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## **Fimiston Operations**

# **Seepage and Groundwater Management Plan**



Prepared by: KCGM

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## 1. INTRODUCTION

Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM) manages the mining and ore processing operations at the Fimiston Open Pit (Super Pit) and Mt Charlotte Underground gold mines on behalf of joint owners Barrick Gold of Australia Ltd and Newmont Australia Limited. KCGM was formed in 1989 by the amalgamation of several small scale mining operations along Kalgoorlie's Golden Mile ore body. KCGM's mining operations are currently projected to continue until about 2012.

Gold ore from KCGM's mining operations 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).

Tailings disposal in the Fimiston I and Fimiston II TSFs has caused groundwater mounds to develop in the natural formations surrounding these TSFs. KCGM has been actively managing seepage from these facilities since the early 1990s by monitoring groundwater levels and hydrochemistry, and recovering seepage by means of production bores and seepage interception trenches. Monitoring of groundwater levels and hydrochemistry, and production of groundwater by the bores and trenches has been authorised and licensed by the appropriate state government agencies (currently the Department of Environment (DoE), and Water and Rivers Commission (WRC)), and performance against the requirements of these licences are routinely reported to the agencies by KCGM.

Natural groundwater in the vicinity of the Fimiston I and Fimiston II TSFs is saline with total dissolved solids (TDS) concentrations from >20,000 – 50,000 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 DoE 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 2003 KCGM submitted a Notice of Intent (NOI) to the Department of Industry and Resources (DoIR) to increase the maximum height of the Fimiston I TSF from 30 m to 40 m. As a consequence of the review of this NOI, which included a referral to the Environmental Protection Authority, and an independent review by Thompson and Brett Pty Ltd, KCGM has committed to develop a long-term Groundwater Management Plan (SGMP) to oversee the planning and management activities associated with controlling groundwater around the Fimiston I and Fimiston II TSFs.

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In response to the Thompson and Brett Report, KCGM was supportive of a management strategy that would allow for the Fimiston I TSF height increase to proceed in a staged manner, with comprehensive checks at each phase. In the EPA Assessment Level Appeals Determination, the Minister for Environment outlined a strategy of staged 2.5 metre increases of the Fimiston I TSF. Progressive raises are subject to KCGM demonstrating that groundwater levels are being managed in accordance with the agreed targets within this SGMP. In addition this plan will be subject to annual independent audit and the results will be made available to the public.

This document presents the SGMP for KCGMs Fimiston I and Fimiston II TSFs. It incorporates current KCGM practices and recommendations from the Thompson and Brett Report to manage and control groundwater around the Fimiston I and Fimiston II TSFs, and establishes performance targets for the long-term management of TSF seepage.

The performance targets identify either standards to be maintained, or tasks and the timeframes over which these tasks are to be conducted. Standards cover items such as licence conditions and specifications for the construction of new monitoring or production facilities.

The SGMP consists of a number of components which can be grouped into the following actions:

- Estimate historic groundwater levels.
- Minimise the normal operating supernatant pool area on the TSFs.
- Maximise the performance of the Eastern Borefield.
- Construct additional groundwater monitoring bores.
- Increase the frequency of monitoring groundwater levels.
- Increase the frequency and scope of monitoring groundwater quality.
- Continue vegetation monitoring.

This SGMP for the Fimiston I and Fimiston II TSFs and associated performance targets will be reviewed annually, and modifications made where necessary.

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## 2. STANDARDS

### 2.1 Licence Conditions

The Department of Environment (DoE) Licence 6420/9 requires that KCGM;

- Operate the Fimiston I and Fimiston II TSFs in line with Conditions W3 (freeboard), W4 (bundling of pipelines), W5 (visual inspections), W6 (stormwater diversion), W11 (groundwater monitoring), and W12 (vegetation monitoring).
- Prepare quarterly reports presenting the results of the monitoring program required by Condition W11.
- Prepare an Annual Environmental Report as required by Condition G2. This report is to include a discussion of the vegetation monitoring program required by Condition W12.

