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DRAFT Kaltails

Seepage and Groundwater

Management Plan



Greening the Golden Mile

Version	Revised By	Approval		Date	Reason for Change
		Manager	Document Owner		
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1. FOREWARD

This document represents the first version of the Seepage and Groundwater Management Plan (SGMP) for the Kaltails Tailings Storage Facility (TSF). This Kaltails SGMP has been prepared for a TSF that is currently non-operational. While the targets and objectives are largely derived from Kalgoorlie Consolidated Gold Mines' (KCGM's) operating knowledge of the Fimiston TSFs there are also a number of factors and considerations that are specific to the Kaltails TSF.

The Kaltails SGMP is intended to be a live document which will evolve from the experience gained during operations, routine performance review and feedback from regulators and other stakeholders. This first version represents KCGM's proposed management strategy for the Kaltails TSF once operations commence. It also provides additional contextual information with regards to the target setting philosophy for the Kaltails TSF.

2. INTRODUCTION

KCGM manages the Fimiston Open Pit, Mt Charlotte Underground Mine, Fimiston Mill and the Gidji Roaster on behalf of the Joint Venture Owners Barrick Gold of Australia Ltd and Newmont Asia Pacific Ltd. KCGM was formed in 1989 and mining operations are currently projected to continue until 2021.

Gold ore is processed at the Fimiston Mill, which is located on the eastern side of the Fimiston Open Pit. Tailings generated by the Fimiston Mill are currently directed into the Fimiston I and Fimiston II Tailings Storage Facilities (TSFs). Further tailings storage capacity is required to meet the needs of the Fimiston Gold Mine Operations Extension Project (including the Golden Pike Cutback) and therefore it is intended to recommission the existing Kaltails TSF.

The Kaltails TSF was formerly a part of the Kalgoorlie Tailings Retreatment Project (Kaltails) - a joint venture project between Normandy Australia LTD and the Western Australian Mint. It was in operation during the period 1988 through to 1999. A rise in groundwater levels early in the life of this operation caused detrimental impacts to the vegetation to the south of the TSF. A loss of vegetation was evident peripheral to the TSF and from the timber reserve further to the south. Seepage management activities implemented at the Kaltails TSF in 1992 subsequently controlled the rising groundwater levels.

KCGM has undertaken extensive groundwater modelling and studies to ensure that the Kaltails TSF can be recommissioned without further impact to vegetation in the surrounding area. Potential impacts from recommissioning the Kaltails TSF on surrounding vegetation including the conservation reserve, is considered manageable through implementation of the Kaltails SGMP. This is supported by the EPA who noted in Bulletin 1273 (Dec 07) that; *“With appropriate management from recommissioning, seepage from the historic Kaltails tailings dam is unlikely to cause any further environmental impact.”*

Groundwater in the vicinity of the Kaltails TSF is saline with total dissolved solids (TDS) concentrations varying from background levels of 40,000 mg/L to >100,000 mg/L. The quality of this groundwater is not suitable for potable or agricultural use (stock water and irrigation). The Beneficial Use of the groundwater in the Goldfields region is recognised by the DEC as that defined in the Goldfields Groundwater Area Management Plan (Water Authority, 1994). Based on this Plan, the primary Beneficial Use is for the purpose of mining and mineral processing.

In 2006 KCGM released a Public Environmental Review (PER) – Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning which included the option of recommissioning the Kaltails TSF. A Mining Proposal for the re-commissioning of the Kaltails TSF will be submitted to the Department of Mining and Petroleum (DMP).

In accordance with the Environmental Protection Act, a prescribed premise (i.e. a TSF) requires a works approval for the construction phase and a licence for the operational phase. Both the works approval and licence are administered by the Department of Environment and Conservation (DEC). This Kaltails SGMP has been prepared for submission to the DEC to describe KCGM’s intended strategy for the management of seepage and groundwater at the Kaltails TSF.

Where applicable, this Kaltails SGMP incorporates the current KCGM practices used at the Fimiston TSFs to control seepage and groundwater. However there are a number of factors specific to the Kaltails TSF which required consideration during development of this plan including:

- Natural land surface elevations around the Kaltails TSF mean that the aquifer is shallower (i.e. closer to the surface) than at the Fimiston TSFs (the shallow water table is expected to pre-date all influences from mining activities).
- The Kaltails TSF is on the fringe of the approved Historical Groundwater Model for Fimiston TSFs, therefore a model specific to the vicinity of the Kaltails TSF is required.

- Different performance indicators for the different infrastructure being used e.g. use of electric rather than air bores, greater reliance upon seepage interception trenches.

This document represents the first draft of the Kaltails SGMP and will be reviewed annually with further modifications made where necessary based on experience gained during operations, routine performance review and feedback from regulators and other stakeholders.

3. STANDARDS

DEC Licence Conditions

KCGM has an existing licence for the Fimiston Plant and Tailings Disposal (L6420/1988/12) which expires on 30 September 2011. It is anticipated that this licence will be amended to incorporate the operational phase of the Kaltails TSF.

The licence requirements currently in place for the Fimiston TSFs, which are expected to apply to the Kaltails TSF are as follows:

- Operate in line with conditions related to a
 - groundwater level limit
 - groundwater level target
 - groundwater quality target
 - groundwater monitoring programme
 - vegetation monitoring programme
- Implement an annual audit of the Seepage and Groundwater Management Plan.
- Take measures to further reduce groundwater levels to protect native vegetation, when advised by the DEC.
- Prepare quarterly reports presenting the results of the groundwater monitoring programme.
- Advise the DEC within 24 hours of becoming aware of any measurement which indicates that the groundwater level limit has been exceeded.
- Prepare an Annual Environmental Report
- Prepare an Annual Audit Compliance Report.

DoW Licence Conditions

The Kaltails TSF seepage recovery network is currently operated by Newmont Kaltails Pty Ltd under the Department of Water (DoW) Licence to Take Water GWL159860(1). This licence will be transferred or another licence issued to KCGM for this activity.

The Department of Water (DoW) licence is expected to require that KCGM;

- Operate the Kaltails TSF Borefield in accordance with conditions specified in the prescribed operating strategy.
- Prepare annual reports on the groundwater monitoring data from the Kaltails TSF Borefield.

