tailings initially deposited into TSF2 • Tailings from TSF1 and 2 returned to base of pit at end of mine life • Information gathered to determine potential actions to remediate WRDs	The TGU Project meets this objective by addressing the risks associated with Acid and Metalliferous drainage. The TGU Project will remove the risk associated with long-term storage of existing and new tailings by placing them in-pit or in an approved, safe long-term storage facility. The TGU Project will also gather information to determine an appropriate long-term strategy for remediation of the existing WRDs. These outcomes will reduce the potential risk of impact and financial burden on future generations.
To provide for equity within and between generations.	• Tailings initially deposited into TSF2 • Tailings from TSF1 and 2 returned to base of pit at end of mine life • Information gathered to determine potential actions to remediate WRDs	The Toms Gully site has existing tailings, waste rock and pit water that have AMD. The TGU Project provides the opportunity to utilise additional underground mining to improve the environmental status of the site with minimal risk. This meets the objective.
To protect biological diversity and maintain essential ecological processes and life-support systems.	• Clearing of native vegetation minimised • Risks to biological diversity assessed and key actions to minimise risk of off-site impacts: o Water treatment and storage prior to discharge o Tailings from TSF1 and 2 returned to base of pit at end of mine life o Information gathered to determine potential actions to remediate WRDs	The objective of protecting biological diversity will be met via the design of the TGU Project and the implementation of the management actions.
Guiding Principles		
Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.	• Development strategy that provides: o New potential long-term asset (WSD) o Safest long-term storage of tailings and waste rock	The TGU Project design has effectively integrated long and short-term considerations by incorporating a strategy that improves the status of the site by dealing incrementally with the existing site issues and

Principle/Objective	Key Management Actions	Predicted Outcome (Meets Principle/Objective)
	• Rejection of development model that utilised waste rock for construction material and placed waste rock above surface	minimising the likelihood of increasing the scale and extent of the environmental issues at the site.
Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	• Threat of serious or irreversible damage arising from tailings avoided by committing to return to base of flooded pit • Commitment to investigate WRDs to improve scientific certainty	Project design assumed worst case scenario that all existing and new waste rock and tailings would be PAF and adopted a development strategy that minimised the risk.
The global dimension of environmental impacts of actions and policies should be recognised and considered.	• TGU Project design has minimised risks from new AMD by best international practice on tailings closure • Commitments to actions to minimise environmental risks whilst operating including AMD pollution, erosion and impacts on flora and fauna • Commitment to investigate WRDs to improve scientific certainty • TGU Project is a small energy user	Key global threats to the environment have been identified by the World Wildlife Fund (WWF). The TGU Project represents a contribution to risk at a local level for the items represented in *italics:* • *Soil erosion and degradation* • *Infrastructure* • *Pollution* • Water scarcity • By-catch (fisheries) • Effects of climate change • Deforestation • Illegal wildlife trade • Oil and gas development • Over fishing • Illegal fishing The extent of TGU Project impacts are not considered to be significant in the context of global dimensions.
The global dimension of environmental impacts of actions and policies should be recognised and considered.	• TGU Project design has minimised risks from new AMD by best international practice on tailings closure • Commitments to actions to minimise environmental risks whilst operating including AMD pollution, erosion and impacts on flora and fauna • Commitment to investigate WRDs to improve scientific certainty	The UN has not recently provided a list of key global threats. Whilst climate change is a key global threat, there is not yet global coordinated action and policies to address it Key global threats to the environment have been identified by WWF. The TGU Project represents a contribution to risk at a local level for the items represented in *italics:*

Principle/Objective	Key Management Actions	Predicted Outcome (Meets Principle/Objective)
	• Project is a small energy user	• *Soil erosion and degradation* • *Infrastructure* • *Pollution* • Water scarcity • By-catch (fisheries) • Effects of climate change • Deforestation • Illegal wildlife trade • Oil and gas development • Over fishing • Illegal fishing Objective able to be met to the extent of TGU Project impacts.
The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.	• Economic benefits from mining and ancillary activities • Employ local personnel • New focus on Toms Gully mine site that will improve environmental status	The TGU Project will assist the NT to retain mining expertise and economic benefits. The capacity for environmental protection will be enhanced by providing badly needed funds for environmental improvements.
The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.	Adoption of international industry best standards for long-term storage of tailings	Environmental best practice resolution of the existing tailings at Toms Gully.
Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.	None planned.	Primary Gold does not set pricing or public policy. Objective not compromised by TGU Project.
Decisions and actions should provide for broad community involvement on issues which affect them.	• This EIS will be available for public review • The TGU Project will maintain consultation processes with the local community and key stakeholders	The decision as to whether or not to approve the TGU Project, and any resultant conditions of approval will have ample opportunity for community involvement.
Mining Objectives		
To ensure mine sites are rehabilitated to sound environmental and safety standards, and to a level at least consistent with the condition of surrounding	• Tailings initially deposited into TSF2 • Tailings from TSF1 and 2 returned to base of pit at end of mine life	Objective met for the TGU Project, but not fully met for some pre-existing issues. TGU Project will address tailings to international best practice.