The WRC Licence to Take Water GWL66252(3) requires that KCGM;

- Operate the Eastern Borefield in accordance with conditions specified and the current Operating Strategy.
- Prepare annual reports on the groundwater monitoring data from the Eastern Borefield.

### 2.2 Construction of Monitoring Bores and Production Bores

New monitoring bores and production bores that are established within KCGM's Eastern Borefield will be, at a minimum, constructed according to the requirements specified by:

- The Department of Environment.
- International Association of Hydrogeologists Australia - Minimum Construction Requirements for Water Bores in Australia.
- WRC Guideline No 4 - Installation of Mine Site Groundwater Monitoring Bores.

If there is an inconsistency in construction standards, the requirements specified by the DoE 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 in line with WRC guidelines.

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### 2.3 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”.

## 3. OBJECTIVE

The primary purpose of this SGMP is to operate, monitor and develop the Eastern Borefield so that, in the long term, groundwater levels are reduced to agreed historic levels. These levels will be based on an assessment of historical data, reasonable hydrogeological estimations, practicability and intent. The determination of the levels is part of the SGMP.

The minimum target depth to groundwater below ground surface (BGS) is currently four (4) metres with a stretch target of six (6) metres. These will remain the targets pending the first review of the SGMP. They may then be modified to progress towards historical levels during the operation of the TSFs.

Based on experience at other sites it is expected that following closure of the TSFs the Eastern Borefield can be progressively shut down over a number of years and the groundwater level remain at the target depth. Once it is confirmed that the groundwater level will remain at the target depth without active management, the Eastern Borefield will be decommissioned. It is anticipated that the groundwater will continue to naturally deepen back to a new equilibrium. Groundwater monitoring data will be reviewed periodically to confirm that in the water levels behave as predicted.

## 4. GROUNDWATER LEVEL MANAGEMENT

The primary focus of the SGMP is groundwater level management as the major environmental value in the area around the TSFs 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.

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It must be recognised that groundwater level management is most difficult near to the TSFs with these levels having the greatest potential to fluctuate due to deposition of tailings within the nearby paddock and the location of the supernatant pool on the TSF surface. About two thirds of all the groundwater bores in the Eastern Borefield are within 100m of the TSF for this reason (see Bore Location Plan).

The Operational Area of the TSFs includes the footprint of the facility plus a halo around the perimeter in which infrastructure associated with the operation of the facility is located and limited vegetation exists. The halo is a maximum of 100m wide or within the premises boundary. In the case of the Fimiston TSFs this Operational Area equates to about 20% of the TSFs footprint and is considered part of the facility.

It may not be practical to lower groundwater levels within this Operational Area below 4m BGS while the TSFs are operational and so this area is not considered as part of the primary goal of the SGMP. Groundwater levels inside the Operational Area will be considered in the annual review of the SGMP however may require exemption with respect to target depths applied beyond the Operational Area.

The following actions are directed towards achieving the primary goal of groundwater level management beyond the Operational Area of the TSFs.

#### **4.1 Establish Historic Groundwater Level Distribution**

Groundwater levels are to be determined that describe the extent to which the water table should trend toward during operation and ultimately reach following decommissioning of the TSFs. A contour plan will be developed indicating a reasonable estimate of the spatial distribution of groundwater levels prior to the commissioning of the Fimiston I and Fimiston II TSFs and take into account the contemporary setting. Once historical levels have been determined the report will be submitted to the DoE and made available to stakeholders for comment.

The data from this study will be used to determine the ultimate goal of this SGMP.

The precise historical groundwater level distribution will be difficult to determine given that there is limited information pre-dating these facilities. Also due to the modified topography in the catchment, some historical drainage patterns no longer exist, thus future natural groundwater level distribution will differ from the past. The development of the contour plan will therefore need to be completed in consultation with the DoE to achieve an outcome that is both a reasonable estimate and will protect the environment in the long term.

It is anticipated that the draft historical water level review will be completed by 31 January 06, with a 3 week public comment period ending on 21 February 2006. Following review of public feedback a final report will be completed by 31 March 2006.