Construction of Monitoring Bores and Production Bores

New monitoring bores and production bores that are established within the Kaltails TSF Borefield will be constructed according to the requirements of the Department of Environment and Conservation (DEC), and to relevant guidance contained in the following:

- National Minimum Bore Specification Committee - *Minimum Construction Requirements for Water Bores in Australia* (2nd ed., 2003).
- Department of Water (DoW), *Water Quality Protection Guideline No 4 - Installation of Mine Site Groundwater Monitoring Bores*.

If there is an inconsistency in construction standards, the requirements specified by the DEC will take precedence over those specified in the *Minimum Construction Requirements for Water Bores in Australia*.

The reporting of details of newly constructed monitoring bores and production bores will be carried out in-line with DoW requirements. Bore construction plans and progress will be outlined to the DEC in the Quarterly Groundwater Reports.

New monitoring bores will be added to the borefield monitoring schedule within three months of installation. In consideration of the additional infrastructure and commissioning requirements in the case of new production bores, these will be added to the borefield monitoring schedule within three months of commencement of operation.

Collection and Analysis of Groundwater Samples

Groundwater sampling conducted within the scope of this SGMP is according to Australian Standard 5667.1-1998.

Groundwater samples collected within the scope of this SGMP and subsequently submitted for laboratory analysis are analysed by a laboratory with current NATA

Accreditation, and in accordance with the “Standard Methods for Examination of Water and Wastewater-APHA-AWWA-WEF”.

4. OBJECTIVE

The primary objective of the Kaltails SGMP is to operate and monitor the Kaltails TSF and the Kaltails TSF Borefield so as to minimise environmental impact to the local habitat. This is particularly in relation to the prevention of harm to vegetation assemblages as a consequence of rising groundwater levels.

The secondary objective of the Kaltails SGMP is to achieve post closure steady state groundwater levels, which remain stable below prescribed closure targets and without the requirement for active management. It is at this point that the Kaltails TSF Borefield would begin to be progressively decommissioned. After this time it is anticipated that groundwater will naturally deepen toward estimated historical groundwater levels for this area.

5. TARGET DEVELOPMENT

Proposed groundwater level targets for the Kaltails TSF have been developed based upon:

- Existing vegetation assemblages (particularly salinity tolerance and root depth); and
- The current and historical groundwater levels in the area.

The Kaltails TSF is located on the edge of a floodway and there is a substantial fall in ground level elevation across the facility. These natural ground level elevation changes mean that the aquifer is significantly shallower (i.e. closer to the surface) in some areas. Depth to groundwater at the Kaltails TSF ranges from >15mBGL to the northeast to <2mBGL to the southwest.

This groundwater level variation has resulted in marked differences in the type and quality of vegetation assemblages that exist around this facility. Whereas the historical depth to groundwater contours across the Fimiston TSFs are relatively flat and deep – prompting a single depth to groundwater target – the degree in variation across the Kaltails facility warrants that different targets be set for different zones.

Operational Area of the TSF

Groundwater level management is most difficult in the immediate proximity of the TSF with this area having the greatest potential to fluctuate due to cyclic deposition of tailings within the nearby paddock and the location of the supernatant pool on the TSF surface.

The Operational Area of the TSF includes the footprint of the facility plus a halo around the perimeter as shown in Appendix 1. The halo is nominally 100m wide (consistent with that in place at the Fimiston TSFs) and will be subject to annual review to ensure that it remains appropriate. In the case of the Kaltails TSF this halo equates to about 20% of the TSF footprint.

The Operational Area forms the key zone of influence for front line seepage recovery systems i.e. interception trenches and recovery bores. It is not practical to lower groundwater levels within this area while the TSF is operational. As is the case for the Fimiston TSFs, it is proposed that nominated licence conditions are only applicable to bores outside of the TSF Operational Area.

Historical Groundwater Levels and Closure Targets

In March 2006 the first draft of the Historical Groundwater Level Review (HGLR) for the Fimiston TSFs was released. This review determined the extent to which the water table should trend toward during operation and ultimately reach following decommissioning of the TSFs. A contour plan was developed indicating a reasonable estimate of the spatial distribution of groundwater levels prior to the commissioning of the Fimiston I and Fimiston II TSFs. The final model arising from this review was approved by the DEC in April 2008.

The Kaltails TSF is located on the extreme fringe of this model and simply extending the contours developed from the Fimiston HGLR is not considered appropriate. The historical depth to groundwater contours across the Fimiston TSFs are relatively flat and deep whereas the Kaltails TSF has a substantial fall in ground level elevation across the facility. These natural ground level elevation changes mean that the aquifer is significantly shallower (i.e. closer to the surface) in some areas.

For this reason, a separate historical groundwater model has been developed for Kaltails. This model indicates a depth to groundwater ranging from approximately 17m on the northeast point of the facility to 4m on the southwest. This shallows to near surface as the floodway approaches Hannan's Lake.

Whilst the Kaltails historical groundwater model forms a substantial consideration in determining the final depth to groundwater targets for this facility upon closure, numerous other factors must be considered including:

- The changes to the natural topography.
- The hydrological behaviour.
- Previous operating history.
- The current environmental values of the area.
- The impact of neighbouring operations.
- The overall purpose and intent.

Thus the final closure targets still need to be determined and agreed by the DEC. KCGM propose however that the closure targets should simply mirror the operational targets set out below with the proviso that the facility reaches some demonstrable equilibrium where these levels can be sustained without any further pumping effort.

Operational Groundwater Targets

It is proposed that two distinct depth to groundwater targets be applied to the Kaltails TSF during operation. The boundaries separating these target zones are largely based around the requirements of the identified vegetation assemblages surrounding the TSF. In addition to this however, these zones also take in to consideration all of the abovementioned factors that apply to closure target setting.

The first zone – Zone A – is the larger zone and encompasses the majority of the area surrounding the Kaltails TSF (Appendix 1). Vegetation surveys conducted during 2009 identified this area as mainly transitional Eucalyptus open woodland (refer to maps in Appendix 2). The proposed target depth to groundwater for Zone A is 6m with a limit of 4m. This is consistent with the current Fimiston target which has been effective in protecting Eucalypt woodland vegetation.

It is proposed that the western boundary of Zone A is the boundary of Prospecting Lease P26/2373. This boundary has been selected in consideration of the proposed TSF expansion at the neighbouring Silver Lake operation and is intended to give some buffer between this facility and the Kaltails TSF. To the south it is proposed that this zone be bounded by an alignment based upon the southern boundary of General Purpose Lease G26/166.