Principle/Objective	Key Management Actions	Predicted Outcome (Meets Principle/Objective)
land.	• Information gathered to determine potential actions to remediate WRDs	
To provide appropriate community returns for using mineral resources and achieve better environmental protection and management in the mining sector.	• Payment of royalties and taxes • Additional local employment and contracting opportunities • Remediation of tailings liability	Objective able to be met
To improve community consultation and information, improve performance in occupational health and safety and achieve social equity objectives.	• Commitment to ongoing consultation and information provision • Commitment to H&S MS implementation	Objective able to be met

18 CUMULATIVE IMPACTS

Cumulative impact assessment (CIA) is an approach to environmental impact assessment that aims to consider the effects of multiple actions or impacts on the environment (MCA 2015b). This CIA focuses on:

- AMD (inclusive of its contaminant products) as it is the key source of contaminant risk for the TGU Project and existing Toms Gully site;
- Mount Bundey Creek as the closest receptor;
- Water as the key vector for transport of contaminants within the Mount Bundey Creek catchment (and potentially beyond); and
- Other actions and activities within Mount Bundey Creek catchment.

Thus, the Mount Bundey Creek catchment forms a logical boundary for CIA.

The design of the TGU Project has attempted to avoid impacts wherever practicable. This EIS has assessed the potential environmental impacts for the TGU Project and identified mitigation measures proposed to minimise adverse impacts.

18.1 MOUNT BUNDEY CREEK CATCHMENT

Review of historic water monitoring data and new baseline environmental data has identified that the existing Toms Gully site has waste rock and tailings that are acid producing. The site configuration, drainage and management aims to minimise the risk of potential impacts arising from the existing site features. AMD and the spatial extent of impacts on groundwater and surface water are not well understood due to the limited scope of existing monitoring locations and paucity of data.

18.1.1 GROUNDWATER

The potential for creating new sources of AMD from waste rock has been significantly reduced by retaining waste rock underground or in-pit, where it will be maintained sufficiently far below water level (sub-aqueous) that the oxidation process (the process that creates acid conditions) is unable to be sustained.

The potential for tailings to produce contaminated seepage during operations will be minimised by placing a GCL over the top of the existing tailings prior to deposition. Additional monitoring bores will be located to improve site monitoring of groundwater, including sites adjacent to Mount Bundey Creek.

The long-term potential for tailings to produce contaminated seepage is also significantly reduced in the mine closure phase by storing the tailings sub-aqueous in the base of the pit. In the short-term operating phase, the risks of AMD contamination spreading from tailings into surrounding groundwater is reduced by dewatering of the pit - creating strong groundwater heads to encourage flow in the direction of the pit. This condition will continue to exist for many years after the cessation of mining as the pit slowly refills. With the commitment by Primary Gold to investigate the site further to support modelling of contaminant sources and pathways

(see Section 6), the TGU Project can be expected to reduce the risks associated with contamination of groundwater from AMD.

18.1.2 SURFACE WATER

Potential impacts on surface water from the TGU Project have been reviewed in Section 6.

18.1.2.1 SURFACE WATER QUALITY

The risks associated with discharging the pit water to the environment have been minimised by building the new WSD and treating the water to reduce metals concentrations. The adoption of the 80% aquatic ecosystem protection level from the ANZECC guidelines at the downstream monitoring point is an effective means of ensuring that the cumulative surface water impacts of both the existing site and TGU Project operations are managed to an appropriate standard.

The water quality in Mount Bundey Creek may be influenced by upstream activities. The (non-operational) Rustlers Roost mine is located in sub-catchment 3 (as shown in Figure 34). No plans exist for any new or additional mining at the Rustlers Roost location that would lead to significant changes in surface water quality upstream of the Toms Gully site.

Continued pastoral grazing activities in the Mount Bundey Creek catchment are expected to result in minor impacts on surface water quality. More intensive monitoring and reporting of water quality upstream and downstream of Toms Gully will be used to manage water quality in the creek.

Cumulative impacts upon surface water quality in Mount Bundey Creek are not expected to be significant as higher water discharge standards have been adopted by the TGU Project and no other significant changes are anticipated in the catchment.