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## 4.2 Management of TSF Supernatant Pool Size

The supernatant pool size is a major contributor to the seepage rate. To limit the potential for seepage, the size of the supernatant pools on top of the Fimiston I and Fimiston II TSFs will be kept to a minimum. The aim is that the pools will be maintained at 15% or about 15Ha during normal operation. This is less than the normal operation target areas described in the NOI documents for these facilities.

If rainfall causes the area of the supernatant pools to increase greater than the target size, decant water from the TSFs will be used as a priority for mineral processing in preference to groundwater derived from remote saline water borefields (ie, the Northern Borefield and Southern Borefield).

## 4.3 Operation of Eastern Borefield Bores

The extraction rate of groundwater is linked to the operation of the Eastern Borefield. To maximise the extraction rate the number of bores operating within the Eastern borefield needs to be as high as practical to maximise the potential for lowering of the groundwater levels around the TSFs. The current DoE licence requires 90% of production bores outside the TSF footprint to be sampled each quarter.

KCGM will target an average 90% of installed production bores to be operational over any full calendar month.

It is not possible for a groundwater production bore to deliver 100% availability as it is a mechanical device. With less than 100% availability on each individual unit and in excess of 100 bores that are currently in service means that typically several bores will be inoperative at any one time.

## 4.4 Semi-Continuous Monitoring of Groundwater Levels

To confirm that the current level of monitoring is sufficient to identify possible effects related to such aspects as the cycling of tailings deposition or rainfall, select bores will be monitored at an increased frequency rate.

Five (5) groundwater level sensors complete with data loggers will be installed in groundwater monitoring bores for a period of six (6) months.

The sensors are proposed to be located in monitoring bores in various areas around the TSFs. The initial logic for locating these will be:

- to identify the impact of the deposition cycle within 100 m of the TSF; and
- to identify rainfall recharge rates near the floodway both between and upstream of the TSFs.

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The record collection interval will be set at 10 minutes. Records will be downloaded from the loggers and presented in the quarterly reports to the DoE, and in the annual report on groundwater monitoring to the WRC.

After the six month monitoring period, an assessment will be made on a bore by bore basis whether to leave the groundwater level sensor and data logger in place or move it to another monitoring bore.

The set of groundwater level sensors and data loggers are to be installed by December 2005. Data will be assessed during the annual review for 2006 (by 30 April 2007), to confirm if the 2004/5 DoE licence frequency of groundwater level monitoring is sufficient.

#### 4.5 Groundwater Level Trends

Groundwater levels and trends are to be examined each quarter during preparation of the quarterly report to DoE. Depending on groundwater levels and trends, a decision will then be made as to whether additional groundwater pumping capacity is required according to the criteria in the following table:

Groundwater Level and Trend	Action
Groundwater level <4m BGS with a shallowing or stable trend	Increase pumping capacity within two quarters
Groundwater level >4m BGS and <6m BGS with a shallowing trend	Increase pumping capacity within three quarters
Groundwater level >6m BGS with a shallowing trend	Extrapolate trend, and increase pumping capacity in sufficient time to maintain groundwater level below 6m BGS

Since its inception the development of the Eastern borefield has been a staged approach due to the highly variable and unpredictable nature of the ground. It is not possible to determine groundwater bore locations prior to the groundwater rising. Increasing pumping capacity can be an unpredictable process. This inconsistent nature of the ground can mean an extended period of time is required to firstly find a suitable location, construct and subsequently equip new bores. This is then followed by an extended period of time to determine a trend from the increased abstraction from the area before any further work is undertaken.

The number of groundwater bores will progressively be increased, where required, to ultimately have a depth to groundwater BGS >6m outside the Operating Area of the TSF. The practicality to achieve this will be reviewed following completion of the historic groundwater level study.

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

The results of the quarterly assessment of groundwater levels and trends are to be presented and discussed in the quarterly report to the DoE.

Infiltration following high rainfall has been observed to make the depth to groundwater shallower by up to two (2) metres in some locations. Groundwater returns to previous levels following such events by operating the Eastern Borefield at a greater extraction rate. This may however, take some months as the volume infiltrating over the catchment could be quite large. The Eastern Borefield is a high priority water source for mineral processing so water extraction will be as high as practicable thus lowering the groundwater in the shortest possible time. Additional pumping capacity is not triggered by these events as they are infrequent.