The second zone – Zone B – applies to the area to the southwest of the Kaltails TSF (Appendix 1). The proposed target depth to groundwater for Zone B is 2m with a limit of 1m. The northern and eastern boundaries of this zone have been established based on vegetation surveys conducted during 2009.

Toward the southwest and to Hannan's Lake the groundwater table naturally tends toward surface and so there must be some limit to which this target applies in this

direction. It is proposed that Zone B is defined by an alignment from the southern boundary of General Purpose Lease G26/165 to the south and by the western boundary of the Prospecting Lease P26/2373 to the west.

It is further proposed that this junction be truncated by an approximation of the 2m GWL contour as indicated by the Kaltails historical groundwater model. The reason for this being that beyond this point groundwater is expected to be naturally less than 2m in any case.

6. GROUNDWATER LEVEL MANAGEMENT

The primary focus of the Kaltails SGMP is groundwater level management as the major environmental value in the area around the TSF is vegetation. Protection of vegetation requires the depth to groundwater to be maintained sufficiently deep so as not to impact on the soils or roots from which plants source water.

Numerous factors ultimately contribute to the effectiveness of the SGMP ranging from management of the active tailings deposition on top of the facility to operation of the seepage recovery system below. Various monitoring mechanisms must be in place to ensure that these unit operations are managed effectively. The following section describes some of the key performance measures proposed by KCGM.

Groundwater Level Targets

The depth to groundwater targets for the proposed Zone A and Zone B areas surrounding the Kaltails TSF (Appendix 1) are set out in Table 1.

Table 1 Proposed Groundwater Level Targets for the Kaltails TSF

Groundwater Area	Minimum Target Depth to Groundwater (mBGL)	Stretch Target Depth to Groundwater (mBGL)
Zone A	4	6
Zone B	1	2

TSF Supernatant Pool Size

The supernatant pool size is a significant contributor to the seepage rate. To limit the potential for seepage, the size of the supernatant pools on top of the Kaltails TSF will be kept to a minimum. Pool size is monitored through a combination of daily visual

inspections and fortnightly area surveys with the rate of reclamation of this water being adjusted to maintain target levels.

The aim is that the pools will be maintained below a maximum of 15% of the total surface area of the paddock in which deposition is occurring. The paddock surface area will be that value determined by survey upon the completion of each wall raise. This is in accordance with current targets in place under the Fimiston SGMP.

In the event that the area of the supernatant pool becomes greater than the target size (e.g. high rainfall), the use of decant water will be prioritised in preference to groundwater derived from remote saline water borefields (i.e. the Northern Borefield and Southern Borefield).

Seepage Recovery

KCGM has undertaken extensive groundwater modelling and studies to ensure that the Kaltails TSF can be recommissioned without further impact to vegetation in the surrounding area. The impact of seepage from the Kaltails TSF will be managed via operation of seepage interception trenches and production bores, and in accordance with this SGMP.

All water that is recovered from the Kaltails TSF Borefield is returned to the Fimiston Processing Plant. The operation of this system has priority over the sourcing of water from other remote borefields.

Under the Fimiston SGMP, KCGM target an average of 90% of the installed production bores to be operational over a full calendar month with provisions to facilitate plant shutdowns as well as maintenance to the broader water transfer system.

At this early stage it is considered that a similar commitment in the Kaltails SGMP would be of limited value for several reasons:

- The borefield is yet to be developed and the operating requirements remain to be established.
- The borefield will be developed on a progressive basis in order to meet forecast seepage loads prior to steady state being achieved. Thus the full compliment of bores will not necessarily be operating from the outset.
- The seepage recovery system will incorporate a seepage interception trench to handle a portion of the seepage load and specific performance measures need to be developed for the management of this.
- The differential in water levels across the facility may result in critical focus areas where a simplified percentage availability target may not suffice.

The ultimate gauge of seepage recovery system performance is the achievement of the groundwater level targets. KCGM proposes that specific system performance indicators be developed as appropriate during the annual Kaltails SGMP review.

Groundwater Monitoring

Groundwater Level Monitoring

Kaltails TSF monitoring requirements are still to be set by the DEC. It is envisaged that these will be based on the requirements in place for the Fimiston TSFs. Groundwater quality and level trends will be monitored in accordance with an agreed schedule and a quarterly report will be provided to the DEC. Depending on the monitoring results and in consultation with the DEC, the requirement for additional groundwater pumping capacity may be identified.

An increase in groundwater recovery capacity may be triggered by the criteria outlined in Table 2:

Table 2 Groundwater Trend Response

Groundwater Trend	Action
Groundwater level <4 mBGL in Zone A	Increase pumping capacity within two quarters
Groundwater level >4 mBGL and <6m BGS in Zone A	Increase pumping capacity within three quarters
Groundwater level <1 mBGL in Zone B	Increase pumping capacity within two quarters
Groundwater level >1 mBGL and <2m BGS in Zone B	Increase pumping capacity within three quarters
Groundwater quality >0.50 mg/L WADCN in a Production or Monitoring Compliance Bore	Increase pumping capacity within three quarters

An increase in pumping capacity can be in the following forms:

- Maximise use of near-by production bores.
- Upgrading existing infrastructure, such as pumps and pipelines.
- Construction of new production bores.

Coincident with any pumping capacity increase, the degree of monitoring required in that area may also be reviewed.

Short-term increases in groundwater levels in response to significant rainfall events do not necessarily trigger the requirement to increase pumping capacity.

The key steps/factors that determine the timeframe required for new bore installation are as follows:

- Expert consultation on water level trend – whether long/short term or event related (rainfall).
- Identification of bore locations.
- Licence application and approval to construct bores.
- Drilling contractor availability.
- Equipping of bores and possible upgrading of related services (air, power, piping).

Groundwater Quality Monitoring

KCGM propose to continue to sample several monitoring bores from the former Kaltails operation - located in the area between the Kaltails TSF and Hannan's Lake - to monitor for possible seepage flows containing WAD-cyanide. This is currently measured against a limit of 0.5mg/L for groundwater as set by the Fimiston DEC Licence and it is proposed that this limit be adopted for this facility.

KCGM also monitors surface waters for WAD-cyanide against a limit of 50mg/L as set by the International Cyanide Management Code. Surface water monitoring is performed for the purpose of protecting wildlife from exposure to WAD-cyanide. It is proposed that where surface water is exposed via trenches and supernatant pools, these will be monitored for WAD-cyanide, pH and EC on a monthly basis.