Downstream of the TGU Project, impacts on surface water quality may occur as a result of grazing, agricultural or other activities, but no data is available that enables downstream impacts to be quantified.

18.1.2.2 SURFACE WATER QUANTITY

The new WSD will result in significantly reduced flow from sub-catchment 10 as the embankment and management of water levels in the dam is expected to minimise the risk of spillway flow. Mount Bundey Creek has very little flow data available, so impact assessment is based on analysis of catchment areas impacted and not impacted by the TGU Project.

As discussed in Sections 6.3.2.2 and 6.3.8.1, Mount Bundey Creek is approximately 30 km long with 13 km of upstream catchment from the mine site. The creek has several tributaries upstream of the TGU Project area. Downstream from the mine site it drains into Hardies Creek, and then the Mary River.

The key potential impact on surface water flows is the new WSD. The area of the catchment within which the WSD is located is 1.61 km^2 within a total catchment area for Mount Bundey Creek of 117 km^2. This represents a potential loss of 1.4% of the upstream catchment (see

Figure 36). It also represents less than 0.02% of the total Mary River catchment (8,100 km^2). Given the dynamic nature of the environment, reductions in flow proportionate to the lost catchment area are not expected to have noticeable impacts on stream beds, riparian vegetation and fauna.

Considering the small proportion of the Mount Bundey Creek and Mary River catchments for which surface water flows will be captured by the WSD (Figure 37), the impacts of the WSD on flows in Mount Bundey Creek are expected to be minor and therefore, any impacts on the Mary River and other downstream wetland areas would be negligible.

During the operations phase, dewatering will be largely from bores located to the east of the pit located directly amongst the proposed underground workings. The water from bores will be released directly to Lake Bazzamundi, adding to the flows in Coulter Creek on a more continuous basis for the life of the underground mining. No quantitative flow data is available for Coulter Creek. This approach to dewatering has been previously implemented and no other significant water management activities planned or currently occurring have been identified in the Coulter Creek catchment.

18.1.3 BIODIVERSITY

Impacts on biodiversity may be direct (such as be direct removal of native vegetation), or indirect (such as by poor water quality discharged from site impacting on downstream aquatic ecosystems).

No data has been identified to make a quantitative estimate of cumulative clearing of land within the Mount Bundey catchment. The assessment provided in Section 8.3.1.1 utilises mapping completed on the mining leases alone. At a local scale, the disturbance of 93 ha for the TGU Project represents 10% of the mining leases and 16% of areas with native vegetation on the mining leases.

Pastoral, mining and agricultural pursuits have modified vegetation within the Mount Bundey Creek catchment. The disturbance area of 93 ha represents 0.7% of the 13,174 ha Mount Bundey catchment. A review of flora and fauna species likelihood to occur in the vicinity of the TGU Project, and consideration of the vegetation types to be cleared has been completed. The assessment concludes that the TGU Project may directly impact on habitat for the following threatened fauna species:

- Northern Quoll;
- Black-footed Tree-rat;
- Fawn Antechinus;
- Partridge Pigeon; and
- Floodplain Monitor.

It is considered unlikely that disturbance on the scale proposed would lead to significant cumulative direct or indirect impacts on biodiversity and no other activities are anticipated in the catchment that would lead to significant cumulative impacts.

The adoption of the 80% aquatic ecosystem protection standard for water quality at the downstream monitoring location SWTG2 is expected to integrate potential cumulative impacts on water quality from the TGU Project and Toms Gully site. Any potential impacts on water quality associated with upstream activity are expected to be monitored at the upstream

monitoring location SWTG1A. Any additional impacts on water quality would be monitored at the downstream monitoring location SWTG2.

The biological monitoring component of the WMP will assist in monitoring for any cumulative impacts as the biota effectively monitor water quality on a continuous basis and are able to provide an integrated response to any contaminants.

19 CONCLUSION

Toms Gully is an existing mine located approximately 190 km south east from Darwin in the NT. The site has a history of mining with a succession of owners since its original development. Most recently it was owned by CGAO who held the site in Care and Maintenance mode from 2008 to present.

Primary Gold purchased the tenements from CGAO in 2013 and has continued to operate the site in Care and Maintenance mode whilst assessing the feasibility and commencing approvals for a new underground mining phase known as the TGU Project. TGU Project involves the following key activities and features:

- Mining underground to the east of the existing underground workings;
- Extraction of approximately 0.9 Mt of ore;
- Removal of 1.7 Mt of waste rock, replaced underground or in the base of the existing pit (no external storage of waste rock);
- Conventional Carbon in Leach gold processing plant renovated and reused;
- Approximately 0.9 Mt of tailings to be stored in raised TSF2;
- New WSD;
- Treatment of pit water and storage in new dam to facilitate mine dewatering; and
- Clearing of 93 ha of native vegetation.