## 5. GROUNDWATER QUALITY MANAGEMENT

The following actions are used to identify changes that may occur in the groundwater quality around the TSFs.

### 5.1 Monitoring

To confirm that the 2004/5 DoE licence level of monitoring is sufficient to identify spikes during the discharge of tailings, monitoring bores will be sampled at an increased frequency rate.

Sampling for pH, Electrical Conductivity (EC), cyanide (Total, WAD and Free) from about one third of all monitoring bores (about 20) will be performed on a monthly basis. The bores will be selected from across the entire monitoring bore network with the aim of obtaining representative coverage.

Sampling for pH, Electrical Conductivity (EC), cyanide (Total, WAD and Free) and Trace Elements (Cu, As, Zn, Fe, Hg) will be performed on a quarterly basis for all monitoring bores.

Results from the sampling will be presented in the quarterly reports to the DoE, and in the annual report on groundwater monitoring to the WRC.

This sampling frequency will commence in the fourth quarter of 2005. Data will be assessed during the annual review for 2006 (by 30 April 2007), to confirm if the 2004/5 DoE licence frequency and range of groundwater quality monitoring is sufficient.

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## 5.2 Groundwater Recovery

Groundwater quality and trends are to be examined quarterly. Depending on the results and in consultation with the DoE, the requirement for additional groundwater pumping capacity may be identified.

Electrical conductivity, WAD cyanide and other Trace Elements may be useful indicators of seepage from the TSFs. A combination of these will be used to define the recovery priority within the context of the Beneficial Use of the groundwater being suitable only for mineral processing.

Groundwater recovery to manage groundwater levels has a higher priority than recovery due to quality in the SGMP because it has the greater potential to impact on the environmental value of the area (i.e. vegetation).

## 5.3 Investigate Cyanide Species

The Thompson and Brett Report recommended that further analysis of cyanide be undertaken to define the species of cyanide that are present in the groundwater.

KCGM will complete an analysis of groundwater from a representative selection of monitoring bores for cyanide species such as chloramine, cyanogen and thiocyanate. A representative bore will be one that has recently shown a WAD cyanide concentration of greater than the detection limit. The results will be reported to DoE by December 2005.

## 5.4 Additional Monitoring Bores

The Thompson and Brett Report recommended the installation of monitoring bores to the north of the Fimiston I TSF. KCGM will install monitoring bores in this area and also at other locations around the Fimiston TSFs (see Bore Location Plan).

Fifteen (15) monitoring bores in total will be constructed. These are intended to either characterise the broad groundwater conditions beyond the 2004/5 DoE licence network of monitoring bores or provide improved definition within the network.

The sampling of these monitoring bores will be incorporated into the revised schedule for monitoring both groundwater level and quality.

The Thompson and Brett Report recommended the installation of monitoring bores south of the Fimiston I TSF within the footprint of the adjacent waste dump. KCGM considers this to be impractical and of limited benefit as the groundwater would be up to 70m beneath the dump surface. Groundwater bores are already installed to the south of this waste dump where natural ground levels occur.