The proposed WAD-cyanide monitoring programme for Kaltails is summarised below in Table 3.

Table 3 Kaltails Groundwater Quality Monitoring Schedule

Parameter	Sampling Frequency	Monitoring Site
SURFACE WATER		
pH, EC & WAD-cyanide	Monthly	Kaltails seepage interception trench, Kaltails TSF supernatant pond, Kaltails spigot
GROUNDWATER		
pH, EC & WAD-cyanide	Quarterly	Kaltails monitoring bores AJ & AK

7. VEGETATION MONITORING

To confirm that the Kaltails SGMP is protecting the environmental value of the area (i.e. vegetation), KCGM propose to implement a vegetation monitoring programme for the Kaltails TSF (Appendix 3 Draft Kaltails TSF Vegetation Monitoring Programme).

In 2005, as part of the Fimiston SGMP a review was undertaken of the Fimiston TSF Vegetation Monitoring Programme. The aim of the review was to determine if the photographic monitoring adequately represented the health of vegetation surrounding the TSFs to ensure that the environmental value of the area is being protected. The findings of this review were that:

- Photographic monitoring was deemed to be an adequate monitoring technique;
- Photographic monitoring should cover vegetation surrounding the entire TSF; and
- Landscape Function Analysis (LFA) monitoring should be implemented in conjunction with photographic monitoring to give a more robust assessment of vegetation health.

The Draft Kaltails TSF Vegetation Monitoring Programme was therefore adapted from the current Fimiston TSF Vegetation Monitoring Programme.

Results from this vegetation monitoring programme shall be reported annually as part of the KCGM Annual Environmental Report submitted by 31st March each year.

8. REVIEW

It is intended that KCGM's performance against the Kaltails SGMP will be audited annually and the plan revised based upon audit findings as well as recommendations from the DEC and key stakeholders.

Groundwater data will be reviewed and reported to the DEC on a quarterly basis. This will continue and will include commentary on performance against Kaltails SGMP targets.

The review of the groundwater component of the Kaltails SGMP will be completed by an experienced, independent groundwater hydrogeologist. Mr Peter Clifton of Peter Clifton and Associates is presently undertaking this role in regard to the Fimiston SGMP.

The review of the vegetation monitoring component of the Kaltails SGMP will be completed by an experienced, independent vegetation specialist. Mr Jim Williams and Ms Andrea Williams of Botanica Consulting are presently undertaking this role in regard to the Fimiston Vegetation Monitoring Programme.

9. DELIVERABLES

The scope of this Kaltails SGMP is wide and has many targets. Some of these form general goals intended to demonstrate KCGM's commitment to continuous improvement (eg increasing pumping capacity dependent on aquifer response). Others may form specific actions that have clear paths and well defined end points (eg install 15 monitoring bores by December). These are detailed in the following two tables.

The timing for action completion dates may be subject to reasonable change based upon factors such as operational changes, additional consultation requirements or the identification of higher priority issues. Any changes to delivery dates will be made in consultation with the DEC.

The achievement of all targets in this SGMP is not necessary to confirm the success of this plan. The measure of success is that the Beneficial Use of the groundwater and condition of the vegetation around the TSFs are not being impacted.

The following tables describe the initial goals and specific actions that have been proposed for the Kaltails TSF. For the actions the timing of delivery is project dependent and thus generic timeframes are used.

Table 4 SGMP Goals

Item	Objective	Goal
TSF Pool Size	Minimise the pool size by operating within a target area.	<15% on the operating paddock under routine operation.
Groundwater Level	Achieve groundwater level targets.	Achieve and maintain depth to groundwater >6 mBGL in all Monitoring Compliance Bores in Zone A Achieve and maintain depth to groundwater >2 mBGL in all Monitoring Compliance Bores in Zone B
Groundwater Quality Monitoring	Maintain groundwater quality (WAD cyanide levels less than 0.5 mg/L).	Maintain groundwater quality <0.5 mg/L WAD cyanide in all Compliance Bores.
Vegetation Monitoring	Assess the effectiveness of the SGMP.	To demonstrate the ongoing effectiveness of the SGMP.

Table 5 SGMP Specific Actions

Item	Objective	Actions	Timing
Closure groundwater level targets	Reach agreement on groundwater level targets for this facility for post closure.	<ul style="list-style-type: none"> Meet operational groundwater level targets in all Compliance Bores 	Each quarter from project commencement
		<ul style="list-style-type: none"> Reach agreement on appropriate post-closure targets. 	Before completion of first audit and revision of Kaltails SGMP
Kaltails SGMP Annual Audit	Kaltails SGMP performance to be reviewed annually	<ul style="list-style-type: none"> Audit Review to be undertaken by external consultant 	Approx 1 year from project commencement
		<ul style="list-style-type: none"> Draft Audit Report to undergo public consultation via the CRG. 	
		<ul style="list-style-type: none"> Final Audit Report to be submitted to the DEC as per licence conditions. 	
Kaltails SGMP Annual Review	Kaltails SGMP document to be reviewed and updated annually	<ul style="list-style-type: none"> Review of SGMP to be undertaken by KCGM (including feedback received via Annual Audit) 	Approx 1 year and two months from project commencement
		<ul style="list-style-type: none"> Reviewed SGMP to be approved by DEC. 	
Vegetation Monitoring	Vegetation monitoring aspect of Kaltails SGMP to be completed annually	<ul style="list-style-type: none"> Annual Vegetation Monitoring to be completed by external consultant in accordance with agreed programme. 	Approx 1 year from project commencement
	Confirm that the Kaltails SGMP is protecting the environmental value of the area. Vegetation monitoring aspect of SGMP to be reported annually	<ul style="list-style-type: none"> Annual Vegetation Monitoring report prepared by external consultant to be submitted to DEC as part of the AER. 	First report referring to Kaltails operations in March 2012

GLOSSARY OF TERMS

Annual: A twelve (12) month period.

Aquifer: A zone of rock or soil which is saturated with water and through which water can easily move. An aquifer is created when all the cracks and voids in soil and rock are filled with water.

As: Symbol for the element, arsenic.

Beneficial Use: The current or future uses of an identified resource. Beneficial Use is also referred to as the Environmental Value of a resource. Beneficial use designations provide objectives for the management, use and protection of the resource.

Bore: A narrow, normally vertical hole drilled in soil or rock to monitor or withdraw groundwater from an aquifer.

Borefield: A group of bores to monitor or withdraw groundwater.