The proposed TGU Project is expected to have an operational life of approximately four years, provide 104 jobs and allow for improvements to be made to the Toms Gully site.

The TGU Project is being assessed under the *Environmental Assessment Act* 1982 as an Environmental Impact Statement (EIS). This EIS document has integrated the information from a series of consultants who have reviewed, completed studies and advised on different components of the TGU Project. It examines the risks associated with the TGU Project and presents management actions and expected environmental outcomes.

The NT EPA decision to require an EIS for the Project was based on risks detailed in the *Statement of Reasons* for the decision. These included risks to:

- Ground and surface water quality;
- Downstream aquatic ecosystems in Mount Bundey Creek and Mary River National Park;
- Terrestrial biodiversity; and
- Human health and safety.

Identified risks were associated with the following environmental factors:

- Proposed management of water quality and quantities;
- Management of waste rock and other material with potential to produce acidic and/or metalliferous drainage (AMD), neutral mine drainage (NMD) and/or saline drainage (SD);
- Infrastructure designs and construction;
- Weeds;
- Erosion and sedimentation;
- Rehabilitation and closure methods; and
- Socio-economic factors.

This EIS assesses the identified risks, impacts and mitigations. Mitigations are described in more detail in the series of management plans that are provided as appendices to this EIS. Residual risks and contingencies, monitoring and environmental impact conclusions are drawn.

The TGU Project provides an opportunity for a short (3-4 years) mining operation to make a valuable economic contribution to the region, as well as an opportunity to reduce the risks associated with long-term site closure by adopting best practice tailings storage for acid producing tailings (both existing and new). The risk of seepage from re-commencement of tailings storage is minimised in the short-term via the use of a Geosynthetic Clay Liner. In the long-term this risk is avoided by placing the tailings in the base of the pit at closure.

The risks associated with acid-producing waste rock are avoided by retaining all waste rock underground and not using waste rock for construction purposes. The short-term risks associated with potential downstream impacts from discharge of poor quality water are managed by treating the pit water and constructing a new WSD to improve the ability to meet dilution requirements for water discharge.

Combined with further data collection, modelling and investigation into contaminant sources and pathways, the overall environmental benefits of the TGU Project are expected to outweigh the short term risks associated with the TGU Project activities.

In conclusion, the ToR objectives have been set by the NT EPA for key factors relevant to the TGU Project. Assessment has reviewed the risks and mitigation measures and demonstrated that they can be met by the TGU Project.

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21 GLOSSARY

Term	Meaning
3D	Three dimensional
AAPA	Aboriginal Areas Protection Authority
ABA	Acid Base Accounting
AGEC	Australasian Groundwater and Environmental Consultants Pty Ltd
AHD	Australian Height Datum
AMD	Acidic and/or metalliferous drainage
ARD	Acid Rock Drainage
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulphate Soils
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act* 1984
Au	Gold produced
AUSRIVAS	Australian River Assessment System
BOM	Bureau of Meteorology
CEO	Chief Executive Officer
CGAO	Crocodile Gold Australia Operations Pty Ltd
CIA	Cumulative Impact Assessment
CIL	Carbon In Leach
cm	Centimetre
CO_2-e	Carbon dioxide equivalent
COC	Contaminants of Concern
Coffey	Coffey Environments Australia Pty Ltd
Cth	Commonwealth
DIWA	Directory of Important Wetlands in Australia
DLPE	Department of Lands Planning and the Environment (NT)
DLRM	Department of Land Resource Management (NT)
DME	Department of Mines and Energy (NT)
DO	Dissolved Oxygen
DoHCS	Department of Health and Community Services
DotE	Department of the Environment (Cth)
EC	Electrical Conductivity
ECMP	Emergency and Crisis Management Plan
EH&S	Environment, Health and Safety
EH&S MS	Environment, Health and Safety Management System