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## 6. VEGETATION

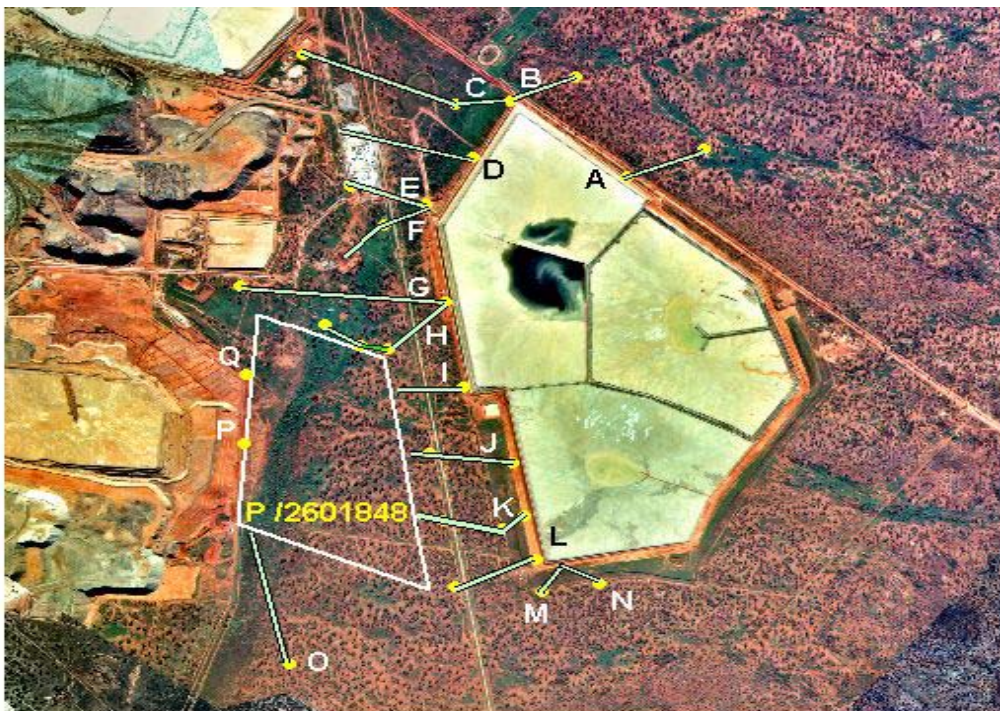
To confirm that the groundwater management plan is protecting the environmental value of the area (i.e. vegetation), KCGM will undertake a photographic vegetation monitoring programme using a professional photographer around the Fimiston I and Fimiston II tailings storage facilities (TSFs). This is in accordance with DoE Licence requirements. The photographic vegetation monitoring will be assessed by an experienced environmental professional.

### 6.1 Monitoring

Transects include monitoring bores or key vegetation features. A total of 17 transects from the Fimiston TSFs were established in 1999 (Figure 1) including 32 photopoints. Where several photographs were taken at the same photograph point the general direction is indicated in Table 1.

KCGM will engage a suitably qualified professional to review this vegetation monitoring programme and ensure it adequately represents vegetation surrounding the Fimiston TSFs. It is anticipated that the draft vegetation monitoring review will be completed by 31 December 05, with a public comment period ending on 31 January 2006. Following review of public feedback a final report will be completed by 28 February 2006.

**Figure 1 - Locations of Vegetation Transects Around Fimiston I and II TSFs**



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**Table 1**  
**Bore Identification and Photograph Directions from Photograph Points**

<b>Transect</b>	<b>Origin (Bore)</b>	<b>Sequence of Bores</b>
A	NTD 1 (n)	MB F1 (n;s)
B	NTD 2 (w)	MB F4 (n;s)
C	NTD 2 (nw)	MB F6 (e;w)      MB F5 (se)
D	NTD 3 (w)	AMG (358537:6597384) (e)
E	NTD 4 (nw)	AMG (358884:6597023) (e)
F	NTD 4 (sw)	MB F32 (e;w)      NEVES DAM (e;w)
G	NTD 5 (sw)	MB F24 (e)
H	NTD 5 (sw)	MB F19 (sw;ne)      MB F33 (w;e)      MB F31 (w;e)
I	NTD 6 (sw)	MB F54 (w;e)
J	MB F51 (sw)	MB F55 (sw;ne)
K	MB F50 (sw)	MB F56 (sw;ne)
L	MB F48 (sw)	MB F57 (sw;ne)
M	MB F46 (sw)	MB F47 (n;s;e;w)
N	MB F46 (e)	MB F45 (n;s;e;w)
O	MB F30 (n;s;e;w)	
P	MB F26 (e)	
Q	MB F25 (e)	

Note: The direction of the photographs is bracketed, and in italics, next to the groundwater bore number. A semicolon separates multiple photographs at one photopoint. Where a monitoring bore is not present the AMG coordinates are given. The numbering system used for photographs below is, for example, A1 where A is the transect and 1 is the origin bore. Successive photograph points, along a transect, are numbered left to right from Table 1.