BGL: Is the groundwater level or depth below ground level.

Compliance Bores: those bores outside the Kaltails TSF Operational Area and within designated Zone A and Zone B as shown in Appendix 1.

Cu: Symbol for the metal, copper.

Cyanide (Free, WAD and Total): These are the three typical measurements of cyanide in groundwater.

- Free is a measure of the concentration of unassociated cyanide ions in solution.
- WAD (Weak Acid Dissociable) is a measure of the concentration of cyanide ions that when mixed in a weak acid will revert to the free cyanide state. This value includes the free cyanide concentration.
- Total is a measure of all forms of cyanide in solution. This value includes the WAD cyanide concentration.

Decant Water: Is water recovered from the tailings storage facility surface after the solids (tailings) have settled.

DEC: Department of Environment and Conservation.

DoW: Department of Water

Electrical Conductivity (EC): A measure of the electrical current transferred through water. The EC of water is a relatively reliable indicator of its TDS or Salt content.

Environmental Value: A quality, characteristic or attribute that is conducive to ecological health or any beneficial use, which requires protection from the effects of pollution, waste

discharges and deposits. Two types of environmental value are considered, ecological and social.

Fe: Symbol for the metal, iron.

Groundwater: Any water contained below the earth's surface. It includes moisture contained inside soil and rock, and water accumulating in gaps between soil particles and in cracks in the rock.

Groundwater Level: The upper surface of groundwater, or the level below which an unconfined aquifer is permanently saturated with water, (also known as water-table, piezometric level).

Groundwater Quality: The chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

Historic Groundwater Levels: Depth to groundwater that is agreed to be reasonably indicative of natural levels that occurred prior to operations commencing.

HGLR: Historical Groundwater Level Review.

Hg: Symbol for the metal, mercury.

Increased Pumping Capacity: Increased abstraction of groundwater from an area which may be achieved by additional bore installation, pump or pipeline upgrade.

Kaltails TSF Borefield: This is the bore network that is constructed around the Kaltails TSF and comprises all of the Production and Monitoring Bores and associated infrastructure. This is distinct from the Kaltails Borefield which is a saline water supply borefield located approximately 5km further to the southeast.

Licence: A statutory document, issued under Part V of The Environmental Protection Act, permitting a person or organisation to discharge, emit, or deposit wastes into the environment subject to a variety of conditions relating to control measures, monitoring, volume, timing, nature, and composition of waste. Licences may often be varied or rescinded at any time. Breaches of licencing conditions may result in prosecution.

Monitoring: Is the process of sampling and measuring certain parameters.

Monitoring Bore: A small diameter bore that is used for monitoring groundwater quality and groundwater levels. These are not used for groundwater extraction and are not typically able to be equipped to become a Production Bore.

NATA: National Association of Testing Authorities.

Operational Area: The area of the Kaltails TSF that includes the immediate footprint of the facility plus a halo around the perimeter in which infrastructure associated with the operation of the facility is located. The halo is a maximum of 100m wide.

pH: a measure of the acidity or the basicity of a solution ranging on a scale from 0 (acidic) to 7 (neutral) to 14 (basic).

Pumping: Extraction of water from saturated soil (groundwater) using an electric, wind powered or compressed air pump and bore hole.

Production Bore: A large diameter bore that is primarily used for extracting groundwater to lower the groundwater level. It is usually permanently equipped with a pump and associated power and pipeline services.

Paddock: An area which the TSF is divided into which the tailings slurry is deposited. The recommissioned Kaltails TSF will be a two paddock facility.

Potable: Water of a quality suitable for drinking.

Quarterly: A three (3) month period.

Seepage: Water infiltration into the soil beneath the TSF.

SGMP: Seepage and Groundwater Management Plan.

Supernatant Pool: This is the pool of water that forms on the surface of an active TSF paddock and comprises water that has bled to the surface from the tailings slurry as it settles. The water then flows to the low point on the TSF surface from where it is reclaimed for reuse in the Plant.

Tailings: Finely ground rock from which minerals have been removed which may include process chemical residues; discarded portion of the ore.

Tailings Storage Facility (TSF): An engineered structure (holding area) that consists of embankments designed for storing tailings usually with a mechanism to recover water for re-use.

Total Dissolved Solids (TDS): A measure of the weight of dissolved solids in water. This is the salt content of the water.

Trace Elements: Elements that occur at very low concentrations.

Transect: A common ecological tool used to observe vegetation along a defined path.

Triennial: A three (3) year period.

Water Table: The upper surface of the groundwater. The zone immediately below the watertable is saturated. The aim of the Groundwater Management Plan is to keep the watertable at least 4 metres from the soil surface.

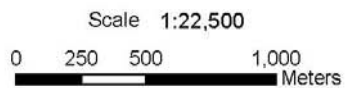
WRC: Water and Rivers Commission, now part of the Department of Environment.




Zn: Symbol for the metal Zinc.

Appendix 1

Kaltails TSF Proposed Groundwater Target Zones including the TSF Operational Area Halo.