Term	Meaning
EIS	Environmental Impact Statement
EMS	Environmental Management System
EMP	Environmental Management Plan
Environmental Policy	Primary Gold's Environmental Policy for the Toms Gully Underground Project
EP1	Evaporation Pond 1
EP2	Evaporation Pond 2
EPA Act	*Northern Territory Environment Protection Authority Act* 2012
EPBC Act	*Environmental Protection and Biodiversity Conservation Act* 1999 (Cth)
ESIS	Economic and Social Impact Statement
g	Grams
g/t	Grams per tonne (metric)
GAI	Geochemical Abundance Index
GBS	GBS Gold Australia
GCL	Geosynthetic Clay Liner
GDEs	Groundwater Dependent Ecosystems
GDP	Ground Disturbance Permit
GIS	Geographical Information System
GL	Gigalitre = 1x109 litres = 1x106 m^3
GSP	Gross State Product
H&S MS	Health and Safety Management System
Ha	Hectares
Hazard	Anything that will cause harm and can affect meeting of outcomes and objectives.
Heritage Act	*Heritage Act* 2011
IBC	Intermediate Bulk Containers
ISO	International Organisation for Standardisation
Kg	Kilograms
km	Kilometres
Km^2	Square kilometres (metric)
KR	Kakadu Resources NL
ktpa	Kilotonnes per annum (metric) = $1x10_3$ tonnes per annum
kv	Kilovolt
kW	Kilowatts
kWh	Kilowatts per hour
L	Litres
L&MGSPL	Land and Marine Geological Services Pty Ltd
LOM	Life of Mine
LPG	Liquefied Petroleum Gas

Term	Meaning
m	Metres
m^3	Cubic metres = 1x1 m
MCA	Minerals Council of Australia
MCP	Mine Closure Plan
MEND	Minesite Environmental Neutral Drainage
The Minister	The Minister for the Environment
ML	Million litres
ML	Mining Lease
ML/yr	Million litres per year
MLN	Mining Lease North
mm	millimetres
MMP	Mine Management Plan
MNES	Matters of Environmental Significance under the *Environmental Protection and Biodiversity Conservation Act* 1999 (Cth)
mRL	Metres Reduced Level
MSDS	Material Safety Data Sheets
Mt	Million tonnes
Mya	Million years ago
NAF	Non-acid Forming
NAG	Net Acid Generation
NAPP	Net Acid Production Potential
NATA	National Association of Testing Authorities Australia
NEPM	National Environment Protection Measures
NLC	Northern Land Council
NMD	Neutral Mine Drainage
NOI	Notice of Intent
NT	Northern Territory (of Australia)
NT Act	*Native Title Act* 1993 (Cth)
NTASS Act	*Northern Territory Aboriginal Sacred Sites Act* 1989
NT EPA	Northern Territory Environmental Protection Authority
NTU	Nephelometric Turbidity Units
NVIS	National Vegetation Information System
ODP	Old Decant Pond
Opex	Operational Expenditure
OPSIM	Operations Simulation Model
OWRD	Oxide Waste Rock Dump (WRD1)
pa	Per annum
PAF	Potentially Acid Forming

Term	Meaning
PASS	Potential Acid Sulfate Soils
PCO	Pine Creek Orogen
PER	Public Environmental Report
PET Richness	The proportional representation of key macroinvertebrate taxa belonging to the sensitive macroinvertebrate orders of Plecoptera (stoneflies), Ephemeroptera (mayflies) and Trichoptera (caddisflies). Higher PET richness is indicative of a healthy macroinvertebrate community.
pH	Measure of the acidity or basicity of an aqueous solution
PMST	Protected Matters Search Tool
PPE	Personal Protective Equipment
Primary Gold	Primary Gold Limited
Primary Minerals	Primary Minerals NL
QA	Quality Assurance
QC	Quality Control
Renison	Renison Consolidated Mines NL
Risk Register	TGU Project Risk Register identifying health and safety risks
RO	Reverse Osmosis
ROM	Run of Mine – Storage pad for mixing of ore prior to input into the plant
SD	Saline Drainage
SOCS	Site of Conservation Significance
SSTVs	Site Specific Trigger Values
Supplement	Supplement document to the Draft Environmental Impact Statement
SWRD	Sulphide Waste Rock Dump (WRD2)
t	Tonnes
TDS	Total Dissolved Solids
TGU	Toms Gully Underground
TGU Project	Toms Gully Underground Project
TJ	Terajoules
tpa	Tonnes per annum
tph	Tonnes per hour
tpm	Tonnes per month
TO	Traditional Owner
ToR	Terms of Reference
TPWC Act	*Territory Parks and Wildlife Conservation Act* 2000 (NT)
TSF	Tailings Storage Facility
TSF1	Existing Tailings Storage Facility – Not proposed to be used as part of this Project
TSF2	Existing Tailings Storage Facility – Proposed to be expanded and used as part of this Project

Term	Meaning
µm	Micrometre
w/w	Wet weight
WMP	Water Management Plan
WONS	Weeds of National Significance
WRD	Waste Rock Dump
WRD1	Oxide Waste Rock Dump
WRD2	Sulphide Waste Rock Dump
WSD	Water Supply Dam
WWF	World Wildlife Fund
yr	year