## 7. REVIEW

Groundwater data is currently reviewed and reported to the DoE on a quarterly basis. This will continue and will include commentary on performance against SGMP targets.

The performance of the SGMP will be reviewed annually and recommendations will be included in the Annual Groundwater Production Summary or Triennial Aquifer Performance Review that is submitted as part of the licence requirements for operation of the Fimiston TSFs and the Eastern Borefield.

The SGMP will be revised based on recommendations from the review and submitted to DoE for approval.

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

The review of the vegetation monitoring component of the SGMP will be completed by an experienced, independent vegetation specialist. Mr Jim Williams and Ms Andrea Williams of Jims Weeds, Seeds and Trees are presently undertaking this role.

## 8. DELIVERABLES

The scope of this SGMP is wide and has many targets. Some of these are easily achieved as they are actions that have clear paths and well defined end points (eg install 15 monitoring bores by December 2005). Other targets are intended to demonstrate KCGMs commitment to continuous improvement (eg increasing pumping capacity dependent on aquifer response). 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.

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**TABLE OF TASKS**

<b>TASK</b>	<b>Description</b>	<b>Target / Goal</b>	<b>Timing</b>
Historic Groundwater Level	Estimate the historic water levels.	Estimate a reasonable depth based on hydrogeological principles and practicality.	Mar 2006.
TSF Pool Size	Minimise the pool size by operating within a target area.	15Ha on the operating paddock under routine operation.	Ongoing.
Operation of Eastern Borefield	Maximise the use of the borefield.	90% of bores operating over any full calendar month.	Ongoing.
Semi-Continuous Monitoring of Groundwater Levels	Confirm if the 2004/5 DoE licence sampling frequency is adequate.	Establish five semi - continuous monitoring bore depth loggers.	Ongoing. Review in 2006.
Groundwater Level Trends	Establish increased pumping capacity to lower water levels.	Progressively increase the No. of groundwater bores that have a depth to groundwater BGS >4m.	Ongoing.
Groundwater Quality Monitoring	Confirm if the 2004/5 DoE licence sampling frequency is adequate.	Increase monitoring frequency to quarterly and the number of analytes to include cyanide and select Trace Elements.	Ongoing Review in 2006.
Groundwater Quality Monitoring	Establish increased pumping capacity to increase seepage recovery.	Recover seepage in areas of high priority based on potential impact on the vegetation or Beneficial Use of the groundwater.	Ongoing.
Investigate Cyanide Species	Define the species of cyanide that are present in the groundwater.	Analyse a representative selection of monitoring bores for cyanide species.	December 2005.
Additional Monitoring Bores	Increase monitoring coverage.	Install 15 monitoring bores.	December 2005.
Vegetation Monitoring	Confirm that the SGMP is protecting the environmental value of the area.	Professionally photograph transects and photopoints.  Review of scope of monitoring is adequate.	Ongoing.  December 2005.

## 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.

**BGS:** Is the groundwater level or depth below ground surface.

**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. This is typically used as a measure of the potential toxicity to fauna if ingested. The typical guideline value of 50ppm is used. Concentrations above this value may be harmful to fauna.
- Total is a measure of all forms of cyanide in solution. This value includes the WAD cyanide concentration. This is not used as an indicator of toxicity as it may include stable and therefore non toxic cyanide salts.

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

**DoE:** Department of Environment.

**Eastern Borefield:** This is the bore network that is constructed around the two Fimiston TSFs and comprises all of the Production and Monitoring Bores and associated infrastructure.

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**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 may occur post mine closure.

**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.

**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 TSFs that includes the footprint of the facility plus a halo around the perimeter in which infrastructure associated with the operation of the facility is located and limited vegetation exists. The halo is a maximum of 100m wide or within the premises boundary.

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**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. Fimiston I TSF is a single paddock and Fimiston II TSF is a three 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.