DRAFT



- Legend**
-  ZONE B
 -  ZONE A
 -  TSF OPERATIONAL AREA

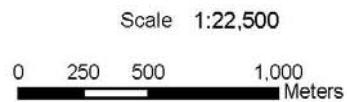
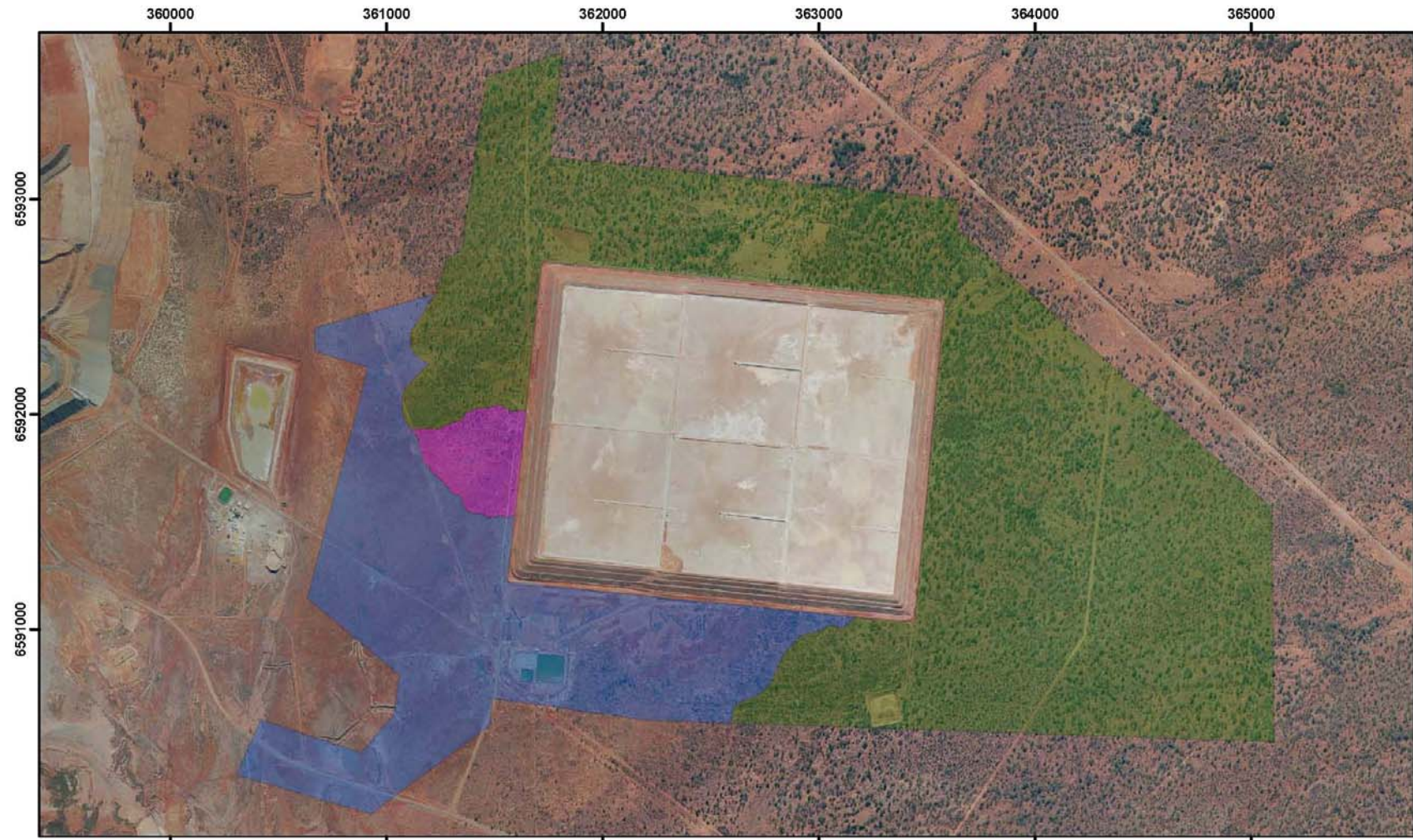


GDA 1994
MGA Zone 51




KALTAILS GROUNDWATER ZONES

Appendix 2

Kaltails TSF Vegetation Survey Maps



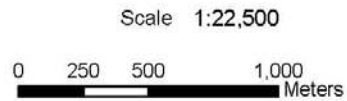
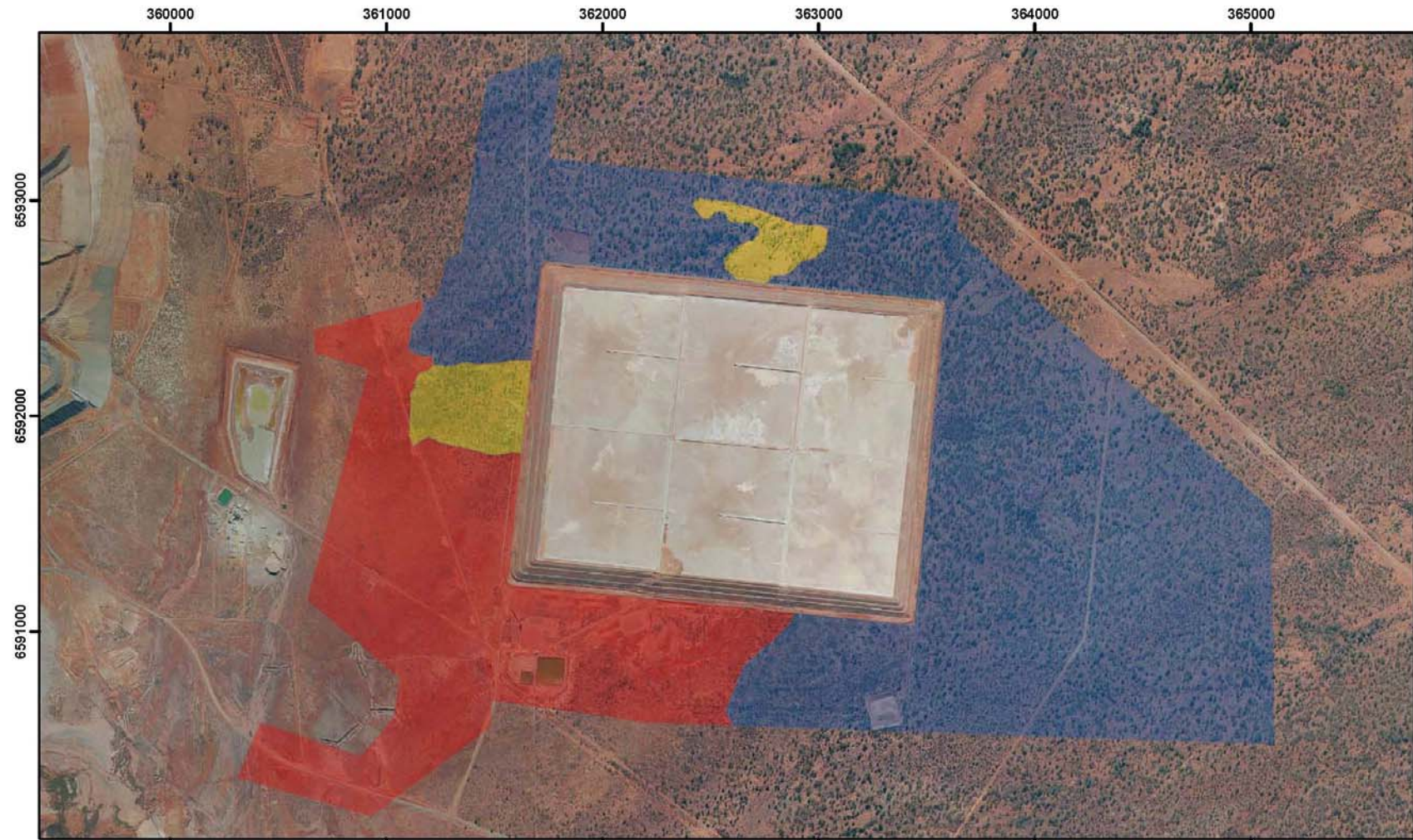
Legend

-  Eremophila scoparia/Saltbush shrubland
-  Transitional Eucalyptus woodland
-  Saltbush/Samphire vegetation



GDA 1994
MGA Zone 51

KALTAILS TSF VEGETATION GROUPS
October 2009



KALTAILS TSF VEGETATION CONDITION
October 2009

Appendix 3

Draft Kaltails TSF Vegetation Monitoring Programme

DRAFT



ABN 97 009 377 619

Vegetation Monitoring Programme

Kaltails Tailings Storage Facility



Greening the Golden Mile

Prepared by: KCGM
Date: November 2009

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1 Introduction

In 2006 Kalgoorlie Consolidated Gold Mines (KCGM) released a Public Environmental Review (PER) – Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning which included the option of recommissioning the Kaltails TSF. The primary purpose of the PER is to provide information on how the proposal may impact the environment and how those impacts may be mitigated and managed so as to be environmentally acceptable.

A rise in saline groundwater levels early in the Kaltails TSF operation caused detrimental impacts to the vegetation to the south of the TSF. A loss of vegetation was evident peripheral to the TSF and from the timber reserve further to the south. Seepage management activities implemented at the Kaltails TSF in 1992 subsequently controlled the rising groundwater levels.

The Kaltails TSF is located near the Lakeside Miscellaneous Conservation Reserve (No. 19214). This reserve declared in 1957, is managed by Department of Environment and Conservation (DEC) for the preservation of sandalwood (*Santalum spicatum*). The reserve is located approximately 800 m to the south-southeast of the Kaltails TSF (Figure 1). The area affected by seepage was excised from the conservation reserve in 1995.

Potential impacts from recommissioning the Kaltails TSF on surrounding vegetation including the conservation reserve, is considered manageable through implementation of the Kaltails Seepage and Groundwater Management Plan (SGMP). This is supported by the EPA who noted in Bulletin 1273 (Dec 07) that; *“With appropriate management from recommissioning, seepage from the historic Kaltails tailings dam is unlikely to cause any further environmental impact.”*

The primary focus of the SGMP is groundwater level management around the TSF to protect vegetation. This requires the depth to groundwater to be maintained sufficiently deep so as not to impact on the soils or roots from which plants source water. To confirm that the SGMP is protecting the environmental value of the area surrounding the Kaltails TSF (i.e. vegetation), KCGM undertakes a vegetation monitoring programme.

In 2005, as part of the Fimiston SGMP, KCGM engaged a suitably qualified professional to review the Fimiston TSFs vegetation monitoring programme. The aim of the review was to determine if the photographic monitoring adequately represented the health of vegetation surrounding the Fimiston TSFs to ensure that the environmental value of the area is being protected.

The findings of this 2005 review have also been considered and incorporated into this Kaltails TSF vegetation monitoring programme. These findings were that:

- Photographic monitoring was deemed to be an adequate monitoring technique;
- Photographic monitoring should cover vegetation surrounding the entire TSF; and
- Landscape Function Analysis (LFA) monitoring should be implemented in conjunction with photographic monitoring to give a more robust assessment of vegetation health.

LFA gives additional information to assess vegetation condition and provides a scientific data component. LFA is a monitoring procedure that assesses the functional performance of a developing ecosystem, including the assessment of factors such as nutrient cycling, water management and species composition and diversity.

The combination of LFA and photographic monitoring enhances the quality and quantity of monitoring relating to vegetation surrounding the TSF, which will help to demonstrate the effectiveness of the SGMP to protect the environmental value of the area.

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2 Vegetation Monitoring Programme Overview

This programme includes both photographic monitoring and Landscape Function Analysis (LFA) of the vegetation surrounding the Kaltails TSF. A summary of the programme is outlined below:

Site Name	Monitoring Points	Number of Photos	Number of LFA Sites
15 - 22	8 LFA and photo sites	32	8
Analogue 3	1 Analogue Site	4	1
*Proposed 23	1 LFA and photo site on Timber Reserve	4	1
Total		40	10

Photographic and LFA monitoring will be conducted annually in early spring by a professional photographer or technician skilled in plant identification. The findings will be reported each year in the KCGM Annual Environmental Report.

The monitoring programme is outlined in Appendix 1. The table indicates the specific monitoring undertaken at each site. Location plans of the vegetation monitoring programme are shown in Figure 1.

Given the history and proximity of the Lakeside Miscellaneous Conservation Reserve to the south-southeast of the Kaltails TSF, KCGM is also proposing that an LFA and photographic monitoring site be established within this Timber Reserve. This site would be located in the northern corner of the Reserve (Figure 1).

It is understood that any person undertaking monitoring within the Timber Reserve will need to complete a Regulation 4 application (Appendix 2) prior to entering the Reserve. The Regulation 4 Authority is an application to enter DEC land for the purpose of undertaking research. All sections of the application form must be completed and at least 20 working days are required to process the application.

While a Regulation 4 approval is sought each time monitoring is undertaken (i.e. annually for this programme), it is also possible to have a Regulation 4 approval extend over a longer period (i.e. 5 years). However any changes to the approved applicant or participants within this period would require submission of another application for approval.