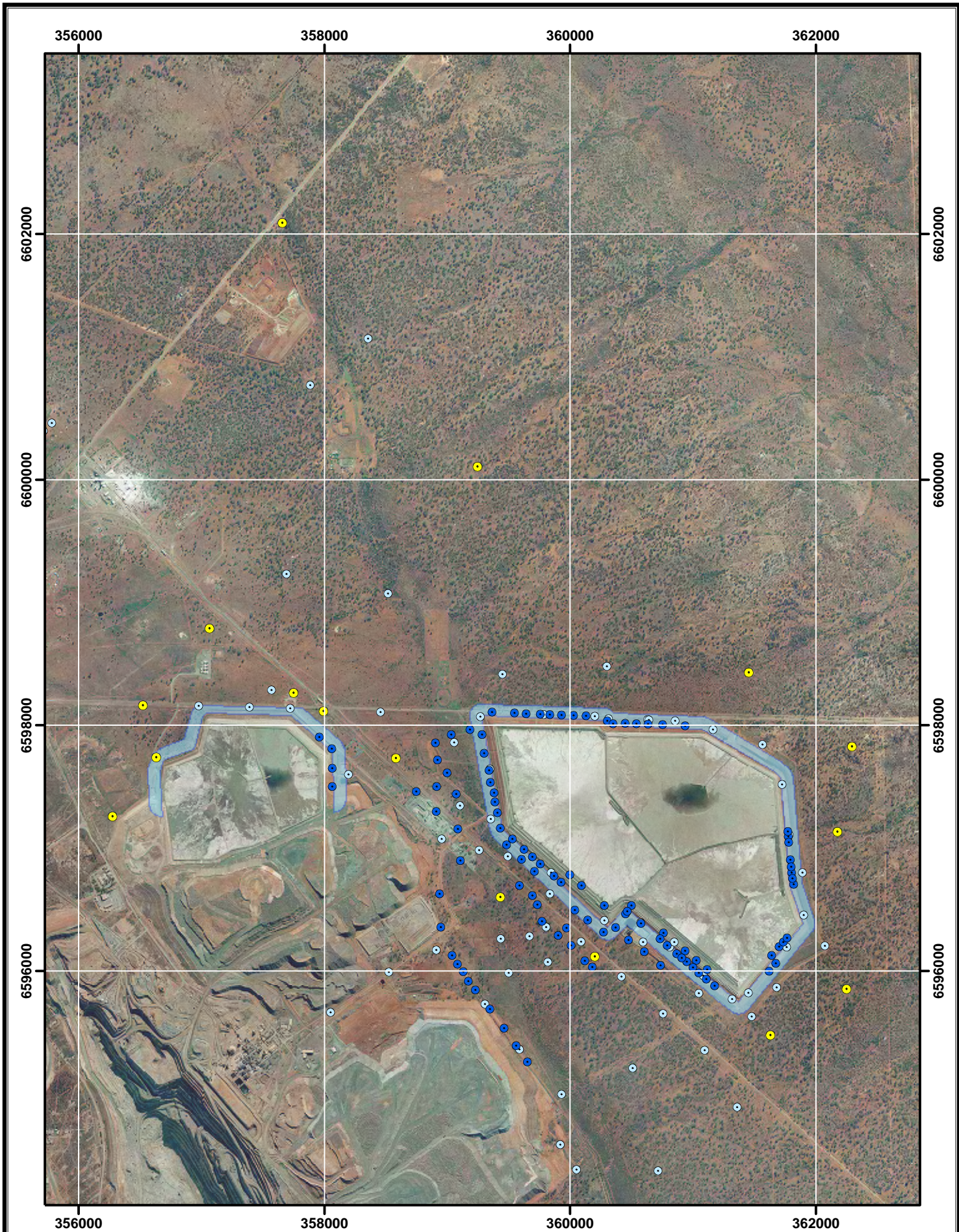
**Water Table:** The upper surface of the groundwater. The zone immediately below the watertable is saturated. The aim of the Groundwater Management Plan is to keep the watertable at least 4 metres from the soil surface.

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

**Zn:** Symbol for the metal, zinc.

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**LEGEND**

Operational Areas

**Bore Type**

Monitoring

Production

KCGM Proposed

# Kalgoorlie Consolidated Gold Mines Pty Ltd Groundwater Management Plan

## LOCATION PLAN