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3 Appendix 1: Kaltails TSF Vegetation Monitoring Programme Detail

Transect	Photo Direction and Distance	Photo Monitoring	LFA Monitoring
15	TSF Corner - SW (0m, 100m, 200m, 300m)	4	1
16	TSF Wall - W (0m, 100m, 200m, 300m)	4	1
17	TSF Corner - NW (0m, 100m, 200m, 300m)	4	1
18	TSF Wall - N (0m, 100m, 200m, 300m)	4	1
19	TSF Corner - NE (0m, 100m, 200m, 300m)	4	1
20	TSF Wall - E (0m, 100m, 200m, 300m)	4	1
21	TSF Corner - SE (0m, 100m, 200m, 300m)	4	1
22	TSF Wall - S (0m, 100m, 200m, 300m)	4	1
Analogue 3	SW (0m, 100m, 200m, 300m)	4	1
*Proposed 23	Timber Reserve – N (0m, 100m, 200m, 300m)	4	1

4 Appendix 2: DEC Regulation 4 Authority Application Form



Department of Environment and Conservation

RETURN APPLICATION TO:
 Department of Environment and Conservation
 Wildlife Licensing Section
 Locked Bag 30 Bentley Delivery Centre, Western Australia, 6983
 Fax (08) 9334 0278

REGULATION 4 AUTHORITY

APPLICATION TO ENTER DEC LAND AND/OR WATERS FOR THE PURPOSE OF UNDERTAKING RESEARCH

APPLICABLE TO REGULATIONS 8, 10, 12, 18 AND 31 OF THE CONSERVATION AND LAND MANAGEMENT REGULATIONS 2002

- Please complete ALL sections of this application.
- Please allow 20 working days to process application

- Name of Applicant:
 Surname _____ Given Names _____
 Address _____
 _____ Phone Contact – Work: _____
 _____ Home: _____
 Postcode: _____ Fax No. _____
 email: _____@_____
- Department/Institution/Company/School/Club etc.

 (A letter of support from the Head of your organisation should be attached to this application)
- Names of other participants _____

- Which **DEC LAND / WATER** (e.g. ... National Park, Nature Reserve, Marine Park, State Forest) will research be undertaken in?
 (Details of name/s, number/s and actual location/s)

- Purpose of project: _____

- Applicants are required to submit a copy of their **research proposal** (including any **maps** of the proposed study sites) with this application.

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7. If you propose to collect specimens, state common and scientific name/s:
 - (a) Species to be taken _____
 - (b) Parts to be taken _____
 - (c) Purpose of samples _____

 - (d) Quantity to be collected _____

 - (e) Where will the specimens be lodged? _____

 - (f) Method of collection _____

8. Who will supervise the work? _____
9. Starting and finishing date: _____ to _____
10. Are vehicles / vessels to be used on the National Parks/Nature Reserves/Marine Parks? If so, give details including make, type, registration number, vessel call sign and marine radio type (27 mHz or Mar VHF)

11. Nature and location of proposed accommodation: _____

12. Will the study sites be reference marked? If so, how? _____

13. How long will the reference marks remain: _____
 - 13.1 When will the reference markers be removed: _____

Please read and sign the following declaration:

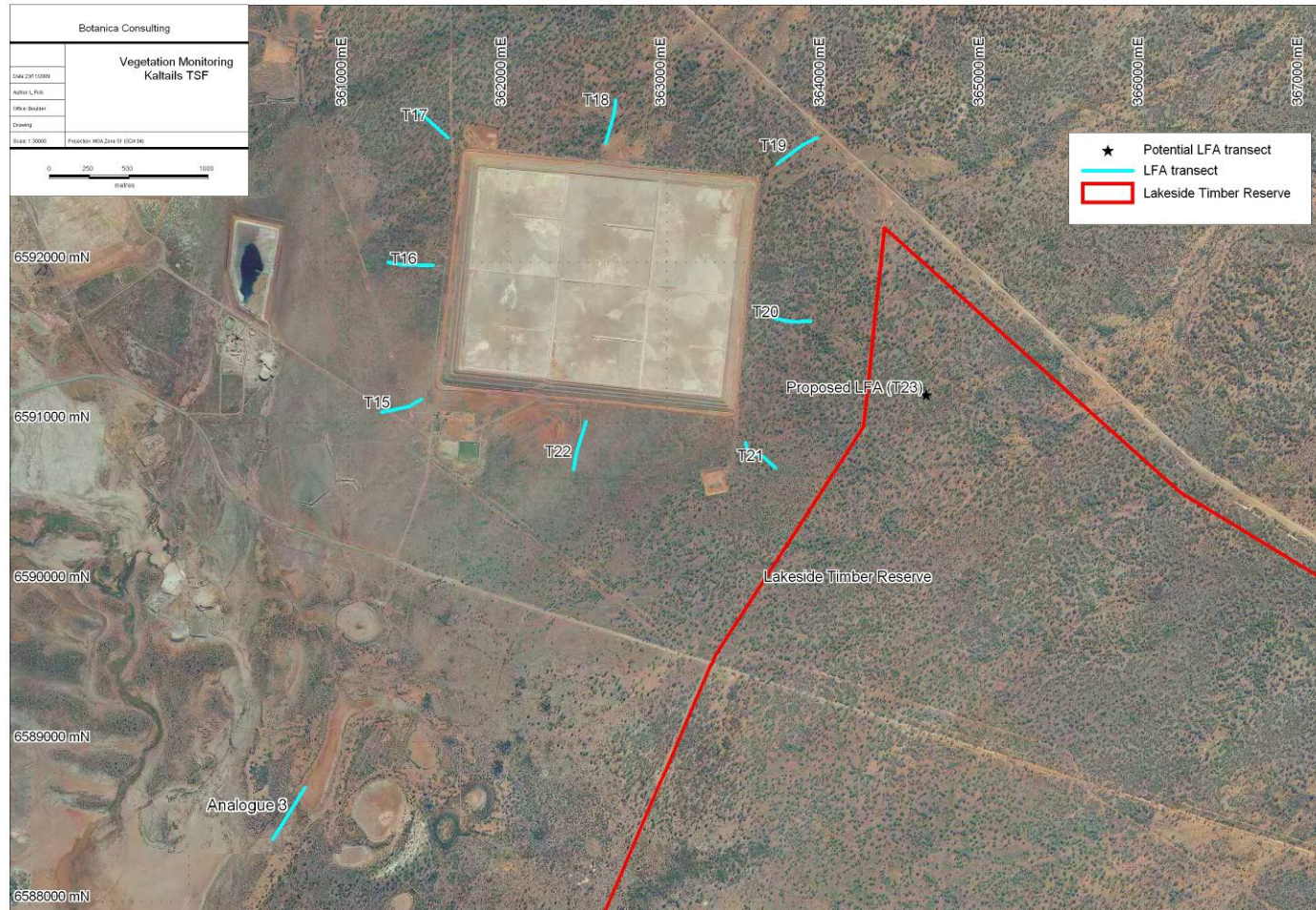
I AGREE THAT:

I will comply with the provisions of the Wildlife Conservation Act and Regulations and the Conservation and Land Management Act and Regulations and all conditions applicable to the issue of this Authority.

_____/_____/200__

Signature of Applicant

5 **Figure 1: Kaltails TSF Photographic and LFA Monitoring Location Plan**



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